## PUBLIC HEARING BINDER

## 100 Amherst Avenue

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| 4) | **Notice** |
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| 5) | **Minutes -** Regular Meeting of Council held January 12, 2026 |
| 6) | **Chemtrade North Vancouver Facility Siting Study (FSS)/Quantitative Risk Assessment (QRA) (Revised and Update)** February 3, 2026, prepared by BakerRisk<br>• The report evaluates offsite public risk from chlorine hazards. It assesses the future facility design, which removes bulk liquid chlorine storage and introduces enclosed, scrubbed railcar loading systems to reduce potential releases, and uses quantitative risk modelling to confirm compliance with land-use safety guidelines.<br>• It has been updated and revised based on peer review comments from District-retained consultant Risktec Solutions. |
| 7) | **Peer Review Confirmation of Revised Quantitative Risk Assessment** February 6, 2026, prepared by Risktec Solutions (Canada) Ltd.<br>• This letter provides an independent confirmation that the revised QRA prepared by BakerRisk for the Chemtrade facility have adequately addressed the previously identified peer review comments.<br>• It confirms that the revisions improve clarity, methodology alignment, and transparency, and that the revised and updated QRA report is suitable to support the District of North Vancouver's consideration of the proposed application. |
| 8) | **Risktec's Third-Party Review Comments and Resolution**<br>• A consolidated matrix documenting Risktec's third-party peer review comments on the original QRA and BakerRisk's responses on how each comment has been addressed in the revised assessment. |
| 9) | ***Historical Information* - Update on Planning and Management Practices Associated with Chemical Hazard Risk in Maplewood (January 2, 2018)**<br>• This 2018 Information Report to Council provides an overview of how chemical hazard risks in the Maplewood area have been assessed, planned |

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| | for, and managed over time, with a focus on land use planning, risk mitigation, and emergency preparedness.<br>• The attached *Maplewood Chemical Hazard DPA Preliminary Study* prepared by McCutcheon & Associates summarizes peer-reviewed Quantitative Risk Assessments (QRAs) related primarily to chlorine and hydrogen chloride hazards from industrial operations (notably Canexus/Chemtrade), explains the establishment and application of risk contours consistent with MIACC guidelines, and outlines how these contours inform allowable land uses, densities, and building design requirements.<br>• The report also describes emergency notification and response protocols, public engagement to date, and confirms that Maplewood planning policies align with accepted Canadian best practices for managing industrial chemical risk. |
| 10) | **Applicant's Response to Council Questions at First Reading (January 12, 2026)**<br>• The applicant provides their response to Council questions from the first reading of the bylaw, including risk, rail safety, safety investments, emergency response coordination, environmental permitting, and facility operations. |
| 11) | **Staff Response to Council Questions from First Reading**<br>• Staff provide response to Council questions that, among other things, confirm no increase in production or rail traffic, and outline how operational safety will be secured through covenants registered on title, the permitting process, and peer-reviewed risk assessments. |
| 12) | **Project Description**<br>• Overview of the proposed rezoning, site context, existing operations, and rationale for the zoning amendment at 100 Amherst Avenue. |
| 13) | **Engagement Summary**<br>• Summarizes Chemtrade's engagement efforts from 2023–2025 in support of their rezoning application.<br>• Starting on Page 36 of this report, a detailed summary of the rezoning application-stage public engagement results, including the June 6, 2024 open house, and the applicant's presentation for engagement.<br>• Last page, a media release regarding a non-binding LOI with the Port.<br>**Chemtrade North Vancouver – Community Newsletter (February 2026)**<br>• The February 2026 Community Newsletter outlines Chemtrade's rezoning application, proposed safety improvements, continued commitment to safe operations, and notice of the upcoming Public Hearing on February 24, 2026. |
| 14) | **Effluent Permit Report -** June 27, 2025, prepared by Envirochem Services Inc.<br>• Summarizes work completed after a 2023 administrative amendment to ENV effluent permit #18, which triggered a comprehensive assessment comparing Chemtrade discharges to Burrard Inlet Water Quality Objectives |

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| | (BIWQO/BCWQO). Describes an approved monitoring plan and a 2024 field monitoring program (stormwater/upland testing and receiving environment sampling). |
| 15) | **Flood Hazard Assessment Report** – August 2025 prepared by Northwest Hydraulic Consultants Ltd<br>• A preliminary review of flood risk at the Chemtrade site, considering river and coastal flooding under current and future climate conditions. It identifies recommended flood construction levels to guide site planning and notes that risks can be addressed through appropriate design as the project moves forward. |
| 16) | **Noise Impact Assessment** – July 15, 2025 by BKL Consultants Ltd.<br>• It summarizes testing and DNV Noise Bylaw 7188 requirements, finds rail movements and existing plant equipment are the main noise sources, and concludes the project upgrades won't significantly increase boundary noise, except emergency ventilation, which could be louder but would only run in rare emergencies. |
| 17) | **Archaeological Overview Assessment** – September 2025 by ISL Engineering and Land Services<br>• The assessment finds that the Chemtrade Safety Upgrades site has low archaeological potential due to extensive past industrial disturbance and shoreline infilling. |
| 18) | **Traffic Impact Assessment Report –** November 17, 2025 by Watt Consulting Group<br>• It finds that the proposed upgrades will not change traffic, parking, access, or rail operations. The existing industrial use remains the same, no additional vehicle or rail trips are expected, and all site access and loading arrangements are unchanged. |
| 19) | ***Historical Information* – Past Reports to Council and Development Permit Approvals (1985–1998)**<br>• The background document contains a series of Development Permits, rezoning reports, and Council decisions from the mid-1980s to late-1990s related to the Canadian Occidental Petroleum (now Chemtrade). These include Development Permits issued in 1985 for storage tanks and spill containment systems, followed by a 1998 rezoning and subdivision process that separated the plant lands south of the CN rail line from future development lands to the north. Council reports from October 1998 outline the rationale for issuing Development Permit 414.0 to facilitate the subdivision, repealing and replacing earlier highway reservation agreements, and registering restrictive covenants to limit chlorine storage and manage risk. Collectively, these documents show long-standing Council oversight of land use, infrastructure, risk management, and transportation planning for the site. |
| 20) | **Land Use** |

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| | • Map illustrating Official Community Plan Industrial designation on the subject site.<br>• Map illustrating Employment Zone – Industrial (EZI) zoning on the subject site |
| **Public Input** | |
| 21) | **Past Public Input**<br>• See Item 2 above – Attachment 2 of the Staff Report summarizes public input received through the virtual Public Information Meeting, includes the Facilitator's Report from the in-person Public Information Meeting, and contains letters of support from the Premier and a local MLA. |
| 22) | **Public Input**<br>• Correspondence / submissions from the public since 1st Reading given January 12, 2026. |

# AGENDA

*PUBLIC HEARING*

**Tuesday, February 24, 2026**
**7:00 p.m.**
**Council Chambers, Municipal Hall**
**355 West Queens Road**
**North Vancouver, BC**
**Watch at** https://dnvorg.zoom.us/j/64484156494

**Council Members:**
Mayor Mike Little
Councillor Jordan Back
Councillor Betty Forbes
Councillor Jim Hanson
Councillor Herman Mah
Councillor Lisa Muri
Councillor Catherine Pope

NORTH VANCOUVER
DISTRICT

www.dnv.org

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DISTRICT OF NORTH VANCOUVER

355 West Queens Road
North Vancouver, BC V7N 4N5
604-990-2311
DNV.org

**PUBLIC HEARING**

**7:00 p.m.**
**Tuesday, February 24, 2026**
**Council Chambers, Municipal Hall,**
**355 West Queens Road, North Vancouver**
**Watch at https://dnvorg.zoom.us/j/64484156494**

**AGENDA**

We respectfully acknowledge the original peoples of these lands and waters, specifically the səlilwətaɬ (Tsleil-Waututh), Sḵwx̱wú7mesh Úxwumixw (Squamish), and xʷməθkʷəy̓əm (Musqueam), on whose unceded ancestral lands the District of North Vancouver is located. We value the opportunity to learn, share, and serve our community on these unceded lands.

**100 Amherst Avenue**
**Amendments to the Zoning Bylaw**

1. **OPENING BY THE MAYOR**
2. **INTRODUCTION OF BYLAW BY THE CORPORATE OFFICER**
3. **PRESENTATION BY STAFF**
4. **PRESENTATION BY APPLICANT**
5. **REPRESENTATIONS FROM THE PUBLIC**
6. **QUESTIONS FROM COUNCIL**
7. **COUNCIL RESOLUTION**
8. **CLOSING**

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**The Corporation of the District of North Vancouver**

**Bylaw 8778**

A bylaw to amend District of North Vancouver Zoning Bylaw 3210, 1965

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The Council for The Corporation of the District of North Vancouver enacts as follows:

## 1. Citation

This bylaw may be cited as "District of North Vancouver Rezoning Bylaw 1462 (Bylaw 8778)".

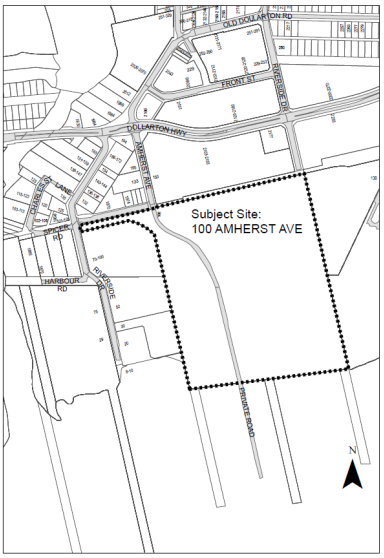
## 2. Amendments

2.1 District of North Vancouver Zoning Bylaw 3210, 1965 is amended as follows:

a) Section 403A Uses Prohibited in All Zones, (1) (f) "the manufacture of hazardous substances except:" is amended as follows:

After (i), add the following:

(ii) for the manufacturing, processing, liquefaction, handling, storage, loading and shipping of chlorine, on the lands located at 100 Amherst Avenue identified on the plan attached hereto.




**READ** a first time January 12, 2026

**PUBLIC HEARING** held

**READ** a second time

**READ** a third time

Certified a true copy of “Rezoning Bylaw 1462 (Bylaw 8778)” as at Third Reading

_____
Deputy Corporate Officer

**ADOPTED**

_____ _____
Mayor Corporate Officer

| AGENDA INFORMATION | | Dept. Manager | GM/ Director | CAO |
|---|---|---|---|---|
| ☑ Regular Meeting | Date: January 12, 2026 | | | |
| ❒ Other: | Date: | | | |

# The District of North Vancouver
# REPORT TO COUNCIL

December 15, 2025
Case: PLN2025-00042
File: 08.3060.20/042.25

**AUTHOR:** Yan Zeng, Manager of Development Planning

**SUBJECT:** **Bylaw 8778 - Text Amendment Rezoning – 100 Amherst Avenue (Chemtrade)**

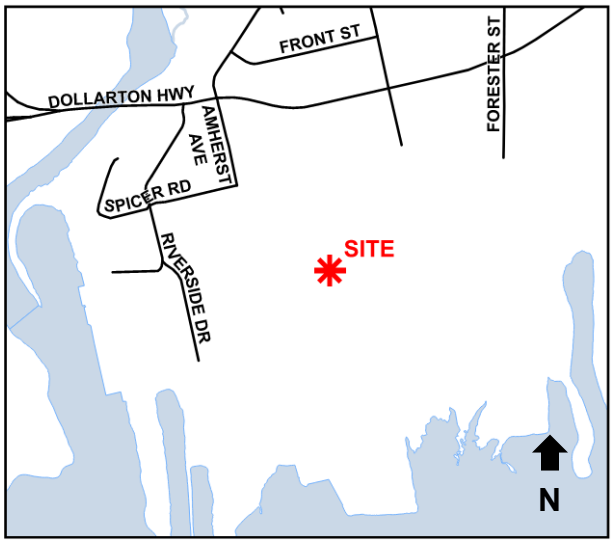
## RECOMMENDATION

THAT "District of North Vancouver Rezoning Bylaw 1462 (Bylaw 8778)", is given FIRST reading;

AND THAT "District of North Vancouver Rezoning Bylaw 1462 (Bylaw 8778)", is referred to a Public Hearing.

## REASON FOR REPORT

The manufacture of hazardous substances is generally prohibited in the District of North Vancouver. Chemtrade Logistics Inc. has applied for a site-specific text amendment to the Zoning Bylaw to permit the continued manufacture of liquid chlorine at 100 Amherst Avenue. The proposal includes safety-focused upgrades to an existing chlor-alkali facility.




## SUMMARY

The applicant, Chemtrade Logistics Inc., has applied to amend the District of North Vancouver Zoning Bylaw to permit the manufacturing of a hazardous substance (liquid chlorine) at 100 Amherst Avenue. The proposed amendment would enable capital improvements to the existing chlor-alkali facility, including removal of legacy infrastructure and construction of new enclosed processing components intended to reduce overall risk to the surrounding community.

The subject site is designated *Industrial* in the Official Community Plan (OCP) and zoned *Employment Zone Industrial (EZ-I)*. The applicant has indicated that the site has been used for liquid chlor-alkali manufacturing operations since 1957. However, even if the applicant were to prove that they should be allowed to continue to use the property as a "non-conforming use" in accordance with Section 530 of the *Local Government Act (LGA)*, the proposed development could not be authorized pursuant to Sections530 and 531 of the *LGA* unless Council approves a corresponding zoning bylaw amendment.

As part of the text amendment rezoning application, Chemtrade submitted a Facility Siting Study and Quantitative Risk Assessment (FSS/QRA) prepared by Baker Engineering and Risk Consultants Inc., which was independently peer-reviewed by Risktec Solutions (Canada) Ltd. on behalf of the District. The studies conclude that the proposed configuration meets accepted risk thresholds and, when implemented, would reduce overall risk relative to existing conditions.

In accordance with the *Local Government Act*, a public hearing for a proposed zoning bylaw amendment related to non-residential development is not required to be held if the bylaw amendment is consistent with the Official Community Plan (OCP). However, Council still has the authority to request that a Public Hearing be held. For this application, given the significant role Chemtrade has played as part of the industrial lands on the north shore, staff are recommending that a Public Hearing be held so that Mayor and Council may hear directly from the public.

## BACKGROUND

The applicant has indicated to the District that the Chemtrade chlor-alkali facility at 100 Amherst Avenue has been in continuous operation since 1957 and produces liquid chlorine primarily used for drinking water treatment across British Columbia and the Pacific Northwest. The facility currently employs approximately 118 full-time staff and produces a significant portion of the liquid chlorine supply used in Western Canada.

In 1984, the District's Zoning Bylaw was amended to include section 403A to prohibit the manufacture of hazardous substances, including compressed or liquefied gases. Site specific exemption to this prohibition would be considered on an individual basis.

Non-conforming uses may continue within the timeframe, extent, and degree authorized by the *Local Government Act*.

While Chemtrade had previously stated that they intend to close the operation on the adjacent lands administered by the Vancouver Fraser Port Authority by 2030, in October 2025, they had submitted a text amendment rezoning application to seek exemption to the section 403A prohibition. The purpose of the application is to allow the operation to continue into the future, while significantly upgrading and improving safety of the facility.

The work proposed by Chemtrade, including the demolition of the unused cell house, removal of on-site chlorine storage tanks, and construction of new enclosed railcar loading and condenser infrastructure are substantial and would trigger the requirement for a site-specific rezoning.

## DISCUSSION

### Site and Surrounding Area

The subject property is approximately 16.4 hectares (163,950 m²) in area and is located within the Maplewood industrial area. Surrounding land uses are predominantly industrial and include:

- North: Northwood Business Park (light industrial commercial uses)
- East: GFL recycling facility and approved HTEC hydrogen liquefaction facility
- South: Port of Vancouver industrial lands (Chemtrade lease area)
- West: Metro Vancouver recycling and Heidelberg Aggregates facilities

The site is well separated from established residential neighbourhoods north of Dollarton Highway.




### Project Description

The application consists of a site-specific text amendment rezoning to permit the continued manufacture of liquid chlorine at the existing Chemtrade chlor-alkali facility located at 100 Amherst Avenue, and to enable a series of safety-focused capital upgrades to the facility. No increase in production capacity is proposed.

Chemtrade has safely operated a chlor-alkali facility on the water lot adjacent to the subject site and currently produces liquid chlorine, sodium hydroxide (caustic soda), hydrochloric acid (muriatic acid), and green gaseous hydrogen through an electrochemical process using water, salt and electricity.

Liquid chlorine produced at the facility is primarily used for municipal drinking water treatment and represents approximately 40% of Canada's total liquid chlorine supply, including over 70% of the supply used in British Columbia and Alberta.

The proposed rezoning would facilitate implementation of Chemtrade's *Vision 2030* safety improvements, which are focused on reducing on-site chlorine storage,

modernizing loading infrastructure, and further lowering risk to the surrounding community, while maintaining existing production volumes.

Key components of the proposed project include:

- Demolition of the existing cell house structure that has not been in use since 2007;
- Elimination of on-site liquid chlorine storage tanks, transitioning the facility to a "produce-and-ship" model that significantly reduces chlorine inventory on site;
- Construction of a new enclosed railcar loading building, equipped with a sophisticated emergency ventilation and air-scrubbing system designed to capture and contain chlorine in the event of a release during railcar loading operations;
- Installation of a new pre-liquefier and four elevated chlorine condensers, located approximately 80 feet above grade to allow for gravity-fed loading of liquid chlorine into railcars, thereby reducing loading pressures and eliminating the need for pumps; and
- Installation of seismically activated safety shut-off valves and other seismic upgrades throughout the facility to enhance resilience during seismic events.

Following the proposed upgrades, chlorine gas produced in the existing electrolysis process would continue to flow through drying and distillation stages before entering the new pre-liquefier and condenser system. Liquid chlorine would then flow by gravity directly into railcars within the enclosed loading building, eliminating the existing 60-tonne bulk storage tank and associated pumping infrastructure currently located on Port of Vancouver lands.

No changes are proposed to upstream production processes or overall production quantities.

All unit operations prior to the pre-liquefier would remain unchanged. The proposed configuration is intended to reduce both the probability and potential consequences of a chlorine release, with technical studies indicating that risk contours would be reduced to near or at the facility property boundary.

Construction of the proposed improvements is anticipated to occur over approximately four years, coordinated with scheduled major maintenance outages planned for 2026 and 2028, to minimize operational disruption and community impacts.

## Policy Alignment

*Land Use Designation and Zoning*
The site is designated Industrial in the OCP and zoned Employment Zone – Industrial (EZ-I). The Chemtrade chlor-alkali facility has operated on the site since 1957 and is a

legal non-conforming use under Section 528 of the *LGA*. No amendment to OCP and EZ-I zone are required.

The proposed site-specific rezoning text amendment would allow the manufacture of liquid chlorine to be explicitly permitted, enabling safety-focused upgrades while maintaining the existing industrial land use.

The proposed amendment relies on a site-specific, risk-based review supported by independent third-party technical analysis. The QRA indicates that risk contours remain within accepted thresholds established by the Canadian Society for Chemical Engineering and that the proposed upgrades improve safety performance relative to the existing facility configuration.

*Economic Development Strategy*
The proposal aligns with the District's economic development objectives by supporting the retention and modernization of industrial employment lands. The Chemtrade facility provides approximately 118 full-time jobs currently and has made a significant contribution to the local and regional economy. The proposed upgrades support long-term industrial viability without increasing production volumes or land use intensity.

*Environmental and Climate Objectives*
The Chemtrade facility is one of the lowest-carbon chlor-alkali operations in North America, powered almost entirely by renewable hydroelectricity and self-produced hydrogen. The proposed upgrades do not increase output and are intended to reduce on-site chlorine storage and overall risk, while maintaining a minimal environmental footprint. The project supports broader climate and sustainability objectives at the municipal, regional, and provincial levels.

*Vancouver Fraser Port Authority*
A portion of the facility is located on lands leased from the Vancouver Fraser Port Authority, with a non-binding letter of intent in place to extend the lease through 2044. The proposal aligns with the Port Authority's mandate to support trade-enabling industrial uses while maintaining high standards of safety and environmental stewardship.

*Provincial, Federal, and Regional Policy*
The proposal aligns with provincial initiatives such as the BC Manufacturing Action Plan, StrongerBC, and CleanBC, which support modernization of industrial facilities and domestic supply chain resilience. Liquid chlorine is identified in federal drinking water guidelines as the primary disinfectant used by Canadian municipalities, and Chemtrade supplies a significant portion of the chlorine used in Metro Vancouver's drinking water treatment system, supporting regional public health infrastructure.

## Safety Study Review

Chemtrade submitted a Facility Siting Study and Quantitative Risk Assessment (FSS/QRA) prepared by Baker Engineering and Risk Consultants Inc. (dated September 24, 2025). The FSS/QRA evaluates the risks associated with the continued manufacture and handling of liquid chlorine at the existing facility, including the proposed safety upgrades.

The FSS/QRA indicates that the proposed safety upgrades reduce both the likelihood and potential consequences of credible chlorine release scenarios compared to existing conditions. Off-site risk was quantified using location-specific individual risk (LSIR) contours and are used to assess compliance with the Process Safety Management Division's (formerly Major Industrial Accidents Council of Canada, i.e. MIACC) risk-based land use planning guidelines. Based on the off-site receptors identified by Chemtrade, the resulting LSIR contours for the proposed facility are in compliance with the guidelines.

The LSIR contours are based on preliminary design information and modelling assumptions available at the time of the study and may be updated if the facility design or process conditions change, including those associated with chlorine railcar loading operations.




Figure 2. LSIR Contours for Current Facility with Proposed Design Changes

To ensure independent oversight, the District of North Vancouver retained Risktec Solutions (Canada) Ltd. to conduct a third-party peer review of the FSS/QRA. The review was commissioned by the District, with costs to be reimbursed by the applicant, and included the option for additional peer review at future Development Permit or Building Permit stages, if required.

In correspondence dated December 1, 2025, Risktec confirmed that no major issues were identified with the study approach, assumptions, or conclusions. Risktec's comments were limited to recommendations to improve clarity and presentation for readers. Overall, the peer review concluded that the FSS/QRA is technically sound and appropriate to support consideration of the rezoning application.

If the text amendment is successful, a covenant will be registered on title to ensure compliance with the proposed FSS/QRA, or as amended or updated from time to time.

### Parking Review

Staff have reviewed the Transportation Impact Assessment (TIA) submitted by the applicant and are satisfied that there would be no change from existing traffic flow and no additional negative impact is anticipated.

### Off-site Improvements

Subject to confirmation at subsequent stages of permitting, watermain upgrade will be required in order to maintain adequate waterflow for fire protection services.

### Development Permits

If the application proceeds to Development Permit stage, the following DPAs will be applicable:

- Form and Character of Industrial Development;
- Energy and Water Conservation and GHG Emission Reduction; and
- Protection from Hazardous Conditions: Creek Hazard.

## CONCURRENCE

The project has been reviewed by staff from Economic Development, Environment, Building and Permits, Legal, Parks, Engineering, Transportation, Community Planning, Fire Department & North Shore Emergency Management.

As the site is within 800 metres to a controlled-access intersection, approval by the Provincial Ministry of Transportation and Infrastructure will be required after third reading of the bylaw and prior to bylaw adoption.

## PUBLIC INPUT

Prior to the application submission, the applicant had conducted extensive community outreach.

After the submission, the applicant undertook public engagement in accordance with the District's *Non-Statutory Public Consultation for Development Applications Policy*. Public outreach included a two-week virtual Public Information Meeting (October 27 to

November 7, 2025) and an in-person Public Information Meeting held on October 29, 2025, at the Holiday Inn & Suites North Vancouver.

Public notification exceeded District requirements and included:

- Delivery of 1,613 invitation brochures to properties within 350 metres of the site, including residential, apartment, and business addresses;
- Two newspaper advertisements placed in the *North Shore News* (October 15 and 22, 2025);
- Installation of six on-site and nearby notification signs at key intersections surrounding the site;
- Advertisement of the meeting in Chemtrade's October 2025 community newsletter distributed to approximately 175 recipients; and
- Promotion of the Public Information Meeting through social media channels.

Virtual Public Information Meeting

The virtual PIM webpage was active for the full two-week period from October 27 to November 7, 2025 and included project information, presentation materials, and a Q&A/comment function. A total of five (5) public comments were received through the virtual platform.

Comments received during the virtual PIM reflected the following themes:

- Safety and land use compatibility concerns, particularly regarding the proximity of industrial operations to an area that has experienced increased residential and mixed-use development over time, and whether any residual risk is appropriate in the Maplewood area.

- Support letters received from elected officials at other levels of government and local business organizations, citing Chemtrade's long history of safe operations, its role in providing liquid chlorine for drinking water treatment, and the importance of retaining a major employer and industrial tax base in North Vancouver.

- Requests for continued oversight and high operational standards, including suggestions for third-party operational or safety reviews to ensure the facility continues to meet or exceed best practices.

In-Person Public Information Meeting

The in-person meeting was attended by 11 members of the public, as recorded on the sign-in sheets. The meeting included an open house, formal presentation, and facilitated dialogue, with District staff and a multidisciplinary project team present to answer questions and receive feedback.

Two written comment sheets were submitted at the meeting. One comment expressed support for the proposal and the quality of information provided, while the other requested additional study related to potential human health impacts.

In addition to the in-person submissions, two letters were received during the notification and comment period. Both letters expressed support for the proposal, including a letter from the Premier of British Columbia, recognizing the regional importance of Chemtrade's operations and the proposed safety improvements.

Response to Public Input

As stated earlier in this report, as part of the application, Chemtrade submitted a Facility Siting Study and Quantitative Risk Assessment (FSS/QRA), which was then peer reviewed by a District appointed third party consultant.

The review result shows that the FSS/QRA is technically sound and that, with the proposed upgrades and safety improvements, there is a significant reduction in risk related to the operation.

If the project proceeds and as more detailed construction drawings become available, it is possible that additional FSS/QRA study as well as additional peer review at future Development Permit or Building Permit stages may be required.

See Attachment 2 for public input summary including letters of support from the Premier and a local MLA.

## IMPLEMENTATION

Implementation of this project will require amendment to section 403A of the Zoning Bylaw, as well as issuance of a development permit, building permits, and registration of legal charges, in form and content acceptable to the municipal solicitor, to, among other things, secure appropriate commitments relating to the production, storage and distribution of chlorine, including, without limitation, commitments relating to the location on the site of such activities, maximum production and storage volumes, and compliance with all safety measures proposed in the FSS/QRA.

## CONCLUSION

The proposed site-specific text amendment rezoning for 100 Amherst Avenue follows a risk-informed approach to improve a long-standing local business with wide reaching economic impacts.

The application is consistent with the OCP and EZ-I zone, supports the District's economic and employment objectives, and enables facility upgrades intended to reduce overall risk.

The rezoning bylaw is ready for First Reading and referral to a Public Hearing.

## OPTIONS

The following options are available for Council's consideration:

1. Give Bylaw 8778, First reading and refer Bylaw 8778 to a Public Hearing (staff recommendation);

2. Refer the project back to staff for further consideration; or

3. Defeat the bylaw at First Reading.

Respectfully submitted,



Yan Zeng

## ATTACHMENTS

1. ~~Rezoning Bylaw 8778~~
2. ~~Summary of Public Input~~
3. ~~Chemtade's information package~~

**REVIEWED WITH:**

| | | | | | |
|---|---|---|---|---|---|
| ❑ Community Planning | _____ | ❑ Clerk's Office | _____ | External Agencies: | |
| ❑ Development Planning | _____ | ❑ Communications | _____ | ❑ Library Board | _____ |
| ❑ Development Engineering | _____ | ❑ Finance | _____ | ❑ NS Health | _____ |
| ❑ Utilities | _____ | ❑ Fire Services | _____ | ❑ RCMP | _____ |
| ❑ Engineering Operations | _____ | ❑ ITS | _____ | ❑ NVRC | _____ |
| ❑ Parks | _____ | ❑ Solicitor | _____ | ❑ Museum & Arch. | _____ |
| ❑ Environment | _____ | ❑ GIS | _____ | ❑ Other: | _____ |
| ❑ Facilities | _____ | ❑ Real Estate | _____ | | |
| ❑ Human Resources | _____ | ❑ Bylaw Services | _____ | | |
| ❑ Review and Compliance | _____ | ❑ Development Services | _____ | | |

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# PUBLIC HEARING

## 100 Amherst Avenue

## ZONING BYLAW AMENDMENTS

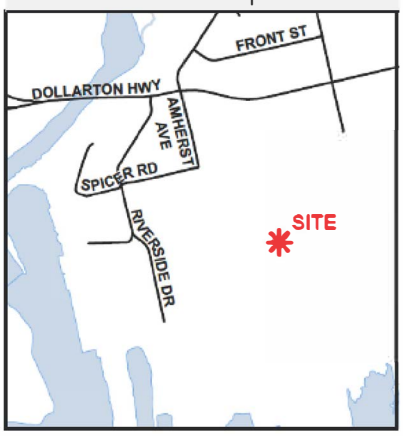
**When:** Tuesday, February 24, 2026, at 7pm

**Where:** Council Chambers, 355 West Queens Road, North Vancouver, BC

**What:** A Public Hearing for Bylaw 8778, proposed amendments to the Zoning Bylaw, to permit the manufacturing, processing, liquefaction, handling, storage, loading and shipping of chlorine, on the lands located at 100 Amherst Avenue.

**What Changes:** Bylaw 8778 proposes to amend the District's Zoning Bylaw, in general terms, by adding an exception to the prohibition of the manufacture of hazardous substances in all zones for the subject site to permit the manufacturing, processing, liquefaction, handling, storage, loading and shipping of chlorine.

**How:** The Public Hearing will be held in a hybrid format with a combination of in-person and electronic participation by some or all members of council, or by staff and the public. The public are invited to attend at the Council Chambers where they will be able to see and hear the entire proceedings. Those wishing to view or to participate in the meeting electronically may do so at https://dnvorg.zoom.us /j/64484156494 or by phone by dialling 1-778-907-2071 and entering webinar ID 644 8415 6494.




**When and How can I provide input?**
We welcome your input on February 24, 2026, at 7pm. You may sign up to speak at the hearing by contacting the Corporate Officer at signup@dnv.org prior to 3pm, Tuesday, February 24, 2026. You may also provide a written submission at any time prior to the close of the public hearing by sending it to the Corporate Officer at input@dnv.org or by mail to Corporate Officer, 355 West Queens Road, District of North Vancouver, BC, V7N 4N5. After the speakers list has been exhausted, there will be an opportunity for additional speakers who had not signed up in advance to make submissions. ***Please note that Council may not receive further submissions from the public concerning this bylaw after the conclusion of the public hearing.***

**Need more info?** Copies of the bylaw are available for review at 355 West Queens Road, North Vancouver, BC, between 8:00am and 4:30pm Monday to Friday (except holidays), starting February 10, 2026, or online at **DNV.org/agenda**

DISTRICT OF NORTH VANCOUVER



***Questions?***
*Afrooz Fallah, Planning Assistant*
*fallaha@dnv.org 604-990-3747*

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| AGENDA INFORMATION | | Dept. Manager | GM/ Director | CAO |
|---|---|---|---|---|
| ☑ Regular Meeting | Date: January 12, 2026 | | | |
| ❒ Other: | Date: | | | |

# The District of North Vancouver
# REPORT TO COUNCIL

December 15, 2025
Case: PLN2025-00042
File: 08.3060.20/042.25

**AUTHOR:** Yan Zeng, Manager of Development Planning

**SUBJECT:** **Bylaw 8778 - Text Amendment Rezoning – 100 Amherst Avenue (Chemtrade)**

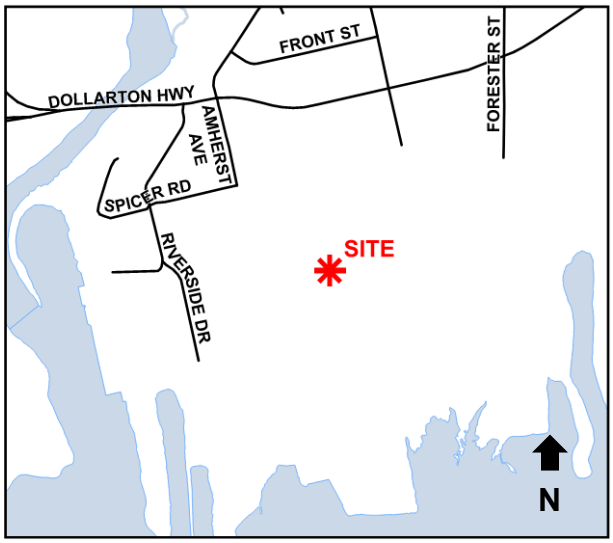
## RECOMMENDATION

THAT "District of North Vancouver Rezoning Bylaw 1462 (Bylaw 8778)", is given FIRST reading;

AND THAT "District of North Vancouver Rezoning Bylaw 1462 (Bylaw 8778)", is referred to a Public Hearing.

## REASON FOR REPORT

The manufacture of hazardous substances is generally prohibited in the District of North Vancouver. Chemtrade Logistics Inc. has applied for a site-specific text amendment to the Zoning Bylaw to permit the continued manufacture of liquid chlorine at 100 Amherst Avenue. The proposal includes safety-focused upgrades to an existing chlor-alkali facility.




## SUMMARY

The applicant, Chemtrade Logistics Inc., has applied to amend the District of North Vancouver Zoning Bylaw to permit the manufacturing of a hazardous substance (liquid chlorine) at 100 Amherst Avenue. The proposed amendment would enable capital improvements to the existing chlor-alkali facility, including removal of legacy infrastructure and construction of new enclosed processing components intended to reduce overall risk to the surrounding community.

The subject site is designated *Industrial* in the Official Community Plan (OCP) and zoned *Employment Zone Industrial (EZ-I)*. The applicant has indicated that the site has been used for liquid chlor-alkali manufacturing operations since 1957. However, even if the applicant were to prove that they should be allowed to continue to use the property as a "non-conforming use" in accordance with Section 530 of the *Local Government Act (LGA)*, the proposed development could not be authorized pursuant to Sections530 and 531 of the *LGA* unless Council approves a corresponding zoning bylaw amendment.

As part of the text amendment rezoning application, Chemtrade submitted a Facility Siting Study and Quantitative Risk Assessment (FSS/QRA) prepared by Baker Engineering and Risk Consultants Inc., which was independently peer-reviewed by Risktec Solutions (Canada) Ltd. on behalf of the District. The studies conclude that the proposed configuration meets accepted risk thresholds and, when implemented, would reduce overall risk relative to existing conditions.

In accordance with the *Local Government Act*, a public hearing for a proposed zoning bylaw amendment related to non-residential development is not required to be held if the bylaw amendment is consistent with the Official Community Plan (OCP). However, Council still has the authority to request that a Public Hearing be held. For this application, given the significant role Chemtrade has played as part of the industrial lands on the north shore, staff are recommending that a Public Hearing be held so that Mayor and Council may hear directly from the public.

## BACKGROUND

The applicant has indicated to the District that the Chemtrade chlor-alkali facility at 100 Amherst Avenue has been in continuous operation since 1957 and produces liquid chlorine primarily used for drinking water treatment across British Columbia and the Pacific Northwest. The facility currently employs approximately 118 full-time staff and produces a significant portion of the liquid chlorine supply used in Western Canada.

In 1984, the District's Zoning Bylaw was amended to include section 403A to prohibit the manufacture of hazardous substances, including compressed or liquefied gases. Site specific exemption to this prohibition would be considered on an individual basis.

Non-conforming uses may continue within the timeframe, extent, and degree authorized by the *Local Government Act*.

While Chemtrade had previously stated that they intend to close the operation on the adjacent lands administered by the Vancouver Fraser Port Authority by 2030, in October 2025, they had submitted a text amendment rezoning application to seek exemption to the section 403A prohibition. The purpose of the application is to allow the operation to continue into the future, while significantly upgrading and improving safety of the facility.

The work proposed by Chemtrade, including the demolition of the unused cell house, removal of on-site chlorine storage tanks, and construction of new enclosed railcar loading and condenser infrastructure are substantial and would trigger the requirement for a site-specific rezoning.

## DISCUSSION

### Site and Surrounding Area

The subject property is approximately 16.4 hectares (163,950 m²) in area and is located within the Maplewood industrial area. Surrounding land uses are predominantly industrial and include:

- North: Northwood Business Park (light industrial commercial uses)
- East: GFL recycling facility and approved HTEC hydrogen liquefaction facility
- South: Port of Vancouver industrial lands (Chemtrade lease area)
- West: Metro Vancouver recycling and Heidelberg Aggregates facilities

The site is well separated from established residential neighbourhoods north of Dollarton Highway.




### Project Description

The application consists of a site-specific text amendment rezoning to permit the continued manufacture of liquid chlorine at the existing Chemtrade chlor-alkali facility located at 100 Amherst Avenue, and to enable a series of safety-focused capital upgrades to the facility. No increase in production capacity is proposed.

Chemtrade has safely operated a chlor-alkali facility on the water lot adjacent to the subject site and currently produces liquid chlorine, sodium hydroxide (caustic soda), hydrochloric acid (muriatic acid), and green gaseous hydrogen through an electrochemical process using water, salt and electricity.

Liquid chlorine produced at the facility is primarily used for municipal drinking water treatment and represents approximately 40% of Canada's total liquid chlorine supply, including over 70% of the supply used in British Columbia and Alberta.

The proposed rezoning would facilitate implementation of Chemtrade's *Vision 2030* safety improvements, which are focused on reducing on-site chlorine storage,

modernizing loading infrastructure, and further lowering risk to the surrounding community, while maintaining existing production volumes.

Key components of the proposed project include:

- Demolition of the existing cell house structure that has not been in use since 2007;
- Elimination of on-site liquid chlorine storage tanks, transitioning the facility to a "produce-and-ship" model that significantly reduces chlorine inventory on site;
- Construction of a new enclosed railcar loading building, equipped with a sophisticated emergency ventilation and air-scrubbing system designed to capture and contain chlorine in the event of a release during railcar loading operations;
- Installation of a new pre-liquefier and four elevated chlorine condensers, located approximately 80 feet above grade to allow for gravity-fed loading of liquid chlorine into railcars, thereby reducing loading pressures and eliminating the need for pumps; and
- Installation of seismically activated safety shut-off valves and other seismic upgrades throughout the facility to enhance resilience during seismic events.

Following the proposed upgrades, chlorine gas produced in the existing electrolysis process would continue to flow through drying and distillation stages before entering the new pre-liquefier and condenser system. Liquid chlorine would then flow by gravity directly into railcars within the enclosed loading building, eliminating the existing 60-tonne bulk storage tank and associated pumping infrastructure currently located on Port of Vancouver lands.

No changes are proposed to upstream production processes or overall production quantities.

All unit operations prior to the pre-liquefier would remain unchanged. The proposed configuration is intended to reduce both the probability and potential consequences of a chlorine release, with technical studies indicating that risk contours would be reduced to near or at the facility property boundary.

Construction of the proposed improvements is anticipated to occur over approximately four years, coordinated with scheduled major maintenance outages planned for 2026 and 2028, to minimize operational disruption and community impacts.

## Policy Alignment

*Land Use Designation and Zoning*
The site is designated Industrial in the OCP and zoned Employment Zone – Industrial (EZ-I). The Chemtrade chlor-alkali facility has operated on the site since 1957 and is a

legal non-conforming use under Section 528 of the *LGA*. No amendment to OCP and EZ-I zone are required.

The proposed site-specific rezoning text amendment would allow the manufacture of liquid chlorine to be explicitly permitted, enabling safety-focused upgrades while maintaining the existing industrial land use.

The proposed amendment relies on a site-specific, risk-based review supported by independent third-party technical analysis. The QRA indicates that risk contours remain within accepted thresholds established by the Canadian Society for Chemical Engineering and that the proposed upgrades improve safety performance relative to the existing facility configuration.

*Economic Development Strategy*
The proposal aligns with the District's economic development objectives by supporting the retention and modernization of industrial employment lands. The Chemtrade facility provides approximately 118 full-time jobs currently and has made a significant contribution to the local and regional economy. The proposed upgrades support long-term industrial viability without increasing production volumes or land use intensity.

*Environmental and Climate Objectives*
The Chemtrade facility is one of the lowest-carbon chlor-alkali operations in North America, powered almost entirely by renewable hydroelectricity and self-produced hydrogen. The proposed upgrades do not increase output and are intended to reduce on-site chlorine storage and overall risk, while maintaining a minimal environmental footprint. The project supports broader climate and sustainability objectives at the municipal, regional, and provincial levels.

*Vancouver Fraser Port Authority*
A portion of the facility is located on lands leased from the Vancouver Fraser Port Authority, with a non-binding letter of intent in place to extend the lease through 2044. The proposal aligns with the Port Authority's mandate to support trade-enabling industrial uses while maintaining high standards of safety and environmental stewardship.

*Provincial, Federal, and Regional Policy*
The proposal aligns with provincial initiatives such as the BC Manufacturing Action Plan, StrongerBC, and CleanBC, which support modernization of industrial facilities and domestic supply chain resilience. Liquid chlorine is identified in federal drinking water guidelines as the primary disinfectant used by Canadian municipalities, and Chemtrade supplies a significant portion of the chlorine used in Metro Vancouver's drinking water treatment system, supporting regional public health infrastructure.

## Safety Study Review

Chemtrade submitted a Facility Siting Study and Quantitative Risk Assessment (FSS/QRA) prepared by Baker Engineering and Risk Consultants Inc. (dated September 24, 2025). The FSS/QRA evaluates the risks associated with the continued manufacture and handling of liquid chlorine at the existing facility, including the proposed safety upgrades.

The FSS/QRA indicates that the proposed safety upgrades reduce both the likelihood and potential consequences of credible chlorine release scenarios compared to existing conditions. Off-site risk was quantified using location-specific individual risk (LSIR) contours and are used to assess compliance with the Process Safety Management Division's (formerly Major Industrial Accidents Council of Canada, i.e. MIACC) risk-based land use planning guidelines. Based on the off-site receptors identified by Chemtrade, the resulting LSIR contours for the proposed facility are in compliance with the guidelines.

The LSIR contours are based on preliminary design information and modelling assumptions available at the time of the study and may be updated if the facility design or process conditions change, including those associated with chlorine railcar loading operations.




Figure 2. LSIR Contours for Current Facility with Proposed Design Changes

To ensure independent oversight, the District of North Vancouver retained Risktec Solutions (Canada) Ltd. to conduct a third-party peer review of the FSS/QRA. The review was commissioned by the District, with costs to be reimbursed by the applicant, and included the option for additional peer review at future Development Permit or Building Permit stages, if required.

In correspondence dated December 1, 2025, Risktec confirmed that no major issues were identified with the study approach, assumptions, or conclusions. Risktec's comments were limited to recommendations to improve clarity and presentation for readers. Overall, the peer review concluded that the FSS/QRA is technically sound and appropriate to support consideration of the rezoning application.

If the text amendment is successful, a covenant will be registered on title to ensure compliance with the proposed FSS/QRA, or as amended or updated from time to time.

### Parking Review

Staff have reviewed the Transportation Impact Assessment (TIA) submitted by the applicant and are satisfied that there would be no change from existing traffic flow and no additional negative impact is anticipated.

### Off-site Improvements

Subject to confirmation at subsequent stages of permitting, watermain upgrade will be required in order to maintain adequate waterflow for fire protection services.

### Development Permits

If the application proceeds to Development Permit stage, the following DPAs will be applicable:

- Form and Character of Industrial Development;
- Energy and Water Conservation and GHG Emission Reduction; and
- Protection from Hazardous Conditions: Creek Hazard.

## CONCURRENCE

The project has been reviewed by staff from Economic Development, Environment, Building and Permits, Legal, Parks, Engineering, Transportation, Community Planning, Fire Department & North Shore Emergency Management.

As the site is within 800 metres to a controlled-access intersection, approval by the Provincial Ministry of Transportation and Infrastructure will be required after third reading of the bylaw and prior to bylaw adoption.

## PUBLIC INPUT

Prior to the application submission, the applicant had conducted extensive community outreach.

After the submission, the applicant undertook public engagement in accordance with the District's *Non-Statutory Public Consultation for Development Applications Policy*. Public outreach included a two-week virtual Public Information Meeting (October 27 to

November 7, 2025) and an in-person Public Information Meeting held on October 29, 2025, at the Holiday Inn & Suites North Vancouver.

Public notification exceeded District requirements and included:

- Delivery of 1,613 invitation brochures to properties within 350 metres of the site, including residential, apartment, and business addresses;
- Two newspaper advertisements placed in the *North Shore News* (October 15 and 22, 2025);
- Installation of six on-site and nearby notification signs at key intersections surrounding the site;
- Advertisement of the meeting in Chemtrade's October 2025 community newsletter distributed to approximately 175 recipients; and
- Promotion of the Public Information Meeting through social media channels.

Virtual Public Information Meeting

The virtual PIM webpage was active for the full two-week period from October 27 to November 7, 2025 and included project information, presentation materials, and a Q&A/comment function. A total of five (5) public comments were received through the virtual platform.

Comments received during the virtual PIM reflected the following themes:

- Safety and land use compatibility concerns, particularly regarding the proximity of industrial operations to an area that has experienced increased residential and mixed-use development over time, and whether any residual risk is appropriate in the Maplewood area.

- Support letters received from elected officials at other levels of government and local business organizations, citing Chemtrade's long history of safe operations, its role in providing liquid chlorine for drinking water treatment, and the importance of retaining a major employer and industrial tax base in North Vancouver.

- Requests for continued oversight and high operational standards, including suggestions for third-party operational or safety reviews to ensure the facility continues to meet or exceed best practices.

In-Person Public Information Meeting

The in-person meeting was attended by 11 members of the public, as recorded on the sign-in sheets. The meeting included an open house, formal presentation, and facilitated dialogue, with District staff and a multidisciplinary project team present to answer questions and receive feedback.

Two written comment sheets were submitted at the meeting. One comment expressed support for the proposal and the quality of information provided, while the other requested additional study related to potential human health impacts.

In addition to the in-person submissions, two letters were received during the notification and comment period. Both letters expressed support for the proposal, including a letter from the Premier of British Columbia, recognizing the regional importance of Chemtrade's operations and the proposed safety improvements.

Response to Public Input

As stated earlier in this report, as part of the application, Chemtrade submitted a Facility Siting Study and Quantitative Risk Assessment (FSS/QRA), which was then peer reviewed by a District appointed third party consultant.

The review result shows that the FSS/QRA is technically sound and that, with the proposed upgrades and safety improvements, there is a significant reduction in risk related to the operation.

If the project proceeds and as more detailed construction drawings become available, it is possible that additional FSS/QRA study as well as additional peer review at future Development Permit or Building Permit stages may be required.

See Attachment 2 for public input summary including letters of support from the Premier and a local MLA.

## IMPLEMENTATION

Implementation of this project will require amendment to section 403A of the Zoning Bylaw, as well as issuance of a development permit, building permits, and registration of legal charges, in form and content acceptable to the municipal solicitor, to, among other things, secure appropriate commitments relating to the production, storage and distribution of chlorine, including, without limitation, commitments relating to the location on the site of such activities, maximum production and storage volumes, and compliance with all safety measures proposed in the FSS/QRA.

## CONCLUSION

The proposed site-specific text amendment rezoning for 100 Amherst Avenue follows a risk-informed approach to improve a long-standing local business with wide reaching economic impacts.

The application is consistent with the OCP and EZ-I zone, supports the District's economic and employment objectives, and enables facility upgrades intended to reduce overall risk.

The rezoning bylaw is ready for First Reading and referral to a Public Hearing.

## OPTIONS

The following options are available for Council's consideration:

1. Give Bylaw 8778, First reading and refer Bylaw 8778 to a Public Hearing (staff recommendation);

2. Refer the project back to staff for further consideration; or

3. Defeat the bylaw at First Reading.

Respectfully submitted,



Yan Zeng

## ATTACHMENTS

1. Rezoning Bylaw 8778
2. Summary of Public Input
3. Chemtrade's information package

**REVIEWED WITH:**

| | | | | | |
|---|---|---|---|---|---|
| ❑ Community Planning | | ❑ Clerk's Office | | External Agencies: | |
| ❑ Development Planning | | ❑ Communications | | ❑ Library Board | |
| ❑ Development Engineering | | ❑ Finance | | ❑ NS Health | |
| ❑ Utilities | | ❑ Fire Services | | ❑ RCMP | |
| ❑ Engineering Operations | | ❑ ITS | | ❑ NVRC | |
| ❑ Parks | | ❑ Solicitor | | ❑ Museum & Arch. | |
| ❑ Environment | | ❑ GIS | | ❑ Other: | |
| ❑ Facilities | | ❑ Real Estate | | | |
| ❑ Human Resources | | ❑ Bylaw Services | | | |
| ❑ Review and Compliance | | ❑ Development Services | | | |

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**The Corporation of the District of North Vancouver**

**Bylaw 8778**

A bylaw to amend District of North Vancouver Zoning Bylaw 3210, 1965

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The Council for The Corporation of the District of North Vancouver enacts as follows:

**1. Citation**

This bylaw may be cited as "District of North Vancouver Rezoning Bylaw 1462 (Bylaw 8778)".

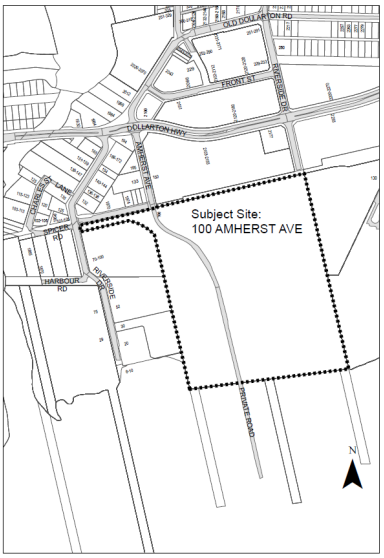
**2. Amendments**

2.1 District of North Vancouver Zoning Bylaw 3210, 1965 is amended as follows:

a) Section 403A Uses Prohibited in All Zones, (1) (f) "the manufacture of hazardous substances except:" is amended as follows:

After (i), add the following:

(ii) for the manufacturing, processing, liquefaction, handling, storage, loading and shipping of chlorine, on the lands located at 100 Amherst Avenue identified on the plan attached hereto.




**READ** a first time

**PUBLIC HEARING** held

**READ** a second time

**READ** a third time

Certified a true copy of “Rezoning Bylaw 1462 (Bylaw 8778)” as at Third Reading

_____
Deputy Corporate Officer

**ADOPTED**

_____ _____
Mayor Corporate Officer

**Public Input Summary and Supporting Materials**
**100 Amherst Avenue – Text Amendment Rezoning Application**

## 1. Overview

Public engagement was undertaken in accordance with, and exceeded, the District of North Vancouver's Non-Statutory Public Consultation for Development Applications Policy.

Engagement included:

- A two-week Virtual Public Information Meeting held from October 27 to November 7, 2025; and
- An in-person Public Information Meeting held on October 29, 2025, at the Holiday Inn & Suites North Vancouver.

## 2. Public Notification

Public notification exceeded the District of North Vancouver's requirements, as detailed in **Appendix A**, and included the following:

- Delivery of approximately 1,613 notification flyers to properties within a 375-metre radius of the site;
- Placement of two newspaper advertisements in the *North Shore News* on October 15 and October 22, 2025; and
- installation of six notification signs at key locations on and near the site.

## 3. Virtual Public Information Meeting

| | |
|---|---|
| **Event Date** | October 27 to November 7, 2025 (two-week duration) |
| **Website** | DNV.org/public-meeting<br>District of North Vancouver: 100 Amherst Avenue |
| **Comments** | 5 comments/questions received online |

**Summary of Virtual PIM Input**

A total of five (5) comments were received:

- Supportive Comments (4):
  These emphasized the importance of Chemtrade's operations for drinking water treatment, employment, and the local and regional economy. Some supportive comments also recommended continued oversight, including consideration of third-party operational or safety reviews to ensure alignment with best practices.
- Opposing Comment (1):
  One comment expressed concern regarding land use compatibility, citing the increase in residential development in the area over time and questioning whether any residual industrial risk is appropriate in the Maplewood area.

A complete record of all Virtual PIM comments is provided in **Appendix B**.

## 4. In-Person Public Information Meeting

The in-person Public Information Meeting was held on October 29, 2025 at the Holiday Inn & Suites North Vancouver and was attended by 11 members of the public.
The meeting included:

- An open house format;

- A formal presentation; and
- A facilitated dialogue involving District staff and Chemtrade's multidisciplinary project team.

Written Submissions
Two written comment sheets were submitted:

- One expressed support for the proposal and the clarity and quality of information provided.
- One requested additional study related to potential human health impacts.

Questions and comments raised during the meeting generally focused on:

- Historical safety performance and incident history;
- The nature and effectiveness of the proposed safety improvements;
- How risk is assessed and communicated; and
- The relationship between Chemtrade's operations and surrounding industrial and residential uses.

Further details are provided in the facilitator's report included as **Appendix C**.

**5. Written Correspondence and Letters of Support**
In addition to comments received through the Public Information Meetings, written correspondence was received, including letters of support from senior elected officials and community representatives.

Key themes raised in these letters included:

- The regional, national, and international importance of Chemtrade's operations for drinking water treatment;
- The facility's long history of safe operation and previous investments in modernization and safety;
- The role of the facility in supporting local employment, economic activity, and industrial land use; and
- Support for the proposed rezoning to enable further safety upgrades and long-term operational certainty.

Letters of support are included in **Appendix D.**

**Conclusion:**
Public input reflected a range of perspectives, including recognition of Chemtrade's role in drinking water treatment, employment, and the local and regional economy, as well as comments emphasizing the importance of ongoing regulatory oversight and high operational and safety standards. Other comments raised questions regarding land use compatibility, residual risk, and the need for additional analysis related to potential human health impacts.

**Attachments:**

- Appendix A: Notification Materials
- Appendix B: Virtual Public Information Meeting Comments
- Appendix C: Facilitator's Report – In-Person Public Information Meeting
- Appendix D: Letters of Support from Elected Officials

## Appendix A: Notification
## Newspaper Advertisement: North Shore News – October 15, 2025



# Development Proposal

**PUBLIC INFO MEETING**

**Wednesday, Oct. 29, 6:00–8:00pm**
700 Lillooet Road North (Holiday Inn & Suites North Vancouver)

Participate virtually Oct. 27–Nov. 7 at **DNV.org/public-meeting**

**PROPOSAL: 100 Amherst Avenue**

A site-specific text amendment to the Zoning Bylaw to permit the production of a hazardous substance (liquid chlorine), which will permit several on-site capital improvements aimed at reducing the overall risk associated with the proposed use to the surrounding community.







CHEMTRADE

**Contact:**
Amy Jonsson, Chemtrade Logistics Inc.
ajonsson@chemtradelogistics.com 236-808-7851

UPHILL BATTLE

# Grouse Grind closes for three weeks for annual maintenance

ABBY LUCIANO
*aluciano@nsnews.com*
*Local Journalism Initiative Reporter*

**If you're looking to take on the Grouse Grind this month, the trek might have to wait.**

The popular North Vancouver trail closed for annual trail maintenance starting Oct. 14. Metro Vancouver said in a media release that crews are working on the upper section of the trail to repair and replace steps and retaining walls to increase trail resilience.

"The Grouse Grind Trail must be closed during these upgrades because the terrain where the work is taking place is steep and hazardous and detours are not possible," the media release said.

Maintenance is needed each fall due to heavy traffic during the spring and summer months, Metro Vancouver said. Each year, the Grouse Grind attracts roughly 250,000 visitors.

The trail is expected to reopen on Nov. 8, if the weather permits. Visitors are urged to stay off the trail while it's closed, as ignoring the closure could result in serious injury and delay reopening, Metro Vancouver stated in the release.



The Grouse Grind will be closed until at least early November for trail maintenance and repair. PAUL MCGRATH / NSN

While the Grouse Grind will be closed, the BCMC Route and Baden Powell Trail will be open to visitors. For those wanting a route like the Grouse Grind, the BCMC Route is a good choice as it's similar in length and elevation and ends in the same location, Metro Vancouver said. The organization recommends people wear hiking shoes with good ankle support, carry lots of water and a snack, and an extra layer of clothing for warmth.




## Construction Progress at Woodfibre LNG

The Woodfibre LNG site is taking shape. On land, crews are progressing on foundations after placing the pipe rack modules. Offshore, piling has begun for the first permanent supports for the floating storage tank — a major step in marine construction.

All marine work is supported by marine mammal observers and hydroacoustic monitoring. These safeguards pause work if underwater sound nears regulatory limits or if marine mammals enter exclusion zones.

We're proud to be building the world's first net zero LNG export facility safely, responsibly, and under the oversight of the Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) — follow us to see how it's taking shape right here in Squamish.

woodfibreLNG.ca/news

## Newspaper Advertisement: North Shore News – October 22, 2025

north shore news nsnews.com WEDNESDAY, OCTOBER 22, 2025 | A19




North Vancouver Football Club's U17 boys team celebrates a bronze finish at nationals on Oct. 13 in Kamloops. NICOLE SKUGGEDAL

# First national medal for club

*Continued from A18*

loss, Robson said. However, the team was able to get back on track.

"I mentioned to them that … when you're driving a car, the windshield is much bigger than the rear view mirror, so we didn't want to look at what happened behind us. We want to look forward to tomorrow," he said. "Then the boys were able to refocus, and came out and played really well in the bronze medal game."

The victory was huge for the team, Robson said.

"It's the first time that a team from NVFC has won a medal at a national event. We're the first boys team to even go to a national event," he said.

Robson emphasized that the team's ability to recover from such a disappointing loss was remarkable.

"It's a testament to how great these kids are, that they're becoming fantastic young men," he said.

In the tournament overall, the team scored 12 goals and allowed just two in five games. Top scorers were Jacob Robson (four goals, one assist), Martin Mastschuch (two goals, two assists), Finn Montgomery (two goals, one assist) and Dexter White (two goals, one assist).

Robson highlighted the team's solid defensive play, which was led by centre backs Russell Ferguson and Jaiden Browning.

The coach also acknowledged the enthusiastic cheer squad, travelling with and rooting for the NVFC team. In one game, they were so rowdy that another team complained.

"The players from Ontario were actually complaining about our fan club," Robson said. "So it's a full team family win when the families are all there."

The sport is important to the players but also to the families, he said.

"I think we've made a lot of memories for a lot of people, which is the whole key thing."




**Development Proposal**

**PUBLIC INFO MEETING**

**Wednesday, Oct. 29, 6:00–8:00pm**
700 Lillooet Road North (Holiday Inn & Suites North Vancouver)

Participate virtually Oct. 27–Nov. 7 at **DNV.org/public-meeting**

**PROPOSAL: 100 Amherst Avenue**

A site-specific text amendment to the Zoning Bylaw to permit the production of a hazardous substance (liquid chlorine), which will permit several on-site capital improvements aimed at reducing the overall risk associated with the proposed use to the surrounding community.







CHEMTRADE

**Contact:**
Amy Jonsson, Chemtrade Logistics Inc.
ajonsson@chemtradelogistics.com 236-808-7851



## Location of notification signs




- One bi-directional sign at the intersection of Amherst Avenue and Spicer Road
- One uni-directional sign at the south terminus of Riverside Drive
- Two bi-directional signs at the intersection of Old Dollarton Highway and Amherst Avenue
- Two bi-directional signs at the intersection of Old Dollarton Highway and Riverside Drive.

**Image of notification signs**



# Notification flyer

### Virtual Public Information Meeting

A two-week public input opportunity will he held through the District of North Vancouver's platform. This is an opportunity for neighbours to share their feedback and ask questions to Chemtrade regarding its rezoning application for their chlor-alkali facility located at 100 Amherst Avenue, North Vancouver.

The virtual information meeting will run from Monday, October 27 through to Friday, November 7, 2025, and be available at www.DNV.org/public-meeting

### In-Person Information Meeting

Chemtrade will be hosting an in-person information meeting on Wednesday, October 29, 2025, from 6:00 p.m. to 8:00 p.m. at the Holiday Inn and Suites, North Vancouver, located at 700 Old Lillooet Rd, North Vancouver, BC.

The meeting will be an open house format with information stations and staff available for questions from 6:00 p.m. to 7:00 p.m., and a formal presentation and questions from the audience from 7:00 p.m. to 8:00 p.m.

### For more information, please contact:

***Amy Jonsson, Director, Corporate Communications***
Chemtrade Electrochem Ltd.
ajonsson@chemtradelogistics.com
236-808-7851

***Christopher Lumsden (he/they), Development Planner***
District of North Vancouver
lumsdenc@dnv.org
604-990-2411 Ext. 7204

### Notice for both an In-Person Information Meeting and a Virtual Public Information Meeting in Your Neighbourhood

Chemtrade is hosting both an in-person information session, as well as a virtual information meeting to present the rezoning application regarding its facility, located at 100 Amherst Avenue, North Vancouver.



*This information is being distributed to the owners and occupants within 375 metres of the proposed rezoning site in accordance with District of North Vancouver policy.*

### Virtual Information Meeting:

**October 27, 2025 – November 7, 2025**
Please visit www.DNV.org/public-meeting to access the virtual two-week meeting.

### In-Person Information Meeting:

**Wednesday, October 29, 2025**
**6:00 p.m. – 8:00 p.m. (presentation to begin at 7:00 p.m.)**
Holiday Inn and Suites, North Vancouver, located at 700 Old Lillooet Rd, North Vancouver, BC.

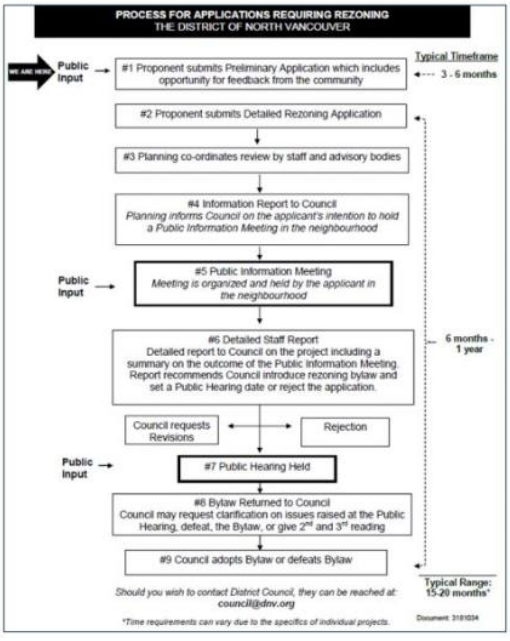
### The Proposal:

Chemtrade's facility in North Vancouver produces up to 70 per cent of the liquid chlorine used to treat drinking water in BC and Alberta. This equates to 40 per cent of available liquid chlorine in Canada.

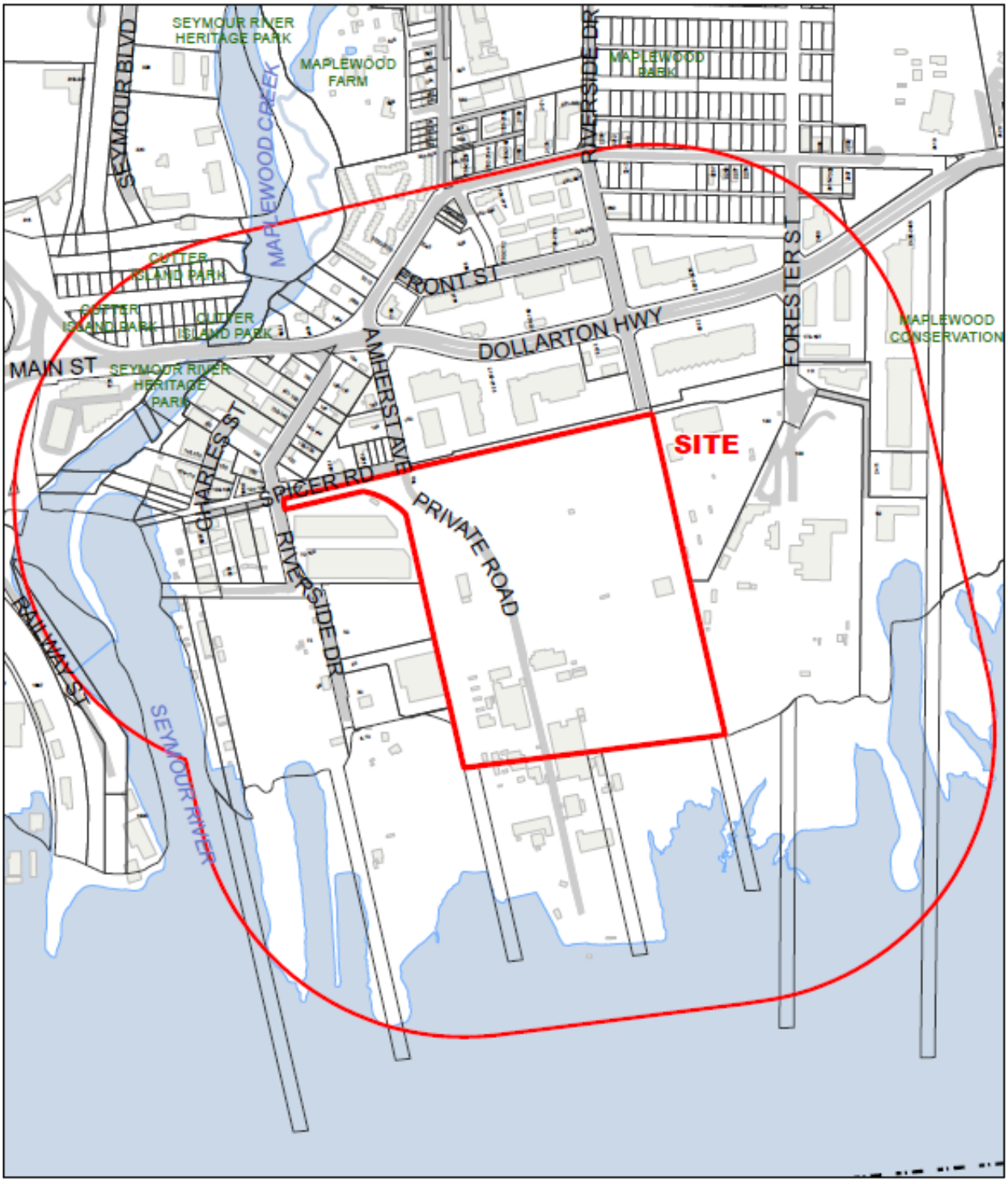
Chemtrade has proposed several major capital improvements aimed at increasing safety and reducing risk for the community. In order to move forward with these projects and to have the production of liquid chlorine listed as an allowable activity on its land, Chemtrade needs the District of Vancouver's approval to amend its prohibited uses regulations in relation to this property. All other zoning regulations related to this property will remain unchanged.




*Proposed safety improvement projects, aimed at improving safety and reducing risk to the community to at or near the property line*



## Map of notification area (375m radius)




**100 Amherst Ave-375M**

**375m BUFFER MAP**

N

## Appendix B: Virtual PIM Comments

**Virtual PIM comments** – Five comments were received via the virtual PIM

- Virtual PIM Comment #1 - 2025-10-28 08:27:18
    - Hello: First, I am in favor of the proposal to allow Chem Trade to continue to operate in NV. We need industry in BC and companies like CT are vital to the economic success of BC. That said, during my work I had responsibilities for assessing risks at petrochemical facilities around the world and saw many facilities. I have had 2 tours of CT and suggest a condition of approval be that they CT commission a 3rd party operations review and develop a plan to meet world class standards.

- Virtual PIM Comment #2 - 2025-10-28 08:32:45
    - Further to my previous comment, I observed during the 2 tours that CT operates a good plant, but it is not to the standards seen in the EU. Specifically, I observed many decommissioned items that had not been dismantled and removed. These can cause operational and safety issues as well as being unsightly. In addition to the decommissioned items, corrosion seemed to be an issue in several areas of the plant, and these should be reviewed. An operations review would address these and other items.

- Virtual PIM Comment #3 – 2025-10-31 10:50:07
    - The North Van Chamber supports this application. Chemtrade's application ensures North Van remains home to this major employer and a critical regional supplier for water treatment. Their investment will not only secure over 120 well paid local skilled jobs and the connected local supply chain of local businesses but will help sustain the local tax base that contributes to community infrastructure in North Van.

- Virtual PIM Comment #4 – 2025-11-07 11:25:13
    - Since 1957, the Chemtrade facility in North Vancouver has been safely producing the liquid chlorine that communities in BC and beyond rely on for their supply of clean drinking water. As the MLA for North Vancouver-Seymour, I encourage the District of North Vancouver to approve this rezoning application so that Chemtrade can move forward with additional safety improvements in a timely manner, securing the future of safe drinking water in Canada and the safety of North Vancouver residents.

- Virtual PIM Comment #5 – 2025-11-07 07:03:05
    - This region is no longer solely industrial. There are high density buildings and more residential buildings being developed. If there is even a slight risk of exposure that cannot be entirely mitigated or prevention set in place, then I strongly believe it should not be taking place. The area has changed over the years and is less and less industrial. This type of risk/exposure should not be considered in that region and should be relocating to a solely industry related region instead.

# 100 Amherst Avenue Development Application

# Public Information Meeting Summary Report

**Event Date**: October 29, 2025
**Time**: 6pm – 8pm
**Location**: Holiday Inn, 700 Lillooet Road, District of North Vancouver
**Attendance**: 11 members of the public signed in.
**Comments**: 2 comments sheets and two letters: 3 in favour and 1 wanting additional study.

**Meeting Purpose:**
1) To present development application materials to neighbours
2) To provide an opportunity for neighbours to ask questions about the development
3) To provide an opportunity for neighbours to comment on the proposal.

**Notification:**

Invitation Brochures

Invitations were delivered to 1,613 addresses within 350m of the site, exceeding the 100m notification radius that is a standard District of North Vancouver requirement for most projects. Appendix A includes a copy of the invitation.

The addresses which were notified included the following:

| | |
|---|---|
| Houses | 1,252 |
| Apartments | 164 |
| Businesses | 197 |
| Total | 1,613 |

Newspaper Ad

Two newspaper ads were placed in the North Shore News: one on October 15, and the other on October 22, 2025. Copies of both of the ads are shown in Appendix A.

Signs Posted On Site

Chemtrade installed six notification signs on and near their site:

- One bi-directional sign at the intersection of Amherst Avenue and Spicer Road
- One uni-directional sign at the south terminus of Riverside Drive
- Two bi-directional signs at the intersection of Old Dollarton Highway and Amherst Avenue
- Two bi-directional signs at the intersection of Old Dollarton Highway and Riverside Drive.

A map of the sign locations and an image of the content is provided in Appendix A.

Newsletter Distribution
Chemtrade advertised the Public Information Meeting in the October 2025 edition of their newsletter, which was distributed to 175 people. The newsletter was also available on their web site. A copy of the newsletter with the ad is provided in Appendix A.

Social Media
Chemtrade advertised the Public Information via social media during the month of October, exceeding District notification requirements. A screenshot of the ad is provided in Appendix A.

**Attendance:**
Eleven members of the public signed in for the meeting.

A copy of the sign-in sheets is included in Appendix B.

The following municipal representatives and project team members were in attendance:

District of North Vancouver:
- Christopher Lumsden, Development Planner

Project Team members:
- Alan Robinson, Group Vice President, Commercial
- Dale Bossons, Vice President, Manufacturing, Electrochem
- Raman Batra, Senior Director, Electrochem
- Alvin Loh, Plant Manager, North Vancouver
- Toofan Ostovar, EHS Manager
- Michelle Campbell, Environmental Specialist
- Blair Hetherington, Emergency Response Systems Manager
- Fareed Ebrahim, Senior Technical Advisor, Process Safety
- Bryan Ritchey, Senior Electrochem Technical Advisor
- Drew Somerville, Project Manager, Electrochem
- Amy Jonsson, Director, Corporate Communications
- Kris Petterson, Production Manager

Facilitator:
- Steven Petersson, Petersson Planning Consulting

**Meeting Format:**
The meeting featured an Open House, Presentation, and Facilitated Dialogue to provide members of the public a variety of ways to participate in the process. The entire meeting ran between 6pm and 8pm.

The Open House portion of the meeting ran from 6pm to 7pm. Open House participants were able to ask questions from the many project team members to learn more about production, planned safety improvements, and the facility.

During the second hour, Alan Robinson and Dale Bossons presented project information to the participants. The presentation included information about the development application, the history of the company, the importance of their product to provide a safe water supply, and technical information to help the public understand the safety improvements that would result if the project is approved.

After the presentation, Steven Petersson facilitated a dialogue with the public and documented all questions and comments. Every participant who wished to speak had opportunity to do so.

**Comment Sheet and Correspondence Summary**

Participants were encouraged to submit written comments for inclusion in this report. Participants could submit their comments during a two-week comment period, which ended on November 10, 2025. Two chose to submit comment sheets: one expressed support for the proposal, and the other advocated additional study.

Two letters were received during the notification and comment period, including a letter from Premier Eby. Both letters were in support of the project.

Redacted copies of each written submission are included in Appendix C.

**Discussion Summary**

Below is a summary of the facilitated dialogue. Questions and answers have been numbered to help follow the flow of the conversation. Q is for Questions, C is for Comments, and A is for Answers.

**Q1**: Has Chlorine gas been unintentionally released from bulk storage since 2010?

> **A1:** There have been no significant unintentional releases of chlorine gas since 2010. There have been minor releases that required precautions, but no incidents. The proposed new safety improvements will significantly decrease risk and increase safety.

**C2**: I don't think a $10^{-6}$ probability of being struck by lightning is a good comparison to represent the risk of harm on this site.

**Q3**: An adjacent industrial site stores hydrogen in a tank. Has Chemtrade analyzed the risk from neighbouring industrial activity?

> **A3**: Chemtrade works with neighbours to understand the impacts of their activities. In this example, Chemtrade currently purchases hydrogen from a neighbouring site. Chemtrade has reviewed the quantitative risk curves of the proposed HTEC hydrogen project, and Chemtrade will be not be at risk from the neighbouring hydrogen storage because of the risk radius.

**Q4**: What is a "minor exposure" or upset? How large were past chlorine leaks?

> **A4**: The leaks were minor because they were measured in kilograms, rather than tons, and the impact did not leave the site. Workers who received minor exposure were treated with no long-term health impacts. There has never been a fatality.

**C5**: Chlorine gas in the air has a much different risk of health impact than chlorine in water. Chlorine can be safely used to purify water for drinking.

**Conclusion**
The purpose of this Public Information Meeting was to present project information to neighbours, provide the public an opportunity to ask questions, and provide an opportunity for public comment.

Over 1,600 invitations were sent to all owners and tenants within 375m of the site, exceeding the 100m notification radius the District typically requires. Two newspaper ads were placed in the North Shore News. Six notification signs were posted at and near the subject site. In addition to District requirements, Chemtrade also advertised the Public Information meeting in the October 2025 edition of their newsletter, which was distributed to 175 people. They also advertised the Public Information Meeting via social media during October 2025.

The public could participate in this process in five ways:

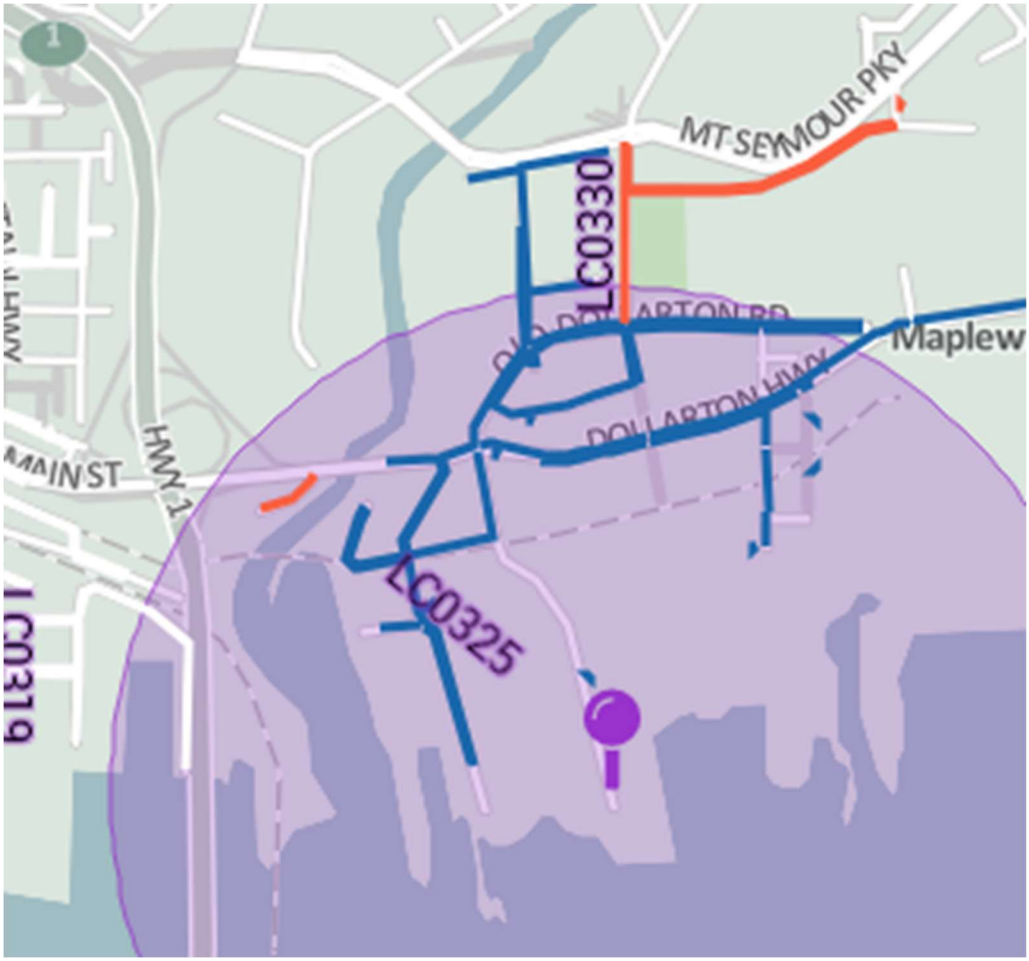
- browsing boards
- talking to the project team and municipal Development Planner
- listening to a presentation
- participating in a facilitated dialogue
- submitting written comments.

Eleven participants signed in and participated in the meeting. Two comment sheets and two letters were submitted during the notification period: three expressed support, and one advocated for additional study.

The meeting length, format, and project team presence was sufficient to provide all participants an opportunity to learn more, ask questions, and provide comments.

**Appendix A: Notification**

Notification Area:



## Notification Letter

### Virtual Public Information Meeting

A two-week public input opportunity will he held through the District of North Vancouver's platform. This is an opportunity for neighbours to share their feedback and ask questions to Chemtrade regarding its rezoning application for their chlor-alkali facility located at 100 Amherst Avenue, North Vancouver.

The virtual information meeting will run from Monday, October 27 through to Friday, November 7, 2025, and be available at www.DNV.org/public-meeting

### In-Person Information Meeting

Chemtrade will be hosting an in-person information meeting on Wednesday, October 29, 2025, from 6:00 p.m. to 8:00 p.m. at the Holiday Inn and Suites, North Vancouver, located at 700 Old Lillooet Rd, North Vancouver, BC.

The meeting will be an open house format with information stations and staff available for questions from 6:00 p.m. to 7:00 p.m., and a formal presentation and questions from the audience from 7:00 p.m. to 8:00 p.m.

### For more information, please contact:

***Amy Jonsson, Director, Corporate Communications***
Chemtrade Electrochem Ltd.
ajonsson@chemtradelogistics.com
236-808-7851

***Christopher Lumsden (he/they), Development Planner***
District of North Vancouver
lumsdenc@dnv.org
604-990-2411 Ext. 7204

### Notice for both an In-Person Information Meeting and a Virtual Public Information Meeting in Your Neighbourhood

Chemtrade is hosting both an in-person information session, as well as a virtual information meeting to present the rezoning application regarding its facility, located at 100 Amherst Avenue, North Vancouver.




*This information is being distributed to the owners and occupants within 100 metres of the proposed rezoning site in accordance with District of North Vancouver policy.*

### Virtual Information Meeting:

**October 27, 2025 – November 7, 2025**
Please visit www.DNV.org/public-meeting to access the virtual two-week meeting.

### In-Person Information Meeting:

**Wednesday, October 29, 2025**
**6:00 p.m. – 8:00 p.m. (presentation to begin at 7:00 p.m.)**
Holiday Inn and Suites, North Vancouver, located at 700 Old Lillooet Rd, North Vancouver, BC.

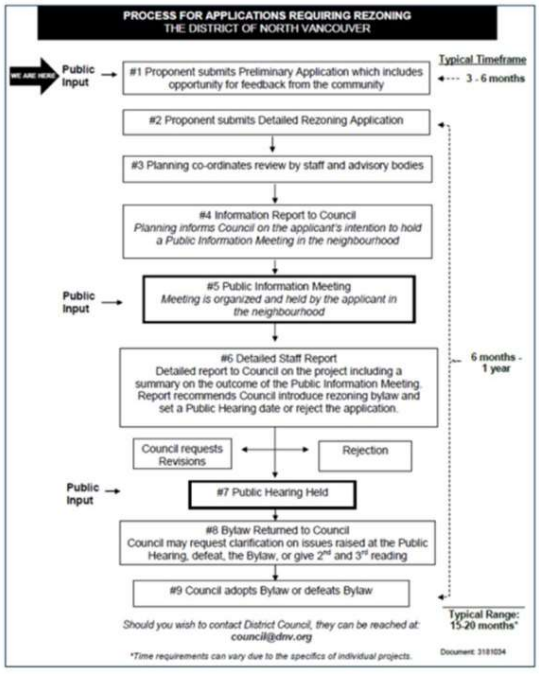
### The Proposal:

Chemtrade's facility in North Vancouver produces up to 70 per cent of the liquid chlorine used to treat drinking water in BC and Alberta. This equates to 40 per cent of available liquid chlorine in Canada.

Chemtrade has proposed several major capital improvements aimed at increasing safety and reducing risk for the community. In order to move forward with these projects and to have the production of liquid chlorine listed as an allowable activity on its land, Chemtrade needs the District of Vancouver's approval to amend its prohibited uses regulations in relation to this property. All other zoning regulations related to this property will remain unchanged.




*Proposed safety improvement projects, aimed at improving safety and reducing risk to the community to at or near the property line*



Newspaper Ads: October 15 and 22, 2025



# Development Proposal

**PUBLIC INFO MEETING**

**Wednesday, Oct. 29, 6:00–8:00pm**
700 Lillooet Road North (Holiday Inn & Suites North Vancouver)

Participate virtually Oct. 27–Nov. 7 at **DNV.org/public-meeting**

**PROPOSAL: 100 Amherst Avenue**

A site-specific text amendment to the Zoning Bylaw to permit the production of a hazardous substance (liquid chlorine), which will permit several on-site capital improvements aimed at reducing the overall risk associated with the proposed use to the surrounding community.







CHEMTRADE

**Contact:**
Amy Jonsson, Chemtrade Logistics Inc.
ajonsson@chemtradelogistics.com 236-808-7851

UPHILL BATTLE

# Grouse Grind closes for three weeks for annual maintenance

ABBY LUCIANO
*aluciano@nsnews.com*
*Local Journalism Initiative Reporter*

**If you're looking to take on the Grouse Grind this month, the trek might have to wait.**

The popular North Vancouver trail closed for annual trail maintenance starting Oct. 14. Metro Vancouver said in a media release that crews are working on the upper section of the trail to repair and replace steps and retaining walls to increase trail resilience.

"The Grouse Grind Trail must be closed during these upgrades because the terrain where the work is taking place is steep and hazardous and detours are not possible," the media release said.

Maintenance is needed each fall due to heavy traffic during the spring and summer months, Metro Vancouver said. Each year, the Grouse Grind attracts roughly 250,000 visitors.

The trail is expected to reopen on Nov. 8, if the weather permits. Visitors are urged to stay off the trail while it's closed, as ignoring the closure could result in serious injury and delay reopening, Metro Vancouver stated in the release.



The Grouse Grind will be closed until at least early November for trail maintenance and repair. PAUL MCGRATH / NSN

While the Grouse Grind will be closed, the BCMC Route and Baden Powell Trail will be open to visitors. For those wanting a route like the Grouse Grind, the BCMC Route is a good choice as it's similar in length and elevation and ends in the same location, Metro Vancouver said. The organization recommends people wear hiking shoes with good ankle support, carry lots of water and a snack, and an extra layer of clothing for warmth.




## Construction Progress at Woodfibre LNG

The Woodfibre LNG site is taking shape. On land, crews are progressing on foundations after placing the pipe rack modules. Offshore, piling has begun for the first permanent supports for the floating storage tank — a major step in marine construction.

All marine work is supported by marine mammal observers and hydroacoustic monitoring. These safeguards pause work if underwater sound nears regulatory limits or if marine mammals enter exclusion zones.

We're proud to be building the world's first net zero LNG export facility safely, responsibly, and under the oversight of the Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) — follow us to see how it's taking shape right here in Squamish.

woodfibrelng.ca/news




North Vancouver Football Club's U17 boys team celebrates a bronze finish at nationals on Oct. 13 in Kamloops. NICOLE SKUGGEDAL

# First national medal for club

*Continued from A18*

loss, Robson said. However, the team was able to get back on track.

"I mentioned to them that … when you're driving a car, the windshield is much bigger than the rear view mirror, so we didn't want to look at what happened behind us. We want to look forward to tomorrow," he said. "Then the boys were able to refocus, and came out and played really well in the bronze medal game."

The victory was huge for the team, Robson said.

"It's the first time that a team from NVFC has won a medal at a national event. We're the first boys team to even go to a national event," he said.

Robson emphasized that the team's ability to recover from such a disappointing loss was remarkable.

"It's a testament to how great these kids are, that they're becoming fantastic young men," he said.

In the tournament overall, the team scored 12 goals and allowed just two in five games. Top scorers were Jacob Robson (four goals, one assist), Martin Mastschuch (two goals, two assists), Finn Montgomery (two goals, one assist) and Dexter White (two goals, one assist).

Robson highlighted the team's solid defensive play, which was led by centre backs Russell Ferguson and Jaiden Browning.

The coach also acknowledged the enthusiastic cheer squad, travelling with and rooting for the NVFC team. In one game, they were so rowdy that another team complained.

"The players from Ontario were actually complaining about our fan club," Robson said. "So it's a full team family win when the families are all there."

The sport is important to the players but also to the families, he said.

"I think we've made a lot of memories for a lot of people, which is the whole key thing."





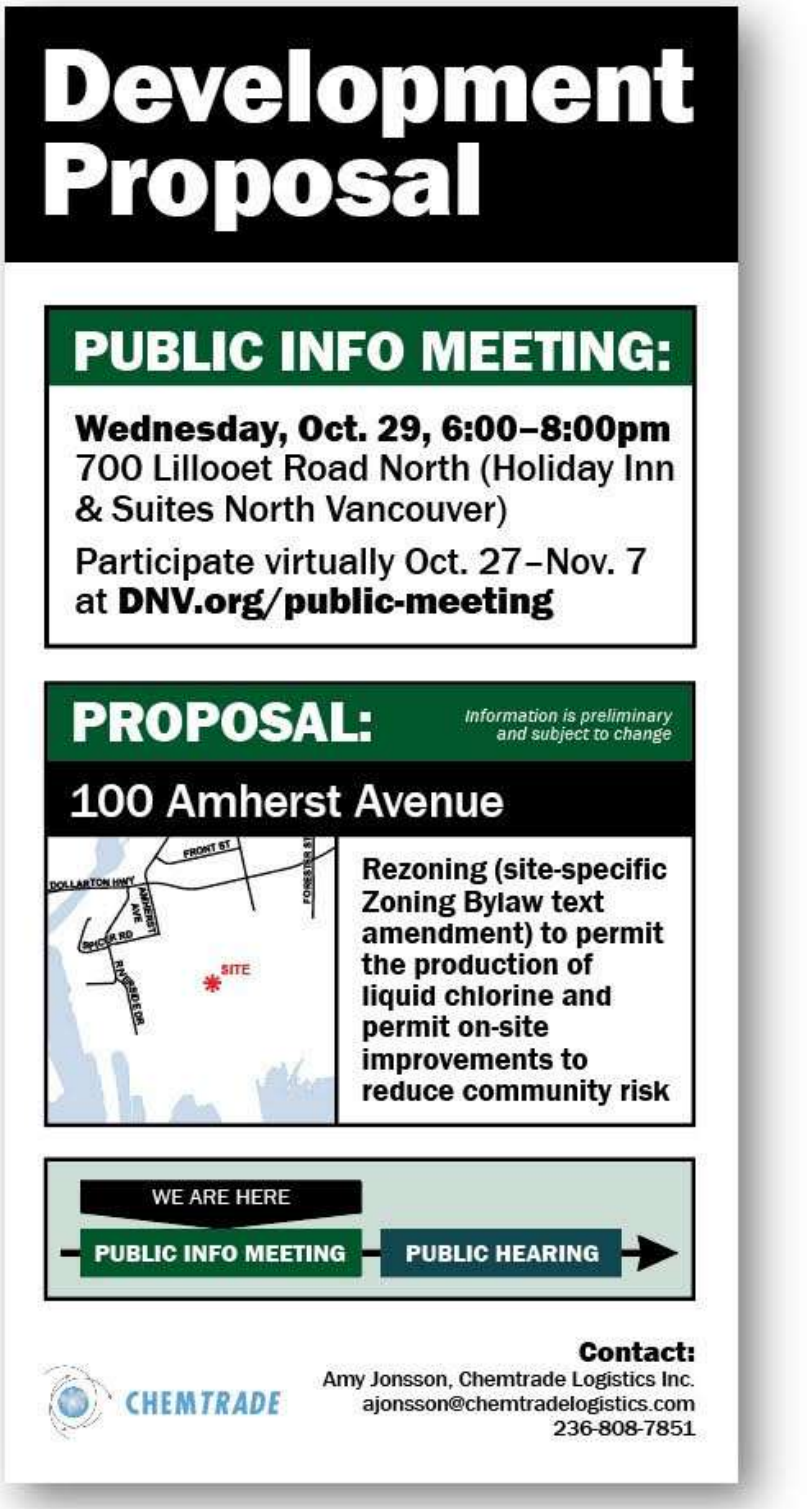




Notification Sign Locations



Notification Sign Content



Notification in October 2025 Chemtrade Newsletter

## Chemtrade North Vancouver Community Update

*October 2025 – Special Update* *Issue 9*

***Knowing the significant role that Chemtrade liquid chlorine plays in supporting safe drinking water for millions of Canadians, and the growing uncertainty in North American trade relationships and uncertain geopolitical conditions, we are having conversations regarding how to maintain our potential future operations and secure our Canadian supply chain of this critical product.***

### About Chemtrade

Chemtrade's North Vancouver chlor-alkali facility is one of Canada's largest providers of liquid chlorine – accounting for 40 per cent of all liquid chlorine available in Canada. Regionally, this equates to over 70 per cent of the liquid chlorine available in BC and Alberta. **Why is this important?** A study conducted by Statistics Canada in 2015 found that 96 per cent of Canadian communities relied on chlorine to treat their municipal water supply, which supplies over 30.7 million Canadians.

**In this issue:**

- *District of North Vancouver rezoning application update*
- *Opportunities to engage*
- *Ways to stay in touch*

### District of North Vancouver Rezoning Application Update

On September 25, we submitted our full rezoning application, to request that the production of liquid chlorine be listed as an allowable activity on our property (100 Amherst Avenue, North Vancouver). We are taking this step so that we can apply for development permits from the District for our planned safety improvement projects, which will substantially reduce potential risk for the community – see below enhanced photo which depicts the planned railcar loading enclosure, condenser tower, and tank farm for the air scrubbing equipment.

#### *What now?*

The District of North Vancouver has a formal process for the rezoning process, which includes several opportunities for the public to engage.

**As part of the process, we will be hosting two Public Information Meeting (PIM) opportunities in the coming weeks, and then following that, there will be a Public Hearing (date to be confirmed).**




CHEMTRADE

*Page **1** of **2***

## Chemtrade North Vancouver Community Update

*October 2025 – Special Update* *Issue 9*

### Virtual Public Information Meeting (PIM)

A two-week public input opportunity will be held through the District of North Vancouver's platform. This is an opportunity for neighbours to share their feedback and ask questions to Chemtrade regarding its rezoning application for their chlor-alkali facility located at 100 Amherst Avenue, North Vancouver. **The virtual PIM will run from Monday, October 27 through to Friday, November 7, 2025, and be available at www.DNV.org/public-meeting**

### In-Person Public Information Meeting (PIM)

Chemtrade will be hosting an in-person PIM on **Wednesday, October 29, 2025, from 6:00 p.m. to 8:00 p.m. at the Holiday Inn and Suites, North Vancouver**, located at 700 Old Lillooet Rd, North Vancouver, BC.

The meeting will be an open house format with information stations and staff available for questions from 6:00 p.m. to 7:00 p.m., and a formal presentation and questions from the audience from 7:00 p.m. to 8:00 p.m.

### For more information on either meeting, please contact:

**Amy Jonsson**
Director, Corporate Communications
Chemtrade Electrochem Ltd.
ajonsson@chemtradelogistics.com
236-808-7851

**Christopher Lumsden (he/they)**
Development Planner
District of North Vancouver
lumsdenc@dnv.org
604-990-2411 Ext. 7204







***Above left:*** *QRA cures developed in 2006 which reflect today's operations*
***Above right:*** *Updated final QRA curves showing projected risk following completion of proposed safety projects and reduction of on-site chlorine storage*

### Ways to contact us

- **Visit www.AskChemtrade.ca** to submit questions, find information, and send a message
- Reach out directly to Amy Jonsson at ajonsson@chemtradelogistics.com
- Visit our Facebook page (https://www.facebook.com/chemtrade) and send us a message.

CHEMTRADE

*Page **2** of **2***

Social Media Notification



**Appendix B – Sign-In Sheets:**

100 Amherst Avenue (Chemtrade)
**Public Information Meeting – October 29, 2025**

**SIGN IN SHEET**

| Name | Address | Email (optional) |
|---|---|---|
| [redacted] | [redacted] | [redacted] |
| | | |
| | | |

The personal information collected on this form is done so pursuant to the *Community Charter* and/or the Local Government Act and in accordance with the *Freedom of Information and Protection of Privacy Act*. The personal information collected herein will be used only for the purpose of this public consultation process unless its release is authorized by its owner or is compelled by a Court or an agent duly authorized under another Act.

Further information may be obtained by speaking with
The District of North Vancouver's Manager of Administrative Services at 604-990-2207.

Document:

100 Amherst Avenue (Chemtrade)
**Public Information Meeting – October 29, 2025**

## SIGN IN SHEET

| Name | Address | Email (optional) |
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| [redacted] | | |
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The District of North Vancouver's Manager of Administrative Services at 604-990-2207.

Document:

**Appendix C – Public Comments: Comment Sheets & Letters:**

**PUBLIC INFORMATION MEETING – COMMENT SHEET**
*The District of North Vancouver*

**APPLICANT:** Chemtrade
**SITE ADDRESS:** 100 Amherst Avenue
**PROPOSAL:** Rezoning (*amendment to Section 403A of the Zoning Bylaw*) to permit the continued production of a hazardous substance (liquid chlorine) at an existing facility on the subject site. The proposed rezoning would allow for the completion of several capital improvements aimed at improving overall site safety.

*To help us determine neighbourhood opinions, please provide us with any input you have on this project (feel free to attach additional sheets):*

A Human Health Risk Assessment has NOT been done. Most major projects require a HHRI and because this facility was built 70 years ago, one has never been done. Acute + chronic Health impact should be assessed. as well as community health impact

Your Name [redacted] Street Address [redacted]

Please check this box if you desire your contact information to be available to the applicant: ☑

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**Please return by mail or email by November 10, 2025 to:**
DNV Development Planner: Christopher Lumsden
Phone: 604-990-2411 Ext. 7204
Email: lumsdenc@dnv.org
District of North Vancouver – Development Planning Department
355 West Queens Road, North Vancouver, BC V7N 4N5

Document:

**PUBLIC INFORMATION MEETING – COMMENT SHEET**
*The District of North Vancouver*

**APPLICANT:** Chemtrade
**SITE ADDRESS:** 100 Amherst Avenue
**PROPOSAL:** Rezoning (*amendment to Section 403A of the Zoning Bylaw*) to permit the continued production of a hazardous substance (liquid chlorine) at an existing facility on the subject site. The proposed rezoning would allow for the completion of several capital improvements aimed at improving overall site safety.

*To help us determine neighbourhood opinions, please provide us with any input you have on this project (feel free to attach additional sheets):*

The precautionary efforts of chemtrade, going beyond the line of duty, appreciated. That means, providing Western pacific with the highly-in-demand liquid chlorine in a self-sufficient & safe manner.
Thanks for well-supported presentation, and honest accurate answers to the public questions.
Nina Yamane, SCD,

Your Name [redacted] Street Address [redacted]

Please check this box if you desire your contact information to be available to the applicant: ☐

The personal information collected on this form is done so pursuant to the *Community Charter* and/or the Local Government Act and in accordance with the *Freedom of Information and Protection of Privacy Act*. The personal information collected herein will be used only for the purpose of this public consultation process unless its release is authorized by its owner or is compelled by a Court or an agent duly authorized under another Act. Further information may be obtained by speaking with The District of North Vancouver's Manager of Administrative Services at 604-990-2207.

**Please return by mail or email by November 10, 2025 to:**
DNV Development Planner: Christopher Lumsden
Phone: 604-990-2411 Ext. 7204
Email: lumsdenc@dnv.org
District of North Vancouver – Development Planning Department
355 West Queens Road, North Vancouver, BC V7N 4N5

Document:



## A MESSAGE *from* PREMIER DAVID EBY

As Premier of British Columbia I extend greetings to everyone attending today's Public Information Meeting for Chemtrade's North Vancouver chlor-alkali facility.

Operating since 1957, this facility is the largest producer of liquid chlorine in Canada, supplying almost 70 per cent of liquid chlorine used in Western Canada, 40 per cent used across the country, and up to 60 per cent used in the Western United States. Liquid chlorine plays a significant role in the treatment of municipal water supplies and holds potential to support the development of clean fuels that support BC's decarbonization efforts.

In 2010, $500 million was invested to modernize this facility's operations and improve safety, ensuring the continued availability of this critical product. Through the proposed rezoning, Chemtrade can ensure business continuity, functioning in its vital role of securing safe drinking water for millions of people across Canada and the US.

I would like to recognize everyone who came out today to lend their voices to this matter. Public engagement ensures that projects like this can move forward with community support.

**Honourable David Eby, KC**
*Premier of British Columbia*

**From:** [redacted]
**Sent:** Tuesday, October 28, 2025 12:56 PM
**To:** council@dnv.org
**Cc:** Jonsson, Amy [redacted]
**Subject:** CHEMTRADE ...

An important company in our community, economically and for the health and safety of residents. I fully support them.

[redacted], cnv Resident

Born 'n Raised in North Vancouver

LEGISLATIVE ASSEMBLY
of BRITISH COLUMBIA



September 4th, 2025

Mayor and Council
District of North Vancouver
355 West Queens Road
North Vancouver, BC V7N 4N5
Sent via email: council@dnv.ca

Dear Mayor and Council of the District of North Vancouver,

I am writing to express my support for the rezoning required for the continued operation of Chemtrade's North Vancouver chlor-alkali facility, located at 110 Amherst Avenue, North Vancouver, BC.

As the main provider of liquid chlorine for water purification in Western Canada, Chemtrade has consistently demonstrated their commitment to ensuring a clean supply of drinking water on the North Shore and beyond.

Now more than ever, it's important that British Columbians can rely on a liquid chlorine supply from within our borders. Chemtrade's North Vancouver facility produces almost 70 per cent of the liquid chlorine used in Western Canada, and 40 per cent of the chlorine used across the country. Chemtrade's continued operations in North Vancouver will guarantee the security of our own chlorine supply here in BC.

I have had the opportunity to visit the facility and to meet with the company multiple times. They keep the safety of their workers, the community, and the ecosystems surrounding the facility at the forefront of their work. It has operated safely and reliably for decades, and the improvements made possible by Chemtrade's rezoning proposal would improve safety even further, virtually eliminating risk beyond the property boundary.

Chemtrade has also made notable strides in sustainability and environmental stewardship. Their efforts to optimize production processes, reduce waste, and adopt sustainable practices align with global goals and our community's values regarding environmental responsibility. Their focus on meeting rigorous compliance standards highlights their dedication to putting communities first. I have also been greatly impressed by Chemtrade's community engagement efforts, which demonstrate values of openness, transparency, and respect.

As an employer in our community, Chemtrade is committed to diversity and equity and creating a safe work environment. Chemtrade's North Vancouver facility is a key component of our local economy, and both current and former employees speak to its well-deserved reputation as a great place to work.

**North Vancouver–Seymour Constituency Office**
217–1233 Lynn Valley Road
North Vancouver, B.C. V7J 0A1
T 604.983.9859
Susie.Chant.MLA@leg.bc.ca

**Legislative Office**
Parliament Buildings
Victoria, B.C. V8V 1X4
T 250.387.3655

Chemtrade Logistics has earned its reputation as a reliable and innovative company, and their commitment to excellence is evident in every facet of their operations.

I am proud to support Chemtrade and their rezoning application, and I look forward to seeing their continued success and positive impact on the North Shore.

Sincerely,



Susie Chant, MLA
North Vancouver-Seymour

cc: Alan Robinson, Group Vice President, Commercial, Chemtrade Logistics Inc.
Amy Jonsson, Director, Corporate Communications, Chemtrade Logistics Inc.

BRITISH COLUMBIA

February 26, 2025

His Worship Mike Little
Mayor of North Vancouver
355 West Queens Road
North Vancouver, BC V7N 4N5
Sent via email: mayor@dnv.org

Dear Mayor Little:

I am writing today to express my support for the continued operation of Chemtrade's North Vancouver chlor-alkali facility. The facility is the largest producer of liquid chlorine in Canada and is critical for securing safe drinking water for millions of Canadians and Americans. It also produces almost 70 per cent of the liquid chlorine used in Western Canada, 40 per cent of the liquid chlorine used across the country, and up to 60 per cent of the liquid chlorine used in the Western United States. I also understand that this facility holds potential to assist in the development of clean fuels that support British Columbia's decarbonization efforts.

The facility has been in continuous, safe operation since 1957. In 2010, over $500 million was invested in the plant to modernize its operations and improve safety, with plans to continue this type of investment should it secure the ability to continue to operate.

I respectfully ask that the rezoning application required through the District of North Vancouver be expedited and approved in a timely manner to ensure business continuity for the facility and the safety of Canadian and US drinking water.

Sincerely,

David Eby, KC
Premier

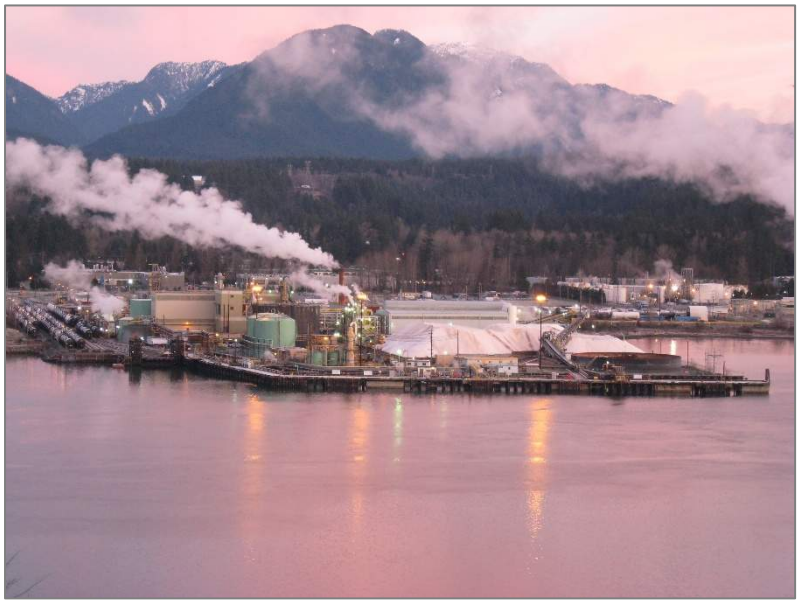
cc: Alan Robinson, Group Vice President, Commercial, Chemtrade Logistics Inc.

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# Chemtrade Electrochem
# Vision 2030 Project Description

For District of North Vancouver Rezoning Application for Facility Located at 100 Amherst Avenue













CHEMTRADE

# Chemtrade Vision 2030 Project

## Project overview

Chemtrade's North Vancouver chlor-alkali facility is Canada's largest provider of liquid chlorine and has been safely producing and distributing this important commodity since 1957. Chlorine is most commonly used as a disinfectant in the treatment of safe drinking water. Chemtrade supplies 40 percent of all liquid chlorine used for drinking water in Canada and regionally, and this equates to over 70 percent of the liquid chlorine available in British Columbia (BC) and Alberta. Chemtrade's site has operated safely in North Vancouver for more than 68 years, and since 2010, over $500 million has been invested to improve safety and reliability, and to modernize the facility.

The facility is a modern chlor-alkali plant, which produces chlorine, sodium hydroxide (caustic soda) and hydrochloric acid (muriatic acid), as well as one co-product, green gaseous hydrogen. These products support a wide range of industrial customers that are the base of our Canadian economy, including water treatment, innovation and technology, the energy sector, pulp and paper, and the automotive industry:

- **Chlorine** – Used to kill bacteria, microbes and viruses, and is an essential ingredient in treating municipal drinking water systems for safe drinking water. Chlorine is also used in consumer products such as textiles, paint and PVC plastics.
- **Sodium hydroxide** – Used in household cleaners and soap, food preservation, pharmaceuticals, textiles, glass production, the energy industry, pulp and paper, and more.
- **Hydrochloric acid** – Has hundreds of applications, including food preservation, and is a key ingredient used to make PVC plastic. It is a key ingredient in battery production, including electric vehicle (EV) batteries, and the energy sectors.
- **Hydrogen** – A co-product of the manufacturing process, this is a 100 percent renewable, green energy source, which could be further developed to help achieve BC and Canada's decarbonization and climate change commitments.

Chemtrade is proposing to undertake strategic safety improvements on a portion of the site located in the jurisdiction of the District of North Vancouver. These improvements require a District of North Vancouver zoning bylaw amendment and development permit. The proposed upgrades and improvements are focused on increasing safety and reliability, while further reducing potential risks to the neighbouring community. The output of products manufactured on the site would not increase as a result of these changes, but the proposed improvements would allow Chemtrade to transition to a produce and ship model resulting in a decrease in on-site storage of liquid chlorine.

## Background

Chemtrade is a Canadian company, headquartered in Toronto, Ontario, with a chlor-alkali plant in North Vancouver, BC. Chemtrade operates a diversified business providing industrial chemicals and services to customers across North America and around the world. In 2017, Chemtrade acquired Canexus, the previous owner of the North Vancouver plant.

The plant was originally constructed in the 1950s with a major technology upgrade in 2011 to modernize and expand production. Since that time, more than $500 million has been invested to improve the safety and reliability of the facility, including:

- Transition of chlorine production from technology using asbestos to new cells that use plastic membranes.
- Installation of updated technology for better mapping of potential risk and scenario modelling.
- Significant operational changes to reduce onsite storage of liquid chlorine by over 94 percent (using year 2000 as the benchmark).

The plant is fully automated and is continuously monitored by state-of-the-art automation systems that feature:

- Multiple sensors capable of detecting chlorine and hydrochloric acid gas as low as 0.1 parts per million and automatically notifying operators of any abnormalities in operations.
- Automated controls that close all valves, securing the chlorine within the system, in the case of a power outage.
- Automatic stop of production and isolation of key areas in the event that levels outside of normal operating ranges are detected.

A portion of the North Vancouver facility is on lands leased from the Vancouver Fraser Port Authority. In April of 2025, Chemtrade and the port authority reached a non-binding letter of intent with terms running through to December 31, 2044.

## Current operations

The North Vancouver Chemtrade facility is located at 100 Amherst Ave., in an industrial area, approximately 700 metres to the east of the Ironworkers Memorial Bridge, with Burrard Inlet bordering the site to the south. The site has both rail and marine access, which is critical for both raw material receiving and final product shipping. Neighbours include an active port terminal, a waste and recycling transfer station, a sodium chlorate production facility, an aggregates supplier and a planned liquid hydrogen facility.




Figure 1 – Current operations at North Vancouver facility

The current Chemtrade facility:

- Has 118 direct, full-time, permanent employees with an annual payroll of over $23.3 million.
- Injects over $137.4 million into the economy through spending with suppliers, contractors and businesses.

- Is a modern chlor-alkali plant, producing chlorine, sodium hydroxide and hydrochloric acid through sustainable electrochemical processes.
- Is one of the greenest producers of chlorine in North America, powered almost exclusively on green, renewable hydroelectricity, self-produced hydrogen and solar-dried ocean salt.

## How the chlorine production process works

To produce chlorine, the North Vancouver facility uses electrochemistry with three simple inputs: water, salt and electricity. The process generates virtually no waste, greenhouse gas or pollutants.

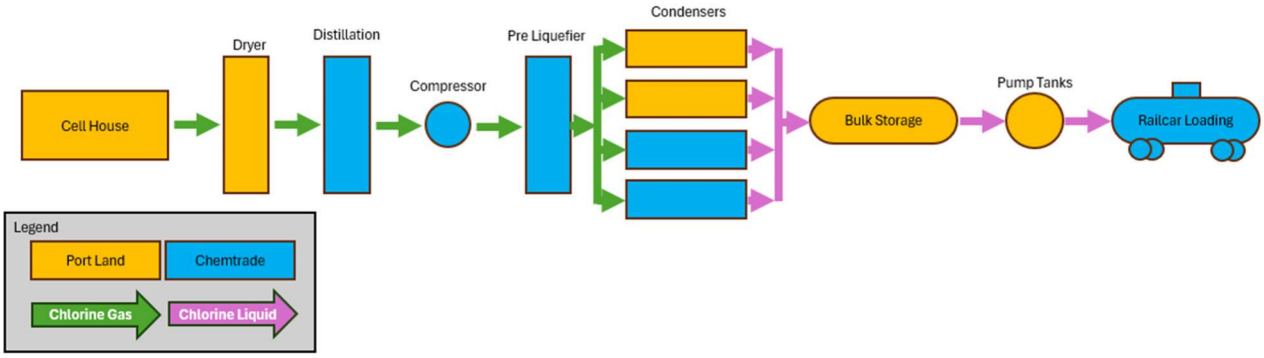



Figure 2 – Chlorine production process diagram (current state)

Chlorine is produced through the electrolysis of brine (salt water) in 14 electrolyzer units located in the "Cell House" building. The chlorine is a vapor at low pressure that is then piped through a three-stage dryer to remove water. The dry chlorine then passes through the distillation column where a slip stream of liquid chlorine is mixed with the chlorine gas in a process designed to pre-cool the chlorine gas and remove process impurities. The cooled chlorine gas continues to flow out of the distillation column to two chlorine compressors that pressurize the chlorine gas.

The chlorine gas then flows through a pre-liquefier that starts to cool the gas even further before it flows into multiple refrigeration condensers, which condense the chlorine gas to liquid.

The liquid chlorine flows from the condensers into a 60-tonne bulk storage tank. From the bulk storage tank, the liquid chlorine is pumped into railcars or back to the distillation column. All loading operations take place via specialized *next generation* chlorine railcars with unprecedented safety protections.

## Proposed facility upgrades

Chemtrade is proposing the following safety improvements to support our ongoing commitment to safe, reliable operations:

- **Enclosed chlorine railcar loading area** – The building would be equipped with sophisticated air scrubbing technology and would capture and contain chlorine leaked during a railcar loading accident — completely removing it from the atmosphere.
- **Seismic upgrades** – Installation of seismically activated safety shutoff valves.
- **Onsite storage reduction** – Elimination of chlorine storage tanks.

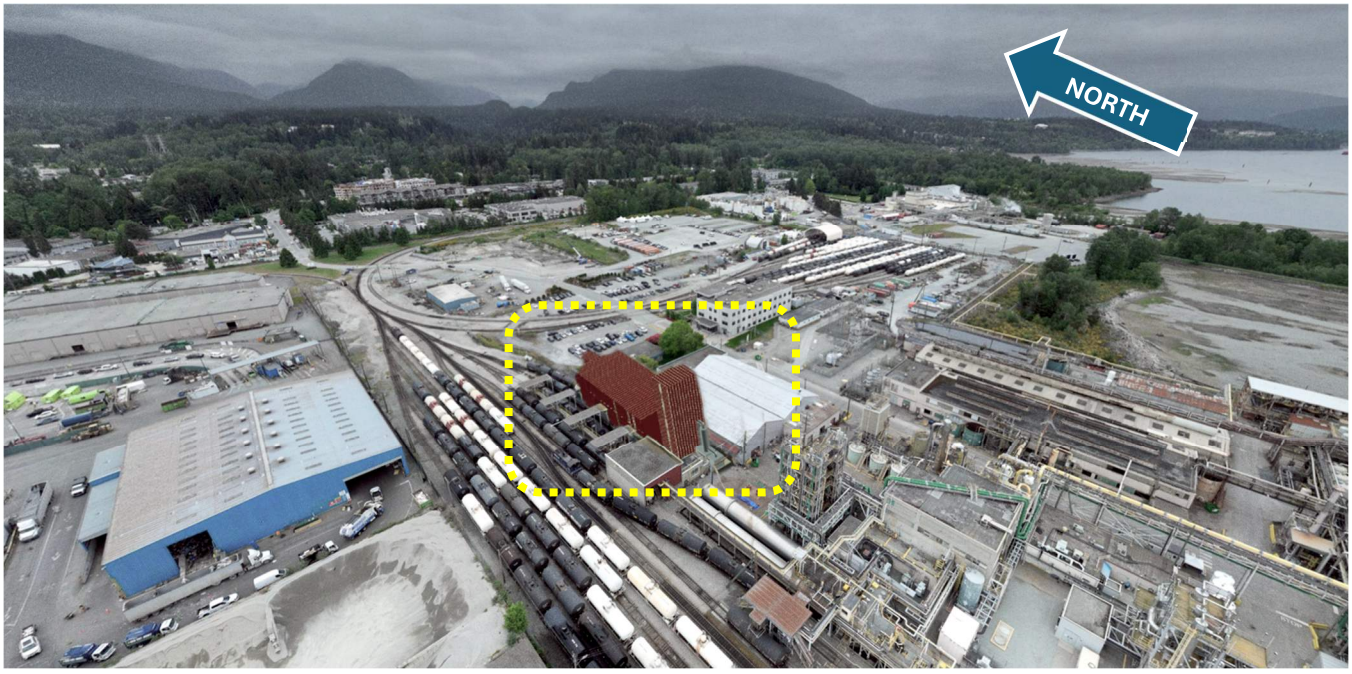



Figure 3 – Rendering of proposed railcar loading building, emergency vent system and condenser tower

Proposed safety upgrades would improve overall site safety and bring operations in line with industry best practices and guidelines by reducing risk to the neighbouring community with risk contours near or at the site property boundary. No changes to chlorine production are planned in terms of quantity or the process. All unit operations upstream of the pre-liquefier remain unchanged.

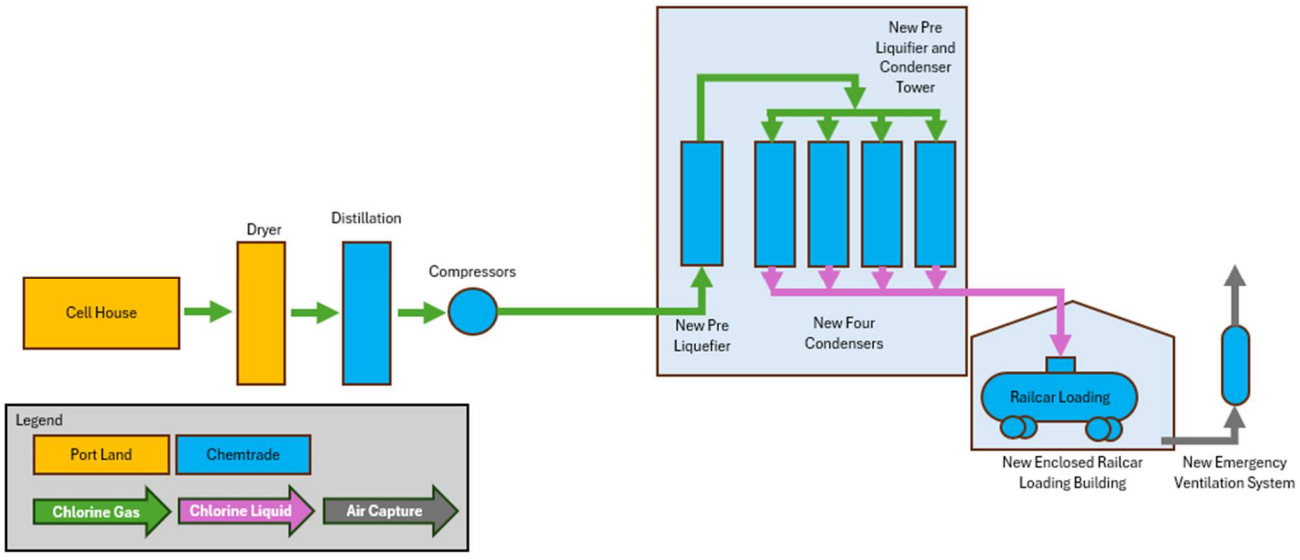



Figure 4 – Chlorine production process diagram (after proposed upgrades)

After the proposed upgrades, the chlorine gas would flow to a new pre-liquefier and four new chlorine condensers that would be located 80 feet above ground to allow for the gravity flow of liquid chlorine down to railcar loading. This

eliminates the 60-tonne bulk storage tank and tank pumps that are currently located on port authority land. The railcar loading pressure would be reduced significantly from the current pump design. All railcar loading activities would take place in a new load out building with an Emergency Ventilation System. The combination of the elimination of the 60-tonne bulk storage tank and the contained and ventilated railcar building significantly reduces the probability and the consequence of a release impacting anyone off site.

**Anticipated project timeline for implementation of safety improvements:**

- Roughly four years to complete all proposed improvements
- All construction work would be tied back into the plant major maintenance outages that are scheduled every two years
- Next planned major outages are scheduled for 2026 and 2028

## Project benefits

The Chemtrade North Vancouver chlor-alkali facility produces over 40 percent of all liquid chlorine available in Canada. This equates to 70 percent of the liquid chlorine used to treat drinking water in Western Canada and 60 percent of the chlorine used to treat drinking water in the Western United States.

According to a Statistics Canada Survey in 2015, 96 percent of municipalities in Canada—supplying almost 31 million Canadians—use chlorine to treat their domestic water supplies. As it stands, safe and responsible liquid chlorine remains the most responsible and safest method of securing drinking water for millions of Canadians.

Extending Chemtrade's operations in North Vancouver into the future will:

- Secure a long-term supply chain for clean drinking water within Canadian borders.
- Support stable operations for our employees and the businesses that use our products.
- Help meet BC's and Canada's climate change goals with key products that support electrification across various sectors, including low-carbon energy production.
- Improve safety and significantly reduce any potential risk to the community, bringing risk contours to the property line on the north edge of the facility.

Removing Chemtrade supply in 2030 would leave a large gap in the supply chain in both Canada and the United States, particularly in Western Canada. The next closest chlor-alkali facility is in Saskatchewan, with the only other two facilities located in Quebec. Recent closure announcements for several United States chlor-alkali facilities create uncertainty about market supply for Canada and how shortages would be filled. Recent labour disruption for railways and ongoing complex trade negotiations with the United States also underscore the importance of establishing and maintaining a reliable domestic supply chain, especially for products essential to the health of Canadians.

Chemtrade can also help supply the critical raw materials for EV and renewable battery production that would bring new investment and supply chains to Canada and is exploring the used of hydrogen co-products to help power industrial facilities.

# Policy Alignment

## District of North Vancouver

The Chemtrade facility has been safely operating since 1957, but a bylaw was passed in 1984, which prohibited the manufacturing of hazardous substances in all zones in the District of North Vancouver. Since that time, the Chemtrade facility has been operating as a "lawful non-conforming use" under s. 528 of the *Local Government Act* given that the facility predates the prohibition on the manufacture of hazardous substances in the Zoning Bylaw.

In order to provide the building permits for Chemtrade's planned safety improvements for the facility, Chemtrade is required to go through the rezoning process to have the manufacturing of liquid chlorine listed as an exemption within the bylaw. The facility aligns with the follow District policies:

**Land Use** – Zoning remains the same as the existing classification, which is Employment Zone – Industrial. The site is consistent with the Official Community Plan (OCP) designation and does not require an OCP amendment. If successful, the rezoning application would allow for the production of chlorine to be listed as an allowable activity at the facility.

**Economic Development** – Alignment with the Targeted OCP Action Plan's economy and employment lands' goals of protecting and intensifying industrial lands for employment uses, generating capital investment, supporting job creation, supporting the creation of a low carbon energy source, and establishing the District as a leader in the green economy. The District aims to partner with port, trade and freight organizations to ensure safe and efficient goods movement to support a diverse and resilient local economy that provides quality employment opportunities.

## Vancouver Fraser Port Authority

In April 2025, Chemtrade and the Vancouver Fraser Port Authority signed a non-binding letter of intent to extend Chemtrade's current land lease until the end of 2044.

The Vancouver Fraser Port Authority is a federally established Canada Port Authority responsible for the shared stewardship of the lands and waters that make up the Port of Vancouver. As mandated under the *Canada Marine Act*, the port authority's purpose is to enable Canada's trade by being reliable and innovative, while protecting the environment. One of the ways in which the port authority carries out its mandate is by leasing out lands to the terminal operators who move cargo through the port.

**Environmental stewardship and sustainability** – Alignment between the port authority's strategic priority to facilitate the transition to net-zero emissions for the Port of Vancouver by 2050 and Chemtrade's current targets to reduce Scope 1 greenhouse gas emissions by 50 percent (from 2021 levels) by 2025.

**Safety and risk management** – The port authority provides a high level of safety and environmental protection by serving as a permitting authority for projects on port authority lands and running a suite of environmental programs. Chemtrade maintains rigorous safety protocols at its North Vancouver chlor-alkali facility and undertakes capital investment projects to enhance safety and reduce on-site chlorine. Chemtrade is also engaged and coordinates emergency response efforts with local first responders such as Northshore Emergency Management and the District of North Vancouver.

## Province of British Columbia

On February 26, 2025, Premier Eby expressed his support for the continued operation of Chemtrade's North Vancouver chlor-alkali facility and acknowledged the facility's critical role in securing safe drinking water for millions of North

Americans. The Premier also urged the District to expedite and approve Chemtrade's rezoning application in a timely manner to ensure business continuity for the facility and the safety of drinking water.

**BC Manufacturing Action Plan** – The BC Manufacturing Action Plan outlines the Province's five strategic pillars to grow BC's manufacturing sector by strengthening industrial competitiveness and capitalizing on industries of highest opportunity. The plan also aligns with other key provincial initiatives, such as StrongerBC Economic Plan, CleanBC Roadmap to 2030 and the Maritime Industries Strategy.

## Government of Canada

The federal guidelines for Canadian drinking water quality refer to chlorine as the primary water treatment chemical for safe drinking water, and almost all technical documents for water treatment use chlorine dosage or testing parameters exclusively for treatment. Furthermore, a survey conducted by Statistics Canada in 2015 found that 96 percent of municipalities were relying on chlorine to treat their municipal water supply.

## Metro Vancouver

Chemtrade's chlor-alkali facility in North Vancouver consistently supplies and delivers various commodity chemicals for Metro Vancouver drinking water treatment plants.

# Overview of project effects

The environmental impact from the production process for chlorine is minimal and does not generate any hazardous waste material or pollution. The overall carbon footprint of the site is very low due to the fact Chemtrade uses green hydroelectricity (BC Hydro supplied), and the salt used in the manufacturing process is solar dried sea salt. Overall, the facility is one of the greenest chlor-alkali facilities in the world.

Based on recent technical studies for the proposed capital improvements, there are no anticipated effects on traffic, noise, odour and air quality.

# Community Engagement

Chemtrade has been leading an extensive community engagement program since 2023 to raise awareness about the project operations, the importance of the facility and to answer questions and address concerns. Through the extensive engagement program, Chemtrade has worked to ensure there is a broad understanding of the company's commitment to safety and responsible operation, as well as the risk to safe drinking water for millions of Canadians should the facility in North Vancouver no longer be able to produce liquid chlorine.

Chemtrade's outreach is ongoing and includes:

- Federal, provincial, regional and municipal governments
- Local First Nations
- District of North Vancouver First Responders
- Vancouver Fraser Port Authority
- Community associations
- Community Advisory Panel (regular monthly meetings)

- North Vancouver Chamber of Commerce
- Local businesses
- Broader community
- Media

Community outreach activities include:

- **Engagement website** – Launched askchemtrade.ca in 2024 to provide information about facility operations, the commodities produced onsite, proposed upgrades, frequently asked questions and a BC-wide survey completed in 2023.
- **Community newsletter** – Regular email newsletter to community associations, elected officials, special interest groups, local media and First Nations to promote community events and provide information about the facility and proposed project.
- **Community events** – Sponsored local projects and initiatives, initiated a public tour program and hosted two community open house meetings.

More information is available in the engagement summary section of Chemtrade's rezoning application.









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**The Corporation of the District of North Vancouver**

**Bylaw 8778**

A bylaw to amend District of North Vancouver Zoning Bylaw 3210, 1965

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The Council for The Corporation of the District of North Vancouver enacts as follows:

## 1. Citation

This bylaw may be cited as "District of North Vancouver Rezoning Bylaw 1462 (Bylaw 8778)".

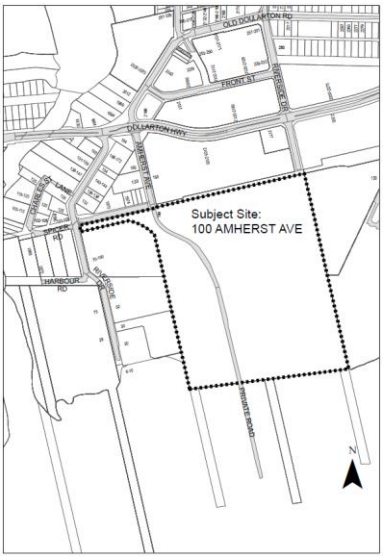
## 2. Amendments

2.1 District of North Vancouver Zoning Bylaw 3210, 1965 is amended as follows:

a) Section 403A Uses Prohibited in All Zones, (1) (f) "the manufacture of hazardous substances except:" is amended as follows:

After (i), add the following:

(ii) for the manufacturing, processing, liquefaction, handling, storage, loading and shipping of chlorine, on the lands located at 100 Amherst Avenue identified on the plan attached hereto.




**READ** a first time January 12, 2026

**PUBLIC HEARING** held

**READ** a second time

**READ** a third time

Certified a true copy of “Rezoning Bylaw 1462 (Bylaw 8778)” as at Third Reading

_____
Deputy Corporate Officer

**ADOPTED**

_____ _____
Mayor Corporate Officer

# PUBLIC HEARING

## 100 Amherst Avenue

## ZONING BYLAW AMENDMENTS

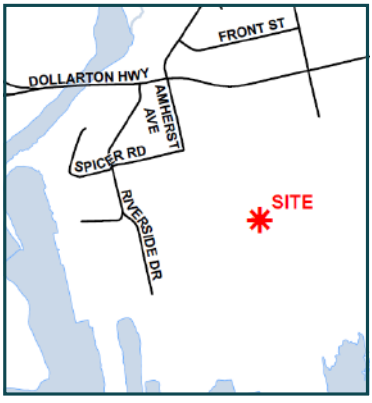
**When:** Tuesday, February 24, 2026, at 7pm

**Where:** Council Chambers, 355 West Queens Road, North Vancouver, BC

**What:** A Public Hearing for Bylaw 8778, proposed amendments to the Zoning Bylaw, to permit the manufacturing, processing, liquefaction, handling, storage, loading and shipping of chlorine, on the lands located at 100 Amherst Avenue.

**What Changes:** Bylaw 8778 proposes to amend the District's Zoning Bylaw, in general terms, by adding an exception to the prohibition of the manufacture of hazardous substances in all zones for the subject site to permit the manufacturing, processing, liquefaction, handling, storage, loading and shipping of chlorine.

**How:** The Public Hearing will be held in a hybrid format with a combination of in-person and electronic participation by some or all members of council, or by staff and the public. The public are invited to attend at the Council Chambers where they will be able to see and hear the entire proceedings. Those wishing to view or to participate in the meeting electronically may do so at https://dnvorg.zoom.us/j/64484156494 or by phone by dialling 1-778-907-2071 and entering webinar ID 644 8415 6494.




**When and How can I provide input?**

We welcome your input on February 24, 2026, at 7pm. You may sign up to speak at the hearing by contacting the Corporate Officer at signup@dnv.org prior to 3pm, Tuesday, February 24, 2026. You may also provide a written submission at any time prior to the close of the public hearing by sending it to the Corporate Officer at input@dnv.org or by mail to Corporate Officer, 355 West Queens Road, District of North Vancouver, BC, V7N 4N5. After the speakers list has been exhausted, there will be an opportunity for additional speakers who had not signed up in advance to make submissions. ***Please note that Council may not receive further submissions from the public concerning this bylaw after the conclusion of the public hearing.***

**Need more info?** Copies of the bylaw are available for review at 355 West Queens Road, North Vancouver, BC, between 8:00am and 4:30pm Monday to Friday (except holidays), starting February 10, 2026, or online at **DNV.org/agenda**

DISTRICT OF NORTH VANCOUVER

***Questions?***
*Afrooz Fallah, Planning Assistant*
*fallaha@dnv.org 604-990-3747*

**DISTRICT OF NORTH VANCOUVER**
**REGULAR MEETING OF COUNCIL**

Minutes of the Regular Meeting of Council for the District of North Vancouver held at 7:05 p.m. on Monday, January 12, 2026 in the Council Chambers of the District Hall, 355 West Queens Road, North Vancouver, British Columbia.

**Present:** Mayor Mike Little
Councillor Jordan Back
Councillor Betty Forbes
Councillor Jim Hanson
Councillor Herman Mah
Councillor Lisa Muri
Councillor Catherine Pope

**Staff**: Dan Milburn, Acting Chief Administrative Officer
Genevieve Lanz, Director – Legislative Services and Corporate Officer
Zeralynne Te, Manager – Community Planning
Yan Zeng, Manager – Development Planning
Nicole Foth, Community Planner
Mackenzie Stonehocker, Development Planner
Kelsey Stuckert, Senior Policy Analyst
Cheryl Archer, Confidential Council Clerk
Jillian Holden, Administration Clerk

## 1. ADOPTION OF THE AGENDA

### 1.1. January 12, 2026 Regular Meeting Agenda

**MOVED by Councillor FORBES**
**SECONDED by Councillor BACK**
THAT the agenda for the January 12, 2026 Regular Meeting of Council for the District of North Vancouver is adopted as circulated.

**CARRIED**

## 2. ADOPTION OF MINUTES

### 2.1. November 17, 2025 Regular Council Meeting

**MOVED by Councillor BACK**
**SECONDED by Councillor MAH**
THAT the minutes of the November 17, 2025 Regular Council meeting are adopted.

**CARRIED**

### 2.2. December 1, 2025 Regular Council Meeting

**MOVED by Councillor BACK**
**SECONDED by Councillor MAH**
THAT the minutes of the December 1, 2025 Regular Council meeting are adopted.

**CARRIED**

### 2.3. December 8, 2025 Regular Council Meeting

**MOVED by Councillor BACK**
**SECONDED by Councillor MAH**
THAT the minutes of the December 8, 2025 Regular Council meeting are adopted.

**CARRIED**

## 3. PUBLIC INPUT

### 3.1. Corrie Kost:

- Requested that additional safety reports are included in the materials for a public hearing for Bylaw 8778 – Text Amendment Rezoning – 100 Amherst Avenue (Chemtrade).

### 3.2. John Lesow:

- Commented on the potential redevelopment of the gas station in Edgemont Village;
- Noted that a property in Tsawwassen that had previously been the site of a gas station remained undeveloped for 20 years after the gas station ceased operations;
- Opined that redeveloping the site into housing would not be in the interest of the community; and,
- Commented on the closure of Columbia Market and the possibility of a liquor store moving into the site and opined this would not be in the interest of the community.

### 3.3. Hazen Colbert:

- Spoke regarding the utility billing notice he recently received;
- Stated that he has requested the utility bill list the amounts for municipal services and the North Shore Wastewater Treatment Plant cost;
- Stated that he would like to compare his utility bill as a condominium owner to single-family homes with more occupants; and,
- Advised that he will not pay property taxes while he is not allowed to contact Council directly.

**3.4. Erik Jensen:**

- Stated that stormwater management measures in the District's bylaws prevent homeowners from building basements due to cost;
- Suggested the District build the required stormwater management infrastructure under its property and at its cost; and,
- Commented on the cost of installing tanks to manage stormwater.

## 4. RECOGNITIONS

Nil

## 5. DELEGATIONS

Nil

## 6. RELEASE OF CLOSED MEETING DECISIONS

Nil

## 7. COMMITTEE OF THE WHOLE REPORT

Nil

## 8. REPORTS FROM COUNCIL OR STAFF

### 8.1. Bylaw 8750: Tenant Relocation Assistance

File No. 09.3900.20/000.000

**MOVED by Councillor MURI**
**SECONDED by Councillor MAH**
THAT "District of North Vancouver Residential Tenant Relocation Assistance Bylaw 8750, 2025" is given SECOND and THIRD Readings.

**CARRIED**

A member of Council proposed a motion regarding the definition of "eligible tenant".

**MOVED by Councillor MURI**
**SECONDED by Councillor HANSON**
THAT staff are directed to report back to Council regarding potential amendments to Bylaw 8750 to ensure the definition of "eligible tenant" does not exclude current occupants who may not be listed on the rental agreement.

**CARRIED**

**8.2. Bylaws 8756 and 8757: OCP Amendment and Rezoning for a 12-unit Townhouse Development at 1883-1901 Glenaire Drive**
File No. 08.3060.20/007.24

**MOVED by Councillor POPE**
**SECONDED by Councillor HANSON**
THAT "District of North Vancouver Official Community Plan Bylaw 7900, 2011, Amendment Bylaw 8756, 2025 (Amendment 60)" is given FIRST Reading;

AND THAT "District of North Vancouver Rezoning Bylaw 1456 (Bylaw 8757)" is given FIRST Reading;

AND THAT pursuant to Section 475 and Section 476 of the *Local Government Act*, additional consultation is not required beyond that already undertaken with respect to Bylaw 8756;

AND THAT in accordance with Section 477 of the *Local Government Act*, Council has considered Bylaw 8756 in conjunction with its Financial Plan and applicable Waste Management Plans;

AND THAT Bylaws 8756 and 8757 are referred to a Public Hearing.

**CARRIED**

**8.3. Bylaw 8778 - Text Amendment Rezoning – 100 Amherst Avenue (Chemtrade)**
File No. 08.3060.20/042.25

**MOVED by Mayor LITTLE**
**SECONDED by Councillor MAH**
THAT "District of North Vancouver Rezoning Bylaw 1462 (Bylaw 8778)" is given FIRST Reading;

AND THAT "District of North Vancouver Rezoning Bylaw 1462 (Bylaw 8778)" is referred to a Public Hearing.

**CARRIED**

Councillor POPE left the meeting at 8:34 p.m.

**8.4. Appointment of Election Officials for the 2026 General Local Elections**
File No. 01.0115.30/002.000

**MOVED by Councillor MURI**
**SECONDED by Councillor BACK**
THAT Genevieve Lanz is appointed Chief Election Officer for the District of North Vancouver for the conduct of the 2026 general local elections;

AND THAT Rhonda Schell is appointed Deputy Chief Election Officer for the District of North Vancouver for the conduct of the 2026 general local elections.

**CARRIED**
Absent for Vote: Councillor POPE

Councillor POPE returned to the meeting at 8:37 p.m.

## 9. REPORTS

### 9.1. Mayor

Mayor Little reported on the following:

- Expressed support for the Iranian community and the people of Iran;
- His attendance at the annual Penguin Plunge in Deep Cove on January 1, 2026; and,
- Congratulated Councillor Hanson and his wife on their 60th anniversary.

### 9.2. Chief Administrative Officer

Nil

### 9.3. Councillors

**9.3.1.** Councillor Muri reported on her participation in the Penguin Plunge at Cates Park/Whey-ah-Wichen on January 1, 2026.

**9.3.2.** Councillor Mah reported on his attendance at the North Shore Public Menorah Lighting on December 17, 2025.

**9.3.3.** Councillor Hanson expressed condolences to the families of the young driver and passenger involved in a fatal collision on Berkley Road on December 12, 2025.

### 9.4. Metro Vancouver Committee Appointees

Nil

## 10. ADJOURNMENT

**MOVED by Councillor MURI**
**SECONDED by Mayor LITTLE**
THAT the January 12, 2026 Regular Meeting of Council for the District of North Vancouver is adjourned.

**CARRIED**
(8:41 p.m.)

Mayor

Corporate Officer

# CHEMTRADE NORTH VANCOUVER FSS/QRA UPDATE

## CHLOR-ALKALI PRODUCTION PLANT

North Vancouver, British Columbia

**Site visit date:** April 29-30, 2025




4th Feb, 2026
Permit Number: 1004908

## FINAL, REV. 2 REPORT

**Issue Date:** February 3, 2026

Prepared for:

# CHEMTRADE ELECTROCHEM, INC.

**Prepared by:**

Kierra McDougall
Oscar Rodriguez
Alexander Fergusson
Anay Raibagkar, P.Eng.

**BakerRisk Project No.**

01-08654-004-25

# APPROVALS

This report has been reviewed and approved for release.

**Author**:



Kierra McDougall
Project I Consultant

**Approval**:



Anay Raibagkar
Manager, Canada Operations
Principal Engineer

# Revision History

| Revision # | Date | Description |
|---|---|---|
| Final, Rev. 1 | Sept. 24, 2025 | Clarified language regarding loading durations, operator response to railcar release scenario, and added Permit to Practice number. |
| Final, Rev. 2 | Feb. 3, 2026 | Update to address comments from third-party review performed by Risktec. See Appendix G for further documentation. |
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# EXECUTIVE SUMMARY

Chemtrade Electrochem, Inc. (Chemtrade) commissioned Baker Engineering and Risk Consultants, Inc. (BakerRisk®) to complete a computational fluid dynamics (CFD) and Facility Siting Study (FSS)/Quantitative Risk Assessment (QRA) of the Chemtrade Chlor-Alkali Production Plant located in North Vancouver, British Columbia. This study was a joint effort between BakerRisk and Chemtrade. As a part of rezoning requirements for the North Vancouver plant, Chemtrade has committed to making modifications to their chlorine production operations. In negotiations between the District of North Vancouver (District) and Vancouver Fraser Port Authority (Port), one of the agreed rezoning conditions was that liquid chlorine would no longer be stored on the Port portion of the property after the year 2030[1]. Chemtrade intends to reduce potential offsite risk by modifying plant operations to limit liquid chlorine storage quantities and install containment, collection, release prevention, release mitigation, and treatment systems.[2] Chemtrade provided the corresponding preliminary engineering design and documentation for these modifications.

The intent of this FSS and QRA study was to evaluate offsite risk of the North Vancouver facility, including the proposed process changes, utilizing available design information. Offsite risk was assessed using location-specific individual risk (LSIR) geographical risk contours. Notable changes for the proposed North Vancouver plant reflected in the modeling are as follows:

- Addition of an Emergency Ventilation System (EVS) for scrubbing chlorine gas releases.
- Addition of a sodium hypochlorite storage and destruction system.
- Addition of a chlorine railcar loading building connected to the EVS to mitigate chlorine releases.
- Removal of all existing liquid chlorine equipment including storage tanks, liquid chlorine pumps, condensers, and piping.
- Addition of an enclosed condenser tower containing new condensers, blow gas heater, and liquid-vapor separator for gravity-fed railcar loading system. The proposed condenser tower will be enclosed and connected to the same EVS as the railcar loading building. The liquid chlorine line from the enclosed condenser platform to the railcar loading area (the only line in the plant with liquid chlorine) will be indoors.
- Removal of distillation column, reboiler, vaporizers, and associated piping.
- Modification of the chlorine compressor design to be a single operating indoor compressor with precooler, intercooler, and aftercooler equipment.

[1] ChemE Consulting, Inc. “Vision 2030 Project - Project Design: Operation and Controls Description,” Draft for Review and Comment issued April 1, 2025.

[2] Easton, B., “Railcar Loading Chlorine Release Fault Tree,” BakerRisk Project No. 02-08654-004-25. Final Report issued September 22, 2025.

- Piping routes from the chlorine compressor to the new chlorine condensers and from the new chlorine condensers to railcar loading will be double-walled piping with interstitial leak detection.
- Improved chlorine detection, automated shutdown, and isolation systems.
- Removal of the Central and East Acid plants.

In addition, the proposed plant design will incorporate seismic considerations during the design of all new equipment and building structures. In this QRA, BakerRisk used industry-average failure rates to define release frequencies which include considerations for loss of containment associated with natural hazards. However, this area of North Vancouver has a higher than typical seismic activity, which is not captured in these rates. The increased frequency will be mitigated through the following criteria that Chemtrade is planning to include in their design basis:

- Piping shall be designed to prevent liquid chlorine leaks from a 2%/50-year earthquake as defined in the British Columbia Building Code (BCBC) 2024. The design must be shown through analysis to prevent any potential liquid chlorine leaks for an earthquake with 2% probability of occurrence in 50 years, as defined in the BCBC.
- The design basis will consider the worst case liquid level, as determined through appropriate nonlinear structural seismic analysis.
- Robust seismic bracing and supports and the anchoring of chlorine equipment shall be implemented to withstand seismic forces.
- Automatic isolation mechanisms for pipelines and high risk equipment will minimize leaks.

Risk was quantified using location-specific individual risk (LSIR) contours, which is defined as the level of risk incurred by a person who is continuously present (24 hours a day, 365 days a year) in a given outdoor location. Onsite risk was not evaluated as part of this scope of work. LSIR contours were generated for calculating offsite risk only and should not be used for evaluating onsite risk. These contours are used to assess compliance with the Process Safety Management Division (previously MIACC) *Risk-based Land Use Planning Guidelines*[3], as shown in Figure 1.

[3] Canadian Society for Chemical Engineers (2008) "Risk Assessment – Recommended Practices for Municipalities and Industry," Ottawa, Ontario.

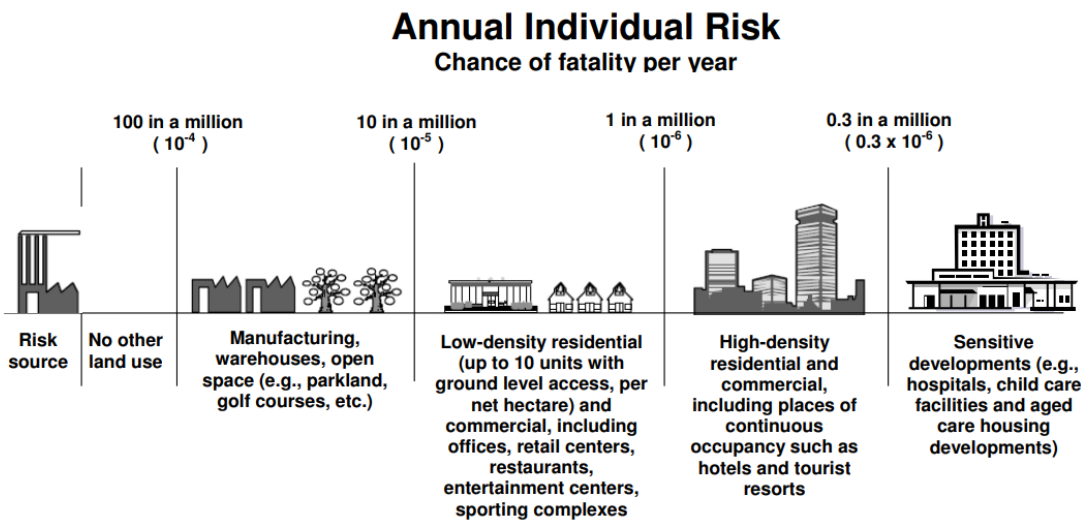



**Figure 1. Process Safety Management Division (MIACC) Land Use Planning Guidelines[3]**

LSIR contours for the proposed Chemtrade North Vancouver plant are shown in Figure 2 and Figure 3. Figure 3 plots these LSIR geographical risk contours in Google Earth™ imaging with offsite receptors of interest identified for comparison to *Risk-based Land Use Planning* Guidelines. These results are also presented in tabular format identifying LSIR per receptor as well as comparison to MIACC tolerance criteria in Table 1. LSIR results presented in this table are based on the universal transverse Mercator (UTM) coordinates provided by Chemtrade in Table 3 as the exact property boundary of these receptors is not known at this time.




**Figure 2. LSIR Contours for Current Facility with Proposed Design Changes**




**Figure 3. LSIR Geographical Risk Contours with Offsite Receptors of Interest Identification[4]**

**Table 1. LSIR Per Receptor and Comparison to MIACC**

| Offsite Receptor | Location-Specific Risk (APoD) | | | | MIACC Receptor Category | MIACC Risk Criteria |
|---|---|---|---|---|---|---|
| | Flash Fire | Toxic | Jet Fire | Total | | |
| Apartments | | 1.0E-7 | | 1.0E-7 | High-Density Residential | 1.0E-6 |
| ChildCare | | 6.1E-9 | | 6.1E-9 | Sensitive Development | 0.3E-6 |
| Commercial | | 3.2E-7 | | 3.2E-7 | Low-Density Commercial | 1.0E-5 |
| Hospital | | | | | Sensitive Development | 0.3E-6 |
| Marina | | 2.5E-8 | | 2.5E-8 | Low-Density Commercial | 1.0E-5 |
| Park1 | | 1.1E-8 | | 1.1E-8 | Open Space / Parkland | 1.0E-4 |
| Park2 | | 1.5E-8 | | 1.5E-8 | Open Space / Parkland | 1.0E-4 |
| Park3 | | 4.0E-8 | | 4.0E-8 | Open Space / Parkland | 1.0E-4 |
| Plant1 | | 4.0E-7 | | 4.0E-7 | Manufacturing | 1.0E-4 |
| Plant2 | | 3.8E-6 | | 3.8E-6 | Manufacturing | 1.0E-4 |
| School | | 1.6E-8 | | 1.6E-8 | Sensitive Development | 0.3E-6 |
| SeniorCare | | 8.4E-9 | | 8.4E-9 | Sensitive Development | 0.3E-6 |
| Waste1 | | 1.5E-5 | | 1.5E-5 | Manufacturing | 1.0E-4 |
| Waste2 | | 4.1E-7 | | 4.1E-7 | Manufacturing | 1.0E-4 |

*Note: Blank cells indicate negligible risk <1E-12*

Based on the offsite receptors identified by Chemtrade, the LSIR geographic risk contours for the proposed Chemtrade North Vancouver plant are in compliance with the MIACC guidelines except for a small area of vegetation to the west of the HCl loading area that exceeds the Control Zone.

Note that the contours are representative of the preliminary design information provided by Chemtrade and modeling inputs/assumptions at the time of this study and are subject to change. Should the plant design or process information deviate from the assumptions documented in this report, updated LSIR calculations should be performed to understand the revised offsite risk. In addition, the release frequency during chlorine railcar loading operations is subject to the process information, assumptions, and recommendations outlined in the supplementary fault tree analysis (FTA) report[2].

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# 1 INTRODUCTION

Chemtrade Electrochem, Inc. (Chemtrade) commissioned Baker Engineering and Risk Consultants, Inc. (BakerRisk®) to complete a computational fluid dynamics (CFD) and Facility Siting Study (FSS)/Quantitative Risk Assessment (QRA) of the Chemtrade Chlor-Alkali Production Plant located in North Vancouver, British Columbia. This study was a joint effort between BakerRisk and Chemtrade. As a part of rezoning requirements for the North Vancouver plant, Chemtrade has committed to making modifications to their chlorine production operations. In negotiations between the District of North Vancouver (District) and Vancouver Fraser Port Authority (Port), one of the agreed rezoning conditions was that liquid chlorine would no longer be stored on the Port portion of the property after the year 2030[1]. Chemtrade intends to reduce potential offsite risk by modifying plant operations to limit liquid chlorine storage quantities and install containment, collection, release prevention, release mitigation, and treatment systems[1]. Chemtrade provided the corresponding preliminary engineering design and documentation for these modifications.

The intent of this FSS and QRA study was to evaluate offsite risk of the North Vancouver facility, including the proposed process changes, utilizing available design information. Offsite risk was assessed using location-specific individual risk (LSIR) geographical risk contours. Onsite risk was not evaluated as part of this scope of work; Chemtrade uses their own internal processes for evaluating and managing onsite personnel risks. The LSIR contours were generated for calculating offsite risk only and should not be used for evaluating onsite risk. Chemtrade personnel knowledgeable in operations, processes, and emergency response provided input for the analysis. The analysis was performed by BakerRisk personnel knowledgeable in process safety.

The model of the future North Vancouver plant anticipates the removal of existing process equipment. This is including but not limited to existing liquid chlorine storage tanks, liquid chlorine pumps, condensers, distillation column, reboiler, supporting piping for the distillation column, Central and East Acid plants, and connecting piping between the main facility and the Central and East Acid plants. Additional modifications to the existing process will include removal of the DeLaval compressors and aftercoolers. This equipment will be replaced with a single operating indoor compressor (one spare) with precooler, intercooler, and aftercooler heat exchanger equipment. The existing precompression blower and precompression cooler have been removed from design and replaced with the aforementioned precooler equipment. New condensing equipment will produce the liquid chlorine product. This equipment will include chlorine condensers, blow gas heater, liquid-vapour separator, and vent knockout pot. All condensing equipment will be elevated on a tower to enable gravity-fed railcar loading. The condenser tower will be enclosed and ventilated to a scrubbing system in the event of a chlorine release. The liquid in the plant is limited to the holdup between the condensation equipment and the railcar loading. The new design does not utilize any liquid chlorine storage or pump tanks. Railcar loading operations will also be located in a second building and ventilated to a scrubbing system in the event of a chlorine release. Chemtrade provided preliminary design Process Flow Diagrams (PFDs) for which the

study assumptions were based on. Model inputs should be validated as detailed design information becomes available.

Figure 4 shows the approximate boundary for the Chemtrade facility outlined in red, which was referenced for offsite risk evaluation.




**Figure 4. North Vancouver Chemtrade Electrochem Facility Aerial View[4]**

This relevant standards and guidance documents used throughout the FSS and QRA study are listed in Section 10.

## 1.1 BRIEF PLANT DESCRIPTION

Chemtrade operates a chlor-alkali facility in North Vancouver, BC, Canada, producing liquid chlorine, 50% sodium hydroxide (caustic soda) and 36% hydrochloric acid products. Liquid chlorine product is shipped by rail to customers within Canada and the United States. The two other products, sodium hydroxide and hydrochloric acid, are shipped by rail and truck.

Liquid chlorine is produced by the electrolysis of a brine solution using membrane electrolyzers. Chlorine gas is then dried, compressed, and condensed to liquefied form for railcar loading. Proposed updates to the plant include removal of the distillation column (and auxiliary equipment) and a modified compression process consisting of a single operating indoor compressor with precooler, intercooler, and aftercooler heat exchangers. All liquid chlorine storage and pumps will be removed from current operations and

[4] Image obtained from Google Earth™ mapping service.

replaced with elevated condenser equipment to facilitate a gravity-fed chlorine liquefaction process for railcar loading. Liquid chlorine is loaded at 3.5 barg and -26 °C into insulated railcars for transportation.

Hydrochloric acid is produced in one of five acid plants by the reaction of chlorine and hydrogen in a water solvent. Vapour chlorine from the main chlorine production process is used as feed for hydrochloric acid production. Currently there are five acid plants in operation: two using older technology and three using newer technology. Two of the acid plants, the Central and East Acid plants, use older technology and will be removed from future operations. The remaining three Acid Growth plants use newer technology and will be included in future operations.

Various modifications will be made to the North Vancouver plant as part of the proposed future operations. Table 2 summarizes the buildings and equipment that are either existing, new, or to be removed from the process that are relevant to this analysis.

**Table 2. List of Relevant Chemtrade North Vancouver Facility Equipment and Buildings**

| Building / Equipment | Existing/New /Removed | Brief Description |
|---|---|---|
| E-5 Chlorine Liquefaction Building | Existing | Building previously housing liquefaction and compression equipment. For the proposed design, will only include the new compressor equipment. |
| E-19 Cell Room | Existing | Building housing electrolysis equipment for chlorine production. |
| Acid Growth plants | Existing | Three acid growth plants using new technology will continue to operate. |
| Railcar Loading Building | New | Proposed building for liquid chlorine railcar loading. Building will be connected to the new EVS. |
| Condenser Tower Equipment | New | New condensers, blow gas heater, and liquid-vapor separator equipment that will be elevated for a gravity-fed railcar loading system. |
| Enclosed Condenser Platform | New | Proposed condenser equipment will be elevated on an enclosed platform to mitigate chlorine releases. Enclosed platform will be connected to the EVS. |
| Emergency Ventilation System (EVS) | New | New EVS system to mitigate chlorine releases in the Railcar Loading Building and Liquefaction Platform. Chlorine will be scrubbed using caustic to produce sodium hypochlorite. |
| Sodium Hypochlorite Storage and Destruction System | New | Storage for sodium hypochlorite and destruction system to support the new EVS. |

| Building / Equipment | Existing/New /Removed | Brief Description |
|---|---|---|
| Chlorine Compressor | New | Current compressor will be removed for addition of modified compressor design including a single operating indoor compressor with precooler, intercooler, and aftercooler. Piping from compressor to condenser tower equipment will be double walled with interstitial leak detection. |
| Central and East Acid plants | Removed | The two acid plants using old technology will be removed in conjunction with distillation column removal. |
| Distillation Column, Reboiler, Vaporizers | Removed | Distillation column equipment and piping will be removed as well as lines supplying the central and east acid plants. |
| Storage Tanks, Liquid Chlorine Pumps, Condensers | Removed | Liquid chlorine will no longer be stored in large inventories onsite. All liquid chlorine storage equipment will be removed. |

## 1.2 PROPOSED RAILCAR LOADING PROCESS AND BUILDING DESIGN

Chemtrade intends to enclose their liquid chlorine railcar loading operations within a building. Conceptual building and process design has been completed and informed the modeling inputs for this study[1]. All liquid chlorine storage hold-up will be removed and the following containment, collection, and treatment systems for chlorine railcar loading operations will be implemented:

- A railcar loading building with substantially sealed walls, floor and roof. The natural ventilation rate of this building is 8 air changes per hour (ACH).
- Emergency vent collection system with ducting system, dampers, and air intake louvers that pull a large volume of room gas out of the building to the scrubber. The proposed ventilation rate of the emergency ventilation system is 7,500 cfm.
- A caustic treatment scrubber to convert collected chlorine to liquid sodium hypochlorite (bleach) and blower to provide gas flow.

A preliminary Process Flow Diagram (PFD) representative of the proposed emergency ventilation system (EVS) is shown in Figure 5. A preliminary plot plan of the proposed building is shown in Figure 6. There are two major locations for potential loss of containment from the railcar loading building: the air intake louvers and the emergency vent stack. A detailed frequency analysis[2] for a chlorine release from the railcar loading building was evaluated in parallel. Subsequently, the scenario basis and associated frequency were implemented as inputs to this FSS and QRA study.

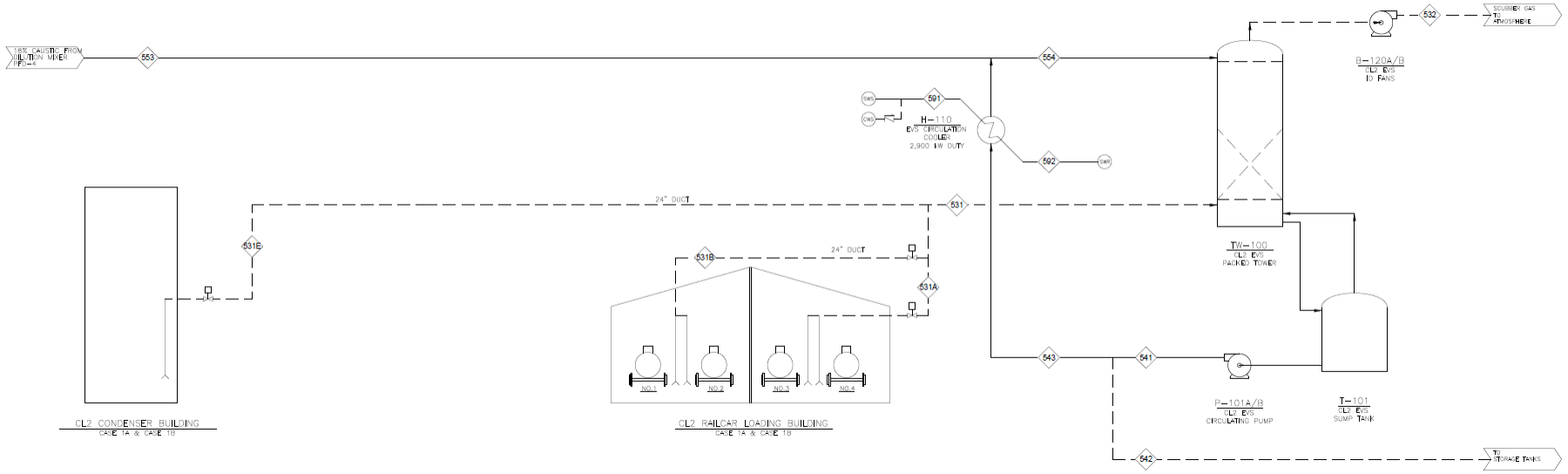



**Figure 5. Proposed Chlorine Emergency Ventilation System[5]**

[5] Process Flow Diagram, Chlorine EVS System, Dwg No. 1A PFD-3 Sens All, Rev. 0, 09/15/2025.

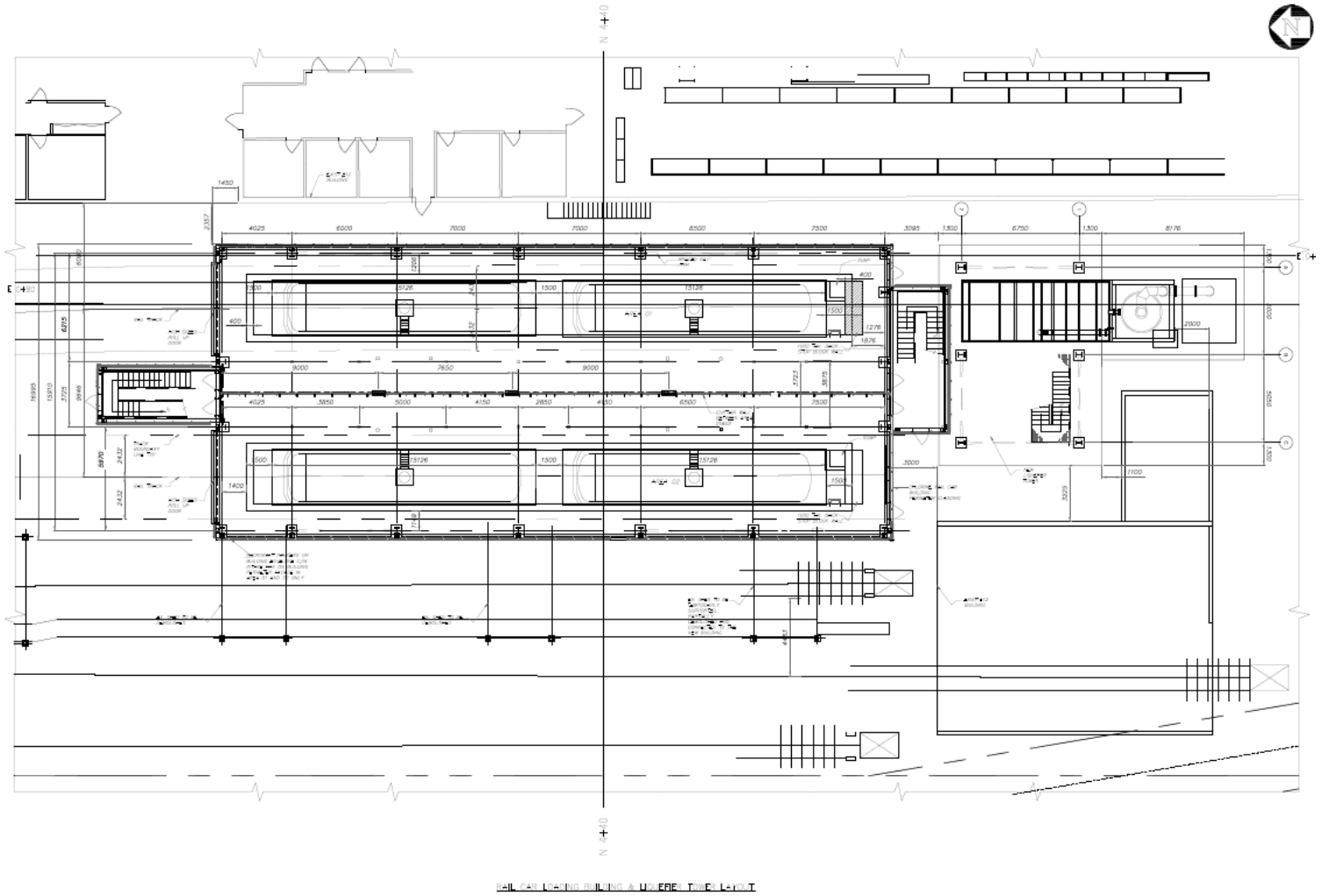


**Figure 6. Proposed Railcar Loading Building Layout[6]**

[6] Rail Car Loading Building & Liquefier Tower, Structural Layout Plant, Dwg No. D-333224-2201, Issue 01, 04/21/2024.

The proposed chlorine loading process will be gravity-fed with condensing equipment elevated on a tower. This includes the replacement of four new chlorine condensers, blow gas heater, liquid-vapor separator, and knockout pot equipment to a new 80 ft platform directly south of the proposed railcar building. This chlorine condenser platform will be enclosed similar to the railcar loading building with the same EVS capacity. Similarly, there are two major locations for potential loss of containment from the enclosed condenser platform: the air intake louvers and the emergency vent stack.

BakerRisk notes that for the gravity-fed system, controlling the pressure and motive force of chlorine flow presents significant challenges in the event of a chlorine release. Chemtrade intends to include emergency shutdown valves to limit available inventory. Alternate designs to the proposed gravity-fed system may warrant consideration if further risk reduction is needed.

Refer to Sections 5.1.1.2, 5.1.1.3, and 5.1.2 for further information on how design assumptions were applied to consequence analyses in the proposed chlorine railcar building and condenser platform. Refer to Sections 6.4.2 and 6.4.3 for further information on how design assumptions were applied to risk analyses in the proposed chlorine railcar building and condenser platform. Assumptions for consequence and risk modelling are further documented in Sections 4.1 and 6.1, respectively.

# 2 OBJECTIVES AND SCOPE OF WORK

The scope of this CFD and FSS/QRA was to perform an evaluation of the risk to offsite receptors from loss of containment scenarios resulting from normal operations of the future Chemtrade North Vancouver Facility, inclusive of the proposed design changes and addition of process buildings and scrubbing system. Risk was quantified with LSIR contours to gauge compliance with the Process Safety Management Division (previously MIACC) land use planning guidelines[3]. Assumptions for consequence and risk analyses are documented in Sections 4.1 and 6.1, respectively.

The primary objectives for this CFD and FSS/QRA were to:

- Identify and assess significant toxic and fire hazards associated with normal operation of the Chemtrade North Vancouver Facility. Notable changes for the proposed North Vancouver plant reflected in the modeling as follows:
    - Addition of an Emergency Ventilation System (EVS) for scrubbing chlorine gas releases.
    - Addition of a sodium hypochlorite storage and destruction system.
    - Addition of a chlorine railcar loading building connected to the EVS to mitigate chlorine releases.
    - Removal of all existing liquid chlorine equipment including storage tanks, liquid chlorine pumps, condensers, and piping.
    - Addition of enclosed condenser tower containing new condensers, blow gas heater, and liquid-vapor separator for gravity-fed railcar loading system. The proposed condenser tower

will be enclosed and connected to the same EVS as the railcar loading building. The liquid chlorine line from the enclosed condenser platform to the railcar loading area (the only line in the plant with liquid chlorine) will be indoors.

- Removal of distillation column, reboiler, vaporizers, and associated piping.
- Modification of the chlorine compressor design to be a single operating indoor compressor with precooler, intercooler, and aftercooler equipment.
- Piping routes from the chlorine compressor to the new chlorine condensers and from the new chlorine condensers to railcar loading will be double walled piping with interstitial leak detection.
- Improved chlorine detection, automated shutdown, and isolation systems.
- Removal of the Central and East Acid plants.

- Determine LSIR associated with toxic and fire hazards to potential offsite receptors posed by normal operation of the proposed Chemtrade North Vancouver plant.

## 2.1 EXCLUSIONS

Onsite societal and individual risk were not evaluated as part of this scope of work; Chemtrade evaluates onsite risks using their own internal process safety management processes. The LSIR geographic risk contours were generated for calculating offsite risk, and they should not be used for evaluating onsite risk. No explosion hazards (i.e., vapor cloud explosion) were evaluated; flammable dispersion scenarios remained well within the facility boundary, and as such, potential explosion hazards from these scenarios are expected to have little impact to offsite receptors. In addition, no buildings were modelled or evaluated for risk; offsite receptors are assumed to be stationary and located outdoors.

Offsite societal risk was not evaluated as part of this scope of work. MIACC tolerance criteria only requires quantification of individual risk to offsite receptors.

# 3 TOLERANCE CRITERIA

Results are presented in the form of location specific individual risk (LSIR) geographic risk contours. LSIR is defined as the level of risk incurred by a person who is continuously present (24 hours a day, 365 days a year) in a given location. Geographical risk results are compared to the *Risk-based Land Use Planning Guidelines*[3] to support municipal planners responsible for land use plans.

The *Risk-based Land Use Planning Guidelines* set forth by the Process Safety Management Division are shown in Figure 1. According to the criteria[3], no other land use other than the risk source (i.e., facility, pipeline, corridor) should be allowed within the 100-in-a-million (10-4) annual individual risk zone. Between 100-in-a-million (1E-4) and 10-in-a-million (1E-5), uses involving continuous access and the presence of limited numbers of people with easy evacuation (e.g., manufacturing facilities, warehouses,

and open spaces) are allowed. Between 10-in-a-million (1E-5) and 1-in-a-million (1E-6), uses involving continuous access with easy evacuation (e.g., commercial uses, offices, and low-density residential areas) are permitted. Between 1-in-a-million (1E-6) and 0.3-in-a-million (3E-7), uses involving continuous access with difficult evaluation (e.g., high-density residential and commercial) are permitted. Below 0.3-in-a-million (3E-7), development is not restricted in any way, including sensitive public receptors (i.e., schools, daycares, and hospitals).

Chemtrade identified receptors nearby the North Vancouver plant to be considered in tolerance criteria comparison for this study. The offsite receptors of interest provided by Chemtrade are documented in Table 3 and shown in Figure 7 based on UTM coordinates. The apartment and commercial receptors are conservatively assumed to be high-density occupancy.

**Table 3. Offsite Receptors of Interest with UTM Coordinate Location (Provided by Chemtrade)**

| ID | Description | UTM Coordinates (m) | | MIACC Receptor Category | MIACC Risk Criteria |
|---|---|---|---|---|---|
| | | Easting | Northing | | |
| Waste1 | North Shore Recycling & Waste Centre | 498692.44 | 5460933.81 | Manufacturing | 1.0E-4 |
| Waste2 | GFL North Vancouver Facility | 499096.80 | 5461213.39 | Manufacturing | 1.0E-4 |
| Plant1 | ERCO Worldwide - North Vancouver | 499244.96 | 5461098.22 | Manufacturing | 1.0E-4 |
| Plant2 | BA Blacktop Ltd. - Asphalt Plant | 498635.95 | 5460684.57 | Manufacturing | 1.0E-4 |
| Park1 | Montrose Park | 498638.88 | 5460033.19 | Open Space / Parkland | 1.0E-4 |
| Park2 | Maplewood Park | 499089.20 | 5461774.29 | Open Space / Parkland | 1.0E-4 |
| Park3 | Cutter Island Park | 498387.59 | 5461439.45 | Open Space / Parkland | 1.0E-4 |
| Apartments | Northwoods Village Apartments | 498753.16 | 5461468.47 | High-Density Residential | 1.0E-6 |
| Commercial | Closest commercial District | 498917.93 | 5461347.33 | Low-Density Commercial | 1.0E-5 |
| ChildCare | Sunshine Cove Preschool | 499524.55 | 5461778.53 | Sensitive Development | 0.3E-6 |
| SeniorCare | Creekstone Care Centre | 497725.24 | 5461505.37 | Sensitive Development | 0.3E-6 |
| School | Kenneth Gordon Maplewood School | 498772.27 | 5461827.70 | Sensitive Development | 0.3E-6 |
| Marina | Lynnwood Marina | 497870.09 | 5461067.91 | Low-Density Commercial | 1.0E-5 |
| Hospital | Lions Gate Hospital | 495078.38 | 5463136.65 | Sensitive Development | 0.3E-6 |

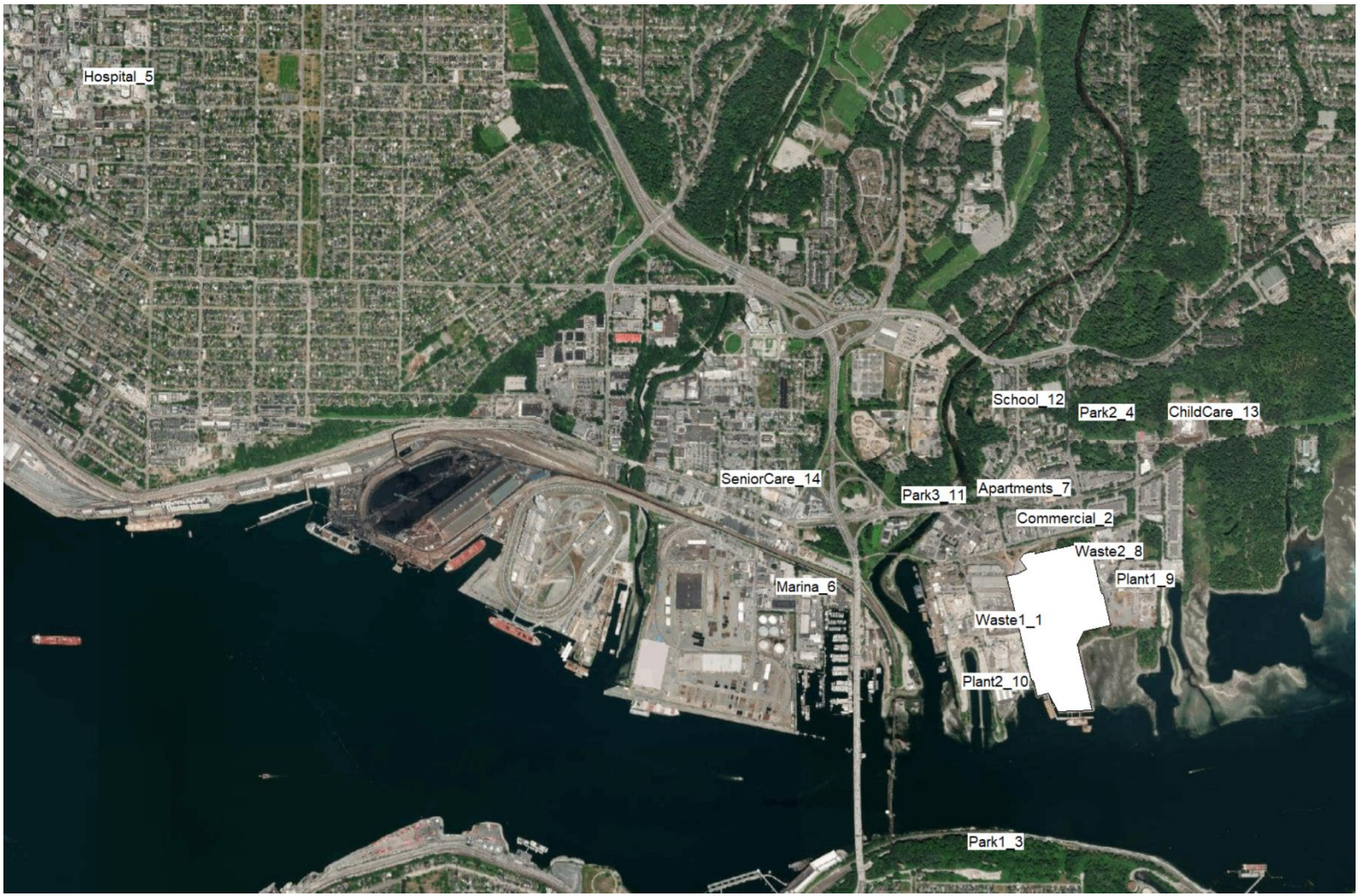



**Figure 7. Aeriel View of Offsite Receptors[7]**

[7] Aerial imaging provided by Chemtrade.

# 4 CONSEQUENCE ANALYSIS METHODOLOGY SUMMARY

This section briefly describes the method used to model consequences associated with the accidental release of process materials. More detailed descriptions of the consequence modeling methodology are given in the appendices.

## 4.1 ASSUMPTIONS

Appendix A provides additional information and documentation of the consequence analysis methodology used in this study. A general list of simplifying assumptions employed in the consequence analysis is provided below.

- Significant equipment removal is expected in the future North Vancouver plant, including but not limited to all liquid chlorine storage, distillation column, reboiler, supporting piping for the distillation column, Central and East Acid plants, and connecting piping between the main facility and the Central and East Acid plants. These scenarios are not evaluated in the consequence or risk analysis.
- Release sizes were modeled at 12.5 mm, 50 mm, and full-bore rupture, up to 150 mm diameter.
- Releases from equipment/piping were assumed to discharge horizontally and aligned with wind direction at an elevation of 1 m.
- Releases from the building louvers were modeled horizontally at louver elevation based on building information provided by Chemtrade.
- Releases from vents were modeled vertically at vent stack elevation based on the building drawings provided by Chemtrade. The modeled orifice diameter was modified to achieve the desired design flow rate based on ventilation information provided by Chemtrade.
- Releases were modeled at instantaneous release rates and assumed to reach steady state conditions up to a maximum duration of 60 minutes.
- Vapour release rates were restricted to maximum production rate when the calculated discharge rate exceeded facility production rate for indoor dispersion scenario refinements only (i.e., equipment housed indoors).
    - Blowdown from initial release to sustained production rate was assumed to be minimal due to limited inventory of chlorine in the affected process equipment.
- Inventories were applied to liquid release scenarios based on liquid holdup information provided by Chemtrade.
- Liquid pooling is limited to the dike area, if specified, or the maximum allowed diameter (default of 25 m). When this limit is reached, the pool increases in depth until the dike height, if specified, or the maximum allowed pool depth (default of 1 m). Excess mass beyond this depth is assumed to be depleted via drainage. This limitation was primarily applied to the HCl scenarios as there is

no liquid chlorine equipment located outdoors. Indoor liquid chlorine release pooling was limited to the building footprint area.

- Sustained compressor/intercooler/aftercooler releases were assumed to be mass-flow limited to typical plant production rates. Larger releases were considered not credible as it is expected the compressors would shut down on surge and/or vibration.
- Refinements were made to the indoor liquid chlorine piping release scenarios (i.e., liquid piping housed indoors) by limiting inventory to the liquid chlorine mass in all piping since loss of back pressure would occur at the chlorine compressors, which would shut down on surge and/or vibration.
- The proposed scrubbing system has the capacity to mitigate a chlorine release up to 15,000 lb/hr.
- Obstructions and topography are not accounted for in SafeSite$_{3G}$© dispersion calculations; however, such obstructions and topography were accounted for in the CFD dispersion calculations. CFD dispersion was only performed for select scenarios; refer to Appendix E.
- Indoor dispersion calculations assumed a well-mixed indoor dispersion within the fixed building volume with ventilation at a specified air exchange rate. Pooling was limited to the building floor plan area. Air exchange rates were assumed and have not been validated by Chemtrade or BakerRisk.
    - Two of the buildings housing process equipment evaluated in this study are proposed and ventilation calculations were performed using preliminary design information provided by Chemtrade.
    - All compressors and equipment containing liquid chlorine will be housed indoors with extensive chlorine detection coverage and automatic plant shutdown upon detection.
- Toxic lethality contours were evaluated for releases from equipment/piping at durations of 10 minutes, 30 minutes, and 60 minutes, up to maximum release duration based on inventory, where an inventory limit was credited. Certain scenarios deviate from this general assumption based on information from Chemtrade regarding operator intervention, chlorine detection, and emergency shutdown valve (ESDV) isolation capabilities. Such scenarios are documented in Table 5, which were subject to more detailed evaluation.
- Toxic lethality contours were evaluated for releases during hydrochloric acid loading operations at baseline durations of 1 minute, 5 minutes, and 60 minutes.
- Toxic lethality contours were evaluated for releases during chlorine loading operations at durations of 5 minutes, 10 minutes, and 60 minutes to account for the associated FTA[2] and Chemtrade input. Additional release time was modelled since this was an indoor release, to allow for the depletion of indoor gas concentrations.
- The stored railcar breach scenario was evaluated using the EPA RMP worst case release within a 10-minute duration. BakerRisk was not involved in determining the basis for the consequence of

this event, as it was previously evaluated in a 2006 QRA study[8] performed by another third-party consultant. However, the railcar storage conditions (i.e., temperature and pressure) were verified by Chemtrade during this study.

- Results are representative of the proposed preliminary design information provided by Chemtrade and modeling inputs/assumptions at the time of this study and are subject to change. Consequence model inputs and analysis revalidation is recommended as detailed design information becomes available.
    - Chemtrade intends to make necessary safety improvements during detailed design, if required, to ensure LSIR contours remain static or are improved.

## 4.2 HAZARD IDENTIFICATION

Representative sources for the proposed Chemtrade North Vancouver Facility were identified by reviewing existing and new design Process Flow Diagrams (PFDs) and piping and instrumentation diagrams (P&IDs) provided by Chemtrade. Sources were then reviewed and validated with a knowledgeable group of Chemtrade operations and engineering personnel. For each release location, 12.5 mm, 50 mm, and full-bore rupture (up to 150 mm) release cases were modeled.

Per Chemtrade's request, a large breach of a stored railcar was assessed. The consequence modeling inputs were consistent with a previous FSS and QRA study[8] performed by a third-party consultant. BakerRisk independently validated the chlorine railcar storage conditions modelled (i.e., temperature, pressure) with Chemtrade. This scenario was previously defined as a 10-minute release duration for which the entire inventory of the railcar was released, as per the Environmental Protection Agency (EPA) Risk Management Program's (RMP) worst case release approach. Although the EPA RMP defines this as a 10-minute release duration, chlorine pool evaporation continues for up to 59 minutes following release of the liquid chlorine railcar inventory. Thus, two dispersions representative of this scenario were modeled in SafeSite: a 10-minute liquid release and a 59-minute pool evaporation release. The higher risk scenario was the evaporating pool for a 59-minute duration rather than a liquid release for a 10-minute duration; this scenario was conservatively modeled with the higher risk approach.

## 4.3 CONSEQUENCE ANALYSIS

Pressure, temperature, maximum release size, and material composition were defined for each release hazard source. Discharge rates were calculated, and dispersion results were predicted for a range of statistically significant meteorological conditions based on local weather data. For each release hazard, 12.5 mm, 50 mm, and full-bore rupture (up to 150 mm) cases were modeled. BakerRisk's SafeSite$_{3G}$© software was used to calculate potential consequences of identified hazards for the units assessed. The SafeSite$_{3G}$© dispersion model has been validated with data obtained from Jack Rabbit II chlorine dispersion tests.

[8] ALP & Associates Incorporated, "North Vancouver Plant Quantitative Risk Assessment," Prepared for Canexus Chemicals Canada Limited Partnership, Richmond Hill, Ontario. Final Report issued October 2006.

Dispersion of the material from releases was modeled using SafeSite$_{3G}$© software, which accounts for thermodynamic properties, flashing, rainout, pooling, evaporation, and gas dispersion. Each release scenario evaluated in SafeSite$_{3G}$© was modeled to steady state conditions. Each dispersion scenarios was assessed for toxic, jet/pool fire (early ignition), and flash fire (delayed ignition) hazards. Jet fire consequences were assessed using the Johnson Model in SafeSite$_{3G}$©. To determine the offsite consequences, dose calculations and probit expressions were used to predict lethality contours for toxic and fire scenarios. Explosion hazards were not assessed as outlined in Section 5. Vulnerability calculations were assessed at a height of 1 m and conservatively assumed that offsite receptors do not evacuate during a release event. Appendix A provides additional information and documentation of the consequence analysis methodology.

The FLACS CFD software was used to model the chlorine release from one release scenario of interest in the northward and westward directions. The release assessed is from the railcar loading building with the chlorine railcar loading modeled at a single point, at the elevated location of the scrubbing system ventilation stack, representative of where the postulated building leakage may be present. The release was assumed to be vertically oriented in a single background atmospheric wind condition in the north and west direction, as requested by Chemtrade. Only the worst-case weather condition (F2.1) was evaluated in the CFD analysis and the intent was to apply subsequent results to all remaining weather conditions. Detailed information on CFD modeling can be found in Appendix E.

The CFD results for this scenario were consistent with the SafeSite$_{3G}$© dispersion results. Since the CFD validated typical SafeSite$_{3G}$© dispersion modeling for this scenario, the CFD consequence results were not included in the consequence or risk analysis. Comparison between CFD consequence results and SafeSite$_{3G}$© consequence results for scenarios of interest is further discussed in Appendix E.

# 5 CONSEQUENCE ANALYSIS INPUT

This section documents the main inputs used in the consequence modeling. The FSS results spreadsheet (Appendix D) provides additional documentation of the input data used in the consequence analysis.

Since only offsite risk was within the scope of this QRA, it was determined that no zones of congestion and confinement needed to be modelled. All flammable dispersion scenarios remained well within the facility boundary, and as such potential explosion hazards from these scenarios are expected to have little impact to offsite receptors. Subsequently, no explosion hazards (i.e., vapor cloud explosion) were evaluated in the consequence analysis. No onsite buildings were modelled for this effort since only offsite risk was within the scope of this QRA.

## 5.1 HAZARD IDENTIFICATION

Input conditions used for release source dispersion modeling are summarized in Appendix D, ***Sources*** and ***Pipelines*** tab. Documentation includes source name, descriptions, material, temperature, pressure, release height, release inventory, and maximum release size modeled. Release locations are provided in

Appendix B. Each case identified in the table is assessed for 12.5 mm, 50 mm, and full-bore rupture (up to 150 mm). Highlighted PFDs with the definition of each source are included in Appendix B. Table 4 documents the release sources modeled for each scenario with their respective process conditions, maximum line size evaluated, inventory/flow rate restrictions, and whether they were modeled as an indoor scenario. The "MF" prefix indicates the main facility, the "AG" prefix indicates the older acid plant operations (e.g., storage tanks and loading), and the "AGN" prefix indicates the newer technology Acid Growth plants. The Central and East Acid plants have been removed from plant operation.

Where maximum vapour production rate exceeded the calculated discharge rate, release scenarios were modified such that the discharge rate evaluated was consistent with maximum production rate. This modification was done for the full-bore (150 mm) releases for compressor (MF-17), aftercooler (MF-18), and chlorine pipelines to Acid Growth plants (MF-35 and MF-38). This was also implemented for the 50 mm and 150 mm releases for the blow gas heater (MF-26).

### 5.1.1 INDOOR DISPERSION SCENARIOS

There is chlorine production equipment, both current and proposed, that are located indoors. Table 4 documents which equipment is indoors in the far-right column as well as their respective process conditions, volumes, and flow rates (if applicable). Indoor release scenarios were modeled as a well-mixed indoor dispersion within the fixed building volume. The resultant mixture of chlorine and air was then modelled as an outdoor release from the building at a specified air exchange rate. Outdoor releases were conservatively modeled at ambient temperature and pressure conditions. For releases from the Liquefaction building, the modelled release hole size was adjusted to achieve the appropriate discharge rate corresponding to the natural leak tightness of the building. For releases from the enclosed chlorine condenser tower and railcar loading buildings, the release hole size was specified based on the surface area of the leak location (i.e., louver or vent stack) and the pressure modified to achieve the appropriate discharge rate.

A plot plan documenting both the current and proposed buildings of interest (outlined in red boxes) are shown in Figure 8.

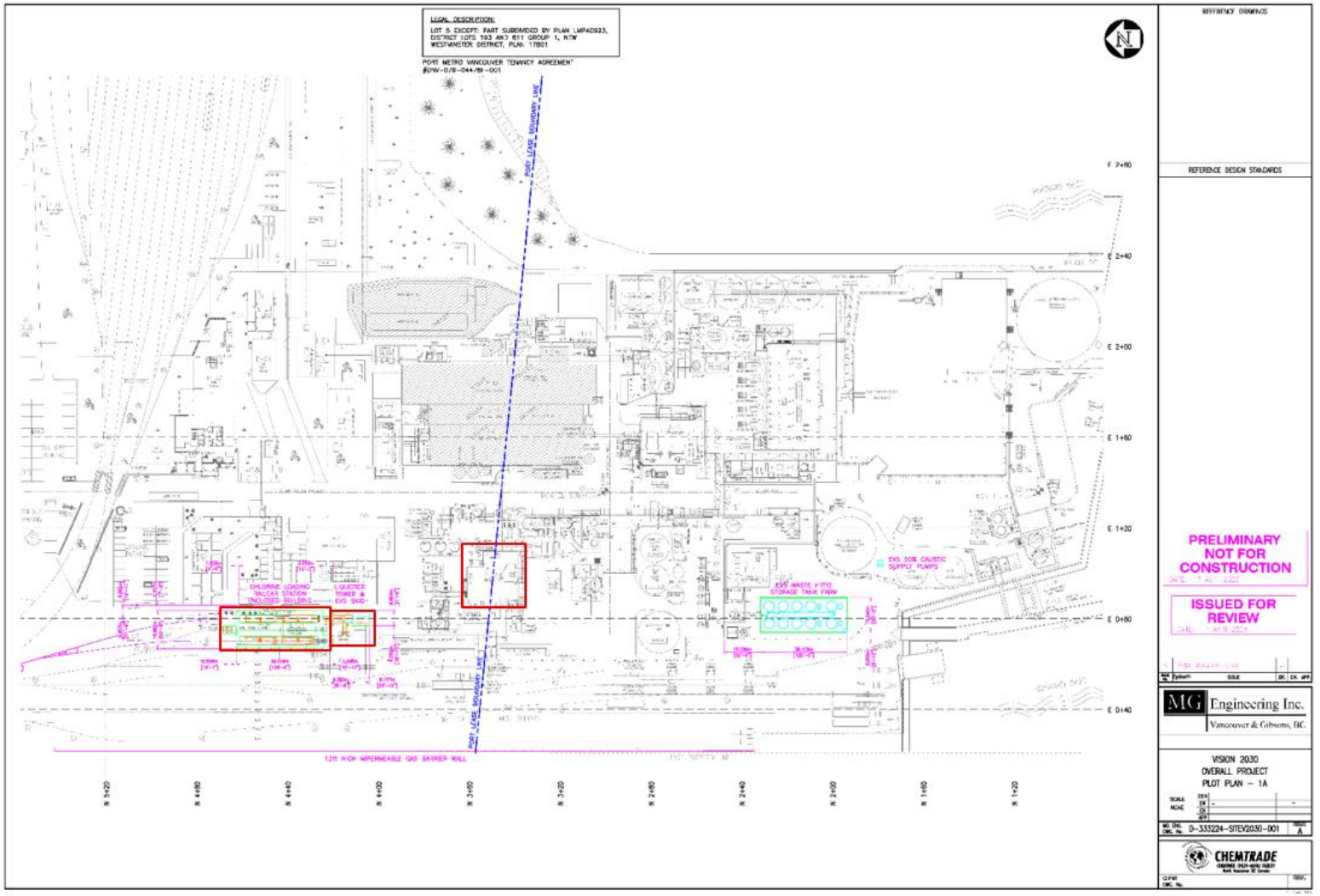



**Figure 8. Plot Plant of the Proposed North Vancouver Facility**[9]

[9] Vision 2030 Overall Project, Plot Plan – 1A, Dwg No. D-333224-SITEV2030-001, Issue A, 04/17/2025.

### *5.1.1.1 LIQUEFACTION BUILDING*

The chlorine precooler, compressors, intercoolers, and aftercoolers are located within the onsite existing E-5 Chlorine Liquefaction building. A highlighted PFD documenting the indoor equipment within the Liquefaction building is shown in Figure 9. Note that this process differs from the current North Vancouver plant operations. In the proposed design shown in Figure 9, there is a singular indoor compressor in operation at a time (i.e., one spare compressor) with a precooler, intercooler, and aftercooler.

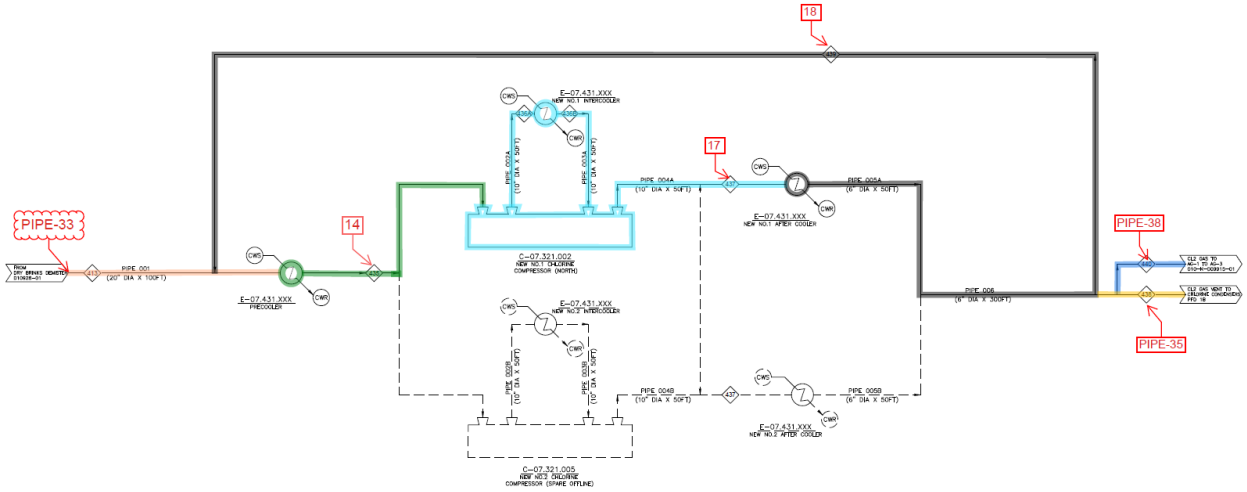



**Figure 9. Highlighted PFD for Indoor Equipment within Liquefaction Building[10]**

The fixed internal volume was approximated to be 135,000 $ft^3$ based on dimensions available from Google Earth™. The natural ventilation of this building is not currently controlled, and doors may be open during summer conditions. The approximate air exchange rate was assumed to be 10 ACH or 22,500 scfm, consistent with typical process buildings in the chemical processing industry. Note that BakerRisk did not validate this assumption using leak-tightness testing or other empirical methods.

The precooler scenario (MF-14) was evaluated using the baseline release durations of 10 minutes, 30 minutes, and 60 minutes. These durations are the time between release and returning the process to a "safe" state (i.e., no additional chlorine release). The precooler equipment is operated at a slight vacuum (-6kPag). As per Chemtrade, any loss of containment would result in a "weep" rather than a pressurized chlorine leak. For smaller release scenarios, air intrusion into the process would occur and result in a process upset rather than a dangerous condition. For a full-bore release (150 mm), it is likely that the upstream operating equipment and subsequent pressure conditions would determine the release conditions from the precooler equipment. As such, a single operating indoor dispersion scenario was evaluated for the precooler using the initial release conditions for the chlorine dryers/demister (MF-09).

[10] Process Flow Diagram, Chlorine Process, Distillation Column, Dwg No. 1A PFD 1 Sens 3, Rev. B, 08/28/2025.

Future plant design will include automatic ESDV activation upon chlorine detection in the Liquefaction building. The automatic action will be to safely shutdown the compressor and isolate or vent down the compressor, intercooler, and aftercooler process sections. Thus, the high-pressure gas operations including the compressor/intercooler/aftercooler (MF-17 and MF-18), Chemtrade anticipates early detection and plant trip from automatic ESDV action or operator intervention. The following sequence of events occurs in the event of a high-pressure chlorine release within the Liquefaction building to initiate plant trip:

1. Compressor controls will reduce the opening on recycle valves PV 7119 ABCD to maintain discharge pressure.
2. Discharge pressure will continue to drop, HCl plants will trip, initiating operator response.
3. Three chlorine sensors on ground floor of chorine building will all hit maximum limit—this will also initiate multiple plant alarms to activate ESDV activation as well as operator response.

Per Chemtrade, the following release durations were used to determine the quantity of chlorine gas released prior to the plant (cellroom) tripping and stopping gas evolution:

- Automated chlorine detection and initiated plant trip/isolation within 1 minute of the event.
- Automated chlorine detection or operator intervention and initiated plant trip/isolation initiated within 10 minutes of the event.
- No automated detection or operation intervention and subsequent initiated plant trip/isolation, unmitigated release occurs for 60 minutes.

The corresponding probabilities of each release duration are discussed further in Section 6.

Following plant trip, the following valves automatically close and isolate the chlorine compressor, intercooler, and aftercooler from the rest of the process: suction valves FV 40042 / FV 40041 close, and compressor valves HV 7109 / FV 7128 close. Following isolation, an additional 97 kg chlorine mass is released from system depressurization. In addition, future plant design will include automatic action upon chlorine detection in the Liquefaction building. The automatic action will be to safely shutdown the compressor and isolate or vent down the compressor, intercooler, and aftercooler process sections.

Due to the large building volume, the chlorine concentration within the building is highly transient in nature. The steady-state concentration varies significantly depending on whether isolation occurs at 1 minute, 10 minutes, or 60 minutes (unmitigated). As such, indoor releases for the compressor and aftercooler were evaluated for three release durations as documented in Table 4. The exact release durations assessed included consideration for the additional 97 kg mass released during equipment depressurization after isolation. Thus, the total quantity of chlorine released includes the release rate for

each specified duration until isolation occurs plus the additional isolated inventory released during depressurization. Note that these indoor dispersion results are heavily dependent upon the assumed release durations and remaining inventory following isolation in toxic risk calculations.

The full-bore (150 mm) release scenarios for the compressor (MF-17) and aftercooler (MF-18) nodes had a calculated discharge rate that exceeded the vapour production rate of the facility. As such, the discharge rate for these scenarios was limited to this maximum production rate, 26,328 kg/hr, based on preliminary design PFDs[10]. Larger releases were considered not credible as it is expected the compressors would shut down on surge and/or vibration.

### *5.1.1.2 PROPOSED ENCLOSED CONDENSER PLATFORM*

The chlorine condensers, blow gas heater, liquid-vapor separator, and vent line knockout pot equipment are located in the proposed enclosed chlorine condenser platform. A highlighted PFD documenting the indoor equipment within the enclosed chlorine condenser platform is shown in Figure 10. Note that the condenser platform and associated equipment are proposed and are not a part of the current North Vancouver plant operations.

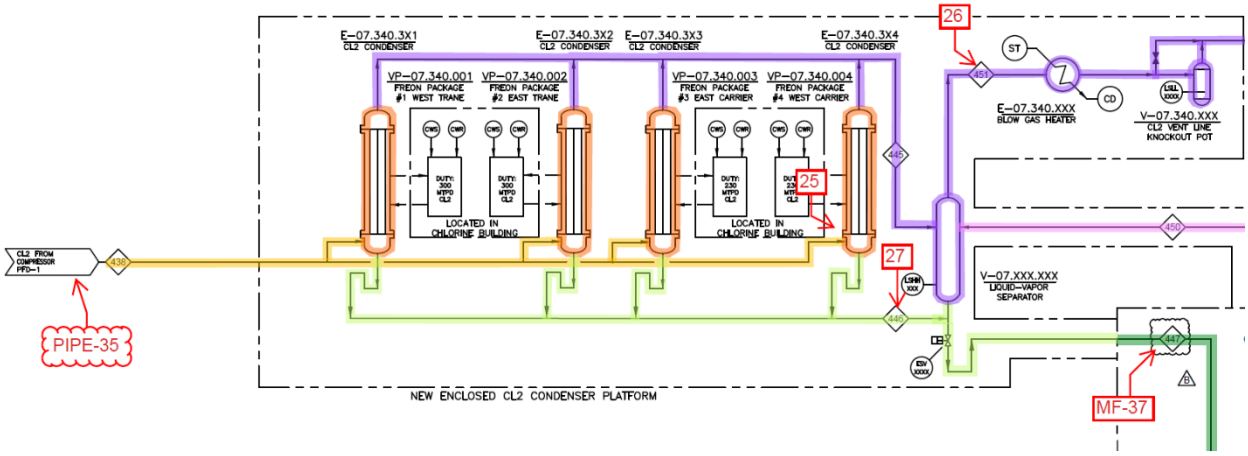



**Figure 10. Highlighted PFD for Indoor Equipment within Enclosed Chlorine Condenser Platform[11]**

The fixed internal volume was approximated to be 69,992 $ft^3$ based on dimensions from Chemtrade. There are two potential locations of loss of containment from the enclosed condenser platform. These loss of containment locations are consistent with the railcar loading building, as this proposed design will be used as a basis for the enclosed condenser tower, and is discussed further in Section 5.1.1.3. The first location is through an elevated louver if the emergency ventilation system fails. The natural ventilation of this building will be controlled to be a maximum air exchange rate of 1 ACH or 1,167 scfm to reduce loss of containment of chlorine from the enclosed platform. The second location for potential loss of containment is through the scrubber vent stack, should scrubbing action fail. A detailed fault tree analysis (FTA)[2] was performed for loss of containment from the railcar loading building associated with railcar

[11] Process Flow Diagram, Chlorine Process, Chlorine Rail Loading, Dwg No. 1A PFD2 Sens 2&3, Rev. B, 08/28/2025.

loading operations but was not performed for any release from the enclosed chlorine condenser tower. As such, a simplified approach was taken to model condenser tower equipment release scenarios and associated frequency. All of the condenser tower releases that were within the scrubber design capacity were considered fully mitigated 90% of the time, which is further discussed in Section 6. Any unmitigated releases were modeled as a loss of containment from the louver at the natural ventilation rate of the enclosed condenser tower (1 ACH). Note that this air exchange rate assumption will need to be validated or updated as detailed building design occurs.

All scenarios within the enclosed condenser platform (MF-25, MF-26, MF-27) were evaluated using the baseline release durations of 10 minutes, 30 minutes, and 60 minutes since the equipment is currently proposed and not in operation. These durations are the time between release and returning the process to a "safe" state (i.e., no additional chlorine release).

The condenser scenario (MF-25) was only evaluated for a full-bore (150 mm) release due to heat exchanger design. Chlorine will be located on the tube-side of the equipment while the Freon coolant will be located on the shell-side of the equipment. Since the design pressure of the shell-side is significantly higher than the tube-side, a tube-side leak of chlorine into the shell-side would result in process upset requiring plant shutdown. There are no anticipated containment issues related to the potential reactivity with the refrigerant should a shell-side leak occur, per Chemtrade. It is not credible for a tube-side leak to overpressure the shell-side, causing a release from the heat exchanger equipment. However, tube rupture case (i.e., full-bore release) was evaluated since shell-side pressure excursion could result in a leak to atmosphere. Chlorine is expected to be vapour phase in the condenser equipment (condensers, liquid-vapour separator, and blow gas heater), as per Chemtrade. The liquid-vapour separator functions similar to a demister. Liquid chlorine is only in the dip leg outlet piping as represented by MF-27 node in light green, shown in Figure 10.

The chlorine concentration within the building is highly transient in nature for the condenser release scenario. The steady-state concentration varies significantly depending on whether the duration evaluated was 10 minutes, 30 minutes, or 60 minutes (unmitigated). As such, indoor releases for the compressor and aftercooler were evaluated for three release durations as documented in Table 4.

The full-bore (150mm) release scenarios for the condenser (MF-25) node had a calculated discharge rate that exceeded the vapour production rate of the condensers. The discharge rate for this scenario was limited to this maximum production rate, 23,043 kg/hr, based on preliminary design PFDs[12]. Similarly, the medium (50 mm) and full-bore (150 mm) release scenarios for the blow gas heater (MF-26) node had a calculated discharge rate that exceeded the vapour production rate of the blow gas heater/liquid-vapour separator. The discharge rate for this scenario was limited to the maximum production rate from this equipment, 691 kg/hr, based on preliminary design PFDs[12]. Larger releases were considered not credible as it is expected the upstream compressors would shut down on surge and/or vibration.

[12] Process Flow Diagram Chlorine Process, Dwg No. 1A PFD 2 Sens 2&3, Rev. B, 08/28/2025.

The indoor liquid piping (MF-27) scenario was evaluated assuming that the pool was limited to the floor plan area. This scenario was inventory-limited to the maximum liquid hold-up as opposed to the liquid production rate. This is because the production rate would be expected to severely drop after loss of containment from this node. It is expected that there would be loss of back pressure at the upstream chlorine compressors feeding the condensers and driving that production rate; compressors would shut down on surge and/or vibration. Any additional production of chlorine is expected to be minor and the consequence is driven by the initial release of holdup liquid chlorine inventory.

Chemtrade intends for this future enclosed condenser tower design to include the installation of three new chlorine sensors. The sensors and associated logic solver would be the same Draeger 7000 models as used in the proposed railcar loading building. The sensors would automatically trip the cellhouse at 10 ppm (2oo3 voting) and close ESDVs on the condenser inlet header (new) and liquid outlet header to limit the isolatable inventory released during depressurization. Consideration of this proposed safeguard is included in risk calculations. Since chlorine detection and isolation safeguards are theoretical, baseline duration probabilities of 10 minutes, 30 minutes, and 60 minutes were used.

### *5.1.1.3 PROPOSED RAILCAR LOADING BUILDING*

The chlorine railcar loading operations (MF-28 and MF-29), railcar vent line knockout pots (MF-40 and MF-41), and associated liquid chlorine piping are located in the proposed chlorine railcar loading building. A highlighted PFD documenting the indoor equipment within the railcar loading buildings is shown in Figure 10. Note that railcar loading infrastructure and supporting equipment is proposed and is not a part of the current North Vancouver plant operations.

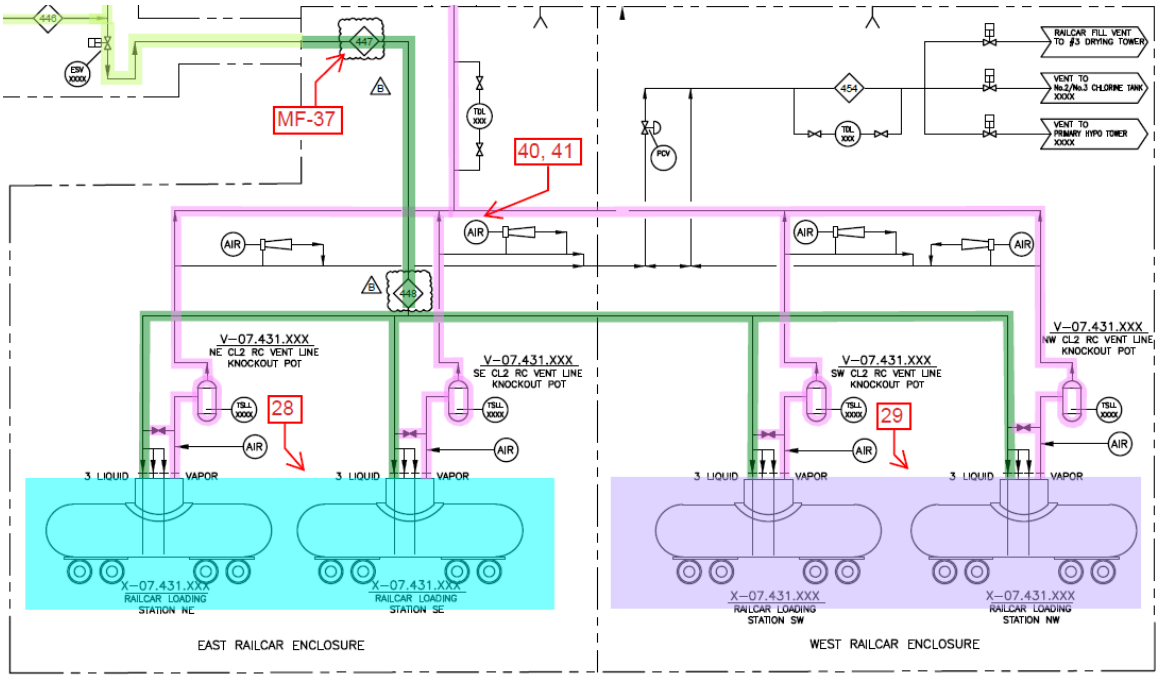



**Figure 11. Highlighted PFD for Indoor Equipment within Railcar Loading Building[12]**

The railcar loading building is segmented into an east and west section; the fixed internal volume of one side was approximated to be 145,687 $ft^3$ based on dimensions from Chemtrade. There are two potential locations of loss of containment from the railcar loading building. The first location is through an elevated louver in the event that the emergency ventilation system fails. The natural ventilation of this building will be controlled to be a maximum air exchange rate of 8 ACH or 19,425 scfm to reduce loss of containment of chlorine from the building through the louver. The second location for potential loss of containment is through the scrubber vent stack, should scrubbing action fail. In this case, forced ventilation is facilitated by the scrubbing system at an air exchange rate of 7,500 scfm, as per Chemtrade. One limitation of the scrubbing system is that this safeguard can only mitigate 15,000 lb/hr chlorine release rates. For release rates that exceeding this scrubbing capacity, partial scrubbing was accounted for in discharge rates by reducing discharge rate by 15,000 lb/hr. Note that the air exchange rate assumptions will need to be validated or updated as detailed building design occurs.

The railcar loading scenarios (MF-28 and MF-29) were evaluated at release durations of 5 minutes, 10 minutes, and 60 minutes based on anticipated operator intervention. Operator intervention will consist of stopping chlorine flow from the process with an emergency shutdown (ESD) button or utilizing enhanced personal protective equipment (PPE) available, including self-contained breathing apparatuses (SCBAs), which the operator can don and then enter the field to close manual valves and stop liquid chlorine flow. Further discussion on release durations and associated probabilities is discussed in Section 6.4.3.

The chlorine vent line knockout pot (MF-40 and MF-41) and liquid chlorine piping (MF-37) were evaluated using the baseline release durations of 10 minutes, 30 minutes, and 60 minutes since the equipment is currently proposed and not in operation. These durations are the time between release and returning the process to a "safe" state (i.e., no additional chlorine release).

The chlorine concentration within the building is highly transient in nature for the chlorine release during loading operations scenario with loss of containment through the louver. The steady-state concentration varies significantly depending on whether the duration evaluated was 5 minutes, 10 minutes, or 60 minutes (unmitigated). As such, indoor releases for the compressor and aftercooler were evaluated for three release durations as documented in Table 4.

All liquid release scenarios (MF-28, MF-29, and MF-37) were evaluated assuming that the pool was limited to the floor plan area. The liquid chlorine process piping was inventory-limited to the maximum liquid hold-up as opposed to the liquid production rate. This is because the production rate would be expected to severely drop after loss of containment from this node. It is expected that there would be loss of back pressure at the upstream condenser inlet would stop chlorine liquefaction, ceasing liquid chlorine production. Any additional production of chlorine is expected to be minor and the consequence would be driven by the initial release of holdup liquid chlorine inventory.

The chlorine railcar vent line knockout pots (MF-40 and MF-41) were modeled using the vapour pressure of chlorine at -26 °C, the operating temperature of the chlorine railcar. A release from this equipment would be dependent upon the evaporating chlorine from the railcar. The steady-state pressure of this release would be synonymous with the vapour pressure within the railcar, not the pressurized liquid storage pressure.

**Table 4. Release Sources Modelled in Each Scenario with Process Conditions**

| Source | Description | Material | Temperature (C) | Pressure (bar(g)) | Inventory (kg) | Pump Rate (kg/s) | State | Max Size (mm dia) | Indoor Scenario |
|---|---|---|---|---|---|---|---|---|---|
| AG-01-HClRailcarLoading | HCl Loading Stations | H2O/HCl 64/36 (mass%) | 20 | 2.3 | | | Liquid | 80 | |
| AG-02-HClTruckLoading | HCl Truck Loading Station | H2O/HCl 64/36 (mass%) | 20 | 3.6 | | | Liquid | 50 | |
| AG-03-HClStorageTankNW | North West HCl Storage Tank | H2O/HCl 64/36 (mass%) | 20 | 0.72 | | | Liquid | 150 | |
| AG-04-HClStorageTankNE | North East HCl Storage Tank | H2O/HCl 64/36 (mass%) | 20 | 0.72 | | | Liquid | 150 | |
| AG-05-HClLoadingPump | HCl Loading pumps to loading area | H2O/HCl 64/36 (mass%) | 20 | 2.3 | | 35 | Liquid | 150 | |
| AG-06-HClStorageTankSE | South East HCl Storage Tank | H2O/HCl 64/36 (mass%) | 20 | 0.72 | | | Liquid | 150 | |
| AG-07-HClStorageTankSW | South West HCl Storage Tank | H2O/HCl 64/36 (mass%) | 20 | 0.72 | | | Liquid | 150 | |
| AG-08-HClSupplyPump | HCl Supply Pump | H2O/HCl 64/36 (mass%) | 20 | 4.7 | | 6.3 | Liquid | 80 | |
| AG-09-HClTransferPump | HCl Transfer Pump to Storage and Dilution System | H2O/HCl 64/36 (mass%) | 20 | 3.6 | | 16 | Liquid | 50 | |
| AG-10-HClMixer | HCl Dilution System to Truck Loading | H2O/HCl 64/36 (mass%) | 20 | 3.6 | | | Liquid | 150 | |
| AG-11-HClDistribution_PIPE | HCl Acid Distribution Pipeline | H2O/HCl 64/36 (mass%) | 20 | 4.7 | | | Liquid | 80 | |
| AG-12-HClRailLoading_PIPE | HCl Acid Pipeline from Loading Pump to Railcar Loading | H2O/HCl 64/36 (mass%) | 20 | 2.2 | | | Liquid | 80 | |
| AGN-01-H2Demister | Hydrogen Demistor Acid Plant 1 | H2/H2O 81/19 (mass%) | 23 | 0.69 | | | 2-Phase | 150 | |
| AGN-02-HClSynthUnitPiping | HCl Synthesis Unit Piping to Tail Gas Tower | H2O/H2/HCl/CO2/N2 7/4/74/7/8 (mass%) | 40 | 4.0E-3 | | | Gas | 150 | |
| AGN-03-TailGasTower | Tail Gas Tower Bottoms Recycle to HCl Synthesis Unit | H2O/HCl 88/12 (mass%) | 25 | 4.0E-3 | | | Liquid | 150 | |
| AGN-04-TransferTank | HCl Product from HCl Synthesis Unit through Transfer Tank to HCl Transfer Pump suction | H2O/HCl 64/36 (mass%) | 25 | 0.33 | | | Liquid | 75 | |
| AGN-05-HClTransferPump | HCl Transfer Pump discharge to HCl Storage Tanks | H2O/HCl 64/36 (mass%) | 25 | 4.5 | | | Liquid | 50 | |
| AGN-06-HClStoragePIPE | Pipeline from Transfer Pumps to HCl Storage Vessels | H2O/HCl 64/36 (mass%) | 25 | 4.5 | | | Liquid | 50 | |
| MF-01-Pump1512C | Spray Overhead to Dechlorinator Gas Vacuum pump | Cl2/H2O 90/10 (mass%) | 53 | 0.10 | | | 2-Phase | 150 | |
| MF-02-BrineDechlorinator1501U | Brine Dechlorinator to Spray | Cl2/H2O 30/70 (mass%) | 53 | 0.10 | | | 2-Phase | 150 | |
| MF-03-ChlorineElectrolyzer | Chlorine Electrolyzer (Typical 14) | Cl2/H2O/O2 82/17/1 (mass%) | 88 | 0.21 | | | Gas | 25 | |

| Source | Description | Material | Temperature (C) | Pressure (bar(g)) | Inventory (kg) | Pump Rate (kg/s) | State | Max Size (mm dia) | Indoor Scenario |
|---|---|---|---|---|---|---|---|---|---|
| MF-03-ChlorinePressureSeal | Chlorine Header from Electrolyzer (Typical 14) to Cooling tower/pressure Seal | Cl2/H2O/O2 82/17/1 (mass%) | 88 | 0.21 | | | Gas | 150 | |
| MF-04-WeakBrineTank2107T | Tank Vent Recycle through Chlorine Pressure Seal and to Chlorine Header | Cl2/H2O 85/15 (mass%) | 88 | 0.21 | | | Gas | 100 | |
| MF-05-HypoDestructionTank5030T | Wet Chlorine from hypo destruction tank to chlorine cooler | Cl2/H2O 83/17 (mass%) | 40 | 0.16 | | | 2-Phase | 150 | |
| MF-06-HydrogenElectrolyzers | Hydrogen Electrolyzer | H2/H2O 25/75 (mass%) | 88 | 0.24 | | | Gas | 150 | |
| MF-06-HydrogenPressureSeal2121T | Hydrogen from Hydrogen Pressure seal to quench tower | H2/H2O 25/75 (mass%) | 88 | 0.10 | | | Gas | 150 | |
| MF-07-ChlorineCoolingTower4005U | Chlorine to Cooling Tower | Cl2/H2O 18/82 (mass%) | 50 | 0.16 | | | 2-Phase | 150 | |
| MF-08-ChlorineCandleFilter4020K | Overhead from Cooling Tower to Chlorine Candle filter, discharging to Chlorine Dryer | Cl2/H2O/O2 98/1/1 (mass%) | 21 | 0.16 | | | 2-Phase | 150 | |
| MF-09-ChlorineDryer4021U | Chlorine from Dryer to Dry Binks Demister to Chlorine Purification | CHLORINE | 18 | 0.11 | | | Gas | 150 | |
| MF-10-PrimaryHypoTower5001U | Blow Gas Heater to Primary Hypo Tower | Cl2/CO2/N2/O2 29/7/9/55 (mass%) | 25 | 5.0E-3 | | | Gas | 150 | |
| MF-11-HydrogenQuenchTower6069U | Cooled hydrogen through Quench Tower to one of two Nash Compressors | H2/H2O 85/15 (mass%) | 20 | 0.17 | | | 2-Phase | 150 | |
| MF-12-S3BNashCompressor | Compressed Hydrogen from Hydrogen Quench towers through hydrogen compressors, separators, and mist eliminators to HCl Burner/Newalta/Boiler | H2/H2O 85/15 (mass%) | 23 | 0.69 | | | 2-Phase | 150 | |
| MF-13-HC60NashCompressor | Compressed Hydrogen from Hydrogen Quench towers through hydrogen compressors, separators, and mist eliminators to HCl Burner/Newalta/Boiler | H2/H2O 85/15 (mass%) | 23 | 0.69 | | | 2-Phase | 150 | |
| MF-14-PreCooler | Vapour chlorine through PreCooler to New No. 1 Chlorine Compressor (North) suction. This scenario is modeled as indoor dispersion within the Liquefaction building. | AIR/Cl2 86/14 (mol%) | 21 | 0.10 | | | Gas | 150 | X |
| MF-17-NewCl2Compressor_01min | Vapour chlorine through New No. 1 Chlorine Compressor (North) and New No. 1 InterCooler to New No. 1 AfterCooler. This scenario is modeled as indoor dispersion within the Liquefaction building. Evaluated for 1-minute until automatic ESDV activation and accounts for additional release of isolated inventory. | AIR/Cl2 96/4 (mol%) | 21 | 0.10 | | | Gas | 150 | X |
| MF-17-NewCl2Compressor_10min | Vapour chlorine through New No. 1 Chlorine Compressor (North) and New No. 1 InterCooler to New No. 1 AfterCooler. This scenario is modeled as indoor dispersion within the Liquefaction building. Evaluated for 10-minute until automatic ESDV activation or operator intervention and accounts for additional release of isolated inventory. | AIR/Cl2 80/20 (mol%) | 21 | 0.10 | | | Gas | 150 | X |
| MF-17-NewCl2Compressor_60min | Vapour chlorine through New No. 1 Chlorine Compressor (North) and New No. 1 InterCooler to New No. 1 AfterCooler. This scenario is modeled as indoor dispersion within the Liquefaction building. Evaluated as an unmitigated scenario for 60 minute duration. | AIR/Cl2 76/24 (mol%) | 21 | 0.10 | | | Gas | 150 | X |
| MF-18-NewAfterCooler_01min | Vapour chlorine through New No. 1 AfterCooler to PreCooler / New No. 1 Chlorine Compressor recycle, Chlorine Condensers, and Acid Plants AG-1 to AG-3. This scenario is modeled as indoor dispersion within the Liquefaction building. | AIR/Cl2 96/4 (mol%) | 21 | 0.10 | | | Gas | 150 | X |

| Source | Description | Material | Temperature (C) | Pressure (bar(g)) | Inventory (kg) | Pump Rate (kg/s) | State | Max Size (mm dia) | Indoor Scenario |
|---|---|---|---|---|---|---|---|---|---|
| | Evaluated for 1-minute until automatic ESDV activation and accounts for additional release of isolated inventory. | | | | | | | | |
| MF-18-NewAfterCooler_10min | Vapour chlorine through New No. 1 AfterCooler to PreCooler / New No. 1 Chlorine Compressor recycle, Chlorine Condensers, and Acid Plants AG-1 to AG-3. This scenario is modeled as indoor dispersion within the Liquefaction building. Evaluated for 10 minutes until automatic ESDV activation or operator intervention and accounts for additional release of isolated inventory. | AIR/Cl2 80/20 (mol%) | 21 | 0.10 | | | Gas | 150 | X |
| MF-18-NewAfterCooler_60min | Vapour chlorine through New No. 1 AfterCooler to PreCooler / New No. 1 Chlorine Compressor recycle, Chlorine Condensers, and Acid Plants AG-1 to AG-3. This scenario is modeled as indoor dispersion within the Liquefaction building. Evaluated as an unmitigated scenario for 60-minute duration. | AIR/Cl2 76/24 (mol%) | 21 | 0.10 | | | Gas | 150 | X |
| MF-19-EffluentNeutralizationTank8556T | 36% HCl entering Effluent Neutralization Tank | H2O/HCl 64/36 (mass%) | 20 | 0.10 | | | Liquid | 25 | |
| MF-20-IonExchangeEffluentTank8545T | 36% HCl entering Ion Exchange Effluent Tank | H2O/HCl 64/36 (mass%) | 20 | 0.10 | | | Liquid | 25 | |
| MF-21-EffluentCollectionTank | 36% HCl entering Effluent Collection Tank | H2O/HCl 64/36 (mass%) | 20 | 0.10 | | | Liquid | 25 | |
| MF-25-Cl2Condenser_10min | Vapour chlorine through Chlorine Condensers. This scenario is modeled as indoor dispersion within the enclosed Condenser Tower. Evaluated for 10-minute release duration. | AIR/Cl2 51/49 (mol%) | 21 | 1.0E-5 | | | Gas | 150 | X |
| MF-25-Cl2Condenser_30min | Vapour chlorine through Chlorine Condensers. This scenario is modeled as indoor dispersion within the enclosed Condenser Tower. Evaluated for 30-minute release duration . | AIR/Cl2 13/87 (mol%) | 21 | 1.0E-5 | | | Gas | 150 | X |
| MF-25-Cl2Condenser_60min | Vapour chlorine through Chlorine Condensers. This scenario is modeled as indoor dispersion within the enclosed Condenser Tower. Evaluated as an unmitigated scenario for 60-minute duration. | CHLORINE | 21 | 1.0E-5 | | | Gas | 150 | X |
| MF-26-BlowGasHeater | Vapour chlorine through Liquid-Vapor Separator, Blow Gas Heater, Chlorine Vent Line Knockout Pot. This scenario is modeled as indoor dispersion within the enclosed Condenser Tower. | AIR/Cl2 83/17 (mol%) | 21 | 4.5E-6 | | | Gas | 100 | X |
| MF-27-CondenserLiquidCl2Piping | Chlorine liquid piping from Chlorine Condensers drip leg and Liquid Vapor Separator liquid line to Railcar Loading Building. This scenario is modeled as indoor dispersion within the enclosed Condenser Tower. | AIR/Cl2 55/45 (mol%) | 21 | 1.0E-5 | | | Gas | 150 | X |
| MF-28-Cl2RailcarLoadingEast_Louver_05min | Chlorine Railcar Loading Release during loading operations in East Building side from Louver. This scenario is modeled as indoor dispersion within the Railcar Loading building. Evaluated for 5-minute release. | AIR/Cl2 88/12 (mol%) | 21 | 1.2E-3 | | | Gas | 25 | X |
| MF-28-Cl2RailcarLoadingEast_Louver_10min | Chlorine Railcar Loading Release during loading operations in East Building side from Louver. This scenario is modeled as indoor dispersion within the Railcar Loading building. Evaluated for 10-minute release duration. | AIR/Cl2 82/18 (mol%) | 21 | 1.3E-3 | | | Gas | 25 | X |
| MF-28-Cl2RailcarLoadingEast_Louver_60min | Chlorine Railcar Loading Release during loading operations in East Building side from Louver. This scenario is modeled as indoor dispersion within the Railcar Loading building. Evaluated as an unmitigated scenario for 60-minute duration. | AIR/Cl2 75/25 (mol%) | 21 | 1.4E-3 | | | Gas | 25 | X |
| MF-28-Cl2RailcarLoadingEast_Vent | Chlorine Railcar Loading Release during loading operations in East Building side from Vent Stack. This scenario is modeled as indoor dispersion within the Railcar Loading building. | AIR/Cl2 55/45 (mol%) | 21 | 1.6E-3 | | | Gas | 25 | X |

| Source | Description | Material | Temperature (C) | Pressure (bar(g)) | Inventory (kg) | Pump Rate (kg/s) | State | Max Size (mm dia) | Indoor Scenario |
|---|---|---|---|---|---|---|---|---|---|
| MF-29-Cl2RailcarLoadingWest_Louver_05min | Chlorine Railcar Loading Release during loading operations in West Building side from Louver. This scenario is modeled as indoor dispersion within the Railcar Loading building. Evaluated for 5-minute release duration. | AIR/Cl2 88/12 (mol%) | 21 | 1.2E-3 | | | Gas | 25 | X |
| MF-29-Cl2RailcarLoadingWest_Louver_10min | Chlorine Railcar Loading Release during loading operations in West Building side from Louver. This scenario is modeled as indoor dispersion within the Railcar Loading building. Evaluated for 10-minute release duration. | AIR/Cl2 82/18 (mol%) | 21 | 1.3E-3 | | | Gas | 25 | X |
| MF-29-Cl2RailcarLoadingWest_Louver_60min | Chlorine Railcar Loading Release during loading operations in West Building side from Louver. This scenario is modeled as indoor dispersion within the Railcar Loading building. Evaluated as an unmitigated scenario for 60-minute duration. | AIR/Cl2 75/25 (mol%) | 21 | 1.4E-3 | | | Gas | 25 | X |
| MF-29-Cl2RailcarLoadingWest_Vent | Chlorine Railcar Loading Release during loading operations in West Building side from Vent Stack. This scenario is modeled as indoor dispersion within the Railcar Loading building. | AIR/Cl2 55/45 (mol%) | 21 | 1.6E-3 | | | Gas | 25 | X |
| MF-30-StoredRailcarEvaporation | Large breach of stored chlorine railcar in yard. Representative of pooled liquid release evaporation for 59-minute duration following 10-minute release of railcar liquid inventory. | CHLORINE | 21 | 1.0E-2 | | | Gas | 84.3 | |
| MF-32-WetCl2_PIPE | Wet chlorine pipeline from Chlorine Candle Filter to Dryers (600 mm pipeline) | Cl2/H2O/O2 98/1/1 (mass%) | 26 | 0.13 | | | 2-Phase | 150 | |
| MF-33-DryCl2_PIPE | Dry chlorine pipeline from Dryers to Precompression Blower (20” pipeline) | CHLORINE | 20 | 8.0E-2 | | | Gas | 150 | |
| MF-35-Cl2Aftercooler_PIPE | Vapour chlorine pipeline from New No. 1 AfterCooler to Chlorine Condensers. | CHLORINE | 25 | 3.7 | | | Gas | 150 | |
| MF-36-Cl2toAG_PIPE | Vapour chlorine pipeline from Chlorine Vent Line Knockout Pot to Acid Plants AG-1 to AG-3 and Primary Hypo Tower. | Cl2/CO2/O2/N2 55/5/36/4 (mass%) | -26 | 3.0 | | | Gas | 100 | |
| MF-37-Cl2RailcarLoadingPiping | Liquid chlorine indoor piping to railcar loading stations. This scenario is modeled as indoor dispersion within the Railcar Loading building. | AIR/Cl2 76/24 (mol%) | 21 | 1.4E-3 | | | Gas | 150 | X |
| MF-38-AGNCl2_PIPE | Main $Cl_2$ feed pipeline to new acid plants | CHLORINE | 25 | 3.7 | | | Gas | 150 | |
| MF-40-VentKOPotEast | Vapour chlorine vent from Chlorine Railcar through East Chlorine Railcar Vent Line Knockout Pots. This scenario is modeled as indoor dispersion within the Railcar Loading building. | AIR/Cl2 99.1/0.9 (mol%) | 21 | 1.0E-3 | | | Gas | 25 | X |
| MF-41-VentKOPotWest | Vapour chlorine vent from Chlorine Railcar through West Chlorine Railcar Vent Line Knockout Pots. This scenario is modeled as indoor dispersion within the Railcar Loading building. | AIR/Cl2 99.1/0.9 (mol%) | 21 | 1.0E-3 | | | Gas | 25 | X |

### 5.1.2 RELEASE DURATIONS

Toxic lethality (i.e., outdoor vulnerability) contours are calculated using multiple release durations to account for early intervention and isolation. Releases from equipment/piping were evaluated at baseline durations of 10 minutes, 30 minutes, and 60 minutes, up to maximum release duration based on inventory, where an inventory limit was credited. Similarly, releases during loading operations at durations of 1 minute, 5 minutes, and 60 minutes. Certain scenarios deviate from this general assumption based on information from Chemtrade regarding operator intervention, chlorine detection, and ESDV isolation capabilities. Such scenarios are documented in Table 5 below, which were subject to more detailed evaluation as discussed in Section 4.2, 5.1.1, and 6.4. Note that MF-17 and MF-18 release durations account for addition time required to depressurize equipment with isolated inventory following automatic ESDV activation.

**Table 5. Refined Scenario Release Durations**

| Scenario | Short (min) | Medium (min) | Long (min) |
|---|---|---|---|
| MF-17-NewCl2Compressor-012.5 | 8.6 | 15.4 | 60 |
| MF-17-NewCl2Compressor-050 | 6.6 | 12.5 | 60 |
| MF-17-NewCl2Compressor-150 | 6.5 | 12.4 | 60 |
| MF-18-NewAfterCooler-012.5 | 8.6 | 15.4 | 60 |
| MF-18-NewAfterCooler-050 | 6.6 | 12.5 | 60 |
| MF-18-NewAfterCooler-150 | 6.5 | 12.4 | 60 |
| MF-28-Cl2RailcarLoadingEast_Vent-012.5 | 5 | 10 | 60 |
| MF-28-Cl2RailcarLoadingEast_Vent-025 | 5 | 10 | 60 |
| MF-28-Cl2RailcarLoadingEast_Louver-025 | 5 | 10 | 60 |
| MF-29-Cl2RailcarLoadingWest_Vent-012.5 | 5 | 10 | 60 |
| MF-29-Cl2RailcarLoadingWest_Vent-025 | 5 | 10 | 60 |
| MF-29-Cl2RailcarLoadingWest_Louver-025 | 5 | 10 | 60 |
| MF-30-StoredRailcarEvaporation-084.32 | 59.4 | | |

## 5.2 MATERIALS

In the FSS results spreadsheet (see Appendix D) the ***Materials*** and ***Mixtures*** tabs summarize flammable and toxic materials and mixtures used for release cases modeled in this analysis. The acute toxic materials identified for the Chemtrade plant are chlorine and hydrochloric acid. The toxic probit values and sources for each acute toxic material are provided in the ***Materials*** tab of the FSS results spreadsheet. Table 6 summarizes the toxic materials and the toxic concentrations that result in a 1%, 10%, and 90% lethality over a 10-minute exposure.

**Table 6. Toxic Materials and Lethality Concentrations (10-minute Exposure)**

| Material | Probits (a, b, N) | Source | Lethality* (ppm) | | |
|---|---|---|---|---|---|
| | | | 1% | 10% | 90% |
| CHLORINE | -4.86, 0.5, 2.75 | TNO Purple Book (2005) | 103 | 222 | 1,429 |
| HYDROCHLORIC ACID | -35.77, 3.69, 1 | TNO Purple Book (2005) | 3,343 | 4,444 | 8,894 |

** Lethality concentrations based on 10-minute exposure duration*

## 5.3 METEOROLOGICAL DATA

Dispersion of each release case was modeled under weather conditions B2.7, D3.5, D7.4, and F2.1. Statistical meteorological data is based on STAR data obtained from Trinity Consultants for Vancouver International Airport (YVR), British Columbia for the years 2018–2022 (see Appendix C). In the weather condition names, the letter represents Pasquill atmospheric stabilities, and the number represents wind speeds in meters per second; therefore, F2.1 refers to atmospheric stability F with a wind speed of 2.1 m/s. In the Pasquill stability classes, A is very unstable, and F is very stable.

# 6 RISK ANALYSIS METHODOLOGY SUMMARY

Risk was assessed for the facilities in a manner consistent with standard risk analysis techniques. The QRA analysis was conducted with BakerRisk's QRATool© software. The following tasks were performed in the QRA study:

- Imported results from the FSS (lethality contours) into the QRA model.
- Used industry-average failure rate data and equipment count data obtained by reviewing PFDs and P&IDs, and pipe size/length data to estimate release frequencies.
- Chlorine loss of containment during railcar loading frequency was determined by FTA using Isograph Reliability Workbench[2,13].
- The probability that a flammable release will ignite is based on industry experience and values are assigned as a function of release magnitude)[14]. Early ignition is assessed for fire impacts (jet), and delayed ignition is assessed for flash fire impacts.
- Calculated location-specific individual risk based on release frequencies, conditional probabilities, and consequences of each scenario assessed.
- Reported risk results consistent with typical industry risk guidance (i.e., LSIR contours).

[13] https://www.isograph.com/software/reliability-workbench/.
[14] Cox, A. W., Lees, Frank P., Ang, M. L. Classification of Hazardous Locations, IChemE, 1990.

Appendix A provides additional information and documentation of the risk analysis methodology.

## 6.1 ASSUMPTIONS

Appendix A provides additional information and documentation of the risk analysis methodology used in this study. A general list of simplifying assumptions employed in the consequence analysis is provided below. Detailed documentation for these assumptions is described further within this section.

- Significant equipment removal is expected in the future North Vancouver plant, including but not limited to all liquid chlorine storage, distillation column, reboiler, supporting piping for the distillation column, Central and East Acid plants, and connecting piping between the main facility and the Central and East Acid plants. These scenarios are not evaluated in the consequence or risk analysis.
- In general, a short, medium, and long duration with corresponding probabilities were evaluated. Baseline durations and probabilities were applied to majority of scenarios. Select scenarios have durations and probabilities that deviate based on input from Chemtrade.
    - The stored railcar release scenario was the only scenario evaluated for a single 59-minute duration since operator or automated intervention is not possible in the event that loss of containment of the entire railcar inventory occurs. Note that although the EPA RMP defines this scenario as a 10-minute release duration of the full railcar inventory, evaporation of chloride from the subsequent pool continues for a 59-minute duration. The cloud formed from this evaporation is the risk-driving hazard and is conservatively evaluated as such.
- Frequency of chlorine release and subsequent loss of containment from the railcar loading building was determined using an FTA. This frequency is applicable to the process information, assumptions, and recommendations documented in the supplementary report[2].
- For indoor release scenarios within the enclosed chlorine condenser tower and railcar loading buildings (excluding railcar loading release scenarios MF-28 and MF-29 where frequency was evaluated with an FTA[2]), an order of magnitude frequency reduction was credited to account for scrubbing action where the release rate did not exceed EVS capacity (15,000 lb/hr).
- Piping routes from the chlorine compressor to the new chlorine condensers and from the new chlorine condensers to railcar loading will be double walled piping with interstitial leak detection and air sweep. Additional reduction in frequency for double-walled piping exceeding a 6-inch diameter was credited since external impact is not considered a credible loss of containment scenario for internal piping.
- BakerRisk was not involved in determining the basis for the frequency of the stored railcar breach scenario, as it was previously quantified in a 2006 QRA study performed by a third-party consultant[8]. The frequency (1.63E-6 per year) previously determined in the 2006 QRA study was used in this QRA performed by BakerRisk, as requested by Chemtrade.

- The North Vancouver plant is online approximately 98% of the time on an annualized basis. Subsequently, a 2% frequency reduction was considered for all process equipment.
- LSIR geographic risk contours assume outdoor receptors and no evacuation occurs.
- The proposed plant design will incorporate seismic considerations during the design of all new equipment and building structures. In this QRA, BakerRisk used industry-average failure rates to define release frequencies which include considerations for loss of containment associated with natural hazards. However, the area of North Vancouver has a higher than typical seismic activity which is not captured in these rates. The increased frequency will be mitigated through certain criteria that Chemtrade is planning to include in their design basis. Further analysis is documented in Appendix F.
- Results are representative of the proposed preliminary design information provided by Chemtrade and modeling inputs/assumptions at the time of this study and are subject to change. Risk model inputs and analysis revalidation is recommended as detailed design information becomes available.
    - Chemtrade intends to make necessary safety improvements during detailed design, if required, to ensure LSIR contours remain static or are improved.

## 6.2 HAZARD IMPACTS

Hazardous sources were identified as part of the FSS and evaluated for potential impacts of toxic exposure and fire (see Section 5). The results from the FSS were imported into the QRATool© model. Lethality contours were imported for thermal radiation and toxics. Plot plan and aerial views of the site were imported from the SafeSite$_{3G}$© model into the QRATool© model.

## 6.3 FREQUENCY RATES

Release frequencies are based on equipment counts generated by reviewing PFDs and P&IDs, pipe size and estimated length data, and industry-average failure rates (References 1-10). Failure rates are summarized in Table 7 and equipment counts and frequencies are provided in the QRA results spreadsheet Appendix D, ***Equipment Count*** tab. Spare equipment is not included in equipment counts, since frequency is based on operational equipment only. Lineal piping failure rates account for presence of valves, flanges, fittings, etc.

The industry-average failure rates in Table 7 include considerations for loss of containment associated with natural hazards. However, the area of North Vancouver has a higher than typical seismic activity which is not captured in these rates. The increased frequency will be mitigated through following criteria that Chemtrade is planning to include in their design basis:

- Piping shall be designed to prevent liquid chlorine leaks from a 2%/50-year earthquake as defined in the British Columbia Building Code (BCBC) 2024. The design must be shown through analysis to prevent any potential liquid chlorine leaks for an earthquake with 2% probability of occurrence

in 50 years, as defined in the BCBC.

- The design basis will consider the worst case liquid level, as determined through appropriate nonlinear structural seismic analysis.
- Robust seismic bracing and supports, and anchoring of chlorine equipment shall be implemented to withstand seismic forces.
- Automatic isolation mechanisms for pipelines and high risk equipment will minimize leaks.

Further analysis related to seismic considerations is documented in Appendix F.

**Table 7. Failure Rate Data – Releases**

| Equipment | F-release (per year) (pipes are per ft-year) | | | Reference |
|---|---|---|---|---|
| | 0.5-in | 2-in | FB | |
| Centrifugal Compressor | 3.0E-3 | 3.0E-4 | 3.0E-5 | References 1-10 |
| Reciprocating Compressor (<3MW) | 5.0E-3 | 1.0E-3 | 5.0E-4 | References 1-10 |
| Reciprocating Compressor (>3MW) | 5.0E-2 | 1.0E-2 | 5.0E-3 | References 1-10 |
| Centrifugal Pump | 3.0E-3 | 5.0E-4 | 8.0E-5 | References 1-10 |
| Reciprocating Pump | 1.0E-2 | 3.0E-3 | 1.0E-3 | References 1-10 |
| 1-inch Diameter Pipe | 3.0E-6 | 6.0E-7 | | References 1-10 |
| 2-inch Diameter Pipe | 1.0E-6 | 1.5E-7 | | References 1-10 |
| 4-inch Diameter Pipe | 1.0E-6 | 2.0E-7 | 6.0E-8 | References 1-10 |
| 6-inch Diameter Pipe | 9.0E-7 | 2.0E-7 | 6.0E-8 | References 1-10 |
| 10-inch Diameter Pipe | 6.0E-7 | 1.0E-7 | 7.0E-8 | References 1-10 |
| 12-inch Diameter Pipe | 5.0E-7 | 1.0E-7 | 6.0E-8 | References 1-10 |
| 20-inch Diameter Pipe | 3.0E-7 | 9.0E-8 | 4.0E-8 | References 1-10 |
| Process Vessel | 1.5E-4 | 3.0E-5 | 7.0E-6 | References 1-10 |
| Storage Vessel | 3.0E-3 | 2.0E-4 | 2.0E-5 | References 1-10 |
| Shell-Tube Heat Exchanger | 5.0E-4 | 7.0E-5 | 3.0E-5 | References 1-10 |
| Fin-Fan Heat Exchanger | 1.0E-3 | 4.0E-4 | 2.0E-4 | References 1-10 |
| Filter | 4.0E-4 | 6.4E-6 | 6.4E-6 | References 1-10 |
| Number of HCl Loads Per Year | 1.0E-4 | 3.0E-5 | 1.0E-5 | References 1-10 |
| Railcar Building Release - Vent | 6.1E-9 | 1.6E-7 | | FTA[2] |
| Railcar Building Release - Louver | | 2.0E-6 | | FTA[2] |
| Stored Railcar Breach | | | 1.6E-6 | Existing 2006 QRA[8] |
| 2-in Diam. Double Wall Pipe | 1.0E-7 | 1.5E-8 | | References 1-10 with credit for double wall and detection |
| 4-in Diam. Double Wall Pipe | 1.0E-7 | 2.0E-8 | 6.0E-9 | References 1-10 with credit for double wall and detection |

| Equipment | F-release (per year) (pipes are per ft-year) | | | Reference |
|---|---|---|---|---|
| | 0.5-in | 2-in | FB | |
| 6-in Diam. Double Wall Pipe | 3.0E-7 | 6.7E-8 | 2.0E-8 | References 1-10 with credit for double wall and detection |
| 10-in Diam. Double Wall Pipe | 2.0E-7 | 3.4E-8 | 2.4E-8 | References 1-10 with credit for double wall and detection |
| 12-in Diam. Double Wall Pipe | 1.7E-7 | 3.4E-8 | 2.0E-8 | References 1-10 with credit for double wall and detection |
| 20-in Diam. Double Wall Pipe | 1.0E-7 | 3.0E-8 | 1.3E-8 | References 1-10 with credit for double wall and detection |

Frequency of release from hydrochloric acid (HCl) truck and railcar loading operations was based on industry-average failure rates. Note that these loading operations are outdoors. In contrast, chlorine railcar loading operations are intended to occur indoors in the railcar loading building. Scenario definition and associated frequency of release from chlorine railcar loading operations was determined using detailed frequency analysis[2].

Based on information provided by knowledgeable Chemtrade personnel and FTA[2] workshop sessions, the failure rate for different loss of containment scenarios from the railcar building during chlorine railcar loading operations was quantified. The failure rates (Railcar Building Release – Vent and Railcar Building Release – Louver) are specific to Chemtrade's railcar loading operations and procedures, accounting for loss of containment at either the louver or scrubbing system vent stack location. Release frequencies for the chlorine loading release scenarios were annualized based on the approximated number of railcar loads per year (2007 per year), based on data from Chemtrade. Since release scenarios were evaluated for both the east and west sides of the railcar building, the "Railcar Building Release" frequencies in Table 7 were multiplied by 0.5 to determine the per loading bay frequency.

The frequency values for railcar loading building release are only valid based on the process information, assumptions, and recommendations identified in the supplementary FTA report[2]. Frequency calculations assume a baseline human error probability of 1E-2 for all individual human actions throughout the FTA since this analysis was performed on future chlorine railcar loading operations. A human reliability analysis (HRA) is recommended to validate these human error probabilities as BakerRisk could not independently validate this assumed probability within the framework of the FTA. The proposed HRA could include the evaluation the risk reduction due to existing and additional administrative controls such as supervisor independent confirmation of manual tasks, remote monitoring and shutdown from the loading control room, or other factors to support the assigned human reliability.

BakerRisk was not involved in determining the basis for the frequency for the stored railcar breach, as it was previously evaluated in a 2006 QRA study performed by a third-party consultant[8]. The frequency

(1.63E-6 per year) previously determined in the 2006 QRA study was used in the QRA, as requested by Chemtrade.

The failure rates for double-walled piping is representative of an inner pipe and an outer pipe, with an interstitial space between the two. Should the inner pipe fail, the outer pipe will provide containment until the line is replaced. These frequencies also assume that leak detection is present for the interstitial space with air sweep (the means of detection could be pressure, detection of the chemical itself, or some other indicator). Additional reduction in frequency for double-walled piping exceeding 6-inch diameter was credited since external impact is not considered a credible loss of containment scenario for internal piping.

The probability of failure on demand for the scrubbing system used in this analysis was 0.1, which is equivalent to that of typical BPCS. Subsequently, an order of magnitude frequency reduction was credited for any chlorine releases that could be completely mitigated by the scrubber system. For indoor chlorine release scenarios within the enclosed chlorine condenser tower and railcar loading buildings, this frequency reduction was credited to account for scrubbing action where the release rate did not exceed 15,000 lb/hr (i.e., scrubbing system capacity). Note that railcar loading release scenarios MF-28 and MF-29 were excluded from this frequency refinement as the overall event frequency for these scenarios was determined in the FTA study[2]. This assumption should be validated in detailed design stages and upon construction and commissioning of this safety system. The applicable scenarios for which this frequency reduction was applied are listed below and documented in Appendix D, ***F Toxic*** tab:

- MF-26-BlowGasHeater-012.5 and MF-26-BlowGasHeater-050 and MF-26-BlowGasHeater-100
- MF-27-CondenserLiquidCl2Piping-012.5
- MF-37-Cl2RailcarLoadingPiping-012.5
- MF-40-VentKOPotEast-012.5 and MF-40-VentKOPotEast-025
- MF-41-VentKOPotWest-012.5 and MF-41-VentKOPotWest-025

### 6.3.1 USAGE FACTOR CONSIDERATIONS

Usage factors are implemented to demonstrate the probability off all equipment being operational and online. As per Chemtrade, the North Vancouver plant is online for approximately 98% of the year. This reduction is representative of historical data available on turnarounds. A usage factor of 0.98 was applied to all process equipment, excluding the stored railcar scenario as it is anticipated that there will always be railcar storage present.

The chlorine railcar vent line knockout pots (MF-40 and MF-41) are evaluated using a usage factor of 0.5. As per Chemtrade, the knockout pots on the railcar vents will be in use approximately 7.5 out of 24 hours in an average day.

Frequencies for release associated with chlorine railcar loading operators were determined using an FTA[2]. The FTA used a basis of 2007 loads per year to calculate frequency of release across all loading bays. In this FSS and QRA study, the loading operators were modeled for west and east loading bays. As such, a 0.5 usage factor was applied to the railcar loading scenarios (MF-28 and MF-29) to calculate the associated frequency on a per bay basis.

## 6.4 FREQUENCIES AND CONDITIONAL PROBABILITIES

Calculated frequencies for flammable dispersion scenarios are documented in Appendix D, ***F Flammable*** tab. The table includes the release name (release/weather and pipeline segment if applicable), release frequency, and immediate ignition probability in 16 release directions. Conditional probabilities of delayed ignition are recorded in the table for each wind direction assessed and are applied to those specific scenarios, as applicable.

Calculated frequencies for thermal radiation scenarios are documented in Appendix D, ***F Fire*** tab. The table includes the scenario name (release/weather and pipeline segment if applicable), release frequency, and immediate ignition probability. Conditional probabilities of delayed ignition are recorded in the table for each wind direction assessed and are applied to those specific scenarios, as applicable.

Calculated frequencies for toxic dispersion scenarios are documented in Appendix D, ***F Toxic*** tab. The table includes the scenario name (release/weather and pipeline segment if applicable), release frequency, durations assessed, and conditional probabilities of those durations (short, medium, and long). Non-ignition probabilities are also included for 16 release directions. Conditional probabilities of weather and direction are not recorded in the table, but are applied to those specific scenarios, as applicable.

The probability that a flammable release will ignite is based on industry experience, and values are assigned as a function of release magnitude, as summarized in Table 8 shown below.[15] Early ignition is assessed for fire impacts (jet and pool), and delayed ignition is assessed for flash fire impacts. Non-ignition events are assumed to have no consequences (unless the material is toxic, in which case the release is evaluated for toxic impact).

**Table 8. Ignition Probabilities**

| Size | Probability of Ignition | | |
|---|---|---|---|
| | Early | Late | None |
| Small (0.5-inch) | 0.0096 | 0.0004 | 0.99 |
| Medium (2-inch) | 0.062 | 0.008 | 0.93 |
| Large (6-inch) | 0.21 | 0.09 | 0.7 |

[15] Cox, A. W., Lees, F. P., and Ang, M. L., "Classification of Hazardous Materials," IChemE, 1990.

Baseline short, medium, and long toxic dispersion durations are discussed in detail in Section 5. For release durations of 10 minutes, 30 minutes, and 60 minutes, the corresponding duration probabilities are 50%, 45%, and 5%. For loading release durations of 1 minute, 5 minutes, and 60 minutes, the corresponding duration probabilities are 90%, 9%, and 1%. These release durations and corresponding probabilities are representative of early intervention by operations to isolate the toxic release.

### 6.4.1 CHLORINE DETECTION IN LIQUEFACTION BUILDING

As discussed in Section 5, Chemtrade has specified the short, medium, and long durations and associated probabilities for release from the chlorine compressors and coolers. BakerRisk did not independently validate these assumed release durations or associated probabilities.

Future plant design will include automatic action upon chlorine detection in the Liquefaction building. The automatic action will be to safely shutdown the compressor and isolate or vent down the compressor, intercooler, and aftercooler process sections. Per Chemtrade, the following release durations were used to determine the quantity of chlorine gas released prior to the plant (cellroom) tripping and stopping gas evolution:

- Automated chlorine detection and initiated plant trip/isolation within 1 minute of the event.
- Automated chlorine detection or operator intervention and initiated plant trip/isolation initiated within 10 minutes of the event.
- No automated detection or operation intervention and subsequent initiated plant trip/isolation, unmitigated release occurs for 60 minutes.

### 6.4.2 CHLORINE DETECTION IN ENCLOSED CONDENSER TOWER

Chemtrade intends the future enclosed condenser tower design to include installation of three new chlorine sensors. The sensors and associated logic solver would be the same Draeger 7000 models as used in the proposed railcar loading building. The sensors would automatically trip the cellhouse at 10 ppm (2oo3 voting) and close ESDVs on the condenser inlet header (new) and liquid outlet header to limit the isolatable inventory released during depressurization. Since chlorine detection and isolation safeguards are theoretical, baseline duration probabilities of 10 minutes, 30 minutes, and 60 minutes were used. However, the probabilities for the shorter duration were weighted more heavily compared to the medium and long duration. The corresponding duration probabilities evaluated were 90%, 9%, and 1% for the 10-minute, 30-minute, and 60-minute durations, respectively. These assumptions should be verified in detailed design.

### 6.4.3 RAILCAR LOADING OPERATIONS RESPONSE

A railcar loading operator is stationed in a positive pressure loading station located within the railcar loading building. The operator is responsible for continuous monitoring of railcar loading operations and has a direct line of sight to the loading area. If a chlorine release is visually detected by this operator, they have the ability to shut down the loading operations and stop chlorine flow from the process with an ESD

button. Additionally, there is enhanced PPE stored within the loading control room, including SCBAs, which the operator can don and then enter the field to close manual valves and stop liquid chlorine flow. The assumption that the positive pressure loading station will provide sufficient protection to operators in the event of a chlorine release should be validated in detailed design stages and upon construction/commissioning. Response by this railcar loading operator is already included in the FTA and corresponding frequencies.

The railcar loading scenarios (MF-28 and MF-29) were evaluated at three release durations: duration (A) was 5 minutes with 90% probability, duration (B) was 10 minutes with 9% probability, and duration (C) was 60 minutes with 1% probability. The assumptions associated with these durations are stated below:

(A) The control room is located approximately 80 m from the railcar loading building. At least one control room operator must always be present in the control room and monitoring process activities. A closed-circuit television (CCTV) system is in place for the railcar loading building, with continuous feed to a unique monitor in the control room. If a chlorine release is visually detected by this operator, they can shut down the loading operations and process with a unique ESD button. It is expected that this control room operator can respond and return the system to a "safe" state within 5 minutes of release. BakerRisk recommends Chemtrade conduct practice drills to validate the assumed duration (5 minutes) and associated probability assumption.
(B) Additionally, there is enhanced PPE stored within the control room, including SCBAs, which the operator can don and then enter the field to close manual valves and stop liquid chlorine flow. Per Chemtrade, it is expected that there will be a total of seven operators onsite at all times. Multiple operators have the training and ability to don the required PPE and manually isolate a chlorine release within 10 minutes. BakerRisk recommends Chemtrade conduct practice drills to validate the assumed duration (10 minutes) and associated reliability assumption.
(C) Should no intervention occur, this would result in an unmitigated 60 minute release.

## 6.5 WIND DIRECTION AND WEATHER PROBABILITY DATA

Weather probability data is based on STAR data obtained from Trinity Consultants for Vancouver International Airport (YVR), British Columbia for the years 2018–2022. See Appendix C for details on weather condition and wind direction probabilities. Early ignition events (jet/pool fires) are assumed to be momentum-driven and not driven by the wind direction; they are therefore assessed with an equal release direction probability of occurrence.

# 7 CONSEQUENCE ANALYSIS RESULTS

This section summarizes the results of consequence analysis calculations performed for this study. Complete results are presented in the FSS results spreadsheet (Appendix D).

Discharge calculations were performed for each release case modeled using SafeSite$_{3G}$©. Results provided in Appendix D, ***Discharge*** tab include mass flow rate, expansion velocity, and the discharge coefficient.

Discharge results are used by dispersion routines included in the SafeSite$_{3G}$© model to estimate the distance to UFL, LFL, and ½ LFL and to toxic concentrations of interest (90%, 10%, and 1% lethality probabilities for an assumed exposure duration of 10 minutes). Dispersion distances are reported in Appendix D, ***Flam-Dist*** tab for flammable dispersion distances and ***Tox-Dist*** for toxic dispersion distances. Jet fire impacts were assessed by determining thermal radiation intensity and calculating thermal dose and resulting vulnerability for each fire scenario assessed. A jet fire is the combustion of pressurized flammable materials as they are dispersed into the air. Distances to threshold intensity levels of interest are presented in Appendix D, ***Rad-Dist*** tab.

CFD was used to model the railcar loading release scenarios from the vent stack in the northward and westward directions. CFD dispersion results were consistent with SafeSite dispersion results; the SafeSite dispersion results were therefore used in the risk analysis instead of CFD. Detailed information on CFD modeling can be found in Appendix E.

# 8 RISK ANALYSIS RESULTS

The Executive Summary documents the risk results calculated in the analysis. The QRA results spreadsheet (Appendix D) provides additional documentation of the risk results and inputs.

Location-specific individual risk (LSIR) is defined as the level of risk incurred by a person who is continuously present (24 hours a day, 365 days a year) in a given location. The LSIR contours presented in this report conservatively assumed that offsite receptors are outdoors and stationary. LSIR contours for the Chemtrade North Vancouver Plant were shown in Figure 2 and Figure 3 within the Executive Summary. Figure 3 plots these LSIR geographical risk contours in Google Earth™ imaging with offsite receptors of interest identified for comparison to *Risk-based Land Use Planning* Guidelines. These contours are also provided via Google Earth in an accompanying (KMZ) file in Appendix B.

The LSIR values for each receptor are also documented in tabular format in Table 1 within the Executive Summary. This table also identifies the risk per hazard type (i.e., flash fire, toxic, jet/pool fire). Risk to all offsite receptors is entirely toxic dispersion-based risk. Flash fire and jet/pool fire scenarios pose negligible risk offsite. Thus, future mitigation and detailed design considerations should focus on addressing toxic risk.

The Chemtrade North Vancouver facility property relative to the LSIR contours are shown below in Figure 12. The “Control Zone” or 1E-4 contour slightly exceeds the property boundary, as provided by Chemtrade. However, this area is vegetation (i.e., uninhabited) and is not utilized by the neighboring manufacturing facility for any purpose. The risk in this location is driven by HCl loading and associated equipment; modelling refinements were not performed for this area of the plant.

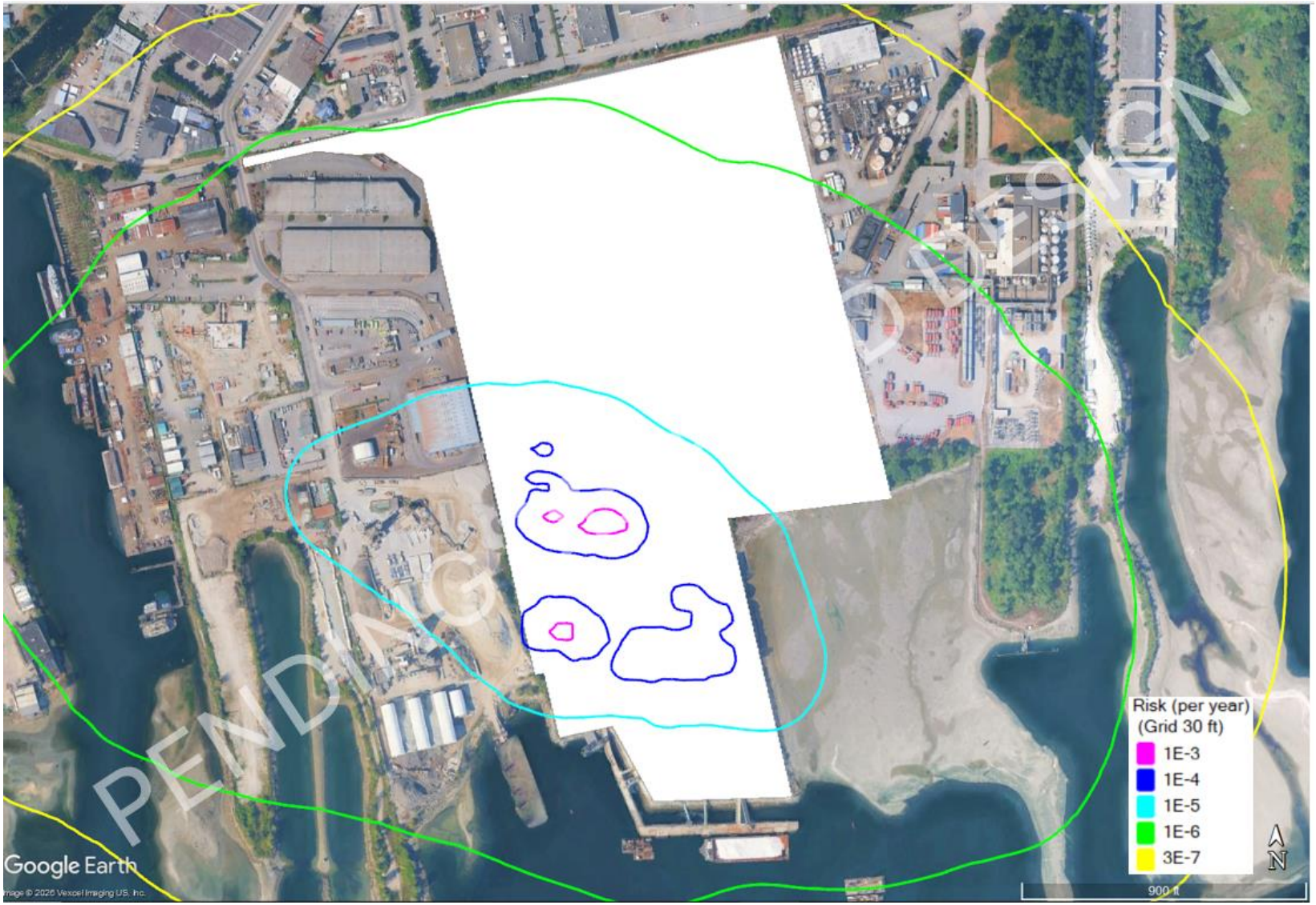



**Figure 12. Comparison of Control Zone to Chemtrade North Vancouver Property Boundary**

Based on the LSIR geographical risk contours presented in Figure 2 and Figure 3, the proposed future North Vancouver Chemtrade plant meets the land use planning guidelines when compared to offsite receptors of interest (Table 3 and Figure 7). Contours are representative of the proposed preliminary design information provided by Chemtrade and modeling assumptions at the time of this study and are subject to change. Should the plant design or process information deviate from the assumptions documented in this report, updated LSIR calculations should be performed to understand the revised offsite risk. In addition, the frequency of release during chlorine railcar loading operations is subject to the process information, assumptions, and recommendations outlined in the supplementary FTA report[2].

The far-field risk-driving scenarios are the large breach of stored chlorine railcar (MF-30), liquid chlorine piping within the railcar loading building (MF-37), and chlorine condensers (MF-25). The near-field risk-driving scenarios are the hydrochloric acid loading operations (AG-01), hydrochloric acid transfer pump (AGN-05), and vapour chlorine pipeline to the Acid Growth plants (MF-36).

# 9 CONCLUSIONS AND RECOMMENDATIONS

Chemtrade Electrochem, Inc. (Chemtrade) commissioned Baker Engineering and Risk Consultants, Inc. (BakerRisk®) to complete a computational fluid dynamics (CFD) and Facility Siting Study (FSS)/Quantitative Risk Assessment (QRA) of the Chemtrade Chlor-Alkali Production Plant located in North Vancouver, British Columbia. This study was a joint effort between BakerRisk and Chemtrade. As a part of rezoning requirements for the North Vancouver plant, Chemtrade has committed to making major modifications to their chlorine production operations. The intent of this FSS and QRA study was to evaluate offsite risk of the North Vancouver facility, including the proposed process changes, utilizing available design information.

LSIR geographical risk contours for the proposed Chemtrade North Vancouver plant are shown in Figure 2 and Figure 3. Risk contours are used to assess compliance with the Process Safety Management Division (previously MIACC) *Risk-based Land Use Planning Guidelines*[3]. Based on the offsite receptors of interest provided by Chemtrade in Table 3 and Figure 7, the LSIR geographic risk contours for the proposed Chemtrade North Vancouver plant are in compliance with these guidelines except for a small area of vegetation to the west of the HCl loading area that exceeds the Control Zone.

The LSIR geographical risk contours presented in this report are representative of the preliminary design information provided by Chemtrade and modeling assumptions at the time of this study and are subject to change. It is recommended that this FSS/QRA be updated as detailed design information becomes available to validate the modeling and corresponding results. A detailed FTA study[2] was performed for a chlorine release from the railcar loading building. The LSIR contour results are sensitive to the frequency output from the fault trees. Should there be any change in the proposed chlorine loading operations that deviates from the current fault tree logic, updated LSIR calculations should be performed to understand the revised offsite risk. Due to the nature of the planned chlorine loading procedure, there is a substantial reliance on human operations and interaction with the system. An HRA is recommended to validate the HEP used as BakerRisk could not independently validate this assumed probability within the framework of the FTA.

# 10 REFERENCES

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# APPENDIX A. CONSEQUENCE AND RISK MODELING DETAILS

# CONSEQUENCE MODELING DETAILS

Figure A- 1 is an example event tree that shows potential outcomes considered in the analysis for each release hazard identified. Note that the figure is for demonstration purposes only and does not necessarily match the conditions such as the release sizes and weather conditions used in this study, and not every branch of the event tree is applicable to this study. Note that the congestion/confinement and explosion, building, sheltering, and isolation branches of the tree are not applicable to this study.

The analysis methodology is more complex than the event tree shown in Figure A- 1, but this gives a simplified summary of the method by which hazard sources are assessed. Following are details of the event tree:

- **Initiator**: The starting point (far left end of the event tree) is a release of hazardous material from the process.
- **Source Location**: The first branch splits indoor scenarios from outdoor releases.
- **Size**: The second branch splits each release into a range of release sizes. Outdoor scenarios are typically assessed for small, medium, and large releases. Indoor scenarios may only distinguish between cases that may overwhelm ventilation and those that are small enough to behave like regular dispersion cases. A small indoor release is assumed to only impact people within the building where the release occurs if it is a fire or toxic event, but it is treated the same as an outdoor release for explosion scenarios.
- **Weather Condition:** This branch is only applicable to outdoor release scenarios. Each release is typically assessed for a range of two or four statistically significant weather conditions.
- **Wind Direction:** Each dispersion is assessed in 16 evenly-spaced horizontal directions.
- **Flammability**: Hazards are split into flammable and non-flammable (toxic only) categories because they get assessed for different things, depending on whether or not they pose fire/explosion hazard.
- **Ignition**: Outdoor flammable releases are assessed for early, late, and non-ignition. Early ignition scenarios are assessed as jet or pool fire, depending on the material conditions. Late ignition scenarios are further divided later in the event tree. Flammable releases that are not toxic and not ignited are non-events (no impact). Flammable releases that are also toxic and are not ignited are grouped together with non-flammable toxic sources and treated together hereafter.

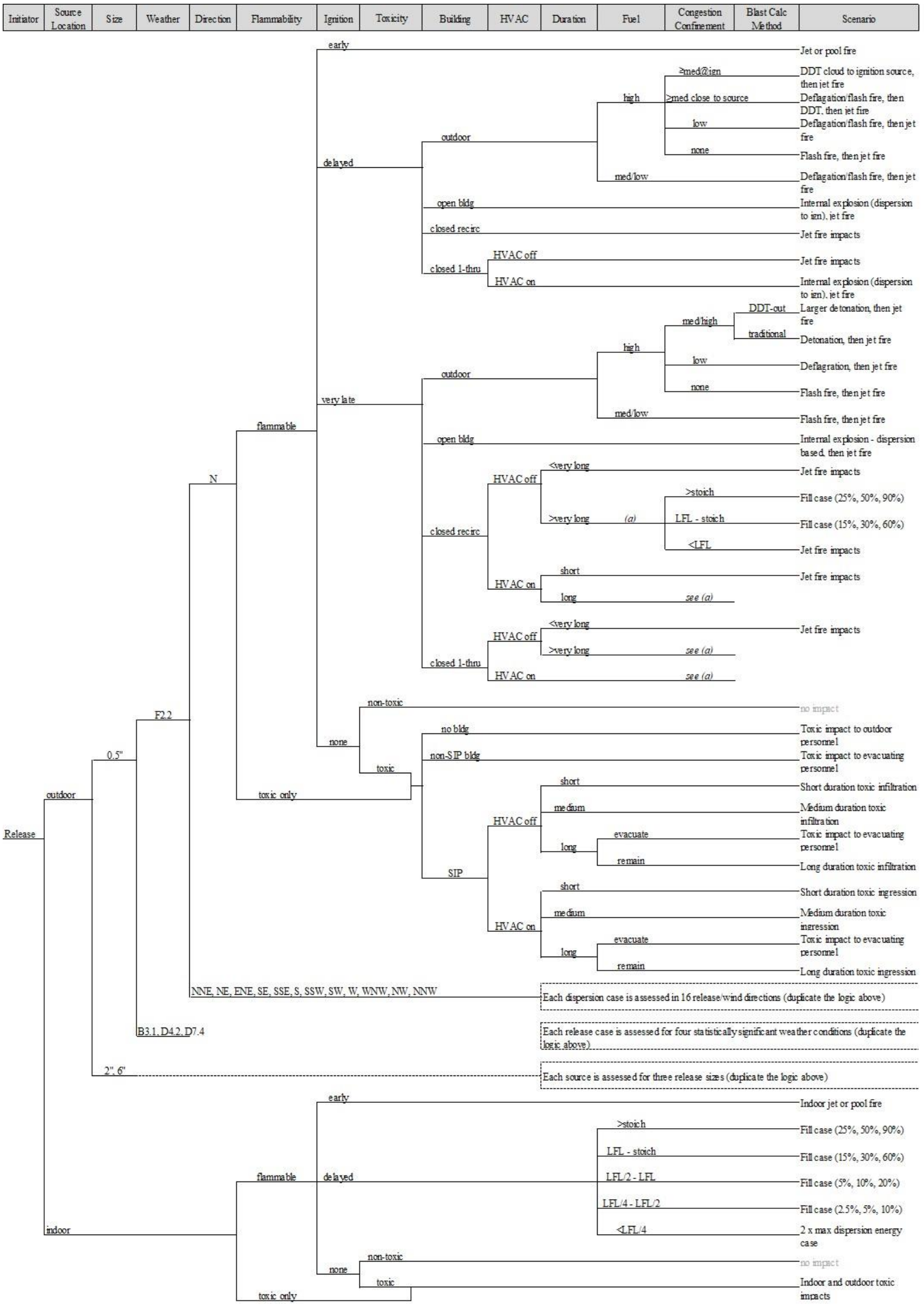



**Figure A- 1: Sample Event Tree**

# HAZARD IDENTIFICATION AND SCENARIO DEVELOPMENT

The first step of consequence analysis is the identification of process hazards and the selection of release scenarios. The concept of equipment grouping or "nodes" is used in this QRA. A node is a grouping of process equipment with similar process conditions and acid concentration, recognizing that a release under similar operating conditions is expected to result in similar consequence zones. Grouping equipment into nodes has been used, as opposed to discrete hazards for each piece of equipment and piping run, to perform the analysis more efficiently. Selection of nodes was a joint exercise using a team of BakerRisk and Chemtrade professionals performing a review of the process design drawings (PFDs and P&IDs).

Specifically, the factors used to define the nodes were:

- Material composition,
- Material phase (gas, liquid, or two phase),
- Process conditions (temperature and pressure),
- Type, size, and location of equipment, and
- Impact of potential mitigation.

# CONSEQUENCE ANALYSIS

In the terminology of risk assessment, consequence is a measure of the expected outcome of an event and is measured or expressed as "hazard distance" or "hazard zone." The impact analysis addresses the potential effects of the hazardous consequences to people, property, and the environment. Consequence analysis is normally carried out using mathematical models and computer software based on physical and chemical phenomenon. Impact analysis considers the presence of people, property, or sensitive environments that can be adversely affected by a chemical release.

For each node, up to three release sizes were modeled to represent the full range of release potential, and included the following up the maximum hole size considered:

a. **Small Release** – 0.5-inch hole
b. **Medium Release** – 2-inch hole
c. **Large Release** – 6-inch hole

# THERMAL HAZARDS

Jet fire consequences were assessed using the Johnson Fire Model incorporated into SafeSite$_{3G}$© software Version 7 for aboveground fire hazards and the Shell-Chamberlain Fire Model for underground fire sources. Pool fires were modeled as solid tilted cylinders, consistent with CCPS guidance.

Vulnerability was evaluated as a function of the following probit equation:

$$Y = A + Bln\left(\int I^{\frac{4}{3}} dt\right)$$

where *Y* is the probit value, *I* is the thermal radiation intensity in kW/m$^2$ along the egress route, and A and B were determined by fitting data for lethality due to exposure to fireballs from a report by the International Association of Oil and Gas Producers.[16]

# TOXIC HAZARDS

The release of a toxic chemical might produce little, if any, property damage, but may result in a significant impact on the surrounding offsite population workforce. Some chemicals pose acute inhalation hazards and can result in damage to the respiratory system or other critical functions. In general, toxic vapor dispersion hazard zones may be characterized by the following parameters. Each of these parameters is discussed below with special emphasis on their influence on estimating downwind dispersion distances:

- Release Quantity
- Duration of Release
- Prevailing Atmospheric Conditions
- Chemical Toxicity

**Release Quantity** (or release rate) refers to the quantity of (or the rate at which) a hazardous chemical is released, in the event of an accident. The quantity (or rate) is the single most important parameter in determining the dispersion hazard distances. In general, larger quantities lead to larger dispersion distances. However, the dispersion distance does not increase linearly with quantity or release rate.

**Duration of Release** is a parameter that is dependent on the release mode. For example, a safety valve release may not last for more than a few minutes, whereas a tank puncture may continue to discharge for several hours. For liquids forming evaporating pools, the duration of the vapor release is dependent on the evaporation rate. Simple dispersion models use one of the two extreme cases (i.e., continuous release or instantaneous release). In the case of a continuous release, the release lasts a relatively long time, and the release rate is the most important parameter.

**Prevailing Atmospheric Conditions** include a representative wind speed and atmospheric stability. Neutral or unstable (typical daytime) weather conditions generally lead to shorter dispersion distances than stable (nighttime) weather. For neutrally buoyant releases (those in which the density of the released material is similar to that of the surrounding air), increased wind speed reduces the dispersion distance. For heavy gases, dispersion distance increases with wind speed. Since the weather conditions at the time of an accident cannot be controlled, it is important to evaluate the release scenarios for both

[16] Vulnerability of Humans, International Association of Oil and Gas Producers, Report No 434-14.1 (2010).

typical and worst-case weather conditions. The weather data used in this assessment is provided further in Appendix C.

**Chemical Toxicity** affects the extent of the hazard zone. A Probit equation is used to equate the exposure dosage of toxic materials (i.e., chlorine, hydrochloric acid) to percent fatality. Dosage at a fixed position is the integral of concentration observed over time at that position. Lower dosage levels are observed at larger dispersion distances. As with release quantity, the effect is not linear. In other words, a reduction in dosage by a factor of 100 does not result in an increase in the dispersion distance by a factor of 100. Since dosage is a function of concentration and exposure duration, both parameters can significantly alter the calculated hazard zone.

A Probit equation for all toxic materials has been used in this analysis to determine the consequence zones for three different levels of impact. The impact levels are selected to represent a wide range of exposure levels and are set at 90%, 10%, and 1% fatality zones.

Vulnerability was evaluated as a function of the following probit equation:

$$Y = A + Bln\left(\int c^n dt\right)$$

where *Y* is the probit value and a, b, and n are chemical specific coefficients, derived by fitting dose-response data. References for chemical specific coefficients for this study are documented in Table 6. The exponent n indicates the relative influence of concentration on the probit value with respect to time, a represents the potency of the toxic, or the lowest effective concentration, and b accounts for variation in response within a homogenous population but does not account for variations between species. The integral of the concentration, c, in time represents the dose.

# FREQUENCY CALCULATIONS

The frequency of each scenario is calculated by multiplying the release frequency by the applicable conditional probabilities (see the event tree for examples of accident sequences and conditional probabilities). For accident scenarios initiated by an accidental release of hazardous material, the initiating event is the accidental release, and conditional probabilities account for weather conditions and release/wind direction, ignition timing, and the time slot.

$$F_{scenario} = F_{release} \times P_{weather} \times P_{direction} \times P_{ignition}$$

The release frequency was estimated by multiplying equipment counts and pipeline length by the corresponding failure rates.

$$F_{release} = N_{equipment} \times R_{failure}$$

The conditional probabilities of weather conditions ($P_{weather}$) and wind speed/direction ($P_{direction}$) were taken from local meteorological data. Note that jet/pool fire impacts were assessed with evenly distributed probabilities for each direction (not significantly affected by wind direction), but dispersion probabilities used the reported wind direction probabilities.

# RISK CALCULATIONS

Risk is defined as the product of consequence (fatalities / event) and frequency (events / year) and is presented in terms of fatalities per year.

$$Risk_{scenario} = F_{scenario} \times Consequence_{scenario}$$

Risk is additive, so it is calculated for each scenario, and results are summed to determine the total amount of risk posed by facility operations.

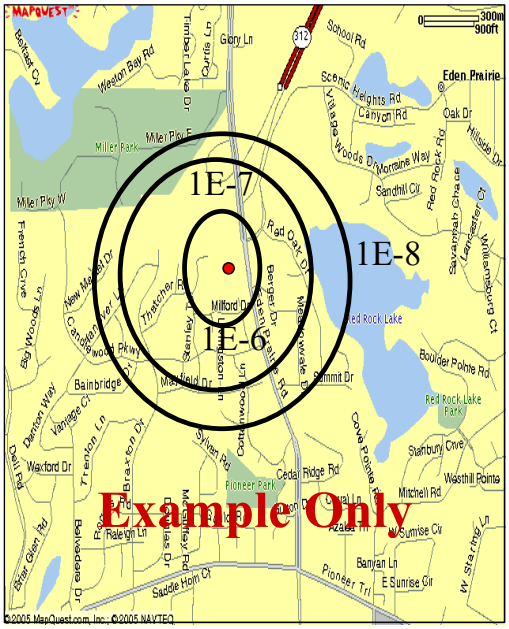
$$Risk_{total} = R_{scenario\text{-}1} + R_{scenario\text{-}2} + \ldots R_{scenario\text{-}N}$$

# INDIVIDUAL RISK

The level of risk incurred by a person who is continuously present (24 hours a day, 365 days a year) in a given building is called location-specific individual risk (LSIR). LSIR values can be used to minimize risk by locating personnel in the lowest risk buildings to the extent practical, and to guide building design / upgrade decisions. LSIR values for buildings are presented in terms of the annual probability of death (APoD).

# GEOGRAPHIC RISK

Geographic risk is expressed in terms of impacts per year and is represented visually in the form of an iso-risk contour (example shown at right). Geographic risk is independent of the actual population surrounding a given hazard, thus capturing only the potential for impacts. Geographic risk considers the equipment failure rate data, meteorological probabilities, impact zones, and the vulnerability probabilities. It is, in essence, the inherent risk of an impact at a given location relative to the process. The result indicates the risk of impact at a given location if an individual continuously occupies that location 24 hours a day, 365 days a year. For example: if a person could be continually present at a particular location, the geographic risk could be the individual risk as well.



The geographic risk is calculated by summing the probability of all outcomes that have the potential to cause an impact at that given location. The impact probability factors in the individual event probability, the atmospheric stability, wind speed and wind direction probability, and the outdoor vulnerability fraction. An x-y coordinate system is used to generate a table of impact probabilities for each coordinate pair. By connecting those points with a common value of impact/year (i.e., 1.0E-05, 1.0E-06) the iso-risk contours are created. These contours are then superimposed on a map of the area or facility plot plan to provide aerial insight as to which areas surrounding the facility are subjected to various levels of risk. Geographic risk provides information that is vital for land use planning. Many international governments have established geographic risk criteria that facilities must meet.

# APPENDIX B. SOURCE DEFINITIONS, LOCATIONS, AND LSIR CONTOURS

Please refer to the attached highlighted PDF file for input source and pipeline definitions:

***Chemtrade North Vancouver Highlighted PFDs and P&IDs _08654-004-25.pdf***

Please refer to the attached KML files for input data and results contours:

***Chemtrade North Vancouver Input Source and Pipeline Locations_08654-004-25.kmz***
***Chemtrade North Vancouver LSIR Contours_08654-004-25.kmz***

# APPENDIX C. STATISTICAL METEOROLOGICAL DATA

STAR format meteorological data for Vancouver International Airport in Vancouver, Canada for the years 2018 to 2022 was supplied by Trinity Consultants. STAR format meteorological data is generated from hourly wind speed, wind direction, cloud height and total cloud cover data and consists of the number of occurrences within each of 6 wind speeds, 16 wind directions and 6 stability categories (Pasquill - Gifford: A through F). The stability classes are defined as follows:

A Extremely unstable
B Unstable
C Slightly unstable
D Neutral
E Slightly stable
F Stable

Note: Wind direction in this document references "Wind From" direction.

**Table C- 1: Wind Direction Probability by Wind Speed**

| Direction | Speed (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 – 3 | 4 - 7 | 8 - 12 | 13 - 18 | 19 - 24 | >24 | Total |
| N | 0.017 | 0.007 | 0.001 | 0.000 | 0.000 | 0.000 | 0.025 |
| NNE | 0.009 | 0.005 | 0.002 | 0.000 | 0.000 | 0.000 | 0.016 |
| NE | 0.007 | 0.007 | 0.006 | 0.001 | 0.000 | 0.000 | 0.021 |
| ENE | 0.010 | 0.022 | 0.027 | 0.008 | 0.000 | 0.000 | 0.068 |
| E | 0.030 | 0.084 | 0.108 | 0.041 | 0.003 | 0.000 | 0.266 |
| ESE | 0.015 | 0.028 | 0.036 | 0.018 | 0.002 | 0.000 | 0.100 |
| SE | 0.012 | 0.019 | 0.022 | 0.012 | 0.002 | 0.001 | 0.067 |
| SSE | 0.008 | 0.010 | 0.012 | 0.007 | 0.001 | 0.000 | 0.039 |
| S | 0.010 | 0.011 | 0.010 | 0.006 | 0.001 | 0.000 | 0.039 |
| SSW | 0.007 | 0.010 | 0.011 | 0.004 | 0.001 | 0.000 | 0.032 |
| SW | 0.007 | 0.016 | 0.014 | 0.002 | 0.001 | 0.000 | 0.040 |
| WSW | 0.006 | 0.018 | 0.013 | 0.003 | 0.001 | 0.000 | 0.041 |
| W | 0.010 | 0.022 | 0.025 | 0.018 | 0.008 | 0.004 | 0.086 |
| WNW | 0.009 | 0.018 | 0.032 | 0.034 | 0.005 | 0.002 | 0.100 |
| NW | 0.010 | 0.012 | 0.012 | 0.005 | 0.000 | 0.000 | 0.039 |
| NNW | 0.012 | 0.006 | 0.002 | 0.000 | 0.000 | 0.000 | 0.020 |
| **Total** | **0.179** | **0.296** | **0.333** | **0.161** | **0.025** | **0.007** | **1.000** |

**Table C- 2: Stability Category Probability by Wind Speed**

| Wind Speed (m/s) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Range:** | **0.5 - 1.3** | **1.8 - 3.1** | **3.6 - 5.4** | **5.8 - 8.0** | **8.5 - 10.7** | **>10.7** | **Total** |
| **Average** | **0.9** | **2.5** | **4.5** | **6.9** | **9.6** | | |
| A | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| B | 0.01 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.05 |
| C | 0.02 | 0.04 | 0.06 | 0.01 | 0.00 | 0.00 | 0.12 |
| D | 0.03 | 0.11 | 0.22 | 0.15 | 0.02 | 0.01 | 0.55 |
| E | 0.00 | 0.07 | 0.03 | 0.00 | 0.00 | 0.00 | 0.11 |
| F | 0.11 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 |
| **Total** | **0.18** | **0.30** | **0.33** | **0.16** | **0.02** | **0.01** | **1.00** |

**Table C- 3: Stability Category/Wind Speed Combinations Used**

| Stability | Wind Speed (m/s) | Probability |
|---|---|---|
| B | 2.7 | 0.054 |
| D | 3.5 | 0.478 |
| D | 7.4 | 0.192 |
| F | 2.1 | 0.276 |
| **Total** | | **1.00** |

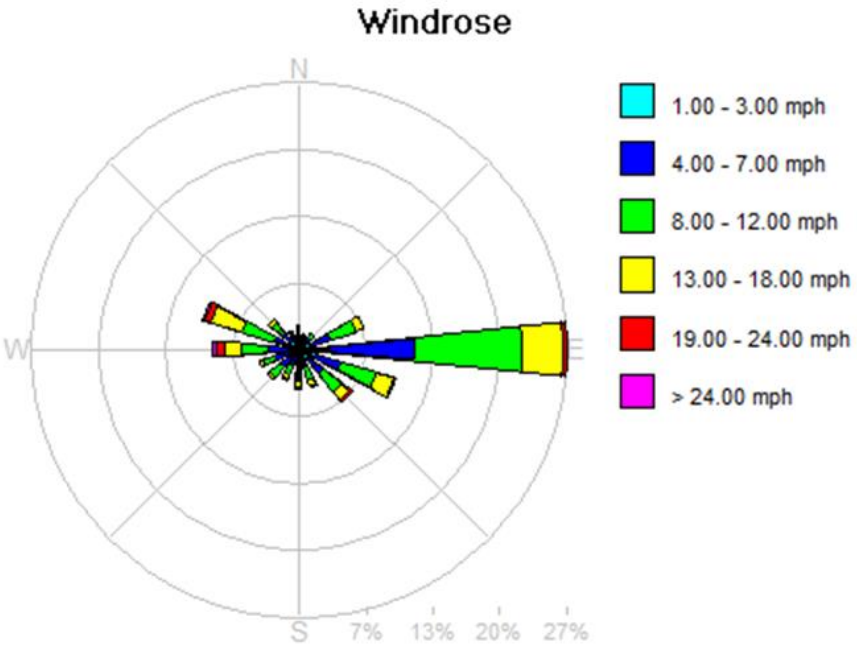



**Table C- 4: Windrose for Vancouver International Airport (YVR) in Vancouver, British Columbia, Canada**

Four time periods were evaluated in this study: weekday day (45 hours per week), weekday night (75 hours per week), weekend day (24 hours per day), and weekend night (24 hours per week). The weather condition with stability class B was not evaluated during nighttime periods; the weather condition with stability class F was not evaluated during daytime periods. These weather conditions were restricted as per the stability class definitions (i.e., defined as during day or night only). The time periods evaluated in this study and their respective weather conditions are documented in Table C- 5 below.

**Table C- 5: Time Periods and Weather Conditions Evaluated**

| Time Period | Duration (hours per week) | B2.7 | D3.5 | D7.4 | F2.1 |
|---|---|---|---|---|---|
| Weekday Day | 45.00 | True | True | True | False |
| Weekday Night | 75.00 | False | True | True | True |
| Weekend Day | 24.00 | True | True | True | False |
| Weekend Night | 24.00 | False | True | True | True |

# APPENDIX D. FSS AND QRA SPREADSHEETS

This appendix provides documentation of results that are voluminous. Instead of generating large tables, results are preserved in electronic form in spreadsheet format to allow sorting, searching, and manipulation of results. The spreadsheets also include summary tables that are provided in the report, and the formulae used to gather the data are included so the source of the data can be reviewed. This may be helpful in further understanding results.

**FSS Results Spreadsheet**:
Chemtrade North Vancouver FSS Results Spreadsheet_01-08654-004-25.xlsx

**QRA Results Spreadsheet**:
Chemtrade North Vancouver QRA Results Spreadsheet_01-08654-004-25.xlsx

# APPENDIX E. CFD ANALYSIS

This appendix provides detailed information on the CFD analysis performed in conjunction with this QRA study. Oscar Rodriguez performed the CFD analysis and documented inputs, methodology, and results in Appendix E.

# INTRODUCTION

BakerRisk performed a Quantitative Risk Analysis (QRA) at the Chemtrade facility in Vancouver utilizing the SafeSite$_{3G}$© software code to model various release and dispersion. The analysis determined that two releases bounded the offsite hazards: (1) release from the new proposed chlorine rail loading scrubbing system and (2) a chlorine release from the distillation tower bottoms. SafeSite$_{3G}$© utilizes a gaussian distribution dispersion model that does not directly account for obstructions or topography.

The Chemtrade facility, shown in Figure E- 1, is located north of the Burrard Inlet fjord and the terrain elevation increases as it moves away from the river. Surrounding the facility are other manufacturing sites with large buildings, forested areas, and numerous obstacles. To account for the terrain effects on the potential hazardous distances from the postulated chlorine releases, Chemtrade requested that BakerRisk utilize a CFD software to more accurately predict the distances to specified chlorine concentrations. Pseudo-sources were then developed in SafeSite$_{3G}$© that matched the predicted distances from the CFD analyses in order to develop risk contours.




**Figure E- 1. Aerial Image Showing Topography at Chemtrade Facility – View from East**

# METHODOLOGY

The FLACS CFD code was utilized to model the chlorine dispersions. A discussion is presented in the **Geometry** section on the geometry developed for this project, and the **Release Source and Atmospheric Conditions** section defines the release and atmospheric conditions analyzed in this study.

## GEOMETRY

A key input to perform a CFD-based dispersion analysis is a 3D solid model of the surrounding obstructions and topography. The terrain model, shown in Figure E- 2, was imported using publicly available data from the U.S. Geological Survey (USGS),[17] which captures the topography data surrounding the Chemtrade site. BakerRisk captured limited congestion near the postulated release location based on aerial images, as shown in Figure E- 3. Railcars typical occupancy present in the railyard west of the Chemtrade were modeled based on direction from Chemtrade[18]. In addition, surface roughness equivalent to the characteristic congestion observed near the release was set to 0.5, which is applicable for large obstacles.[19] This surface roughness was included to capture additional obstructions (trees, equipment, buildings, etc.) that would impact the release but that are not explicitly captured in the 3D solid model.

To assess a potential mitigation option, Chemtrade requested that simulations were modeled with and without a twelve foot high wall located along the west boundary of the plant to determine whether the wall mitigated the external hazard distance. The wall location shown in Figure E- 3 represents the proposed wall.

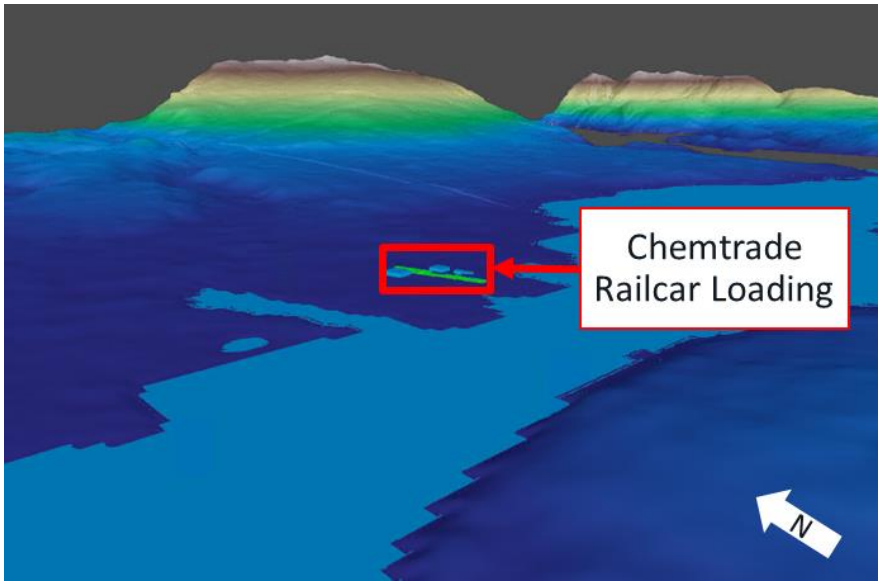
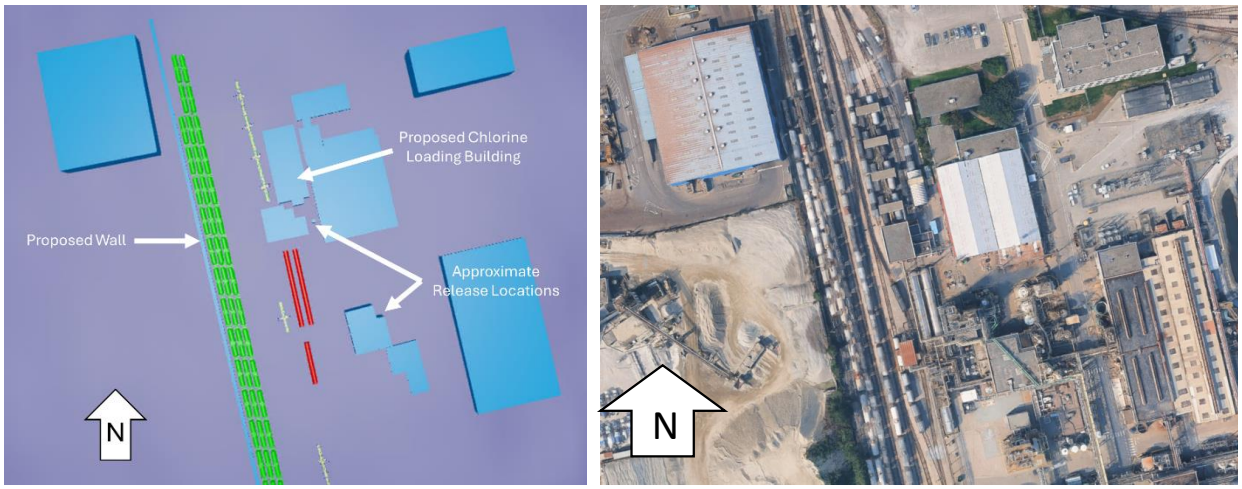



**Figure E- 2. Topographical Geometry near Chemtrade Plant**

[17] Earth Resources Observation and Science (EROS) archives of the USGS: https://earthexplorer.usgs.gov.
[18] Schultheiss, Donald, "RE: Chemtrade Baker Kick-Off Meeting – Rail Car Invty on site, Placement?", April 19, 2025.
[19] Gexcon AS, "FLACS-CFD v22.2 User's Manual." February 2023.




FLACS Model Aerial View

**Figure E- 3. Congestion Modeled near Release Location**

## RELEASE SOURCE AND ATMOSPHERIC CONDITIONS

Chemtrade identified two postulated chlorine release sources for this analysis: (1) a chlorine release that occurs inside the proposed rail loading building which is exhausted through the scrubbing system vent stack, and (2) a release from the distillation column bottoms. This modeling was completed before the distillation column equipment was removed from future North Vancouver Plant design. Note that these results are not included in the FSS and QRA study.

Both release conditions were defined in conjunction with Chemtrade based on the proposed chlorine rail loading intended design and distillation tower conditions. The chlorine rail loading release is set to match the flow that is exhausted through the scrubbing system stack if the scrubbing system failed to remove any chlorine during a release inside the loading building. The postulated flow rate is equivalent to a flow rate of 7.4 kg/s composed of 50/50 mixture of chlorine and air. The scrubbing system vents through a 24-inch vertical vent stack located approximately 27 meters above grade which impinges onto a stack cone after the release, shown in Figure E- 4. A single vertical release direction was modeled for the chlorine rail loading release to match the scrubbing system vent stack.

The distillation column bottom release is an approximately 100 mm chlorine release at 0.34 bar-g and -29 °C. The release is modeled to occur near the ground at 1 meter elevation where the equipment is surrounded by a 0.33 meter concrete dike with a set area of 25 $m^2$. The SafeSite$_{3G}$© thermodynamic model, a two-phase multicomponent vapor-liquid-equilibrium model, was utilized to determine the equivalent vapor release which accounts for the flashing liquid and the pool evaporation rate. The calculated equivalent vapor release flow rate following pooling for the distillation column bottom release is 6.5 kg/s which was modeled in the CFD code. Both horizontal north and west release directions were modeled for the distillation column scenario. Both the release location and direction are shown in Figure E- 5.

A single wind condition was modeled to capture the bounding atmospheric condition from the QRA analysis. The wind velocity was 2.1 m/s with a Pasquill Stability Class F (i.e., F2 weather). For both releases, the wind direction was modeled towards the west and north direction, per Chemtrade's specification. The wind direction was taken to match the release direction for the distillation tower bottom release, which maximizes the distance to a given chlorine concentration.

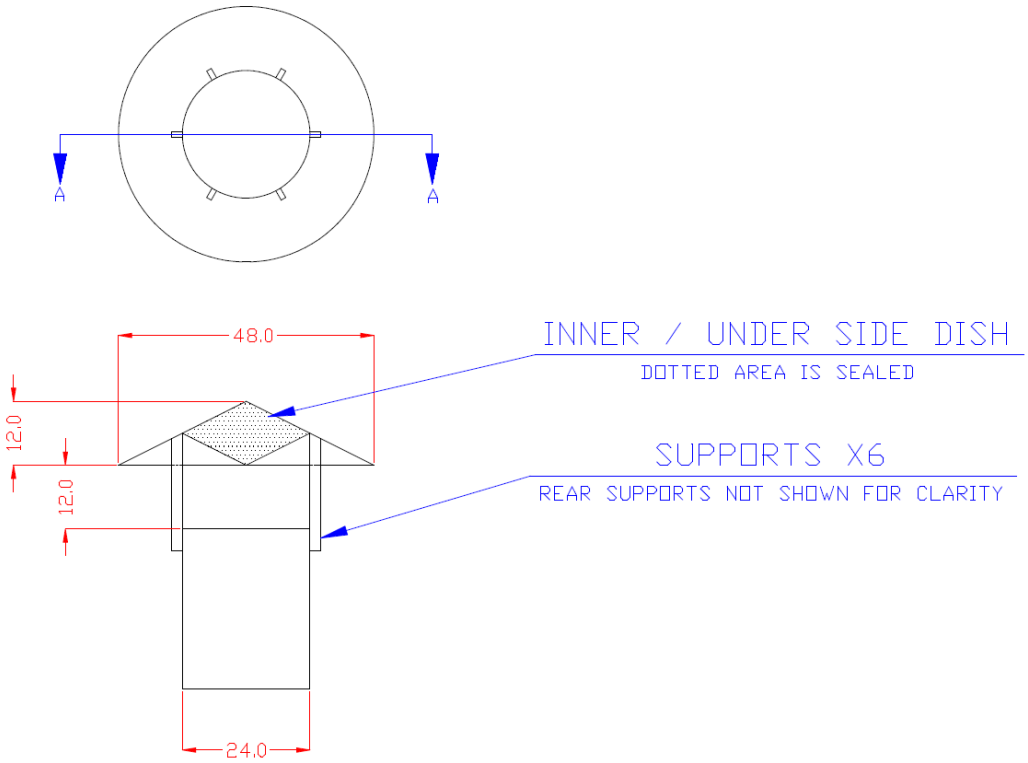



**Figure E- 4. Scrubber System Vent Stack Cone Layout**

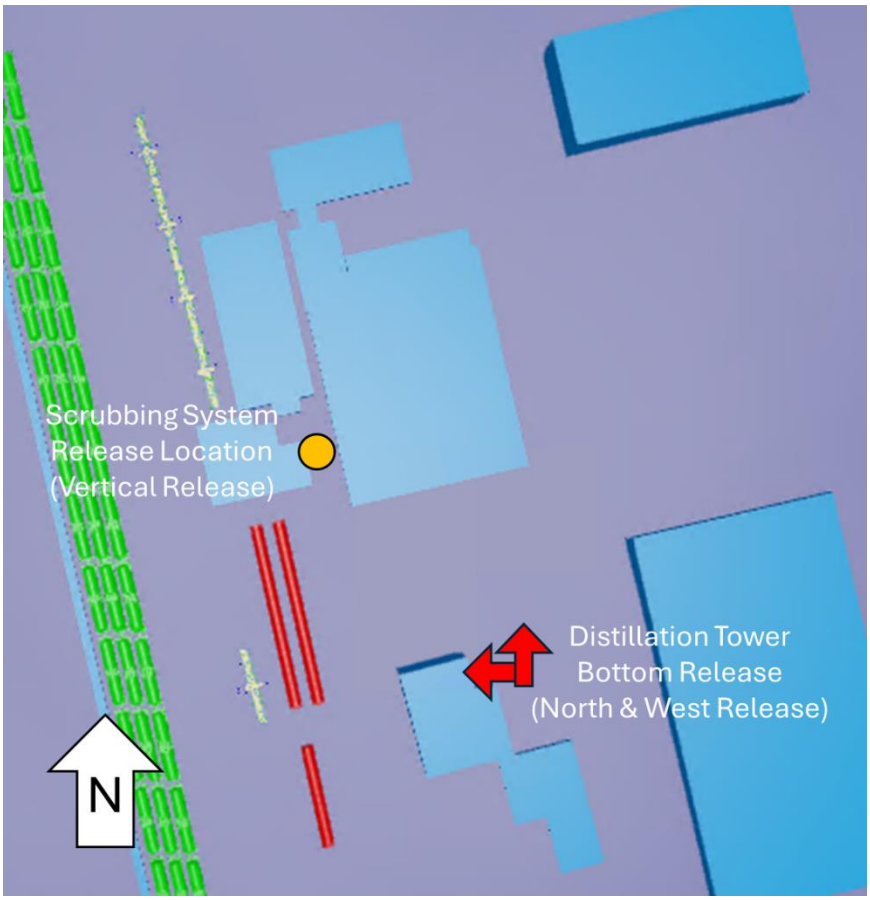



**Figure E- 5. Release Source Location and Direction**

# RESULTS

The analysis captured the transient chlorine dispersion and interaction with buildings, congestion, and topography changes. Figure E- 6 shows a 103 ppm chlorine concentration isopleth (shown as blue) for the distillation bottoms north release. The chlorine concentration of 103 ppm represents the 1% probability of fatality for a 10-minute exposure time. The isopleth depicts the chlorine release traveling north interacting with both structures located immediately near the release as well as the incline gradient that is present north of the Chemtrade plant. The maximum distance from the release source to the 103-ppm chlorine concentration predicted by the CFD dispersion simulation for the north release was 846 meters.

Table E- 1 summarizes the distances from the source to the 103-ppm chlorine concentration for both SafeSite$_{3G}$© and the CFD analysis. SafeSite$_{3G}$© dispersion results are independent of wind direction as there is no consideration for topography or ground interactions. The maximum distance from the release source to the 103-ppm chlorine concentration was predicted for the distillation tower bottom scenario directed northward. The rail loading scenario resulted in the maximum distance to the 103-ppm chlorine concentration for the north release at 825 meters. The SafeSite$_{3G}$© release was consistent with the CFD

analysis in the west release direction at approximately 750 meters. The SafeSite$_{3G}$© results were used in the QRA rather than the CFD results due to the added computational complexity of adding pseudo-sources. In addition, there is a greater degree of uncertainty in using the CFD results as only the distance to the 103 ppm concentration is calculated.

Figure E- 7 and Figure E- 8 show the 103 ppm chlorine isopleths from the CFD analysis. There was no difference observed between the west release with and without the barrier wall. The release locations are modeled away from the wall and interact with other obstructions before reaching the west edge of the Chemtrade plant (e.g., other buildings or vent stack cone); therefore, the initial jetting momentum has diminished and the release is driven largely by the background wind flow field which naturally flows over the barrier and the railcars that are present limiting the walls dilution effect. Figure E- 9 and Figure E- 10 show the 103 ppm chlorine isopleths from the SafeSite$_{3G}$© dispersion analysis for the distillation column and railcar scenarios, respectively.

A SafeSite$_{3G}$© pseudo-source was developed for each release scenario (i.e., north and west) to match the 103 ppm chlorine concentration distance from the CFD analysis. Due to the uncertainty of the hazard distances for a chlorine release in directions not analyzed in the CFD model, the pseudo-sources were only applied in the same release directions considered in the CFD analysis and the two adjacent release orientations (i.e., which are located +/- 22.5 degrees from the specified release direction). The SafeSite$_{3G}$© pseudo-sources were created but not integrated into the QRA. The distillation column equipment is to be removed from future operations and as such, this scenario was excluded entirely from the QRA. The rail loading dispersion results from SafeSite$_{3G}$© were consistent with the CFD results in the westward direction and as such the SafeSite$_{3G}$© results were used in the QRA.

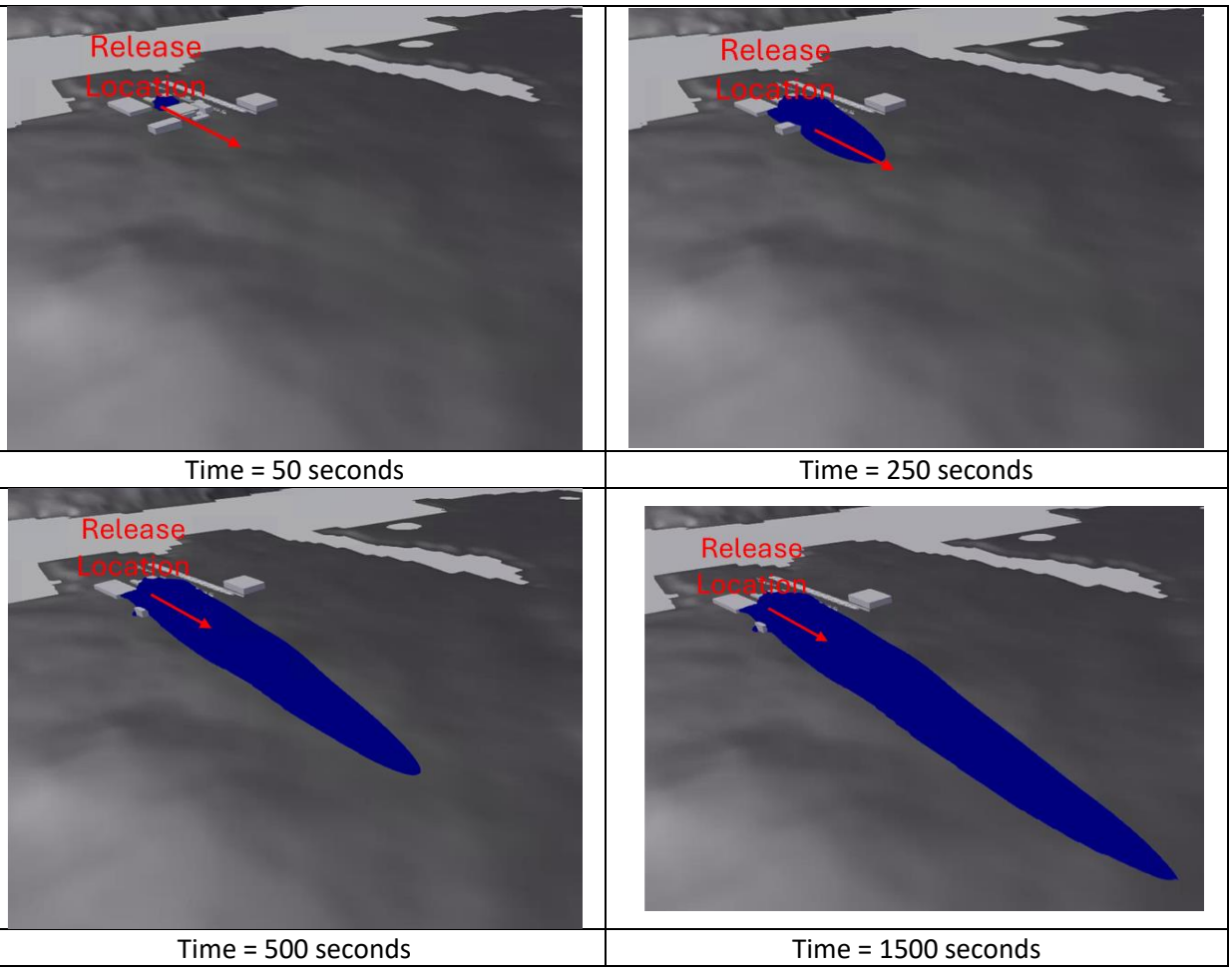



**Figure E- 6. 103 ppm Chlorine Concentration Isopleths (Distillation Tower Bottoms – North Release)**

**Table E- 1. Summary of Distances to 103-ppm Chlorine Concentration**

| Scenario | Direction | Maximum Distance to Chlorine Concentration of 103 ppm [m] using CFD | Maximum Distance to Chlorine Concentration of 103 ppm [m] using SafeSite$_{3G}$© |
|---|---|---|---|
| Rail Loading - Elevated Release | North | 825 | 754 |
| Rail Loading - Elevated Release with Wall | West | 751 | 754 |
| Rail Loading - Elevated Release w/o Wall | West | 751 | 754 |
| Distillation Tower Bottoms | North | 846 | 1730 |
| Distillation Tower Bottoms with Wall | West | 803 | 1730 |
| Distillation Tower Bottoms w/o Wall | West | 803 | 1730 |

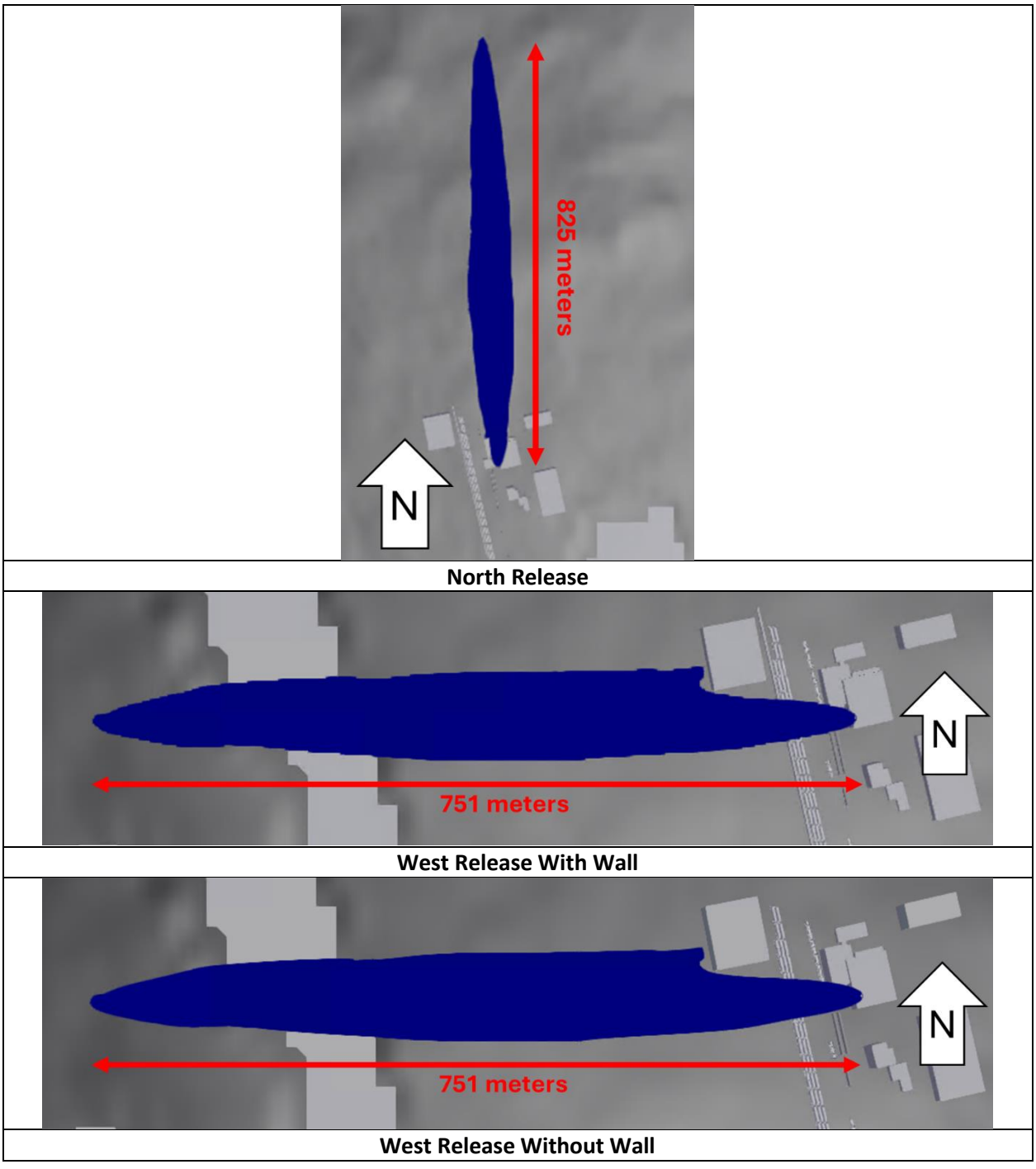
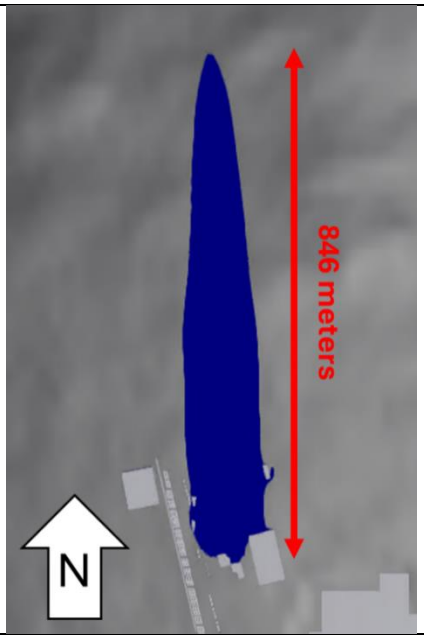
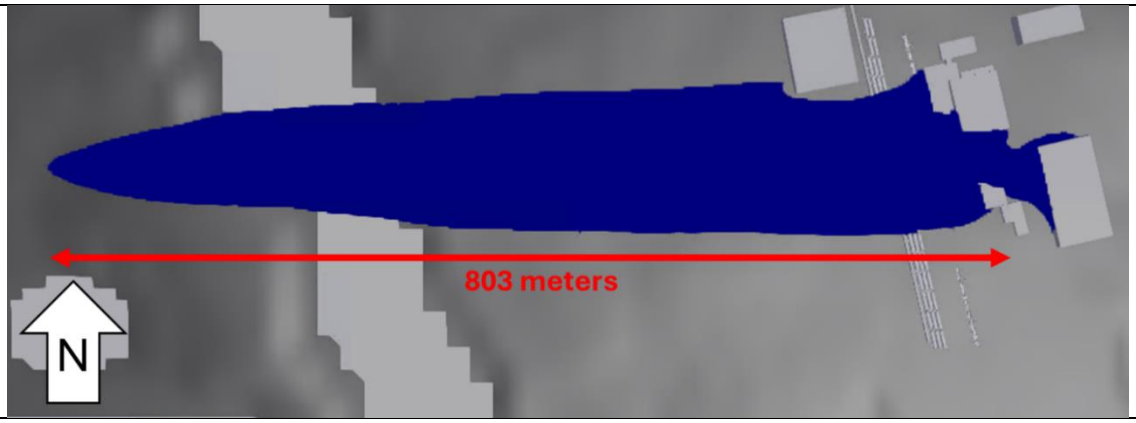


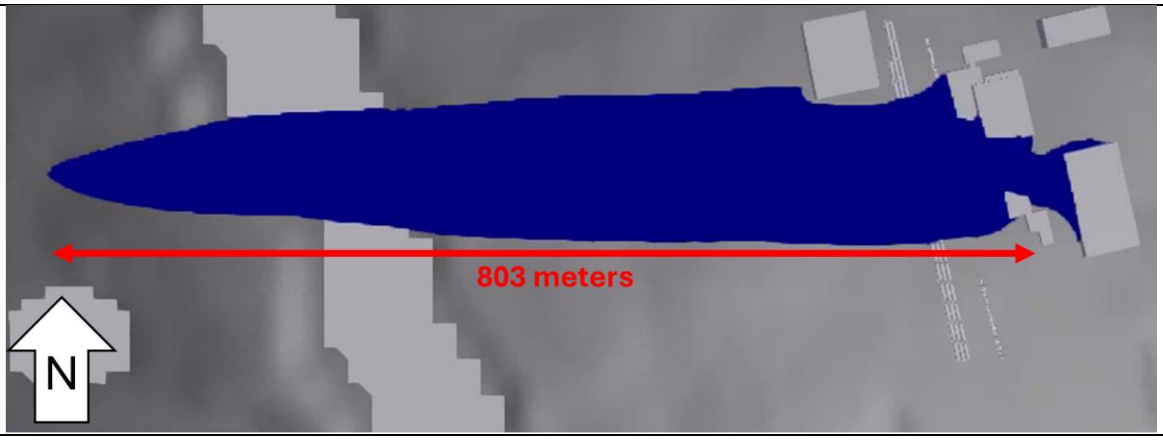

**Figure E- 7. Rail Loading - 103 ppm Chlorine Concentration Isopleths**




North Release




West Release With Wall




West Release Without Wall

**Figure E- 8. Distillation Tower Bottoms - 103 ppm Chlorine Concentration Isopleths**

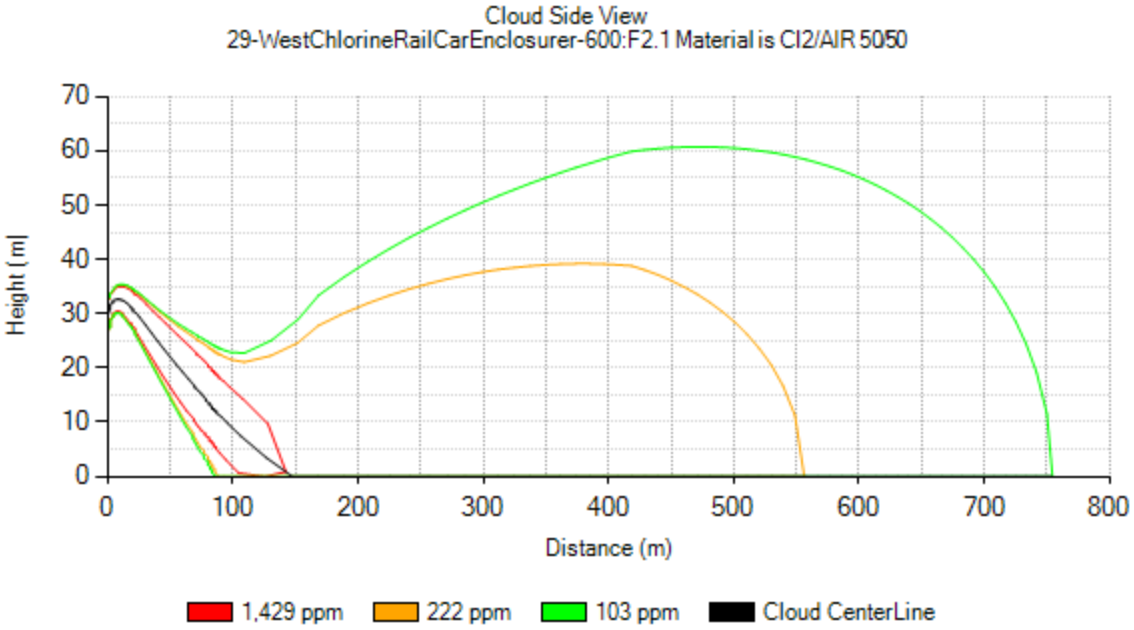



**Figure E- 9. Rail Loading SafeSite Dispersion Results**

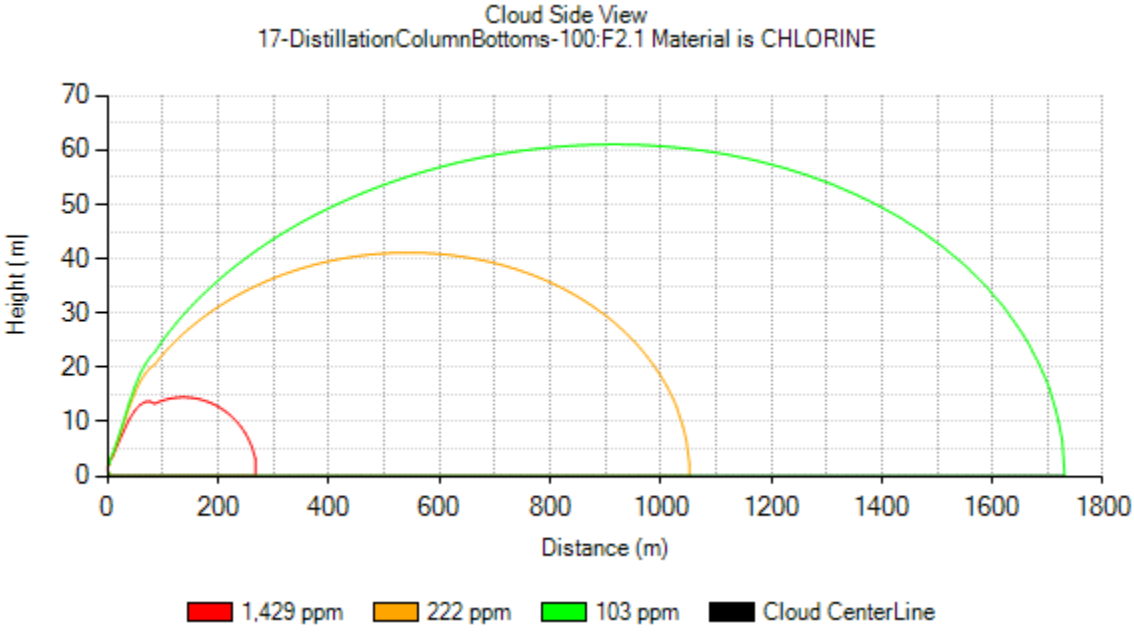



**Figure E- 10. Distillation Tower Bottoms SafeSite Dispersion Results**

# APPENDIX F. SEISMIC RISK ANALYSIS

This appendix provides detailed information on the seismic risk analysis performed in conjunction with this QRA study. Anay Raibagkar performed the seismic analysis and documented inputs, methodology, and results in Appendix F.

# OBJECTIVE

The objective of this analysis was to assess the toxic risk associated with a chlorine release initiated by a seismic event. Scope included defining the size and location of a potential chlorine leak in order to model the corresponding Loss of Containment (LOC) scenario, then assigning an associated likelihood to event occurrence.

# BACKGROUND

A third-party consultant performed a Quantitative Risk Assessment (QRA) for the Chemtrade North Vancouver facility in 2006[8]. As part of the assessment, several release scenarios associated with a seismic event were included in the analysis. Only liquid chlorine in large hold-up was considered in this analysis. Per the QRA report[8], the frequency of chlorine release from a storage tank was determined to be 3.5E-5 per year. Chemtrade intends to remove all liquid chlorine storage tanks and pumps from operations.

# FREQUENCY QUANTIFICATION

The determination of seismic hazards with return periods of 1 in 5,000 or 1 in 10,000 years (corresponding to annual probabilities of 0.0002 or 0.0001, respectively) is typically required only for special facilities, such as nuclear power plants or dams, where failure would result in severe consequences. These low-probability events fall outside the scope of the current British Columbia Building Code (BCBC), which is designed for standard structures and is based on a return period of 1 in 2,475 years (0.000404 per annum), or 4.04E-4 per year—this is the proposed return period for typical building design. Thus, this frequency was considered to be equivalent to frequency of a potential liquid chlorine release at the Chemtrade North Vancouver facility for existing equipment.

# SCENARIO OF INTEREST

Based on seismic testing data[20], the equivalent hole size predicted for a potential liquid chlorine loss of containment scenario associated with a seismic event is 0.5 inches or 12.5 mm. However, Chemtrade intends to remove all outdoor liquid chlorine equipment as a part of their new plant design. Thus, no liquid chlorine release from a seismic initiating event was explicitly modeled. Note that the industry-average failure rates used in this QRA do account for consideration of natural hazards at an average facility. The increased seismic activity frequency present at the North Vancouver will be mitigated through the following design considerations:

- Piping shall be designed to prevent liquid chlorine leaks from a 2%/50-year earthquake as defined in the BCBC 2024. The design must be shown through analysis to prevent any potential liquid Chlorine leaks for an earthquake with 2% probability of occurrence in 50 years, as defined in the BCBC.

[20] Kiremidjian, Anne, et al. “Seismic Risk to Major Industrial Facilities,” Report No. 72, Blume Earthquake Engineering Center, Stanford University, Jan. 1985.

- The design basis will consider the worst case liquid level, as determined through appropriate nonlinear structural seismic analysis.
- Robust seismic bracing and supports, and anchoring of chlorine equipment shall be implemented to withstand seismic forces.
- Automatic isolation mechanisms for pipelines and high risk equipment will minimize leaks.

# APPENDIX G. THIRD-PARTY REVIEW COMMENTS AND RESOLUTION

See separately sent Excel sheet for reference.

- Third Party Review Comments and Resolution_Revised Report

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355 West Queens Road
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*Risktec Solutions (Canada) Ltd*
*Suite 1000*
*Bankers Hall West*
*888, 3rd Street SW*
*Calgary. AB T2P 5C5*
*Canada*
*Website: www.risktec.tuv.com*
*E-mail: enquiries@risktec.tuv.com*
*Tel: +1 403 269 2106*

6th February 2026

Risktec Project No.: CHEML-4

BakerRisk Project No.: 01-08654-004-25 Rev. 2

## Confirmation of Response to Peer Review Comments – Revised QRA

Dear Afrooz,

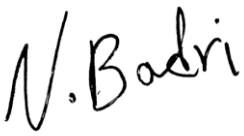
Risktec Solutions (Canada) Ltd. (Risktec) has reviewed the revised Quantitative Risk Assessment (QRA) prepared by BakerRisk on behalf of Chemtrade, together with the accompanying response matrix addressing Risktec's earlier peer review comments.

Based on our review, it is our professional opinion that the key peer review comments have been adequately addressed in the revised QRA and associated Fault Tree Analysis (FTA). The updates provided improve clarity, transparency, logic, referencing and alignment with the risk assessment methodology and risk tolerance framework. The revised assessment reasonably reflects the current facility design and proposed risk reduction measures, and the conclusions presented are consistent with the updated analysis.

Consequently, Risktec considers the revised QRA, and associated FTA, to be suitable for its intended purpose in supporting the District of North Vancouver's consideration of the proposed application.

Please do not hesitate to contact Risktec should further clarification be required.

Yours sincerely



Naser Badri
*for Risktec Solutions (Canada) Limited*

*Risktec Document Number* *CHEML-04-R01*

| Report Section | Observations | Recommended Improvement | BakerRisk Response | Report Revisions | Recommendation Type |
|---|---|---|---|---|---|
| **Report - Chemtrade North Vancouver FSS/QRA Update - 01-08654-004-25** | | | | | |
| **Executive Summary** | - Provides a clear overview of the QRA/FSS objectives, key findings, and risk mitigation measures<br>- Figure 2 shows the LSIR contours, but not relative to the offsite receptors | - Recommend adding the offsite receptor locations in Figure 2 (similar to Figure 11) and adding the LSIR values for each receptor | BakerRisk revised Executive Summary to include identification of offsite receptor locations and provide LSIR information per receptor in tabular format. | Added previously Figure 11 to the Executive Summary and LSIR information in Table 2 (page v and vi). | Editorial |
| **Section 1 - Introduction** | - Clearly states the purpose: conduct FSS, QRA, and CFD to support rezoning applications and evaluate the proposed design of Chemtrade chlor-alkali plant<br>- Would be helpful to clarify upfront which facility areas are included/excluded from the QRA, instead of relying on later sections. | - Recommend to define all standards and guidance documents that were followed for this study. | BakerRisk added standards and guidance reference to report. | Added a list of standards and guidance used in this FSS and QRA study to new Section 10 (page 41); added reference to this in Section 1 (page 2). | Editorial |
| **Section 1.1 - Brief Plant Description** | - The description emphasizes the proposed modifications, but would be helpful to consolidate a single system-level description (i.e. major chlorine inventories, pressure systems, isolation boundaries) | - Recommend clearly identifying which buildings/equipment are existing vs proposed (tabular format would be ideal) | BakerRisk added a table to communicate existing vs new buildings/equipment. | Added Table 2 to this section of the report (page 3-4) to document this information. | Editorial |
| **Section 1.2 - Proposed Railcar Loading Process and Building Design** | - The dependencies on design assumptions are not introduced in this section, but are critical to both consequence and frequency modelling. | - Recommend referencing the sections detailing the design assumptions | BakerRisk added reference to sections further discussing design assumptions in Section 1.2. | Referenced relevant sections with design assumptions in Section 1.2 (page 7). | Editorial |
| **Section 2 - Objectives and Scope of Work** | - This section provides a detailed breakdown of the objectives and scope for the FSS/QRA and CFD modelling.<br>- The scope does not formally define what is excluded<br>- Would be good to clarify how the CFD results were intended to be used (i.e. supplement to SafeSite) | - Recommend adding a subsection detailing what is excluded in the study (e.g. onsite risk, societal risk, etc.) | BakerRisk added a subsection regarding exclusions. | Exclusions section added to report, Section 2.1 (page 8). | Editorial |
| **Section 3 - Tolerance Criteria** | - MIACC land use planning guidelines appear in a figure in the executive summary, but are not well summarized textually in the main body.<br>- The offsite receptors of interest are organized well; however, it does not detail their corresponding MIACC threshold.<br>- Would be ideal to move the MIACC land use planning guidelines figure to Section 3 instead of the Executive Summary. | - Recommend to add a column in Table 1 providing the individual risk thresholds (i.e. LSIR thresholds) for the identified offsite receptors | BakerRisk added a column to identify LSIR at each receptor point. | Added additional column to Table 1 with LSIR thresholds for receptors (page 9). | Editorial |
| **Section 4 - Consequence Analysis Methodology Summary** | - Methodology references SafeSite dispersion modelling, jet/pool fire models, and probit methods.<br>- States reliance on Jack Rabbit II chlorine validation for the dispersion model<br>- Provides a mix of high-level summary and detailed assumptions, but some assumptions are presented without justification (i.e. pool diameter and depth limits)<br>- CFD results are said to be consistent with SafeSite, but numerical comparison or validation method is not shown. | - No recommendations | | None | |
| **Section 4.1 - Assumptions** | - Assumptions are listed clearly and are comprehensive<br>- Several assumptions significantly affect conservatism but are not justified, such as the use of default pool limits (25 m diameter, 1 m depth)<br>- Some assumptions rely on Chemtrade input (e.g. compressor shutdown behaviour)<br>- The last bullet in Section 4.1 should be clearly stated at the beginning of the section as it's an important statement.<br>- Assumptions based on Chemtrade input (i.e. compressor shutdown) will need to be validated in detailed design | - Recommend providing technical justification or cite design documents for assumed used pool limits | Pool limits are applied to prevent prediction of an infinitely large pool with negligible depth. The default pool limit used in this QRA is a conservative limitation to account for pool surface composition, barriers to flow, topography, and drainage. The limits are set using engineering judgment based on past QRA studies where sites were surveyed for maximum pool surface size. | None | Technical |
| **Section 4.2 - Hazard Identification** | - Hazard identification is thorough and tied to PFDs/P&IDs<br>- Three (3) release sizes applied uniformly, which is standard practice<br>- The large railcar breach scenario is based on a previous assessment made by another 3rd party consultant in 2006 | - Recommend reviewing and validating that the conditions used in 2006 large railcar break scenarios remain applicable to the current design. | BakerRisk has validated the railcar storage conditions (i.e., temperature, pressure) as part of this study and added language to the report to reflect this. | Added confirmation that BakerRisk validated stored railcar process conditions (page 13). | Technical |
| **Section 4.3 - Consequence Analysis** | - Describes full modelling chain (i.e. discharge to consequence results)<br>- SafeSite used as the software<br>- CFD was used for only two railcar release direction, but is summarized in detail in Appendix E<br>- Scenarios were run to steady-state up to 60 minutes | - Suggest adding a summary table comparing CFD vs SafeSite results to demonstrate consistency | BakerRisk added a summary table in the appendix comparing CFD vs SafeSite. | Added CFD vs Safesite dispersion distance comparison summary table to Appendix E (page E-9). This is referenced in Section 4.3 (page 14). | Editorial |
| **Section 5 - Consequence Analysis Inputs** | - Provides a brief introduction the section detailing the consequence analysis inputs and where additional information can be found (i.e. Appendix D)<br>- Details the exclusions for consequence modelling | - No recommendations | | none | |
| **Section 5.1 - Hazard Identification** | - Hazard sources mapped from PFDs and P&IDs and releases appear comprehensive and aligned with equipment locations<br>- Indoor vs outdoor scenarios are provided | - No recommendations | | none | |
| **Section 5.1.1 - Indoor Dispersion Scenarios** | - Indoor dispersion assumed to be well-mixed within the fixed volume<br>- Scrubber capacity (15,000 lb/h) applied as a mitigation limit and partial scrubbing is modelled by subtracting scrubber capacity from the release rate<br>- Table 2 provides all of the release sources (or hazard sources), but inventory values are not provided | - No recommendations | | none | |
| **Section 5.1.2 - Release Durations** | - Releases from piping scenarios use 10 min, 30 min, and 60 min durations<br>- Releases during loading operation scenarios use 1 min, 5 min, and 60 min durations | - No recommendations | | none | |
| **Section 5.2 - Materials** | - Toxicity values sourced from TNO Purple Book; lethality concentrations listed for 1%, 10%, 90% fatalities over 10 min averaging time<br>- Materials list appears to be complete | - Recommend to validate the toxic probit parameters (i.e. A, B, N) for Chlorine and Hydrochloric Acid against the latest revision of the TNO Purple Book. Changes to these parameters may have an impact on the 1%, 10%, and 90% lethality concentrations | The QRA study uses the latest edition of the probit references from TNO Purple Book (2005). This reference is typical across industry for chlorine and hydrochloric acid probits (e.g., DNV/Phast). | Added year of publicaton to Table 6 (page 29). | Technical |
| **Section 5.2 - Meteorological Data** | - STAR data used with a reasonable dataset (YVR 2018-2022)<br>- Explains the nomenclature for weather conditions and specifies where to find additional information in the appendices. | - No recommendations | | none | |
| **Section 6 - Risk Analysis Methodology Summary** | - The QRA was conducted using BakerRisk's internal software: QRATool<br>- The tasks associated with the methodology is consistent with industry practices | - No recommendations | | none | |
| **Section 6.1 - Assumptions** | - The assumptions are comprehensive<br>- Several frequency reductions are applied, and benchmarked by the FTA and not literature (e.g. CCPS or API guidance)<br>- LSIR assumes outdoor offsite receptors, which may be considered conservative | - No recommendations | | none | |
| **Section 6.2 - Hazard Impacts** | - The consequence results from SafeSite were imported into QRATool to conduct the risk modelling, which is a standard process. | - No recommendations | | none | |

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| **Section 6.3 - Frequency Rates** | - Industry average failure rate data was used; however, the report does not state the source.<br>- The equipment counts and frequencies are provided in the QRA results spreadsheet (Equipment Count tab); however, it does not state that this spreadsheet is found in Appendix D | - Recommend adding the source associated with the failure rates summarized in Table 5 (Failure Rate Data - Releases) | BakerRisk provided a list of references for the industry average failure rate used to develop Table 5 and referenced Appendix D for the equipment counts and frequencies. References for each individual rate value will not be provided. | Added reference to Appendix D, Equipment count tab (page 31). Added industry-average failure rate database references as well as information regarding unique failure rates, e.g., FTA (page 32 and 33). | Editorial |
| **Section 6.4 - Release Frequencies** | - Release frequencies for all hazard sources are appropriately discussed in this section.<br>- Risktec does not have access to the spreadsheets in Appendix D (FSS and QRA Spreadsheets); therefore, it is assumed that all event frequencies are summarized for all hazard sources<br>- Assumed that the F Flammable, F Fire, and F Toxic tabs are in the QRA Results Spreadsheet, as it's not specified.<br>- Immediate and delayed ignition probability split is not discussed | - If not done already, it is recommended to specify in a tabular format the data source corresponding to the frequency rates used for each hazard source (e.g. FTA, 2006 QRA, CCPS, IOGP, etc.). This information can be added to the QRA Results Spreadsheet<br><br>- Recommend adding discussion regarding the immediate and delayed ignition (typical split is 50:50) | BakerRisk provided a list of references for the industry average failure rate used to develop Table 5 and referenced Appendix D for the equipment counts and frequencies. References for each individual rate value will not be provided.<br><br>BakerRisk added additional discussion on ignition probability calculations. | See above for report changes corresponding to failure rates.<br><br>Added discussion and table regarding early vs late vs no ignition probability (page 35). | Editorial |
| **Section 6.5 - Wind Direction and Weather Probability Data** | - The assumption associated with the early ignition events (i.e. jet fires / pool fires) is sensible | - No recommendations | | none | |
| **Section 7 - Consequence Analysis Results** | - This section appropriately summarizes where all the consequence analysis results can be found (i.e. Appendix D) using SafeSite.<br>- Comment was made that the CFD dispersion results were consistent with SafeSite, but there's no side-by-side comparison of the results. Based on the discussion in Appendix E they are identical, but this result may be surprising given the additional detail needed to model CFD. | - No recommendations | | none | |
| **Section 8 - Risk Analysis Results** | - A bit odd referencing the Executive Summary as its purpose is to be a standalone section. Additionally, the purpose of Section 8 is to summarize the risk results.<br>- Provides the location of where to find additional risk results and inputs (i.e. Appendix D)<br>- Correctly defines LSIR and introduces the LSIR contours overlapping with the offsite receptor locations, which are clearly identified.<br>- LSIR contours indicate compliance with MIACC land use planning thresholds; however, does not include LSIR values for each offsite receptor along with its relative MIACC threshold.<br>- There is no discussion regarding the Control Zone (Represented by the 1E-04/year LSIR contour)<br>- The far-field and near-field risk-driving scenarios are summarized at the end of the section, but does not provide its impact to the offsite receptors | - Recommend to add LSIR values for each of the offsite receptors, as well as their corresponding MIACC threshold. It provides additional insight regarding the risk at each location.<br><br>- Recommend to add discussion regarding the Control Zone, which is represented by the 1E-04 /year LSIR contour. Under the MIACC risk tolerance framework, the Control Zone is intended to reflect the highest level of risk reasonably expected to occur during normal plant operation and is used to guide land-use decisions and operations controls. The 1E-04 /year contour must remain entirely within the industrial facility property boundary. Based on the LSIR contours, this seems to be the case; however, it should be discussed in this section of the report (as well as the Conclusion and Executive Summary).<br><br>- Recommend adding a table detailing the event percentage contributions (i.e. fire and toxic) from the risk-driving scenarios impacting the offsite receptors. This information could be used to support more informed decision-making regarding where additional mitigation or design improvements should be made. This recommendation may be more beneficial in the detailed design stages. | BakerRisk added LSIR values for each offsite receptor and hazard distribution between fire, toxic, and flash fire. Chemtrade provided the approximate property boundary for BakerRisk to comment on Control Zone. | Added a table showing LSIR values for each offsite receptor and the portion contributed by toxic and fire hazards in Executive Summary (page vi). All offsite risk is due to toxic hazards, negligible risk is posed by flash fire and jet / pool fires.<br><br>Added discussion on Control Zone in the main body of the report (page 38) as well as high-level statements in Executive Summary (page vi) and Conclusion (page 40). A figure was added (page 39) showing comparison of the risk contours (i.e., 1E-4 Control Zone) to the property boundary. | Editorial & Technical |
| **Section 9 - Conclusions and Recommendations** | - Concludes that the risk tolerability criteria are met<br>- Notes the need for updated LSIR calculations if the design changes<br>- Highlights the dependency on the assumptions and the need for detailed design verification | - No recommendations | | none | |
| **Appendix A - Consequence and Risk Modelling Details** | - Provides a good summary of the consequence and risk modelling details; however, not all of the sections are applicable to this study (e.g. societal risk) | - Suggest removing the aspects of this appendix that are not applicable to this study to avoid potential confusion for the reader. | BakerRisk reviewed and adjusted appendix accordingly. | Appendix A revised to reflect appropriate modeling methodology for this study (page A-2 through A-8). | Editorial |
| **Appendix B - Source Definitions, Locations, and LSIR Contours** | - All information provided in attachments not accessed by Risktec | - No recommendations | | none | |
| **Appendix C - Statistical Meteorological Data** | - All information provided in this appendix is consistent with industry practices | - No recommendations | | none | |
| **Appendix D - FSS and QRA Spreadsheets** | - All information provided in attachments not accessed by Risktec | - No recommendations | | none | |
| **Appendix E - CFD Analysis** | - The CFD analysis provides information and results consistent with industry practices<br>- States that Table E-1 summarizes the distances from the source to the 103 ppm chlorine concentration for both SafeSite and CFD analysis. Were the identical distances reached for both software? | - Recommend providing a graph and/or table showing a side-by-side comparison between the results from SafeSite and the CFD analysis. | BakerRisk added documentation comparing SafeSite and CFD dispersion results. | CFD and SafeSite comparison added (pages E-9, E-13) | Editorial |
| **Appendix F - Seismic Risk Analysis** | - Reviewed the structural anchoring, piping supports, and seismic survivability of key chlorine systems | - No recommendations | | none | |

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| **Overview of Reports**<br>Provide a summary outlining the purpose of each risk assessment report (Quantitative Risk Assessment and Fault Tree Analysis) and confirm that the appropriate studies have been and are being undertaken. | The QRA/FSS and supporting CFD analyses were undertaken to evaluate the potential offsite and onsite risks associated with the proposed modifications at the Chemtrade North Vancouver facility. The report aims to:<br>- Identify credible chlorine release scenarios associated with the existing and proposed facility configuration.<br>- Quantify the potential fire, flammable disperison, and toxic exposure impacts, including indoor and outdoor dispersion, under various meteorological and operating conditions.<br>- Assess the individual risk (i.e. LSIR) relative to established risk tolerance criteria (i.e. MIACC/CSChE).<br>- Evaluate the performance of existing and proposed safeguards, including detection, scrubbing, ventilation, and isolation systems.<br>- Provide engineering input to support the District's review of the Rezoning Application by demonstrating risk acceptability based on recognized Canadian and international best practices.<br><br>Based on the review of the QRA/FSS and associated appendices, the appropriate studies have been conducted, including:<br>- Hazard identification<br>- Consequence modelling (indoor and outdoor)<br>- CFD analysis of key scenarios<br>- Frequency analysis (frequency data, parts count, ignition probability)<br>- Individual risk (LSIR) calculations<br>- Review of mitigation performance (scrubbers, detection, ventilation)<br>- Seismic screening<br><br>The report represents a complete and appropriate study for a facility of this type and are consistent with typical QRA/FSS expectations for rezoning and regulatory consultation. |

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| **Compliance with Risk Tolerance Standards**<br>Confirm whether the risk and safety work continues to satisfy the prescribed methodology and criteria established by the Canadian Society of Chemical Engineers (CSChE) publication, "Risk Assessment – Recommended Practices for Municipalities and Industry" (formerly Major Industrial Accidents Council of Canada or MIACC). Confirm that the facility meets current industry standards for risk tolerance. | The CSChE publication "Risk Assessment – Recommended Practices for Municipalities and Industry" (formerly MIACC) is the most widely recognized Canadian framework for evaluating offsite risk acceptance. The key criteria include:<br>- Individual risk thresholds<br>- Guidance for land-use planning in proximity to industrial facilities<br>- Use of transparent methodology grounded in recognized engineering practice.<br><br>Based on the QRA results:<br>- The LSIR results at the offsite receptors do not exceed their corresponding thresholds<br>- The facility's overall risk profile falls within acceptable MIACC/CSChE tolerability limits<br>- Methodologies used are consistent with the recommended practices<br>- The application of conservative modelling assumptions contributes to a protective assessment in line with MIACC expectations<br><br>The QRA/FSS demonstrates compliance with CSChE/MIACC risk tolerance standards and meets current industry expectations for risk assessments. |
| **Progression of Risk Reduction and Safety Work**<br>Based on the reviewer's professional assessment of the materials and any discussions with the project team, provide commentary on the expected effectiveness and validity of risk reduction measures in comparison to the current facility design. Confirm whether this work aligns with industry best practices and identify any notable improvements or continued risk reduction measures. | The report documents several significant improvements in the proposed facility configuration that are expected to reduce risk relative to the current operating arrangement. These include:<br>- Installation of enhanced chlorine detection and improved shutdown logic in the Liquefaction Building.<br>- Addition of a ventilated and more controlled enclosure for the railcar loading process, including louvers, stack ventilation, and dedicated chlorine scrubbing.<br>- Increased mitigation capacity with a 15,000 lb/hr emergency scrubber, which significantly reduces release magnitudes for indoor events.<br>- Proposed improvements to isolation and compressor shutdown logic, reducing frequency of large indoor releases.<br>- Updated building configurations that reduce worker exposure pathways and enable improved shelter-in-place performance.<br><br>Risk reduction measures adopted in the proposed design provide improvements in both:<br>- Consequence severity through improved ventilation/scrubbing<br>- Event frequency through enhanced detection and automated shutoff actions<br><br>These measures align with industry best practices, including CCPS and API guidance for chlorine systems, which emphasize early detection, rapid isolation, and enclosed mitigation where feasible. The progression of safety work represents a strong, well-aligned path toward risk reduction and demonstrates continuous improvement consistent with industry expectations for facilities handling chlorine. |
| **Building Location and Construction**<br>For the District's consideration of the Rezoning Application, confirm that the locations and methods of construction of process equipment and buildings will support safe facility operations and meet the CSChE criteria for acceptable risk, to the extent that information is available at the present engineering stage. | Based on the information currently available, the siting and construction approach for major process buildings is generally consistent with risk-based design practices. Some observations include:<br>- The proposed Railcar Loading Building features enhanced ventilation and mitigation provisions that reduce indoor chlorine accumulation.<br>- Building locations maintain separation distances from high-risk equipment as far as practical within the constrained industrial site.<br>- Some buildings appear to support Shelter-in-Place (SIP) strategies, and probit-based toxicity assessments support their expected performance.<br>- No MIACC/CSChE criteria are exceeded at property boundaries given current building placement.<br>- The FSS and QRA support the conclusion that building siting does not introduce unacceptable risk.<br><br>Based on the engineering information provided, building locations and construction methods support safe facility operation and meet CSChE tolerability criteria for offsite risk. However, future detailed design validation is recommended, but does not change the present conclusion. |
| **Reliability of the Reports**<br>Assess whether the reports are reasonable and reliable. If there are any deficiencies or areas of concern, identify them and provide recommendations for resolution. | The QRA/FSS and CFD analyses appear reasonable, technically defensible, and consistent with industry practices. The methodologies are appropriate for the hazards at the site, and the underlying logic is aligned with recognized risk assessment practices.<br><br>The following are the areas of strength:<br>- Comprehensive hazard identification and scenario selection<br>- Conservative modelling choices<br>- Robust use of validated models<br>- Transparent assumptions and clear traceability to process information<br>- Consistency between modelling results and previous studies (i.e. 2006 QRA)<br><br>The following are the areas of improvement:<br>- Providing more detailed information regarding the risk results (e.g. tabular LSIR results for each offsite receptor and their corresponding MIACC thresholds)<br>- Certain assumptions rely on Chemtrade's design intent (e.g. compressor shutdown timing, ventilation rates, scrubber capacity) and should be validated during detailed engineering<br>- CFD was performed for only limited scenarios. Additional comparisons may be beneficial in future iterations.<br>- Sensitivity analyses could be strengthened and beneficial for future iterations (e.g. low wind speed, varying operator response times)<br><br>The report is reliable, internally consistent, and appropriate for rezoning and land-use planning decisions. Any remaining uncertainties are typical for a project at this stage and do not materially affect the overall conclusion that the facility meets the applicable risk tolerance criteria. |

*Risktec Document Number* *CHEML-04-R01*

| Report Section | Observations | Recommended Improvement | BakerRisk Response | Report Revisions |
|---|---|---|---|---|
| **Report - Railcar Loading Chloride Release Fault Tree - Chemtrade - 02-08654-004-25** | | | | |
| **Section 1 - Scope of Work** | Reviewed - no comments. | n/a | | None |
| **Section 2 - Fault Tree Analysis - Team** | Reviewed - no comments. | n/a | | None |
| **Section 3 - Fault Tree Analysis** | Section 3.1.1 - minor comment, author should ensure that that the system boundary definition is explicit, this does not impact the methodology but useful for understanding the logic to the FTA. | No specific recommendations that require report revision. | | None |
| | Section 3 would assist with adding any assumptions, exclusions, and data justification, that has been used in the methodology, however the section still reads well and is logical. | See 'Observations' no specific recommendations that require immediate revision. | | None |
| | Section 3.1.4 - FTA logic and methodology appears sound and consistent with relevant standards and best practice. | No recommendations. | | None |
| | Section 3.1.6 - would be beneficial to include discussion of HEART assessment for frequencies / probabilities, however methodology is sound / logical. | No recommendations. | | None |
| | Section 3.1.8 - Availability, it should be explicit here that any safety system / measure require regular proof testing to ensure it's functionality. | No specific recommendations that require report revision. | | None |
| | Section 3.4.2 - review has confirmed that formulas stated / used here are consistent with CSChE guidance. | No recommendations. | | None |
| | Section 3.4.4 - A HEP of 0.01 is acceptable for some human activities under CSChE guidance, however, it does not account of poor training etc. For such activities with poor culture etc. a HEP of 0.1 may be more appropriate. | HEPs are critical on some FTA on calculated frequencies, thus on those with potential cliff edges effects they HRA should be reviewed and consider whether it is conservative. | BakerRisk agrees that an HRA should be performed at some point to verify the HEPs. A simplified HEART analysis was performed for this QRA as an exercise to estimate the order of magnitude for the HEP. Conducting a formal HRA was identified as an area for improvement during the detailed design stage of this project. Chemtrade has assured that additional safeguards and independent checks will be added should the HEP be greater than 0.01. | Revised wording for Recommendation 5 (page 20). |
| | Section 3.3.4 - HEART task identifiers look appropriate, although would be useful to see how the APOA etc. was calculated as does effect the final HEP. Note that HEART calculations are for a single action / activity. | The reader would be benefit from understanding the APOA, see later comment on HEART appendix calculations. | APOA selection documented in Appendix E. | Added reference in Section 3.3.4 to Appendix E (page 11). Added additional APOA discussion to Appendix E (page E-5). |
| | Section 3.3.4 - review has confirmed that for HEP calculations HEART is allowed / consistent with CSChE guidance and international best practice. | No recommendations. | | None |
| **Section 4 - System Description** | No comments | n/a | | None |
| **Section 5 Assumptions** | No comments, apart from above comments relating to listing specific FTA assumptions which are not included in this section. | n/a | | None |
| **Section 6 Recommendations** | A review has confirmed that recommendations look sound / logical. For Recommendation 4 we would suggest that rather than 'validate', that the client ensure training procedures etc. in place, as HEPs are key to frequencies etc. thus review should be key to findings. | Review of wording of recommendation 4, minor comment - see Observation notes. | Reviewed and revised wording of Recommendation 4. | Revised wording for Recommendation 4 (page 20). |
| **Section 7 Event Descriptions and Results** | A review of the section has confirmed that the logic for the gates etc. appears correct and consistence with guidance / best practice. | No recommendations. | | None |
| | The review has noted that identified scenarios are heavily reliant on human factors / HEP based on basic HEART methodology, however the use of this methodology appears appropriate under CSChE guidance. | No recommendations. | | None |
| **Appendix A - Fault Trees** | Note: Appendix A has been reviewed based on selection of sample data. | n/a | | None |
| | TP1 - Review of FTA shows that top level logic appears correct. | No recommendations. | | None |
| | GT11 - Review of FTA, shows that HEPs reflect HRA discussed in main body of text, and logic appears correct. | No recommendations. | | None |
| | GT43 - Review of FTA shows logic and frequencies look logical gates look correct. | No recommendations. | | None |
| | GT23 - Review of FTA shows logic and frequencies look logical gates look correct. | No recommendations. | | None |
| | GT27 - Review of FTA shows logic and frequencies look logical gates look correct. | No recommendations. | | None |
| | GT31 - Review of FTA shows logic and frequencies look logical gates look correct. | No recommendations. | | None |
| | GT39 - Review of FTA shows logic and frequencies look logical gates look correct. | No recommendations. | | None |
| **Appendix B - Fault Trees** | TP2 - Review shows that logic appears sound, with loadings and unavailability. | No recommendations. | | None |
| | GT56 - Review of failures with respect to each hose and consistency across failure routes, appears correct. | No recommendations. | | None |
| | GT47 - review has shown that Page 8 reference within the FTA appears incorrect, although GT48 unavailability appears accurate, this comment applies through other FTAs in the appendices where page references have been added to the trees. | Referencing with FTA to specific trees / pages should be reviewed across the appendices to ensure accuracy and maintain traceability of route. | BakerRisk reviewed FTA referencing to ensure traceability between pages. | Page referencing corrected for Appendix A and B. |
| | GT12 - HEPs and associated failure modes appear accurate. | No recommendations. | | None |
| | GT36 - Review shows that logic / methodology appears correct. | No recommendations. | | None |
| **Appendix C - Failure Models**<br><br>**Note**: Appendix C has been reviewed based on selection of sample data. | DICC - IEC reference and logic, assumptions appear logical / correct. | No recommendations. | | None |
| | ERC - check of referencing etc. and logic, all appear correct | No recommendations. | | None |
| | HEP001 - review of HEP shows that it appears correct based on main body text, note wording is consistent with HEART methodology. | No recommendations. | | None |
| | HS5 - reference appears to be missing, however consistent with above lines. | Review of references to ensure all correctly linked. | BakerRisk updated the reference for HS5. | Added HSE reference for HS5 failure model (page C-8). |
| **Appendix D - Base Event Failure Models** | Review of Appendix shows that FTA links and logic appear correct | No recommendations. | | None |
| **Appendix E - Human Error Probability Verification via HEART** | A review of the HEART calculations has show that it is difficult for the reader to understand the selection of EPCs etc. It would be beneficial to add the logic to the section so that the reader can understand / check the selection of EPCs. | Review of the EPC logic and add justification / assumptions to section, as key to final HEP value. | There is a lack of documented justification for EPC selection as procedures, processes, manning resource, and operator training are yet to be finalized. Based on confirmation from Chemtrade, it was assumed that all operators carrying any stages of the loading process shall be adequately trained in the required procedures, hazards, safeguards, and the importance of each critical step. Language was added in the report to reflect these assumptions. | Additional language added to Recommendation 4 and 5 (page 20) and following Table E-3 (page E-5) commenting on assumptions supporting EPC selection. |
| | Noting the above comment, a review of the EPCs has been carried out. The logic behind the selection of EPC 35, appears unclear? What is the justification for disruption of normal sleep cycles? | See above and below recommendations. | See response above. Disruption of sleep cycles was included as loading operators work rotating shifts. | Additional language following Table E-3 (page E-5) commenting on assumptions supporting EPC selection. |
| | A further review notes that the selected EPCs are not necessarily logical, it would be more influenced by high stress, etc. The methodology behind the EPC selection is not clear to the reader and does not appear consistent with the scenarios considered, and without justification of selection may not be accurate for use within the HEART methodology. | Review of all EPC selection, and add justification to selection based on scenarios and likely contributing factors to human error. | See responses above. | None |
| **Whole Report** | A review of the report shows that it appears well written, logical and comprehensive based on sample data review. However, some of the HEP and logic for referencing within the FTA requires review. Recommendations here reflect these findings. | n/a | | None |

☑ Info Package Date: January 4, 2018

| Dept. Manager | GM/ Director | CAO |
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# The District of North Vancouver
# INFORMATION REPORT TO COUNCIL

January 2, 2018
File: 13.6480.30/00.003

**AUTHOR**: Tom Lancaster, Manager of Community Planning
Fiona Dercole, Director, North Shore Emergency Management

**SUBJECT**: **Update on Planning and Management Practices Associated with Chemical Hazard Risk in Maplewood**

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**REASON FOR REPORT**:
At the Regular Meeting of Council on November 20, 2017, clarifying questions were raised about the planning for chemical hazard risk mitigation in the Maplewood area. This report provides a summary of information relevant to chemical hazard risk management in Maplewood.

**SUMMARY**:
Planning for the Maplewood area has included analysis by consulting professionals for management and mitigation of potential risks due to chemical hazards. Risk contours have been identified in the Maplewood Village Centre and Innovation District Implementation Plan & Design Guidelines (The Plan), approved by Council on November 6, 2017. The risk contours were developed through a Quantitative Risk Assessment (QRA). These contour lines identify varying levels of risk associated with proximity to potential chemical hazards from industrial uses.

District staff engaged the services of McCutcheon and Associates prior to the Maplewood Charrette process, subsequent to adoption of the OCP in 2011, to reassess the risk analysis. The findings of that analysis reaffirmed the land uses and densities deemed acceptable within the risk contours. The Plan includes policies and guidelines to mitigate risk within the contours.

Emergency notification and response protocols have been established by Chemtrade, Fire, and North Shore Emergency Management. The protocols are reviewed and revised on an ongoing basis, with the next review scheduled for early 2018.

**BACKGROUND**:
Planning for Maplewood in the Official Community Plan is consistent with the recommendations of the 2006 peer reviewed Quantitative Risk Assessment (QRA) undertaken for the Canexus chemical plant Technology Conversion Project and using the Major Industrial Accidents Council of Canada (MIACC) guidelines for land use planning. This risk analysis

assessed the probability and consequence of a catastrophic chlorine spill in a multitude of scenarios (including an earthquake). Updated risk contours were identified around the Canexus plant at this time. The $10^{-6}$ risk contour represents a one in one million probability of fatality due to the hazard and is situated at approximately Front Street (Figure 1). The MIACC guidelines support sensitive developments (e.g. hospitals, child care facilities) beyond the 0.3 x $10^{-6}$ risk contour, high-density residential and commercial land uses beyond the $10^{-6}$ risk contour and low density residential and unrestricted commercial and industrial uses between the $10^{-6}$ and $10^{-5}$ risk contours. The land uses laid out in the Plan are consistent with these guidelines and residential land uses are predominantly beyond the $10^{-6}$ contour.

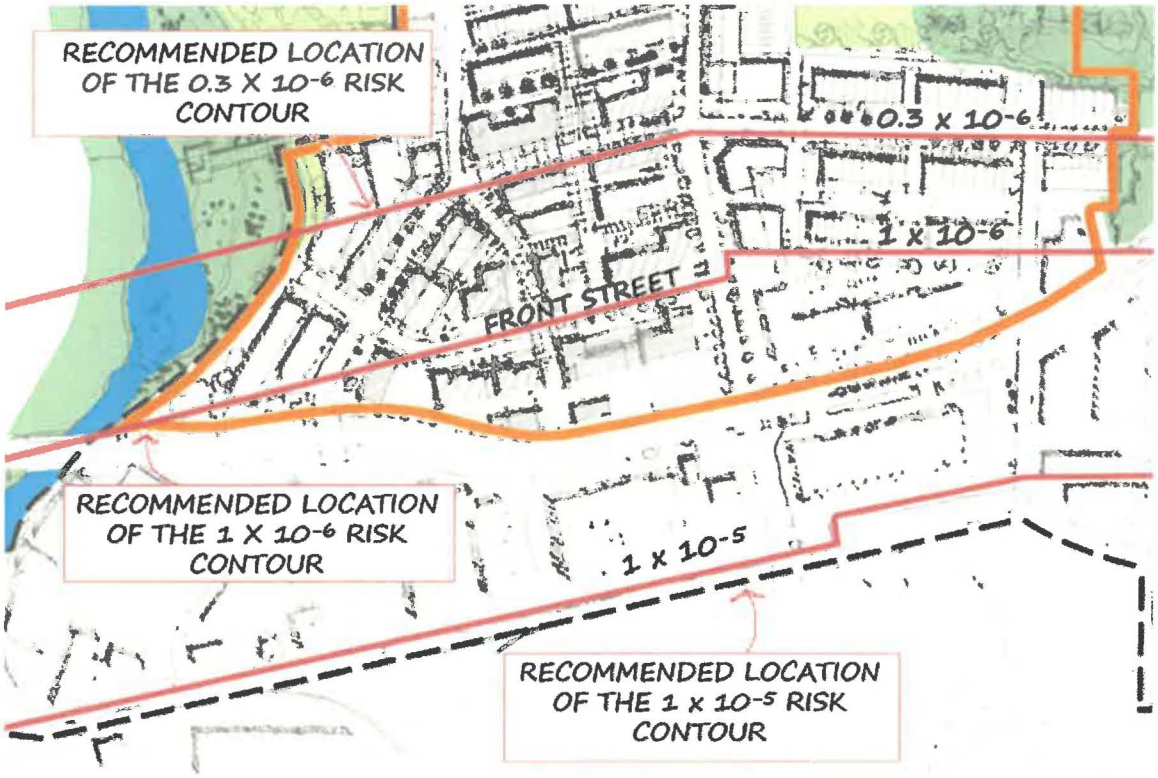



*FIGURE 1: Risk Contours in Maplewood Village Centre*

Peer Reviews of the QRA were completed by Norman Nibber on behalf of the District of North Vancouver and by Doug McCutcheon & Associates on behalf of the Port Metro (now Port of Vancouver) in 2007 as part of the process to potentially extend Canexus' lease. Both peer reviews supported the QRA results of Canexus' consultant which quantified a significant reduction of the risk of the plant to the community. Within the context of Maplewood Village planning at the time, the District provided feedback to Metro Port Vancouver on the lease extension application of Canexus for its the Technology Conversion Project and it included recommendations regarding two land assemblies located between the $10^{-5}$ and $10^{-6}$ risk contours (north of Dollarton and south of Front Street)(Great West Life Developments). Following completion of the 2006 QRA, and taking into account the District's feedback to Metro Port Vancouver, OCP planning shifted the village high street to Old Dollarton and the

residential land uses beyond the $10^{-6}$ contour to the unrestricted land use area and sensitive development beyond the $0.3 \times 10^{-6}$ risk contour.

The 2006 QRA is a geographic risk and assumes an individual is stationary in an area of potential risk 24 hours a day, 7 days a week, 52 week a year. A societal risk assessment considers the specific occupation, movement and characteristics of the population in the area of risk. Societal risk assessment is used, for example, where people reside in areas between the $10^{-5}$ and $10^{-6}$ contour to precisely determine how many households may be at risk in order to determine what reasonable and practical management strategies should be considered to further mitigate the risk (e.g. building measures, emergency preparedness, etc.). Given that the village heart, high street, and residential densities have moved northward into the unrestricted land use area, it is staff's understanding based on analysis and consultation with QRA peer reviewer Doug McCutcheon (University of Alberta), that societal risk assessment in Maplewood is not anticipated to result in further knowledge or different recommendations than the 2006 QRA. It should be noted that, unlike MIACC, there are no well accepted land use planning guidelines associated with societal risk QRA's.

Port of Vancouver approved the extension of Canexus' lease in May, 2007. The extension is to July 1, 2030 and requires the production of liquid chlorine be terminated on the site by this date.

Following adoption of the OCP in 2011, and in preparation of undertaking an implementation plan for Maplewood Village, the Maplewood Chemical Hazard DPA Preliminary Study was prepared by Doug McCutcheon and Associates, Consulting (A Division of "Human Factors Impact Ltd."), in August, 2012. This study reviewed the inventory of chemicals by substance type, location, and maximum quantity and assessed what substances pose a theoretical risk to residents/businesses in the nearby Maplewood Village Centre. Industrial operations reviewed included Canexus (Chemtrade Logistics), Newalta, Univar, HTEC (Hydrogen Technology and Energy Corporation), and ERCO Worldwide. The study identified the geographical scope of potential risk and recommended risk contours; and discussed the relative merits of buildings, site, and area-level measures to mitigate any identified theoretical risks (see risk contour map in Attachment 1).

To ensure full transparency and responsible governance, a list of the maximum theoretical amounts of all chemicals in the Maplewood and Lynn Creek areas was provided to the consultant in order to enable modelling a worst case scenario. Findings from the study concluded that only chlorine and hydrogen chloride used at Canexus (Chemtrade Logistics) have the potential to cause offsite impacts in the village in the worst case scenario.

The District re-engaged the services of Doug McCutcheon and Associates prior to the Maplewood charrette to reaffirm the proposed locations of the risk contours for the Maplewood area and to comment on allowable land uses within each contour to help inform the planning process, i.e. intensive residential uses is based on there being an annual one in a million chance of a fatality north of this risk contour, which is a level of risk deemed acceptable for intensive residential uses by international standards. An additional "sensitive use" risk contour of $0.3 \times 10^{-6}$ was also established as shown on Figure 1.

A follow up report from Doug McCutcheon was received on November 7, 2016 (Attachment 2) and staff have included the updated risk contours in the Maplewood plan and continue to follow the Major Industrial Accidents Council of Canada (MIACC) – Risk Acceptability Criteria within this area, considered to be Canada's best practice.

**ANALYSIS**:

***Risk Contours***

Three risk contours have been established for the Maplewood area due to the proximity of hazardous substances potentially used in areas designated for heavy industrial activities. Each risk contour identifies allowable land uses and densities permitted, based on the distance from the risk source and are included in Part 2, Section 2.14 Proximity to Heavy Industry of the Maplewood Village Centre and Innovation Implementation Plan & Design Guidelines, Figure 14 (Attachment 1). Accompanying policies include:

- Encourage safety in the location and construction of development.
- Land uses, densities, building design and construction should generally be consistent with the MIACC (Major Industrial Accidents Council of Canada) best practice recommendations for appropriate land uses and densities from the risk source, or any similar, successor or replacement agency that may exist from time to time.

Part 3, Section 3 Area-Wide Guidelines, subsection 3.2 (e) includes design guideline measures for parcels located within the $1 \times 10^{-6}$ risk contour. New buildings or structures and associated accessory buildings or structures with residential components should incorporate the following measures in their design:

i. HVAC systems that maintain a slight positive pressure inside the building to prevent chlorine from entering.
ii. Toxic gas detectors for chlorine on building HVAC systems to automatically shut down air intake on high chlorine levels.
iii. Adequate exit routes (stair wells, doors, etc.) for evacuation, including battery backup lighting and/or other failsafe means of directional signage and guidance.
iv. Sealable doors at each floor level and/or within floor levels to restrict airflow movement as necessary.
v. Emergency phones for contact with emergency responders and building residents.
vi. Building public address systems for contact and communication with building occupants.
vii. Emergency plans clearly defining for all building occupants what to do to protect themselves should they be asked to evacuate or to shelter inside.
viii. Designated "shelter in place" locations within buildings, where merited.

As part of the development review process for properties identified within the various risk contours, a report from a qualified professional (risk assessment specialist) is required to provide opinion on specific land use implications associated with any proposed land use change on a site-by-site basis as a condition of the review process. New individual

developments must have a risk assessment prepared by a qualified professional that will direct building measures that respond to any potential risks associated with chemical industry in the neighbourhood.

On November 20, 2017, District staff consulted with McCutcheon and Associates to confirm the specific risk management approaches in the Plan were appropriate. At that time staff were provided with a written response from the consultant (Attachment 3) which clarified and confirmed the risk management approaches in the Plan were consistent with best practices.

***Emergency Notification and Response***

In the event of a chemical release that has the potential to cause adverse health impacts, Chemtrade will activate its siren, which automatically triggers a call to 911 and messaging via Rapid Notify, Chemtrade's emergency notification system. District of North Vancouver Fire & Rescue Services is dispatched to the staging area and while en route, communicates directly with Chemtrade to determine if the site is safe to enter and whether or not there is need for a specialized HazMat response by City of North Vancouver Fire Department. Concurrently, public messaging is sent to occupants within a selected geographic area using Rapid Notify. The message may direct people to Shelter in Place, which means to go indoors, close doors and windows, turn off ventilation systems, and wait for further messages.

Chemtrade has allowed North Shore Emergency Management (NSEM) access to Rapid Notify for any type of emergency. Individuals and businesses are encouraged to subscribe to Rapid Notify in order to receive emergency notifications by way of text message, cell phone, landline and/or email. The system has the ability to rapidly push out messaging to a defined geographic area. The geographic area can be pre-loaded into the system or defined at the time of incident. In addition to sending notifications to subscribers, Rapid Notify will also pull telephone data from the white pages. Anyone can subscribe to the system by registering on the NSEM website. The system is tested monthly by Chemtrade.

The major limitation with Rapid Notify is that it relies on individuals to voluntarily subscribe to the service and keep their contact information up to date. The intent is to improve the system to address this shortfall. In April 2017 the CRTC directed all wireless service providers to implement a wireless public alerting system on their networks by April 2018. Service providers are now working with federal and provincial counterparts to develop an awareness campaign and accompanying test schedule.

Education about Shelter in Place is available on the NSEM website and targeted training has been offered in the Maplewood neighbourhood. All residents and employees of local businesses are encouraged to register for Rapid Notify.

Chemtrade, Newalta, Univar, HTEC, ERCO, and others, along with District Staff, NSEM Staff, and the Maplewood Community Association are members of the Community Advisory Panel (CAP). At the next CAP meeting in February 2018, the Rapid Notify system will be reviewed in light of the recent CRTC improvements. Hazard awareness and Shelter-in-Place education will also be a major focus to determine the best format for targeting education programs in this growing village centre. District Communications staff is engaged in this process.

**Public Input**:
Considerable public input has been received in the development of the OCP and in the implementation planning for Maplewood since OCP adoption. Additional public input will be received during the Public Hearing process for the OCP Bylaw Amendment.

**Conclusion**:
The Maplewood policies in the Official Community Plan (OCP) are consistent with the recommendations of the 2006 peer reviewed Quantitative Risk Assessment (QRA) undertaken for the Canexus chemical plant and the Major Industrial Accidents Council of Canada (MIACC) guidelines for land use planning. Subsequent planning has included peer reviewed QRAs for chemical hazards related to industrial uses, which have been revisited prior to implementation planning. Areas identified for acceptable land uses and densities have been indicated in the Maplewood Village Centre and Innovation District Implementation Plan & Design Guidelines through the establishment of risk contours. The contours have been peer-reviewed by consulting professionals. Emergency notification and response protocols have been established to address potential chemical hazards.

Respectfully submitted,

Tom Lancaster,
Manager of Community Planning

Tom for
Fiona Dercole,
Director, North Shore Emergency Management

Attachment 1: Risk Contours map from the Maplewood Village Centre and Innovation District Implementation Plan & Design Guidelines

Attachment 2: Follow-up report from Doug McCutcheon, November 7, 2016

Attachment 3: Written Response to Risk Assessment Questions from Doug McCutcheon, November 20, 2017

**REVIEWED WITH:**

| | | | | | |
|---|---|---|---|---|---|
| ❑ Sustainable Community Dev. | ____ | ❑ Clerk's Office | ____ | External Agencies: | |
| ❑ Development Services | ____ | ❑ Communications | ____ | ❑ Library Board | ____ |
| ❑ Utilities | ____ | ❑ Finance | ____ | ❑ NS Health | ____ |
| ❑ Engineering Operations | ____ | ❑ Fire Services | ____ | ❑ RCMP | ____ |
| ❑ Parks | ____ | ❑ ITS | ____ | ❑ NVRC | ____ |
| ❑ Environment | ____ | ❑ Solicitor | ____ | ❑ Museum & Arch. | ____ |
| ❑ Facilities | ____ | ❑ GIS | ____ | ❑ Other: | ____ |
| ❑ Human Resources | ____ | ❑ Real Estate | ____ | | |

## 2.14 Proximity to Heavy Industry

Industry contributes significantly to the prosperity and success of the District, by providing employment opportunities, goods, and services enjoyed by businesses and residents. Heavy industrial activity does create some risk to nearby areas. In the District, studies and assessments have determined chemical hazard associated to an accidental release of chlorine as a risk having potential off-site impacts to neighbouring or proximate areas. The District's intention is to manage risk associated with development in these areas through appropriate site planning and building design.

Risk contours have been established for the Maplewood area due to the proximity of hazardous substances potentially used in areas designated for heavy industrial activities. Each risk contour identifies allowable land uses and densities permitted, based on the distance from the risk source.

**RISK CONTOURS**




*Figure 14: Risk Contours*

### POLICIES

- Encourage safety in the location and construction of development.
- Land uses, densities, building design and construction should generally be consistent with the MIACC (Major Industrial Accidents Council of Canada) best practice recommendations for appropriate land uses and densities from the risk source, or any similar, successor or replacement agency that may exist from time to time.

ATTACHMENT 2

*Doug McCutcheon and Associates, Consulting*
*A Division of "Human Factors Impact Ltd."*

November 7, 2016

To: Natasha Letchford
Community Planner
District of North Vancouver

The proposed location for the 1 X $10^{-6}$ and 0.3 X $10^{-6}$ risk contour lines for the Maplewood area are correct as recommended by my report of August 8, 2012 (attached as an appendix). There is one exception noted which is important to establishing the separation distance for light and medium industrial activity from commercial activities. That being the location of the 1 X $10^{-5}$ risk contour line which is suggested to be along Spicer Road and is missing from District of North Vancouver drawing (*Proposed Risk Acceptable Contours Maplewood Charrette – October 2016, "Official Community Plan – Risk Contours*). I reference the *Major Industrial Accidents Council of Canada (MIACC) – Risk Acceptability Criteria* for acceptable level of risk shown on the following pages. This is considered to be Canada's best practice.

As part of the overall recommendations in my August 8, 2012 report, I included this contour to define the boundary between heavy industrial development (Canexus, Erco, Newalta, etc) and light to medium industries such as repair shops, or fabrication shops which are usually connected close to heavy industry. I would strongly suggest including the 1 X $10^{-5}$ line along Spicer Road and continuing it to the east and west as you see fit.

The 1 X $10^{-6}$ and 0.3 X $10^{-6}$ line to the West appears to be good as it parallels the heavy industrial area (darker blue) to the South. Again I would extend the 1 X $10^{-5}$ contour line probably up to the Iron Workers Memorial Bridge.

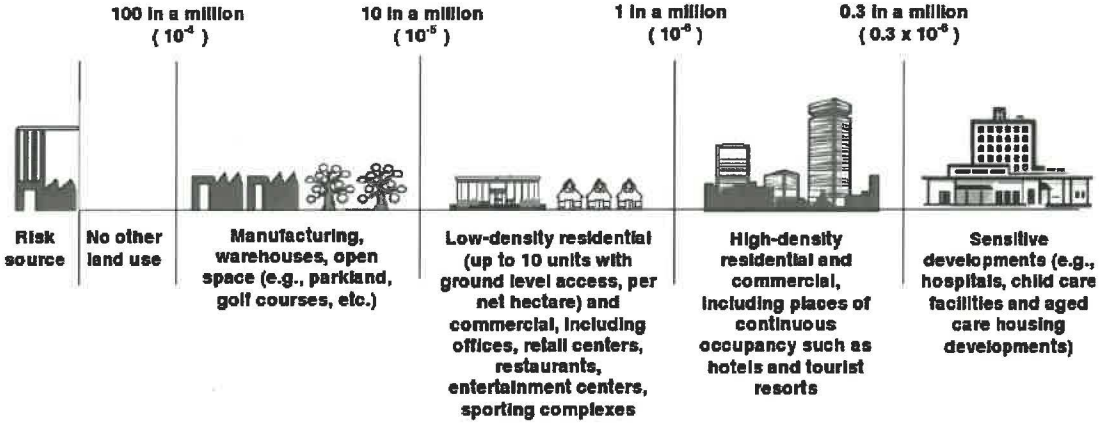
To the East you have properly shown the risk contours to bend towards the South giving the appropriate distance from the heavy industrial area. You may want to consider bending both lines towards the North if you have in mind more industrial development along the shoreline. Again the 1 X $10^{-5}$ contour is important to draw here as well.

Major Industrial Accidents Council of Canada – Risk Acceptability Criteria

*(Now managed through the Canadian Society for Chemical Engineering – Process Safety Management Division)*

## Annual Individual Risk

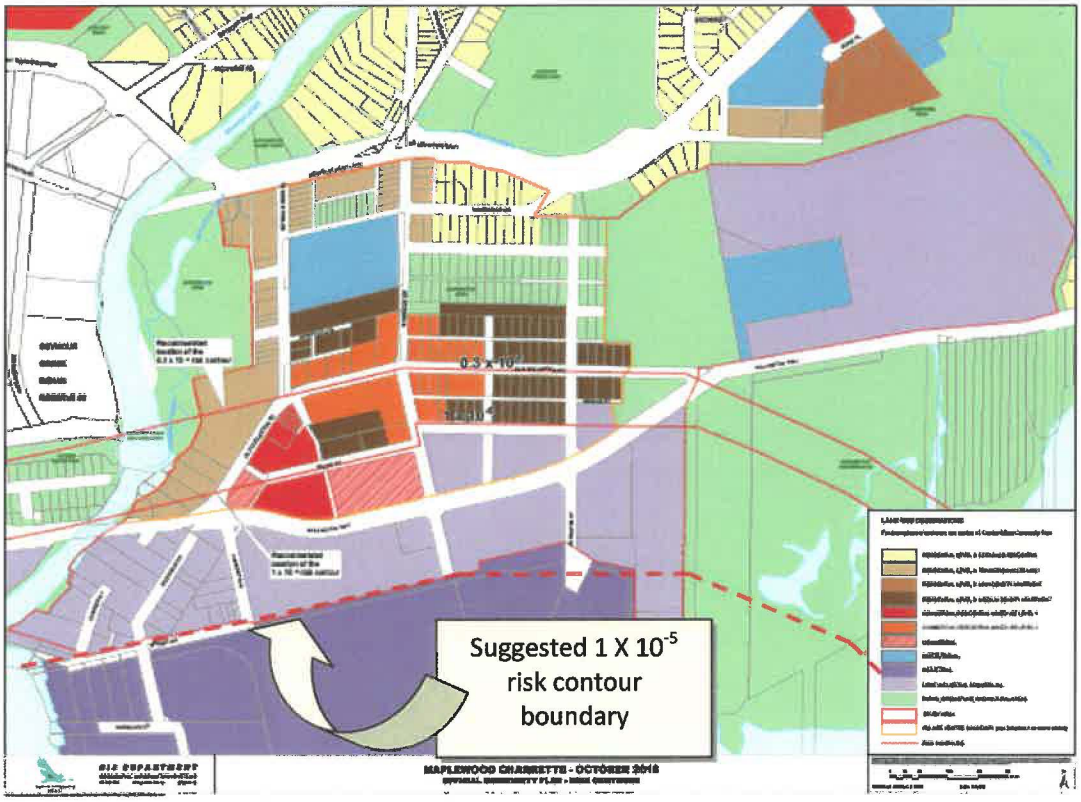
**Chance of fatality per year**




## Allowable Land Uses

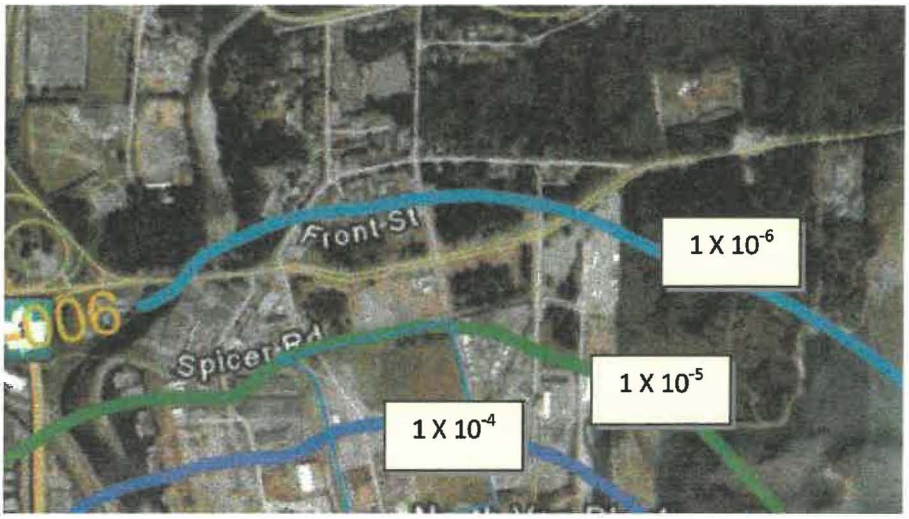
**Proposed Risk Acceptable Contours**

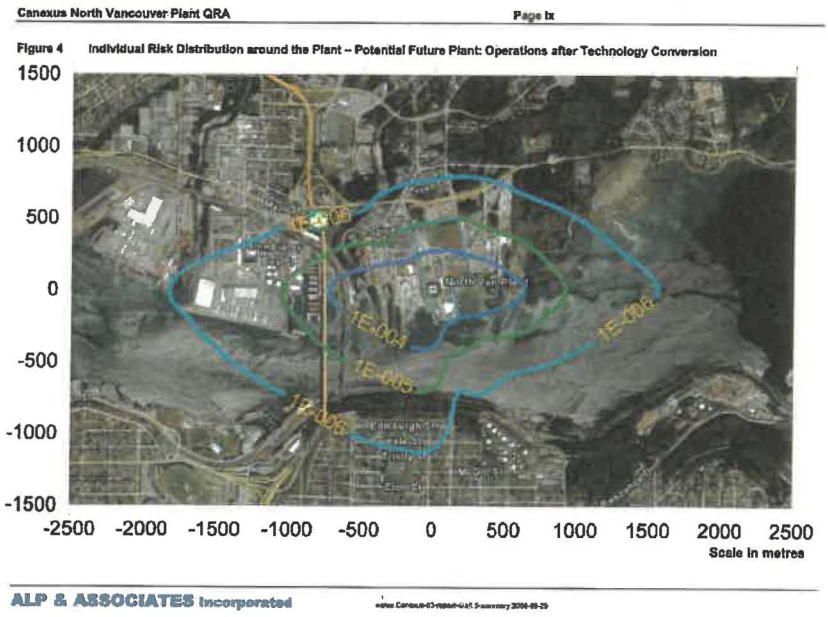
*Maplewood Charrette – October 2016, "Official Community Plan – Risk Contours*



Originally in 2006 a risk assessment was conducted by Alp and Associates showing the risk contours for 1 X $10^{-5}$ and 1 X $10^{-6}$ to be located as shown below.

Original Risk Assessment Conducted for the Chlorine Plant before the TCP Project
*Conducted by Alp and Associates (2006)*

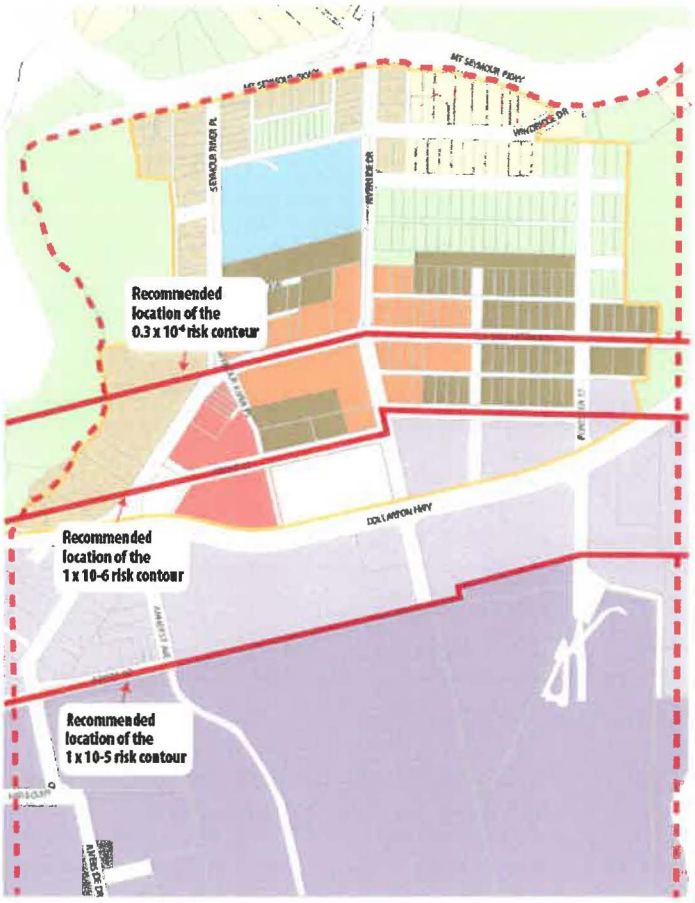



Subsequently Canexus upgraded their facility to reduce the quantity of hazardous Chlorine on site through up to date technology (their TCP project) and were able to accept to reduce the risk contours to those shown below.

Risk Assessment Conducted for the Canexus Chlorine Plant after the TCP Project

*Maplewood Chemical Hazard DPA Preliminary Study for The District of North Vancouver Final Report August 8th, 2012 - Prepared By: Doug McCutcheon and Associates, Consulting - A Division of "Human Factors Impact Ltd."*




**Summary:**

The choice to locate the risk contours as shown is correct based on the previous work conducted August 8th, 2012. The final drawing should include the 1 X 10-5 risk contour as discussed. I trust this meets your needs. Should you have any further questions please do not hesitate to get in touch.

Doug McCutcheon, P. Eng.

**APPENDIX:**

# Maplewood Chemical Hazard DPA Preliminary Study

**For**

## The District of North Vancouver

## FINAL REPORT

**AUGUST 8th, 2012**

**Prepared By:**

DOUG MCCUTCHEON AND ASSOCIATES, CONSULTING
A DIVISION OF "HUMAN FACTORS IMPACT LTD."

PROFESSIONAL ENGINEER ALBERTA
DOUGLAS J. McCUTCHEON

Doug McCutcheon, P. Eng
PO Box 254
Canal Flats, BC, Canada, V0B 1B0
Phone: 250.349.5515
Fax: 250.349.5515
Email: doug.mccutcheon@ualberta.ca

## EXECUTIVE SUMMARY:

The "Scope of Work" included:

1. *Review the inventory of chemicals by substance type, location and maximum quantity and assess what substances pose a theoretical risk to residents/businesses in the nearby Village Centre.*
2. *Identify the geographical scope of potential risk and recommend the boundaries of the eventual Development Permit Area.*
3. *Discuss the relative merits of building, site and area-level measures to mitigate any identified theoretical risks.*

In "Step 1" the identified chemicals were assessed for potential to cause harm to the community of Maplewood. Four existing industrial operations plus a proposed new one were looked at in terms of risk and acceptability to the community using the Major Industrial Accidents Council of Canada risk based land use planning criteria. An analysis for hazards followed by calculations to determine the extent of impact outside the company property lines and the probability of such events was undertaken for this report. The result showed only those hazards and risks for the Canexus facilities are of concern. All other facilities either had no concerns or the impact could only be felt within their company property lines.

For "Step 2" of the Scope of Work, The opportunity to utilize the Canexus peer reviewed Quantitative Risk Assessment was instrumental in forming the basis for suggesting risk based planning needs for the proposed Maplewood community development. Because there are no other company risks to consider using the Canexus study provided a sound approach to determine acceptable buildings and occupancies, a clear opportunity to implement the MIACC criteria, Canada's best practice.

The MIACC Criteria is shown as a pictorial view on Figure 3 on page 16. It was developed in conjunction with a global approach to understanding just what society is willing to accept in terms of the impact from industrial operations. An industrial facility needs to control its level of risk but if it has the potential to impact beyond the property line, certain activities are allowed as one gets further away from the industrial site because the risk levels decline as one moves further from the industrial source based on the MIACC approach. The further away from the source of risk more activities for a higher concentration of people are allowed. As seen in Figure 3 a smaller graph indicates the numbers of people impacted can grow continuously the further out from the industrial facility one gets. The point is it is not a "step change" but a continuous gradual change.

The MIACC approach does not prescribe specific distances to each risk level. This is left up to individual jurisdictions to decide on based on their circumstances such as the type of industry, the type of community, and the emergency planning needs of the area, either way the company is responsible to meet the risk criteria and the most stringent criteria will dictate what they include in their facility designs.

The MIACC approach to risk based land use planning accepts that if the risk levels to the community are less than one chance in a million of a fatality ($1 \times 10^{-6}$), there is no requirement

to add additional measures to the already existing building codes. This review specifically noted the impact of a Chlorine or Hydrogen Chloride release from Canexus would have offsite consequences potentially leading to fatalities. The Canexus *"Technology Conversion Project" (TCP) - 2006* Quantitative Risk Assessment by Dr. Alp shows there can be consequences impacting the community but since the probability is so low the impacts are within acceptable limits. Further, if advance warning systems are in place to alert the community and if residents close their windows and doors (shelter in place) there is ample time to protect oneself in an emergency (*Dr. David Wilson University of Alberta*). Typically a major release will take a lot of time (many minutes and possibly up to an hour) to travel to the residential community leaving the emergency response teams time to work at implementing an effective plan to evacuate people.

A release of Chlorine will create a heavier than air cloud that will stay together and move with the wind. That cloud will stay close to the ground as it moves forward mixing with air on the cloud surface. The mixing action will eventually dilute the cloud to a lower safe concentration a certain distance down wind. Because the cloud is heavier than air it moves with the wind but slowly as the wind brushes over the body of the cloud. Further the cloud movement will be slowed by obstructions on the ground. Some of it will be absorbed by moisture in the air and vegetation. it will take time to reach the Village area. Further the cloud will have some early warning odours at very low concentrations giving time for people to take action before their safety is compromised.

For the case of a Hydrogen Chloride (HCl) vapour release the scenario is somewhat different because HCl is not as heavy as Chlorine gas and closer to air. The cloud will move forward with the wind with more mixing action. Similar to Chlorine the cloud will travel next to the ground and be impacted by obstructions as it moves forward. HCl is easily absorbed in water where Chlorine is not. And HCl also is detectable at very low concentrations giving time for people to react in a safe manner.

Applying the MIACC criteria to the proposed community layout it is recommended to designate Spicer Road as risk contour $1 \times 10^{-5}$, Front Street as risk contour $1 \times 10^{-6}$ and Old Dollarton as the $0.3 \times 10^{-6}$ risk contour, appropriate building developments would fit the existing plan as well as provide tools for determining acceptable future development projects. Applying the MIACC criteria to the proposed community beyond the $1 \times 10^{-6}$ risk contour line (north of Front Street) would require no additional scope to the building designs. This would also mean no specific additions to building requirements would be needed to ensure acceptable risk levels, with the exception of a small area on the south side of the $1 \times 10^{-6}$ risk contour (GWL holdings, north of Dollarton Highway and south of Front Street) for buildings with residential components where the following are suggested:

- HVAC systems that maintain a slight positive pressure inside the building to keep Chlorine from entering.
- Including toxic gas detectors for Chlorine on building HVAC systems to automatically shutdown air intake on high Chlorine levels.
- At least two stair wells with battery back up lighting and sealed doors at each floor level.
- Emergency phones for contact with emergency responders and building residents.
- Building PA system.
- Use local radio and TV stations for communications to residents.

- Building owners and management would need to ensure emergency plans for all residents in the building clearly defining what to do to protect themselves should they be asked to evacuate or to shelter inside.

"Step 3" of the Scope of Work basically boils down to developing a specific emergency plan for the new Maplewood community with special consideration for the zone between Front Street and Dollarton Highway. Here there is some residential development proposed. Because the design for the residential area is for multi story buildings there is a need to recognize some special design considerations as noted above.

Emergency planning and notification systems complement building designs and for the Maplewood area should also be considered as a means to protect residents and at least provide comfort and quality of life. Although risk assessments do not take into consideration existing emergency response planning the outcome of risk assessments is the basis for developing emergency plans, based on understanding the risks involved. In fact this is exactly the premise for emergency planning in Canada as described in Canadian Standards Association guideline *"CAN/CSA-Z731-03 - Emergency Preparedness and Response"*. Such emergency plans when promptly initiated and followed through will reduce the consequences of major incidents.

Recommendations include:

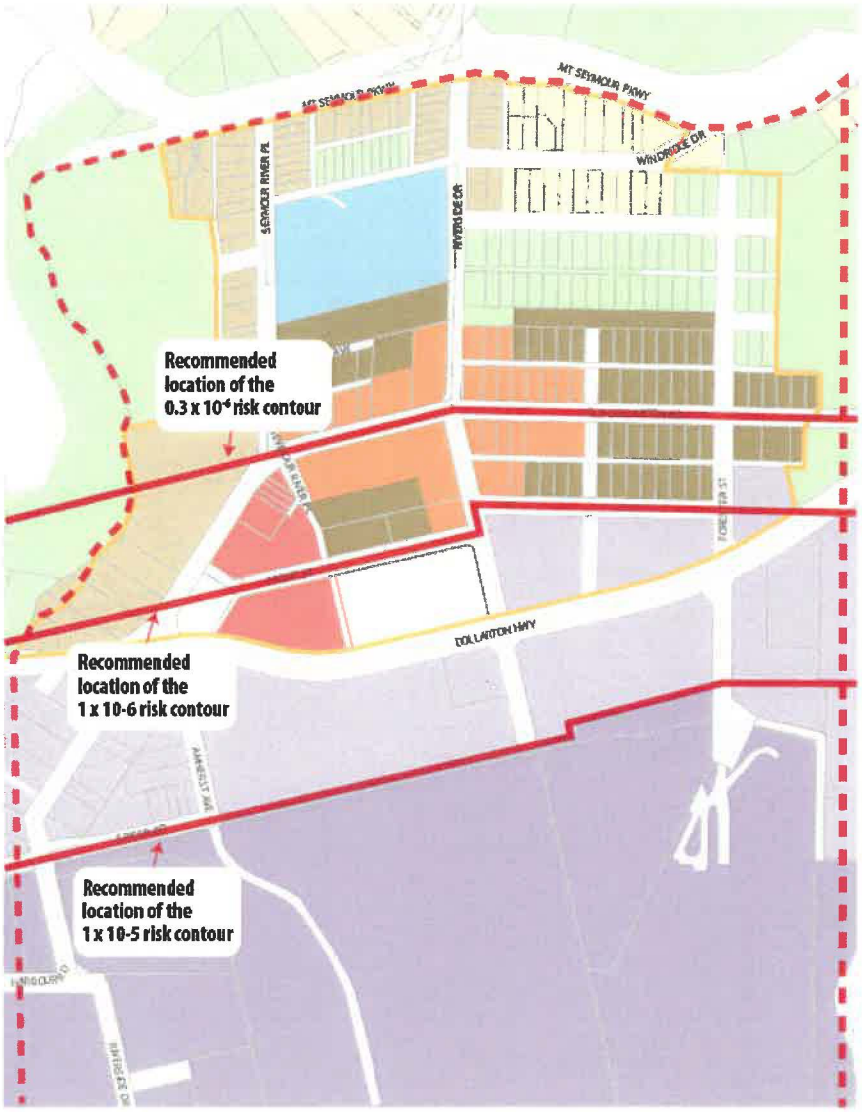
- Ensure there is a special emergency planning recognition of the residents living in the zone between $1 \times 10^{-5}$ and $1 \times 10^{-6}$ risk contours (New Dollarton and Front Street).
- For any residences between the $1 \times 10^{-5}$ and $1 \times 10^{-6}$ risk contours provide for at least two roads in and out of the areas and no dead end roads where there is only one exit. Where possible this may not be practical to do for example Seymour River Place), the emergency plan should note these as a special case within the emergency plan for alternative action such as alternate evacuation pathways.
- Recommend including an automated phone calling system to alert citizens downwind of a Chlorine release in the area between the $1 \times 10^{-5}$ and $1 \times 10^{-6}$ risk contours. These systems do have challenges but are a reliable tool to use in emergency communications. It is recommended the District strongly encourage residents in the area to register annually and make it a requirement for strata's and rental buildings.
- Consider including emergency sirens activated specifically for Chlorine releases for notification of people within the $1 \times 10^{-5}$ and $1 \times 10^{-6}$ risk contours. They have a simple way of communicating serious emergencies and if their installation and use are communicated well with the community they can be a very useful tool. They need to be routinely and regularly tested which is something that can be incorporated into regular emergency planning communications activities already conducted. The sirens are costly and do require regular maintenance though. It is recommended that these be a requirement for Strata and rental buildings.
- All the recommendations need to be done in consultation with the Emergency Services department.

The intention of this report is to assess the proposed development and make recommendations for defining the "Development Permit Area" (DPA) from a risk based land use planning approach. Maintaining a positive relationship between the industrial activities and the residential life style is at the basis of the risk based approach and the MIACC criteria. Through recognizing the global involvement towards determining acceptability of risk and applying that

outcome into developments like this that positive relationship can be successful. The community can be satisfied they meet the global and Canadian standards and industry can be successful into the future knowing what they need to do to manage their operations to meet that standard., and not fear future encroachment on their operations.

I believe this analysis is appropriate for the study area. Please let me know of any questions. Thank you for asking me to develop this review.

Doug McCutcheon, P. Eng.



ATTACHMENT 3

# Maplewood Village Centre and Innovation District Implementation Plan & Design Guidelines

## Response to Risk Assessment Questions

**for**

## The District of North Vancouver

**NOVEMBER 20th, 2017**

**Prepared By:**

DOUG MCCUTCHEON AND ASSOCIATES, CONSULTING
A DIVISION OF "HUMAN FACTORS IMPACT LTD."

Doug McCutcheon, P. Eng
PO Box 254
Canal Flats, BC, Canada, V0B 1B0
Phone: 250.349.5515
Fax: 250.349.5515
Email: doug.mccutcheon@ualberta.ca

November 20, 2017

**Karen Rendek, MCIP, RPP – Sr. Planner**
**Community Planning**
**District of North Vancouver**

Thank you Karen for asking me to respond to the questions.

First off I would like to congratulate the District in reaching this point with respect to finalizing the Maplewood development plan it has been a lot of work I am sure. I would add that from an industrial risk view the use of the MIACC (Major Industrial Accidents Council of Canada) work with respect to the Canexus Technology Conversion Project (TCP) and leading into the land use planning approach for the central Maplewood area has been the right approach to take. The MIACC criteria is considered to be Canada's best practice with respect to risk based land use planning. This criteria developed in the late 1980's and into the 90's was done in conjunction with the work underway in many other industrial countries driven mainly by the tragedy of the Bhopal India in 1984 resulting in a globally accepted approach to defining acceptable levels of risk for exposure of the public to unwanted industrial events. The MIACC criteria is maintained current through to today with the latest advancement included in the Maplewood Plan referencing the inclusion of the $0.3 \times 10^{-6}$ risk criteria for "sensitive institutions" such as homes for the elderly, hospitals and schools.

The questions are good ones and deserve to be answered. Hopefully I can shed light on them.

**QUESTIONS AND ANSWERS:**

1. **A universal minimum industry requirement is that the $1 \times 10^{-4}$ risk contour not go outside the (*industrial company*) property line.**

   **Response:** *This often is an issue once communities start to look at the existing risk levels they have as many if not most industries are well established before the MIACC criteria was developed. Hence a very good question. The MIACC criteria has helped several communities in Canada to set in place guidelines even bylaws for the purpose of evaluating new facilities or new projects within older facilities to minimize risk in an acceptable way. Without these guidelines or bylaws communities and companies can be at risk of not doing their due diligence and potentially become liable. It is important to note the MIACC criteria is Canada's best practice and is not regulated but it is a guideline and has found to be referred to in such documents as several jurisdiction bylaws, CSA documents and Environment Canada regulations to mention a few.*

   *When risk assessments of older facilities uncover risk levels that do not meet the MIACC criteria it then leads into the need to develop solutions in order to take due diligent actions which is a positive result. Often this leads into methods to reduce the probability of the event happening or people being exposed to the hazard. Specific to the Canexus Chlorine facility this was undertaken through the TCP project which reduce risk contours, proving for a proactive emergency response, by the requirements for emergency response planning for the DNV, and for the building construction to be to code and*

*include special designs for protecting people. These types of actions do serve to meet the "reasonably practicable" needs of due diligence. Forcing a company to close its doors has immediate negative impacts on the community but having the company involved in the community emergency planning provides for sound response if needed. It should also be noted from a company point of view maintaining this as a priority is very important to their future success.*

2. **Low Density Residential Density Requirements**
**Response:** *There is no regulated number with respect to population density but some suggestions. Some research work was conducted in the 1990's suggesting 8 units per net acre (19.8 Units/net Hectare)* 1 acre = 0.40468 hectares *and through MIACC it was suggested 4 units per net acre (10 units per net Hectare). This was suggested for low density housing within the 1 x $10^{-5}$ and the 1 x $10^{-6}$ risk zones. For anything beyond the 1 X $10^{-6}$ risk contour much higher densities are allowed. This applies for the Maplewood residential area and commercial area north of Front Street (the 1 X $10^{-6}$ contour line). Also as a basis the MIACC criteria does describe the type of development that would be acceptable within the risk contours and also points out having fewer people near the industrial facility (1 X $10^{-4}$ to 1 X $10^{-5}$ risk zone) is preferred.*

*The second point to consider is the allowable residential densities for the area between 1 X $10^{-5}$ and 1 X $10^{-6}$ risk contours. The commercial office space along Dollarton Highway fits the zone and the project, provided rationale to allow development for the lands of 8 units/net acre (19.8 Units/net Hectare). This focus is on residential buildings but the following consideration for building design requirements should be given to all buildings within the 1 X $10^{-5}$ and 1 X $10^{-6}$ risk contours. It is recommended to make it a requirement for a professional to review building designs for these considerations. Consideration to building design features includes:*

- *HVAC systems that maintain a slight positive pressure inside the building to keep Chlorine from entering.*
- *Including toxic gas detectors for Chlorine on building HVAC systems to automatically shutdown air intake on high Chlorine levels.*
- *At least two stair wells with battery back up lighting and sealed doors at each floor level.*
- *Emergency phones for contact with emergency responders and building residents.*
- *Building PA system.*
- *Use local radio and TV stations for communications to residents.*
- *Emergency plans for all residents in the building clearly defining what to do to protect themselves should they be asked to evacuate or to shelter inside.*

*If protective design action is included as described there is no need to require specially designed "sheltering in place rooms" within the buildings.*

*The Canadian Building code sets standards for the construction of buildings in Canada and Provinces generally follow those requirements and will be adequate for buildings where the risk levels are lower than 1 X $10^{-6}$. Research (Dr. David Wilson – University of Alberta) has shown building constructed to the Canadian code standards are tight because of our winters in comparison to those in warmer climates and in fact can offer*

*several hours (typically 2 – 3hours in Canada) of protection (sheltering in place) should a toxic gas release impact the building. Following the building code for development north of Front Street (the 1 X $10^{-6}$ risk contour) would be sufficient protection. For buildings south of Front Street, adding some if not all the suggested additions noted above provide a safe haven as well as time for emergency responders to provide safe rescue.*

*Earthquake impacts are not part of industrial risk assessments but should be included in building codes which I suspect the Canexus TCP project followed.*

3. **Voluntary –vs- Involuntary Risk**
   **Response:** *The use of commercial air travel to describe involuntary acceptable levels of risk is a means to make the average person's understanding of risk meaningful. Risk is not an easy topic to digest. Primarily the act of travelling in a commercial plane, train or bus is an act of giving the responsibility of our personal safety and life to the driver ("involuntary risk"). Most of us are willing to do this. And this is what is considered to be acceptable globally.*

4. **Societal Risk**
   **Response:** *A Societal risk study is difficult to do in a meaningful way because it has many variables to consider. An F/N curve (Fatalities / Number of people) provides approximate numbers at best. However once it is conducted it is best used as a basis for developing a dialogue around what is acceptable and what can be done to improve on the risk should it be needed. The Maplewood design where the individual risk contour of 1 X $10^{-6}$ as drawn along Front Street means the risk criteria for the development as defined by MIACC is met. However because of the resulting dialogue it has lead to defining additional requirements for buildings to design into them additional features for emergency detection and protection as well as defining specific emergency plans including "sheltering in place".*

5. **Other Locations (Australia, Lloydminster, and Lumsden)**
   **Response:** *Risk based land use planning guidance does not define acceptable distances for risk contours. Each jurisdiction can do what they like but generally a distance for the 1 X $10^{-5}$ risk contour and the 1 X $10^{-6}$ risk contour are based on time to activate effective emergency response which reasonable. These are generally based on the release of heavier than air hazardous chemicals and how long they will take to travel downwind.*

   *The 1 X $10^{-6}$ risk contour was moved to Front Street and the 1 X $10^{-5}$ risk contour set on Spicer Road. Both to allow for reasonable land use planning purposes. The risk contour was moved with the involvement of the Canexus management input as well as the expertise from the original risk assessment of Dr. Ertugrul Alp.*

   *Again the impact of an earthquake is not considered in the risk assessments however it is assumed local building codes will include direction in this regard.*

6. City of Edmonton Study
   **Response:** *A reference was made to a risk assessment conducted by myself for a planned development in the City of Edmonton. The analysis was a hypothetical one and asked the question as to how much of three hazardous chemicals would need to be*

*released to impact a new children's park development 1.8km away. Obviously any amount of inventory that is greater would impact the development and beyond. The point is people would be impacted and the likelihood is 4.5 X $10^{-5}$ for the review. The area was designated as Heavy Industrial with no industry on it and residential, commercial and light industry in the general area. No heavy industrial development would happen. Should a developer propose such a development the required risk assessment would suggest it as unacceptable and the land rezoned to commercial / residential or something like that.*

*But yes for hazardous chemicals like Chlorine it does not take a large amount to impact the public.*

7. **Release of 60 Tons of Chlorine**
   *The concern is real of course. Could it happen? Yes and we have developed risk assessments to help define such an event and put in place mitigation to prevent it such as: management of inventory to lowest practical levels, include emergency shutdown override on controls systems, emergency block valves to isolate in process inventories, managing tank car integrity as well as in plant equipment integrity, remote detectors, access to foam to reduce the vapourization of Chlorine into the wind, selecting and training of operations staff and supervision, to mention a few. These are part of what is called "Risk Management" which is again well defined on a global basis and best practice. Some jurisdictions are now moving forward with auditing of company risk management programs.*

I trust my answers will help. Overall the risk impact on the Maplewood development from any of the local industries in the area does meet the acceptable level of risk criteria as defined by MIACC. The design of the new Canexus TCP Project specifically has gone a long way to ensure the risk criteria is met.

Doug McCutcheon, P. Eng.

# Chemtrade North Vancouver Rezoning Application Supporting Information

## *Securing safe drinking water for Canada*

## *February, 2026*

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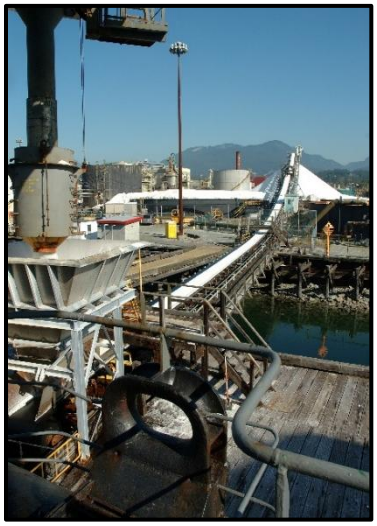

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## Understanding Risk, the MIACC Guidelines, and what this means to the community in terms of safety

One of the most common questions Chemtrade receives regarding the ongoing operation of the North Vancouver Chlor-Alkali facility is around the safety of the operations, and the potential risk to the community.

Chemtrade is proposing a series of projects that will significantly reduce potential risk to the community, while increasing both the safety and reliability of its operations – that once complete, will essentially reduce risk to at or near the facility's property line.

### *How is a facility's risk determined?*

The Major Industrial Accidents Council of Canada (MIACC) guidelines were developed between 1987 and 1999 to establish national, consensus-based standards for preventing, preparing for, and responding to major industrial accidents involving hazardous substances. They were created in response to global and domestic industrial disasters to provide a standardized approach to land-use planning and risk management.

The guidelines were designed to protect the public by creating buffer zones and controlling the location of hazardous facilities by providing guidelines and tools to assist organizations and municipalities in:

- ***Risk-Based Land Use Planning****: Guidelines were developed to help municipalities make decisions on locating new, or expanding existing, hazardous facilities.*
- ***Safety Management****: Tools to assist in calculating risks, including "exclusion" and "no restriction" distances for land use.*
- ***Dangerous Goods Occupancy****: Definitions and criteria for managing hazardous materials in industrial, commercial, or storage zones.*

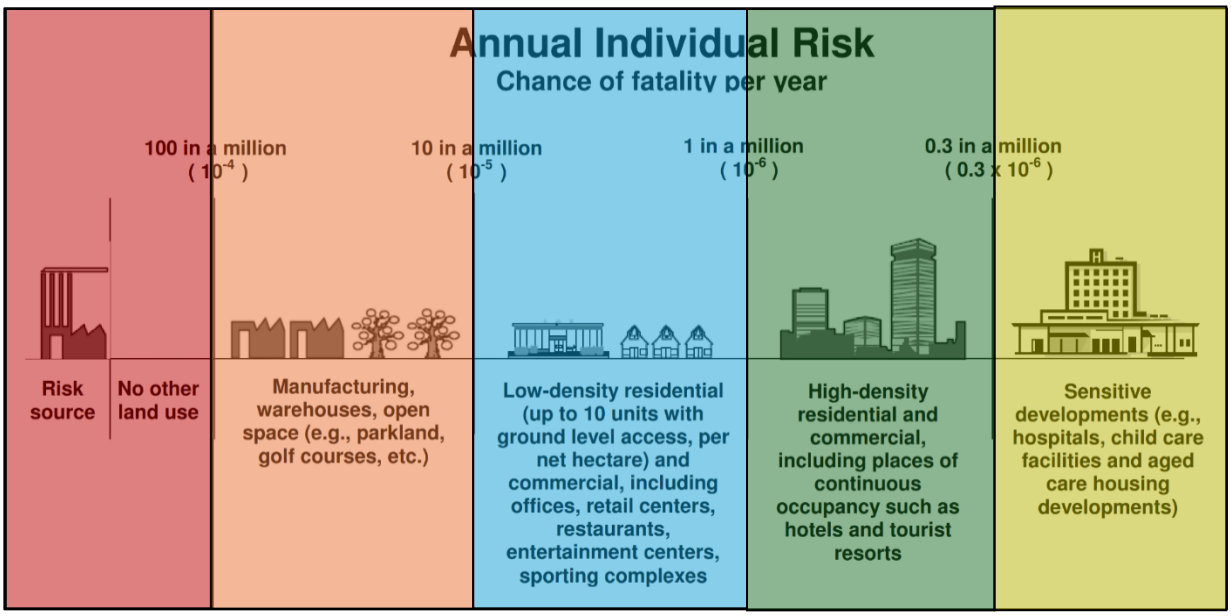
### *Understanding how risk is calculated*

When determining the risk posed by a facility, there are three main factors considered:

- ***Consequence:*** this is where the modelers look at the physical impacts of a potential hazard and potential resulting levels of harm from a particular identified event (like the release of a large volume of liquid chlorine, regardless of cause of release)
- ***Likelihood or probability***: this looks at how probable any one of the release scenarios are, using historical failure rate data, along with known engineering, safety systems and practices in place, and logic models
- ***Exposure:*** This looks at the risk that either people or infrastructure will be impacted, taking into account:
    - ***Historical weather:*** *Using decades of weather patterns – including wind speed and direction, temperature and precipitation*
    - ***Occupancy/Population Distribution:*** *Looking at geographical risk, assuming humans are always present, both indoors and outside, 24 hours a day, seven days a week, 365 days a year*
    - ***Probability:*** *The chance that a specific scenario could happen, based on historical data and safety protocols*

### *Explaining the MIACC risk*

Below are the MIACC guidelines for acceptable risk and development within each risk area. The risk for each area is defined as the likelihood of death resulting from the operations of a facility, if a person were to stand at the property line, 24 hours a day, seven days a week, for the full year (365 days). It should be noted that risk is calculated on a per year basis (it is not cumulative).




**For further clarity, each area is defined further within the MIACC guidelines as:**

- ***Within the facility, out to the 1 in 10,000 or $10^{-4}$*** risk contours: no other land uses, except the source facility, pipelines or corridors
    - ***Riding a motorcycle for roughly 100 to 200 miles within a year carries a risk of death of approximately 1 in 10,000.***
- ***Between the $10^{-4}$ and 1 in 100,000 or $10^{-5}$*** risk contours: uses involving continuous access and the presence of limited numbers of people but easy evacuation, examples provided include open space activities such as golf courses, parks, conservation areas, trails, as well as warehouses and manufacturing plants (other industrial production)
    - ***Going skydiving one time carries the risk of death at approximately 1 in 100,000***
- ***Between the $10^{-5}$ and one in 1,000,000 or $10^{-6}$*** risk contours: uses involving continuous access but easy evacuation locations such as commercial uses, low-density residential areas, office buildings
    - ***Travelling on a long-haul flight (1,000 km) carries the risk of a fatal crash at approximately 1 in 1,000,000***
- ***Between the $10^{-6}$ and three in 10,000,000 or $10^{-7}$*** risk contours: allowable uses include continuous occupation, high-density residential or commercial areas and hotels
    - ***Getting killed by a falling tree during normal everyday life carries the risk of approximately 3 in 10,000,000***
- ***Outside of the three in 10,000,000, or $10^{-7}$*** risk contour: all other land uses without restriction including sensitive developments such as hospitals, daycare facilities and senior care homes are allowable
    - ***The risk of death outside of the $10^{-7}$ curve represents an extremely rare event, low probability event like being hit be a meteor***

### *Understanding Chemtrade's QRA curves and risk assessment*

Chemtrade engaged BakerRisk to complete the QRA. BakerRisk is an international organization that is one of the world's leading organizations in developing quantitative risk assessment (QRA) reports. Chemtrade provided BakerRisk with the draft engineering for the planned safety upgrades to model the impact of the planned upgrades on the facilities risk assessment.

BakerRisk uses advanced modelling technology and internationally accepted practices to develop the risk modeling for Chemtrade's facility – incorporating several scenarios in the risk assessment planning, including the release of hydrogen, gaseous chlorine, liquid chlorine, and hydrochloric acid.

Areas assessed in the QRA for possible releases include all process equipment, pressure vessels, piping systems, and railcar loading systems on site. Over 50 different potential leak sources (including areas like accidental railcar release, storage release, rail loading area accidental release), and various causes (such as human error, piping rupture, equipment failure, or earthquake) are reflected in the final QRA curves. It should be noted that specific consideration was given to understanding the chlorine rail loading system release risk, as that is considered one of the high-risk activities on site.

***The findings of the report showed that following the completion of the planned safety updates, the $10^{-6}$ risk contour would be at or near the property line.*** According to MIACC guidelines, there would be very few development restrictions beyond that line, which means that there would be very few development restrictions outside of Chemtrade's property line, and greatly reduced risk to the community.

Below is the updated quantitative risk assessment (QRA) map, which was received as part of the complete BakerRisk report, which was submitted to the District, and peer reviewed by RiskTec. ***It is important to note that the below QRA map reflects the sum of all release scenarios, regardless of the cause (human error, earthquake, accidental release, equipment failure), including what has been deemed as the worst-case scenario – which is the full release of a chlorine railcar on site.***



### *The rezoning application process, including the peer review process for the risk assessment report*

In the fall of 2025, Chemtrade submitted the completed BakerRisk risk assessment report to the District of North Vancouver (the District) as part of its rezoning application package. As part of the District's rezoning application process, BakerRisk's final risk assessment report was sent to a company named RiskTec for independent peer review.

During the peer review process, RiskTec did have several questions, or areas flagged for more information, which BakerRisk reviewed and responded to. The updated report has now been submitted back to the District of North Vancouver.

## Looking at risk from neighbouring facilities

Chemtrade's chlor-alkali facility is located at 100 Amherst Ave, North Vancouver in a region zoned as Employment Zone – Industrial. It should be noted that the rezoning application is not to have this zoning changed, it is required to have the production of liquid chlorine listed as an allowable activity at the site.



The closest neighbors to the facility include an active Port, a waste and recycling transfer station, a sodium chlorate facility, an aggregates supplier, and a proposed liquid hydrogen facility.

The planned liquid hydrogen facility, to be located at 100 Forester Steet, would be a new neighbor to the Chemtrade facility, located to the northeast of the plant. As part of HTEC's proposed development, a detailed risk assessment study was developed and the peer review of the study concluded that the planned facility met or exceeded MIACC guidelines, and that overall:

- the report was very credible and defensible,
- found that the recommendations contained within the report were reasonable, and that
- the development had a good risk management program.

**Based on the report conclusions, HTEC's implementation of all recommended improvements will result in a low probability of risk to the Chemtrade facility from the operations of the proposed liquid hydrogen facility.**

The question has also been raised regarding the concern of Chemtrade liquid chlorine being transported by railcar in the same train length as liquid hydrogen.

During the June 2023 Public Hearing, HTEC stated that they do not have plans to ship liquid hydrogen via rail at this time, and plan to use transport trailers.

## Rail safety – at site and on route to customers

The movement of liquid chlorine is highly regulated in both Canada and the US, and aside from the use of pipelines, rail is the only way that it can be shipped in Canada. Chemtrade is fully compliant with Transport Canada's extensive requirements and has several layers of safety built in at all stages of operation to ensure the safe and responsible production, and delivery of its products.

It should be noted that Chemtrade's location is ideal as it provides access to a deep ocean port, which it requires for the delivery of its main raw material – solar dried ocean salt imported from the Baha region of Mexico, but also its direct access to Vancouver's rail system. The Port of Vancouver, where the facility is located, is the only port in North America connected to three Class 1 railways that service the Pacific Coast: Canadian National (CN), Canadian Pacific Kansas City (CPKC) and BNSF (Burlington Northern Santa Fe Railway Company).

### Chemtrade rail safety record

Since taking on ownership of the facility in 2017, Chemtrade has never experienced a release of Chlorine during transportation, whether from an accident or a Non-Accidental Release (NAR). Starting in 2022, Chemtrade has been the annual recipient of several awards for safe rail operations. Thanks to Chemtrade's rigorous safety protocols, Chemtrade has been awarded the American Association of Railroads Non-Accidental Release (NAR) Grand Slam Award in 2022, 2023 and 2024.

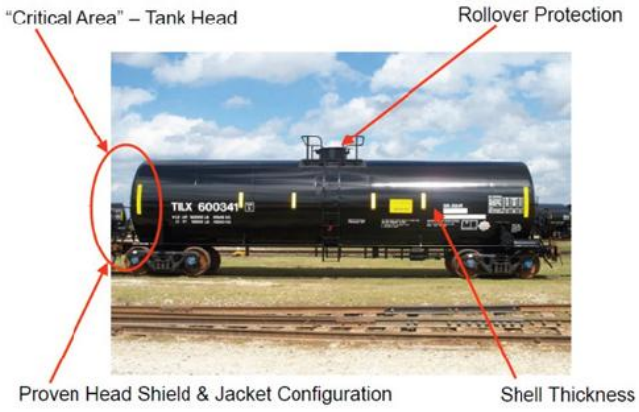
This prestigious award is presented annually to companies that are exemplary shippers of hazardous materials who have been recognized by at least four Class I railroads and recorded zero non-accident releases involving their shipments in the previous calendar year. Chemtrade has also received recognition from Canadian National Railway (CN), earning both the Platinum award for Zero Process Safety Related Incidents and the Gold Level CN Safe Handling award for no NARs.

### Let's take a look at the chlorine railcars used to transport liquid chlorine

On January 13, 2009, the Canadian Department of Transportation issued new tank car safety regulations for the transportation of toxic by inhalation (TIH) materials.

Liquid chlorine can only be transported using custom designed and built railcars, designed to prevent accidental release of liquid chlorine. Chemtrade leases a fleet of almost 300 chlorine rail cars. To help ensure the safety of these cars, there are several layers of safety built into the next-gen rail car design to ensure they meet or exceed or safety and regulatory requirements.

It needs to be noted that next-gen improvements are focused heavily on crashworthiness, adding thicker steel jackets, stronger head shields, better top-fitting protection to prevent the accidental release of chlorine, and top-fitting protection capable of surviving nine mile per hour (almost 15 km per hour) rollover speeds.



**Other improvements include:**

- **Enhanced safety standards:** *The cars are designed to meet or exceed the latest Association of American Railroads (AAR) requirements*
- **Pressure tested cars***: approved to transport products up to 600 PSI pressure rating (10 times higher than the normal pressure inside the car - which is loaded to 60 PSI)*
- **Improved structural integrity:**
    - *Minimum tank shell thickness has been increased by 25% to is 25 millimetres (one inch)*
    - *Minimum tank head thickness increased 44% to 29 millimetres (1.13 inches)*
    - *Protective housing thickness (rollover protection) increased 67% to is 32 millimetres (1.25 inches)*
    - *Addition of 13 millimetres (0.5 inch) head shields*

## Looking at Chemtrade's railcar operations on site

Chemtrade follows all industry and railroad-specific procedures, including mandatory employee training, train speed limits, railcar inspections, rail yard protocols, locomotive operation, and compliance with hazardous material shipping routes. These practices are regulated by both provincial and federal regulations, and Chemtrade adheres to all standards, while also implementing a stringent onsite maintenance and inspection program:

- Chlorine cars are specifically designed to prevent accidental release of liquid chlorine. The cars are inspected four times while on our site - when they first arrive at site, before loading, after loading and before they depart our site to ensure they are functioning properly.
- Chemtrade employees are extensively trained on proper operations and safety protocols (including car inspection process and maintenance of railcars railcar safety)
- Cars undergo a full maintenance overall haul every three years, or immediately if an issue is flagged or noted
- The lifecycle of each next-gen car is approximately 30 to 40 years, but part of the onsite inspection process is determining the cars service readiness, and overall condition.
- While on site, railcars are moved at low speeds, under 10 km/hour, to ensure the safety of employees, other railcars and vehicles arriving and leaving site
- As part of our continuous improvement philosophy, Chemtrade continues to explore ways to further improve the plant and rail operations, both for the safety of our employees and local community, and to continue contributing to safe drinking water for millions of people across Canada.

## Chemtrade employees are trained to respond to dangerous goods incidents, including accidental chlorine releases

- Chemtrade provides comprehensive training for employees, rigorous safety protocols and procedures at all stages of production, facility safety drills, and emergency response planning.
- Chemtrade has two teams of highly trained employees, who are part of the Chlorine Institute's CHLOREP Team (one based in North Vancouver, one based in Brandon, Manitoba)– a specialized response team comprised of volunteers equipped with specialized training and equipment, is the primary response unit for chlorine, sodium hydroxide (caustic soda), or hydrochloric acid transportation incidents in BC and Alberta.
- In North Vancouver, Chemtrade works closely and collaboratively with local first responders, including the North Shore Emergency Management and the District of North

Vancouver First Responders like Fire, RCMP and Ambulance. This includes providing support for other emergency response initiatives and running joint training scenarios.

- Chemtrade's Emergency Response Assistance Plan (ERAP) has been reviewed and approved by Transport Canada. The ERAP is a detailed document providing a detailed plan in regard to how Chemtrade would respond to a potential incident involving liquid chlorine or hydrochloric acid. The plan details internal training required for employees, external supports (contractors and other services available 24 hours a day), and critical contacts. The plan is rigorously practiced through a full-scale exercise two years to ensure employees are ready to respond.
- Chemtrade staffs an Emergency Response line (1-866-416-4404) with Chemtrade technical advisors, which is available 24 hours a day, seven day a week, 365 days a year.

## Understanding the contents of railcars on site

It can be intimidating to look at all of the railcars stored onsite at the Chemtrade North Vancouver facility, and there have been questions regarding whether storage would be moved from onsite to railcars. While there is the space to store up to 270 railcars at the site at any given time, the number of cars on site can vary from one day to the next.

Chemtrade looked at data from full years 2023, 2024 and the partial 2025 data, to determine averages. Using this information, it was determined that on average, there are approximately 251 railcars on site. Within that, however, there is deeper data available:

- The average number of rail cars that are ***sitting empty*** on the North Vancouver facility at any given time is 159, which ***accounts for over 63 per cent (63.3%) of the total cars on site***.
- On average, there are ***32 cars containing liquid chlorine on site awaiting shipment – this represents just under 13 per cent (12.7%) of all cars on site***.
- The remaining ***24 per cent (24%) of railcars are a combination of caustic soda (27 cars) and hydrochloric acid (28 cars).***

## Operating for safety – handing over the product to rail operators

- Rail operators classify liquid chlorine as a Toxic Inhalant Hazard (TIH), which means it is subject to strict regulation and processes
- Rail shipment of TIHs is the safest option for above-the-ground transport, with more than 99.99 percent of rail hazmat shipments reached their destination without a release caused by a train accident
- Overall rail hazmat accident rates are down 91 per cent since 1980
- TIH shipments are required to be on rail routes with Positive Train Control (PTC). PTC is a safety system that uses GPS, wireless communication, and computing technology to automatically stop a train and prevent accidents. It works by monitoring a train's speed and location, comparing it to permitted limits and track conditions, and activating the brakes if necessary.
- Railroads have invested in initiatives to improve TIH transportation safety and security including:
    - *Compilation and analysis of data to select the safest and most secure route*
    - *Mandatory communication requirements associated with delays in transit and delivery*
    - *Security audits and car/track inspections*

    - *Yard surveillance*
    - *Speed restriction*
    - *Strict chain of custody and control - for High Threat Urban Areas (HTUA), customers share responsibility with the delivering rail carrier to maintain positive control of incoming rail cars during the physical custody transfer of those rail cars. The transfer of custody must be documented in writing or electronically, and the hazmat receiver must keep the rail car in a rail secure area until the car is unloaded.*
- When in transport, the operator follows all regulatory requirements for volumes, reduced train speeds (30 miles/hour in urban areas, 50 miles per hour outside of residential areas) and car placement
- Rail operators are subject to routine audits for regulatory compliance
- Rail operators use hazardous materials routes for the delivery of liquid chlorine to customers – these routes avoid urban and densely populated areas when possible
- Rail operators are required to maintain a regularly updated Emergency Response Assistance Plan (ERAP)

You can read more about the regulatory requirements regarding the transportation of liquid chlorine in Canada, as regulated by Transport Canada: https://tc.canada.ca/en/rail-transportation

## Continuous improvement – looking a major safety upgrades to the North Vancouver facility

The North Vancouver facility has been operating safely in the current location, under the ownership of several different corporations, since 1957, ***with no major accidental releases.***

Chemtrade bought the North Vancouver chlor-alkali facility in 2017, and since that time, has continued to invest in modernizing the facility to improve overall safety and reliability. Every two years the site hosts a bi-annual facility shut down, during which regular maintenance – aimed at preventative care as well as planned capital projects and improvements are completed.

### Planned improvements:

Chemtrade is prepared to invest tens of millions of dollars into advanced safety and risk reduction projects, significantly reducing potential risk and elevating safety standards for the community. Chemtrade is in the final stages of preliminary engineering for these projects - including the construction of an enclosure around the rail loading area which will include an emergency scrubber to neutralize chlorine at the point of release, and the addition of seismic sensors to the existing network of 72 onsite leak sensors, monitoring continuously for abnormal operations. As part of this work, Chemtrade is also committing to removing all onsite storage of liquid chlorine.

Chemtrade is also planning for the decommissioning of unused facilities or buildings onsite, which will not only help to improve the site's appearance, but will also improve site safety.

All improvements are designed to current seismic building code requirements.

Although Chemtrade does not have access to complete records of improvements completed before 2017, several employees have remained with the company – some with over 40 years of service – providing details on previous works completed.

### 2010-2015: Modernization projects

Between 2010 and 2015, over $500 million was invested to improve plant safety and efficiency through several phases of modernization. Improvements were made to all areas of the site:

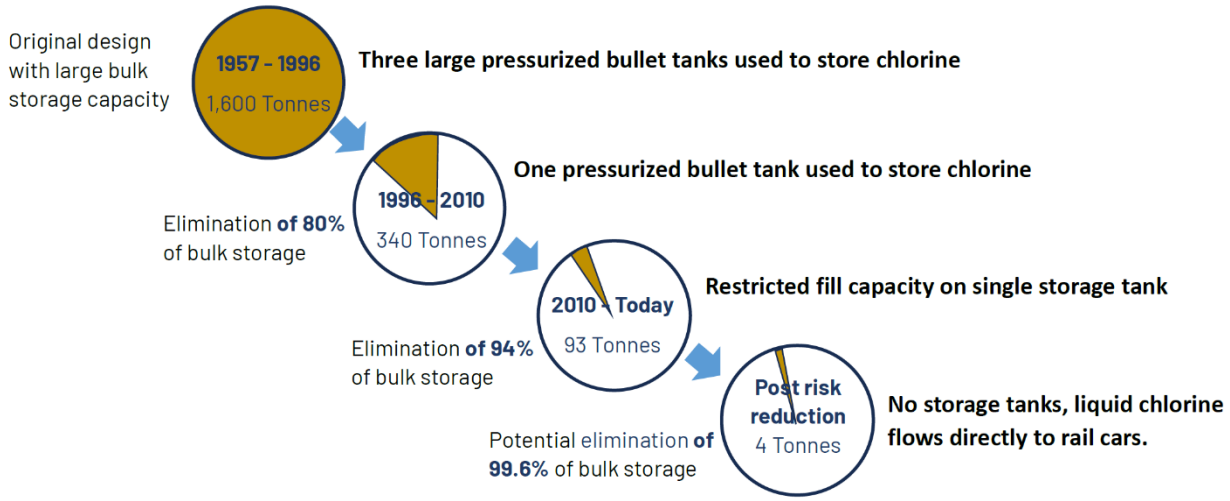
- *Process technology was completely modernized – outdated production processes were replaced with cutting edge technology. Electrochemical cells which used asbestos for the production of chlorine were replaced with modern membrane technology.*
- *The site's Caustic Evaporation Plant was replaced with a modern and energy efficient process which reduced seawater effluent contamination potential.*
- *New hydrochloric acid synthesis units were installed, incorporating gas scrubbers to eliminate fugitive emissions.*
- The site's extensive safety control systems were upgraded and equipped with levels of redundancy. The fully automated safety system monitors the site 24 hours a day, seven days a week, and if unusual operations or chlorine at levels above 0.1 parts per million (PPM) are detected, the system will immediately notify operators and also begin the process of shutting down and isolating the area of abnormal detection. In the case of a power outage, the system will automatically close all valves, securing and neutralizing the chlorine within the system.

## The 1990s to the mid-2000s: Reduction in onsite storage by 94% and seawater effluent management

In the mid-1990s, a portion of the site was subdivided to create space for the Maplewood commercial development north of Spicer Road and east of Amherst Avenue. Significant operational changes were undertaken to reduce onsite liquid chlorine storage by 80 percent cent – taking onsite storage from 1,600 tonnes to approximately 340 tonnes.

In 2010, further changes reduced that onsite storage even further, lowering it from 340 tonnes to 93 tonnes. Overall, large reduction of onsite storage of has significantly reduced risk for the community.

During this same time period, numerous changes were completed to the plant effluent management system, allowing Chemtrade to divert, capture and treat cooling seawater before returning it to Burrard Inlet.



## Safety – for employees, but also building partnerships and networks within the community partnerships

Chemtrade has strict safety protocols in place that begin with the moment employees set foot on site, continue through the production process and are carried through to the delivery of its products to customers.

### It all starts with employee safety

Chemtrade provides regular annual safety training to all of its employees, including job specific safety training, to ensure all employees are aware of the proper work processes, required personal protective equipment (PPE), and safety protocols.

Employees at the North Vancouver facility are required to complete between 40 and 50 courses annually, depending on their role. Training topics range from proper PPE, process safety, operations, security, and equipment specific training.

Much of this training is provided inhouse, through ChemU, Chemtrade's employee learning system, or through employee-led training by peers and leaders. It is also offered by external trainers in the case of special role requirements, like first aid certification.

One of Chemtrade's core values is Safety – at all times. The company is committed to providing employees with physical, psychological, and process safety as the company continues to move closer to its goal of zero injuries.




Employees at site host annual safety drills where a release scenario is practiced in real time to ensure that all employees are ready to respond in the unlikely event of a real emergency. The site also maintains an Emergency Response Plan, providing direction for Chemtrade employees, but also local first responders. This annual plan is shared with local first responders to help ensure the safety of employees, and the responders potentially coming to site.

In addition to employee training, Chemtrade has several employees who have joined the Chlorine Institute's CHLOREP team, which consists of highly trained volunteers capable of responding to chlorine spills across western Canada.

### Engaging the community in safety protocols

Chemtrade believes in building strong networks and relationships with emergency response organizations and first responders in the regions in which they live and operate. As mentioned, Chemtrade shares its emergency response plans with Northshore Emergency Response, and the District of North Vancouver Fire Department and has started the practice of coordinating joint emergency response exercises.

Chemtrade participates in the Alterable system, which in the unlikely chance of an emergency, would be used to notify area residents of the potential risks, along with providing any required instructions, such as sheltering in place. In the case of an actual emergency, Chemtrade would also activate it emergency response plan, which includes senior leaders directly contacting area municipalities, First Nations, and providing updates and instructions through its social media.

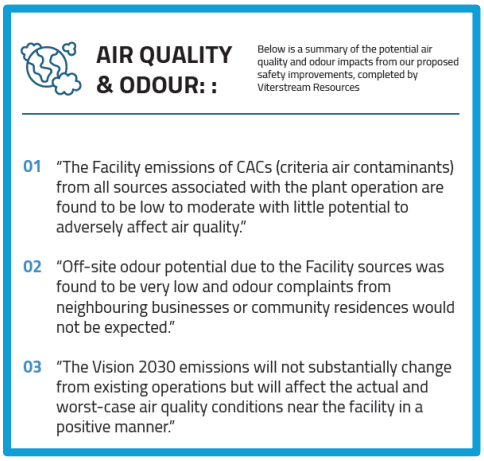
## Environmental impacts from our operations

The North Vancouver facility produces liquid chlorine, along with sodium hydroxide and hydrochloric acid. There is very little waste, none of it hazardous, generated by the production of chlorine. There are only two byproducts of the process: hydrogen gas, and a brine sludge that comes from the purification of the sea salt. Again, none of these are hazardous. In fact, Chemtrade produces a portion of the hydrogen produced as a clean energy source. The brine sludge is safely disposed of at the local landfill. It should be noted that the facility is one of the lowest carbon intensity chlor-alkali facilities, using green hydro-electric power (from BC Hydro).

All discharge from the facility is closely monitored, and most be within the limits as outlined in both the facility's air quality permit, as the facility's effluent permit – both issued through the Province of British Columbia's Ministry of Environment.

### Air quality:

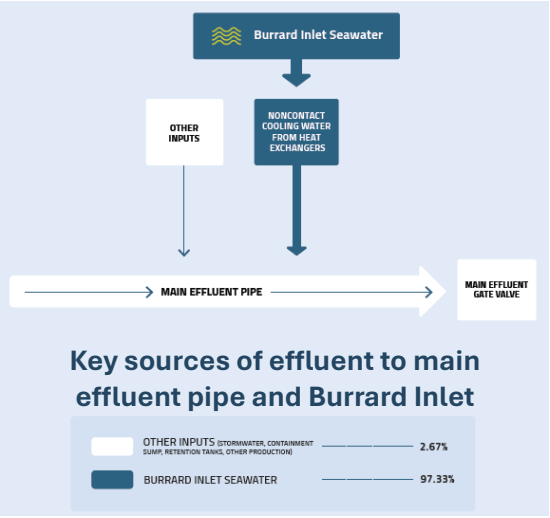
Chemtrade's North Vancouver facility operates under an Air Quality permit, issued by the BC Ministty of Environment. Emissions are closely monitored to ensure compliance, and the safety of employees and nearby communities.




As part of the rezoning application process, several studies were completed regarding air quality and odour. The studies found that the facility's emissions of criteria air contaminants (CACs), from all sources associated with the plant operation are found to be low to moderate with little potential to adversely affect air quality. The studies also concluded that off-site odour potential due to the facility's operations was found to be very low, and potential odour complaints from neighbouring businesses or community residences would not be expected.

### Facility effluent:

The primary effluent discharged from the North Vancouver facility is cleaned and cooled ocean water – comprising over 97 per cent of all discharge from site. The ocean water is used for non-contact cooling within the production process (it remains separated from the facility's effluent). All incoming ocean water is metered, and best practices are in place to minimize overall intake. The Ocean water used in operations is cooled, and its quality is monitored in real time. If needed, the effluent is treated to ensure key parameters remain within levels that are safe for aquatic life. Once these standards are met, the effluent is safely returned to the Burrard Inlet, protecting the surrounding marine environment.




Process water used on site is recycled and reused as much as possible to reduce the overall amount of fresh water required for production.

## Human Health Risk Assessment

A human health risk assessment (HHRA) is a scientific process that identifies, evaluates, and quantifies the potential adverse health effects on people exposed to environmental contaminants (such as chemicals in air, water, soil, or food).

It uses four main steps—problem formulation, hazard assessment, exposure assessment, and risk characterization—to inform regulatory decisions and protect public health. It is generally completed by government entities or industry associations, meant to identify and address overall potential health risks from a particular industrial process or product.

**Key aspects of a human health assessment include:**

- **Purpose:** To estimate the likelihood and magnitude of health risks from specific hazards.
- **Process:** It involves analyzing contaminants, understanding exposure pathways (e.g., breathing, eating), and determining potential health impacts.
- **Components:**
    - **Hazard Identification:** Determining if a substance can cause harm.
    - **Toxicity Assessment:** Evaluating the relationship between exposure level and adverse effects.
    - **Exposure Assessment:** Measuring the intensity, frequency, and duration of human contact with the hazard.
    - **Risk Characterization:** Estimating the probability of adverse health effects.
- **Applications:** Used in environmental impact assessments, site remediation, and setting regulatory standards.

### The human health impacts of liquid chlorine

Chlorine, or chlorine products have been used to treat drinking water since the early 1900s. Even though, waterborne diseases remain the leading cause of human morbidity and mortality worldwide, even though over 95 per cent of waterborne diseases are preventable *(Source: Researchgate.net, Sciencedirect.com).* In Canada, 96 per cent of Canadian municipalities use chlorine to treat their drinking water supply (Source: StatsCan).

In general, data available agrees that consuming chlorine in drinking water is safe at regulated levels, as the benefits of disinfection (eliminating waterborne diseases like cholera and typhoid fever) far outweigh the potential health risks, and classifying chlorine as unlikely to be carcinogenic. (Source: health Canada https://publications.gc.ca/collections/collection_2008/hc-sc/H50-3-57-2004E.pdf)

In looking for HHRA data in regard to inhaled liquid chlorine, while unable to find Canadian studies, there is an Australian study (available here: industrialchemicals.gov.au/sites/default/files/Chlorine_Human health tier II assessment.pdf)

The study concludes that prolonged exposure, at high-levels can lead to long term damage and even death. In regard to short term exposure, the report sites an experiment conducted with eight male volunteers where exposed to low concentrations of chlorine vapour for six hours a day, over a three-day period. The report noted that the study found no significant effects on lung function parameters and respiratory function.

The below is pulled from page nine of the report:

Observation in humans

Chlorine gas produces immediate severe effects at the site of contact including the skin, eyes and respiratory tract (OECD, 2003).

In a case study, observations taken two weeks after an accident involving spillage of 200 ppm chlorine gas in a tanker cars derailment, skin rashes and skin burns were reported in 16-25 % of the 682 people exposed. In another derailment incident, people exposed to the vapour were reported to have minor first-degree skin burns (ATSDR, 2010).

Skin irritation complaints were reported by fire fighters who responded to a chlorine gas leak in Henderson, Nevada, with exposure to <0.2 to 17 ppm of chlorine concentrations in the air (ATSDR, 2010).

In a human study conducted according to the principles of good laboratory practice (GLP), eight male volunteers were exposed to chlorine vapour at concentrations of 0, 0.1, 0.3 or 0.5 ppm (0, 0.3, 0.9 or 1.5 $mg/m^3$) for six hours/day for three consecutive days for each of the four exposure concentrations. No significant effects on lung function parameters and respiratory function for up to 0.5 ppm were observed (REACH).

## Operating requirements for Chemtrade's North Vancouver facility

Chemtrade's facility is the largest producer of liquid chlorine in Canada – responsible for producing over 40 per cent of the liquid chlorine used for water treatment for millions of Canadians. A 2015 Stats Canada study confirmed that 96 per cent of Canadian municipalities use chlorine to treat their domestic water supplies.

In order to produce this product, Chemtrade requires access to a deepwater port for the delivery of solar dried sea salt, imported from the Baja region of Mexico. Salt is the primary raw material used to produce chlorine (water, salt and electricity is all that is required for production of liquid chlorine).

Without access to this port, Chemtrade's ability to continue to produce chlorine would be significantly impeded.

Since liquid chlorine can only be moved by rail, access to the North American rail system is also required.

# Rezoning Bylaw 8778 – Text Amendment to Permit Chemtrade to Continue Operation and Conduct Site Improvement at 100 Amherst

## Staff Response to Council Questions

**This document contains staff response to date to Council questions raised during the first reading of Rezoning Bylaw 8778, a text amendment to permit Chemtrade to continue to operate a chlor-akali production facility at 100 Amherst and to conduct site improvement.**

**Council has referred the bylaw to a Public Hearing, scheduled for February 24, 2026. If there are additional questions raised by Council leading up to the Public Hearing, staff will continue to update this document to provide timely response to Council questions.**

### Q1. Port lease, jurisdiction, and the District's decision-making role

**Question:** Given the facility spans District-administered land and lands leased from the Vancouver Fraser Port Authority (VFPA), is the District approval 'secondary'—i.e., if the Port does not renew the lease, would operations stop regardless of District zoning?

**Response:** The rezoning request before Council concerns the District-administered portion of the site and seeks to amend the Zoning Bylaw to allow the manufacturing of liquid chlorine as an exemption, enabling the applicant to proceed with proposed safety upgrades (and related permits) on District lands.

A portion of the facility is on VFPA-leased lands, and Chemtrade and VFPA have a non-binding letter of intent with terms running through December 31, 2044. These Port-land tenure arrangements are separate from (and not determined by) the District's zoning authority.

The District's zoning decision would establish long-term use permission on District administered lands, while the Port's lease decisions would continue to govern the Port-administered parcel. If Port tenure were to change in the future, that could affect the facility's ability to operate as a whole.

### Q2. Whether zoning can include a "sunset clause" or time-limit

**Question:** Can the rezoning approval be time-limited (e.g., reviewed in 50 years) rather than granting permanent zoning permissions?

**Response:** Municipal zoning bylaw provisions are generally ongoing until amended or repealed by Council through a bylaw process. There is no time limit with regards to the allowed use under the Zoning.

The risk-management approach proposed in this application is instead to (a) tie future permits and implementation to the safety configuration analyzed in the Facility Siting Study / QRA, and, (b) register a covenant on title to ensure the site operates in

accordance with the FSS/QRA (or an updated version, as amended over time). This is presented as a mechanism to maintain the safety basis over the long term.

### Q3. Mechanisms to prevent increases in production volume / throughput

**Question:** What mechanisms ensure the proposal does not become an 'expansion' or increase production volumes over time?

**Response:** The intent is to reduce on-site chlorine storage and the overall risk while maintaining existing production volumes and if the rezoning proceeds, a covenant would be registered on title to ensure compliance with the FSS/QRA (or as amended/updated). This creates a legal mechanism intended to bind the operation to the safety configuration and assumptions underpinning the risk assessment.

The applicant's proposal states that production is not increasing and, accordingly, they do not anticipate additional railcar traffic; they provide a current baseline of an average of four railcars arriving/leaving daily and state the 'produce-and-ship' model will not result in storing chlorine in railcars.

Together, the rezoning (land use permission), covenant (legal compliance mechanism), and subsequent permitting (development/building permits tied to detailed designs) are intended to work together as means to ensure the proposal is a safety upgrade rather than an expansion.

### Q4. Operational viability if the VFPA lease is not renewed in 2044

**Question:** If the facility lost access to the Port-side lands in 2044, could the plant continue to operate?

**Response:** The overall facility footprint includes both District-administered privately-owned lands and VFPA-leased lands, and that some existing infrastructure located on Port portion of the lands is to remain.

Applicant's proposal refers to a non-binding letter of intent to extend the Port lease through 2044 but does not provide an operational scenario analysis for the period after 2044.

Accordingly, (a) the District's rezoning decision governs only the District-administered lands, and (b) continued operation over the long term would also depend on Port tenure arrangements, which are outside the District's zoning authority.

### Q5. Why formal public feedback appeared limited

**Question:** Why did the District receive relatively limited formal public feedback despite outreach (e.g., only a small number of open house attendance and written submissions noted at First Reading)?

**Response:** The applicant's engagement summary documents multi-year outreach activities (2023–2025) including direct outreach to community associations and stakeholder groups, an engagement website (AskChemtrade.ca), newsletters, and hosted open house sessions.

The engagement summary also reports attendance at applicant-hosted open houses prior to detailed rezoning application submission in November 2025 and stated that there

were approximately 65 residents across two sessions on June 6, 2024. The same report describes the launch and continuation of a public tour program to help the public understand operations and proposed safety improvements.

Within the context of this multi-year applicant-initiated public outreach and education effort, the participation in the formal rezoning-stage public engagement has been relatively low.

### Q6. Chemtrade safety record and safety management information

**Question:** Council requested additional facts regarding Chemtrade's specific safety record over its long history and recent operations.

**Response: Please refer to the applicant's response to Council questions.**

To add to applicant's response, the 2018 District report on Maplewood chemical hazard risk summarizes the District's approach to managing chemical hazard risk through land-use planning, MIACC-based risk contours, and emergency notification/response protocols coordinated among Chemtrade, the Fire Department, and North Shore Emergency Management. The report is included in the Public Hearing binder.

### Q7. Independence of the safety analysis and peer review approach

**Question:** Why did the District not commission a completely separate 'independent' safety report, rather than peer-reviewing the applicant's study?

**Response:** It is a standard process for the applicant to provide the study and for the District to hire an independent third party to peer-review and validate it.

Chemtrade submitted the Facility Siting Study / Quantitative Risk Assessment (FSS/QRA) prepared by BakerRisk, and that the District retained Risktec Solutions (Canada) Ltd. to conduct a third-party peer review on behalf of the District. The peer review was commissioned by the District, with costs reimbursed by the applicant. Risktec confirmed no major issues were identified with the study approach, assumptions, or conclusions, and that comments were limited to recommendations to improve clarity and presentation.

### Q8. Future peer review at Development Permit / Building Permit stages

**Question:** Can independent validation (peer review) be required again at the detailed design / permitting stages?

**Response:** As more detailed construction drawings become available, it is possible that additional FSS/QRA study and additional peer review may be required at future permitting stages.

### Q9. Rail safety once railcars leave the site (off-site transport through other municipalities)

**Question:** What analysis or controls exist for railcar risks once railcars leave the facility and travel through other municipalities?

**Response:** The movement of liquid chlorine by rail is highly regulated in Canada and the United States, and that Chemtrade is fully compliant with Transport Canada requirements, with multiple layers of safety in place for rail shipments.

**Please refer to the applicant's response for further detail.**

### Q10. Historical context (prior applications, development permits, and evolution of risk management)

**Comment:** Council asked if earlier historical information (e.g., earlier applications/subdivision history) can also be provided.

**Response:** This information is included in the Public Hearing binder. It includes relevant prior District documents (including Development Permits and related materials) associated with earlier periods of the site's development and operations. These provide documentary context on what approvals were issued and what conditions were attached at the time.

### Q11. Emergency preparedness, worst-case scenarios, and public communication ("shelter in place")

**Comment:** Council asked if information on emergency communication protocols and preparedness for worst-case scenarios (e.g., earthquake or accidental failure), including how nearby residents and businesses would be instructed to shelter in place.

**Response: Please refer to the applicant's response for further detail.**

To add to applicant's response, Chemtrade participates in an emergency notification system that can be used to notify area residents and provide instructions such as sheltering in place. Chemtrade's emergency response plan includes direct contact with local municipalities and First Nations and public updates through social media during an incident.

The District's 2018 report outlines the emergency notification and response framework for chemical releases in Maplewood, including the use of Chemtrade's notification system (Rapid Notify, as referenced in that report), coordination with the District Fire Department and North Shore Emergency Management, and the meaning of 'Shelter in Place' (go indoors, close doors/windows, and follow instructions).

These present a layered approach: prevention and risk reduction through engineering controls at site; neighborhood-wide emergency response planning and coordination; and public notification systems that can deliver shelter-in-place instructions when required.

# 1.7.1 Chemtrade Integrated Contingency Plan (ICP) Guide – Chlorine Release

## Priorities – People, Environment, Business:

1. Life safety (consider yourself, responding personnel, and the public)
2. Incident stabilization (control and containment)
3. Minimize impact to environment and property

## Chlorine Hazards:



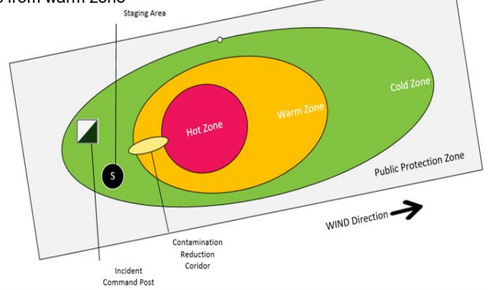
- Health Concerns:
  - 1 to 3 ppm for 1 hour – Mild mucous membrane irritation
  - 5 to 15 ppm – Moderate irritation of upper respiratory tract, stinging and burning eyes
  - 30 ppm – Immediate chest pain, vomiting, choking and coughing
  - 40 to 60 ppm – Toxic pneumonitis and pulmonary oedema
  - 430 ppm for 30 minutes – Lethal
  - 1, 000 ppm, few minutes – Fatal
- Life- threatening symptoms may be delayed up to 36 hours!
- Contact with compressed liquid gas may cause frostbite or chemical burns.
- Persons with pre-existing respiratory disease, e.g. asthma may be at greater risk
- Vapours react violently with many combustible materials, other chemicals and water.
- Can form an explosive mixture with oils.
- Extremely corrosive to most metals in the presence of moisture.
- Combustibles burn in chlorine as they do in oxygen.

## Isolation Response & Protection Zones:

Hot Zone – Physical product/ hazard location (>0.1 ppm)

Warm Zone – 3 meters from hot zone perimeter (0 ppm)

Cold Zone >3 meters from warm zone




## Immediate Strategies and Tactics:

*If odours are detected or the mandatory Cl2 monitor alarms and is above 0.1ppm, notify the Shift Supervisor, don emergency chlorine respirator IMMEDIATELY and evacuate.*

***Chlorine monitors, Shelter in Place locations, and sock and flag locations is presented on Figure 4.***

*Activate the emergency horn, Shift Supervisor to activate if Site shelter-in-place is required. Move straight to the nearest shelter-in-place. Understand that you should not attempt to perform any job or task that you have not been trained for, or that will put you in a position that is dangerous to your health or wellbeing.*

*Once outside of the building, look for the windsock (see Figure 4) to determine wind direction and proceed to the safest upwind shelter-in-place and remain there until you are directed to do otherwise.*

*Wear impervious, chemical-resistant clothing, gloves, footwear, and goggles.*

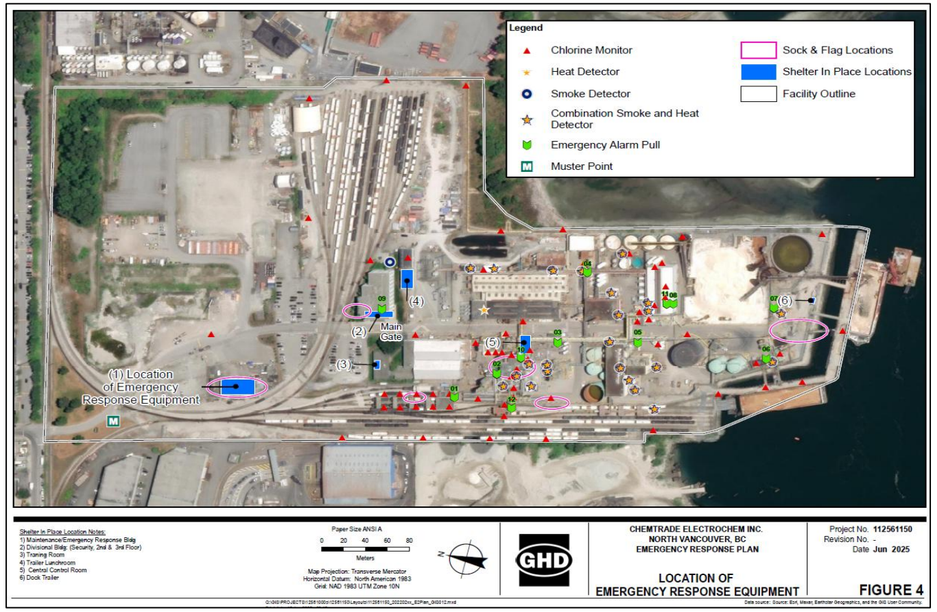
*Eliminate ignition sources.*

*Evacuate area in vicinity and downwind of release. Activation of public first responders 911.*

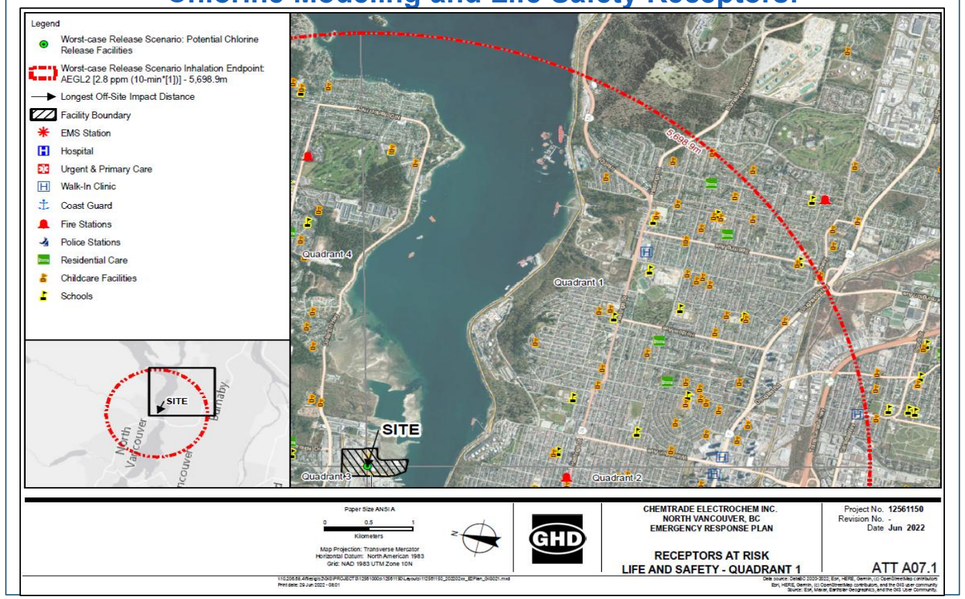
### Chlorine Alarms:

| Level | Trigger | Internal Notification | External Notification |
|---|---|---|---|
| Alert | 1 ppm local alarm | Strobe & siren | None |
| 1 | 1–10 ppm local; 0.3 ppm fence | Strobe & siren | Fence siren; neighbor notice |
| 2 | >10 ppm sustained; 0.3–1 ppm fence | Strobe & siren; SIP horn | Fence siren; SIP horn; neighbor + Alertable (Zone 1) |
| 3 | >10 ppm escalating; ≥1 ppm fence | Strobe & siren; SIP horn | Fence siren; SIP horn; mass public alert + Alertable |

## Shelter-in-Place Locations:



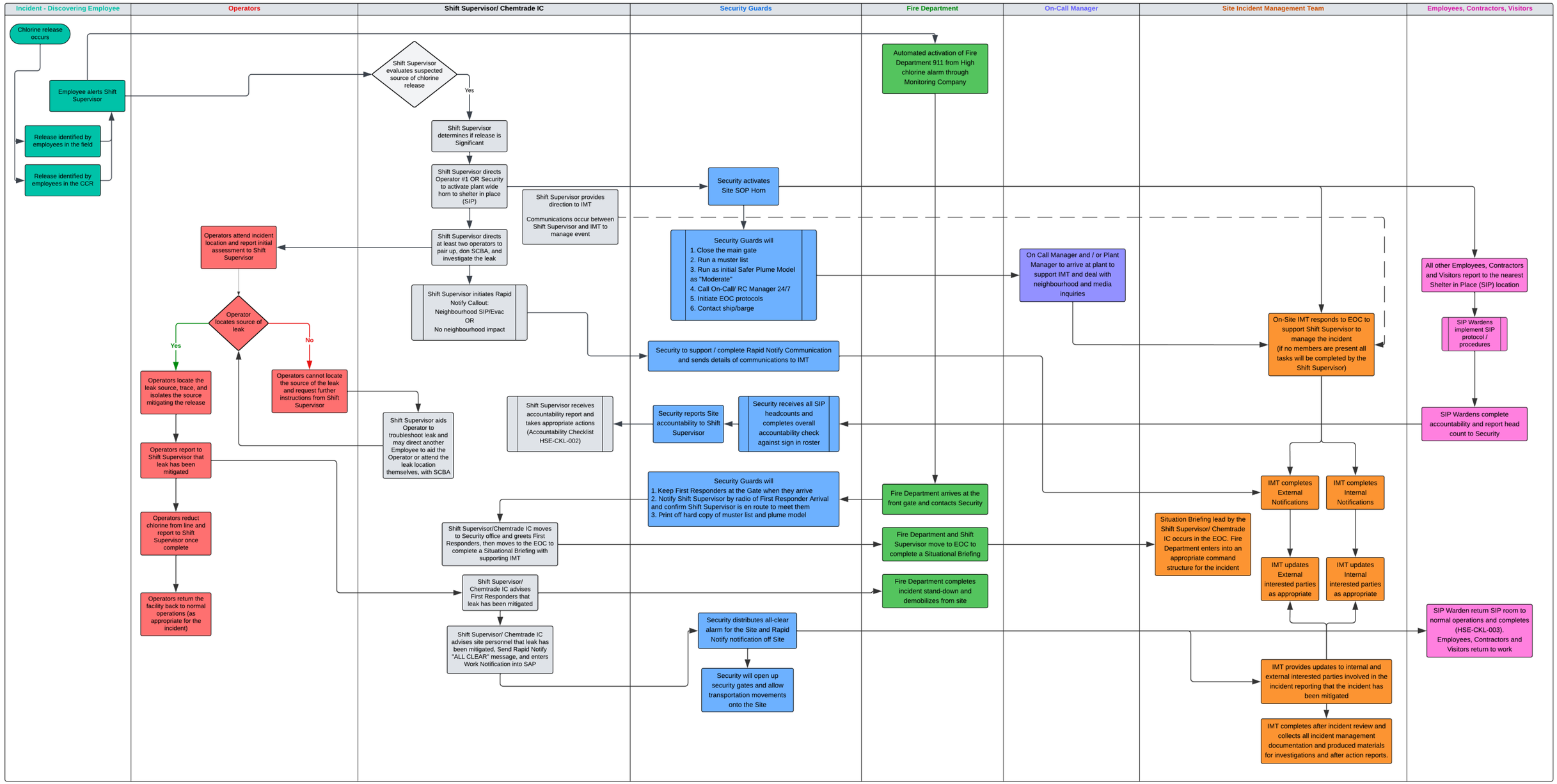

## Chlorine Modeling and Life Safety Receptors:




## Chemtrade ICP – Quick Reference Guide


Section 1: Introduction
Section 2: Core Plan
(2.1) Discovery
(2..1.2) Incident Classification
(2.1.3) Preliminary Assessment
(2.1.4) Response Zone Determination and Scene Control
(2.1.5) Notifications
(2.2) Initial Response
(2.2.1.1) Response Structure
(2.2.5.1.1) Chlorine Product Release
Annex A: Chlorine
Annex A, Attachment A.1:SDS
Annex A, Attachment A.2: Technical Brief
Annex A, Attachment A.3: P&ID
Annex A, Attachment A.4: Scenario Modeling
Appendix A: Internal/ External Contact List
Appendix B – Disciplined Approach
Appendix C – Notification and Reporting
Appendix G – Public Communications

# 1.7.1 Chlorine Release – Response Workflow and Responsibilities



# 1.7.2 Chemtrade Integrated Contingency Plan (ICP) Guide – Hydrochloric Acid Release

## Priorities – People, Environment, Business:

1. Life safety (consider yourself, responding personnel, and the public)
2. Incident stabilization (control and containment)
3. Minimize impact to environment and property

## Hydrochloric Acid Hazards:



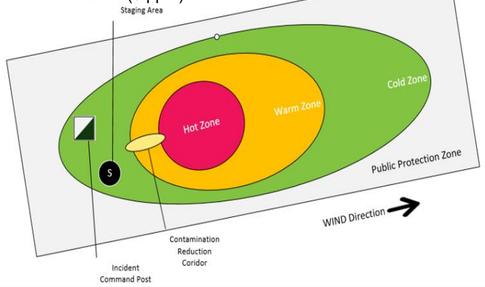
- Health Concerns:
  - Nose, throat and larynx irritation
  - Cough, choking
  - Eye, skin burns
  - Dermatitis
- Symptoms may be delayed 24 to 36 hours!
- Persons with pre-existing respiratory disease, e.g. asthma may be at greater risk
- Toxic and corrosive gases such as hydrogen chloride and chlorine may be released during thermal decomposition.
- Contact with metals reacts to produce explosive/flammable hydrogen gas.
- Heating can cause decomposition

## Isolation Response & Protection Zones:

Hot Zone – Physical product/ hazard location (>2 ppm)

Warm Zone – 3 meters from hot zone perimeter (0 ppm)

Cold Zone >3 meters from warm zone (0 ppm)




## Immediate Strategies and Tactics:

*If odours are detected or the HCl monitor alarms and is above 2ppm, notify the Shift Supervisor, don emergency respirator IMMEDIATELY and evacuate.*

***Monitors, Shelter in Place locations, and sock and flag locations is presented on Figure 4.***

*Activate the emergency horn, Shift Supervisor to activate if Site shelter-in-place is required. Move straight to the nearest shelter-in-place. Understand that you should not attempt to perform any job or task that you have not been trained for, or that will put you in a position that is dangerous to your health or wellbeing.*

*Once outside of the building, look for the windsock (see Figure 4) to determine wind direction and proceed to the safest upwind shelter-in-place and remain there until you are directed to do otherwise.*

*Wear impervious, chemical-resistant clothing, gloves, footwear, and goggles.*

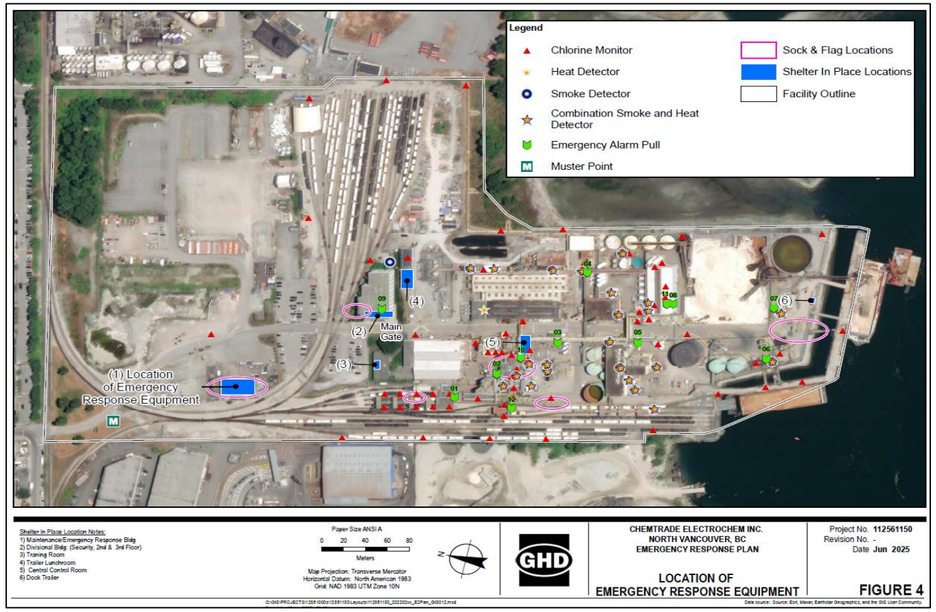
*Eliminate ignition sources.*

*Evacuate area in vicinity and downwind of release. Activation of public first responders 911.*

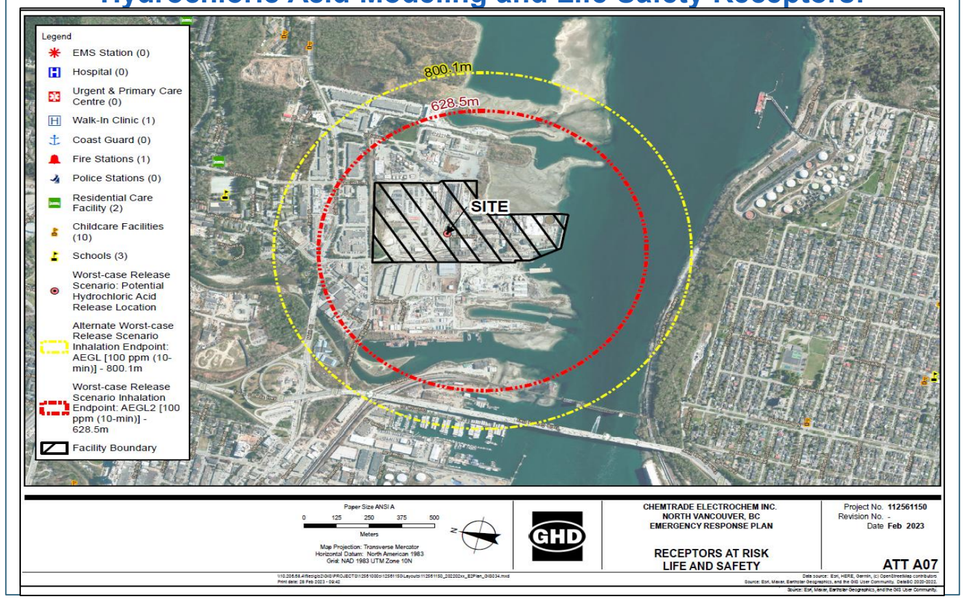
### Chlorine Alarms:

| Level | Trigger | Internal Notification | External Notification |
|---|---|---|---|
| Alert | 1 ppm local alarm | Strobe & siren | None |
| 1 | 1–10 ppm local; 0.3 ppm fence | Strobe & siren | Fence siren; neighbor notice |
| 2 | >10 ppm sustained; 0.3–1 ppm fence | Strobe & siren; SIP horn | Fence siren; SIP horn; neighbor + Alertable (Zone 1) |
| 3 | >10 ppm escalating; ≥1 ppm fence | Strobe & siren; SIP horn | Fence siren; SIP horn; mass public alert + Alertable |

## Shelter-in-Place Locations:



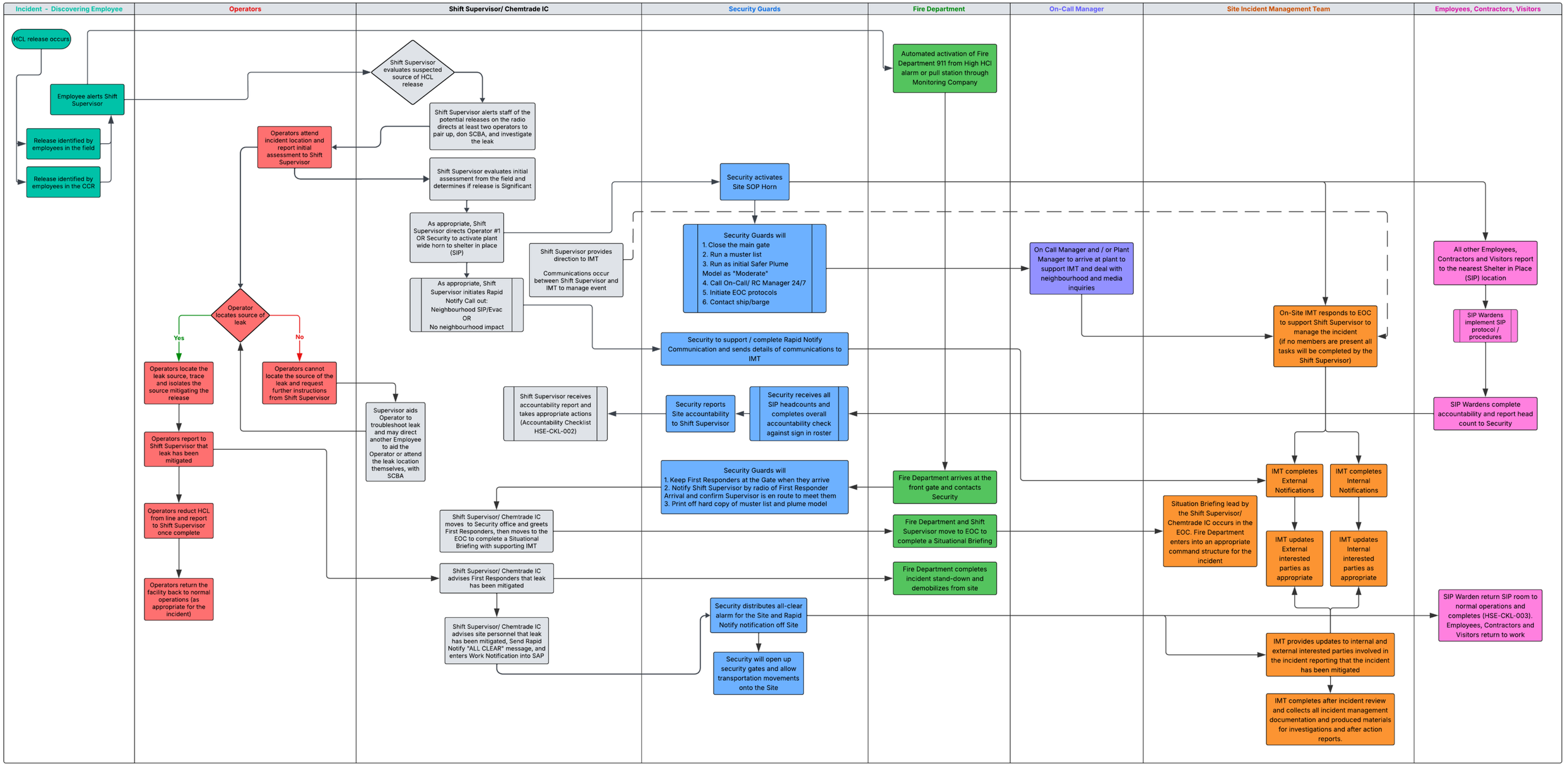

## Hydrochloric Acid Modeling and Life Safety Receptors:




## Chemtrade ICP – Quick Reference Guide


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(2.1.5) Notifications
(2.2) Initial Response
(2.2.1.1) Response Structure
(2.2.5.1.1) Hydrochloric Acid Product Release
Annex B: Chlorine
Annex B, Attachment B.1:SDS
Annex B, Attachment B.2: Technical Brief
Annex B, Attachment B.3: P&ID
Annex B, Attachment B.4: Scenario Modeling
Appendix A: Internal/ External Contact List
Appendix B – Disciplined Approach
Appendix C – Notification and Reporting
Appendix G – Public Communications

# 1.7.2 Hydrochloric Acid Release – Response Workflow and Responsibilities



# 1.7.3 Chemtrade Integrated Contingency Plan (ICP) Guide – Fire and Explosion

## Priorities – People, Environment, Business:

1. Life safety (consider yourself, responding personnel, and the public)
2. Incident stabilization (control and containment)
3. Minimize impact to environment and property

## Hazards:

- Chemical asphyxiant, may displace oxygen and cause rapid suffocation due to smoke and fumes
- Radiant heat causing burns
- Secondary hazards – product releases (chlorine, hydrochloric acid, caustic, and natural gas)
- Secondary hazards – building collapse following a fire or explosion

## Immediate Strategies and Tactics:

- Continuous alarm activated by fire pull station

R
- Remove those in immediate danger without risk to self

E
- Ensure the room is closed. This will help confine the fire to the room of origin. This will also help prevent the spread of smoke and toxic gases

A
- Activate the fire alarm (if not already done)

C
- Call. Activation of public first responders 911 . A designated individual should call the fire department, even though the alarm is connected to the monitoring station. Answer the dispatcher's questions

T
- Try to extinguish or control the fire, if the fire is small and you are trained to use a fire extinguisher. Evaluate if fire may impinge chlorine storage vessels.

**IN CASE OF FIRE**

**UPON DISCOVERY OF FIRE**

**ACTIVATE A FIRE ALARM PULL STATION**

**CALL 9.1.1**

**LEAVE BUILDING VIA NEAREST SAFE EXIT**

**PROCEED TO NEAREST MUSTER LOCATION**

**DO NOT USE ELEVATOR**

**UPON HEARING FIRE ALARM**

**LEAVE BUIDLING VIA NEAREST SAFE EXIT**

**PROCEED TO NEAREST MUSTER LOCATION**

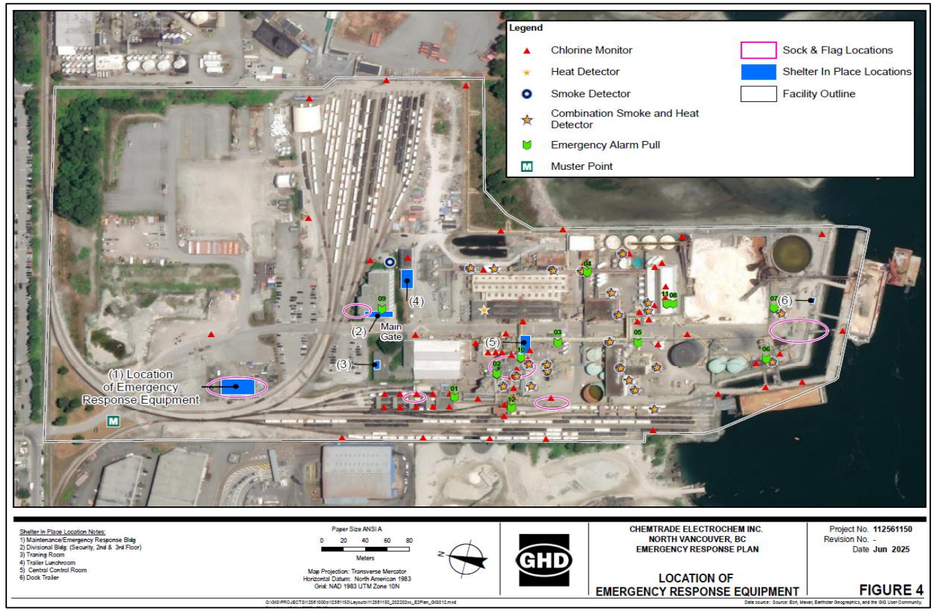
**CLOSE DOORS BEHIND YOU**

**CAUTION**

**IF YOU ENCOUNTER SMOKE, USE ALTERNATE EXIT**

**REMAIN CALM**

## Evacuation Routing and Equipment Locations:

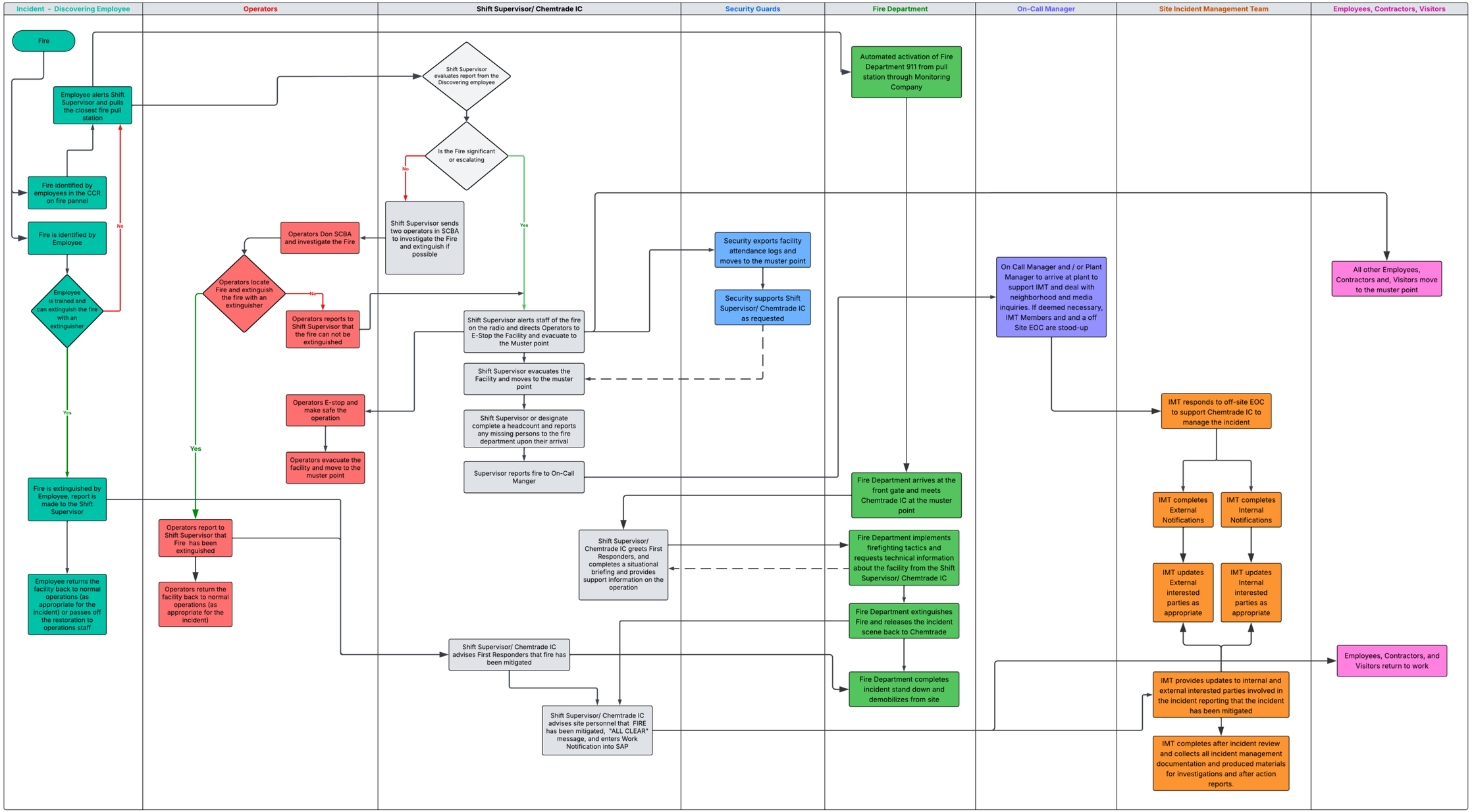



Full size versions of the above plans are presented on Figures 4.

## Chemtrade ICP – Quick Reference Guide


Section 1: Introduction
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(2.1.5) Notifications
(2.2) Initial Response
(2.2.1.1) Response Structure
(2.2.5.2) Fire and Explosion
Appendix A: Internal/ External Contact List
Appendix B – Disciplined Approach
Appendix C – Notification and Reporting
Appendix G – Public Communications

# 1.7.3 Fire and Explosion – Response Workflow and Responsibilities



# 1.7.4 Chemtrade Integrated Contingency Plan (ICP) Guide – Power Outage

## Priorities – People, Environment, Business:

1. Life safety (consider yourself, responding personnel, and the public)
2. Incident stabilization (control and containment)
3. Minimize impact to environment and property

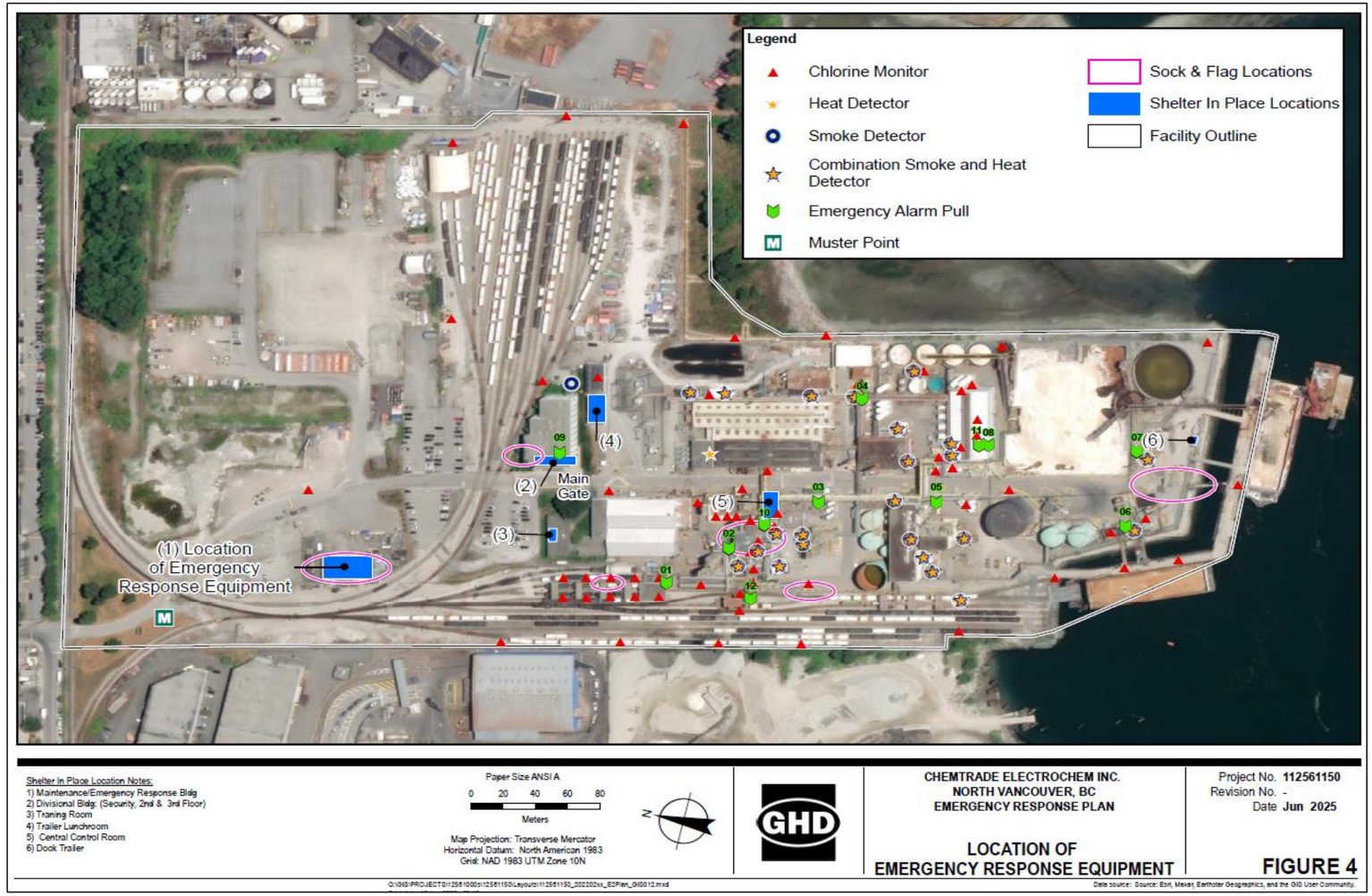
## Hazards:

- Possible product releases due to chlorine isolation or insufficient operational management
- Possible personal injury due to isolation or limited light
- Possible impairment of fire suppression system
- Product degradation due to increases temperature

## Immediate Strategies and Tactics:

- Local system alarms
- Monitor radio, Internet, and TV for emergency broadcast and outage timing
- Evacuate employees, contractors and visitors if it is not safe to remain in the facility
- Start backup emergency generator (automatic switch over)
- Monitor Facility systems during outage

## Evacuation Routing and Equipment Locations:

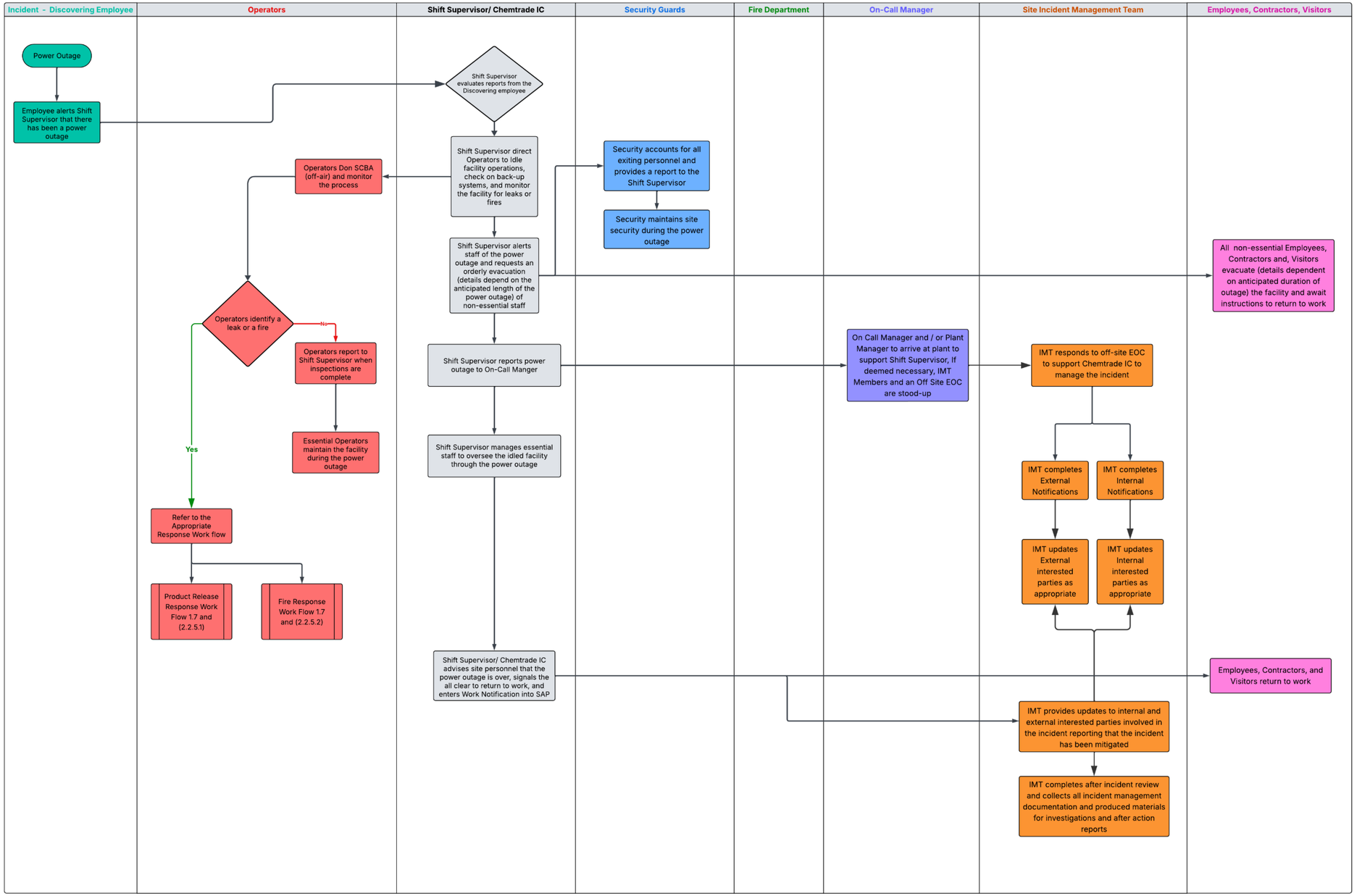



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## Chemtrade ICP – Quick Reference Guide


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(2.2) Initial Response
(2.2.1.1) Response Structure
(2.2.5.3) Power Outage
Appendix A: Internal/ External Contact List
Appendix B – Disciplined Approach
Appendix C – Notification and Reporting
Appendix G – Public Communications

# 1.7.4 Power Outage – Response Workflow and Responsibilities



# 1.7.5 Chemtrade Integrated Contingency Plan (ICP) Guide – Injury or Fatality

## Priorities – People, Environment, Business:

1. Life safety (consider yourself, responding personnel, and the public)
2. Incident stabilization (control and containment)
3. Minimize impact to environment and property

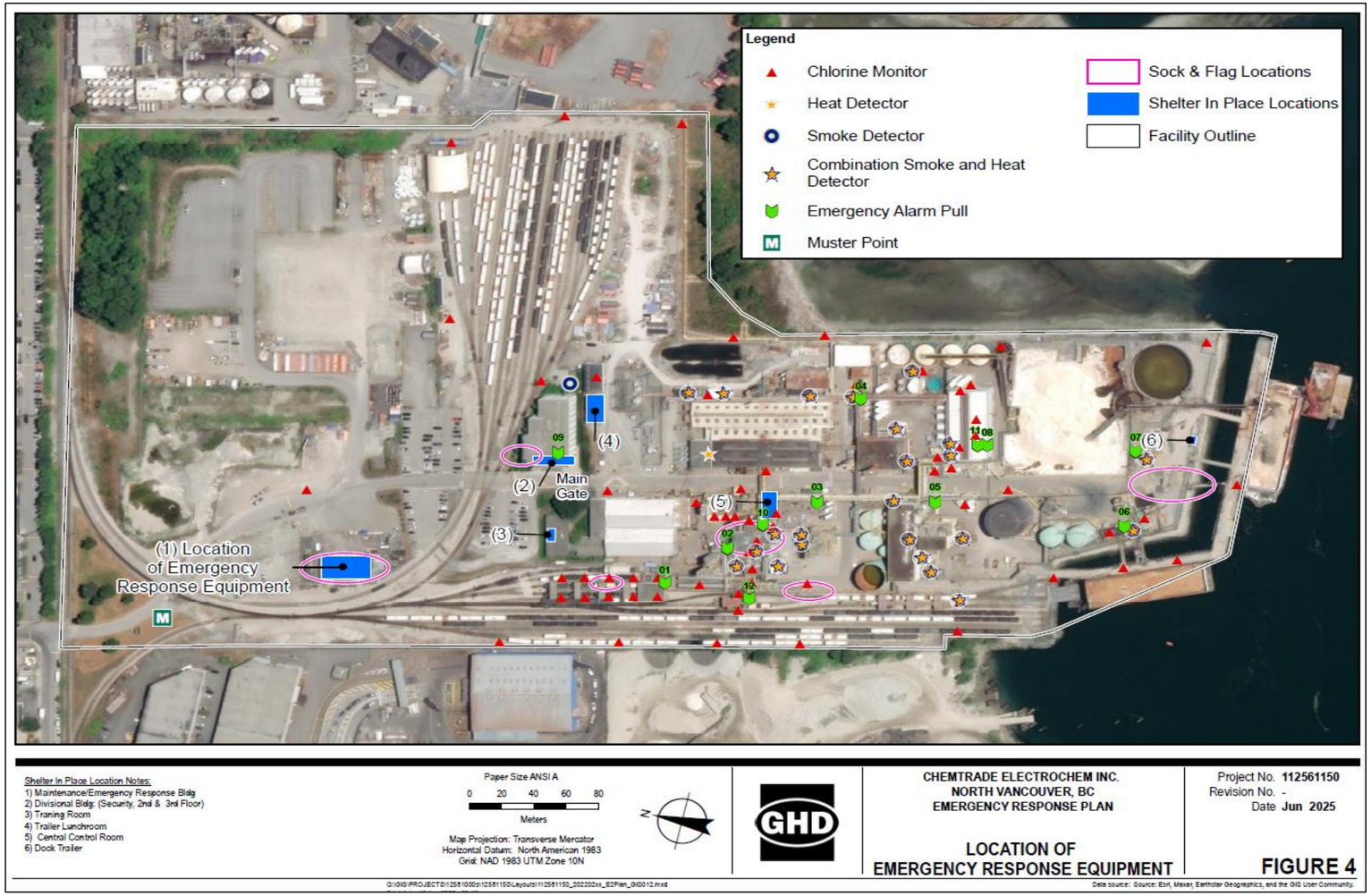
## Hazards:

- Associated with the cause of the injury
- The location of the injury
- Special considerations should be made in confined spaces, elevated areas, hazard restricted areas at the facility.

## Immediate Strategies and Tactics:

- Report from impacted or discovering individual
- Activation of public first responders, 911 as required
- Evaluate situation and ensure it is safe for individuals with first aid to assess and assist the injured individual
- Evacuate staff and visitors  the if it is not safe to remain in the facility
- If an incident involving equipment results in the death of a worker, the person who is in charge of the equipment must ensure the site of the incident is not disturbed, unless:
  - Protecting the health and safety of other personnel
  - Aiding an injured person involved in an incident
  - Taking essential action to make the scene safe or to prevent a further occurrence of the incident

## Evacuation Routing and Equipment Locations:

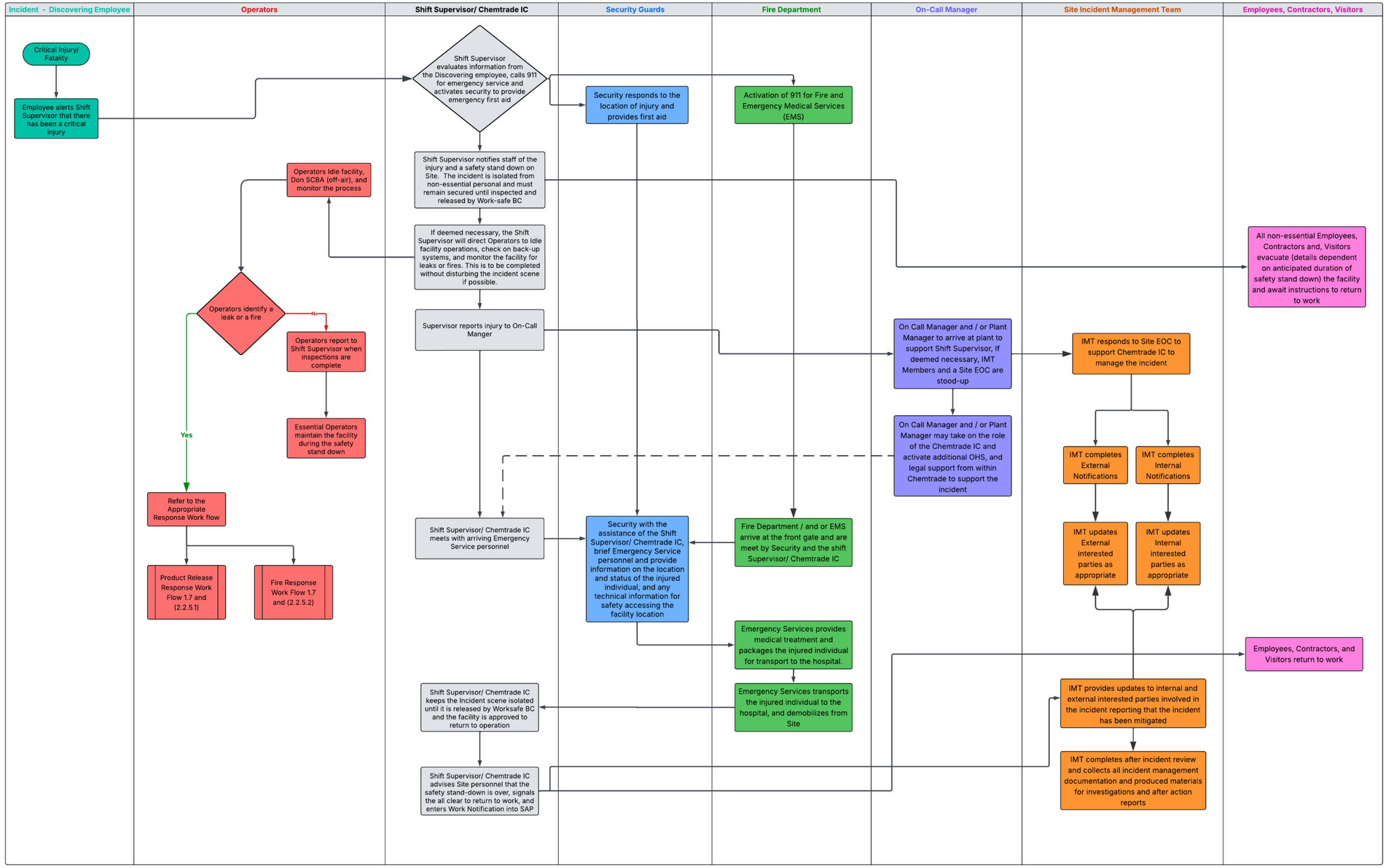



Full size versions of the above plans are presented on Figures 4.

## Chemtrade ICP – Quick Reference Guide


Section 1: Introduction
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(2.2.1.1) Response Structure
(2.2.5.4) Injury or Fatality
Appendix A: Internal/ External Contact List
Appendix B – Disciplined Approach
Appendix C – Notification and Reporting
Appendix G – Public Communications

# 1.7.5 Critical Injury or Fatality – Response Workflow and Responsibilities



# 1.7.6 Chemtrade Integrated Contingency Plan (ICP) Guide – Natural Disasters

## Priorities – People, Environment, Business:

1. Life safety (consider yourself, responding personnel, and the public)
2. Incident stabilization (control and containment)
3. Minimize impact to environment and property

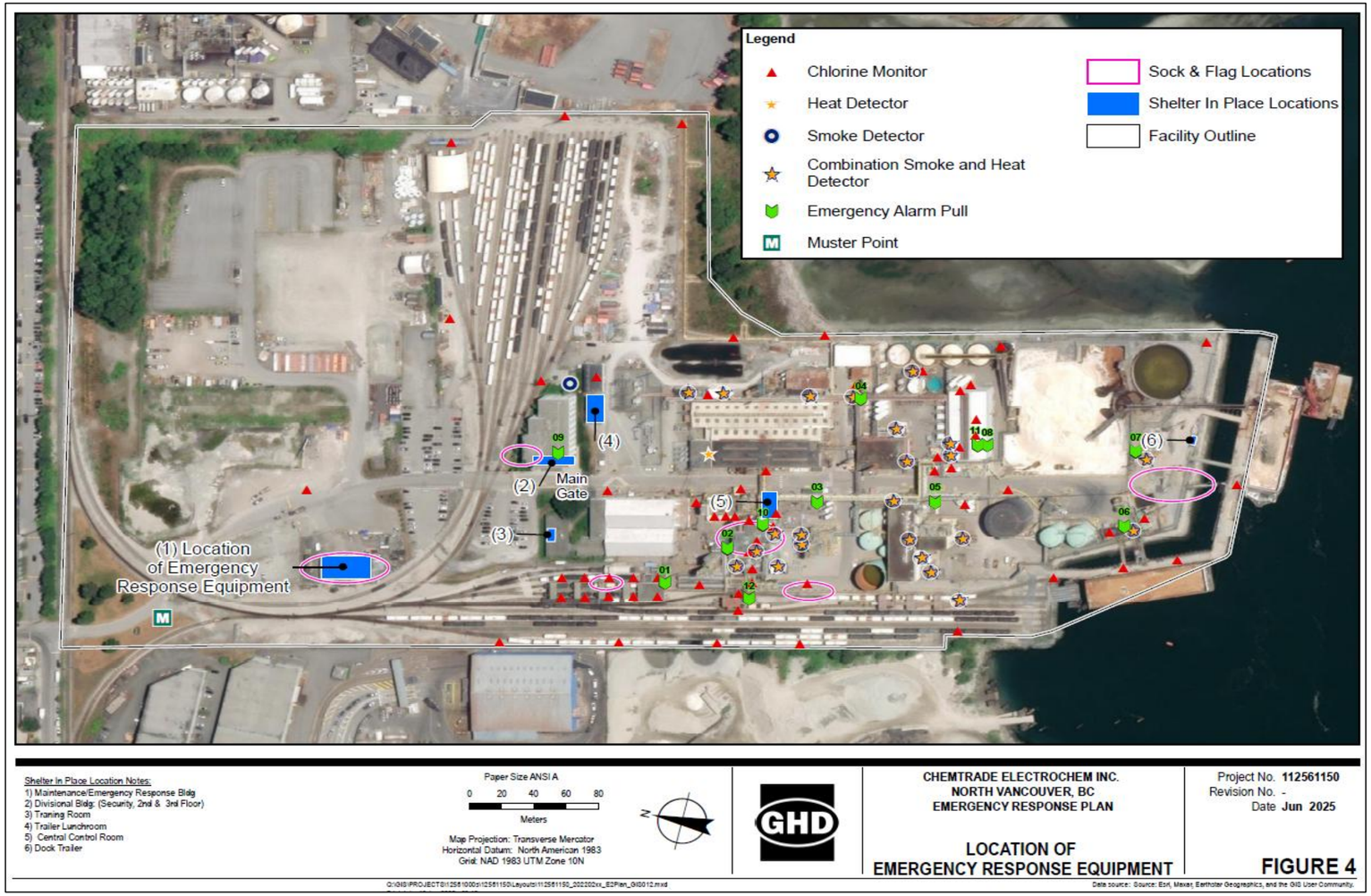
## Hazards:

- Possible product releases due to chlorine isolation or insufficient operational management
- Possible personal injury due to physical contact, extreme heat/ cold, water, contact with energy source, isolation within the facility, limited light
- Possible impairment of fire suppression system
- Product degradation due to temperature change, physical destruction

## Immediate Strategies and Tactics:

- Canadian public alerting system
- Monitor radio, Internet, and TV for emergency broadcast and outage timing
- Evacuate staff and visitors if it is not safe to remain in the facility
- Isolate staff and visitors in place if not safe to leave the facility
- For tornados isolate to lowest level in a hallway

## Evacuation Routing and Equipment Locations:

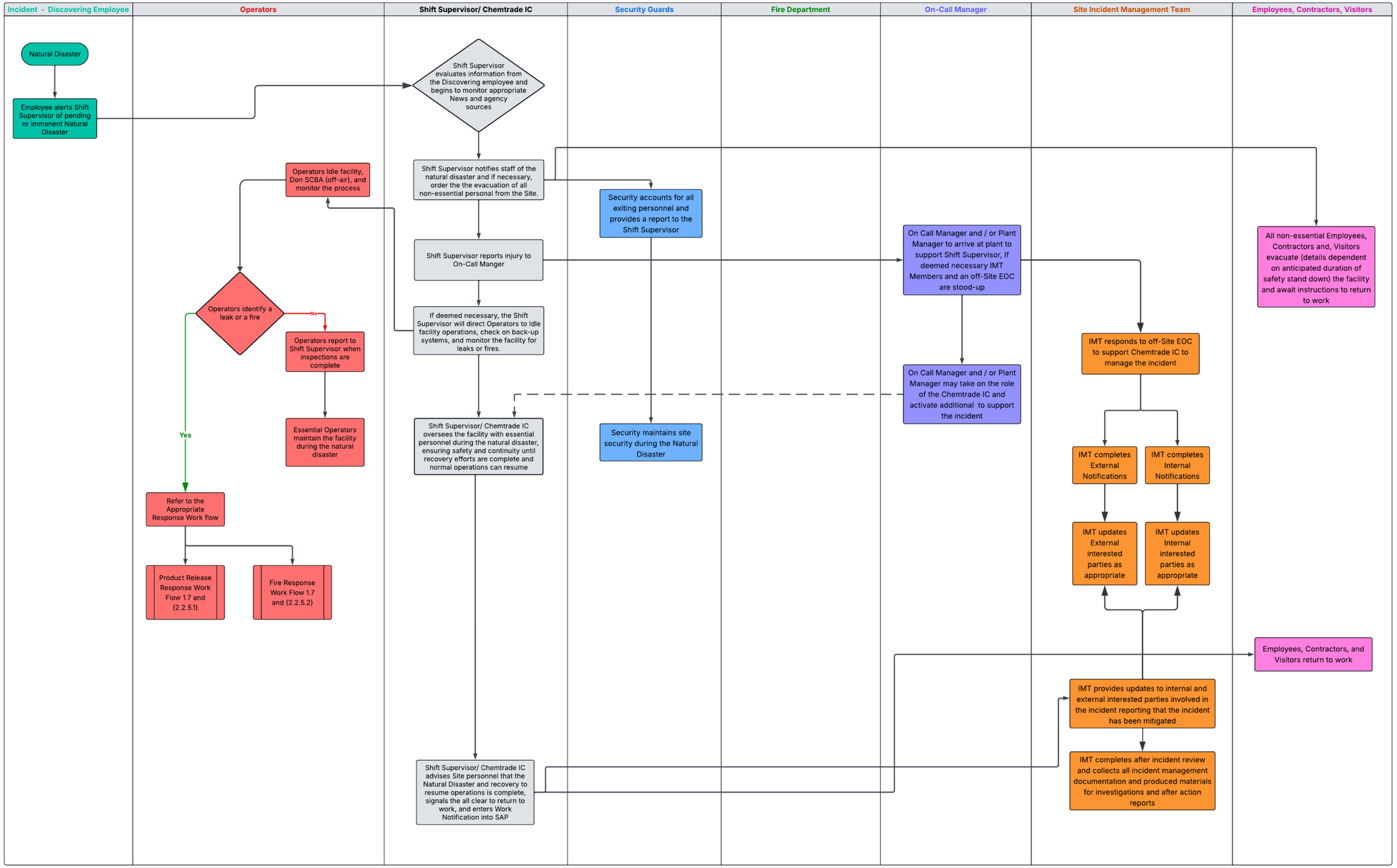



Full size versions of the above plans are presented on Figures 4.

## Chemtrade ICP – Quick Reference Guide


Section 1: Introduction
Section 2: Core Plan
(2.1) Discovery
(2..1.2) Incident Classification
(2.1.3) Preliminary Assessment
(2.1.4) Response Zone Determination and Scene Control
(2.1.5) Notifications
(2.2) Initial Response
(2.2.1.1) Response Structure
(2.2.5.5) Natural Disasters
Appendix A: Internal/ External Contact List
Appendix B – Disciplined Approach
Appendix C – Notification and Reporting
Appendix G – Public Communications

# 1.7.6 Natural Disaster – Response Workflow and Responsibilities



# 1.7.7 Chemtrade Integrated Contingency Plan (ICP) Guide – Security Events

## Priorities – People, Environment, Business:

1. Life safety (consider yourself, responding personnel, and the public)
2. Incident stabilization (control and containment)
3. Minimize impact to environment and property

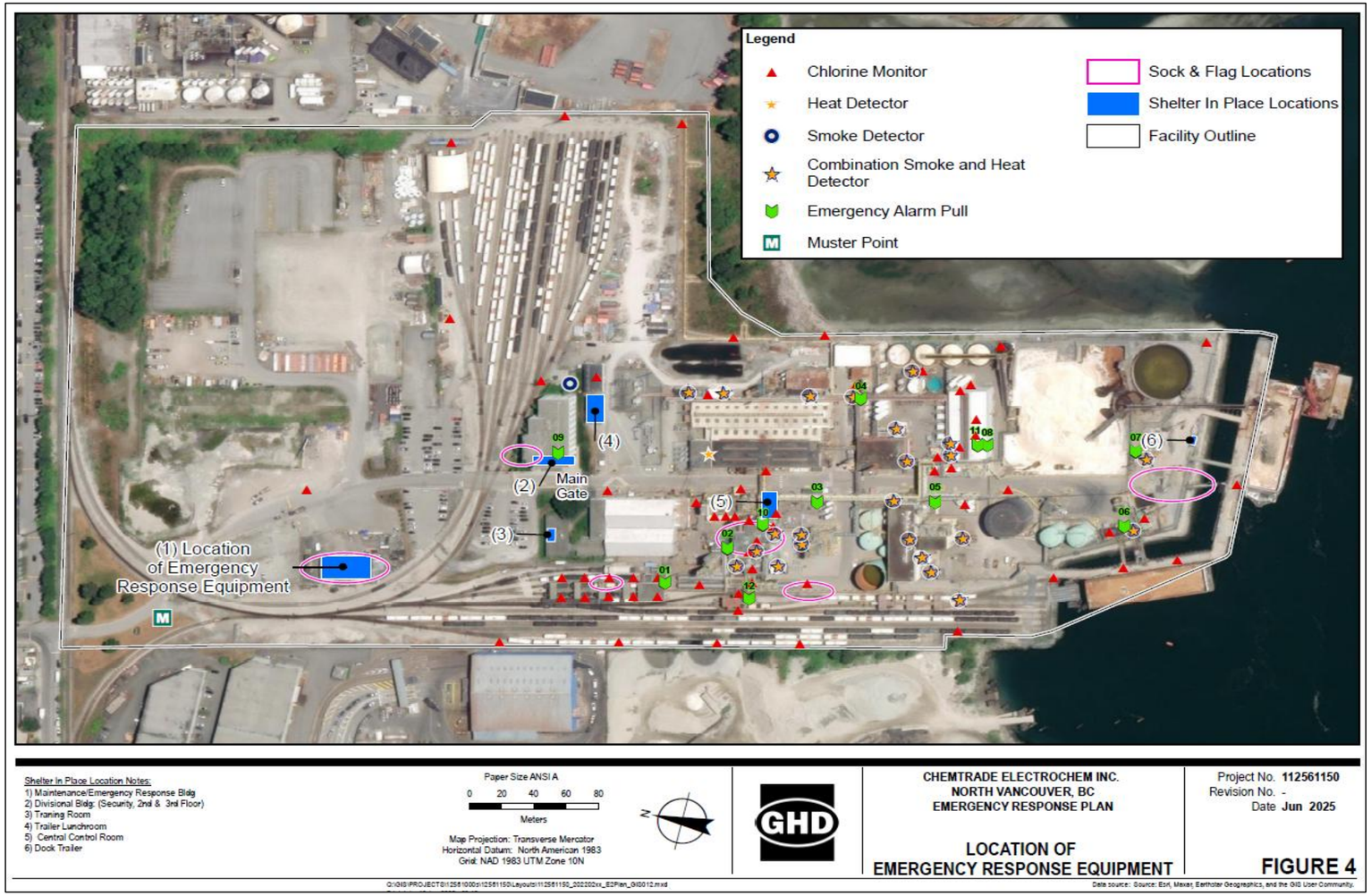
## Hazards:

- Threat targeted at personnel, facility or operational property
- Terrorism targeted at personnel, facility or operational property
- Bomb threats, sabotage, vandalism, intruder/unauthorizes entry, demonstrations/labour unrest

## Immediate Strategies and Tactics:

- Written or verbal notice
- Activation of public first responders, 911
- Communicate with staff and other in the facility
- Evacuate staff and visitors if it is not safe to remain in the facility
- Shelter staff and visitors in place if it is not safe to leave the facility

## Evacuation Routing and Equipment Locations:

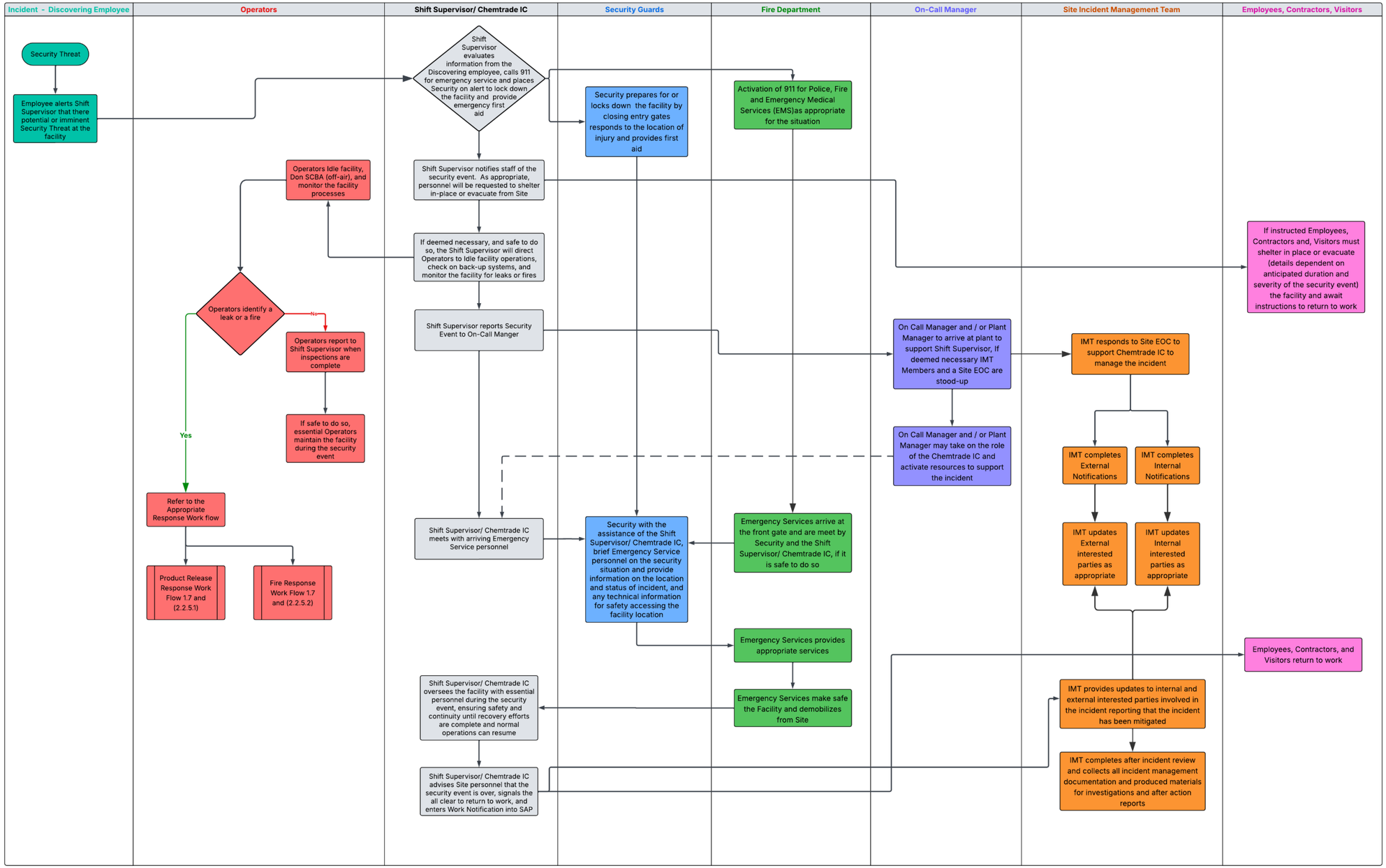



Full size versions of the above plans are presented on Figures 4.

## Chemtrade ICP – Quick Reference Guide


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(2.2) Initial Response
(2.2.1.1) Response Structure
(2.2.5.6) Security Events
Appendix A: Internal/ External Contact List
Appendix B – Disciplined Approach
Appendix C – Notification and Reporting
Appendix G – Public Communications

# 1.7.7 Security Events – Response Workflow and Responsibilities



# 1.7.8 Chemtrade Integrated Contingency Plan (ICP) Guide – Transportation Events

## Priorities – People, Environment, Business:

1. Life safety (consider yourself, responding personnel, and the public)
2. Incident stabilization (control and containment)
3. Minimize impact to environment and property

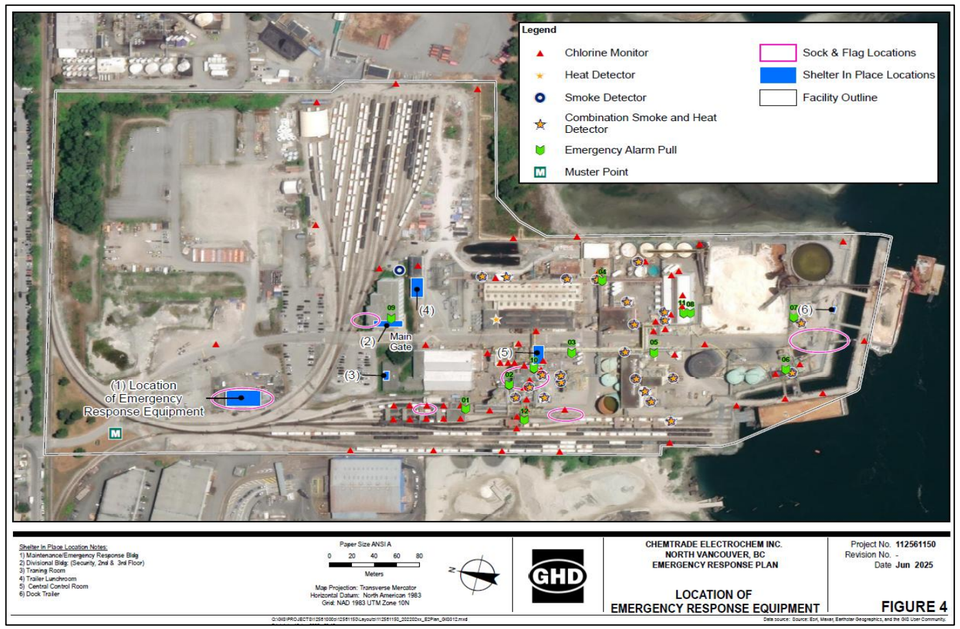
## Hazards:

- Product releases from the means of containment (Chlorine or HCl)
- Environmental impacts from accident or product releases
- Injury or fatality related to the transportation accident or product release
- Secondary hazards due to transportation corridor disruption

## Immediate Strategies and Tactics:

- Call CHLOREP Team, if transportation-related chlorine incident
- Call 911 to report the accident and notify if Dangerous Goods involvement
- Call Canutec and implement the Emergency Response Assistance Plan (ERAP)
- Secure the scene if safe to do so
- Complete damage assessment of the means of containment if safe to do so
- Communicate hazards to public first responders

## Evacuation Routing and Equipment Locations:




Full size versions of the above plans are presented on Figures 4.

## Chemtrade Emergency Response Assistance Plan (ERAP):

| | | | |
|---|---|---|---|
| **Title:** | **1.0 - Chemtrade Emergency Response Assistance Plan (ERAP)** | **Doc Number:** | CHE-ESH-ERAP-1.0 |
| | | **Revision Number:** | 9.2 |
| **Site:** | ALL | **Approval Date:** | May 13th, 2022 |
| **Department:** | ESHA | **Approver:** | Blair Hetherington |
| **Area:** | Emergency Response | **Approver Title:** | Emergency Response Systems Manager |

| Section Number | Sub-Section Number | Section Description | Rev. # | Comment |
|---|---|---|---|---|
| 1 | 1.0 | ERAP TABLE OF CONTENTS | 9.1 | This document – Reorganized and updated section #'s |
| | 1.1 | Chemtrade Emergency Response Assistance Plan (ERAP) | 12.1 | Updated Crisis Management Team Info. Updated Technical Advisors, Implementation procedure, mobilization timeline |
| | 1.2 | Chemtrade Emergency Response Assistance Plan - Potential Incident | 7.1 | Updated verbiage and formatting |
| | 1.3 | Chemtrade Emergency Notification Protocol | 20.2 | Update Emergency Action Contact Protocol (questions asked), Updated Primary contact list, updated Chemtrade Manager List |
| | 1.4 | Communication Devices | 1.0 | Separated from document 1.1 |
| | 1.5 | Quebec Incident Support | 1.0 | Creation of the document |
| **Response Protocols & Guidance Documents** | | | | |
| 2 | 2.1 | Sulfur Dioxide ERAP Guidance | 8.1 | Updated shipment map |
| | 2.2 | Chemtrade Sulfuric Acid - Oleum ERAP Guidance | 8.1 | Updated verbiage and formatting |
| | 2.3 | Chemtrade Sodium Hydrosulfite Powder ERAP Guidance | 7.1 | Updated verbiage and formatting |
| | 2.4 | Hydrochloric Acid ERAP Guidance | 7.1 | Updated verbiage and formatting |
| | 2.5 | Chemtrade Hydrogen Sulfide ERAP Guidance | 7.1 | Updated verbiage and formatting |
| | 2.6 | Chemtrade Carbon Disulfide ERAP Guidance | 7.1 | Updated verbiage and formatting |
| | 2.7 | Chemtrade Chlorine ERAP Guidance | 7.1 | Updated risk assessment |

## Chemtrade ICP – Quick Reference Guide


Section 1: Introduction
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## Chemtrade ERAP

Chemtrade Emergency Response Assistance Plan (ERAP) - CHE-ESH-ERAP-1.0

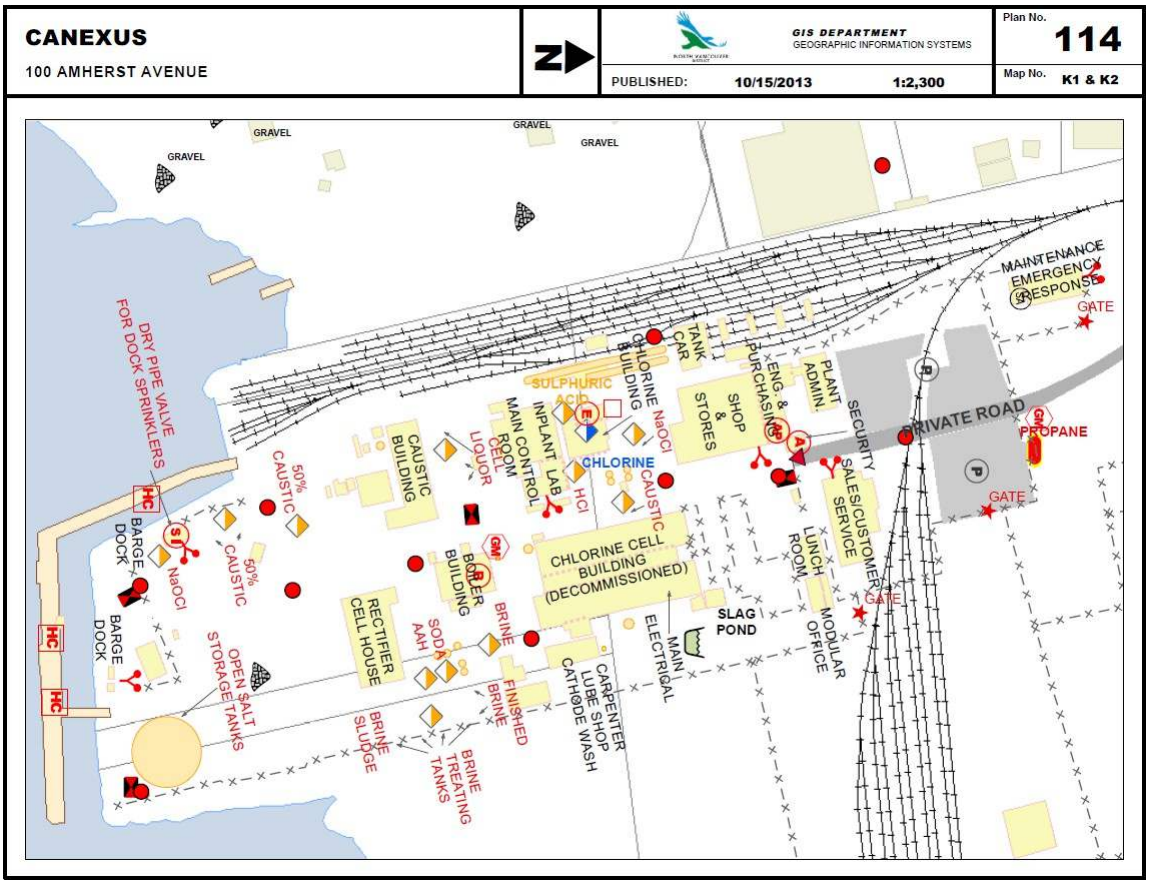
# HAZMAT PREPLANS

# Chemtrade Logistics

## 100 Amherst Avenue, North Vancouver

### Contact Information:

**Tony Gutenberg – EHS Regional Manager**
Office: (604) 924-2831
Cell: (604) 374-5423
Main Gate: (604) 929-1107




### Initial Response Considerations:

Chemtrade has chemical experts trained in Hazmat response specific to the products that they produce and have the capability to manage releases internally. However, the fire department will continue to respond in the event that they require assistance with any rescue, evacuation or support of their control procedures.

## Alarm Procedure:

There are two distinct alarm notifications that can happen at Chemtrade – Fire and Chlorine
If the fire alarm is activated it will be reported as such and be dispatched as a fire call. The first alarm assignment will be two Engines, one Aerial and a Duty Chief.

If the chlorine sensors are activated it will be reported and dispatched as a Hazmat call. The first alarm assignment will be a District Quint/Engine and a full CNV Hazmat response (2 Engines, Haz10 and CDC)

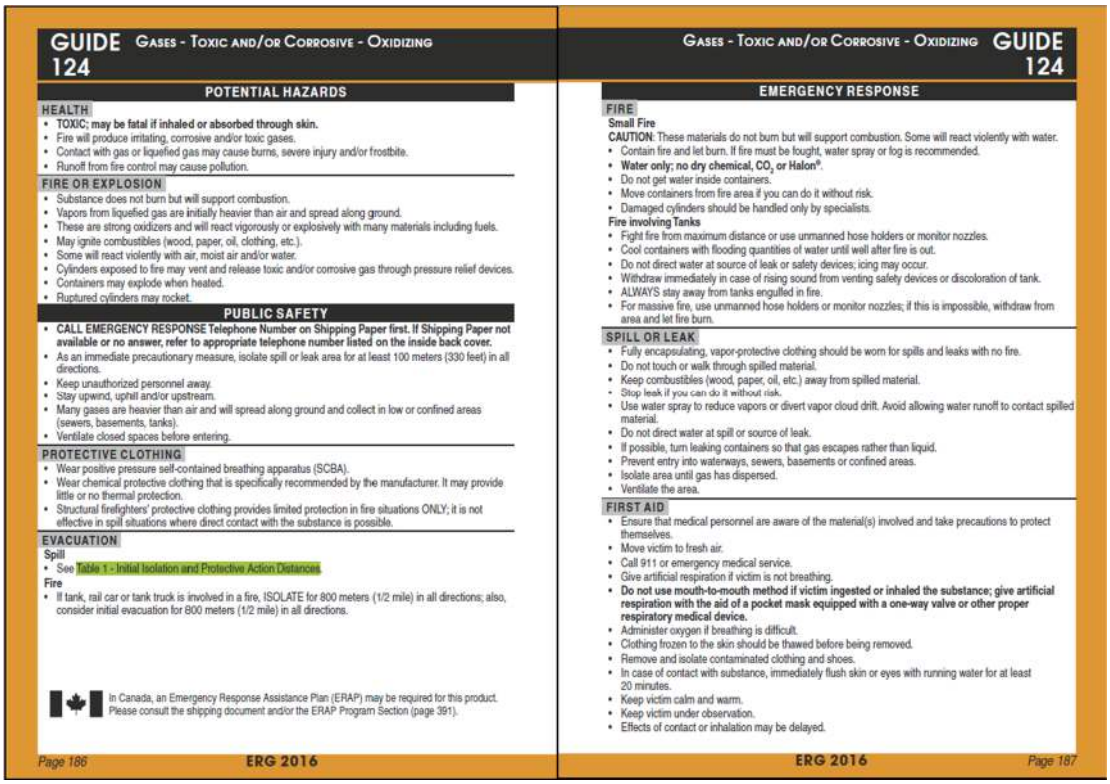
## Response Procedures:

The first arriving Quint/Engine should approach based on wind direction and conditions. The first arriving officer establishes command and sets up command post outside the front gate at Chemtrade. The Command officer should use the intercom to get any updates from security as well as access to the “man-gate” just to the right of the main gate.
Once through the man-gate, proceed 30 paces to the guard shack where the Command officer will retrieve a portable radio and a cheat sheet that accompanies the radio. This portable radio will allow the Incident Commander to speak directly to the plant superintendent who will be able to provide a situation report.

All incoming units will stage behind the first in truck and report to Command.
***Under no circumstances is anyone to get past the gate without authorization from the plant superintendent.***

Chlorine, Sulphuric Acid, Caustic, Sodium Hypochlorite

ERG Guide – Chlorine



GUIDE 124 GASES - TOXIC AND/OR CORROSIVE - OXIDIZING

POTENTIAL HAZARDS

HEALTH
- **TOXIC; may be fatal if inhaled or absorbed through skin.**
- Fire will produce irritating, corrosive and/or toxic gases.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Runoff from fire control may cause pollution.

FIRE OR EXPLOSION
- Substance does not burn but will support combustion.
- Vapors from liquefied gas are initially heavier than air and spread along ground.
- These are strong oxidizers and will react vigorously or explosively with many materials including fuels.
- May ignite combustibles (wood, paper, oil, clothing, etc.).
- Some will react violently with air, moist air and/or water.
- Cylinders exposed to fire may vent and release toxic and/or corrosive gas through pressure relief devices.
- Containers may explode when heated.
- Ruptured cylinders may rocket.

PUBLIC SAFETY
- **CALL EMERGENCY RESPONSE Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind, uphill and/or upstream.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Ventilate closed spaces before entering.

PROTECTIVE CLOTHING
- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.
- Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible.

EVACUATION

Spill
- See Table 1 - Initial Isolation and Protective Action Distances.

Fire
- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

In Canada, an Emergency Response Assistance Plan (ERAP) may be required for this product. Please consult the shipping document and/or the ERAP Program Section (page 391).

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GASES - TOXIC AND/OR CORROSIVE - OXIDIZING GUIDE 124

EMERGENCY RESPONSE

FIRE

Small Fire

**CAUTION:** These materials do not burn but will support combustion. Some will react violently with water.
- Contain fire and let burn. If fire must be fought, water spray or fog is recommended.
- **Water only; no dry chemical, $CO_2$ or Halon®.**
- Do not get water inside containers.
- Move containers from fire area if you can do it without risk.
- Damaged cylinders should be handled only by specialists.

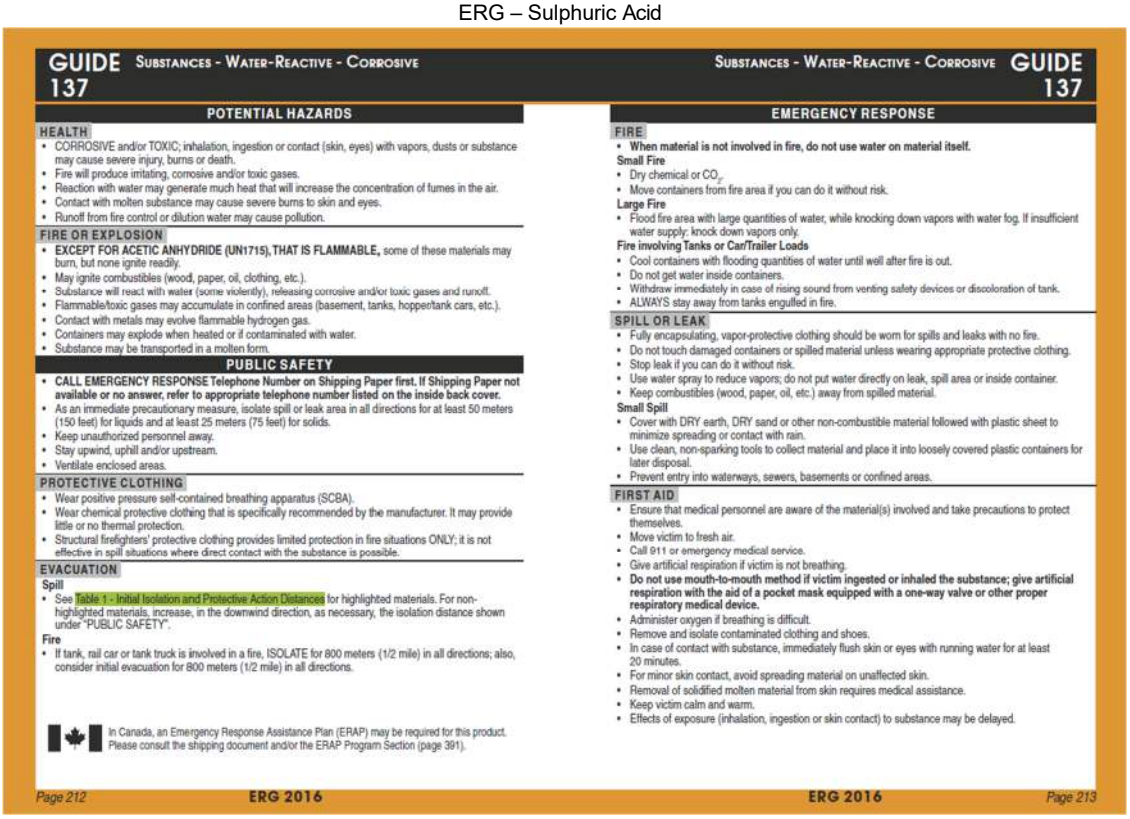
**Fire involving Tanks**
- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK
- Fully encapsulating, vapor-protective clothing should be worn for spills and leaks with no fire.
- Do not touch or walk through spilled material.
- Keep combustibles (wood, paper, oil, etc.) away from spilled material.
- Stop leak if you can do it without risk.
- Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material.
- Do not direct water at spill or source of leak.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Prevent entry into waterways, sewers, basements or confined areas.
- Isolate area until gas has dispersed.
- Ventilate the area.

FIRST AID
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.
- Move victim to fresh air.
- Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- **Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.**
- Administer oxygen if breathing is difficult.
- Clothing frozen to the skin should be thawed before being removed.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Keep victim calm and warm.
- Keep victim under observation.
- Effects of contact or inhalation may be delayed.

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ERG – Sulphuric Acid



GUIDE 137 Substances - Water-Reactive - Corrosive

Substances - Water-Reactive - Corrosive GUIDE 137

**POTENTIAL HAZARDS**

**HEALTH**
- CORROSIVE and/or TOXIC; inhalation, ingestion or contact (skin, eyes) with vapors, dusts or substance may cause severe injury, burns or death.
- Fire will produce irritating, corrosive and/or toxic gases.
- Reaction with water may generate much heat that will increase the concentration of fumes in the air.
- Contact with molten substance may cause severe burns to skin and eyes.
- Runoff from fire control or dilution water may cause pollution.

**FIRE OR EXPLOSION**
- **EXCEPT FOR ACETIC ANHYDRIDE (UN1715), THAT IS FLAMMABLE,** some of these materials may burn, but none ignite readily.
- May ignite combustibles (wood, paper, oil, clothing, etc.).
- Substance will react with water (some violently), releasing corrosive and/or toxic gases and runoff.
- Flammable/toxic gases may accumulate in confined areas (basement, tanks, hopper/tank cars, etc.).
- Contact with metals may evolve flammable hydrogen gas.
- Containers may explode when heated or if contaminated with water.
- Substance may be transported in a molten form.

**PUBLIC SAFETY**
- **CALL EMERGENCY RESPONSE Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.
- Keep unauthorized personnel away.
- Stay upwind, uphill and/or upstream.
- Ventilate enclosed areas.

**PROTECTIVE CLOTHING**
- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.
- Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible.

**EVACUATION**

**Spill**
- See Table 1 - Initial Isolation and Protective Action Distances for highlighted materials. For non-highlighted materials, increase, in the downwind direction, as necessary, the isolation distance shown under "PUBLIC SAFETY".

**Fire**
- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

In Canada, an Emergency Response Assistance Plan (ERAP) may be required for this product. Please consult the shipping document and/or the ERAP Program Section (page 391).

**EMERGENCY RESPONSE**

**FIRE**
- **When material is not involved in fire, do not use water on material itself.**

**Small Fire**
- Dry chemical or $CO_2$.
- Move containers from fire area if you can do it without risk.

**Large Fire**
- Flood fire area with large quantities of water, while knocking down vapors with water fog. If insufficient water supply: knock down vapors only.

**Fire involving Tanks or Car/Trailer Loads**
- Cool containers with flooding quantities of water until well after fire is out.
- Do not get water inside containers.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.

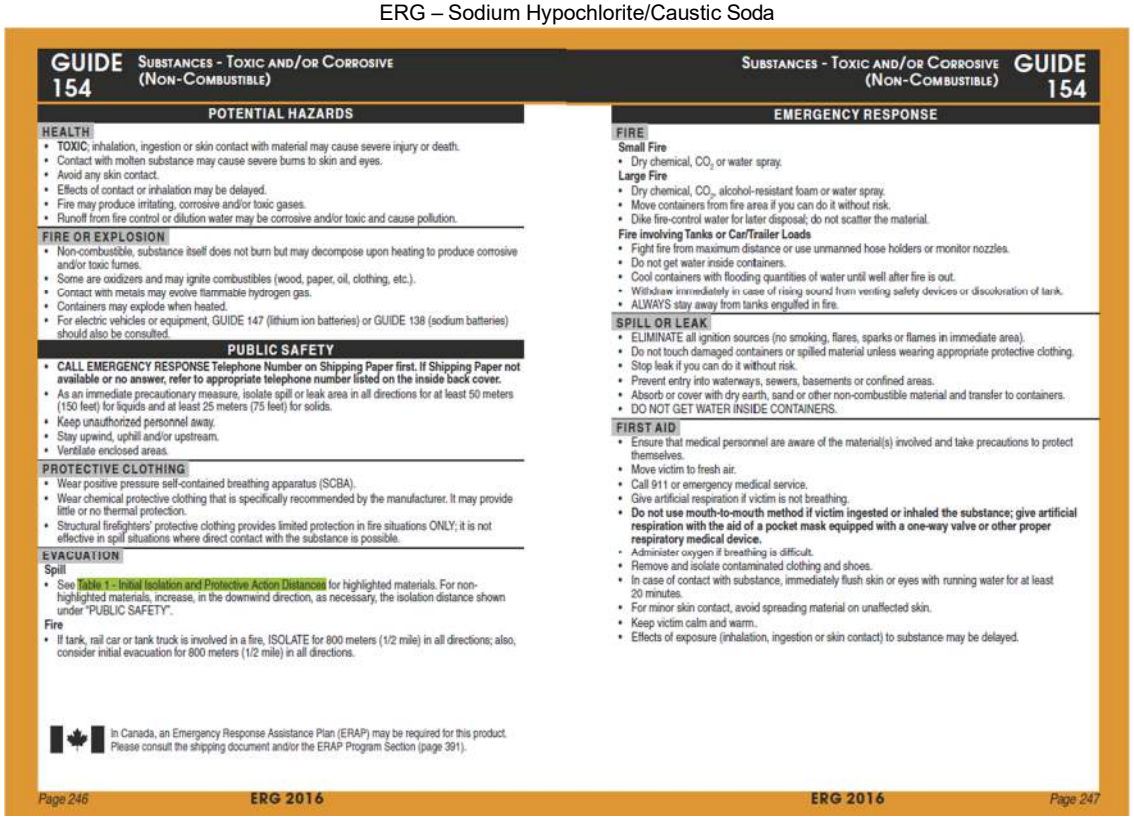
**SPILL OR LEAK**
- Fully encapsulating, vapor-protective clothing should be worn for spills and leaks with no fire.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- Use water spray to reduce vapors; do not put water directly on leak, spill area or inside container.
- Keep combustibles (wood, paper, oil, etc.) away from spilled material.

**Small Spill**
- Cover with DRY earth, DRY sand or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain.
- Use clean, non-sparking tools to collect material and place it into loosely covered plastic containers for later disposal.
- Prevent entry into waterways, sewers, basements or confined areas.

**FIRST AID**
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.
- Move victim to fresh air.
- Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- **Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.**
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- For minor skin contact, avoid spreading material on unaffected skin.
- Removal of solidified molten material from skin requires medical assistance.
- Keep victim calm and warm.
- Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.

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ERG – Sodium Hypochlorite/Caustic Soda



GUIDE 154 Substances - Toxic and/or Corrosive (Non-Combustible)

Substances - Toxic and/or Corrosive (Non-Combustible) GUIDE 154

**POTENTIAL HAZARDS**

**HEALTH**
- **TOXIC**; inhalation, ingestion or skin contact with material may cause severe injury or death.
- Contact with molten substance may cause severe burns to skin and eyes.
- Avoid any skin contact.
- Effects of contact or inhalation may be delayed.
- Fire may produce irritating, corrosive and/or toxic gases.
- Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.

**FIRE OR EXPLOSION**
- Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.
- Some are oxidizers and may ignite combustibles (wood, paper, oil, clothing, etc.).
- Contact with metals may evolve flammable hydrogen gas.
- Containers may explode when heated.
- For electric vehicles or equipment, GUIDE 147 (lithium ion batteries) or GUIDE 138 (sodium batteries) should also be consulted.

**PUBLIC SAFETY**
- **CALL EMERGENCY RESPONSE Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.
- Keep unauthorized personnel away.
- Stay upwind, uphill and/or upstream.
- Ventilate enclosed areas.

**PROTECTIVE CLOTHING**
- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.
- Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible.

**EVACUATION**

**Spill**
- See Table 1 - Initial Isolation and Protective Action Distances for highlighted materials. For non-highlighted materials, increase, in the downwind direction, as necessary, the isolation distance shown under "PUBLIC SAFETY".

**Fire**
- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

In Canada, an Emergency Response Assistance Plan (ERAP) may be required for this product. Please consult the shipping document and/or the ERAP Program Section (page 391).

**EMERGENCY RESPONSE**

**FIRE**

**Small Fire**
- Dry chemical, $CO_2$ or water spray.

**Large Fire**
- Dry chemical, $CO_2$, alcohol-resistant foam or water spray.
- Move containers from fire area if you can do it without risk.
- Dike fire-control water for later disposal; do not scatter the material.

**Fire involving Tanks or Car/Trailer Loads**
- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Do not get water inside containers.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.

**SPILL OR LEAK**
- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements or confined areas.
- Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
- DO NOT GET WATER INSIDE CONTAINERS.

**FIRST AID**
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.
- Move victim to fresh air.
- Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- **Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.**
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- For minor skin contact, avoid spreading material on unaffected skin.
- Keep victim calm and warm.
- Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.

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**DNV Fire Department Response – Emergency Preparedness and Shelter-in-Place Protocols (Chemtrade)**

On a high level we have a collaborative response along side our partners at North Vancouver City Fire Department in the event of a Fire or Chlorine event on site.

Please refer to the attached document titled – Chemtrade Logistics and the Response Workflow and Responsibilities Chemtrade -document/response procedure.

**Low likelihood of large-scale release**, but Chemtrade maintains a *detailed and comprehensive Emergency Response Plan (ERP)*.

**ERP covers multiple scenarios**, including catastrophic chlorine release.

**Training & Preparedness**

- Regular review and practice of safety processes.
- Annual tabletop exercises simulating emergency scenarios.
- Full-scale facility-wide exercises to test and update ERP effectiveness.

**External Notification Procedures**

- Employees *immediately call 911* upon detecting a significant spill.
- Northshore Emergency Management is notified to activate the *Alertable* public alerting system.
- Public receives detailed instructions, including:
    - Nature of the incident
    - Shelter-in-place steps (close windows/doors, turn off air intakes, HVAC systems)
- Instructions also shared with first responders and posted on Chemtrade's social media.
- Direct phone notifications sent to:
    - Local First Nations
    - Immediate neighbors
    - All levels of elected officials

**Incident Response**

- Chemtrade establishes an Incident Command Centre.
- Activation of their CHLOREP team, contractors, and consultants.
- Emergency modeling software used to predict release impacts and share real-time data with first responders.

**Collaboration with Fire Department & Partners**

- DNVFRS and Chemtrade agree that resuming *joint emergency response exercises* is a priority. Planned for fall 2026.
- Site tours provided to DNVFRS members in 2024 and 2025 to familiarize teams with risks.
- Chemtrade and CN Rail committed to ongoing product-specific training, including liquid chlorine response.

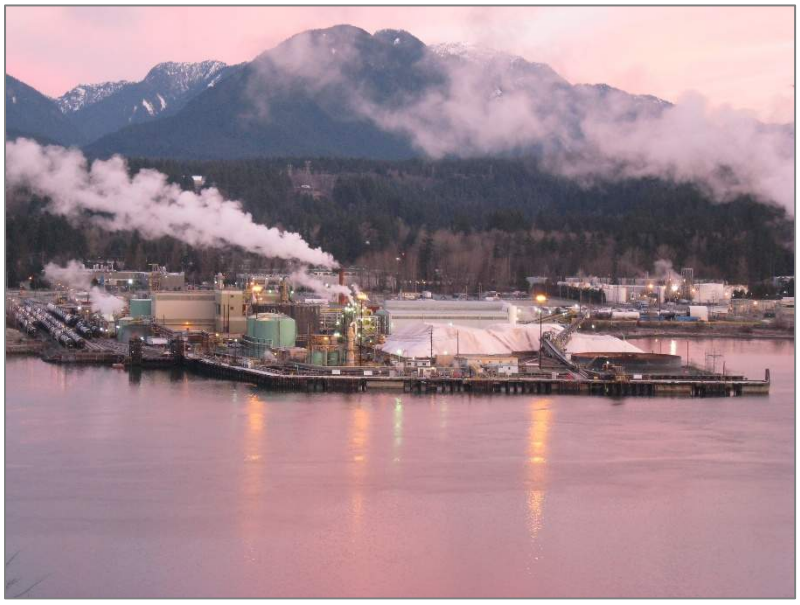
**Documentation**

- A Response Workflow and Responsibilities document is attached.
- ERP and ERAP, currently under review, will be shared with the Fire Department once finalized.

# Chemtrade Electrochem
# Vision 2030 Project Description

For District of North Vancouver Rezoning Application for Facility Located at 100 Amherst Avenue













CHEMTRADE

# Chemtrade Vision 2030 Project

## Project overview

Chemtrade's North Vancouver chlor-alkali facility is Canada's largest provider of liquid chlorine and has been safely producing and distributing this important commodity since 1957. Chlorine is most commonly used as a disinfectant in the treatment of safe drinking water. Chemtrade supplies 40 percent of all liquid chlorine used for drinking water in Canada and regionally, and this equates to over 70 percent of the liquid chlorine available in British Columbia (BC) and Alberta. Chemtrade's site has operated safely in North Vancouver for more than 68 years, and since 2010, over $500 million has been invested to improve safety and reliability, and to modernize the facility.

The facility is a modern chlor-alkali plant, which produces chlorine, sodium hydroxide (caustic soda) and hydrochloric acid (muriatic acid), as well as one co-product, green gaseous hydrogen. These products support a wide range of industrial customers that are the base of our Canadian economy, including water treatment, innovation and technology, the energy sector, pulp and paper, and the automotive industry:

- **Chlorine** – Used to kill bacteria, microbes and viruses, and is an essential ingredient in treating municipal drinking water systems for safe drinking water. Chlorine is also used in consumer products such as textiles, paint and PVC plastics.
- **Sodium hydroxide** – Used in household cleaners and soap, food preservation, pharmaceuticals, textiles, glass production, the energy industry, pulp and paper, and more.
- **Hydrochloric acid** – Has hundreds of applications, including food preservation, and is a key ingredient used to make PVC plastic. It is a key ingredient in battery production, including electric vehicle (EV) batteries, and the energy sectors.
- **Hydrogen** – A co-product of the manufacturing process, this is a 100 percent renewable, green energy source, which could be further developed to help achieve BC and Canada's decarbonization and climate change commitments.

Chemtrade is proposing to undertake strategic safety improvements on a portion of the site located in the jurisdiction of the District of North Vancouver. These improvements require a District of North Vancouver zoning bylaw amendment and development permit. The proposed upgrades and improvements are focused on increasing safety and reliability, while further reducing potential risks to the neighbouring community. The output of products manufactured on the site would not increase as a result of these changes, but the proposed improvements would allow Chemtrade to transition to a produce and ship model resulting in a decrease in on-site storage of liquid chlorine.

## Background

Chemtrade is a Canadian company, headquartered in Toronto, Ontario, with a chlor-alkali plant in North Vancouver, BC. Chemtrade operates a diversified business providing industrial chemicals and services to customers across North America and around the world. In 2017, Chemtrade acquired Canexus, the previous owner of the North Vancouver plant.

The plant was originally constructed in the 1950s with a major technology upgrade in 2011 to modernize and expand production. Since that time, more than $500 million has been invested to improve the safety and reliability of the facility, including:

- Transition of chlorine production from technology using asbestos to new cells that use plastic membranes.
- Installation of updated technology for better mapping of potential risk and scenario modelling.
- Significant operational changes to reduce onsite storage of liquid chlorine by over 94 percent (using year 2000 as the benchmark).

The plant is fully automated and is continuously monitored by state-of-the-art automation systems that feature:

- Multiple sensors capable of detecting chlorine and hydrochloric acid gas as low as 0.1 parts per million and automatically notifying operators of any abnormalities in operations.
- Automated controls that close all valves, securing the chlorine within the system, in the case of a power outage.
- Automatic stop of production and isolation of key areas in the event that levels outside of normal operating ranges are detected.

A portion of the North Vancouver facility is on lands leased from the Vancouver Fraser Port Authority. In April of 2025, Chemtrade and the port authority reached a non-binding letter of intent with terms running through to December 31, 2044.

## Current operations

The North Vancouver Chemtrade facility is located at 100 Amherst Ave., in an industrial area, approximately 700 metres to the east of the Ironworkers Memorial Bridge, with Burrard Inlet bordering the site to the south. The site has both rail and marine access, which is critical for both raw material receiving and final product shipping. Neighbours include an active port terminal, a waste and recycling transfer station, a sodium chlorate production facility, an aggregates supplier and a planned liquid hydrogen facility.




Figure 1 – Current operations at North Vancouver facility

The current Chemtrade facility:

- Has 118 direct, full-time, permanent employees with an annual payroll of over $23.3 million.
- Injects over $137.4 million into the economy through spending with suppliers, contractors and businesses.

- Is a modern chlor-alkali plant, producing chlorine, sodium hydroxide and hydrochloric acid through sustainable electrochemical processes.
- Is one of the greenest producers of chlorine in North America, powered almost exclusively on green, renewable hydroelectricity, self-produced hydrogen and solar-dried ocean salt.

## How the chlorine production process works

To produce chlorine, the North Vancouver facility uses electrochemistry with three simple inputs: water, salt and electricity. The process generates virtually no waste, greenhouse gas or pollutants.

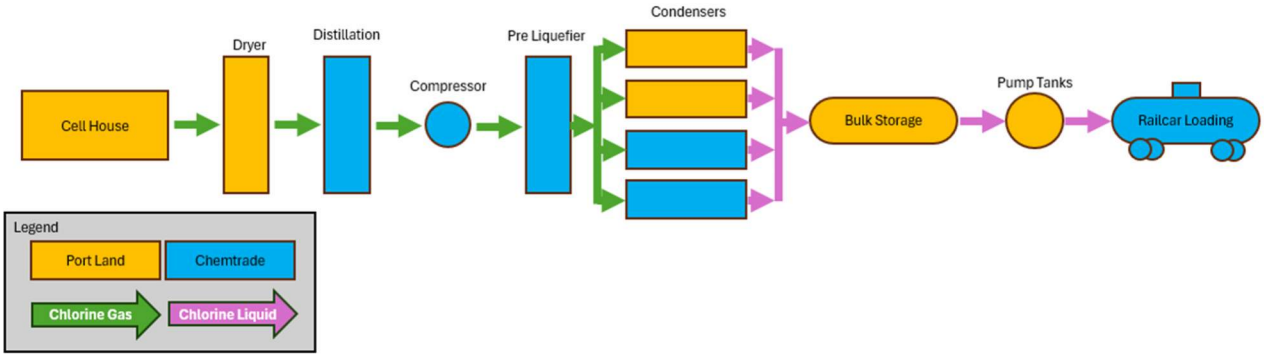



Figure 2 – Chlorine production process diagram (current state)

Chlorine is produced through the electrolysis of brine (salt water) in 14 electrolyzer units located in the "Cell House" building. The chlorine is a vapor at low pressure that is then piped through a three-stage dryer to remove water. The dry chlorine then passes through the distillation column where a slip stream of liquid chlorine is mixed with the chlorine gas in a process designed to pre-cool the chlorine gas and remove process impurities. The cooled chlorine gas continues to flow out of the distillation column to two chlorine compressors that pressurize the chlorine gas.

The chlorine gas then flows through a pre-liquefier that starts to cool the gas even further before it flows into multiple refrigeration condensers, which condense the chlorine gas to liquid.

The liquid chlorine flows from the condensers into a 60-tonne bulk storage tank. From the bulk storage tank, the liquid chlorine is pumped into railcars or back to the distillation column. All loading operations take place via specialized *next generation* chlorine railcars with unprecedented safety protections.

## Proposed facility upgrades

Chemtrade is proposing the following safety improvements to support our ongoing commitment to safe, reliable operations:

- **Enclosed chlorine railcar loading area** – The building would be equipped with sophisticated air scrubbing technology and would capture and contain chlorine leaked during a railcar loading accident — completely removing it from the atmosphere.
- **Seismic upgrades** – Installation of seismically activated safety shutoff valves.
- **Onsite storage reduction** – Elimination of chlorine storage tanks.

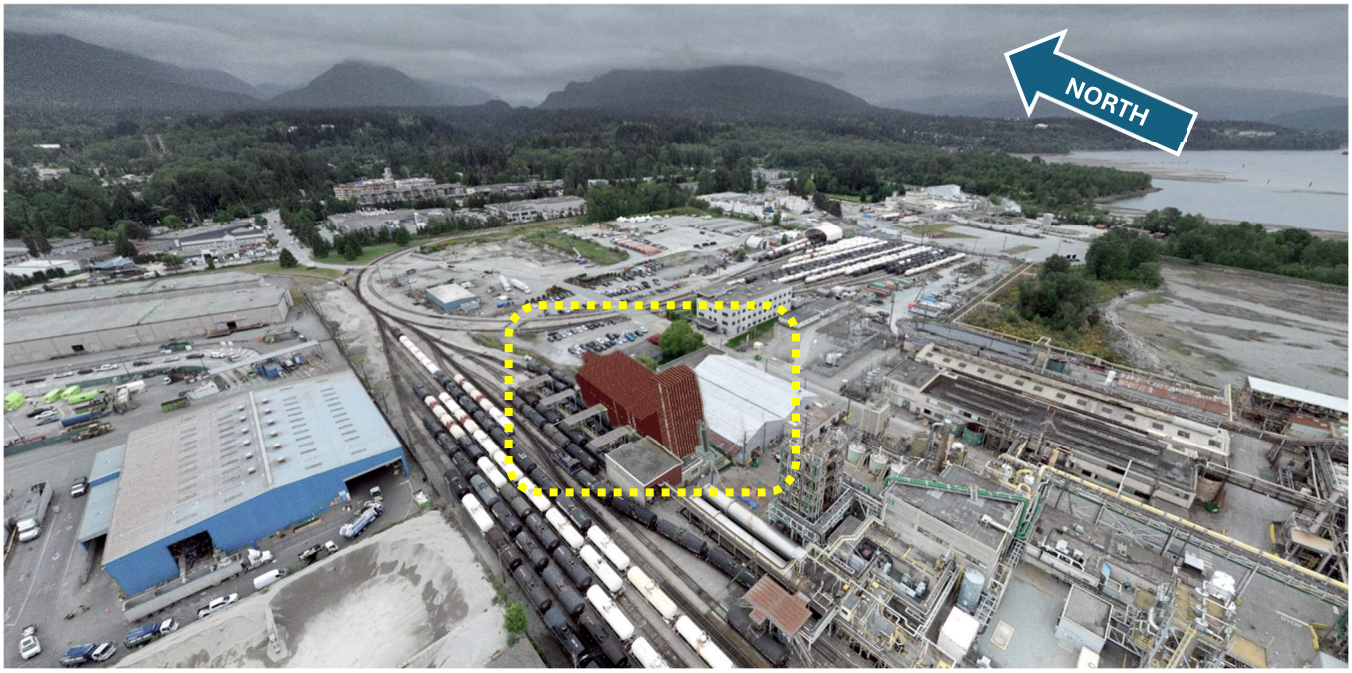



Figure 3 – Rendering of proposed railcar loading building, emergency vent system and condenser tower

Proposed safety upgrades would improve overall site safety and bring operations in line with industry best practices and guidelines by reducing risk to the neighbouring community with risk contours near or at the site property boundary. No changes to chlorine production are planned in terms of quantity or the process. All unit operations upstream of the pre-liquefier remain unchanged.

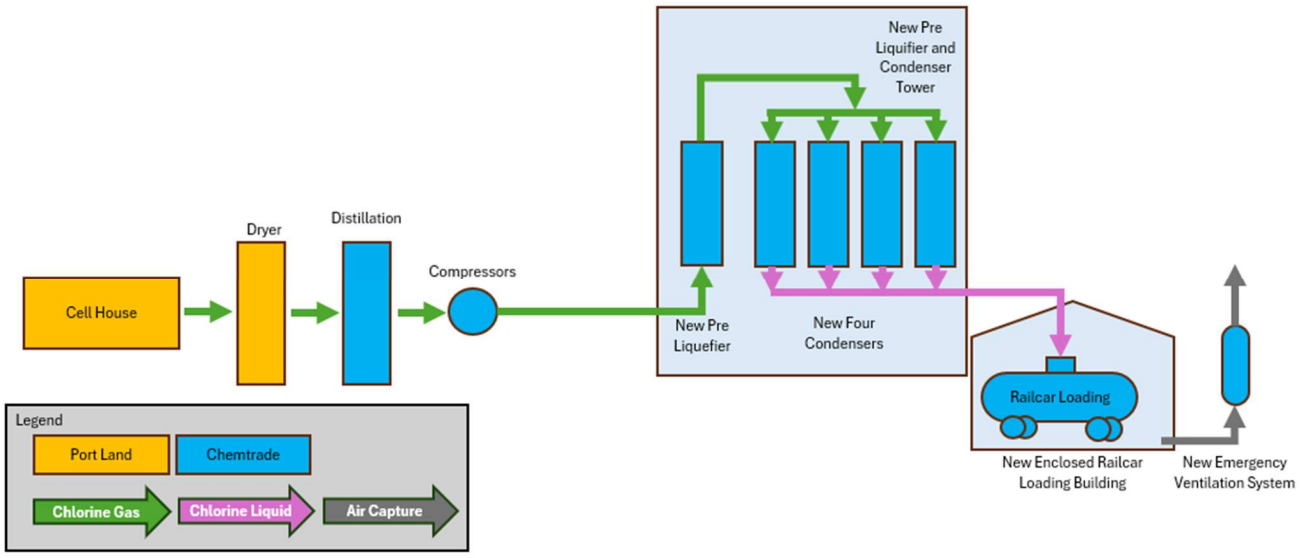



Figure 4 – Chlorine production process diagram (after proposed upgrades)

After the proposed upgrades, the chlorine gas would flow to a new pre-liquefier and four new chlorine condensers that would be located 80 feet above ground to allow for the gravity flow of liquid chlorine down to railcar loading. This

eliminates the 60-tonne bulk storage tank and tank pumps that are currently located on port authority land. The railcar loading pressure would be reduced significantly from the current pump design. All railcar loading activities would take place in a new load out building with an Emergency Ventilation System. The combination of the elimination of the 60-tonne bulk storage tank and the contained and ventilated railcar building significantly reduces the probability and the consequence of a release impacting anyone off site.

**Anticipated project timeline for implementation of safety improvements:**

- Roughly four years to complete all proposed improvements
- All construction work would be tied back into the plant major maintenance outages that are scheduled every two years
- Next planned major outages are scheduled for 2026 and 2028

# Project benefits

The Chemtrade North Vancouver chlor-alkali facility produces over 40 percent of all liquid chlorine available in Canada. This equates to 70 percent of the liquid chlorine used to treat drinking water in Western Canada and 60 percent of the chlorine used to treat drinking water in the Western United States.

According to a Statistics Canada Survey in 2015, 96 percent of municipalities in Canada—supplying almost 31 million Canadians—use chlorine to treat their domestic water supplies. As it stands, safe and responsible liquid chlorine remains the most responsible and safest method of securing drinking water for millions of Canadians.

Extending Chemtrade's operations in North Vancouver into the future will:

- Secure a long-term supply chain for clean drinking water within Canadian borders.
- Support stable operations for our employees and the businesses that use our products.
- Help meet BC's and Canada's climate change goals with key products that support electrification across various sectors, including low-carbon energy production.
- Improve safety and significantly reduce any potential risk to the community, bringing risk contours to the property line on the north edge of the facility.

Removing Chemtrade supply in 2030 would leave a large gap in the supply chain in both Canada and the United States, particularly in Western Canada. The next closest chlor-alkali facility is in Saskatchewan, with the only other two facilities located in Quebec. Recent closure announcements for several United States chlor-alkali facilities create uncertainty about market supply for Canada and how shortages would be filled. Recent labour disruption for railways and ongoing complex trade negotiations with the United States also underscore the importance of establishing and maintaining a reliable domestic supply chain, especially for products essential to the health of Canadians.

Chemtrade can also help supply the critical raw materials for EV and renewable battery production that would bring new investment and supply chains to Canada and is exploring the used of hydrogen co-products to help power industrial facilities.

# Policy Alignment

## District of North Vancouver

The Chemtrade facility has been safely operating since 1957, but a bylaw was passed in 1984, which prohibited the manufacturing of hazardous substances in all zones in the District of North Vancouver. Since that time, the Chemtrade facility has been operating as a "lawful non-conforming use" under s. 528 of the *Local Government Act* given that the facility predates the prohibition on the manufacture of hazardous substances in the Zoning Bylaw.

In order to provide the building permits for Chemtrade's planned safety improvements for the facility, Chemtrade is required to go through the rezoning process to have the manufacturing of liquid chlorine listed as an exemption within the bylaw. The facility aligns with the follow District policies:

**Land Use** – Zoning remains the same as the existing classification, which is Employment Zone – Industrial. The site is consistent with the Official Community Plan (OCP) designation and does not require an OCP amendment. If successful, the rezoning application would allow for the production of chlorine to be listed as an allowable activity at the facility.

**Economic Development** – Alignment with the Targeted OCP Action Plan's economy and employment lands' goals of protecting and intensifying industrial lands for employment uses, generating capital investment, supporting job creation, supporting the creation of a low carbon energy source, and establishing the District as a leader in the green economy. The District aims to partner with port, trade and freight organizations to ensure safe and efficient goods movement to support a diverse and resilient local economy that provides quality employment opportunities.

## Vancouver Fraser Port Authority

In April 2025, Chemtrade and the Vancouver Fraser Port Authority signed a non-binding letter of intent to extend Chemtrade's current land lease until the end of 2044.

The Vancouver Fraser Port Authority is a federally established Canada Port Authority responsible for the shared stewardship of the lands and waters that make up the Port of Vancouver. As mandated under the *Canada Marine Act*, the port authority's purpose is to enable Canada's trade by being reliable and innovative, while protecting the environment. One of the ways in which the port authority carries out its mandate is by leasing out lands to the terminal operators who move cargo through the port.

**Environmental stewardship and sustainability** – Alignment between the port authority's strategic priority to facilitate the transition to net-zero emissions for the Port of Vancouver by 2050 and Chemtrade's current targets to reduce Scope 1 greenhouse gas emissions by 50 percent (from 2021 levels) by 2025.

**Safety and risk management** – The port authority provides a high level of safety and environmental protection by serving as a permitting authority for projects on port authority lands and running a suite of environmental programs. Chemtrade maintains rigorous safety protocols at its North Vancouver chlor-alkali facility and undertakes capital investment projects to enhance safety and reduce on-site chlorine. Chemtrade is also engaged and coordinates emergency response efforts with local first responders such as Northshore Emergency Management and the District of North Vancouver.

## Province of British Columbia

On February 26, 2025, Premier Eby expressed his support for the continued operation of Chemtrade's North Vancouver chlor-alkali facility and acknowledged the facility's critical role in securing safe drinking water for millions of North

Americans. The Premier also urged the District to expedite and approve Chemtrade's rezoning application in a timely manner to ensure business continuity for the facility and the safety of drinking water.

**BC Manufacturing Action Plan** – The BC Manufacturing Action Plan outlines the Province's five strategic pillars to grow BC's manufacturing sector by strengthening industrial competitiveness and capitalizing on industries of highest opportunity. The plan also aligns with other key provincial initiatives, such as StrongerBC Economic Plan, CleanBC Roadmap to 2030 and the Maritime Industries Strategy.

## Government of Canada

The federal guidelines for Canadian drinking water quality refer to chlorine as the primary water treatment chemical for safe drinking water, and almost all technical documents for water treatment use chlorine dosage or testing parameters exclusively for treatment. Furthermore, a survey conducted by Statistics Canada in 2015 found that 96 percent of municipalities were relying on chlorine to treat their municipal water supply.

## Metro Vancouver

Chemtrade's chlor-alkali facility in North Vancouver consistently supplies and delivers various commodity chemicals for Metro Vancouver drinking water treatment plants.

# Overview of project effects

The environmental impact from the production process for chlorine is minimal and does not generate any hazardous waste material or pollution. The overall carbon footprint of the site is very low due to the fact Chemtrade uses green hydroelectricity (BC Hydro supplied), and the salt used in the manufacturing process is solar dried sea salt. Overall, the facility is one of the greenest chlor-alkali facilities in the world.

Based on recent technical studies for the proposed capital improvements, there are no anticipated effects on traffic, noise, odour and air quality.

# Community Engagement

Chemtrade has been leading an extensive community engagement program since 2023 to raise awareness about the project operations, the importance of the facility and to answer questions and address concerns. Through the extensive engagement program, Chemtrade has worked to ensure there is a broad understanding of the company's commitment to safety and responsible operation, as well as the risk to safe drinking water for millions of Canadians should the facility in North Vancouver no longer be able to produce liquid chlorine.

Chemtrade's outreach is ongoing and includes:

- Federal, provincial, regional and municipal governments
- Local First Nations
- District of North Vancouver First Responders
- Vancouver Fraser Port Authority
- Community associations
- Community Advisory Panel (regular monthly meetings)

- North Vancouver Chamber of Commerce
- Local businesses
- Broader community
- Media

Community outreach activities include:

- **Engagement website** – Launched askchemtrade.ca in 2024 to provide information about facility operations, the commodities produced onsite, proposed upgrades, frequently asked questions and a BC-wide survey completed in 2023.
- **Community newsletter** – Regular email newsletter to community associations, elected officials, special interest groups, local media and First Nations to promote community events and provide information about the facility and proposed project.
- **Community events** – Sponsored local projects and initiatives, initiated a public tour program and hosted two community open house meetings.

More information is available in the engagement summary section of Chemtrade's rezoning application.









# Chemtrade North Vancouver Rezoning Application Engagement Summary

## *Securing safe drinking water for Canada*

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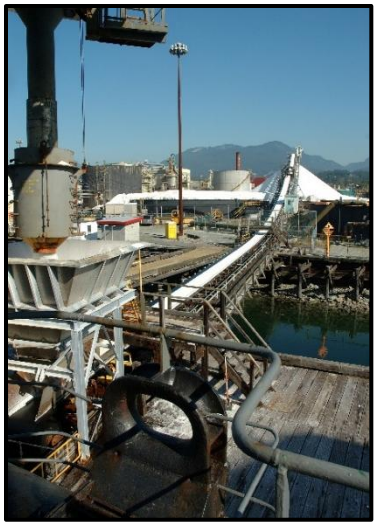

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## Chemtrade North Vancouver Rezoning Application Engagement Summary
## Securing safe drinking water for Canada

***Engagement efforts to secure the long-term operations of Chemtrade's North Vancouver chlor-alkali facility***

This document summarizes Chemtrade Electrochem Inc.'s (Chemtrade) engagement efforts between 2023 and 2025, what we have learned, and key considerations for ongoing operations in support of Chemtrade's rezoning application to the District of North Vancouver.

## Background



Operating since 1957, the facility is a modern chlor-alkali plant, which produces chlorine, caustic soda, and hydrochloric acid. These products support industries like water treatment, innovation and technology, oil and gas, pulp and paper and the automotive industry. Chemtrade has a proven track record of safe operations, with plans to continue to improve and reduce potential risk to the local community.

In reviewing business options for the facility, Chemtrade became aware of the significant role the facility plays in securing safe drinking water for millions of Canadians and Americans. The facility produces up to 70 per cent of the liquid chlorine used to treat drinking water supplies in British Columbia (BC) and Alberta, which equates to 40 per cent of the available liquid chlorine in Canada. A 2015 Statistics Canada survey showed that 96 per cent of Canadian municipalities rely on chlorine to treat its municipal water supply, making the ongoing operation of the North Vancouver chlor-alkali facility critical for securing safe drinking water supplies in Canada.

The facility is located on land owned by Chemtrade, in the District of North Vancouver (the District), as well as on land that Chemtrade leases from the Vancouver Fraser Port Authority (the Port). Within the current lease, which expires in 2032, there is a restriction on liquid chlorine production beyond June 2030 on Port-owned land. In order to secure long-term operations, Chemtrade began to engage with the Port in mid-2023 to determine the possibility of securing a long-term lease renewal. The process included not only engaging with the Port, but with government (municipal, provincial and federal), local First Nations, and the community to determine support for our continued operations.

During this engagement, Chemtrade shared its plans for continued operations, including significant investment in additional improvements that will significantly lower potential risk for the community and improve safety. These improvement projects would include enclosing the rail car loading area and equipping the building with air scrubbers, installing seismically-activated safety shutoff valves, and reducing onsite storage of liquid chlorine to four tonnes – a reduction of over 99 per cent from year 2000 levels. Once completed, these projects will significantly reduce any potential risk to the community, bringing risk contours to the property line on the north edge of the facility. More

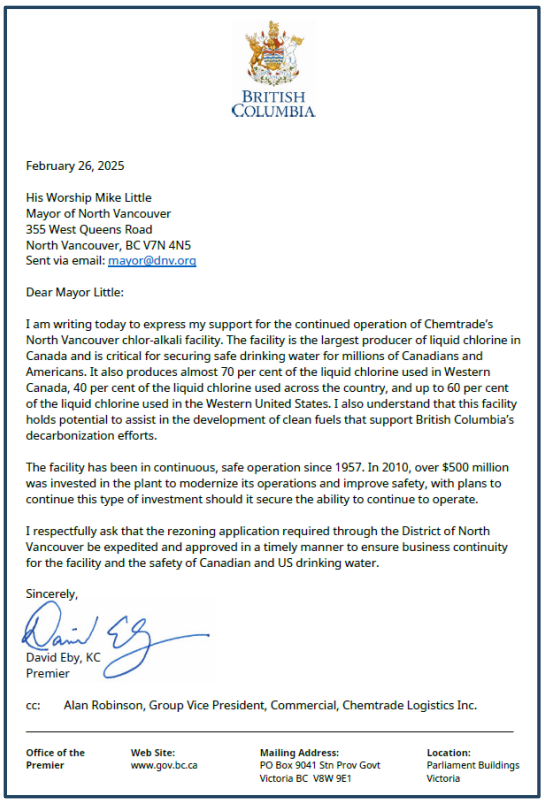
information regarding these planned improvements is included as part of the rezoning application and is further detailed as part of this engagement summary.

In the fall of 2024, through continued engagement with the District, it was determined that in order to proceed with planned safety improvements, Chemtrade would need to apply for a Development Permit, which would trigger the need to apply for rezoning of the property to allow for the continued production of liquid chlorine.

This report provides information on Chemtrade's significant engagement efforts, and details feedback from various stakeholders and Nations, and how concerns have been addressed or mitigated.

It should be noted that as a result of ongoing engagement efforts, Chemtrade has received the following important demonstrations of support towards its ongoing operations:

- In January 2024, Chemtrade received a letter of support for its continued and ongoing operations from City of Kelowna Mayor and Council. Letter included in Appendix A
- In March 2024, Chemtrade received a letter of support for its continued and ongoing operations from City of Fort St John, BC Mayor and Council. Letter included in Appendix A
- In October 2024, Chemtrade received an email from the Government of Alberta (Environment and Protected Areas, Drinking Water and Municipal Wastewater Program) expressing support for Chemtrade's ongoing operations. Email enclosed as part of Appendix A
- In October 2024, Chemtrade received a letter of support for its continued and ongoing operations from the Chemistry Industry Association of Canada. Letter included in Appendix A
- In December 2024, Chemtrade received a letter of support for its continued and ongoing operations from the American Chemical Association. Letter included in Appendix A
- In January 2025, Chemtrade received a letter of support for its continued and ongoing operations from EPCOR, a major supplier of municipal water in Alberta – serving Calgary, Edmonton and many other communities. Letter included in Appendix A
- **In February 2025, a letter of support for Chemtrade's ongoing operations was sent by the Premier of British Columbia, David Eby to the District of North Vancouver asking for the expedited review and approval of Chemtrade's rezoning application. Letters included in Appendix A**



BRITISH COLUMBIA

February 26, 2025

His Worship Mike Little
Mayor of North Vancouver
355 West Queens Road
North Vancouver, BC V7N 4N5
Sent via email: mayor@dnv.org

Dear Mayor Little:

I am writing today to express my support for the continued operation of Chemtrade's North Vancouver chlor-alkali facility. The facility is the largest producer of liquid chlorine in Canada and is critical for securing safe drinking water for millions of Canadians and Americans. It also produces almost 70 per cent of the liquid chlorine used in Western Canada, 40 per cent of the liquid chlorine used across the country, and up to 60 per cent of the liquid chlorine used in the Western United States. I also understand that this facility holds potential to assist in the development of clean fuels that support British Columbia's decarbonization efforts.

The facility has been in continuous, safe operation since 1957. In 2010, over $500 million was invested in the plant to modernize its operations and improve safety, with plans to continue this type of investment should it secure the ability to continue to operate.

I respectfully ask that the rezoning application required through the District of North Vancouver be expedited and approved in a timely manner to ensure business continuity for the facility and the safety of Canadian and US drinking water.

Sincerely,

David Eby, KC
Premier

cc: Alan Robinson, Group Vice President, Commercial, Chemtrade Logistics Inc.

Office of the Premier | Web Site: www.gov.bc.ca | Mailing Address: PO Box 9041 Stn Prov Govt Victoria BC V8W 9E1 | Location: Parliament Buildings Victoria

- Chemtrade announced in April 2025 that they had signed a non-binding Letter of Intent (LOI) with the Vancouver Fraser Port Authority to extend its land lease until December 31, 2044. A copy of the news release is included in Appendix F.

## Approach to engagement: understanding the concerns and issues

Chemtrade is committed to transparent, factual, and timely engagement with all stakeholders and First Nations.

To ensure full and proper engagement, efforts to communicate have been focused on several audiences. To ensure consistent information is shared, and in-line with Chemtrade's commitment to transparency, the same information is shared with all audiences. See the community engagement presentation used, included in Appendix C of this report.

### Identified audiences

**Government**

- *Municipal elected officials and staff*
- *Provincial elected officials and staff*
- *Federal elected officials and staff*
- *The Vancouver Fraser Port Authority*
- *Metro Vancouver Regional District*

**First Nations**

- *Tsleil-Waututh First Nation*
- *Squamish Nation*

**Stakeholders**

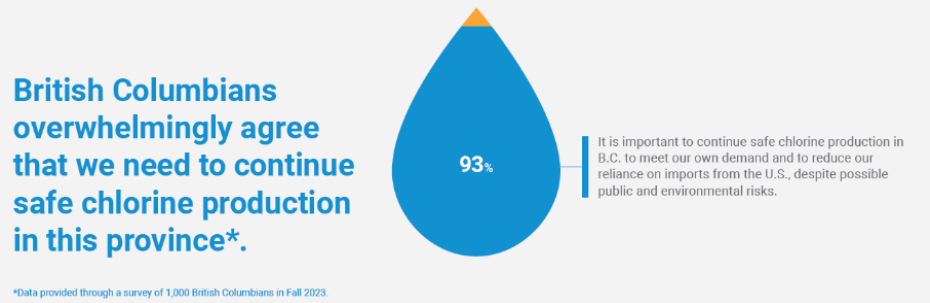
- *Local special interest groups (Lions Club, Chamber of Commerce, local school Parent Advisory Committees, etc.)*
- *Media*
- *Community Advisory Panel (CAP) for the facility and neighboring businesses*

**Local community**

- *Community Associations*
- *Local businesses*
- *North Vancouver residents*
- *Lower Mainland residents*
- *British Columbians and Albertans*
- *Canadians*

### Ensuring community questions and concerns are being addressed

To further confirm that Chemtrade was engaging on the right issues, Chemtrade commissioned a survey through H+K, which was conducted between September 28 and October 4, 2023. In total, 1,002 adult respondents from across BC were surveyed online. The associated margin of error for a probability-based sample of this size would be ±4%, 19 times out of 20. The results showed that an overwhelming 93 per cent (93%) of survey respondents agree that chlorine should continue to be safely produced in BC. A full summary of the survey is available on Chemtrade's engagement website www.AskChemtrade.ca.



Using all of this information, a comprehensive engagement plan was developed, that included outreach to all levels of government – federal, provincial and municipal, as well as local First Nations, the Port, special interest groups (community associations, Community Advisory Panel, Chamber of Commerce, local businesses, etc.) and the broader community.

## Identifying and mitigating concerns

As Chemtrade started to engage with the community, Nations and local elected officials with all levels of government, it became aware of historical issues that were influencing perception of the facility and its operations. Many were based on outdated or inaccurate information, but some were focused on current operations and the risk associated with continued operations. In general, Chemtrade encountered three major areas of concern:

1. Concerns regarding the behavior and impact of liquid chlorine during a potential large-scale release incident
2. Concerns regarding safety risk to the community
3. Concerns regarding the shipment of chlorine (rail safety)

Although Chemtrade did not purchase the facility until 2017, it is aware of these historical concerns and is working to both raise awareness on the risk to Canada's drinking water supply, while also addressing the community's safety concerns.

### Addressing concerns: Working to reduce risk for the community

The biggest concern voiced by the community was in regard to risk to the community. To support the engagement efforts, Chemtrade engaged BakerRisk, an independent third-party company with significant expertise in developing quantitative risk assessments (QRAs). Using current practices and technology, BakerRisk revised the previously completed QRA mapping to reflect Chemtrade's current operations.

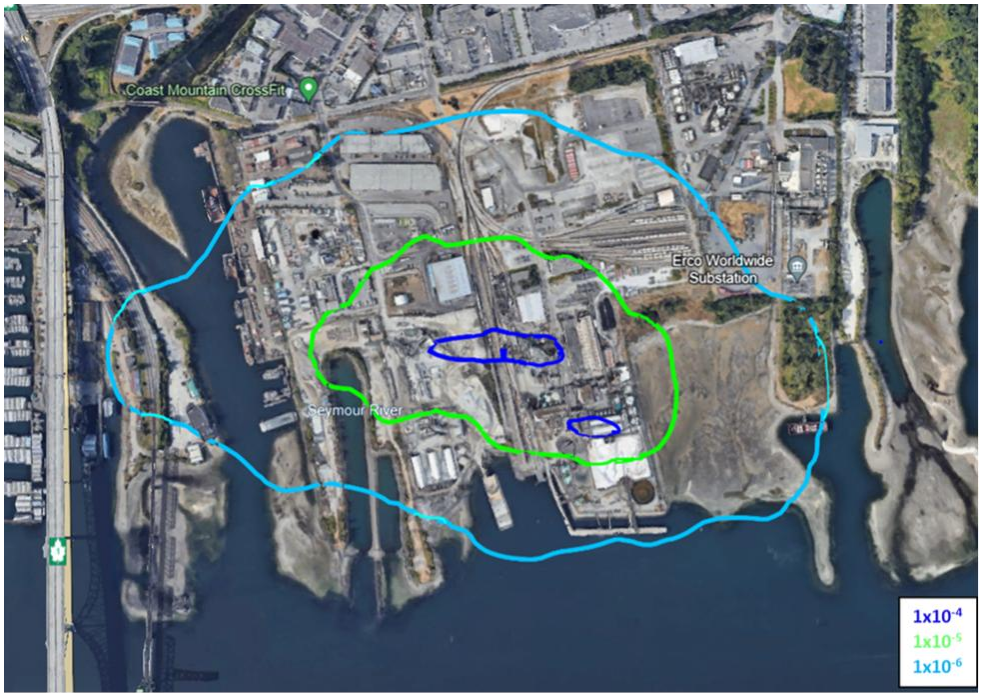
This mapping (below) has been shared widely as part Chemtrade's engagement efforts and is also available at any time to the public on www.AskChemtrade.ca.




***Most recent risk curves, as developed in 2006, reflecting current operations***

Baker Risk also completed QRA modelling to reflect proposed additional safety investments in the site, aimed at further reducing potential risk to the community, and bringing the $10^6$ line either to, or near, the facility property line (note: the $10^6$ line represents the odds of someone being fatally injured by Chemtrade's operations and equates to one in a million).

The draft updated mapping (below) reflects the changes to the QRA curves following the completion of these proposed capital projects, which include the elimination of the bulk storage of liquid chlorine and moving all loading activities to a sealed building that would use scrubbers to remove any chlorine from the air, should a leak occur during the rail loading process. It also includes the installation of seismic sensors, capable of initiating a site shutdown in the event seismic activity is detected. ***It is important to note that the below QRA map reflects the full release of all chlorine onsite – regardless the cause.*** Sharing this information with community members has been critical in helping residents understand that in the case of a major disaster, such as an earthquake, or accidental release, the impacts to the community – following the completion of the proposed safety upgrades – would be greatly reduced and mostly contained to within the facility property lines.




***Risk curve modelling following execution of additional risk mitigation projects***

Chemtrade intends to move forward with filing for the development permits required for this work as soon as rezoning approval is obtained. The projects will require time to complete, as they would need to be completed during facility maintenance shutdowns, which are scheduled every two years. Once this risk reduction work is complete, the details will be shared with the community.

This information, including the detailed maps pictured above, is shared as part the community engagement presentation (***available in Appendix C***), on www.AskChemtrade.ca , and has been included in the majority of community newsletters (***available in Appendix E of this report***).

## Addressing concerns: The behavior of chlorine in the event of a large release

There were concerns raised by residents that in the event of a large release, chlorine would travel up the nearby slope and into the community. Through engagement efforts, Chemtrade has been able to address these concerns by sharing the properties of chlorine that would make this scenario highly unlikely.  in the event of an accidental release, the liquid chlorine would almost immediately turn into a gas because to remain a liquid, it needs to be below -32 degrees Celsius. Once in its gaseous form, chlorine is two and a half times heavier than air and tends to sink rapidly to ground level and flow downhill, pooling in lower areas. Once exposed to the elements – wind, water, rain, temperature, and sunlight - it will begin to quickly break down. Given the right circumstances, chlorine can be moved by strong wind, but that action would help to further dilute and breakdown the chlorine. In water, like the ocean, which is directly to the south of the facility, the gas would dissolve, converting to chloride and hypochlorous acid – both of which are not harmful to the environment.

This information has been shared widely as part of the engagement efforts and is also available as an FAQ on www.AskChemtrade.ca. The specific FAQ regarding the behavior of liquid chlorine is listed below but is also ***included in Appendix D of this report***.

***If there were to be a large release of chlorine from the Chemtrade North Vancouver facility, would the chlorine liquid or gas travel uphill into surrounding communities?***

The facility is equipped with several layers of automated safety equipment, including backup systems, which would help to prevent or greatly minimize the impact of any potential accidental release of chlorine from the facility.

The system includes 72 sensors, located around the site, that can detect chlorine at less than 1 part per million. If detected, the system will automatically notify operators and begin to shut down and isolate the system. The site also has negative pressure tanks that are capable of capturing all of the chlorine on site if required and can safely store it for proper disposal. There have also been significant changes in how liquid chlorine is stored, reducing onsite storage of liquid chlorine by over 94 per cent using the year 2000 as the benchmark (onsite storage in the year 2000 was up to 1,600 tonnes, while today's storage is up to 93 tonnes) which greatly reduces the impact and risk from a potential release incident.

All of this being said, in the unlikely event that an accidental release occurs, it is highly unlikely that the chlorine would travel uphill to higher elevations. The liquid chlorine would immediately change from a liquid to a gas, as it will not remain as a liquid under ambient conditions (chlorine needs to be chilled to -32 Celsius  to convert to a liquid). Once in its gaseous form, chlorine is two and a half times heavier than air and tends to sink rapidly to ground level and flow downhill, pooling in lower areas. Once exposed to the elements – wind, water, rain, temperature, and sunlight - it will begin to quickly break down. Given the right circumstances, chlorine can be moved by strong wind, but that action would help to further dilute and breakdown the chlorine. In water, like the ocean, which is directly to the south of the facility, the gas would dissolve, converting to chloride and hypochlorous acid – both of which are not harmful to the environment.

### Addressing concerns: The safety of transporting chlorine

In Canada, aside from those facilities that are directly connected to a customer via pipeline, the only way to transport liquid chlorine is by rail. Given this, the transport of chlorine is highly regulated to ensure the safe movement of chlorine from loading, through to the delivery of the product to customers.

Chemtrade maintains and operates a fleet of leased railcars, all meeting the latest regulatory specifications and industry standards for the shipment of our chlorine. The cars themselves have several layers of protection – from roll-over protection bars to increased shell thickness and are the safest way to transport liquid chlorine.

The rail cars that Chemtrade uses for the transport of liquid chlorine are inspected when they arrive at site, then again before they are loaded. If any defects are found during either pre-loading inspection, the cars are immediately pulled into our onsite railcar shed for repair. The cars are inspected again after loading to ensure they are safely sealed and ready for transport.

The rail cars have a regular maintenance schedule, with a full car overhaul scheduled for every three years. In general, the life span of a chlorine railcar is approximately 25 years.

It should be noted that rail cars are not used as a method of onsite storage for liquid chlorine, as some residents have expressed concerns regarding the number of cars at the Chemtrade site at any given time, as well as questions regarding the contents of the cars.

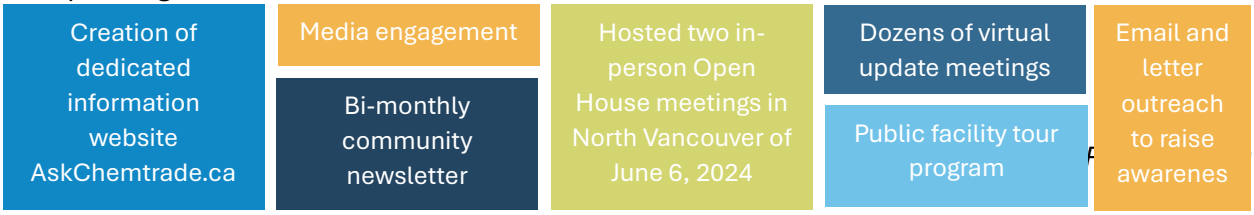
While there is space for up to 270 railcars at the site at any given time at the facility, the number of cars on site can vary from one day to the next. Using data from full years 2023, 2024 and the beginning of 2025, Chemtrade determined averages in terms of numbers of cars on site, and contents of cars by product.

The average number of rail cars that are sitting empty on the site at any given time is 159, which accounts for over 63 per cent (63.3%) of the total cars on site. In comparison, at any given time, there is an average of 32 cars containing liquid chlorine on the site awaiting transport - representing just under 13 per cent (12.7%) of all cars on our site. The remaining 24 per cent (24%) of railcars are a combination of those that contain caustic soda (27 cars) and hydrochloric acid (28 cars).

This information has been shared during engagement opportunities but is also available through www.AskChemtrade.ca in both the safety section, as well as through the FAQs (***available in Appendix D of this report***).

## Engagement philosophy, approach and tools

In order to ensure that the public, stakeholders, Nations, and elected officials receive information regarding their areas of concern, Chemtrade has continued to add to the information available. As well as the tools used to share information, to ensure relevant information was easily available for all audiences. Several tools were created specifically for the engagement process, while still incorporating traditional tools like letters and direct outreach. Tools used include:



### *Community engagement update presentation for use in all engagements (in person and virtual)*

All engagement has been initiated by Chemtrade through direct outreach by Chemtrade employees via email, phone or letter, requesting formal meetings and offering site tours. A consistent community engagement presentation has been shared during all meetings and presentations (***the presentation is included in Appendix C***) to ensure all audiences receive the same information. To date – Chemtrade has shared this presentation with dozens of elected officials and staff, local First Nations, stakeholders, special interest groups and members of the community.

### *Creation of engagement website – www.AskChemtrade.ca*

Following this, a formal engagement website – http://www.askchemtrade.ca/ www.AskChemtrade.ca - was created and launched to the community. The site contains information on our operations, the planned safety improvements, updated and draft quantitative risk mapping (QRA curves), as well as links to all issues of the community newsletter, information shared at our open house, FAQs, and the opportunity to submit feedback or ask questions. Visitors to the website are invited to sign up for information alerts and are also provided with the email address for the District of North Vancouver Mayor and Council so they can provide their feedback on Chemtrade's proposed continued operations.

### *Hosting two Open House Information meetings in June 2024*

On June 6, 2024, Chemtrade hosted two Open House meetings in North Vancouver to raise awareness of Chemtrade's efforts to secure long-term operations, as well as provide information on the facility, its operations, current and planned safety improvements, and the role the facility plays in securing drinking water for millions of Canadians. ***There is a detailed summary of this meeting included in Appendix B of this report.***

### *Launch of public tour program*

As part of the Open House meetings, attendees were provided with the opportunity to sign up for a facility tour. This offering was so popular, that Chemtrade decided to launch a formal public tour program – which to date, has taken dozens of residents through the facility. Sign up is through email, and directions for how to do this are available on www.AskChemtrade.ca, as well as in all community newsletters.

### *Creation of bi-monthly community newsletter*

Chemtrade also launched a bi-monthly community newsletter, which was used as a tool to provide timely updates, address concerns from the community and share progress updates. To-date, Chemtrade has produced and distributed seven issues of the newsletter – which can be ***found in Appendix E of this report***, or on www.AskChemtrade.ca.

### *Social and traditional media engagement*

To help promote our efforts, and counter misinformation, Chemtrade has engaged with the traditional media, the NorthShore News. In April 2024, Chemtrade was contacted by the outlet to confirm the information that it was seeking to renew its facility lease and secure long-term operations. Chemtrade participated in that interview, and were disappointed to find the information regarding securing safe drinking water and planned safety improvements was not included. https://www.nsnews.com/local-business/chemtrade-seeking-to-continue-liquid-chlorine-production-in-north-vancouver-8675809. It should be noted that one of the opponents quoted in

the article, Graham Gilley, has since reached out to Chemtrade to share that he was disappointed in how he was misquoted and is actually a support of Chemtrade's continued operations. ***This exchange and admission of support is included in Appendix A of this report.***

In May of 2024, in the lead up to the Open House meetings, Chemtrade engaged with NorthShore News and offered to provide an embargoed copy of the public presentation to be used in the meetings to the outlet. Senior leaders met with a reporter from the newspaper in late May and share the presentation and answered questions. The news outlet did not attend the open house but did provide advance coverage of the meeting (in the June 3, 3024 issue) to help drive awareness and spark attendance. It provided minimal coverage following the meetings.
https://www.nsnews.com/local-business/chemtrade-launches-public-engagement-with-open-house-thursday-8967643

In terms of online presence, in the summer of 2024, Chemtrade began to share online ads through Facebook, targeted at North Vancouver residents. The goal of these ads is to inform, and drive traffic to www.AskChemtrade.ca where residents could learn more about Chemtrade's efforts to secure long-term business certainty.

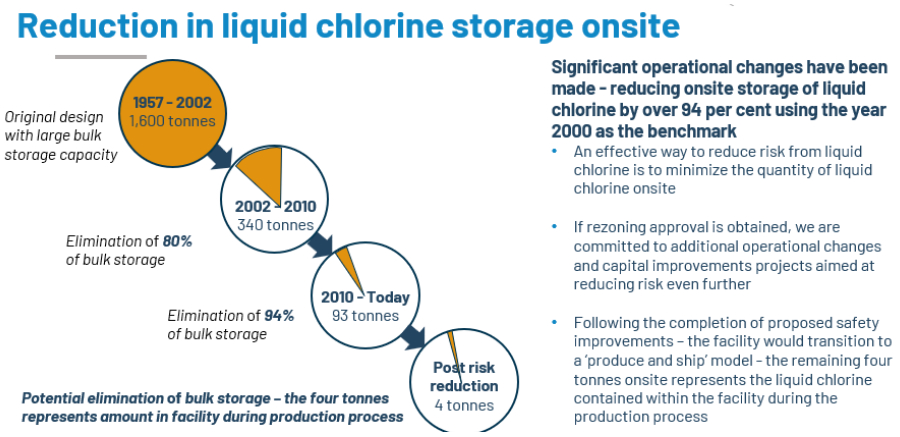
## Key information shared during all engagements:

The approached used during all engagement was to raise awareness regarding the potential risk to Canada's liquid chlorine supply should Chemtrade's North Vancouver chlor-alkali facility close, as well as share information regarding proposed safety improvements and the significant impact those improvements would have on reducing potential risk for the community.

### Information shared included:

- Chemtrade's North Vancouver chlor-alkali facility supplies 40 per cent of all liquid chlorine in Canada and is the only producer west of Saskatchewan - supplying over 70 per cent of the available liquid chlorine to BC and Alberta.
- Recent changes in both United States (US) supply priorities (i.e., secure domestic use first), policy changes through the US Environmental Protection Agency (EPA) i.e., banning asbestos diaphragm technology beyond 2029 which will directly impact eight chlor-alkali in the US. This paired with recent policy changes from the US Administration, calls into question the ability of Canada to reliably import chlorine from the US in the future.
- In addition to supplying over 40 per cent of Canada's liquid chlorine, Chemtrade's facility in North Vancouver supplies up to 60 per cent of the chlorine used in the Western US. The closure of the Chemtrade facility would increase US domestic demand, further reducing the likelihood of Canada being able to import chlorine for water treatment.
- A 2015 Statistics Canada survey showed that 96 per cent of Canadian municipalities rely on chlorine to treat its municipal water supply, making the ongoing operation of the North Vancouver chlor-alkali facility critical for securing safe drinking water supplies in Canada.
- The facility that is there today is very different than the facility of the early 2000s. Since 2010, over $500 million has been invested in the facility to modernize the operation and improve safety and reliability.
- There have been significant changes to how the facility is operated. Using the year 2000 as the benchmark, onsite storage of liquid chlorine has been reduced from 1,600 tonnes to the current onsite storage amount of approximately 93 tonnes. This has helped significantly reduce potential risk to the community as stored chlorine poses the highest risk.

- If the rezoning is approved, Chemtrade is committed to moving forward with several capital projects aimed at improving safety for the site and reducing risk for the nearby community. These projects include ethe construction of an enclosure around the rail loading area, which will be equipped with air scrubbers – capable of capturing, removing and storing any leaked chlorine form the air. Chemtrade would also look to install seismic sensors as part of its monitoring system, which would be able to trigger a site shut down in the vent of seismic activity.



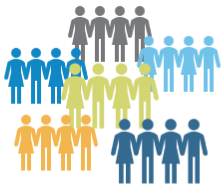

- Once the proposed safety improvements have been completed, the site will move to a manufacture and ship operating model, which will result in less that four tonnes of liquid chlorine – equivalent to the chlorine within the manufacturing system – being stored on site.
- The site has access to both rail and port – critical for both raw material import and shipping of completed products.
    - *The facility receives thousands of tonnes of salt – delivered via barge – from Mexico approximately every five weeks. To have the salt transported by any other means would be impractical and cost prohibitive.*
    - *The salt is solar dried ocean salt from the Baja region, making it a sustainable and green source of salt for production.*
    - *The location allows for direct loading of rail cars – which has been proven to be the safest way to transport hazardous materials (source AAR.org).*
    - *Chemtrade uses specifically designed cars for the shipping of its products, like liquid chlorine, to its customers.*
- In the fall of 2023, Chemtrade commissioned a poll of over 1,000 British Columbians, and results showed that an overwhelming 93 per cent of respondents agree that safe chlorine production in this province needs to continue.
- As experienced globally during the pandemic and currently being reinforced with the change in US administration, securing a domestic supply of goods and materials that are critical to the overall health of the country is critical.
- Chemtrade North Vancouver employees 118 full-time employees and has an annual payroll of over $23.3 million. The facility contributes over $137 million to the economy through spending with suppliers, vendors, contractors and service providers.

## Engagement timeline and actions:

As part of Chemtrade's application for rezoning with the District of North Vancouver, required in order to secure long-term business certainty and move forward with proposed safety improvements, below is a summary of Chemtrade's community engagement efforts to date.



***Hosted over 65 information update meetings** with all levels of elected officials (including US), First Nations, stakeholders, special interest groups, community members*



***Held two open house meetings** in 2024, attended by over 65 residents with overwhelming positive support*



***Initiated over 300 interactions** (letters, emails, phone calls, meetings, presentations) with overwhelmingly positive feedback received*



***Created three new engagement tools** www.AskChemtrade.ca, a community newsletter, and launched a public tour program*

### Summer 2023

- Initial contact was made with the Port to raise awareness that Chemtrade would like to open conversations regarding a long-term renewal of the facility's lease.

### Fall 2023

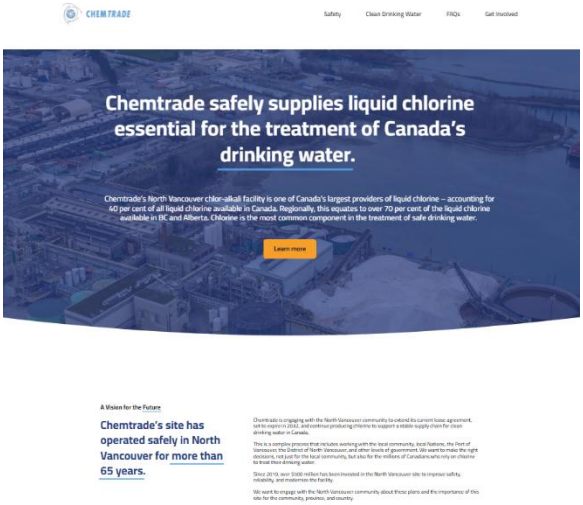
- Engagement with the Port continued
- Engagement with Federal Ministers and elected officials (Health; Public Safety; Citizens' Services; Innovation, Science and Industry; Transport; Energy and Natural Resources; BC Caucus Chair) began
- An awareness campaign within municipalities in both BC and Alberta was launched, with over 30 municipalities being contacted to raise awareness regarding the potential threat to a reliable, safe, domestic supply of liquid chlorine for water treatment.
- Outreach to two local First Nations was initiated
- Engagement with the Mayor and Dan Milburn initiated
- Engagement with Metro Vancouver Regional District (main supplier of water to Lower Mainland communities supplying 2.8 million residents with access to clean, safe drinking water) was initiated.
- Update provided to the Community Advisory Panel (CAP) – the panel is made up of local community volunteers and meets monthly. It is independently facilitated and consists of all businesses operating with the Vancouver Fraser Port Authority property. Ongoing updates continue to be provided.
- Chemtrade commissioned a survey through H+K, which was conducted between September 28 and October 4, 2023. In total, 1,002 adult respondents from across BC were surveyed online. The associated margin of error for a probability-based sample of this size would be ±4%, 19 times out of 20. **The results showed that an overwhelming 93 per cent of survey respondents agree that chlorine should continue to be safely produced in BC** (a full summary of the survey is available on Chemtrade's engagement website www.AskChemtrade.ca)

## Winter 2023/Early 2024:

- In late 2023, initial outreach began with Provincial Ministers and MLAs (the Premier; Emergency Management and Climate Readiness; Energy, Mines and Low Carbon innovation; Jobs, Economic Development and Innovation; Water, Land and Resource Stewardship, area MLAs). Engagement continues with these organizations
- Continued to engage with the District of North Vancouver
- Locally, Chemtrade reached out multiple times to local first responders, including the DNV Fire Department and North Shore Emergency Management to share updates. As part of ongoing operations, close contact with these organizations remains ongoing
- Continued to engage with Metro Vancouver Water Committee to provide ongoing updates
- Engagement with Port continued
- Outreach with federal, provincial and municipal governments continued
- Outreach with two local First Nations continued

## Spring 2024

- Launched www.askchemtrade.ca, an engagement website focused on sharing information about the facility and our proposed continued operations.
    - *To-date, hundreds of site visits, driven from various platforms (search platforms, Chemtrade Facebook, social media ads, open house ads, and post-newsletter publication spikes in visits)*
    - *We have received approximately eight questions through the website and have responded to all requests with information. We have then added those questions/responses to the FAQ section on AskChemtrade.ca. See Appendix D for a full listing of questions received and the response provided*




- Engaged with NorthShore News on three separate occasions, including walking through the engagement presentation (Appendix A) prior to the public Open house on June 6, 2024, to ensure local media was aware of plans and could accurately communicate work underway to the community.
- Hosted a special meeting for the Community Advisory Panel to provide targeted updates to members
- Created and shared a community newsletter via AskChemtrade.ca as well as through direct email distribution to over 30 local organizations/groups or individuals such as community associations, elected officials, special interest groups, local media and First Nations.
- Shared information updates with the District of North Vancouver staff and members of the Council, including an invitation to the June 6 Open House sessions
- Engagement with Port continued, including providing an invite to the June 6, 2024, Open House meetings
- Sent direct invitation to June 6, 2024, Open House, along with an invitation to meet with the group directly, and/or provide a facility tour, with:
    - *Community Advisory Panel*

- *Maplewood Community Association*
- *Blueridge Community Association -*
- *Seymour Community Association (includes Windsor Park community)*
- *Seymour Valley Community Association*
- *Lower Lynn Community Association*
- *Inter River Community Association*
- *Windsor Secondary PAC*
- *Local DNV consultant and risk expert used by District*
- *North Shore Safety Council*
- *North Shore Emergency Management*
- *Unifor*
- *Berkley Care Centre*
- *Capilano University*
- *Lynnmour Elementary School PAC*
- *Seymour Heights Elementary School PAC*
- *Ecole Windsor Secondary PAC*
- *Park Place Montessori Daycare*
- *North Vancouver Chamber of Commerce*
- *North Vancouver School District*
- *Kenneth Gordon Maplewood School PAC*
- *North Star Montessori*
- *Blueridge Elementary School PAC*
- *Vancouver Coastal Health*
- *Local MLAs (three)*
- *Local MPs (three)*
- *The District of North Vancouver*
- *The NorthShore News*
- *Local First Nations*




- Provided separate site tours for: local elected officials and staff (municipal and provincial), the Port, and representatives from the Tsleil-Waututh First Nation
- Ongoing engagement with federal, provincial and municipal governments continued.
- Ongoing engagement with two local First Nations.
- Sponsorship of the Tsleil-Waututh Nation's Whey-ah-Wichen Canoe Festival

## Summer 2024

- Hosted two open house sessions in North Vancouver on June 6 (**see Appendix B for a full summary**)
- Open house meetings were promoted through ads in two issues of the NorthShore News - as well as through NorthShore News digital ads for a two-week period leading up to the meeting. The sessions were also promoted through AskChemtrade.ca, our community newsletter, and through direct invitation via emails sent to over 30 local organizations/groups or individuals such as community associations, elected officials, and special interest groups
- Engagement with the District of North Vancouver Planning department to understand next steps in the rezoning process
- Chemtrade launched its official Public Tour Program – open to all members of the public. To date, approximately 100 local residents have toured the facility
- Presented our Community Engagement presentation at the North Vancouver Community Association Network AGM, attended by representatives from nine local community associations, such as Maplewood, Blueridge, Seymour, Lynn Valley and others
- Launched online social media ads to drive more traffic to our website (AskChemtrade.ca), creating awareness of efforts to secure long-term operations.
- Released second community newsletter (August 1) through AskChemtrade.ca, and direct email distribution to dozens of identified stakeholders
- Met Executive Director of the North Vancouver Chamber and provided site tour
- Engaged with the Province of BC Clean Energy Major Projects Office
- Engaged with HTEC and provided updates on the status of our proposed improvements and continued operations
- Engagement with Port to secure long-term lease renewal continued
- Continued to provide engagement updates to the District of North Vancouver Mayor and Council through email updates and newsletter distribution
- Outreach with federal and provincial governments to raise awareness of the risk of losing chlorine production from our facility, as well as the



***Above:*** *photo from June 6, 2024 Open House* ***Below****: Photos from our public tour program*









opportunity ahead should we find a path to long-term operations (planned safety improvements, risk reduction, support for other Canadian industries from products created at facility)
- Outreach with two local First Nations (the Tsleil-Waututh and Squamish Nations) to raise awareness of our proposed continued operations
- As part of the August 2024 rail strike, Chemtrade engaged with federal, provincial and municipal government to raise awareness of the risk of interrupted access to liquid chlorine and effects on drinking water treatment operations in Canada in the US
- Chemtrade was also contacted by the US EPA, and others within the US government. Several meetings were held, including with the Office of the Prime Minister and the Minister of Labour's staff, the need to restore the movement of chlorine was mentioned in then Labour Ministers' decision to order binding arbitration
- Release of the second community newsletter, providing information to the local community

### Fall 2024 and Winter 2024/2025

- Continuation of tour program to help the public better understand the operations at the facility – including touring of the Windsor Secondary PAC
- Engagement with Port to secure long-term lease renewal continued – which resulted in signed non-binding letter of intent (LOI) with the Post, outlining terms to December 31, 2044
- Continued to provide engagement updates to the District of North Vancouver Mayor and Council through email updates and newsletter distribution
- Outreach with federal and provincial governments to raise awareness of the risk of losing chlorine production from our facility, as well as the opportunity ahead should we find a path to long-term operations (planned safety improvements, risk reduction, support for other Canadian industries from products created at facility)
- Outreach with two local First Nations continued, working to build a meaningful relationship and ensure there is awareness of our efforts to secure long-term operations
- Continuation of community sponsorship/donation program
- Release of two more additional community newsletters aimed are raising awareness of our efforts to secure long-term operations
- Sponsorship and participation in the pumpkin drop at the Maplewood Firehall, November 2

### Spring/Summer 2025

- Continuation of tour program to help the public better understand the operations at the facility
- Continuation of community sponsorship/donation program – including sponsorship of the Upper Lonsdale Preschool, the District of North Vancouver Fire Department Barn Burner dance, support for the Tsleil-Waututh Nation Canoe Festival, and the Maplewood Community Association Butterflyway
- Continued to provide engagement updates to the District of North Vancouver Mayor and Council through email updates and newsletter distribution
- Presented to the North Vancouver Community Association Network on June 18, 2025. The presentation included information on the role the facility plays in securing drinking water for millions, overall operations, and information on our planned safety improvements which would significantly reduce risk to the community
- Outreach with federal and provincial governments to raise awareness of the risk of losing chlorine production from our facility, as well as the opportunity ahead should we find a path to

long-term operations (planned safety improvements, risk reduction, support for other Canadian industries from products created at facility)
- Outreach with two local First Nations continued, working to build a meaningful relationship and ensure there is awareness of our efforts to secure long-term operations

**Summer/Fall 2025:**
- Continuation of tour program to help the public better understand the operations at the facility – notable tours include the Board for the North Vancouver Chamber of Commerce, Minister Neill, MLA Chant and other senior provincial staffers
- Outreach with two local First Nations continued, working to build a meaningful relationship and ensure there is awareness of our efforts to secure long-term operations
- Supported the Indigenous Try a Trade program, providing tool kits for all students, well as a site tour and opportunity to speak with employees about their roles, skills and experiences
- Continued to provide engagement updates to the District of North Vancouver Mayor and Council through email updates and newsletter distribution
- Releases the seventh issue of the community newsletter in July
- Presented to the Federal BC Caucus to raise awareness of our planned continued operations, the risks an the opportunity
- Planned a Community Day celebration for the facility – to be held on September 6, which will include family activities, information stations, shuttle tours of the facility, District of North Vancouver Fire Department fire truck on scene, and more

## Contact

If you have any questions regarding any of the information contained in this report, please reach out to Amy Jonsson, Director, Corporate Communications, at ajonsson@chemtradelogistics.com

## Appendix A: Letters of support


| | |
|---|---|
| Premier of British Columbia David Eby | Page 19 |
| MLA Susie Chant, North Vancouver – Seymour | Page 20 |
| Maplewood Community Association | Page 22 |
| Government of Alberta, Environment and Protected Areas, Drinking Water and Municipal Wastewater Program | Page 24 |
| City of Kelowna | Page 25 |
| City of Fort St. John | Page 26 |
| Chemistry Industry Association of Canada | Page 27 |
| American Chemical Association | Page 29 |
| EPCOR | Page 30 |
| Mario Santos, BC Area Director, Unifor | Page 31 |
| Graham Gilley, resident | Page 33 |
| Joshua Peters, resident | Page 34 |
| Eleanor (Elly) Reading, resident | Page 35 |

BRITISH COLUMBIA

February 26, 2025

His Worship Mike Little
Mayor of North Vancouver
355 West Queens Road
North Vancouver, BC V7N 4N5
Sent via email: mayor@dnv.org

Dear Mayor Little:

I am writing today to express my support for the continued operation of Chemtrade's North Vancouver chlor-alkali facility. The facility is the largest producer of liquid chlorine in Canada and is critical for securing safe drinking water for millions of Canadians and Americans. It also produces almost 70 per cent of the liquid chlorine used in Western Canada, 40 per cent of the liquid chlorine used across the country, and up to 60 per cent of the liquid chlorine used in the Western United States. I also understand that this facility holds potential to assist in the development of clean fuels that support British Columbia's decarbonization efforts.

The facility has been in continuous, safe operation since 1957. In 2010, over $500 million was invested in the plant to modernize its operations and improve safety, with plans to continue this type of investment should it secure the ability to continue to operate.

I respectfully ask that the rezoning application required through the District of North Vancouver be expedited and approved in a timely manner to ensure business continuity for the facility and the safety of Canadian and US drinking water.

Sincerely,

David Eby, KC
Premier

cc: Alan Robinson, Group Vice President, Commercial, Chemtrade Logistics Inc.

**Office of the Premier**

**Web Site:**
www.gov.bc.ca

**Mailing Address:**
PO Box 9041 Stn Prov Govt
Victoria BC V8W 9E1

**Location:**
Parliament Buildings
Victoria

LEGISLATIVE ASSEMBLY
of BRITISH COLUMBIA



September 4th, 2025

Mayor and Council
District of North Vancouver
355 West Queens Road
North Vancouver, BC V7N 4N5
Sent via email: council@dnv.ca

Dear Mayor and Council of the District of North Vancouver,

I am writing to express my support for the rezoning required for the continued operation of Chemtrade's North Vancouver chlor-alkali facility, located at 110 Amherst Avenue, North Vancouver, BC.

As the main provider of liquid chlorine for water purification in Western Canada, Chemtrade has consistently demonstrated their commitment to ensuring a clean supply of drinking water on the North Shore and beyond.

Now more than ever, it's important that British Columbians can rely on a liquid chlorine supply from within our borders. Chemtrade's North Vancouver facility produces almost 70 per cent of the liquid chlorine used in Western Canada, and 40 per cent of the chlorine used across the country. Chemtrade's continued operations in North Vancouver will guarantee the security of our own chlorine supply here in BC.

I have had the opportunity to visit the facility and to meet with the company multiple times. They keep the safety of their workers, the community, and the ecosystems surrounding the facility at the forefront of their work. It has operated safely and reliably for decades, and the improvements made possible by Chemtrade's rezoning proposal would improve safety even further, virtually eliminating risk beyond the property boundary.

Chemtrade has also made notable strides in sustainability and environmental stewardship. Their efforts to optimize production processes, reduce waste, and adopt sustainable practices align with global goals and our community's values regarding environmental responsibility. Their focus on meeting rigorous compliance standards highlights their dedication to putting communities first. I have also been greatly impressed by Chemtrade's community engagement efforts, which demonstrate values of openness, transparency, and respect.

As an employer in our community, Chemtrade is committed to diversity and equity and creating a safe work environment. Chemtrade's North Vancouver facility is a key component of our local economy, and both current and former employees speak to its well-deserved reputation as a great place to work.

**North Vancouver–Seymour Constituency Office**
217–1233 Lynn Valley Road
North Vancouver, B.C. V7J 0A1
T 604.983.9859
Susie.Chant.MLA@leg.bc.ca

**Legislative Office**
Parliament Buildings
Victoria, B.C. V8V 1X4
T 250.387.3655

Chemtrade Logistics has earned its reputation as a reliable and innovative company, and their commitment to excellence is evident in every facet of their operations.

I am proud to support Chemtrade and their rezoning application, and I look forward to seeing their continued success and positive impact on the North Shore.

Sincerely,



Susie Chant, MLA
North Vancouver-Seymour

cc: Alan Robinson, Group Vice President, Commercial, Chemtrade Logistics Inc.
Amy Jonsson, Director, Corporate Communications, Chemtrade Logistics Inc.

**Maplewood Area Community Association,**
**Concerns and Recommendations 2025**

To whom it may concern,

I am writing to convey witnessed events in and around the Chemtrade Chlorine facility located in North Vancouver BC.

In my tenure as community association chairperson and Maplewood resident, I have participated in CAP- Community Advisory Panel as an advocate for the village's Environmental Health and Safety reporting.

68 years ago, my family helped build the original chlorine facility with pride. I believe that no chlorine-related fatalities have occurred since the plant came online under the name of Hooker Chemicals. Now flying the Chemtrade flag, the team that now runs the plant do so with caution and respect.

During the plant's operation over the years the plants administration has engaged the community in a dialogue of preventive and proactive Health and Safety on a quarterly schedule. A proper and transparent report was offered to all members of the community, the Mayor and Council.

Plant safety tours are graciously and traditionally offered by Chemtrade to explain operations, improvements and allay any fears that plant operations pose any form of risk to residents or nature.

Chemtrade Electrochem has facilitated and encouraged a joint Health and Safety Community newsletter, "the Maplewood Home Companion," is delivered door to door, informing readers of Local Safety protocols and best practices. A summer 2025 addition will address residential fire and hazardous goods best practices for disposal. Chemtrade maintains a beneficial partnership with North Shore Emergency Management, and we jointly promote "Shelter in Place" and Emergency Preparedness education and outreach.

Canada needs a reliable and affordable supply of Chlorine products to keep us strong, healthy and free in the market. Chemtrade has earned the respect of Responsible Care systems, I can find no fault that was not corrected with transparency. Canadian Occupational Health and Safety reporting has been 100% since I joined in 2010 and remains an industry leader.

Having Chemtrade as a member of our village and family for another generation has yielded much debate, science and speculation of the effect on quality of life. Result: No real singular risk can be identified in the plants continued, or future operation, but transportation and nearby storage of liquid Hydrogen is of concern to nearby housing designs. A call for further review local planning and Building codes will ensure future Village Environmental Health and Safety standards. The reduction of risk as the facility experiences systemic renewal is of comfort to the informed population.

The Chemtrade team kindly participates in the following Maplewood Area Community Association programs including: Maplewood Safety Festival, Maplewood Safety Dance, East Seymour Butterflyway pollinator gardens installations, Music on Maplewood Riverside, Art under the Bridge, Blueridge Good Neighbour Day, North Shore Stream Keepers, Kenneth Gordon School in Maplewood and the creation of "Miyawaki Micro Forest".

It seems common consensus that we are a proud family of Biologists, Chemists, Engineers, Executives and Tradespeople who enjoy meeting and exceeding the challenge of 68 years at this multimodal location. It is hoped Chemtrade Electrochem will continue to be in the family, to exceed and define industry standards in the proposed future of the plant.

We are thankful for the resource and welcome Chemtrade's' outreach in the future.

Kind Regards,

Stuart DC Porter Hogan

Maplewood Area Community Association

mymaplewoodca@gmail.com

604 929 2978

# Chemtrade Liquid Chlorine Production in North Vancouver -AR125496

SC

Steve Craik <Steve.Craik@gov.ab.ca>
To Jonsson, Amy; Robinson, Alan

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Tue 10/29/2024 2:44 PM

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Hello Amy, Alan:

Your e-mail of Friday, October 25, 2024, to the Alberta ministry of Jobs, Economy and Trade (JET) was forwarded to me to provide a response. I am the Director of the Drinking Water and Municipal Wastewater Program within the Alberta ministry of Environment and Protected Areas (EPA). EPA regulates approximately 700 drinking water systems in Alberta and all of these systems are required by regulation to use some form of chlorine for disinfection. Many of these systems use liquid chlorine to achieve disinfection and to ensure safety of the drinking water.

Given that the Chemtrade facility in North Vancouver is the largest producer of liquid chlorine in Canada, it is critical for securing safe drinking water for many of the EPA regulated facilities in Alberta, and other facilities in the rest of Canada and in the U.S. We are aware that the facility produces almost 70 per cent of the liquid chlorine used in Western Canada, and on a federal level, produces 40 per cent of the chlorine used across Canada. It also supplies up to 60 per cent of the liquid chlorine used in the Western United States.

A significant and extended interruption of chlorine production at the North Vancouver facility will very likely have serious consequences for drinking water facilities in Alberta and may potentially lead to widespread boil water advisories. We, therefore, support continued operation of this facility as it is critical to the liquid chlorine supply chain in Alberta.

Please share this information with the District of North Vancouver.

Best regards

**Steve Craik,** PhD, PEng (he/him)
Director
Drinking Water & Municipal Wastewater Program
Water and Waste Sustainability Branch
Water the Circular Economy Division
Alberta Environment and Protected Areas
Government of Alberta

Tel 587-341-7683

Alberta ENVIRONMENT AND PROTECTED AREAS
respect accountability integrity excellence

January 30, 2024

# OFFICE OF THE MAYOR

Don Boonstra
Vice-President, Electrochem
Chemtrade Logistics Inc
100 Amherst Avenue
North Vancouver, BC V7H 1T9

Dear Sir,

I am writing to you today on behalf of the City of Kelowna to express our support for Chemtrade Logistics Inc.'s continued production of chlorine.

In Kelowna, we rely on chlorine and related products to ensure that our drinking water is safe for our residents when they turn on their taps. The reliability and quality of your Chemtrade products is and remains critical to our water treatment operations. ChemTrade is an important supplier, and an integral part of our water treatment processes and has been for many years.

The impact of Chemtrade closing would likely result in higher costs due to transport from either the east coast or Gulf of Mexico as well as a reduction in supply options. As British Columbians/Canadians continue to be faced with increasing affordability challenges, with a reduction in supply of chlorine the cost of safe drinking water would be another added layer of cost increases. The long distance as well as a reduction in total suppliers in north America would also likely reduce reliability and resiliency of this critical product.

I also recognize that your facility currently located in North Vancouver, has been in continuous operation for over 65 years, and in that time has operated in a safe and responsible manner. This facility produces almost 70 per cent of the chlorine used in Western Canada, and on a federal level, produces 40 per cent of the chlorine used across Canada. In recent years, over $400 million has been invested in the facility to ensure the continued safe, reliable, and responsible production of chlorine.

The closure of this facility located within the province of BC causes us concern regarding the future of domestic chlorine supply in Western Canada, a critical product required for the maintenance of our community's safe drinking water supply.

Respectfully,

Tom Dyas
Mayor | City of Kelowna

City of Kelowna

City Hall | 1435 Water Street, Kelowna BC V1Y 1J4
TEL 250-469-8980 | FAX 250-862-3399
mayorandcouncil@kelowna.ca
kelowna.ca

FORT ST JOHN
*The Energetic City*

City of Fort St. John
10631 100 Street | Fort St. John, BC | V1J 3Z5
250 787 8150 City Hall
250 787 8181 Facsimile

March 11, 2024
File # 0220-20
Via email: dboonstra@chemtradelogistics.com

Chemtrade Logistics Inc.
100 Amherst Ave
North Vancouver, BC V7H 1T9

Attention: Don Boonstra, Vice President – Electrochem

**Re: Letter of Support for the Safe Supply of Liquid Chlorine**

On behalf of the City of Fort St. John, I am pleased to provide this letter in support of the safe supply of liquid chlorine to meet the demand in the Canadian market.

The Chemtrade North Vancouver Chlo-Alkali facility produces over 40% of all liquid chlorine available in Canada, which equates to 70% of liquid chlorine used to treat drinking water in Western Canada. Being the only manufacturer in BC and Alberta, this facility is extremely important in treating and protecting municipal drinking water.

The City of Fort St. John values the importance of having a secure and reliable access to liquid chlorine to provide clean and safe drinking water. Council supports Chemtrade in continuing to produce and provide safe supply of liquid chlorine to meet the vast demand of the Canadian market.

Sincerely,

Gord Klassen
Acting Mayor

CHEMISTRY INDUSTRY ASSOCIATION OF CANADA | ASSOCIATION CANADIENNE DE L'INDUSTRIE DE LA CHIMIE

October 29, 2024

Mayor and Council
The District of North Vancouver
355 West Queens Road North Vancouver,
BC V7N 4N5
c/o: council@dnv.ca

Your Worship Mike Little, Mayor of the District of North Vancouver and Members of Council

Re: Water Treatment Supply Chain Resiliency and Renewal of Chemtrade Rezoning Application

In my capacity as President and CEO of the Chemistry Industry Association of Canada (CIAC), I am writing today to express my support for the continued operation of Chemtrade's North Vancouver chlor-alkali facility, located at 110 Amherst Avenue, North Vancouver, BC.

The facility is the largest producer of liquid chlorine in Canada. The facility and its products are critical for securing safe drinking water for millions of Canadians and Americans. The facility produces almost 70 per cent of the liquid chlorine used in Western Canada, and on a federal level, produces 40 per cent of the chlorine used across Canada. It also supplies up to 60 per cent of the liquid chlorine used in the Western United States.

The facility has been in continuous, safe operation since 1957. In 2010, over $500 million was invested in the plant to modernize its operations and improve safety and reliability, Chemtrade has plans to continue this investment should it secure the ability to continue to operate, further reducing potential risk and improving safety.

As a member company of the Chemistry Industry Association of Canada, the facility is also audited regularly for its conformance to the requirements of Responsible Care®. Responsible Care is the leadership standard for the global chemistry industry and incorporates auditable requirements in relation to: worker, public, and environment safety; stewardship of the site's products across their lifecycle and value chain; community right to know, including transportation communities; process safety; emergency response preparation; and engagement with Indigenous Peoples, amongst other aspects.

I am writing today to express support for Chemtrade, and also to respectfully ask that the rezoning application required through the District of North Vancouver be expedited and approved in a timely manner to ensure business continuity for the facility and ensure the safety of Canadian and US drinking water.

45 O'CONNOR ST., SUITE 1240
OTTAWA, ONTARIO K1P 5E1
613-237-6215 ciac-accic.ca

Responsible Care® Our commitment to sustainability
Gestion responsable™ Notre engagement envers le développement durable

As has been witnessed in recent years, and again over the past 18 months in regards to port and rail labour disruptions, both global and continental supply chains are fragile and disruptions can have large and unintended impacts – both on cost and availability of key inputs to support public safety and a well functioning economy.

With the limited number of chlor-alkali facilities in North American and which produce liquid chlorine in support of direct or indirect (i.e. manufacture of bleach) production of clean drinking water, a decision not to move forward with the requested rezoning and renewal of the site's license would increase reliance on facilities already at capacity and at much longer distances from the region. This will have the unfortunate outcome of reducing the resilience of the chlorine supply chain which is essential to North Vancouver and Westrn North America more broadly.

Sincerely,



**Bob Masterson**
Chief Executive Officer
Chemistry Industry Association of Canada (CIAC).

.cc Alan Robinson alrobinson@chemtradelogistics.col

Mayor Mike Little and Members of Council
The District of North Vancouver
355 West Queens Road
North Vancouver, BC V7N 4N5

**Re: Support for Continued Operation of Chemtrade's North Vancouver Chlor-Alkali Facility**

Dear Mayor Little of the District of North Vancouver and Members of Council,

The American Chemistry Council (ACC) respectfully urges the District of North Vancouver to expedite and approve Chemtrade's rezoning application to allow the continued operation of its chlor-alkali facility in North Vancouver. This facility plays an essential role in providing safe drinking water for millions of Canadians and Americans by producing and supplying liquid chlorine—a critical component for water treatment. Chemtrade's facility provides nearly 70% of Western Canada's chlorine supply, approximately 40% of Canada's total chlorine supply, and up to 60% of the chlorine used specifically for water treatment in the Western United States.[1]

The facility adheres to the rigorous standards of our Responsible Care® program, which is the premier initiative of the global chemical industry for advancing safety, sustainability, and environmental stewardship. Through Responsible Care®, Chemtrade demonstrates its commitment to continuous improvement in safety and operational efficiency across its facilities and supply chain. By meeting these high standards, Chemtrade contributes to a safer, more sustainable future for the surrounding community and for our industry as a whole.[2]

Chemtrade's operations significantly benefit the local and national economies, with the facility employing 118 full-time staff and contributing an additional $165 million annually to the BC and Canadian economy through local spending.[3] The facility also serves as a critical link in both Canadian and U.S. supply chains for essential products.

For these reasons, Chemtrade's continued operations will help secure safe drinking water for millions, uphold environmental and community safety, and support public health on both sides of the border.[4]

Thank you for your consideration of this matter, which is vital to the health, safety, and resilience of our communities.

**Respectfully,**



Chris Jahn
President and CEO
American Chemistry Council
700 2nd Street, NE
Washington, DC 20002

cc: Alan Robinson, Group Vice President, Commercial, Chemtrade Logistics Email: alrobinson@chemtradelogistics.com

1.Chemtrade, water treatment. Available at: https://www.askchemtrade.ca/frequently-asked-questions-faq
2.American Chemistry Council. Responsible Care Overview. Available at: americanchemistry.com
3.Chemtrade, general facility Available at: https://www.askchemtrade.ca/frequently-asked-questions-faq
4.Chemtrade, clean drinking water. Available at: https://www.askchemtrade.ca/clean-drinking-water

EPCOR Utilities Inc.
2000-10423 101 St NW
Edmonton, Alberta
T5H 0E7
**epcor.com**

January 7, 2025

The Honourable Minister Dominic LeBlanc
Minister of Public Safety, Democratic Institutions, and
Intergovernmental Affairs House of Commons
Ottawa, Ontario K1A 0A6
Dominic.leblanc@parl.gc.ca

Dear Minister LeBlanc,

We are writing today on behalf of EPCOR, a utility company headquartered in Edmonton, Alberta, to express our concerns regarding the future of domestic chlorine and caustic soda supply in Western Canada. Both products are critical for treating drinking water to ensure that it is safe for consumption.

EPCOR uses caustic soda to treat the drinking water that we supply to almost one third of all Albertans in more than 93 communities in the greater Edmonton area, and chlorine is used in many other smaller communities in our operations throughout Western Canada. We were notified that the supply was threatened due to restrictions placed on the Chemtrade facility in North Vancouver related to its lease agreement with the Port Authority of Vancouver. Within the lease, a restriction states the facility can no longer produce chlorine beyond mid-2030. This calls into question the future of the facility, risking access to caustic soda.

EPCOR currently sources all its caustic soda from Chemtrade. Chemtrade is the only domestic caustic soda producer of significance in Western Canada, providing approximately 50 per cent of the available product. If the Chemtrade facility closes due to leasing restrictions, we would be reliant on a single distributer who imports the product from Asia. Purchasing caustic soda from a supplier farther away means longer lead times for delivery, increased operational costs due to the longer transportation distance, and likely increased pricing due to supply and demand. These increased costs would in turn result in higher rates for our customers, and at a time when affordability continues to be top-of-mind for all Canadians, making this a significant concern for us.

**We are writing to express support for Chemtrade and to respectfully ask that the chlorine and caustic production restriction is removed from Chemtrade's lease with the Port Authority of Vancouver. It is critical that Chemtrade continue to be allowed to produce chlorine and caustic soda at its facility to help secure Canada's safe drinking water supply.**

Frank Mannarino
Senior Vice President
EPCOR Water Services

New Westminster Office
326 – 12th Street 2nd Floor
New Westminster British Columbia
V3M 4H6

UNIFOR
theUnion | lesyndicat

Bureau de New Westminster
326 - 12th rue, 2e étage
New Westminster (Colombie-Britannique)
V3M 4H6

LEN POIRIER
National Secretary-Treasurer
Secrétaire-trésorier national

LANA PAYNE
National President
Président national

DANIEL CLOUTIER
Quebec Director
Directeur québécois

June 25, 2025

Mayor and Council
The District of North Vancouver
355 West Queens Road
North Vancouver, BC V7N 4N5

By email: council@dnv.org

His Worship Mike Little, Mayor of the District of North Vancouver and members of Council,

**RE: SUPPORT FOR THE CONTINUED OPERATION OF CHEMTRADE'S, NORTH VANCOUVER**

I am writing today to express my support for the continued operation of Chemtrade's North Vancouver chlor-alkali facility, located at 110 Amherst Avenue, North Vancouver, BC.

The facility is the largest producer of liquid chlorine in Canada, and it critical for securing safe drinking water for millions of Canadians and Americans. The facility produces almost 70 per cent of the liquid chlorine used in Western Canada, and on a federal level, produces 40 per cent of the chlorine used across Canada. It also supplies up to 60 per cent of the liquid chlorine used in the Western United States.

The facility has been in continuous, safe operation since 1957. Since 2010, over $500 million has been invested in the plant to modernize its operations and improve safety and reliability, Chemtrade has plans to continue this investment should it secure the ability to continue to operate, further reducing potential risk and improving safety.

Tel/Tél: 604.522.7911 | Toll-free/Sans frais: 1.800.665.3553 | Fax/Télec: 604.522.8975 | unifor.org

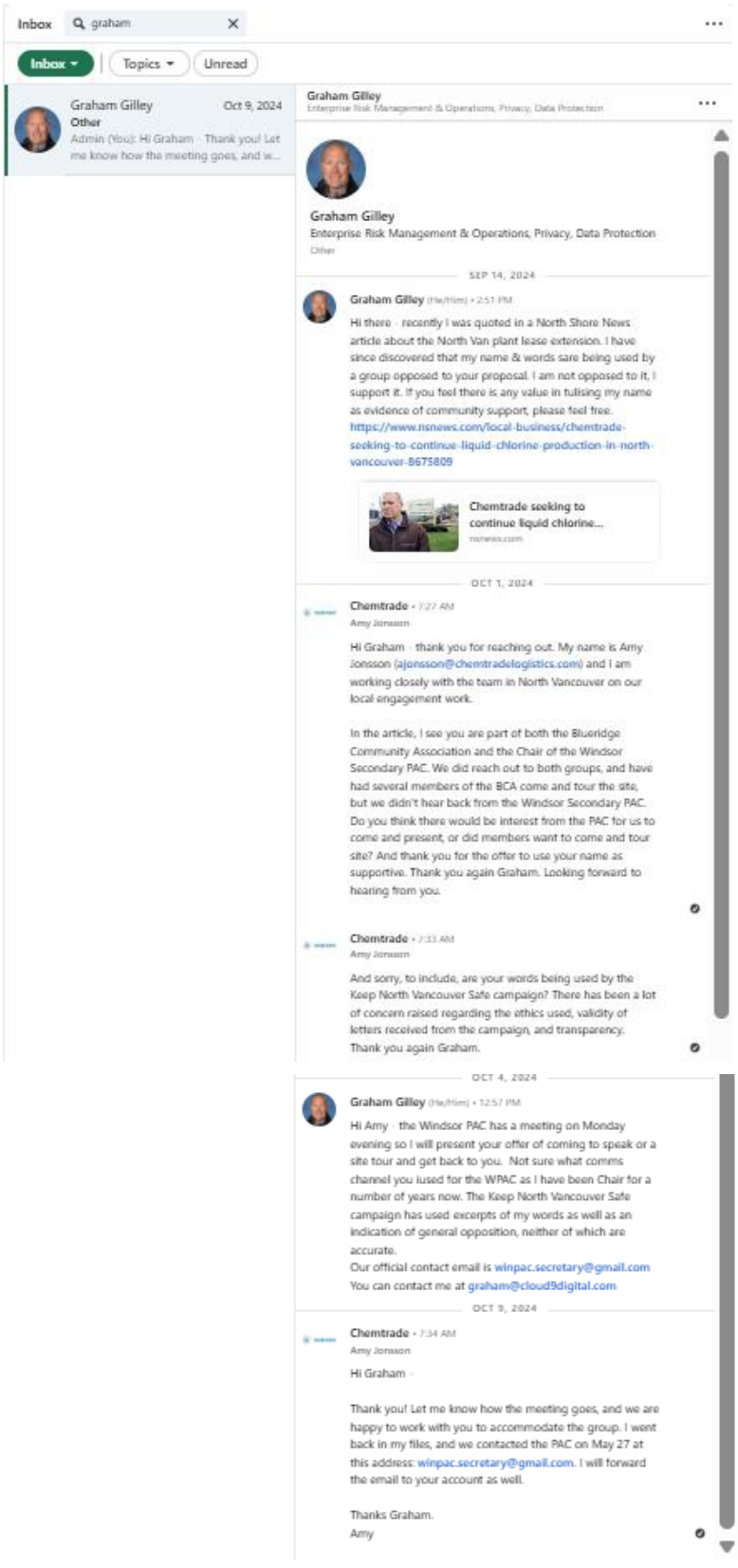
**I am writing today to express support for Chemtrade, and also to respectfully ask that the rezoning application required through the District of North Vancouver be expedited and approved in a timely manner to ensure business continuity for the facility and ensure the safety of Canadian and US drinking water.**

Respectfully,

Mario Santos, BC Area Director
Mobile: 604-349-9058
Email: Mario.Santos@unifor.org

MS:do/cope343

cc: Chris Poskitt President Local 697 chris@local697.com
Alan Robinson, alrobinson@chemtradelogistics.com


Inbox
graham
Inbox
Topics
Unread
Graham Gilley
Oct 9, 2024
Other
Admin (You): Hi Graham - Thank you! Let me know how the meeting goes, and w...
Graham Gilley
Enterprise Risk Management & Operations, Privacy, Data Protection
Graham Gilley
Enterprise Risk Management & Operations, Privacy, Data Protection
Other
SEP 14, 2024
Graham Gilley (He/Him) • 2:51 PM
Hi there - recently I was quoted in a North Shore News article about the North Van plant lease extension. I have since discovered that my name & words sare being used by a group opposed to your proposal. I am not opposed to it, I support it. If you feel there is any value in tulising my name as evidence of community support, please feel free.
https://www.nsnews.com/local-business/chemtrade-seeking-to-continue-liquid-chlorine-production-in-north-vancouver-8675809
Chemtrade seeking to continue liquid chlorine...
nsnews.com
OCT 1, 2024
Chemtrade • 7:27 AM
Amy Jonsson
Hi Graham - thank you for reaching out. My name is Amy Jonsson (ajonsson@chemtradelogistics.com) and I am working closely with the team in North Vancouver on our local engagement work.
In the article, I see you are part of both the Blueridge Community Association and the Chair of the Windsor Secondary PAC. We did reach out to both groups, and have had several members of the BCA come and tour the site, but we didn't hear back from the Windsor Secondary PAC. Do you think there would be interest from the PAC for us to come and present, or did members want to come and tour site? And thank you for the offer to use your name as supportive. Thank you again Graham. Looking forward to hearing from you.
Chemtrade • 7:33 AM
Amy Jonsson
And sorry, to include, are your words being used by the Keep North Vancouver Safe campaign? There has been a lot of concern raised regarding the ethics used, validity of letters received from the campaign, and transparency.
Thank you again Graham.
OCT 4, 2024
Graham Gilley (He/Him) • 12:57 PM
Hi Amy - the Windsor PAC has a meeting on Monday evening so I will present your offer of coming to speak or a site tour and get back to you. Not sure what comms channel you iused for the WPAC as I have been Chair for a number of years now. The Keep North Vancouver Safe campaign has used excerpts of my words as well as an indication of general opposition, neither of which are accurate.
Our official contact email is winpac.secretary@gmail.com
You can contact me at graham@cloud9digital.com
OCT 9, 2024
Chemtrade • 7:34 AM
Amy Jonsson
Hi Graham -
Thank you! Let me know how the meeting goes, and we are happy to work with you to accommodate the group. I went back in my files, and we contacted the PAC on May 27 at this address: winpac.secretary@gmail.com. I will forward the email to your account as well.
Thanks Graham.
Amy

Chemtrade support

JP

J. Peterman <joshuadpeters@gmail.com>
To Mayor and Council - DNV
Cc Jonsson, Amy

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Sat 6/21/2025 8:00 AM

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To Mayor and Council
District of North Vancouver

Dear Mayor and Council and good morning:

I am writing to express my support for Chemtrade's formal rezoning application to allow the continued production of liquid chlorine at their North Vancouver facility. As a longstanding local employer and significant contributor to the municipal tax base, Chemtrade plays a vital role in our community's economic stability. And Chemtrade plays an incredibly important role as the largest provider of chlorine in Canada (over 40%). This is an essential product in our Metro Vancouver water systems including pool facilities.

This rezoning is a key step in enabling the company to move forward with important risk reduction projects that will enhance both operational safety and community wellbeing.

I strongly encourage the District to support this application and continue fostering a strong partnership with industry that prioritizes both economic and environmental responsibility. We need to support our local, Canadian companies.

Sincerely,

Joshua Peters
Private resident - DNV
1295 Conifer Street North Van BC
Tel: 778-231-1982

**From:** Elly Reading <readinge@gmail.com>
**Sent:** Tuesday, October 8, 2024 11:11 AM
**To:** Catherine Pope <popec@dnv.org>
**Subject:** Chemtrade - support

CAUTION: This email originated from outside of the DNV. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Catherine,

I just watched a YouTube video of your interview on 'On the Coast' regarding the K2 lobbying against Chemtrade. Thank you for bringing this issue to light.

I am a DNV resident (Blueridge) and recently took the opportunity to tour the Chemtrade facility with my husband. I just want to let you know that, having done that and seen their safety practices, I am fully in support of their licence renewal. They provide good jobs for local people and provide chemicals which make drinking water safe for us and very many families across the west coast. If not here, then where? They have been in place since long before we moved here in 2013. Anyone that calls for the plant to be removed would be a NIMBY of the highest order.

Regards
Eleanor Reading
+1 778 939 8853

## Appendix B: Summary of the two Chemtrade North Vancouver Open House meetings hosted on June 6, 2024

Approximately 65 residents (40 at the first session from 2:00 p.m. – 4:00 p.m., and ~25 at the second from 6:00 p.m. – 8:00 p.m.) attend the two Open House sessions held on Thursday, June 6, 2024 in North Vancouver, at the North Vancouver Hospitality Inn.

The same format and information used at both sessions. The first hour was an informal open house set up, which allowed attendees to visit one of the seven information stations set up around the room to learn more and ask questions. Information stations included:

1. Overall safety
2. Rail operations and safety (hosted by the CIAC)
3. General facility operations overview
4. QRA curves and reducing risk
5. Environmental monitoring
6. The role the facility plays in securing water

The second hour was used to share a formal presentation (see Appendix C to view the community engagement presentation) and answer questions from the audience.

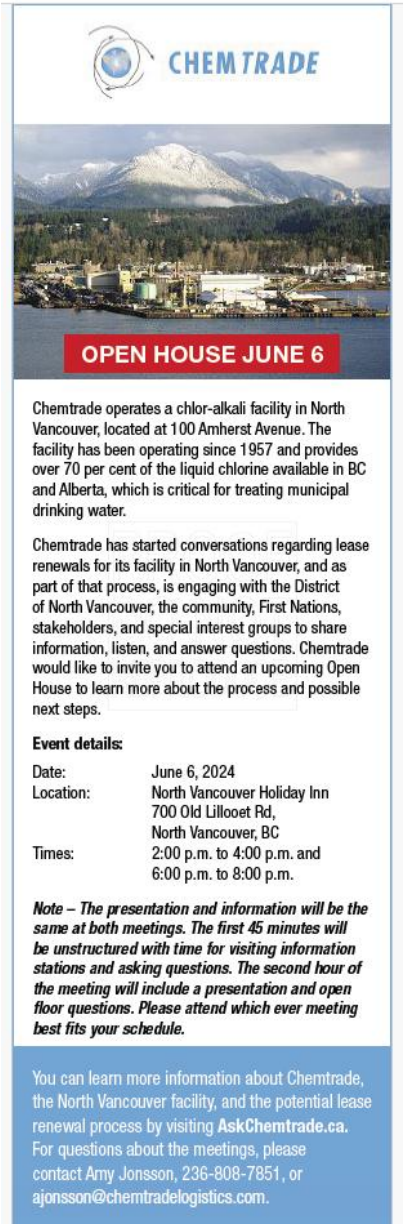
There were members of Chemtrade's senior leadership team in attendance, including the CEO Scott Rook, and the Group Vice President, Commercial Alan Robinson.

The event was advertised in the NorthShore News – in the May 29 and June 5 issues (see print add included on the right), as well as through NorthShore News digital advertising, where 50,000 units of online ads were purchased to run between May 29 and Jun 6.

At both sessions, there were a number of people arrive for the information portion of the event but not stay for the presentation – sharing that they had found that information they were looking for, or had their questions answered.

As noted in the report, Chemtrade senior leadership hosted a pre-Open House interview with a reporter from the NorthShore News where the team shared the presentation which was used at both Open House meetings and answered the reporters questions. The reporter was directly invited to attend the session, but did not, and subsequently, did not file a story on the event.

In the open question period following the formal presentation, Chemtrade received nine questions during the afternoon session and four in the evening. The majority were geared towards better understanding current operations as well as future safety planning to further reduce any potential risk to the community. All


CHEMTRADE

OPEN HOUSE JUNE 6

Chemtrade operates a chlor-alkali facility in North Vancouver, located at 100 Amherst Avenue. The facility has been operating since 1957 and provides over 70 per cent of the liquid chlorine available in BC and Alberta, which is critical for treating municipal drinking water.

Chemtrade has started conversations regarding lease renewals for its facility in North Vancouver, and as part of that process, is engaging with the District of North Vancouver, the community, First Nations, stakeholders, and special interest groups to share information, listen, and answer questions. Chemtrade would like to invite you to attend an upcoming Open House to learn more about the process and possible next steps.

**Event details:**

Date: June 6, 2024
Location: North Vancouver Holiday Inn
700 Old Lillooet Rd,
North Vancouver, BC
Times: 2:00 p.m. to 4:00 p.m. and
6:00 p.m. to 8:00 p.m.

***Note – The presentation and information will be the same at both meetings. The first 45 minutes will be unstructured with time for visiting information stations and asking questions. The second hour of the meeting will include a presentation and open floor questions. Please attend which ever meeting best fits your schedule.***

You can learn more information about Chemtrade, the North Vancouver facility, and the potential lease renewal process by visiting **AskChemtrade.ca.** For questions about the meetings, please contact Amy Jonsson, 236-808-7851, or ajonsson@chemtradelogistics.com.

were answered during the session, with a commitment to follow up with one attendee regarding a technical production question (which was completed the following week).

A majority of feedback or questions received was focused on understanding more about Chemtrade's current operations, the role the facility plays in securing safe drinking water for millions of Canadians and better understanding the proposed safety improvements and the impact they will have on reducing risk for the community.

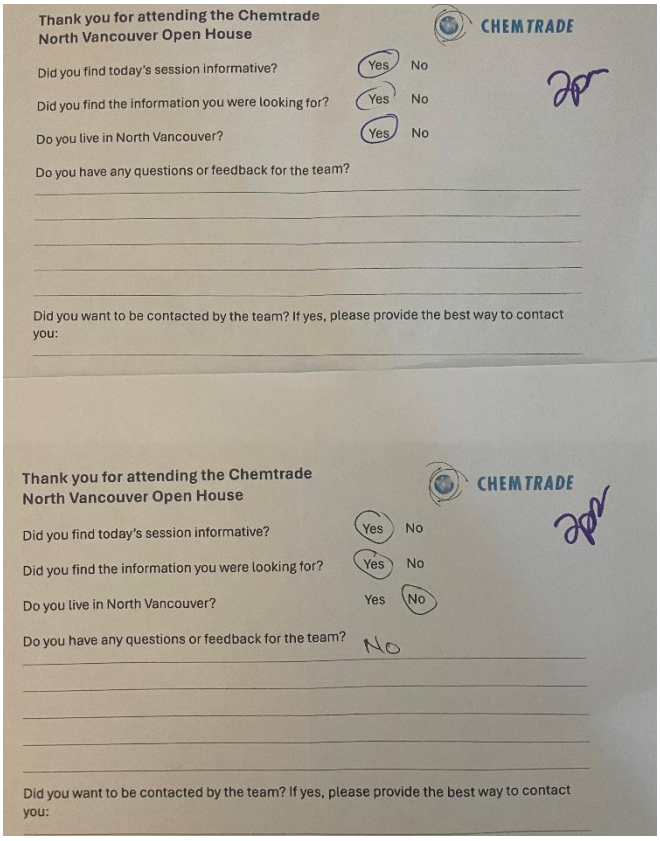
Several local elected officials (federal, provincial and municipal) were invited and made aware of the events. MLA Susie Chant attended the evening session and spoke with attendees on the importance of securing local chlorine production.

At engagement sessions, engagement opportunities included leave behind comment cards and sign-up for a tour of the facility. Over 25 people expressed interest in touring the facility, and all were followed up with in the week following the meetings. The majority have toured the facility with two expressing they no longer wanted to tour the site. Chemtrade received four comment cards (see photos, right) – three from the afternoon session, and one from the evening session with the following responses:

1. Did you find today's session helpful? *All four answered yes*.
2. Did you find the information you were looking for? *All four answered yes*.
3. Do you live in North Vancouver? *Three answered yes, one stated no, but did not provide their community.*

Two open-ended comments were received:

- Request for more low calories or low carbs snacks at events
- Comment the information session was well done and provided good information



Thank you for attending the Chemtrade North Vancouver Open House

CHEMTRADE

Did you find today's session informative? (Yes) No

Did you find the information you were looking for? (Yes) No

Do you live in North Vancouver? (Yes) No

Do you have any questions or feedback for the team?

Did you want to be contacted by the team? If yes, please provide the best way to contact you:

Thank you for attending the Chemtrade North Vancouver Open House

CHEMTRADE

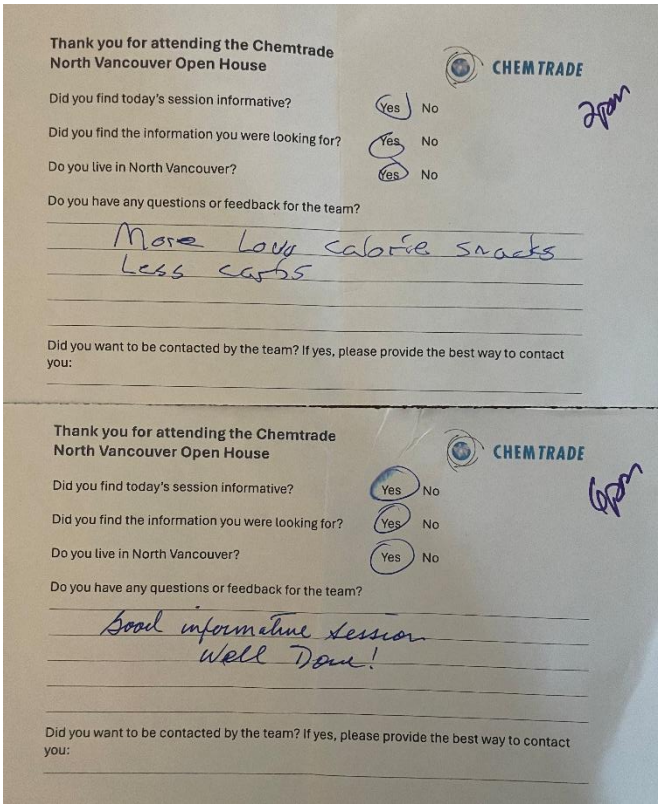
Did you find today's session informative? (Yes) No

Did you find the information you were looking for? (Yes) No

Do you live in North Vancouver? Yes (No)

Do you have any questions or feedback for the team? No

Did you want to be contacted by the team? If yes, please provide the best way to contact you:



Thank you for attending the Chemtrade North Vancouver Open House

CHEMTRADE

Did you find today's session informative? (Yes) No

Did you find the information you were looking for? (Yes) No

Do you live in North Vancouver? (Yes) No

Do you have any questions or feedback for the team? More Low calorie snacks Less carbs

Did you want to be contacted by the team? If yes, please provide the best way to contact you:

Thank you for attending the Chemtrade North Vancouver Open House

CHEMTRADE

Did you find today's session informative? (Yes) No

Did you find the information you were looking for? (Yes) No

Do you live in North Vancouver? (Yes) No

Do you have any questions or feedback for the team? Good informative session Well Done!

Did you want to be contacted by the team? If yes, please provide the best way to contact you:

## Appendix C: Community Engagement presentation

***Please note:*** the presentation continues to be updated as the project moves forward and new information is received, or milestones are achieved. All versions of the presentation are available for viewing. Please contcat Amy Jonsson (ajonsson@chemtrdaelogistics.com) to view any previous version.

CHEMTRADE








Responsible Care®
Good Chemistry at Work

**Securing safe drinking water for Canadians and reducing potential risk to the community**

We acknowledge that Chemtrade operates on the unceded territory of the Squamish, Tsleil-Waututh, and Musqueam Nations

# Agenda

- A quick overview of the facility and Chemtrade
- Why are we talking with you now, what has changed?
- Significance in protecting drinking water
- Community engagement
- Safety history and future safety enhancements
- Plans moving forward – reducing the risk to the community while securing safe drinking water for Canadians



*A look at the cell room in North Vancouver, which contains the specialized units where chlorine is created*



# Chemtrade North Vancouver overview



Chlor-Alkali facility
North Vancouver, BC

- Chemtrade provides industrial chemicals and services to customers in North America and Brazil. Listed on the TSX since 2001, Chemtrade has 1,400 employees across 60+ locations.
- The North Vancouver site has ***operated safely since 1957***, and since 2010, ***over $500 million has been invested to improve safety, reliability and modernize the facility***.
- The facility has ***118 direct, full-time employees*** with an ***annual payroll of over $23.3 million***. The facility ***also injects an additional $140 million into the BC and Canadian economy*** through spending with suppliers, contractors, and businesses.
- We pay the ***District of North Vancouver over $3.7 million in taxes***, and over ***$2.7 million in municipal water fees***
- The North Vancouver facility is a modern chlor-alkali plant, ***which produces chlorine, caustic soda, and hydrochloric acid***, supporting industries like water treatment, innovation and technology, oil and gas, pulp and paper and the automotive industry.
- The facility also creates ***clean, carbon neutral hydrogen*** as a co-product – some of which is harnessed and sold as a clean energy source, and some of which is used as a power source for the facility.
- ***The facility is one of the greenest producers of chlorine in North America***, run almost exclusively on green, renewable hydroelectricity or self-produced hydrogen, and solar-dried ocean salt.
  - The facility is one of ***BC Hydro's largest customers, spending almost $30 million annually*** on clean, hydroelectric energy

# Chemtrade across Canada

- Chemtrade has operations in seven provinces: **BC, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and New Brunswick,** including our head office located in Toronto, Ontario
- We **operate 16 facilities, creating dozens of products** – from products critical to **safe water treatment**, to products that support the **energy sector, pulp and paper, manufacturing, and steel production**
- We have **almost 600 direct employees**, who live and work in various communities across the country
- **In 2024:**
  - Our annual **Canadian payroll was just over $81.3 million**
  - We paid over **$8.1 million** to various municipalities through **municipal taxes**
  - We **injected almost $208 million into the economy** through our spend with suppliers, contractors and vendors






# Why are we engaging now?

**Responsibility to raise concerns regarding chlorine supply, as we produce up to 70 per cent of the chlorine for Western Canada, which equates to 40 per cent of all liquid chlorine available in Canada – critical for the treatment of municipal drinking water supplies.**

- *A 2015 Stats Canada survey showed that **96 per cent of Canadian municipalities use chlorine to treat their domestic water, supplying over 30.7 million Canadians***

**The market for chlorine in Canada has changed significantly in recent years.**

- *In recent years, several US chlor-alkali facilities have closed, and recently passed US legislation is expected to impact the potential ongoing operations of several more facilities - restricting the US supply chain*
- ***The pandemic taught us the importance of having secure domestic sources, and the recent change in US administration is furthering highlighting the need for secure Canadian-based manufacturing and supply sources***

**Intention to continuing investing in the facility with significant capital upgrades aimed at reducing potential risk to the community and improving safety.**

- *In order to proceed with the planned capital improvements, **we are required to apply for rezoning through the District of North Vancouver***
- *Working with BakerRisk to develop updated risk mapping for the facility which reflects recent operational changes and planned investment in safety and reliability*
- *Work will require long-term business certainty in the form of both a renewed lease with the Port, and approved rezoning application from the District of North Vancouver*

## Why is this site important for Canada?

- The site has **access to both rail and port** – critical for both raw material import and shipping of completed products.
- **Securing Canadian production**
  - Liquid chlorine is critical for the treatment of safe drinking water – ensuring we can continue to produce this product in Canada is critical
- The **products produced at this facility (liquid chlorine, caustic soda, hydrochloric acid and hydrogen gas) support several major industries**, and are a critical link in the Canadian supply chain. Some examples include:
  - ***Drinking water treatment***
  - ***Oil and gas sector***
  - ***Industrial chemical production***
  - ***Metal (steel) production***
  - ***Pulp and paper industry***
  - ***Clean hydrogen energy (potential)***
  - ***Renewable battery production (potential)***





## Better understanding the important role chlorine plays in securing Canada's safe drinking water supply



# What happens if Chemtrade's facility closes?

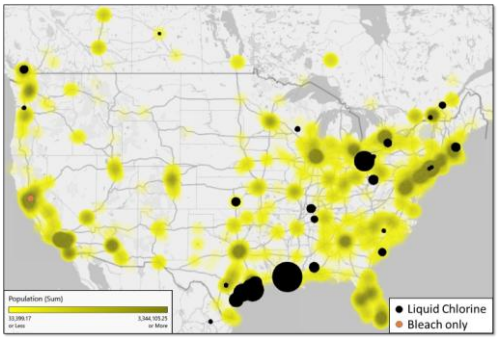
### High risk to reliable chlorine supply in Western Canada

- US will secure domestic chlorine supply before exporting to Canada
- Western US demand is ~10 times western Canadian demand
- US protectionism and change in recent US administration putting trade agreements in question

### If Chemtrade stops producing chlorine?

- The other three Canadian chlor-alkali facilities don't have capacity to replace Chemtrade's production
- Chemtrade supplies up to 60 per cent of Western US with chlorine, so US domestic requirements will dramatically increase, further reducing likelihood of exports to Canada
- US population will likely exhaust available US manufactured chlorine supply
- Any chlorine that was able to be imported from the US could be subject to tariffs
- The bulk of production resides in the Southern US or Eastern Canada, creating logistical challenges in getting chlorine to municipalities across Canada, particularly Western Canada – it should be noted that chlorine can only be shipped using specialized rail cars and that chlorine would need to be shipped significantly longer distances

### Water treatment demand vs. chlorine production locations



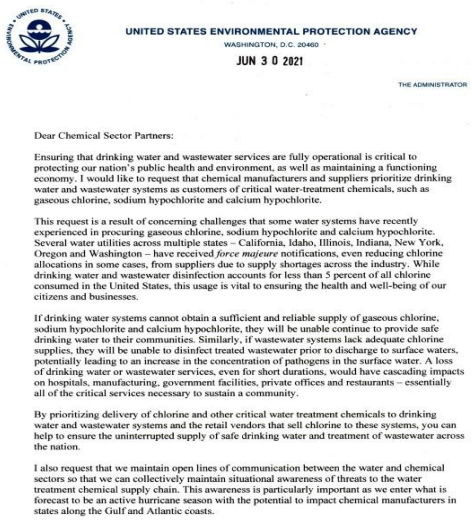

- *Black/orange circles represent chlorine production sites and size of capacity*
- *Yellow to grey heat map represents population density (drinking water consumption)*



# US mandating chlorine to drinking water

**The US will protect its own drinking water and limit chlorine supply to Canada, paired with recent closure of chlorine plants, puts Canadian supply at high risk**

- In 2021, the EPA and Department of Homeland Security were concerned re: reliable supply of chlorine for safe drinking water
- **Approximately five per cent of the North American chlorine supply shut down in 2020 & 2021**
  - *Plants had asbestos diaphragm technology, unwilling to convert (see next slide for details)*
- Result is a **stretched chlorine supply chain that is sensitive to any disruptions**



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460
JUN 30 2021
THE ADMINISTRATOR

Dear Chemical Sector Partners:

Ensuring that drinking water and wastewater services are fully operational is critical to protecting our nation's public health and environment, as well as maintaining a functioning economy. I would like to request that chemical manufacturers and suppliers prioritize drinking water and wastewater systems as customers of critical water-treatment chemicals, such as gaseous chlorine, sodium hypochlorite and calcium hypochlorite.

This request is a result of concerning challenges that some water systems have recently experienced in procuring gaseous chlorine, sodium hypochlorite and calcium hypochlorite. Several water utilities across multiple states – California, Idaho, Illinois, Indiana, New York, Oregon and Washington – have received *force majeure* notifications, even reducing chlorine allocations in some cases, from suppliers due to supply shortages across the industry. While drinking water and wastewater disinfection accounts for less than 5 percent of all chlorine consumed in the United States, this usage is vital to ensuring the health and well-being of our citizens and businesses.

If drinking water systems cannot obtain a sufficient and reliable supply of gaseous chlorine, sodium hypochlorite and calcium hypochlorite, they will be unable continue to provide safe drinking water to their communities. Similarly, if wastewater systems lack adequate chlorine supplies, they will be unable to disinfect treated wastewater prior to discharge to surface waters, potentially leading to an increase in the concentration of pathogens in the surface water. A loss of drinking water or wastewater services, even for short durations, would have cascading impacts on hospitals, manufacturing, government facilities, private offices and restaurants – essentially all of the critical services necessary to sustain a community.

By prioritizing delivery of chlorine and other critical water treatment chemicals to drinking water and wastewater systems and the retail vendors that sell chlorine to these systems, you can help to ensure the uninterrupted supply of safe drinking water and treatment of wastewater across the nation.

I also request that we maintain open lines of communication between the water and chemical sectors so that we can collectively maintain situational awareness of threats to the water treatment chemical supply chain. This awareness is particularly important as we enter what is forecast to be an active hurricane season with the potential to impact chemical manufacturers in states along the Gulf and Atlantic coasts.

# US EPA finalizes ruling impacting US chlorine production

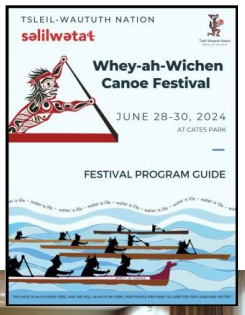
- On March 18, 2024, the US Environmental Protection Agency (EPA) finalized its previous ruling under the Toxic Substance Control Act, prohibiting the use of chrysotile asbestos.
- Currently, **eight chlor-alkali facilities in the US use asbestos diaphragms** to make both sodium hydroxide and chlorine.
- **These eight facilities represent 30 per cent of the annual chlorine production in North America (US, Canada and Mexico).**
- Six of the eight **US facilities were given five years to convert to non-asbestos diaphragms** or to modern membrane technology, **making the deadline March 2029**. The other two facilities were given eight and 12-years respectively.
- Note – our ***North Vancouver facility has already been converted to modern membrane technology*** and will not be affected by the new EPA regulations

## Why does this matter to Canadians?

- *Converting technologies is a significant cost (approximately $1 billion), and requires significant shut down and construction time, which would further reduce available chlorine from the supply chain–* ***making it critical that Canada secures its own domestic supply.***
- *The 2029 deadline for US facility conversion, approximately one year in advance of North Vancouver's current lease restriction going into effect,* ***makes securing our chlorine production critical for securing Canada's safe drinking water supply***



# Engaging with the community, First Nations and all levels of government











# Overall engagement summary

**Since the summer of 2024, we have:**

***Hosted over 65 information update meetings*** *with all levels of elected officials (including US), First Nations, stakeholders, special interest groups, community members*

***Held two open house meetings*** *in 2024, attended by over 65 residents with overwhelming positive support*

***Initiated over 300 interactions*** *(letters, emails, phone calls, meetings, presentations) with overwhelmingly positive feedback received*

***Created three new engagement tools*** *www.AskChemtrade.ca, a community newsletter, and launched a public tour program*



# Engaging with government

**Continuing to engage with all levels of government to ensure there is an understanding and awareness of the role that Chemtrade plays in protecting safe drinking water for millions of Canadians**

- Have provided dozens of updates ***to federal, provincial, and municipal elected officials and staff including many MLAs, MPs, Ministers (both provincial and federal), the Premier of BC, and staff from the Office of the Prime Minister***
- Ongoing outreach to ***District of North Vancouver*** to provide updates, including hosting a tour for several members of Council
  - *Rezoning application in development, planned for submission in summer 2025, with public engagement in early fall 2025.*
- In April, we signed a non-binding ***LOI with the Port of Vancouver with terms through to Dec 31, 2044***
- ***Letter of support received from the Government of BC, the Government of AB, several municipalities in BC and AB, along with drinking water providers,*** showing support for our ongoing operations
- The rail strike in August 2024 raised the profile and risk associated with disruption to liquid chlorine production and supply within Canada and the US- following this, Chemtrade was contacted by senior levels across both the Canadian and US government – including the **White House National Economic Council, the US Environmental Protection Agency (EPA), and the Supply Chain Disruptions Task Force**




***Above***: *GVP Alan Robinson talks about chlorine disruptions and potential impacts as a result of the 2024 rail strike on the CBC National News.* ***Below:*** *Minister Randene Neill and staff tour the North Vancouver facility*



# Community and First Nations engagement

**In May 2024, Chemtrade launched an in-depth and comprehensive education-based community engagement strategy that included both traditional and digital engagement techniques, such as:**

- *In-person and virtual meetings*
- *Large stakeholder group presentations (community associations, Community Advisory Panel, etc.)*
- *Launch of **an interactive engagement website** (www.askchemtrade.ca)*
- *Community participation through increased **sponsorship and donation support***
- *Hosted **two open house sessions** in North Vancouver on June 6, 2024*
- ***Social media ads** to drive readers to AskChemtrade.ca*
- *Development of a **public facility tour program** (through which we have hosted dozens of residents, stakeholders and elected officials)*
- *Creation of a **community newsletter***

**In the Fall of 2024, we began reaching out to both the Tsleil-Waututh First Nations and the Squamish First Nation. We continue to work with the Nations to develop a relationship and path forward**

**We continue to host engagement opportunities, including those which are part of the District of North Vancouver Rezoning application process**

***Overall, we have received overwhelming positive feedback and support through our engagement opportunities***



# Enhancing community safety



# Safety improvements and operational changes at site

**Since 2010, over $600 million has been invested to modernize the facility, resulting in improvements to safety and reliability**

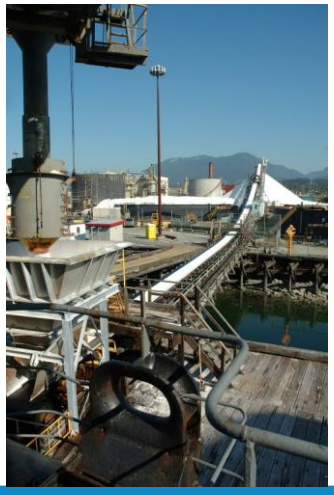
- *Plant is fully automated and is continuously monitored by a state -of-the-art system*
- *Automatically notifies operators of any abnormality in operation*
- *If the system detects something outside of the normal operating ranges it will notify operators and begin to implement automatic shut down and isolate the area of production*
- *Equipped with 72 sensors capable of detecting chlorine as low as 0.1ppm*
- *In the case of a power outage, the system will automatically close all valves, securing the chlorine within the system.*

**Improved risk mapping technology**

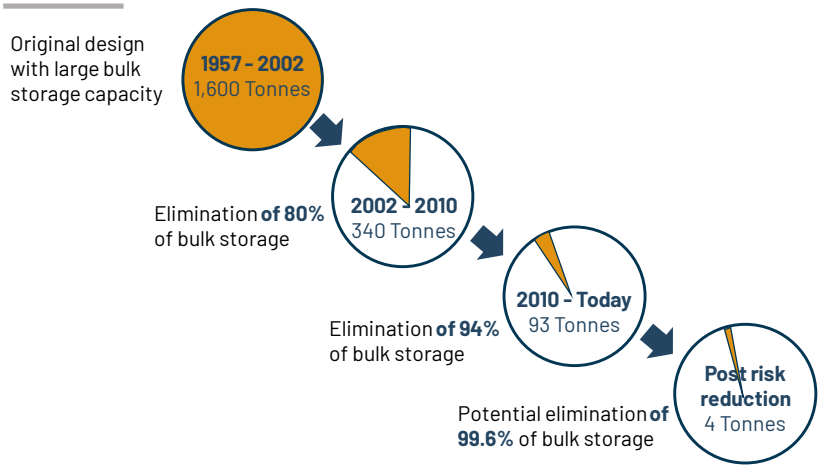
- *Updated technology allows for better mapping of potential risk, and creation of scenario modeling*

**Significant operational changes, reducing onsite storage of liquid chlorine by over 94 per cent using year 2000 as the benchmark**

- *An effective way to reduce risk from liquid chlorine is to minimize the quantity of liquid chlorine onsite*
- *If rezoning approval is obtained, we are committed to additional operational changes and capital improvements projects aimed at reducing risk even further*



# Reduction in liquid chlorine storage onsite



# Transportation safety procedures

**We have strict safety protocols in place that start with our production and continue through to our products reaching our customers.**

- We provide comprehensive training for employees, rigorous safety protocols and procedures at all stages of production, facility safety drills, and emergency response planning.
- We have a group of employee volunteers who are highly trained to respond to a chlorine or caustic soda transportation incident, including specialized equipment and training– the primary Chlorep Team in BC and Alberta.
- Industry and railroad-specific procedures followed by Chemtrade include employee training, train speeds, inspections, rail yard practices, locomotive operation, and adhering to hazmat shipping routes. All of this is regulated through provincial and federal regulations.

**Since taking ownership of the facility in 2017, Chemtrade has never experienced a release of Chlorine during transportation – whether because of an accident or a Non-Accidental Release (NAR).**

**Awards:**

- *2022 American Association of Railroads Non-Accidental Release (NAR) Grand Slam Award which is awarded to companies with operations on at least four Class 1 railroads and have had zero non-accident releases within the year) involving their shipments the previous calendar year.*
- *2023 Canadian National Railway (CN) both the Platinum award for Zero Process Safety Related Incidents, and the Gold Level CN Safe Handling award for no NARs.*



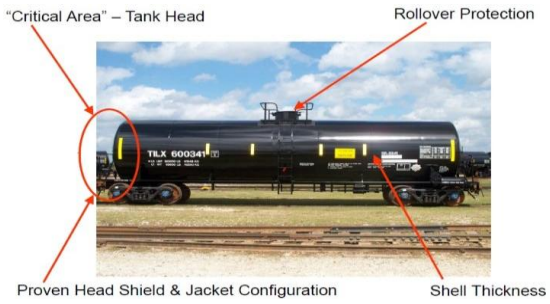
# Using "next gen" cars to ship our products

**Railroads are the safest way to move materials - including chlorine - over land (reference AAR.org).**

- On January 13, 2009, the Canadian Department of Transportation issued new tank car safety regulations for the transportation of toxic by inhalation (TIH) materials.
- The designs required the construction of any tank car built for the purpose of transporting TIH material to have a tougher and thicker tank shell and heads, stand-alone full-height head shields, and top-fitting protection capable of surviving nine mile per hour (almost 15 km per hour) rollover speeds.

**Changes/improvements included:**

- *600 PSI pressure rating*
- *Tank shell thickness increased 25% to 0.981"*
- *Tank head thickness increased 44% to 1.136"*
- *Protective housing thickness (rollover protection) increased 67% to 1.25"*
- *Addition of 0.5" head shields*



# Proven safe operations

- Since 2010, **over $500 million has been spent to modernize the facility, improving safety and reliability**
- Well established **Process Safety Management Systems**
- Active member of Chlorine Institute of North America
- **Platinum award** from CI Institute **(zero process safety related events**)
- **CN Safe Handling Award – Gold level** (no non-accidental releases)
- **Committed to further investments at site that increase safety and reduce risk**

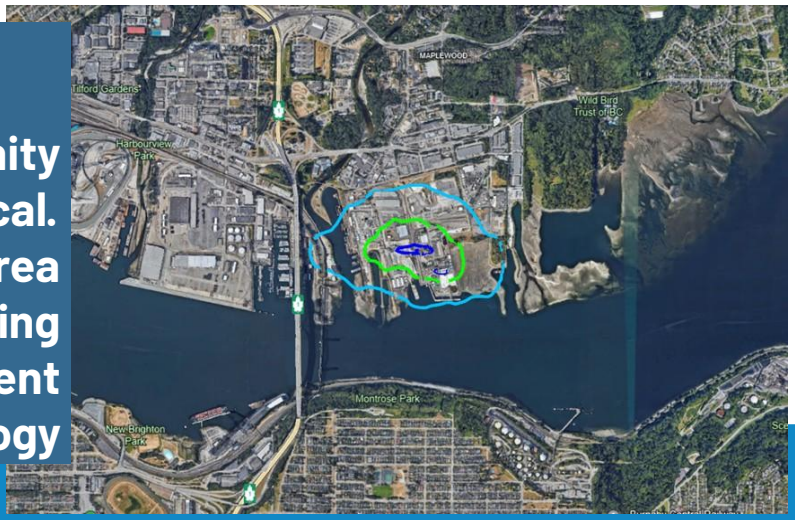








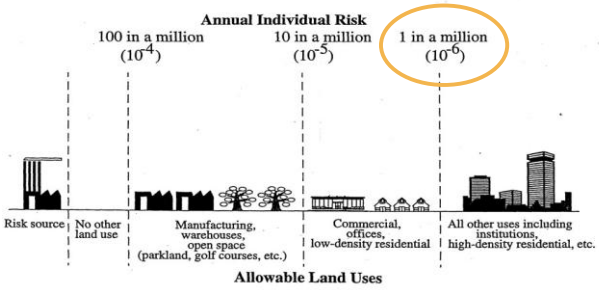

# Community safety is critical. Updating area risk mapping with current technology



# Steps to further increase safety to community

If we are able to secure a long-term lease renewal with the Port and rezoning approval from the District of North Vancouver,Chemtrade plans to implement a series of risk reduction capital projects intended to drastically reduce the risk that liquid chlorine poses to the surrounding area.

***Major Industrial Accidents Council of Canada (MIACC) Guidelines***




## Steps to further enhance safety:

- **Reduce liquid chlorine storage onsite to absolute minimum**
- **Remove all bulk storage** and load directly to railcars
- **All loading activities in a sealed building with air scrubbing**
- Install **seismically activated safety shutoff valves**

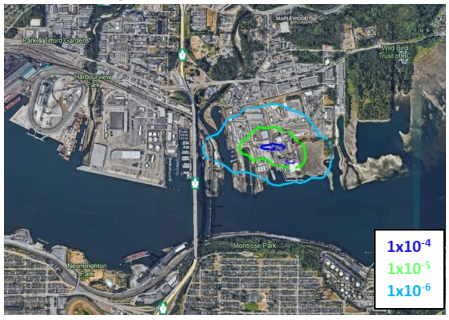


# Reducing the risk to the surrounding community

***2006 risk curves***




***Potential risk curves following proposed operation changes and capital improvements***




In 2006, quantitative risk assessment (QRA) risk curves (above left) were developed by recognized professional Dr. Alp. The updated curves (above right) reflect the proposed operational and capital improvements, and were developed by BakerRisk using improved modelling software, enhanced techniques, and using a more conservative approach, resulting in a more accurate map.

# Potential risk reduction curves

- To help provide context, **outside of the $10^{-6}$ curve**, you would have a **better chance of being hit by lightning (one in 775,000)** than being harmed by our North Vancouver operations (one in 1,000,000)
- There would be **very limited restrictions on land development outside of Chemtrade fence line** and **potential risk to the surrounding community would be greatly reduced**.

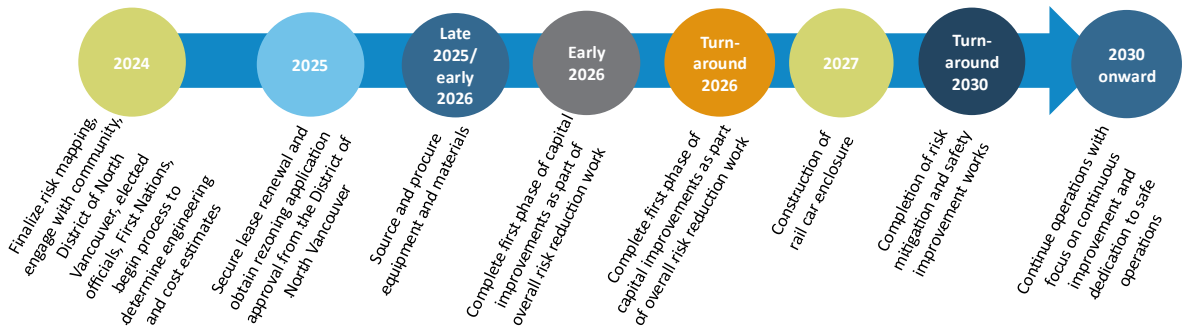





# Implementation of safety improvements

**Roughly six years from start to completion**

- Engineering work has started with cost estimatesexpected later in 2025
- Begin sourcing and ordering required equipment and materialsin 2025
- All construction work would be done during plant turnarounds that are scheduled every two years
  - *Next planned turnarounds are scheduled for 2026, 2028 and 2030*



CHEMTRADE

# Next steps and ways to stay engaged



CHEMTRADE

## Intentions moving forward





**Our intentions are to further invest in the facility with the goal of eliminating risk to the community at the property line of our facility once we secured necessary approvals and a long -term lease renewal**

- We feel there is **strong a case to be made to continue liquid chlorine production in North Vancouver**
- Our **facility supplies over 40 per cent of all liquid chlorine in Canada**, which equates to **over 70 per cent in BC and Alberta**. We also provide up to 60 per cent of the chlorine used in the western US
- It is **unlikely that the other three Canadian facilities or US producers will be able to replace this demand** if the facility closed
- **96 per cent of Canadian communities rely on chlorine to treat municipal water supplies**
- We have **a long history of safe operations**, and are **committed to working with the community, local Nations, government and stakeholders**

MADE IN CANADA MADE IN CANADA

# What can you do?

**Get involved!**

- Attend our community engagement opportunities to learn more
- Join a facility tour to see firsthand the work we do and talk with our employees (*we are really proud of our team and the work they do!*)

**Show your support**

- ***Reach out to the District of North Vancouver and let them know you support securing safe drinking water for Canada***
  - Email Mayor Little and Council at **Council@dnv.org**
- Contact the Office of the Prime Minister of Canada and let them know you support our operations
  - Email the Office of the Prime Minister at **PM@pm.gc.ca**

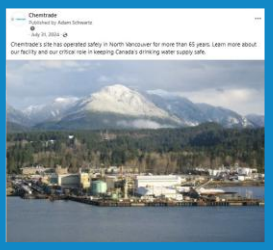
**Engage online**

- Visit **www.Askchemtrade.ca**
- View our social media ads and engage, comment and share!





DISTRICT OF NORTH VANCOUVER



Canada

Proudly made in Canada

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CHEMTRADE

# Questions

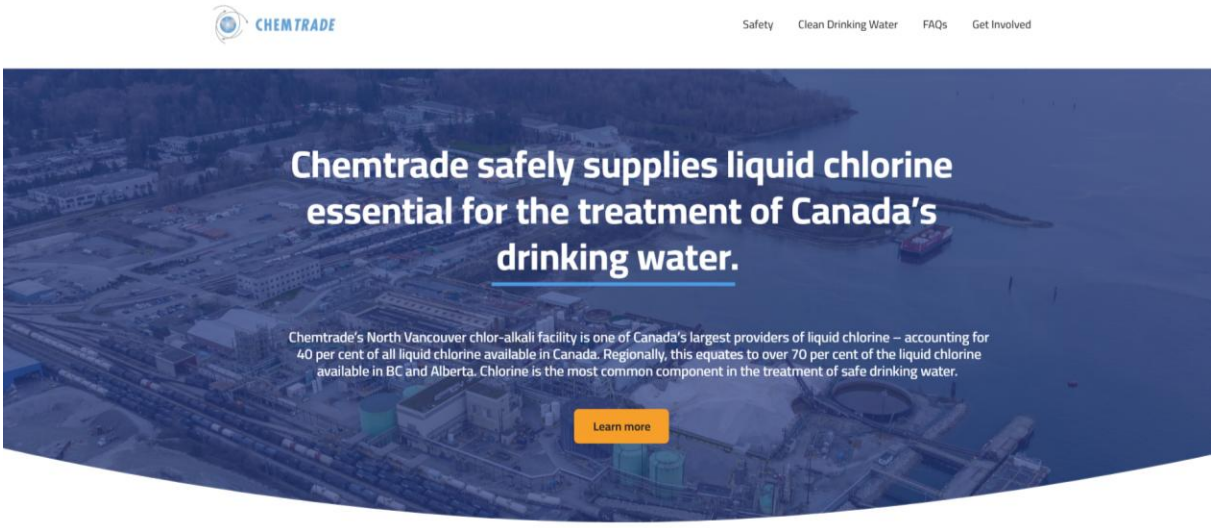




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## Appendix D: AskChemtrade.ca site and AskChemtrade.ca FAQs

Below are the FAQs available on www.AskChemtrade.ca, which is regularly reviewed and updated as Chemtrade received new inquiries from the community.




### Why are you starting engagement with the Port now, when the lease restriction on liquid chlorine doesn't go into effect for another six years (mid 2030)?

It may seem as though 2030 is far off, however, given the complexities of the process, and the significant role our facility plays in securing Canadian production of liquid chlorine, critical for safe water treatment across Canada, we wanted to ensure that we were engaging early and that there is an opportunity to thoroughly discuss both the potential benefits and risks to the community and Canada. Simply put, we feel that it would be a mistake to no longer have liquid chlorine produced in Western Canada.

**We are happy to share that we have entered into a non-binding letter of intent (LOI) with the Port to extend our land lease until December 31, 2044** on similar terms and conditions, including the chlorine restriction. You can read our official release here: Chemtrade Provides Update on North Vancouver Chlor-Alkali Facility. While we can't disclose the terms of the agreement, and it should be noted that the LOI is non-binding and is not a guarantee that we will enter into a new lease, we are of course happy with this development and look forward to a continued positive relationship with the Port.

We continue to focus on our rezoning application with the District of North Vancouver, which would allow for an exception in the current restricted uses and allow us to continue to produce liquid chlorine at our facility. If our application is approved, we will be able to move forward with planned safety improvements which will greatly reduce our facility's quantitative risk curves, improve overall facility safety, and ensure we continue to be able to produce liquid chlorine, critical for the treatment of drinking water across Canada. You can read more about our proposed safety improvements on our engagement website: Safety page.

### If you aren't changing your operations, or increasing production, then why do you need to apply for rezoning through the District of North Vancouver?

Our facility has been safely operating since 1957, but due to a bylaw passed in 1984, our facility has been operating as a legal non-conformity since that time and has been grandfathered up until this point.

As part of our efforts to secure long-term operations, we are proposing several major capital improvements at our site that will not only increase safety but reduce risk to the community. The most visible project, and the one with the largest ability to reduce risk for the community, is the proposed construction of a building around the current rail car loading area. The building would be equipped with sophisticated air scrubbing technology and would be able to capture and contain any chlorine leaked during rail car loading – completely removing it from the atmosphere.
In order to move forward with construction, we would need a development permit from the District of North Vancouver, which will trigger the need for a rezoning application as the District believes this change meets the threshold of rezoning criteria.

To confirm, we are not increasing our output of any of the materials we produce. We are simply looking to ensure we are correctly zoned so we can move forward with planned safety and risk reduction projects.

### What if your rezoning application is not approved?

We are applying for rezoning as part of the process to complete our proposed safety improvements, which would dramatically reduce risk for the community – bringing our current risk curves to near or at our property line, while also improving overall facility safety.

When we engaged with the District regarding our planned safety improvements for the facility, they advised us that in order to provide the building permits required for the improvements, we would need to go through the rezoning process to have the manufacturing of liquid chlorine listed as an exemption within the bylaw.

There are a few things that are important to note. The first is that if the rezoning application is approved, there will be no change in how we operate, the products we produce, and the volume of our production. The second is that the facility has been operating safely and reliably in the current location since 1957. And the third is that we are the largest producer of liquid chlorine in Canada, providing over 40 per cent of the chlorine used to treat drinking water in Canada. We know from a 2015 Stats Canada survey, that 96 per cent of Canadian municipalities use chlorine to treat their municipal water supplies.

If the District does not approve our rezoning application, we would be unable to move ahead with our planned safety improvements. This leaves the future of the facility uncertain beyond 2030 and would leave a large gap in the supply chain in both Canada and the US, particularly in Western Canada as the next closest chlor-alkali facility is in Saskatchewan. Recently, the closure of several chlor-alkali facilities across the United States in the coming years has been announced, making it even more unclear as to how this market gap for Western Canada and the Western US would be filled.

### Will you go ahead and do the safety improvements without the rezoning approval?

No – we would be unable to. We need development permits from the District of North Vancouver to move forward with the safety improvements as the improvements include capital projects such as the construction of a containment structure around the rail loading area.

If the rezoning application is not successful, we will not be able to apply for development permits so we would not be able to move forward with our safety improvements

### Would you continue to operate without rezoning approval?

We are engaging with the District to ensure we are meeting all requirements for rezoning and demonstrating our value to the community - but also our value nationally as the largest domestic supplier of liquid chlorine, critical for safe drinking water here in Canada.

We hope to secure rezoning so we can move forward with our proposed safety improvements, which will greatly reduce potential risk to the community, bringing our current risk curves to near or at our property line, while also improving overall facility safety.

The District would also see immense benefits from our proposed safety improvements. This is because with the reduced risk curves, the District would be able to develop the land outside of our property line without restrictions.

Ultimately, if the District does not approve our rezoning application, we will have to look at our current operations, and what our options are moving forward. Again, this is not our preference as our hope is to be able to move forward with our planned safety improvements which will reduce risk to the community and secure safe drinking water for millions of Canadians.

### What is your zoning changing from and to?

Our actual zoning for the land the facility is located on would not change from its existing classification, which is Employment Zone – Industrial. If successful, the rezoning application would allow for the production of chlorine to be listed as an allowable activity for our facility.

Just as a reminder, our facility is located in a heavily industrial area – our neighbors include an active Port, a waste and recycling transfer station, a sodium chlorate facility, an aggregates supplier, and a proposed liquid hydrogen facility.

### If you get the rezoning application approved, will you be changing how you operate?

The approval of our rezoning application is required so that we can apply for development permits to move forward with our proposed safety improvements. These improvements will make the facility even safer and further reduce potential risk. We would not be increasing production amounts or products manufactured at the facility – production levels would remain consistent.

What we would change is the amount of liquid chlorine stored on site, reducing it from the approximately 94 tonnes which we currently store on site, down to four tonnes. To give you context,

using the year 2000 as the benchmark, at that time we stored over 1,600 tonnes of liquid chlorine on site. The reduction to 94 tonnes stored onsite today and planned further reduction to four tonnes following rezoning approval, represents a significant change in how we operate and contributes to our significant reduction in risk profile for the area surrounding our facility.

The transition to four tonnes of storage will require us to move towards a manufacture and ship model, but as our production is not increasing, we do not anticipate an increase in railcars to or from the site.

### Why does your facility need to be located in North Vancouver? Why not just move it?

This is a common question we receive, and although the question seems simple, the answer has several components.

First, we need to recognize the critical role that our facility plays in supporting safe drinking water. At our North Vancouver facility, we make over 70 per cent of the liquid chlorine used to treat drinking water in BC and Alberta. On a national level, we represent over 40 per cent of the available liquid chlorine. We also need to point out that the facility has been safely operating since 1957, and through continuous investment in projects aimed to modernize the facility, we have continued to increase safety and reliability for the facility, while also significantly reducing risk for the community.

The second is the physical location, and the access the site provides to both an ocean port, and the railway system. We rely on ocean barges to deliver the solar dried ocean salt required for our production, and access to three national railway systems – required for the shipment of our liquid chlorine (in Canada, unless you are connected to your customer via pipeline, the only approved way to transport liquid chlorine is by rail). It should be noted that the Port of Vancouver is the only port in North America connected to all three Class 1 railways that service the Pacific Coast: Canadian National (CN), Canadian Pacific Kansas City (CPKC) and BNSF (Burlington Northern Santa Fe Railway Company).

And the third is cost. If we were to rebuild our facility today, the cost would be approximately $1 billion, making it financially unfeasible.

### What changes have you made at the facility that have reduced the risk to the surrounding community?

Since 2010, over $500 million has been invested in modernization projects at the facility, enhancing both safety and reliability. Significant changes have also been made to our operations and the amount of liquid chlorine stored on-site. Using the year 2000 as a benchmark, we have significantly decreased our on-site liquid chlorine storage by over 94 per cent, greatly reducing potential risks to the surrounding area.

As part of our plans to secure long-term operations for our North Vancouver facility, we are proposing several capital improvement projects that will further improve safety and reduce potential risk. The safety improvements we are proposing on-site include the construction of an

enclosure around the rail car loading area, along with other changes like the removal of old infrastructure, and other modernization projects.

### How does Chemtrade mitigate risks related to chlorine production, storage, and transport currently?

At all our sites, including our North Vancouver facility, we implement rigorous safety protocols that begin with production and extend to our products reaching our customers.

Our safety measures include comprehensive employee training, rigorous protocols and procedures throughout every production stage, regular facility safety drills, and thorough emergency response planning. In North Vancouver, we work closely with local first responders, including the North Shore Emergency Management team, and includes providing support for other emergency response initiatives.

As previously stated, we have made significant investments in the continuous modernization of the plant, enhancing both safety and reliability. Additionally, we have changed our operations, resulting in a 96 per cent reduction in on-site liquid chlorine storage compared to levels in the year 2000. As part of our commitment to continuous improvement, Chemtrade is dedicated to enhancing our plant's operations to ensure the safety of our employees and the local community, while also contributing to the provision of safe drinking water for millions across Canada and the Western United States.

In terms of transporting liquid chlorine, rail transport has proven to be one of the safest and most reliable methods. At Chemtrade, we adhere to rigorous inspection, testing, and monitoring standards for all aspects of product transport.

As a company, we operate in full compliance with Transport Canada rules and regulations. We own, maintain, and operate a fleet of railcars, specifically designed for transporting products – like liquid chlorine, and have numerous safety precautions built into the design. We continuously invest in our fleet to meet the latest safety regulations in both Canada and the US.

In 2023, Chemtrade demonstrated its commitment to safety and excellence by receiving two prestigious awards from Canadian National Railway (CN): the Platinum Award for Zero Process Safety Related Incidents and the Gold Level CN Safe Handling award for no non-accidental releases. In 2022, Chemtrade was awarded the American Association of Railroads Non-Accidental Release (NAR) Grand Slam Award, which is awarded annually to companies that demonstrate excellence in the safe shipping of hazardous materials. To be eligible for the award, a recipient must have received recognition from at least four Class I railroads and have had no non-accident releases involving their shipments in the previous calendar year. (A NAR is an unintentional release of a hazardous material while in transportation, but not involving an accident).

### If a leak were detected, what would happen?

On a facility level, we are fully automated. The system is continuously monitored by a state-of-the-art system that automatically notifies operators, shuts down and isolates areas within the plant

should something outside of the normal operating range be detected. This allows for continuous operation and significantly reduces the chance of an accidental release or incident.

Currently, the site has 72 sensors located throughout the facility, including along the perimeter and in the railcar loading area. The sensors can detect chlorine as low as 0.1 parts per million. Once the sensors are triggered, automated shut down processes are initiated, isolating the area, and site operators are notified.

In the case of a power outage, the facility is equipped with several safety mechanisms that are immediately deployed and do not require an operator's support. When the facility loses power, valves are immediately closed, securing the chlorine supply within the system.

If a potential leak or spill is detected, the site launches an immediate response, and as part of our emergency response plan an alert is issued using Alertable. The North Shore Emergency Management team would receive the alert and would further amplify the notification.

At all Chemtrade sites, including the North Vancouver facility, rigorous safety protocols are in place, starting with production and continuing through to our products reaching our customers. Our safety protocols include comprehensive employee training, rigorous safety protocols and procedures throughout every stage of production, facility safety drills, and emergency response planning. In North Vancouver, we work closely and collaboratively with local first responders, including the North Shore Emergency Management team. This includes providing support for other emergency response initiatives.

### Will Chemtrade make the suggested capital improvements identified through the risk mapping process?

Yes! As part of our plans to secure long-term operations for our North Vancouver facility, we are proposing several capital improvement projects that will further improve safety and reduce potential risk. Through meetings and conversations with the District of North Vancouver to better understand the process to implement these improvements, it became clear that we need to apply for a development permit, which would trigger a rezoning process as well.

We are currently preparing all of the information required for the rezoning application, including the commissioning of several studies.

### Is rail the safest way to ship chlorine?

Railroads are the safest method for transporting hazardous materials, such as chlorine, across land (Reference AAR.org). Vancouver is the only port city in North America which is serviced by three Class 1 railroads: CN, CPKC and BNSF. On average, freight railways move over six million carloads of goods on behalf of Canadian customers, supporting several industries involved in key commodities.

Chemtrade operates a fleet of leased railcars, all of which have been specifically designed for the transport of our various products, including liquid chlorine, and meet or exceed all required regulatory specifications.

Chemtrade follows all industry and railroad-specific procedures, including mandatory employee training, train speed limits, railcar inspections, rail yard protocols, locomotive operation, and compliance with hazardous material shipping routes. These practices are regulated by both provincial and federal regulations.

Since taking on ownership of the facility in 2017, Chemtrade has never experienced a release of Chlorine during transportation, whether from an accident or a Non-Accidental Release (NAR). In 2022, in recognition of our rigorous safety protocols, Chemtrade was awarded the American Association of Railroads Non-Accidental Release (NAR) Grand Slam Award. This prestigious award is presented annually to companies that are exemplary shippers of hazardous materials who have been recognized by at least four Class I railroads and recorded zero non-accident releases involving their shipments in the previous calendar year. As we look forward to the 2023 awards, Chemtrade has already received recognition from Canadian National Railway (CN), earning both the Platinum award for Zero Process Safety Related Incidents and the Gold Level CN Safe Handling award for no NARs.

### How does the plant ensure compliance with all levels of safety regulations?

At our facility, as a member of Responsible Care®, the Chemistry Industry Association of Canada (CIAC), and The Chlorine Institute, we meet or exceed all regulatory requirements, and safety association guidelines, while also being committed to reducing the environmental impact of our activities and improving the health & safety of our employees and the communities in which we operate. We have standard operating procedures (SOPs) in place to ensure the safety of our employees, contractors on site and the surrounding community. In terms of safety in regard to our rail operations, we follow all Canadian and US federal regulations and ensure that our employees receive training and follow all industry and railroad-specific procedures related to the manufacturing, handling, loading, and shipping of liquid chlorine and other products. This includes following strict speed limits, thorough inspections, rail yard practices, and using identified shipping routes for materials deemed hazardous. We maintain and operate a fleet of leased railcars, all of which have been specifically designed for the transport of our various products – like liquid chlorine and meeting all of the required regulatory specifications.

### What information and resources are provided to the local community regarding plant safety and emergency procedures?

Chemtrade participates in a Community Advisory Panel, at which it shares updates on its operations, safety plans, procedures, and planned upcoming work or projects. The Panel is free to ask questions, request information, and have been provided with tours of the facility. As a company, we work closely with our neighbours, first responders - specifically North Shore Emergency Management. Any potential incident would be shared with first responders and through the Alertable system. If the public have concerns, they are asked to contact Chemtrade, either through www.askchemtrade.ca, our Facebook page, or by reaching out to Amy Jonsson at ajonsson@chemtradelogistics.com.

### How does the plant communicate with local authorities and residents in case of an emergency?

The community and first responders would be notified of any potential risk through the use of the Alertable program, and direct outreach to North Shore Emergency Management. Communication updates would continue to be provided as needed through the system. Updates to local elected officials, First Nations, and the media would also be discussed, and if deemed appropriate, direct communications with those organizations and Nations would begin via email and phone calls.

### What safety training programs are in place for employees?

All employees are provided safety training which includes on-the-job demonstrations and training, on-line learning, and when required, classroom training. Every employee on site is provided with the required safety equipment for their specific role and can include items such as protective eye wear and clothing, respirators, and high visibility vests. The training is logged and employees are provided with updates about upcoming expiring training so they can rebook and ensure their training remains current.

### If there were to be a large release of chlorine from the Chemtrade North Vancouver facility, would the chlorine liquid or gas travel uphill into surrounding communities?

The facility is equipped with several layers of automated safety equipment, including backup systems, which would help to prevent or greatly minimize the impact of any potential accidental release of chlorine from the facility.

The system includes 72 sensors, located around the site, that can detect chlorine at less than 1 part per million. If detected, the system will automatically notify operators and begin to shut down and isolate the system. The site also has negative pressure tanks that are capable of capturing all of the chlorine on site if required, and can safely store it for proper disposal. There have also been significant changes in how liquid chlorine is stored, reducing onsite storage of liquid chlorine by over 94 per cent using the year 2000 as the benchmark (onsite storage in the year 2000 was up to 1,600 tonnes, while today's storage is up to 93 tonnes) which greatly reduces the impact and risk from a potential release incident.

All of this being said, in the unlikely event that an accidental release occurs, it is highly unlikely that the chlorine would travel uphill to higher elevations. The liquid chlorine would immediately change from a liquid to a gas, as it will not remain as a liquid under ambient conditions (chlorine needs to be chilled to -32C to convert to a liquid). Once in its gaseous form, chlorine is two and a half times heavier than air and tends to sink rapidly to ground level and flow downhill, pooling in lower areas. Once exposed to the elements – wind, water, rain, temperature, and sunlight - it will begin to quickly break down. Given the right circumstances, chlorine can be moved by strong wind, but that action would help to further dilute and breakdown the chlorine. In water, like the ocean, which is directly to the south of the facility, the gas would dissolve, converting to chloride and hypochlorous acid – both of which are not harmful to the environment.

### If you proceed with the safety improvements projects you are proposing, what is the risk to the community outside of the largest risk curve?

The risk curves have been developed for us by an independent company, BakerRisk, using the latest in software and data to develop updated quantitative risk curves, known as the QRA curves, which signify the level of risk presented to an individual, as well as restrictions on types of development allowed within each level of risk, or curve.

The current QRA maps that both we, and the District of North Vancouver use for planning purposes, show the rings extended across the Dollarton Highway and to the east and west of the facility. Although this map is slightly dated thanks to new and emerging technology, it still provides a snapshot of areas we need to be aware of should we have an accidental release.
The risk within each curve is defined as:

- Within the 10-4 curve, the risk is described as one fatality within 10,000 years, and is comparable, or presents the same risk as working in a manufacturing plant.
- Within the 10-5 curve, the risk is described as one fatality in a hundred thousand years, and is comparable, or presents the same risk as a pedestrian being fatally struck by a car.
- Within the 10-6 curve, the risk is described as one fatality in a million years, and is comparable, or presents the same risk as travelling on a commercial airplane.
- *It should be noted, that outside of the 10-6 curve, there are no restrictions on allowable developments or land uses, and the risk to an individual is the same as if the facility wasn't in place.

BakerRisk developed updated modeling for us, based on the completion of our proposed safety projects, which show the impact the projects would have on the QRA curves for the facility. The overall reduction in the curves is dramatic and eliminates the majority of risk for the community at, or near, our facility property line.

The safety improvements we are proposing on-site include the construction of an enclosure around the rail car loading area, along with other changes like the removal of old infrastructure, and other modernization projects. Through meetings and conversations with the District of North Vancouver to better understand the process to implement these improvements, it became clear that we need to apply for a development permit, which would trigger a rezoning process as well.
We are currently preparing all of the information required for the rezoning application, including the commissioning of several studies.

*View the risk curves and proposed safety improvements on our Safety page.*

### Why do you use rail to move your liquid chlorine?

In Canada, aside from those facilities that are directly connected to a customer via pipeline, the only way to transport liquid chlorine is by rail. Given this, movement of chlorine is highly regulated to ensure the safe movement of chlorine from loading, through to delivery to customers.

### Are railcars a safe way to move liquid chlorine?

Chemtrade maintains and operates a fleet of leased next-generation railcars, all meeting the latest regulatory specifications and industry standards for the shipment of our chlorine. The cars

themselves have several layers of protection – from roll-over protection bars to increased shell thickness, and are the safest way to transport liquid chlorine.

Our cars are inspected when they arrive at site, then again before they are loaded. If any defects are found during either pre-loading inspection, the cars are immediately pulled into our onsite railcar shed for repair. The cars are inspected again after loading to ensure they are safely sealed and ready for transport.

Our cars also have a regular maintenance schedule, with a full car overhaul scheduled for every three years. In general, the life span of a chlorine railcar is approximately 25 years.

### What is stored in the railcars on your site?

While we have the space to store up to 270 railcars at our site at any given time, the number of cars on site can vary from one day to the next.

We looked at data from full years 2023, 2024 and the beginning of 2025, to determine some averages. Using this data, we have determined that on average, we have approximately 251 railcars on our site. Within that, however, we can go even deeper to provide additional details.

The average number of rail cars that are sitting empty on our site at any given time is 159, which accounts for over 63 per cent (63.3%) of the total cars on site. In comparison, at any given time, we have an average of 32 cars containing liquid chlorine on our site, representing just under 13 per cent (12.7%) of all cars on our site. The remaining 24 per cent (24%) of railcars are a combination of those that contain caustic soda (27 cars) and hydrochloric acid (28 cars).

### How many people are employed at the North Vancouver facility, and specifically in relation to liquid chlorine (approximately)?

Our facility employs 118 fulltime, permanent staff members. Based on 2022 data, our annual payroll exceeds $21 million, and we contribute more than $165 million annually to the BC and Canadian economies through spending with suppliers, contractors, and businesses. The operations and activities at our facility either directly or indirectly support the production of three products – chlorine, caustic soda, and hydrochloric acid – and one co-product, green hydrogen produced by the facility.

### How does the plant handle chlorine waste and byproducts?

There is very little waste, none of it hazardous, generated by the production of chlorine. There are only three byproducts of the process: hydrogen gas, a calcium/magnesium solid material that comes from the purification of the sea salt, and brine sludge. Again, none of these are hazardous, and in fact we do sell a portion of the hydrogen produced as a clean energy source. The brine sludge and the calcium/magnesium solid material are both safely disposed of at the local landfill. It should be noted that the facility is one of the lowest carbon facilities, using green hydro-electric power (from BC Hydro).

### With the removal of the majority of liquid-chlorine storage from the facility, do you anticipate an increase in railcar traffic to and from site? Will you just store liquid chlorine on site in the railcars?

In short, the answer to both questions is no. We are **not** increasing our production so we would not require any additional rail car transport. We currently operate with a very limited amount of liquid chlorine stored onsite (our maximum storage is up to 93 tonnes, down from 1,600 tonnes stored onsite in the year 2000), so the further change to a "produce and ship" operating model will not impact or create additional railcar traffic. Currently we have an average of four rail cars arriving and leaving our site on a daily basis. We do not anticipate that this will change. This also means that we do not anticipate an increase in the amount of switching or shunting of onsite railcars.

The movement and storage of liquid chlorine is highly regulated, including caps on the number of cars that can be stored onsite. We would continue as we operate now, which is to securely load our products and then ship at the earliest possible opportunity.

### Do you have any plans to address potential sea level rise?

As a facility that is located in the Port of Vancouver, we are committed to working with municipal, provincial, federal and First Nations emergency preparedness planning.

### How is your facility linked to securing drinking water in Canada?

By our estimates, our North Vancouver facility produces over 40 per cent of the liquid chlorine in Canada. This represents over 70 per cent of the liquid chlorine available in Alberta and BC. Additionally, we are a key supplier to the US, delivering up to 60 per cent of the chlorine for the Western US.

Chlorine is most commonly used for water treatment. A 2015 study by Statistics Canada revealed that over 96 per cent of Canadian communities, representing more than 30.7 million Canadians, depend on chlorine to treat their municipal drinking water.

### What communities buy chlorine from Chemtrade for treating their municipal water?

We cannot share customer information, however, we can share that most of the liquid chlorine we produce is used to treat municipal drinking water systems. Our estimates show that our facility provides over 70 per cent of the liquid chlorine available in Western Canada (BC and Alberta), which equates to over 40 per cent of the total liquid chlorine available in Canada. Additionally, we supply up to 60 per cent of the liquid chlorine available in the Western United States.

A survey conducted by Statistics Canada in 2015 found that 96 per cent of municipalities, representing over 30.7 million Canadians, relied on chlorine to treat their municipal drinking water supply.

The loss of liquid chlorine production at our facility would significantly impact its availability, particularly in Western Canada, including BC and Alberta, as well as across Canada and the Western United States.

### How many other facilities in Canada produce chlorine?

Three other facilities produce chlorine in Canada – one in Saskatchewan, and two in Quebec. Our North Vancouver facility produces more than 40 per cent of Canada's liquid chlorine, which accounts for over 70 per cent of the available supply in BC and Alberta.

### Couldn't BC just import chlorine from the other facilities in Canada or the US?

As with most chemicals, transporting and storing chlorine presents challenges. Chlorine needs to be shipped in specially designed railcars.

There are also production capacity issues, both in Canada and the US. Recently, the US implemented two significant policy changes: the first ensures domestic availability of chlorine, the second limits the use of asbestos diaphragms in the production of chlorine which starts to come into effect by 2029. This ruling will impact eight US facilities, accounting for 30 per cent of North American production.

Given the substantial production we represent in Canada, with 40 per cent of the national supply and over 70 per cent of the supply in BC and Alberta, replacing this significant amount of chlorine within the domestic market is a challenge. Our facility currently supplies up to 60 per cent of the Western US's chlorine. Removing our production would significantly increase demand in the US. The pandemic underscored the importance of establishing and maintaining a reliable domestic supply chain, especially for products essential to the health of Canadians.

### Is the production process for chlorine harmful to the environment?

The environmental impact from the production process for chlorine is minimal and does not generate any hazardous waste material or pollution. The overall carbon footprint of the site is very low due to the fact we use green hydroelectricity (BC Hydro supplied), and the salt used in the manufacturing process is solar dried sea salt. Overall, the facility is one of the greenest chlor-alkali facilities in the world.

### Why doesn't Chemtrade make bleach instead of liquid chlorine for water treatment?

Bleach as a product is very rarely, if ever, used in large-scale water treatment and comes with its own challenges – such as very limited shelf life (depending on the dilution ratio, the product can break down within hours, or last as long as six months), and due to the diluted but still hazardous nature, requires special transportation via secure rail car, and less commonly, transport trailer. The diluted nature also presents challenges in terms of volumes – requiring significantly more available transport methods to ship the product to achieve the same level of protection provided by liquid chlorine. This not only adds to the cost for municipalities, but also increases the carbon footprint of the product.

Given all of these limitations, using bleach is not a reasonable or practical solution for large-scale water treatment.

We know that 96 percent of municipalities in Canada use chlorine to treat their domestic water supplies. Although the actual product used by municipalities to treat varies, but we do know it is

some form of chlorine, chloramine, or chlorine dioxide. All three of these products can be easily created using liquid chlorine. As it stands, safe and responsible liquid chlorine remains the most responsible and safest method of securing drinking water for millions of Canadians.

Learn more about water treatment in BC: https://www.healthlinkbc.ca/healthlinkbc-files/drinking-water-chlorination-facts. The need for chlorine in securing safe drinking water supplies was also just highlighted in a recent Vancouver Sun article, which you can find here: Water has flowed from our taps for 100 years. What about the next 100? | Vancouver Sun

## Appendix E: Community Newsletters

By August, 2025, Chemtrade has created and distributed seven issues of its community newsletters, which are shared electronically with Chemtrade's external Stakeholder and First Nations contacts; the list is now over 150 recipients. All issues are listed below, but also available on https://www.askchemtrade.ca/get-involved

### Chemtrade North Vancouver Community Update

***May 21, 2024*** ***Issue 1***

Chemtrade's North Vancouver chlor-alkali facility is one of Canada's largest providers of liquid chlorine – accounting for 40 per cent of all liquid chlorine available in Canada. Regionally, this equates to over 70 per cent of the liquid chlorine available in BC and Alberta. Why is this important? A study conducted by Statistics Canada in 2015 found that 96 per cent of Canadian communities relied on chlorine to treat its municipal water supply, which equates to over 30.7 million Canadians.

Knowing the significant role that liquid chlorine plays is supporting safe drinking water for millions of Canadians, we need to start having conversations now regarding our potential future operations.



To support this, we are starting a series of community meetings and will be engaging with local First Nations, special interest groups like community associations, and other identified stakeholders, as well as municipal, provincial, and federal elected officials. We will be launching a new website, AskChemtrade.ca, where you will find resources, information, be able to submit questions, as well as sign up for email updates.

#### What has changed at the site in recent years?

Today's North Vancouver chlor-alkali facility is not the same as the facility of the early 2000s. Since 2010, we have invested over $500 million in modernization projects that have improved both the safety and reliability of the plant. There has also been a significant change in how the facility is operated. Using liquid chlorine storage levels from the year 2000 as the benchmark, the amount of liquid chlorine stored on site has been reduced by over 94 per cent.

We have also seen regulations in the United States regarding the export of liquid chlorine become more stringent as they look to secure chlorine for domestic use. In addition, earlier this year, the US Environmental Protection Agency (EPA) finalized its previous ruling under the Toxic Substance Control Act, prohibiting the use of chrysotile asbestos. This ruling – which will come into effect in 2029 - will have a direct impact on eight facilities in the US who use asbestos diagrams in their chlorine production. These eight facilities represent about 30 per cent of the total supply available in North America (Canada, the US and Mexico).

Converting technologies is a significant cost (approximately $1 billion per facility), but also requires a lengthy facility shut down to convert the equipment. As these facilities shut down for conversion of their equipment, this will remove a significant amount of production from the US, making it is even more critical that Canada secures its own domestic supply.

Further to the modernization projects described above, North Vancouver facility has already been converted to modern membrane technology and will not be affected by the new EPA regulations.

CHEMTRADE

*Page **1** of **4***

## Safety above all else

At all of our sites, including our North Vancouver facility, we have strict safety protocols in place that start with production and continue through to our products reaching our customers.

These safety protocols include comprehensive training for employees, rigorous safety protocols and procedures at all stages of production, facility safety drills, and emergency response planning. On a facility level, we are fully automated, and the system is continuously monitored by a state-of-the-art system that can automatically notify operators, shut down and isolate areas within the plant should something outside of the normal operating ranges be detected. This significantly reduces the chance of an accidental release or incident.

Currently, there are 72 sensors located throughout the facility site, including along the perimeter and in the railcar loading area. These sensors are capable of detecting chlorine as low as 0.1 parts per million. Once the sensors are triggered, automated shut down processes to isolate the area are initiated, and site operators are notified.



Facility's rail loading area, where strict safety and operating procedures are followed

In the case of a power outage, the facility is equipped with several safety mechanisms that are immediately deployed and do not require operator support. Valves are immediately closed once the facility loses power, securing the chlorine supply within the system.

In North Vancouver, we work closely and collaboratively with local first responders, including North Shore Emergency Management. This includes providing support for other emergency response initiatives.

Moving forward, we will continue to explore ways to further improve the plant, both for the safety of our employees and local community, and to be able to contribute to support the availability of safe drinking water for millions of people across Canada and the Western US.

## Transporting our products

Chemtrade transports chlorine using specially designed rail cars which are custom designed for the transport of liquid chlorine. We lease and maintain our own fleet of rail cars, which we monitor and test to ensure full functionality and safety both prior to and after loading. Rail transport has been proven as the safest method to transport our product over land (source – AAR.com), and we are proud to share that since we have taken over operation of the facility in 2017, Chemtrade has not had a release of chlorine during transportation – either as the result of an accident or a non-accidental release (known as a NAR). Examples of a NAR would include leaks, splashes, or other releases from improperly secured or defective valves, fittings, tank shells or release through a safety relief device.

In fact, we are proud to share that in 2022, we were awarded the American Association of Railroads NAR Grand Slam Award, which is presented annually to companies that are exemplary shippers of hazardous materials. An award winner must have been recognized by at least four Class I railroads and have had zero NARs involving their shipments the previous calendar year. In 2023, Chemtrade was awarded both the Canadian National Railway (CN) Platinum award for Zero Process Safety Related Incidents, and the Gold Level CN Safe Handling award for no non-accidental releases.

At our facility, as a member of Responsible Care®, the Chemistry Industry Association of Canada (CIAC), and The Chlorine Institute, we follow all safety association guidelines, while also being committed to reducing the environmental impact of our activities and improving the health & safety of our employees and the communities in which we operate.

We also follow all Canadian and US federal regulations and ensure that our employees receive training and follow all industry and railroad-specific procedures related to the handling, loading, and shipping of liquid chlorine. This includes following strict speed limits, thorough inspections, rail yard practices, and using identified shipping routes for materials deemed hazardous.
We maintain and operate a fleet of leased railcars, all of which have been specifically designed for the transport of our various products – like liquid chlorine and meeting all of the required regulatory specifications.

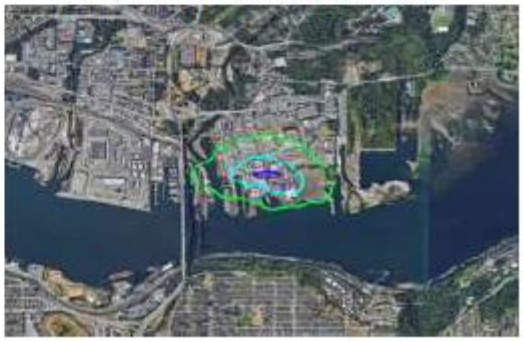
## Looking at ways to further reduce potential risk to the community

We are working with an independent third-party company – BakerRisk – who have developed updated risk information for the facility using the latest technology and accepted parameters. The risk survey work also considers the work already completed at the site – like the modernization projects completed since 2010 – and the changes to operations which have reduced the amount of liquid chlorine stored on site by over 94 per cent based on year 2000 storage levels.

**Below**: 2006 modelling reflecting our current operations



**Below:** possible updated risk, should full risk mitigation measures be implemented



While the risk mapping work is still underway, initial results are promising and show that with the completion of strategic improvement projects, like the construction of a containment shed with air scrubbers around the rail loading area, we could reduce risk to the community by reducing the risk to the area at or close to the facility's property lines.

Our intention is to move forward with the strategic improvements as suggested by the BakerRisk risk reduction modeling to significantly reduce any potential risk to the community from continued liquid chlorine production. This investment will require initial engineering studies and a full estimation process as well as regulatory permits and an extension of Chemtrade's lease for adjacent Port lands, used for both operations and to import

salt for production. As an organization who prioritizes safety above all else, we are willing to begin this work, and do not expect the cost to be an impediment to our desire to move forward. We are also looking at ways to make further operational changes – like reducing onsite storage of liquid chlorine by over 99.6 per cent from year 2000 levels.

As part of our continuous improvement philosophy, Chemtrade continues to explore ways to further improve the plant, both for the safety of our employees and local community, and to contribute to safe drinking water for millions of people across Canada and the Western US.

## Frequently Asked Questions

### How is your facility linked to securing drinking water in Canada?

By our estimates, our North Vancouver facility produces over 40 per cent of the liquid chlorine in Canada. This equates to over 70 per cent of the available liquid chlorine in Alberta and BC. We also supply the US, providing up to 60 per cent of the chlorine for the Western US. The most common use for chlorine is water treatment. In fact, according to a 2015 study by Stats Canada, over 96 per cent of Canadian communities, representing over 30.7 million Canadians, rely on chlorine to treat their municipal drinking water.

### Is Chemtrade willing to look at additional measures to reduce risks related to the production of liquid chlorine?

We are working with a third-party company – BakerRisk – who is developing updated risk mapping for us. As part of this work, they are modelling how the risk map would change if various changes to the plant were implemented. The results have been very encouraging and - reduce the risk to either near or within our property line.

Although the work is still draft, initial possible capital improvements to help further reduce risk include building an enclosure over both the rail loading area and the distillation column, both of which would be equipped with scrubbers that can remove chlorine particles from the air. On an operational level, and using the year 2000 as a benchmark, we would look to further reduce the amount of liquid chlorine stored on site by over 99 per cent.

Our intention is to move forward with the strategic improvements as suggested by the BakerRisk risk reduction modeling to significantly reduce any potential risk to the community from continued liquid chlorine production. This investment will require initial engineering studies and a full estimation process as well as regulatory permits and an extension of Chemtrade's lease for adjacent Port lands, used for both operations and to import salt for production. As an organization who prioritizes safety above all else, we are willing to begin this work, and do not expect the cost to be an impediment to our desire to move forward.

## Who can you contact for more information?

There are several ways to get in touch with us. The first is by visiting www.AskChemtrade.ca where you will be able to submit questions, find all of our information and request email updates. The second is by reaching out directly to our Director, Corporate Communications Amy Jonsson at ajonsson@chemtradelogistics.com.

# Chemtrade North Vancouver Community Update

***August 1, 2024*** ***Issue 2***

Chemtrade's North Vancouver chlor-alkali facility is one of Canada's largest providers of liquid chlorine – accounting for 40 per cent of all liquid chlorine available in Canada. Regionally, this equates to over 70 per cent of the liquid chlorine available in BC and Alberta. Why is this important? A study conducted by Statistics Canada in 2015 found that 96 per cent of Canadian communities relied on chlorine to treat its municipal water supply, which equates to over 30.7 million Canadians. Knowing the significant role that Chemtrade liquid chlorine plays is supporting safe drinking water for millions of Canadians, we need to start having conversations now regarding our potential future operations.

## Thank you for attending the Chemtrade June open house sessions!

On June 6, we hosted two Open House sessions at the Holiday Inn in North Vancouver. We were happy to have over 65 residents attend the sessions, where we shared information about our facility, the importance we place on safety, our role in securing drinking water for Canada, and proposed further improvements to reduce risk and increase safety at the plant.

During the session, we had information stations set up around the room – from operations, to safety, rail transport, water protection and risk mapping and reduction where attendees would learn more and ask questions. We had a team of subject matter experts from Chemtrade on hand, including two members of our executive team – our President and CEO Scott Rook, and our Group Vice President, Commercial Alan Robinson. We also had representatives from BakerRisk, the company hired to review and update the facilities quantitative risk assessments (QRA), and the Chemistry Industry Association of Canada (CIAC) to speak to rail safety.



Following the information stations, we shared a presentation which touched on all of the topics covered in the information stations, and closed with open questions from the floor.

*Above and right: We were pleased to welcome over 65 attendees, mostly North Vancouver residents, to our June 6 Open House sessions.*

*Below: the team from Chemtrade, BakerRisk and CIAC.*





We were impressed at the level of knowledge residents have about the plant and pleased to see how engaged the community is. We received a lot of positive feedback and some great questions, and we are looking forward to continuing to work with the community as we continue to provide safe drinking water for millions of Canadians, while continuing to operate safely and responsibly.

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## Come and see our facility for yourself! Our tour program is up and running




*MLA Susie Chant and Minister George Chow tour the Chemtrade North Vancouver facility, April 2024*

As part of the Open House sessions, we launched a facility tour program to give people the chance to come and see our facility firsthand. We will be running the program seasonally (summer months) moving forward and are offering tours on Thursday mornings, and they must be pre-booked. We are able to facilitate groups of up to 10, and we will provide a full safety briefing and personal protective gear (PPE) to all participants before heading out for a walking tour of the facility. We ask participants to wear close toed shoes, along with long sleeve shirts and pants. If you are interested in learning more, or to book a tour for yourself, please reach out to Amy Jonsson at ajonsson@chemtradelogistics.com.

## Taking a closer look at our production process and site safety precautions

The two areas we received the most questions and interest in at our Open House sessions and through our website – askchemtrade.ca – are questions about overall site safety precautions and procedures, and the actual production process for the products we manufacture at the facility. Understandably so! We live and operate in one of the most beautiful communities in Canada and agree that we need to ensure the protection of the community, our employees and the environment in all that we do. Below we are sharing the questions we have received, along with the answers, which you can also find on our updated FAQ section on askchemtrade.ca. If you have a questions you would like to see answered, please send it to us, either through www.askchemtrade.ca/frequently-asked-questions-faq or by email to Amy Jonsson at ajonsson@chemtradelogistics.com.

### *Is the production process for chlorine harmful to the environment?*

The environmental impact from the production process for chlorine is minimal and does not generate any hazardous waste material or pollution. The overall carbon footprint of the site is very low due to the fact we use green hydroelectricity (BC Hydro supplied), and the salt used in the manufacturing process is solar dried sea salt. Overall, the facility is one of the greenest chlor-alkali facilities in the world.

### *What specific safety measures are in place to prevent chlorine leaks?*

At all of our sites, including our North Vancouver facility, we have strict safety protocols in place that start with production and continue through to our products reaching our customers. These safety protocols include comprehensive training for employees, rigorous safety protocols and procedures at all stages of production, facility safety drills, and emergency response planning.

On a facility level in North Vancouver, we are fully automated, and the system is continuously monitored by a state-of-the-art system that can both automatically notify operators while also

shutting down and isolating areas within the plant should something outside of the normal operating ranges be detected. This significantly reduces the chance of an accidental release. Currently, there are 72 sensors located throughout the facility site, including along the perimeter and in the railcar loading area. These sensors are capable of detecting chlorine as low as 0.1 parts per million. Once the sensors are triggered, automated shut down processes to isolate the area are initiated, and site operators are notified. In the case of a power outage, the facility is equipped with several safety mechanisms that are immediately deployed and do not require operator support. Valves are immediately closed once the facility loses power, securing chlorine within the system.

In North Vancouver, we work closely and collaboratively with first responders, including North Shore Emergency Management. We also provide support for other emergency response initiatives.

### *How often are safety drills and emergency response exercises conducted?*

The site runs several different levels of safety drills on a monthly and annual basis. The facilities safety siren is tested monthly to ensure it is operational. Neighbors, first responders and other agencies are notified in advance of the testing. On an annual basis, the site runs large-scale safety exercises, where the full emergency response program is put into effect and tested. Each year a different emergency response scenario is developed and used as an exercise to ensure the team remains refreshed on all appropriate responses.

### *Why doesn't Chemtrade make bleach instead of liquid chlorine for water treatment?*

Bleach as a product is very rarely, if ever, used in large-scale water treatment and comes with its own challenges – such as very limited shelf life (depending on the dilution ratio, the product can break down within hours, or last as long as six months), and due to the diluted but still hazardous nature, requires special transportation via secure rail car, and less commonly, transport trailer. The diluted nature also presents challenges in terms of volumes – requiring significantly more available transport methods to ship the product to achieve the same level of protection provided by liquid chlorine. This not only adds to the cost for municipalities, but also increases the carbon footprint of the product.

Given all of these limitations, using bleach is not a reasonable or practical solution for large-scale water treatment.

We know that 96 percent of municipalities in Canada use chlorine to treat their domestic water supplies. Although the actual product used by municipalities to treat varies, but we do know it is some form of chlorine, chloramine, or chlorine dioxide. All three of these products can be easily created using liquid chlorine. As it stands, safe and responsible liquid chlorine remains the most responsible and safest method of securing drinking water for millions of Canadians.

Learn more about water treatment in BC: https://www.healthlinkbc.ca/healthlinkbc-files/drinking-water-chlorination-facts. The need for chlorine in securing safe drinking water supplies was also just highlighted in a recent Vancouver Sun article, which you can find here: Water has flowed from our taps for 100 years. What about the next 100? | Vancouver Sun

### *How does the plant ensure compliance with all levels of safety regulations?*

At our facility, as a member of Responsible Care®, the Chemistry Industry Association of Canada (CIAC), and The Chlorine Institute, we meet or exceed all regulatory requirements, and safety association guidelines, while also being committed to reducing the environmental impact of our

activities and improving the health & safety of our employees and the communities in which we operate. We have standard operating procedures (SOPs) in place to ensure the safety of our employees, contractors on site and the surrounding community. In terms of safety in regard to our rail operations, we follow all Canadian and US federal regulations and ensure that our employees receive training and follow all industry and railroad-specific procedures related to the manufacturing, handling, loading, and shipping of liquid chlorine and other products. This includes following strict speed limits, thorough inspections, rail yard practices, and using identified shipping routes for materials deemed hazardous. We maintain and operate a fleet of leased railcars, all of which have been specifically designed for the transport of our various products – like liquid chlorine and meeting all of the required regulatory specifications.

### *What steps have been taken to mitigate risk for the surrounding community?*

Along with all of the onsite safety mechanisms outlined above and also available on our website (www.askchemtrade.ca), we know that the on-site stored liquid chlorine is the largest potential risk to the surrounding community. Since the year 2000, onsite liquid chlorine storage has been reduced by over 94 per cent – from 1,600 tonnes of storage, down to the current onsite storage of 93 tonnes. Moving forward, we would look to reduce that storage to approximately four tonnes – which would represent the liquid chlorine in the production facility itself, with no onsite storage. We would be able to do this by changing how we operate – moving from a produce and store to a produce and ship system. This would not change the number of railcars on site or leaving the facility as our production amounts won't change. It will simply mean that there will be significantly less storage onsite as we would produce to meet demand.

We are also looking to enclose the liquid chlorine railcar loading area in a sealed building equipped with air scrubbers, which would be able to capture and remove any potentially escaped chlorine. Both of these changes, along with additional plans to install seismically activated safety shutoff valves and the removal of the reboiler from the distillation column – would achieve significant risk reduction for the surrounding community.

### *What information and resources are provided to the local community regarding plant safety and emergency procedures?*

Chemtrade participates in a Community Advisory Panel, at which it shares updates on its operations, safety plans, procedures, and planned upcoming work or projects. The Panel is free to ask questions, request information, and have been provided with tours of the facility. As a company, we work closely with our neighbours, first responders - specifically North Shore Emergency Management. Any potential incident would be shared with first responders and through the Alertable system. If the public have concerns, they are asked to contact Chemtrade, either through www.askchemtrade.ca, our Facebook page, or by reaching out to Amy Jonsson at ajonsson@chemtradelogistics.com.

### *How does the plant communicate with local authorities and residents in case of an emergency*

The community and first responders would be notified of any potential risk through the use of the Alterable program, and direct outreach to North Shore Emergency Management. Communication updates would continue to be provided as needed through the system. Updates to local elected officials, First Nations, and the media would also be discussed, and if deemed appropriate, direct communications with those organizations and Nations would begin via email and phone calls.

*Are there any recent upgrades or planned improvements to enhance plant safety?*

The plant typically spends $10 million - $20 million a year on capital investments to sustain the condition of the site and fund improvement projects. Many of these are focused on enhancing the sites' safety systems. The most recent project was completed in 2024 and saw the installation of a new, improved chlorine evacuation system to sweep the piping system of chlorine and run it through a scrubbing system for plant shutdown and rail car evacuation.

The facility also just completed its bi-annual maintenance shutdown, during which all systems within the facility are inspected, and planned maintenance work and improvement projects are completed. The next maintenance shut down is scheduled for 2026.

The proposed additional safety projects suggested as part of the risk reduction work (enclosed rail car loading area, seismically activated shut off valves, removal of some equipment, etc.) through would be scheduled to be completed over the next two turnarounds (2026 and 2028) should we secure a long-term lease renewal.

*How does the plant handle chlorine waste and byproducts?*

There is very little waste, none of it hazardous, generated by the production of chlorine. There are only three byproducts of the process: hydrogen gas, a calcium/magnesium solid material that comes from the purification of the sea salt, and brine sludge. Again, none of these are hazardous, and in fact we do sell a portion of the hydrogen produced as a clean energy source. The brine sludge and the calcium/magnesium solid material are both safely disposed of at the local landfill. It should be noted that the facility is one of the lowest carbon facilities, using green hydro-electric power (from BC Hydro).

*What safety training programs are in place for employees?*

All employees are provided with safety training which includes on-the-job demonstrations and training, on-line learning, and when required, classroom training. Every employee on site is provided with the required safety equipment for their specific role and can include items such as protective eye wear and clothing, respirators, and high visibility vests. The training is logged, and employees are provided with updates about upcoming expiring training so they can rebook and ensure their training remains current.

## Ways to get in touch with us

We would love to hear from you, and there are several ways to contact us. The first is by visiting www.AskChemtrade.ca where you will be able to submit questions, find up-to-date information, and send us a message directly. The second is by reaching out directly to our Director, Corporate Communications Amy Jonsson at ajonsson@chemtradelogistics.com who will be able to answer questions or connect you with someone who can. Or you can visit our Facebook page (https://www.facebook.com/chemtrade) and send us a message that way.




*Visit* www.AskChemtrade.ca

CHEMTRADE

# Chemtrade North Vancouver Community Update

***October 2024*** ***Issue 3***

Chemtrade's North Vancouver chlor-alkali facility is one of Canada's largest providers of liquid chlorine – accounting for 40 per cent of all liquid chlorine available in Canada. Regionally, this equates to over 70 per cent of the liquid chlorine available in BC and Alberta. Why is this important? A study conducted by Statistics Canada in 2015 found that 96 per cent of Canadian communities relied on chlorine to treat its municipal water supply, which equates to over 30.7 million Canadians. Knowing the significant role that Chemtrade liquid chlorine plays is supporting safe drinking water for millions of Canadians, we need to start having conversations now regarding our potential future operations.

## Thank you to everyone who joined our public facility tours!

Our public tour program has just wrapped up for the season, and we want to thank the dozens of people who took the time to attend one of the tours offered. In total, we had over 40 people go through our facility, learn more about what we do, and see firsthand how we do it.

Our facility team were happy to seethe level of interest from the community and are excited to look at ways we can improve the program for next year. "There is nothing that can compare to the experience of coming to site and seeing our operations for yourself. There can be a lot of mystery around what we do, as from the outside, we look like a large industrial operation. Once you get into the facility, see all of our technology in place, understand the level of safety built into all of our systems, the care taken by our team, and our commitment to ensuring we are operating responsibility, it helps to build confidence in the community and an understanding of what we do here every day," says Dave Gosse, Director, North Vancouver Operations. "We are looking forward to the program next year and welcoming more residents onsite."

If you are interested in learning more about the tour program, or want to provide feedback on ways we can improve the program for next year, please reach out to Amy Jonsson at ajonsson@chemtradelogistics.com.




*MLA Susie Chant and Minister George Chow tour the Chemtrade North Vancouver facility*




*Community members tour the facility on October 9, 2024*

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*MLA Susie Chant and Minister George Chow tour the Chemtrade North Vancouver facility*




*Community members tour the facility on October 9, 2024*

impact or create additional railcar traffic. Currently we have an average of four rail cars arriving and leaving our site on a daily basis. We do not anticipate that this will change. This would also mean that we do not anticipate an increase in the amount of switching or shunting of onsite railcars.

The movement and storage of liquid chlorine is highly regulated, including caps on the number of cars that can be stored onsite. We would continue as we operate now, which is to securely load our products and then ship at the earliest possible opportunity.

### *If you proceed with the safety improvements projects you are proposing, what is the risk to the community outside of the larges risk curve?*

The risk curves have been developed for us by an independent company, BakerRisk, using the latest in software and data to develop updated quantitative risk curves, known as the QRA curves, which signify the level of risk presented to an individual, as well as restrictions on types of development allowed within each level of risk, or curve.

The current QRA maps that both we, and the District of North Vancouver use for planning purposes, show the rings extended across the Dollarton Highway and to the east and west of the facility. Although this map is slightly dated thanks to new and emerging technology, it still provides a snapshot of areas we need to be aware of should we have an accidental release.




*Right: QRA curves developed for the facility in 2006 reflecting current operations*

The risk within each curve is defined as:

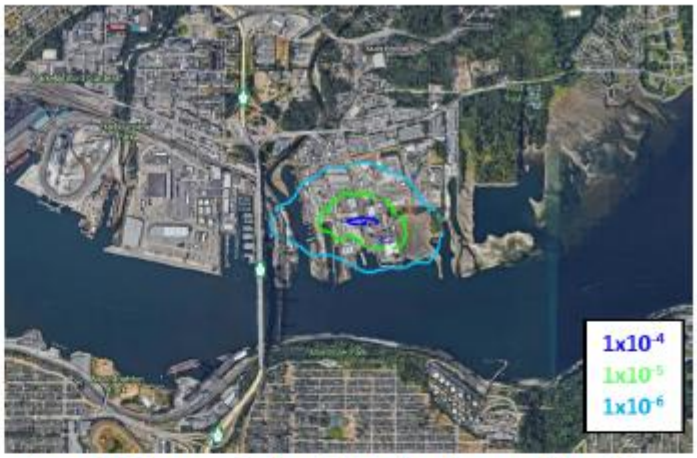
- Within the **$10^{-4}$ curve**, the risk is described as one fatality within 10,000 years, and is comparable, or presents the same risk as working in a manufacturing plant.
- Within the **$10^{-5}$ curve**, the risk is described as one fatality in a hundred thousand years, and is comparable, or presents the same risk as a pedestrian being fatally struck by a car.
- Within the **$10^{-6}$ curve**, the risk is described as one fatality in a million years, and is comparable, or presents the same risk as travelling on a commercial airplane.
- *It should be noted, that **outside of the $10^{-6}$ curve**, there are no restrictions on allowable developments or land uses and the risk to an individual is the same as if the facility wasn't in place.

If we secure the ability to continue to operate for the long-term, we will proceed with several projects aimed at reducing risk to the community and even further improving safety.

The largest of these projects would be the construction of a building around the rail loading area, which would be equipped with air scrubber technology. In the remote possibility of a leak or accidental release, the building would be able to capture the air, run it through a scrubbing process, and remove the chemical from the air.

BakerRisk developed updated modeling for us, based on the completion of our proposed safety projects, which show the impact the projects would have on the QRA curves for the facility. The overall reduction in the curves is dramatic and eliminates the majority of risk for the community at, or near, our facility property line.

All of this information, plus more, can be found on our website as www.AskChemtrade.ca/safety




*Above: QRA curves developed reflecting the completion of our proposed risk mitigation projects.*
*Below: A closer look at the updated risk curves, reflecting the greatly reduced risk to the community*




## Ways to get in touch with us

We would love to hear from you, and there are several ways to contact us. The first is by visiting www.AskChemtrade.ca where you will be able to submit questions, find up-to-date information, and send us a message directly. The second is by reaching out directly to our Director, Corporate Communications Amy Jonsson at ajonsson@chemtradelogistics.com who will be able to answer questions or connect you with someone who can. Or you can visit our Facebook page (https://www.facebook.com/chemtrade) and send us a message that way.




*Visit* www.AskChemtrade.ca

CHEMTRADE

# Chemtrade North Vancouver Community Update

***December 2024*** ***Issue 4***

Chemtrade's North Vancouver chlor-alkali facility is one of Canada's largest providers of liquid chlorine – accounting for 40 per cent of all liquid chlorine available in Canada. Regionally, this equates to over 70 per cent of the liquid chlorine available in BC and Alberta. **Why is this important?** A study conducted by Statistics Canada in 2015 found that 96 per cent of Canadian communities relied on chlorine to treat its municipal water supply, which equates to over 30.7 million Canadians. Knowing the significant role that Chemtrade liquid chlorine plays in supporting safe drinking water for millions of Canadians, we need to start having conversations now regarding our potential future operations.

## In this issue:


- *A look back at 2024*
- *Planning to apply for rezoning with the District of North Vancouver*
- *Ways you can engage, learn more, and show your support*
- *Frequently Asked Questions*
- *Ways to stay in touch*


## A look back at 2024:



***Hosted over 50 information update meetings*** *with elected officials, First Nations, stakeholders, special interest groups, and US elected officials/agencies*



***Held two open house meetings*** *attended by over 65 residents with overwhelming positive support*



***Initiated over 200 interactions*** *(letters, emails, phone calls, meetings, presentations) with overwhelmingly positive feedback received*



***Created three new engagement tools*** *www.AskChemtrade.ca, community newsletter, and launch of public tours of facility*

Since our first newsletter in May 2024, we have continued our efforts to raise awareness of our operations, the role we play in supporting safe drinking water (not just for BC, but for all of Canada and the Western US), as well as the significant updates and investment made at the site that have significantly improved safety and reduced the risk to the community.

Moving forward, we will continue to engage with all members of the community, special interest groups, the municipal, provincial, federal governments and First Nations to ensure there is an understanding of the risks, as well as the benefits of our continued operation, and how we are planning to continue to invest in the facility to ensure we remain a good neighbor.

**In August, 2024, we received national and international media coverage regarding the importance of liquid chlorine during the unprecedented rail strike by both Canadian railways.**

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Many people don't know this, but the only way to transport liquid chlorine is by rail car. When talks between the railroads and the unions were breaking down, we saw embargos on the transportation of goods start to go into effect, and we were unable to ship any liquid chlorine two weeks in advance of what turned out to be labour action at both railways. In response, we reached out immediately to ministries within the federal government, raising awareness about the risk to municipal drinking water supplies. In response, we were contacted by staff from several key ministries, including the Office of the Prime Minister, to better understand the risk to Canadians. We were also in touch with committees and departments within the US government, who shared concerns regarding the protection of water for the millions of Americans who also rely on Chemtrade-produced chlorine for securing their safe drinking water.




***Above:*** *Chemtrade's Vice-President, Commercial, Alan Robinson speaks on CBC National News about chlorine disruptions.*
***Below:*** *Robinson on the Vancouver Early Edition providing and update regarding the risk to national chlorine supplies from the rail labour dispute.*




When Labour Minister Steven MacKinnon announced his decision to order binding arbitration, the need to ensure access to critical products was cited as a reason, with liquid chlorine for water treatment being specifically named. This unprecedented rail strike highlighted just how quickly the impacts would be felt across Canada and the US if we were unable to continue to produce and ship liquid chlorine from our facility.

## Chemtrade is preparing to apply for rezoning with the District of North Vancouver, and is asking for support from the community

The District of North Vancouver passed a bylaw in 1984 restricting the production of hazardous materials within District's limits. As a facility that has been operating safely since 1957, it has always been granted grandfather status.

As part of our plans to secure long-term operations for our North Vancouver facility, **we are proposing several capital improvement projects that will further improve safety and reduce potential risk.** Through meetings and conversations with the District of North Vancouver to better understand the process to implement these improvements, it became clear that **we need to apply for a development permit, which would trigger a rezoning process** as well.

The safety improvements we are proposing on-site include the construction of an enclosure around the rail car loading area, along with other changes like the removal of old infrastructure, and other modernization projects.

**To be clear – we are not making any changes to how we operate. We will not be increasing production or increasing the delivery of raw materials or the shipment of completed products from site.** We will not be increasing on-site storage (in fact we will be reducing it) nor will we be increasing transportation to or from site for our raw materials or completed products. **We are simply applying for rezoning so we can move from a state of legal non-conformity to conformity to pursue further capital investments at our site aimed at increasing safety and reducing risk to the community.** To learn more about our proposed improvements, and the impact these will have on risk reduction, please visit www.AskChemtrade.ca/safety.

## What's next?

We are currently preparing all of the information required for the rezoning application, including the commissioning of several studies. **We plan to submit the full application in the spring of 2025.** Following this, and as outlined within the District of North Vancouver's rezoning application process, **there will be a series of engagement opportunities – both online and in person.** There will be a public open house, with a date to be confirmed following the application filing. We anticipate using a similar format to what we used during both our June 6 Open House sessions, with hosted information stations as well as a formal presentation and open question period.



*One of the many information stations at the open house meetings held on June 6, 2024.*

**As we get closer to filing the application, we will provide detailed information on how you can get involved, learn more, and show your support.** We are committed to working closely with the District to ensure we meet all of the requirements within the rezoning application process.

## Ways to engage, learn more and show your support:

We continue to offer **public tours of the facility** on a first-come basis. If you are interested in visiting our site and seeing our operations firsthand, we would welcome the opportunity to show you what we do. We can accommodate groups of up to 10, and we provide attendees with a safety briefing, and all required personal protective equipment (PPE). The tours run for approximately an hour and a half and require you to be able to walk on uneven surfaces.




If you have any questions about the tour program or would like to be added to the tour list, please reach out to our Director, Corporate Communications, Amy Jonsson at ajonsson@chemtradelogistics.com.

## Taking questions from the community

We have continued to receive questions through our engagement website, www.AskChemtrade.ca, and are happy to share the answers to those questions below, and also post them on our website.

If you have a questions you would like to see answered, please send it to us, either through www.askchemtrade.ca/frequently-asked-questions-faq or by email to Amy Jonsson at ajonsson@chemtradelogistics.com.

### *If you aren't changing your operations, or increasing production, then why do you need to apply for rezoning through the District of North Vancouver?*

Our facility has been safely operating since 1957, but due to a bylaw passed in 1984, our facility has been operating as a legal non-conformity since that time and has been grandfathered up until this point.

As part of our efforts to secure long-term operations, we are proposing several major capital improvements at our site that will not only increase safety but reduce risk to the community. The most visible project, and the one with the largest ability to reduce risk for the community, is the proposed construction of a building around the current rail car loading area. The building would be equipped with sophisticated air scrubbing technology and would be able to capture and contain any chlorine leaked during rail car loading – completely removing it from the atmosphere.

In order to move forward with construction, we would need a development permit from the District of North Vancouver, which will trigger the need for a rezoning application as the District believes this change meets the threshold of rezoning criteria.

**To confirm, we are not increasing our output of any of the materials we produce. We are simply looking to ensure we are correctly zoned so we can move forward with planned safety and risk reduction projects.**

## Ways to get in touch with us

We would love to hear from you, and there are several ways to contact us. The first is by visiting www.AskChemtrade.ca where you will be able to submit questions, find up-to-date information, and send us a message directly. The second is by reaching out directly to our Director, Corporate Communications Amy Jonsson at ajonsson@chemtradelogistics.com who will be able to answer questions or connect you with someone who can. Or you can visit our Facebook page (https://www.facebook.com/chemtrade) and send us a message that way.







CHEMTRADE

# Chemtrade North Vancouver Community Update

***March 2025*** ***Issue 5***

Chemtrade's North Vancouver chlor-alkali facility is one of Canada's largest providers of liquid chlorine – accounting for 40 per cent of all liquid chlorine available in Canada. Regionally, this equates to over 70 per cent of the liquid chlorine available in BC and Alberta. **Why is this important?** A study conducted by Statistics Canada in 2015 found that 96 per cent of Canadian communities relied on chlorine to treat its municipal water supply, which equates to over 30.7 million Canadians. **Knowing the significant role that Chemtrade liquid chlorine plays in supporting safe drinking water for millions of Canadians, and the growing uncertainty in North American trade, we need to start having conversations now regarding our potential future operations.**

## In this issue:


- *Securing Canadian production of a critical product*
- *Moving forward with rezoning application*
- *Updated Frequently Asked Questions*
- *Ways to stay in touch*


## Securing Canadian production has never been more important

As we have seen in recent weeks, growing uncertainty in the trade relationships across North America, but particularly between Canada and the United States has brought the need to secure Canadian production and manufacturing to the forefront.



*Our North Vancouver chlor-alkali facility is a critical Canadian producer of liquid chlorine, required for the treatment of safe drinking water by communities across Canada*

Our facility in North Vancouver has been operating safely and reliably since 1957. We are the largest producer of liquid chlorine in Canada – supplying 40 percent of all liquid chlorine on a national scale, and up to 70 per cent of the available liquid chlorine in Western Canada. Liquid chlorine has many uses, but arguably the most significant use is for the treatment of safe drinking water by 96 per cent of Canadian municipalities.

There are three other chlor-alkali facilities in Canada (one in Saskatchewan and two in Quebec), which have a combined production of less than our facility in North Vancouver. Should we stop production, Canadians would be left to source chlorine from these smaller facilities, or look to import from the United States, a market which has limitations on what it can export, and growing uncertainty in our trade relationships.

In 2021, the Unites States Environmental Protection Agency ordered that domestic market needs for liquid chlorine must be meet before export, and at the same time, the US is facing the closure of several chlor-alkali facilities in the coming years. This will result in even more challenges for an already stretched US supply chain.

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The products produced at this facility - liquid chlorine, caustic soda, hydrochloric acid and hydrogen gas – support several major industries, and are a critical link in the Canadian supply chain. Some examples include:

- **Drinking water treatment** – *used by 96 per cent of Canadian municipalities to treat local drinking water supplies*
- **Metal production** – *such as steel manufacturing*
- **Oil and gas industry** – *used in the refinement process*
- **Industrial chemical production** – *like solvents, cleaners, food preservatives, etc.*
- **Pulp and paper industry** – *for paper production*
- **Clean hydrogen energy** – *the hydrogen produced at our facility is a carbon neutral source of power and is currently being utilized as a local energy source at the facility and through sale to nearby businesses*
- **Renewable battery production** – *Canada is the world's second largest producer of renewable batteries, and the products we produce have the potential to further support this growing industry*

**Water treatment demand vs. chlorine production locations**




- *Black/orange circles represent chlorine production sites and size of capacity*
- *Yellow to grey heat map represents population density (drinking water consumption)*

As we continue to engage with the Vancouver Fraser Port Authority, the District of North Vancouver, all levels of government, community members, First Nations and stakeholders, we want to ensure there is an understanding not only of the role we play in support Canadian drinking water and several key industries in Canada, but also in supporting the BC and Canadian economies.

The facility creates 118 local, well-paid jobs, and injects hundreds of millions of dollars into the BC and Canadian economy through taxes, payroll, and direct and indirect spending with contractors, suppliers, and vendors.



***Have you ever wondered what that pile of white material is at the Chemtrade site?*** *The answer is solar-dried sea salt, which we import from the Baja region of Mexico. It is delivered via barge every six weeks or so and is critical for our production process. In order to make chlorine, we combine salt, water and electricity.*

## Continuing to move forward with plans to apply for rezoning with the District of North Vancouver

Through conversations with the District regarding our plans to move forward with some proposed safety improvement projects at site, we learned that in order to proceed, we will be required to apply for rezoning.

We are currently working to prepare our application, a process we expect to take several weeks to potentially months as it requires the preparation of several detailed reports, many of which require third-party support. Once the application is filed, there will be both in-person and virtual and engagement opportunities – which will be communicated through ads in the NorthShore News, this newsletter, our website (www.AskChemtrade.ca) and direct email notifications for those people who have signed up for notifications through the website.



*Chemtrade hosted two public open house meetings regarding planned continued operations and proposed safety improvements in North Vancouver on June 6, 2024*

Until this process formally launches, we will continue with our current engagement efforts, which include public tours of the facility, updates to the Community Advisory Panel (CAP), offers of presentations to local groups and associations, and dedicated engagement with Nations and government.

To request a presentation, or to sign up for a tour of the facility, please contact Amy Jonsson at ajonsson@chemtradelogistics.com.

## Taking questions from the community

We have continued to receive questions through our engagement website, www.AskChemtrade.ca, and are happy to share the answers to those questions below, and also post them on our website.

If you have a questions you would like to see answered, please send it to us, either through www.askchemtrade.ca/frequently-asked-questions-faq or by email to Amy Jonsson at ajonsson@chemtradelogistics.com.

### What if your rezoning application is not approved?

We are applying for rezoning as part of the process to complete our proposed safety improvements, which would dramatically reduce risk for the community – bringing our current risk curves to near or at our property line, while also improving overall facility safety.

When we engaged with the District regarding our planned safety improvements for the facility, they advised us that in order to provide the building permits required for the improvements, we would need to go through the rezoning process to have the manufacturing of liquid chlorine listed as an exemption within the bylaw.

There are a few things that are important to note. The first is that **if the rezoning application is approved, there will be no change in how we operate, the products we produce, and the volume of our production.** The second is that the **facility has been operating safely and reliably in the current location since 1957**. And the third is that we are the **largest producer of liquid chlorine in Canada, providing over 40 per cent of the chlorine used to treat drinking water in Canada**. We know from a 2015 Stats Canada survey, that 96 per cent of Canadian municipalities use chlorine to treat their municipal water supplies.

***If the District does not approve our rezoning application, we would be unable to move ahead with our planned safety improvements.*** This leaves the future of the facility uncertain beyond 2030 and would leave a large gap in the supply chain in both Canada and the US, particularly in Western Canada as the next closest chlor-alkali facility is in Saskatchewan. Recently, the closure of several chlor-alkali facilities across the United States in the coming years has been announced, making it even more unclear as to how this market gap for Western Canada and the Western US would be filled.

## Will you go ahead and do the safety improvements without the rezoning approval?

No – we would be unable to. We need development permits from the District of North Vancouver to move forward with the safety improvements as the improvements include capital projects such as the construction of a containment structure around the rail loading area.

**If the rezoning application is not successful, we will not be able to apply for development permits so we would not be able to move forward with our safety improvements.**

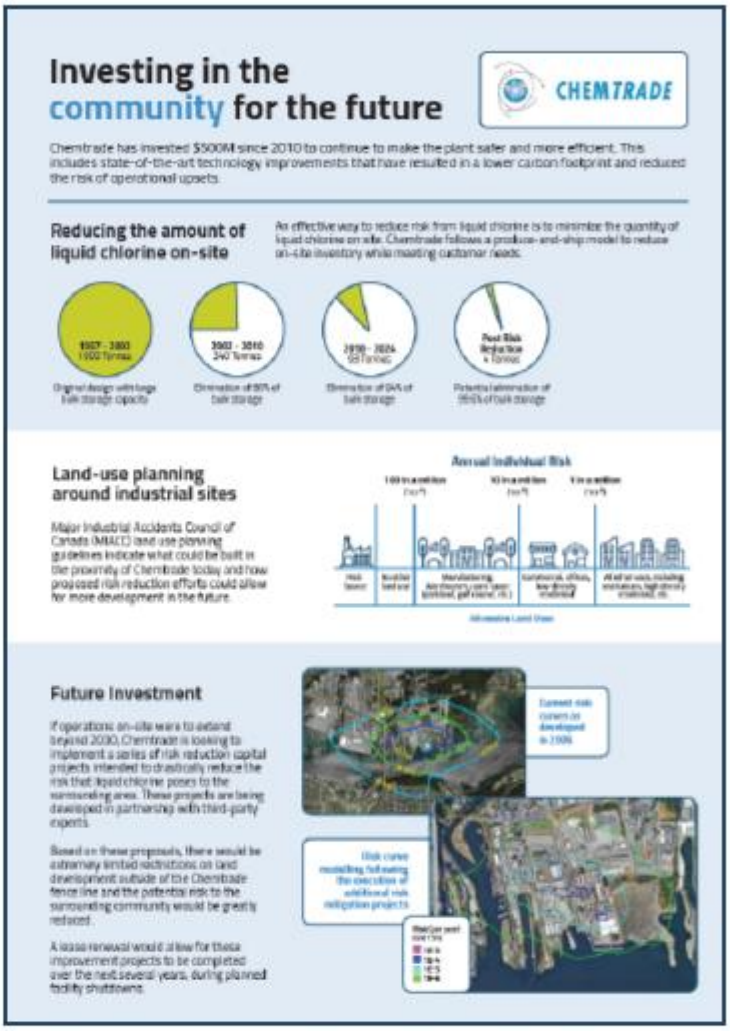
## Would you continue to operate without rezoning approval?

We are engaging with the District to ensure we are meeting all requirements for rezoning and demonstrating our value to the community - but also our value nationally as the largest domestic supplier of liquid chlorine, critical for safe drinking water here in Canada.

We hope to secure rezoning so we can move forward with our proposed safety improvements, which will greatly reduce potential risk to the community, bringing our current risk curves to near or at our property line, while also improving overall facility safety.

The District would also see immense benefits from our proposed safety improvements. This is because with the reduced risk curves, the District would be able to develop the land outside of our property line without restrictions.

Ultimately, if the District does not approve our rezoning application, we will have to look at our current operations, and what our options are moving forward. Again, this is not our preference as our hope is to be able to move forward with our planned safety improvements which will reduce risk to the community and secure safe drinking water for millions of Canadians.




*Above is an example of the information shared during our June 6, 2024 open house (also available on www.AskChemtrade.ca) regarding our planned safety improvements and changes to operations, and how they will impact the facility risk curves.*

## What is your zoning changing from and to?

Our actual zoning for the land the facility is located on would not change from its existing classification, which is Employment Zone – Industrial. If successful, the rezoning application would allow for the production of chlorine to be listed as an allowable activity for our facility.

Just as a reminder, our facility is located in a heavily industrial area – our neighbors include an active Port, a waste and recycling transfer station, a sodium chlorate facility, an aggregates supplier, and a proposed liquid hydrogen facility.

## If you get the rezoning application approved, will you be changing how you operate?

The approval of our rezoning application is required so that we can apply for development permits to move forward with our proposed safety improvements. These improvements will make the facility even safer and further reduce potential risk. **We would not be increasing production amounts or products manufactured at the facility – production levels would remain consistent.**

What we would change is the amount of liquid chlorine stored on site, **reducing it from the approximately 94 tonnes which we currently store on site, down to four tonnes.** To give you context, using the year 2000 as the benchmark, at that time we stored over 1,600 tonnes of liquid chlorine on site. The reduction to 94 tonnes stored onsite today and planned further reduction to four tonnes following rezoning approval, represents a significant change in how we operate and contributes to our significant reduction in risk profile for the area surrounding our facility.

The transition to four tonnes of storage will require us to move towards a manufacture and ship model, but as our production is not increasing, we do not anticipate an increase in railcars to or from the site.

## Ways to contact us

We would love to hear from you, and there are several ways to contact us. The first is by visiting www.AskChemtrade.ca where you will be able to submit questions, find up-to-date information, and send us a message directly. The second is by reaching out directly to our Director, Corporate Communications Amy Jonsson at ajonsson@chemtradelogistics.com who will be able to answer questions or connect you with someone who can. Or you can visit our Facebook page (https://www.facebook.com/chemtrade) and send us a message that way.



# Chemtrade North Vancouver Community Update

***May 2025*** ***Issue 6***

Chemtrade's North Vancouver chlor-alkali facility is one of Canada's largest providers of liquid chlorine – accounting for 40 per cent of all liquid chlorine available in Canada. Regionally, this equates to over 70 per cent of the liquid chlorine available in BC and Alberta. **Why is this important?** A study conducted by Statistics Canada in 2015 found that 96 per cent of Canadian communities relied on chlorine to treat its municipal water supply, which supplies over 30.7 million Canadians.

## In this issue:


- *LOI reached with Port of Vancouver*
- *Answering your questions on our rail operations*
- *Planned community support and events*
- *Ways to stay in touch*


***Knowing the significant role that Chemtrade liquid chlorine plays in supporting safe drinking water for millions of Canadians, and the growing uncertainty in North American trade, we need to start having conversations now regarding how to maintain our potential future operations and secure maintain our Canadian supply chain of this critical product.***

## Letter of Intent (LOI) reached with Port of Vancouver

Our facility is located partly on land that we lease from the Port of Vancouver (the Port) and partly on land that we own. Our current lease with the Port expires in 2032, and within the lease is a restriction on chlorine production beyond mid-2030.

For almost two years, we have been engaging with the Port to secure a pathway to continued operations of our facility, which is the largest manufacturer of liquid chlorine in Canada, critical for safe drinking water treatment.

***In April, we were happy to share that we (Chemtrade) and the Port have entered into a non-binding Letter of Intent (LOI) to extend our land lease until December 31, 2044.***

However, this is only one step in the process to securing our long-term operations.

As part of our work to secure long-term operations, we developed a comprehensive safety improvement program that included several proposed capital projects. These projects are aimed at both increasing safety and significantly reducing risk for the community.



***Above:*** *Salt + Water + Electricity = Chlorine, a look at our cellhouse in North Vancouver*

***Below:*** *Looking at our salt storage on site. We barge in solar-dried ocean salt from the Baja region of Mexico for the production of our chlorine*



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In approaching the District of North Vancouver (the District) to secure a development permit for these proposed improvements, we learned that the application was sufficient to trigger the need to apply for rezoning.

### *Why do you need to apply for rezoning?*

Our facility has been safely operating since 1957. A bylaw passed by the District in 1984 restricted the manufacturing of certain goods, including liquid chlorine, and our facility has been operating as a legal non-conformity since that time. We have been grandfathered up to this point.

***To be clear, we are not changing anything about our operations.*** We are applying for rezoning to have the production of chlorine added as an allowable activity for our facility. If that application is approved, we can then apply for development permits and move forward with our proposed capital safety improvements.

### *What are the proposed safety improvements?*

The proposed capital safety improvements include eliminating bulk storage of liquid chlorine, moving all chlorine loading activities to a closed building that would use a scrubber to remove any chlorine from the air should a leak occur during the rail loading process, and installing seismic sensors.

In 2024, we commissioned an updated risk assessment for our facility using the latest modelling technology and best practice approach. BakerRisk, an independent third-party company, is developing the updated risk mapping, taking into consideration site modernization projects completed since 2010, operational changes that have reduced the volume of liquid chlorine stored on site, and our proposed safety improvements (learn more at www.askchemtrade.ca/safety).

The updated quantitative risk curves (QRAs), while still being finalized as we continue to provide updated engineering information, show a significant reduction in risk for the community. Outside of the largest curve, known as the one in a million, or $10^{-6}$ (*ten to the minus six* line, shown in light blue below), the risk to the community is extremely low and land outside of this curve has no restrictions for development because of risk from plant operations.






***Above left:*** *QRA cures developed in 2006*
***Above right:*** *Updated draft QRA curves showing projected risk following completion of proposed safety projects and reduction of on-site chlorine storage*

## Taking a deep dive into our rail operations

One area we receive questions about is our rail operations and the safety measures we take related to loading, storing cars on site, and shipping our products.

### *Let's start with the vital role rail plays in shipping chlorine*

In Canada, the only way to transport liquid chlorine is by rail. Given this, movement of chlorine is highly regulated to ensure the safe movement of chlorine from loading, through to delivery to customers.

The location of our facility is critical, as the Port of Vancouver is the only port in North America connected to three Class 1 railways that service the Pacific Coast: Canadian National (CN), Canadian Pacific Kansas City (CPKC) and BNSF (Burlington Northern Santa Fe Railway Company). Our location allows us to have access to the rail system for the movement of chlorine, and other products, from our facility to our customers.

Within our site, we have a rail switching yard, several hundred metres of track, three railcar loading areas, and a railcar repair facility. We make it a priority to maintain the rail tracks on our site and ensure that railcars are stored and moved safely. We have a dedicated team of employees who focus on the maintenance, movement, and coordination of railcars on our site.

We should also add that our facility is home to the primary CHLOREP (which stands for Chlorine Emergency Response) team in BC and Alberta. The team is made up of our employees, who have received specialized training in how to respond to hazardous material spills. The team is ready and able to respond to spills, whether they are Chemtrade products or not.

### *What about the railcars used to ship chlorine?*

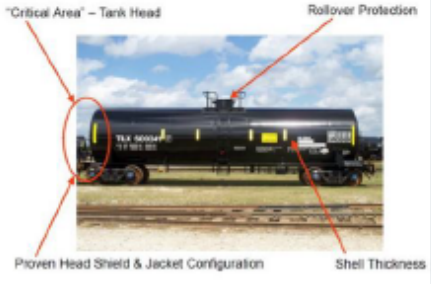
Chemtrade maintains and operates a fleet of leased next-generation railcars, all meeting the latest regulatory specifications and industry standards for the shipment of our chlorine. Our cars are inspected when they arrive at site, then again before they are loaded. If any defects are found during either pre-loading inspection, the cars are immediately pulled into our onsite railcar shed for repair. The cars are inspected again after loading to ensure they are safely sealed and ready for transport.

Our cars also have a regular maintenance schedule, with a full car overhaul scheduled for every three years. In general, the life span of a chlorine railcar is approximately 25 years.

The cars themselves have several layers of protection – from roll-over protection bars to increased shell thickness.

**Significant design improvements for safety and regulatory requirements**

- Pressure tested cars approved to transport products up to 600 PSI pressure rating
- Pressure release device or pressure release valve (PRD or PRV) for chlorine set to 375 PSI with chlorine in the car usually around 60 PSI
- Minimum tank shell thickness increased 25% to 0.981"
- Minimum tank head thickness increased 44% to 1.136"
- Protective Housing thickness (rollover protection) increased 67% to 1.25"
- Addition of 0.5" head shields



***How many railcars do you store on site?***

While we have the space to store up to 270 railcars at our site at any given time, the number of cars on site can vary from one day to the next.

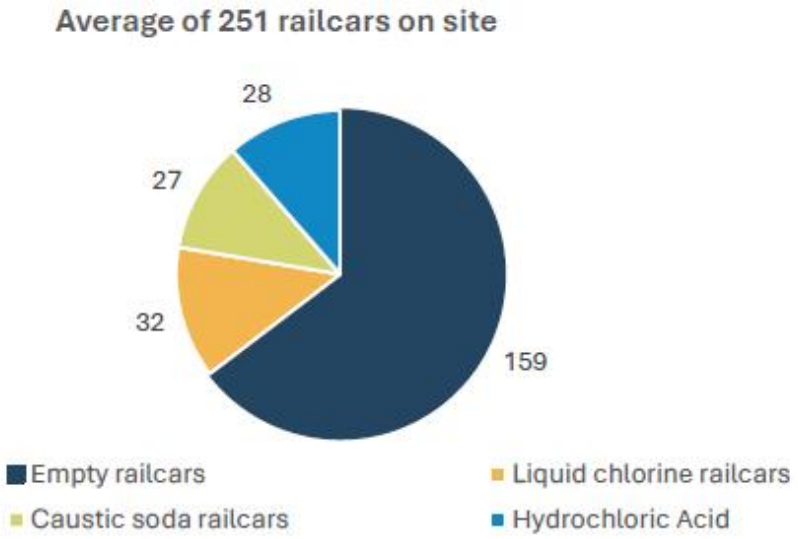
We looked at data from full years 2023, 2024 and the beginning of 2025, to determine some averages, and using this data, we have determined that on average, we have approximately 251 railcars on our site. Within that however, we can go even deeper to provide additional details.

The average number of rails cars that are sitting empty on our site at any given time is 159, which accounts for over 63 per cent (63.3%) of the total cars on site. In comparison, at any given time, we have an average of 32 cars containing liquid chlorine on our site, representing just under 13 per cent (12.7%) of all cars on our site. The remaining 24 per cent (24%) of railcars are a combination of those that contain caustic soda (27 cars) and hydrochloric acid (28 cars).



***Above:*** *One of our rail car loading areas on site*
***Below:*** *aerial of site showing rail area*





**Let's talk about chlorine storage, and if we anticipate an increase in either the number of chlorine cars stored on site, or chlorine car rail traffic after we move to a "produce and ship" operating model.**

Currently we safely store up to 93 tonnes of liquid chlorine on site (down from over 1,600 tonnes stored on site in the year 2000) within our storage tanks. As part of our planned improvements, we will be moving to a "produce and ship" model, which will reduce onsite storage to approximately four tonnes, which is equivalent to the chlorine within our piping system.

Our facility has the capacity to fill up to five chlorine cars per day – although the number actually filled varies depending on demand. The change in our operation from site storage to produce and ship will not materially impact the number of chlorine railcars onsite or shipping rates since the total production volume will remain unchanged.

## Upcoming community events

We are excited to sponsor several initiatives in the community in the coming months and continue to offer public tours of the facility. As part of our rezoning application, we will be hosting both virtual and in-person engagement opportunities, anticipated to be in early fall. We will be sharing all of the events we are sponsoring or participating in on our website – www.AskChemtrade.ca, and through this newsletter.

We hope to see you at one of these upcoming events:

- **Blueridge Good Neighbor Day**, May 25, 2025, 11:00 a.m. – 3:00 p.m.
  https://blueridgeca.org/blueridge-good-neighbour-day/
- **District of North Vancouver Fire Charity Barn Burner Dance**, June 14, 2025
  - https://dnvfirecharity.ca/events
- **Sign up for our public tour program**
  - Contact Amy Jonsson at ajonsson@chemtradelogistics.com

## Ways to contact us

We would love to hear from you, and there are several ways to contact us:

- **Visit or newly updated www.AskChemtrade.ca** where you will be able to submit questions, find up-to-date information, and send us a message directly.
- Reach out to our Director, Corporate Communications Amy Jonsson at ajonsson@chemtradelogistics.com who will be able to answer questions or connect you with someone who can.
- Visit our Facebook page (https://www.facebook.com/chemtrade) and send us a message that way.



*The Chemtrade team at the June 2024 Open House*

# Chemtrade North Vancouver Community Update

***July 2025*** ***Issue 7***

***Knowing the significant role that Chemtrade liquid chlorine plays in supporting safe drinking water for millions of Canadians, and the growing uncertainty in North American trade, we need to start having conversations now regarding how to maintain our potential future operations and secure our Canadian supply chain of this critical product.***

## About Chemtrade

Chemtrade's North Vancouver chlor-alkali facility is one of Canada's largest providers of liquid chlorine – accounting for 40 per cent of all liquid chlorine available in Canada. Regionally, this equates to over 70 per cent of the liquid chlorine available in BC and Alberta. **Why is this important?** A study conducted by Statistics Canada in 2015 found that 96 per cent of Canadian communities relied on chlorine to treat their municipal water supply, which supplies over 30.7 million Canadians.

### In this issue:


- ***Community Day***
- ***Answering questions from the community on safety***
- ***Ways to stay in touch***


## We would like to invite everyone to Community Day on Sept. 6

We are excited to invite our community neighbours to join us, along with our employees and their families, and visit our site to learn more about what we do, and how we do it safely. There will be facility tours, family activities, food, and information stations so you can learn more about Chemtrade, and our plans to secure long-term operations while also improving safety and reducing potential risk to the surrounding community.

### Event details:

**When:** **11:00 A.M. – 3:00 P.M. Saturday, September 6, 2025**

**Where:** **Chemtrade's North Vancouver facility 100 Amherst Avenue, North Vancouver**

**What:** **Tours, activities, food, information, and family fun!**

### Good to know:

- Limited parking will be available on site. We ask that where possible, please use transit or carpool.
- Tours of the site will be provided using shuttle buses so everyone can participate.
- Chemtrade employees from across the company, including senior leadership, will be on-site to answer your questions.
- No need to RSVP, but for more information about the facility, please visit www.AskChemtrade.ca. For more information about the event, please email Amy Jonsson at ajonsson@chemtradelogistics.com



***Above:*** *our salt pile is always a popular stop on our public tours. Did you know that our salt is actually solar-dried ocean salt? Every month, we import this salt from the Baja region of Mexico and use it to manufacture our chlorine. Salt + Water + Electricity = Chlorine (and gaseous hydrogen)*

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## Answering questions from the community: Facility safety

One of the most common things we get asked about is facility safety, including our rail operations. While we can't speak on behalf of the railroad operators, we can share information on the steps Chemtrade takes to ensure the safe manufacturing and transportation of our product and provide background on the rules governing the rail industry in Canada.

### Rail is one of the safest ways to transport hazardous materials overland in Canada

In both Canada and the US, the only way to transport liquid chlorine is either through pipeline, or with specially designed railcars.



***Above:*** *One of the rail loading areas at our North Vancouver facility*

Products classified as Toxic Inhalation Hazards (TIH), which include liquid chlorine, are among the most stringently regulated materials to transport via rail, ensuring safe and secure transportation.

Chemtrade's transportation safety and security programs have established our company as a leader in the industry. Our programs meet and exceed requirements defined by regulatory agencies and industry associations including:

- *Transport Canada, Transportation of Dangerous Goods (TDG)*
- *US Department of Transportation, Federal Railroad Agency (FRA), Pipeline & Hazardous Materials Safety Administration (PHMSA)*
- *U.S. Customs-Trade Partnership Against Terrorism (CTPAT),*
- *The Chlorine Institute (CI)*
- *Chemistry Industry Association of Canada (CIAC)*
- *American Chemistry Council (ACC)*
- *Responsible Care®*

From car design and maintenance, through each step in the rail transportation cycle, Chemtrade has developed standards, procedures, assessments and inspections, providing multiple layers of protection to ensure safe and secure transportation of our products. It should be noted that ***Chemtrade has never had a TIH release during transportation.***

## Review of safety procedures at Chemtrade's North Vancouver facility

We are serious about safety in all aspects at our site – including the maintenance of equipment to ensure we are preventing potential incidents before they occur. This goes for our rail operations and our production processes as well.

***Triple-checking all rail cars:*** We inspect all rail cars when they arrive at site, prior to loading, monitor the filling process and conduct one final inspection before the cars leave our site.

***Adhering to all regulatory requirements:*** Industry and railroad-specific procedures cover employee training, train speeds, inspections, rail yard practices and locomotive operation. Federal regulations from various agencies, including the Federal Railroad Association (FRA) and the Pipeline & Hazardous Materials Safety Administration (PHMSA), dictate safety practices in areas such as placement of railcars carrying certain commodities in the train "consist," hazmat routes, an inspection of equipment and track, speed restrictions and more. *Reference AAR.org*




***Above:*** *A liquid chlorine rail car, equipped with additional protections meant to reduce the risk of an accidental release, like reinforced walls and rollover protection*

***Maintaining a dedicated fleet of liquid chlorine railcars:*** Chemtrade maintains and operates a fleet of about 200 leased railcars, all of which have been specifically designed for the transport of our various products – like liquid chlorine - and meet all the required regulatory specifications.

***Safe storage of chlorine on site:*** Once our proposed safety improvements are complete, we will be moving to a *produce and ship model*, meaning we will have less than four (4) tonnes of liquid chlorine in the facility at any given time, which will consist of the amount of chlorine within the facility pipes and at different stages of production.

Currently, we can store up to 93 tonnes of liquid chlorine onsite, and we do that in a specially designed storage tank. We have three tanks on site – made from one and half inch thick (just under four centimetres) titanium – which are regularly inspected to ensure proper operations. Two of those tanks have now been converted into vacuum storage tanks, capable of capturing the chlorine in the facility and storing it safely. The remaining tank is closely monitored, and inspections and maintenance are completed on a regular schedule.



***Above:*** *one of three onsite chlorine storage tanks. Note that only one is used to store liquid chlorine, the other two have been converted to vacuum storage capable of capturing and storing all chlorine on site*

## Employee training

***Overall training for all employees:*** At all of our sites, including our North Vancouver facility, we have strict safety protocols in place, starting at production and continuing through to our products reaching our customers. Our protocols include employee safety training, rigorous safety protocols and procedures throughout all stages of production, facility safety drills and emergency response planning.

***Emergency response training:*** In North Vancouver, we work closely and collaboratively with local first responders, including the North Shore Emergency Management. Part of our safety training includes emergency training where we simulate real world scenarios and test our processes and procedures to ensure all employees will be ready to respond in the event of an actual incident.



***Above:*** *Our facility and rail safety information station at our June 6, 2024, Open House session was a popular stop for residents wanting to learn more about everything we do to ensure the safety of our employees, and the community*

***CHLOREP Team:*** We also have an onsite, fully trained CHLOREP team. Our employees receive highly specialized training to respond to hazardous materials spills, including liquid chlorine. Our team is ready and able to respond to any spill in Western Canada, whether the incident involves a Chemtrade product or not. Oversight of these teams is maintained by the Chlorine Institute, who perform a site visit every two or three years, ensuring all team members are fully prepared to respond to any potential emergency involving chlorine or its by-products.

When an incident occurs and a contractor's assistance is required, industry officials and emergency responders can be assured that CHLOREP contractors have been thoroughly vetted and are subject to ongoing review. Under this program, verification teams comprised of representatives from chlorine producers, packagers, railroads, and Institute staff visit these contractors every two or three years (depending on the capability level) to ensure they are fully prepared to safely resolve potential emergencies. Contractors have substantial experience in responding to chlorine emergencies and can be either a Level 2 or Level 3 contractor.

## What would happen if there were to be an accidental release

We can confidently state the risk of a large accidental release of liquid chlorine at Chemtrade's facility is very low. Our facility is fully automated and can shut down and isolate any area of production as soon as any one of the 72 sensors located around the site trigger a reading (they can detect chlorine in concentrations as low as one part per million), or any of the equipment provides irregular readings.

We also have cameras located around the site, providing operators and our security team with the ability to visually monitor our site at all times.

Our control room is monitored 24 hours a day, seven days a week where our team closely monitors the operations of every aspect of our facility. These operators are in constant contact with employees working around the site discussing readings and general operations.

Our employees are trained on what to do in the case of an accidental release and regularly practice safety drills based on our emergency procedures and policies. We do this in partnership with local first responders – like Northshore Emergency Management and the District of North Vancouver Fire Department, to ensure all parties are ready and able to respond to a potential release should it occur.



***Above:*** *Tour members get a look at our control room, and the opportunity to ask our operators questions. This room is monitored 24 hours a day, seven days a week to ensure proper and safe operations of our facility*

**If an accidental release were to happen, several immediate actions and processes would be triggered:**

1. Operators would shut down and isolate the area of the facility where the leak was detected
2. The facility would sound the emergency alarm to notify employees and neighboring businesses
3. Employees would launch emergency response protocols which, depending on the location and severity, would include the donning of emergency response gear (rebreathers, protective gear and in some cases, self-contained breathing equipment – similar to scuba gear), evacuation, and sheltering in place
4. Local first responders would be notified and an alert to all Lower Mainland residents would be sent using Alertable. This message would include instructions on what to do – which would generally be to shelter in place, close windows and shut down heating or cooling devices.
5. Employees on site would work with First Responders and our own CHLOREP team to identify, stop and then begin mitigation work for any potential spills.
6. Updates would continue to be provided on the status of the leak, the containment efforts, and any required actions for residents through Alertable. Employees would also be contacting local elected officials and First Nations to provide updates. This would continue until we were able to give the all clear signal.
7. Following the incident, an investigation would be undertaken and the results, along with steps taken to mitigate any future potential incidents, would be shared publicly

## Do the new safety curves account for an earthquake, or other natural disaster?

As part of our plans to secure long-term operations for our North Vancouver facility, we are proposing several capital improvement projects that will further improve safety and reduce potential risk. The safety improvements we are proposing on-site include the construction of an enclosure around the rail car loading area, the removal of old infrastructure, the installation of seismic sensors, and other modernization projects. These projects, along with the substantial decrease in onsite storage of liquid chlorine – a reduction of over 99 per cent from levels stored on site in the year 2000 – are expected to have a positive impact on the reduction of the quantitative risk assessment (QRA) curves. ***The assessment looks at the implications from a full release of all liquid chlorine stored on site – regardless of the cause, whether it is from an earthquake, mechanical failure or human error.***






***Above left:*** *QRA cures developed in 2006 which reflect today's operations*
***Above right: Updated draft QRA curves showing projected risk following completion of proposed*** *safety projects and reduction of on-site chlorine storage*

## Where can I go to find more information?

We have a website dedicated to providing information regarding our operations in North Vancouver along with proposed safety improvements, detailed FAQs, all of our community newsletters, our public tour program, upcoming events, and ways to contact us: www.AskChemtrade.ca

## Ways to contact us

We would love to hear from you, and there are several ways to contact us:

- **Visit our newly updated www.AskChemtrade.ca** where you will be able to submit questions, find up-to-date information, and send us a message directly.
- Reach out to our Director, Corporate Communications Amy Jonsson at ajonsson@chemtradelogistics.com who will be able to answer questions or connect you with someone who can.
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## Appendix F: News release - Chemtrade Provides Update on North Vancouver Chlor-Alkali Facility

# News Releases

Back

10 APR 2025

### Chemtrade Provides Update on North Vancouver Chlor-Alkali Facility

**TORONTO, Ontario,** April 10, 2025– Chemtrade Logistics Income Fund (TSX: CHE.UN) today provided an update regarding its chlor-alkali facility located in North Vancouver, British Columbia.

- Chemtrade has entered into a non-binding letter of intent with the Vancouver Fraser Port Authority (the "**Port of Vancouver**") to extend its land lease until December 31, 2044.
- The land lease covers a portion of the site and will be on similar terms to the existing lease, including a restriction on the receipt, manufacture, storage and distribution of liquid chlorine commencing July 1, 2030. The remaining portion of the site is owned by Chemtrade.
- Chemtrade is preparing the requisite materials to submit, as soon as possible, an application for rezoning to the District of North Vancouver.
- If the rezoning application is approved, Chemtrade will be able to continue producing liquid chlorine on the owned portion of the site and to implement several safety-enhancing capital improvements.

Scott Rook, President and CEO of Chemtrade said, "We have been in discussions with the Port of Vancouver and the District of North Vancouver to secure a pathway to continued operations of this strategic asset. We are pleased to provide a progress report on our North Vancouver facility, which plays such a critical role in supplying millions of Canadians with clean drinking water. Liquid chlorine is used to treat municipal drinking water, and we estimate that our plant provides over 70 per cent of the liquid chlorine available in Western Canada (BC and Alberta)."

Mr. Rook added, "Through our extensive engagement program, we have worked to ensure there is a broad understanding of our commitment to safety and responsible operation, as well as the risk to safe drinking water for millions of Canadians should we no longer be able to produce liquid chlorine. Our facility has been operating safely since 1957, and our planned enhancements, following rezoning approval, are focused on further increasing safety, reliability and reducing potential risk. As a result, we have received several letters of support for our continued operations, including one from the Province of British Columbia asking for the timely review and approval of our rezoning application. The non-binding letter of intent with the Port of Vancouver is an important step to enable us to continue to operate our chlor-alkali facility past 2030 and provide liquid chlorine to ensure clean drinking water for millions of Canadians."

As part of both Chemtrade's ongoing engagement efforts, and as required through the formal rezoning process, there will be several engagement opportunities in the coming months, including facility tours, a public open house and virtual engagement. These will be shared through community updates, newsletters, local advertising, and the engagement website www.AskChemtrade.ca

The letter of intent with the Port of Vancouver is non-binding. There is no guarantee that the parties will enter into a new lease and the current lease expires on June 30, 2032. There is no guarantee that the rezoning application will be approved. Chemtrade would be unable to undertake its planned safety-enhancing capital improvements and may choose not to enter into a new lease with the Port of Vancouver if the rezoning application is not approved by the District of North Vancouver.

**About Chemtrade**

Chemtrade is a Canadian company, headquartered in Toronto, Ontario, which operates a diversified business providing industrial chemicals and services to customers across North America and around the world. Chemtrade is one of North America's largest suppliers of sulphuric acid, spent acid processing services, inorganic coagulants for water treatment, sodium chlorate, sodium nitrite and sodium hydrosulphite. Chemtrade is also a leading producer of high purity sulphuric acid for the semiconductor industry in North America. Chemtrade is a leading regional supplier of sulphur, chlor-alkali products, and zinc oxide. Additionally, Chemtrade provides industrial services such as processing by-products and waste streams.

**Caution Regarding Forward-Looking Statements**

Certain statements contained in this news release constitute forward-looking statements within the meaning of certain securities laws, including the Securities Act (Ontario). Forward-looking statements can be generally identified by the use of words such as "anticipate", "continue", "estimate", "expect", "expected", "intend", "may", "will", "project", "plan", "should", "believe" and similar expressions. Specifically, forward-looking statements in this news release include statements respecting certain future expectations about: Chemtrade's intention and ability to enter a new lease with the Vancouver Fraser Port Authority and the possible expiry date of any such lease; its ability to obtain the approval of the District of North Vancouver to rezone Chemtrade's property; Chemtrade's ability to implement safety-enhancing capital improvements at its North Vancouver facility; Chemtrade's ability to continue its plant operations and to provide liquid chlorine to Western Canada and ensure safe drinking water; and the ability of the planned plant enhancements to further improve plant safety.

Forward-looking statements in this news release describe the expectations of the Fund and its subsidiaries as of the date hereof. These statements are based on assumptions and involve known and unknown risks, uncertainties and other factors that may cause actual results or events to differ materially from those anticipated in such forward-looking statements for a variety of reasons, including without limitation the risks and uncertainties detailed under the "RISK FACTORS" section of the Fund's latest Annual Information Form and the "RISKS AND UNCERTAINTIES" section of the Fund's most recent Management's Discussion & Analysis.

Although the Fund believes the expectations reflected in these forward-looking statements and the assumptions upon which they are based are reasonable, no assurance can be given that actual results will be consistent with such forward-looking statements, and they should not be unduly relied upon. Except as required by law, the Fund does not undertake to update or revise any forward-looking statements, whether as a result of new information, future events or for any other reason. The forward-looking statements contained herein are expressly qualified in their entirety by this cautionary statement.

Further information can be found in the disclosure documents filed by Chemtrade Logistics Income Fund with the securities regulatory authorities, available at www.sedarplus.com.

\# \# \# \#

For further information:

Rohit Bhardwaj
Chief Financial Officer
Tel: (416) 496-4177

Ryan Paull
Senior Manager, Corporate Development
Tel: (973) 515-1831

Amy Jonsson
Director, Corporate Communications
Tel: (236) 808-7851

# Chemtrade North Vancouver Community Update

*February 2026* *Issue 11*

***Knowing the significant role that Chemtrade liquid chlorine plays in supporting safe drinking water for millions of Canadians, and the growing uncertainty in North American trade relationships and uncertain geopolitical conditions, we are having conversations regarding how to maintain our potential future operations and secure our Canadian supply chain of this critical product.***

## In this issue:


- *Why are we applying for rezoning?*
- *An update on our rezoning application*
- *Ways to stay in touch*


## About Chemtrade

Chemtrade's North Vancouver chlor-alkali facility is one of Canada's largest providers of liquid chlorine – accounting for 40 per cent of all liquid chlorine available in Canada. Regionally, this equates to over 70 per cent of the liquid chlorine available in BC and Alberta. **Why is this important?** A study conducted by Statistics Canada in 2015 found that 96 per cent of Canadian communities relied on chlorine to treat their municipal water supply, which supplies over 30.7 million Canadians.

## Why are we applying for a rezoning? *Securing safe drinking water for millions of Canadians*

We are Canada's largest producer of liquid chlorine. Our liquid chlorine is used by over 70 per cent of the municipalities right here in BC and Alberta to treat municipal water supplies. We have a critical role to play in securing your safe drinking water, and with this in mind, we need to secure our long-term ability to operate.

The facility itself has been safely operating since 1957, but due to a bylaw passed in 1984, our facility has been operating as a legal non-conformity since that time and has been grandfathered up until this point.

As part of our efforts to secure long-term operations, we are proposing several major capital improvements at our site that will not only increase safety but reduce risk to the community, such as building an enclosure around the rail loading area equipped with air scrubbing technology, and the installation of seismic sensors. ***To move forward with construction, we need a development permit from the District of North Vancouver. This will trigger the need for rezoning to allow for the production of chlorine at our facility.***

To confirm, we are not increasing our output of liquid chlorine. In fact, once the improvements are completed, we will be moving to a "produce and ship" model, effectively removing almost all on-site storage of liquid chlorine. The application is to ensure we are correctly zoned so we can continue operations and move forward with planned safety and risk reduction projects.

### A history and ongoing commitment to safe operations:

We have a strong commitment to safety; we provide our employees with hours of annual safety training and have strict safety protocols and procedures in place. We partner with local first responders to host join training and emergency response exercises and are part of the Alertable notification system. Our employees receive training in chlorine response, and some have gone on to join a highly specialized and skilled team of volunteers called the CHLOREP team through the Chlorine Institute.

We lease a fleet of almost 300 railcars for the movement of liquid chlorine, which are inspected four times while on site (at arrival, prior to loading, post loading and before departure) to ensure proper functioning of the car. We work closely with the rail operators, and ensure we are compliant with all regulatory requirements. Chemtrade has been the annual recipient of several awards for safe rail operations. Thanks to Chemtrade's rigorous safety protocols, Chemtrade has been awarded the American Association of Railroads Non-Accidental Release (NAR) Grand Slam Award in 2022, 2023 and 2024.

## Rezoning application update

We submitted our rezoning application in the fall of 2025, and it is now moving through the formal rezoning application process. On January 12, 2026, our application received First Reading at the Regular Council Meeting, and by unanimous vote, was recommend to move to a Public Hearing, which has been scheduled for Tuesday, February 24 at 7:00 p.m.

To find our more details about the meeting, including information on how to watch the hearing virtually, or how to register to speak, please visit the District of North Vancouver's website, at www.dnv.org.

## Ways to contact us

- **Visit www.AskChemtrade.ca** to submit questions, find information, and send a message
- Reach out directly to Amy Jonsson at ajonsson@chemtradelogistics.com
- Visit our Facebook page (https://www.facebook.com/chemtrade) and send us a message




*The Chemtrade team and MLA Chant at Community Day held on site, September 2025*

CHEMTRADE

**REPORT**

# Technical Assessment Report
# Effluent Permit #18 Amendment Application

*Chemtrade Electrochem Inc.*

Version No. 1.0

Prepared for:

**Chemtrade Electrochem Inc.**
100 Amherst Avenue
North Vancouver, BC
V7H 1T9

**Envirochem Project No.: 22285-24**

**June 27, 2025**

**Envirochem Services Inc.**
#206 – 267 Esplanade West
North Vancouver, BC
V7M 1A5

Main: 1-604-986-0233
Fax: 604-986-8583
Email: response@envirochem.com
**envirochem.com**

# EXECUTIVE SUMMARY

In 2023, a minor administrative amendment to Ministry of Environment and Parks (ENV) effluent permit #18 triggered a comprehensive assessment comparing Chemtrade discharges to the recently developed Burrard Inlet Water Quality Objectives (BIWQOs). Chemtrade and its agent, Envirochem Services Inc., engaged with BC ENV to generate approved planning documentation including an Information Request Table (IRT) and Methods Package for acquiring discharge data. The latter was acquired through Chemtrade operations, upland testing of stormwater and extensive receiving environment water and sediment quality testing near the facility. The 2024 field monitoring program was designed to account for potential effects of seasonal variation on samples including but not limited to temperature, flows and tides.

Consideration of operational context for the monitoring program includes permit compliance and local conditions as follows:

- 10-year operations monitoring data indicated between 99.3% to 100% compliance with all existing effluent permit #18 criteria with the exception of a single parameter, Zinc (90%). Fish toxicity (survival) test results in undiluted effluent were 100% compliant. Additionally:
  - Average discharge volumes are approximately 71% of the 90,000m$^3$ / day flow limit (leading to less loading);
  - A water budget (inventory) indicated 97.3% of the discharge was attributed to seawater (e.g., background) used for non-contact cooling water. The balance, less than 3%, is comprised of a combination of other process water, stormwater, and domestic wastewater.
  - A combination of numerous nearby discharges (e.g., industrial and municipal) and third-party modelling indicating hydrodynamic and sediment transport effects (e.g., predominant strong flood tides) from Second Narrows which can influence sediment and water characterization.

In summary, monitoring data analysis revealed the following key findings:

- A total of 50 Parameters of Potential Concern (POPC) were identified. After screening the POPCs per approved methods (Defining Parameters of Concern for Effluent Discharge Authorization Applications guidance document, BC ENV 2024) six (6) Parameters of Concern (POCs) were advanced for detailed assessment: Chlorate, Copper, Nickel, Zinc, pH and temperature.
- Receiving Environment field measurements indicated temperature exceeded the 1$^o$C above ambient condition of the BIWQOs in one location (at the point of discharge);
- An Initial Dilution Zone (IDZ) with an approximately 30m radius from the diffuser discharge point was interpreted by a third-party specialist (Troy Vassos, Ph.D FEC P.Eng., Integrated Sustainability). Calculations confirmed:
  - Facility discharge met Burrard Inlet Water Quality Objectives outside the IDZ; and
  - Through Mass Balance based on a sample of four metals (Aluminum, Copper, Iron and Zinc) on a flood tide are many orders of magnitude greater than the effluent contribution from Chemtrade.

The Impact Assessment determined the following:

- Copper, nickel, zinc, and cadmium were conformant BIWQO/BCWQG criteria within the IDZ, suggesting no adverse effects on aquatic organisms;
- Temperature exceeded the 1$^{o}$C increase criteria (by 0.5$^{o}$C) at one station within the IDZ and otherwise was conformant outside the IDZ boundary;
- Minor seasonal pH exceedances were observed during colder months; and
- No BIWQO has been established for chlorate; however, based on available data, no major adverse impacts are anticipated.

Despite occasional exceedances of certain parameters in effluent samples, the overall impact assessment on resident marine biota is expected to be negligible, as supported by 100% survival in toxicity tests using undiluted effluent.

As a result of extensive field testing and supporting references, effluent permit amendment recommendations are limited to:

- reducing fish toxicity testing to semi-annual from quarterly frequency based on an extended period of consecutive 100% criteria conformance.

# ACRONYMS & ABBREVIATIONS

**BC –** British Columbia

**BCAWQG** – British Columbia Approved Water Quality Guidelines

**BC ENV** – British Columbia Ministry of Environment and Parks (previously known as Ministry of Water, Land and Air Protection, Ministry of Environment, or British Columbia Ministry of Environment & Climate Change Strategy)

**BCRWQG** – British Columbia Recreational Water Quality Guidelines

**BCWWQG** – British Columbia Working Water Quality Guidelines

**BIWQO** – Burrard Inlet Water Quality Objective

**BIWQO CH** – Burrard Inlet Water Quality Objective for Central Harbour

**BOD** – Biochemical Oxygen Demand

**CFU** – Colony Forming Units

**Chemtrade** – Chemtrade Electrochem Inc.

**CRWQG** – Canadian Recreational Water Quality Guidelines

**E. coli** – Escherichia coli

**Envirochem** – Envirochem Services Inc.

**IRT** – Information Request Table

**$LC_{50}$** – Lethal Concentration 50%

**$m^3$** – cubic meters

**MWR** – British Columbia Municipal Waste Regulation

**NA** - Not Available

**NBOD** – Nitrogenous Biochemical Oxygen Demand

**NS** – Not Sampled

**pH** – Potential of Hydrogen

**POC** – Parameter(s) of Concern

**POPC** – Parameter(s) of Potential Concern

**TAR** – Technical Assessment Report

**TSS** – Total Suspended Solids

**<** – Less Than, **>** – Greater Than

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# 1.0 INTRODUCTION

The Technical Assessment Report (TAR) was prepared as part of the BC Ministry of Environment and Parks (BC ENV) effluent permit amendment application process for the Chemtrade Electrochem (Chemtrade) facility located in the Central Harbour of the Salish Sea (Burrard Inlet) in North Vancouver, BC.

Procedurally, the TAR was prepared based on:

- the Application Instruction Document (AID) and final Information Requirement Table (IRT) provided by BC ENV) dated November 2, 2023;
- the approved Methods Package dated February 14, 2024, including a receiving environment sampling program focused on comparing results against the Burrard Inlet Water Quality Objectives (BCWQOs); and
- correspondence and meetings throughout the application process including the initial onsite kick-off meeting where BC ENV officials toured the facility during October 2023.

In summary, the TAR includes the following key content to assess the potential effects of the Chemtrade discharge:

- 10 Year Effluent Permit Compliance Summary
- Water budget
- Water Quality and Sediment Monitoring Results (data acquired by both Chemtrade operations and a 2024 marine sampling program)
- Parameters of Concern (POC) Assessment
- Initial Dilution Zone including Mass Balance
- Management Plans (Infiltration Pond Closure Plan)
- Sewage Disposal
- Impact Assessment.

Please see **Appendix A** for the IRT concordance table associated with this report content. Please see **Appendix B** for TAR contributing qualified professionals signed Conflict of Interest & Declaration of Competency forms.

# 2.0 ABOUT CHEMTRADE

## 2.1 Location

The Chemtrade North Vancouver Chlor-Alkali Plant is located on industrial zoned land. As illustrated in **Figure 2-1** below, the north portion of the site is owned by Chemtrade (fee simple property) within the District of North Vancouver, and the south portion is leased property from the Port of Vancouver. It is also important to note that the site is located on the unceded territory of local First Nations including but not necessarily limited to the Squamish and Tsleil-Waututh Nations.

Immediately north of Chemtrade is the CN rail line and light industrial and commercial zoned area with including ALS Geochemistry and Arc'teryx North Vancouver Outlet. Further north is the Maplewood Community Centre and a Squamish First Nation property.

Bordering the west side of Chemtrade is a CN railway spur and industrial operations including E-Z Rect Manufacturing, the North Shore Recycling Centre, Heidelberg Materials Aggregate and BA Blacktop Ltd (Asphalt Plant). Bordering the site to the east is a mudflat, and industrial operations which include ERCO Worldwide North Vancouver, and GFL North Vancouver Facility. Further east is the Maplewood Conservation Area and Tsleil-Waututh First Nation reserve. The adjacent mudflat on the eastern perimeter includes a stormwater discharge.




**Figure 2-1: Chemtrade Site Map**

The southside of the Chemtrade property borders Burrard Inlet Central Harbour. A Vancouver Fraser Port water lot lease granted to Chemtrade is used for unloading salt at the facility-owned dock. Chemtrade's authorized effluent outfall discharges via a diffuser immediately below the wharf.

## 2.2 Company History

Chemtrade is an international manufacturer and distributor of chemical products. It operates a Chlor-Alkali production plant (Sodium Hydroxide, Hydrochloric Acid and Chlorine) located at 100 Amherst Ave, North Vancouver, BC. which produces liquid chlorine, 50% caustic soda, and 36% hydrochloric acid. The plant was originally commissioned by Hooker Chemicals and has operated at this site since Oct. 9, 1957. Over the past 67 years, the facility has undergone process changes to improve operational, environmental, and safety performance. In summary:

- 1957-2001 - Numerous expansions, process upgrade and remediation projects were executed.
- 1999 – Effluent diversion tank installed along with effluent gate and controls for monitoring pH and Oxidation Reduction Potential (ORP) and installation of sodium bisulfite dosing to better control residual chlorine down to <0.2 mg/L (the permit limit).
- 2010 - Technology Conversion Project (TCP) to membrane electrolyzer cell technology from diaphragm cell technology which involved a capital investment of $282 million.
- 2010 to date - Over $50 million in process design changes:
    - The chlorine stripper (identified in the BC ENV effluent permit) was taken out of service as part of process improvements to modernize the plant. The chlorine stripper was removed and the residual chlorine gas stream that used to go to the chlorine stripper was re-routed to a process that converts it to product (hydrochloric acid production) thus eliminating it from it being in direct contact with seawater (used in the system).
    - In addition, the cathode washing facility which discharged cathode wash water to the infiltration pond (BC ENV permit E20829) was decommissioned.
    - Suspended solids loading in effluent was significantly reduced by removal of precipitated salt impurities of magnesium and calcium from effluent by filter pressing and sending it to secure landfill to be treated.
- 2012 - Effluent Collection Tank was installed - The intent was to collect and treat concentrated spills prior to discharge to the general effluent rather than diverting and treating the entire contents of the general effluent. This provided improved control of the effluent treatment system and reduced the need to divert the general sewer to the diversion tank.

- 2015 - A $22-million caustic modernization project which started in 2015 and involved the installation of a high efficiency evaporation system eliminating direct contact of seawater with condensing water from sodium hydroxide evaporation. Removing the steam ejector system for generating vacuum in caustic evaporation system resulted in an overall reduction in effluent temperature

## 2.3 Operations Summary

The Chlor-Alkali production plant operates 24 hours a day, 7 days a week except for maintenance shutdown periods which often occur in the spring for a one-week period. Through the Chlor-Alkali Process, Chemtrade produces liquid chlorine, 50% caustic soda and 36% Hydrochloric acid using membrane electrolyzer cell technology. This approach is preferred over the diaphragm cell or mercury cell method because it uses the least amount of electric energy, produces the highest quality sodium hydroxide (NaOH), and does not use mercury. Of the three technologies, the membrane electrolyzer cell technology is preferred from an environmental perspective.

**Figure 2-2** provides a high-level overview of the Chlor-Alkali Process at Chemtrade which starts with two main raw materials of electricity and solar evaporated salt that is delivered to the plant by ship from Mexico. Using city water, the salt is dissolved in water to form a concentrated solution (brine) which is then treated and reacted with a large about of DC current to “electrolyze” the salt water. The electrolyzation of saltwater produces chlorine gas, sodium hydroxide as well as byproduct hydrogen gas to produce hydrochloric acid. Some of the chlorine gas is burned in specialized burners with the byproduct hydrogen gas to produce hydrochloric acid. The remaining chlorine gas is chilled and liquified for shipment by rail. Hydrochloric acid is shipped by truck or rail, sodium hydroxide is shipped by truck, rail, or ocean barge and chlorine is shipped from the site only in specialized rail cars designed specifically to haul liquid chlorine.

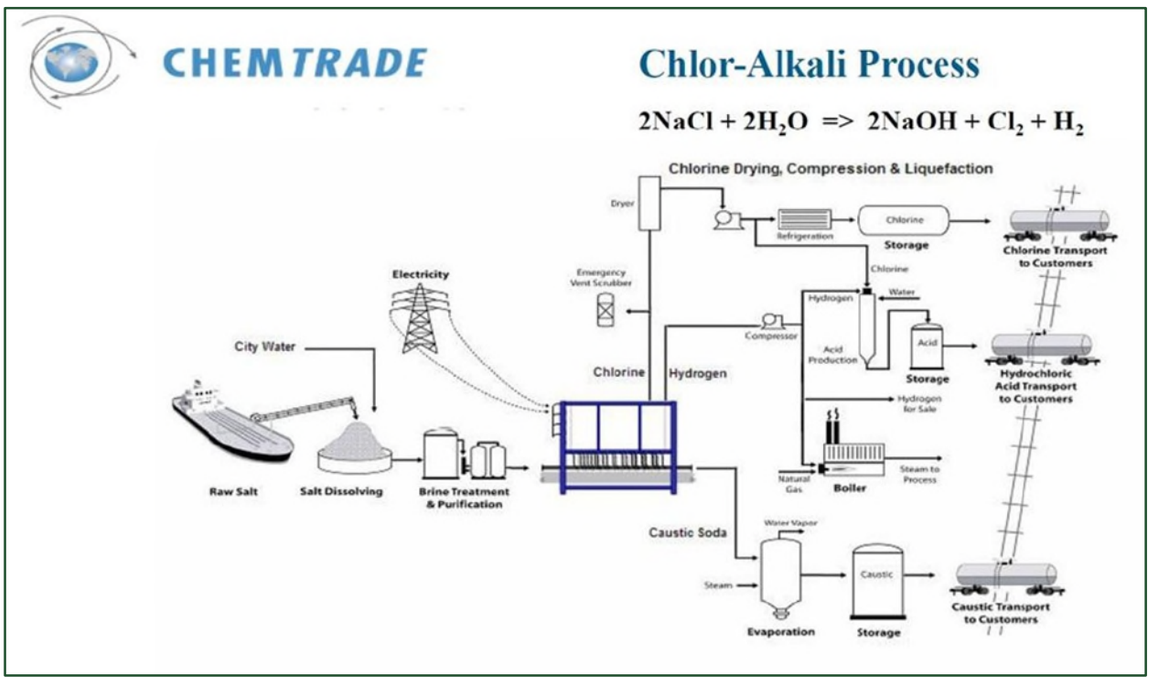



**Figure 2-2: Chemtrade Process Summary**

These chemicals made at the Chemtrade facility are used for many beneficial applications:

- Chlorine – water purification, building products, pharmaceuticals, plastics, and clothing
- Hydrochloric Acid – oil and gas well production, cleaning products and water treatment chemicals.
- Caustic Soda – pulp and paper production, plywood manufacturing, steel manufacturing and beverage brewing.

## 2.4 Effluent Controls

Effluent in the main effluent pipe is dechlorinated using sodium bisulfite solution to reduce the effluent chlorine below the permit limit of 0.2 mg/L. Typical values for residual chlorine are 0.01 mg/L or lower before being discharged to the Burrard Inlet. This is continuously monitored by Oxidation-Reduction Potential (ORP) measurements and tied directly to the effluent gate. Thus, if the ORP were to exceed a set level, the

main effluent gate would close and divert effluent to the effluent diversion tank until an acceptable level is met. In addition, the effluent line has continuous monitoring for Total Suspended Solids (TSS) and pH. and again, there are preset triggers for TSS and pH which close the main effluent gate and send effluent to the effluent diversion tank until acceptable levels are met. Thus, this monitoring system helps ensure compliance with the effluent permit limits for Residual Chlorine, TSS and pH.

A summary of key operational controls for the effluent system include:

- Continuous in line TSS, ORP and pH monitoring system and routine calibration.
- Addition of sodium bisulfite solution to reduce the effluent chlorine in the main effluent pipe to below the permit limit.
- Gate valve on effluent pipe and pump system to divert effluent to a diversion tank should in line monitoring instrumentation indicate values trending toward permit limits.
- Fish screens on inlet of seawater pumps.
- Heat exchangers for noncontact cooling water.
- Filters throughout the process to reduce TSS.
- Effluent neutralization tank and effluent collection tank to adjust pH and residual chlorine levels as needed.
- Seasonal “as” required use of anti-foaming agent – SPAN 85-NV-LQ-(AP) to control foam in the effluent discharge. Note: This product does not contain a hazardous substance or mixture based on SDS information.
- Oil/water separator for parts cleaning pad which is inspected routinely.
- Routine clean-out of catch basins and yard sweeping as part of Chemtrade’s stormwater management program.
- Clean out of domestic sewage tanks as per preventive maintenance schedule.
- Preventative maintenance program to ensure all operational equipment is working effectively.

## 2.5 Discontinued Operations

A cathode washing facility used to operate west of the infiltration pond and discharge cathode wash water into the infiltration ponds. The cathode washing facility has been discontinued since 2010, and no process water enters the infiltration pond. The only sources of water to the infiltration pond since 2010 include:

- Seawater is used as the primary dust suppressant on the surface of the infiltration ponds and is applied at an approximate flowrate of 4 $m^3$/hr over 24 hours.
- Supplemented Metro Vancouver drinking water which is used as a secondary source dust suppressant on the surface of the infiltration ponds and is applied at an approximate flowrate of 4 $m^3$/hr over 24 hours.
- Rainwater which falls directly on the pond (i.e., no surface water from other areas is directed to the ponds).

Past and recent studies indicate these ponds pose a low to negligible risk to the receiving environment:

- In the 2012 Tier I Ecological Risk Assessment prepared by URS Canada Inc. and peer reviewed by SLR, the Risk Assessor concluded there is little potential for adverse effects to populations of ecological receptors in the area where groundwater from the Canexus (i.e., Chemtrade) facility discharges.
- As a Port of Vancouver requirement, there is an annual groundwater monitoring program in place administered by third party environmental professionals which includes monitoring in the area adjacent to (west) and downgradient (south/southeast) of the infiltration ponds. These reports are provided to the Port of Vancouver annually. The downgradient groundwater data does not suggest this to be an area of concern at this time.
- The 10 years of historical permit sampling results provided to BC ENV from the east/west infiltration ponds (Site E208289), downgradient groundwater well (Site E208292) and tidal pool (Site E20893) indicate a high level of compliance with the permit criteria.

As required by the effluent permit amendment process, an Asbestos (Infiltration) Pond Closure Plan has been prepared and provided in **Appendix C** and discussed under **Section 7.1**. Executing the plan will be dependent on facility operational planning and related logistics. Above-noted controls will remain in place until then.

## 2.6 Permit History and Before and After Conditions

Based on public information regarding waste discharges authorizations which is available from the BC ENV website, and information available from Chemtrade, a brief history of permit 18 is summarized below. This is followed by the before and after conditions for the Dec. 1, 2022, minor permit amendment request which this TAR is supporting.

- Permit 18 was initially issued on Oct. 29, 1957, to Hooker Chemicals Ltd. (authorizes the discharge of effluent composed mostly of cooling water using seawater from the Burrard Inlet)
- Permit amendment issued Oct 16, 2008, to Canexus Chemicals Canada Limited Partnership
- Permit amendment issued Mar.26, 2014 to Canexus Corporation
- Permit amendment issued Jan. 19, 2018, to Chemtrade Electrochem Inc.
- Permit amendment issued Jan. 17, 2024, to Chemtrade Electrochem Inc. (minor adjustments to monitoring program).

### 2.6.1 Before and After Conditions for the 2022 Permit Amendment Application

As per the Minor Effluent Permit 18 Amendment Letter submitted to BC ENV dated December 1, 2022, Chemtrade has undergone various upgrades to the facility since the amendment to the effluent permit in 2014. These changes included:

- decommissioning of the cathode washing operation (including the process discharge to the infiltration pond) and;
- removal of chlorine stripper for cooling effluent.

Consequently, these changes to the Chemtrade facility modify the relevant discharge effluent that requires testing and constitute for rewording on the permit to align with the current operation of the plant.

#### Removal of Chlorine Stripper:

More specifically, under section “1.1.4 authorized works” of the Permit, a chlorine stripper is described to be used for the direct contact cooling effluent. This chlorine stripper has since been removed as chlorine is now retained in the process.

#### Removal of Cathode Washing Operation:

A cathode washing facility used to operate west of the infiltration pond (E20829), where process water from the cathode washing process would discharge into the infiltration pond. Permit monitoring requirements for this discharge include three sample sites:

- E208289 located centre of the active infiltration pond (representing the discharge);
- E208292 a monitoring well located south-east of the infiltration pond (representing a receiving environment location downgradient of the discharge); and
- E208293 a tide pool mudflat location (representing a receiving environment location downgradient of the monitoring well).

The cathode washing facility has been discontinued since 2010, and no process water enters the infiltration pond, therefore, there is no need to monitor the related monitoring points for pH.

As a result, Chemtrade would like to request:

- Removal of the cathode washing effluent from the permit given it has been discontinued; and
- Removal or at a minimum a reduction in the pH monitoring program associated with the three monitoring locations namely E208289, E208292, and E208293.

#### Flexibility on Fish Toxicity Testing:

Under section “1.1.3 characteristics of discharge” of the Permit, toxicity testing is done using Threespine stickleback. There have been various instances in the past where Stickleback has been difficult to obtain in a timely manner for testing. This is due to stickleback being a seasonal species, and labs having difficulty obtaining them from suppliers. For this reason, flexibility on the marine species used for toxicity testing is requested, on the basis that Stickleback is unable to be obtained in a timely manner. The following marine species are requested to be used as a substitute for stickleback: topsmelt or inland silverside. It is our understanding that the BC ENV has accepted these marine species for permit sampling in the past.

### 2.6.2 Permit Performance

Chemtrade effluent has been highly compliant with applicable permit criteria. Historical compliance, 2015 to date, is summarized in **Table 2-1,** below.

**Table 2-1: Historical Effluent Permit Performance**

| Parameters | Criteria | Compliance % Since 2015 | Period Results (Average) | Date of Last Exceedance |
|---|---|---|---|---|
| Flow | 90,000m$^3$ / day | 99.29% | 64,200 m$^3$ /day | 2019-10-16 |
| pH | 6-9 pH units | 99.98% | 7.3 pH units | 2023-04-12 |
| TSS | Max. 130 mg/L<br>Avg. 20 mg/L | 99.98% | 4.4 mg/L | 2023-04-11 |
| Temperature | 32$^o$C | 100% | 19.4°C | NA |
| Total Cl Residual | Max. 1 mg/L<br>Avg. 0.2 mg/L | 100% | 0.010 mg/L | NA |
| Total Copper | 0.02 mg/L | 98.7% | 0.004 mg/L | 2018-01-09 |
| Total Nickel | 0.02 mg/L | 97.5% | 0.003 mg/L | 2016-10-24 |
| Total Zinc | 0.02 mg/L | 89.9% | 0.017 mg/L | 2020-05-06 |
| Fish Toxicity | 96 Hour Mortality | 100% | Fish test using ‘raw’ effluent | NA |

### 2.6.3 Permit Setting

Numerous historical and existing point source and non-point source discharges in Burrard Inlet may influence water quality near Chemtrade. Located directly to the west of Chemtrade’s plant is the Inner Harbour which is one of the most industrialized sub-basins with heavy port activity, cruise ship and float plane terminals, marina and transportation connections via road and rail. Upwards of 80% of the Inner Harbour shoreline has been altered (Stantec, 2009). Additionally, the Seymour River has a reported annual average flow rate of 14.2m$^3$/s which includes alluvial deposits and 18 stormwater outfalls possibly discharging organic and inorganic pollutants (Seymour Salmonid Society, 2001).

According to Rao (2022), the following discharge or potential discharge sources in **Table 2-2** were noted within Central Harbour.

**Table 2-2: Discharge Sources in Central Harbour**

| Discharge Type | Central Harbour |
|---|---|
| BC ENV Effluent Permit | 6 active (which includes one from Chemtrade) |
| BC ENV Hazardous Waste Regulation | 1 active, 1 cancelled |
| BC ENV Wastewater Regulation | 0, Note: 1 active in Inner Harbour, 1 active in Port Moody |
| BC ENV Code of Practice Concrete Products | 2 active |
| BC ENV Organic Matter Recycling | 1 (status not specified) |
| BC ENV Petroleum Storage and Distribution | 2 active |
| Combined sewer overflow | 4 active, 1 historic |
| Recreational boating activities | 1 public dock, private docks |
| Marine transport | 2 anchorages, marine terminals, shipping vessels |
| Stormwater outfalls (approximate) | 54 |
| Sewage | 2 wastewater lift station emergency overflow outfalls |
| Wood waste and treated wood | Former log storage |
| Total (active and historical) | 77+ |

The southside of the Chemtrade property borders the Central Harbour of the Burrard Inlet which also includes an industrial Port of Vancouver waterlot lease. Chemtrade's authorized effluent outfall related to the BC ENV permit discharges immediately below the wharf into the water.

**Figure 2-3** below illustrates potential anthropogenic sources within the vicinity (<2km) of Chemtrade that, when also considering sediment transport and hydrodynamics of the Inlet (i.e., flood tide dominated), are likely to influence background water and sediment quality. This is particularly relevant for the effluent which is made up of approximately 97% of seawater from Burrard Inlet that is used for non-contact cooling purposes. Pre-existing background concentrations of POCs will be assessed to determine the differential loading and effects from plant effluent.




envirochem

206-267 Esplanade W,
North Vancouver, BC V7M1A5
T: 604-986-0233
E: response@envirochem.com

NOTE:
- Aerial image is downloaded from Esri Base Map (2022).
- Original drawing is ANSI full bleed B (11.00 x17.00 Inches) and in colour

SCALE:

0 55 110 220 330 440 m

Scale: 1:7,500

| | | |
|---|---|---|
| Title: Discharge Effluent Permits Locations within 2 km of Chemtrade | Figure No: 1 | Rev. No: 00 |
| Client: Chemtrade Electrochem Inc. | Date: May 2025 | |
| Project: Chemtrade Technical Assessment Report | Project No: 22285-24 | |
| Site Location: 100 Amherst Avenue, North Vancouver, BC | Drawn: HL | Checked: AM |

Path: C:\Autodesk\ArcGIS_GeoDatabase\22285\22285_Discharges.aprx

# 3.0 ENVIRONMENTAL BACKGROUND

A summary of physical and biological components near the Chemtrade facility is provided in the following sections.

## 3.1 Meteorology

Environment and Climate Change Canada (ECCC) have numerous surface weather stations throughout the province and country that provide hourly, daily, and monthly meteorological data (Government of Canada, 2019). Of these, two stations are in proximity to the Chemtrade facility, Vancouver Harbour CS and N Vancouver 2nd Narrows (**Table 3-1**).

**Table 3-1: ECCC Climate Stations near Chemtrade**

| Name | Location | Station ID | Period of Record | Climate Data Available |
|---|---|---|---|---|
| Vancouver Harbour CS | 49°17'43.270" N 123°07'18.730" W | 1108446 | 1925-2025 | Precipitation |
| | | | 1958-2025 | Temperature |
| N Vancouver 2nd Narrows | 49°17'52.600" N 123°00'53.700" W | 1105666 | 1957-2008 | Precipitation |

Although the N Vancouver 2nd Narrows station is closer to the site, the period of record does not extend beyond 2008. Consequently, the Vancouver Harbour CS station provides more up to date information and is more representative of current conditions.

### 3.1.1 Ambient Air Temperature

Ambient air temperature fluctuations can directly influence water temperatures. Changes in water temperature can affect several environmental variables, including dissolved oxygen (DO), biological activity, chemical reaction rates, and ocean stratification.

Within the project area, the average annual temperature is expected to range from 4.3°C to ~18.3°C. Monthly daily average, minimum and maximum temperatures at the Vancouver Harbour climate station over the period of record (1958-2020) are summarized in **Table 3-2**. As expected, the highest recorded daily temperatures were recorded in July and August (average ~18°C and maximum ~34°C). December (4.4°C) and January (4.3°C) have the lowest recorded temperatures in a year.

**Table 3-2: Daily Average, Minimum and Maximum Temperatures at the Vancouver Harbour Climate Station (1958-2024)**

| Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Daily Temperature (°C) | 4.3 | 5.6 | 7.5 | 9.7 | 12.8 | 15.7 | 17.7 | 18.3 | 15.2 | 10.7 | 6.5 | 4.4 |
| Maximum Daily Temperatures (°C) | 15.6 | 16.4 | 19.8 | 26.7 | 32.7 | 33.8 | 34.9 | 32.2 | 28.5 | 24.2 | 18 | 15.2 |
| Minimum Daily Temperature (°C) | -13.3 | -6.7 | -5 | -1.1 | 1.1 | -2.8 | 2.8 | 5 | 1.7 | -3.2 | -9.9 | -15.6 |

### 3.1.2 Precipitation

The effects of precipitation, such as salinity changes, increased runoff, and changes in nutrient and sediment input, can all influence water quality within a marine environment such as the Central Harbour. The monthly average precipitation records at the Vancouver Harbour Climate Station are provided below in **Table 3-3**. For calculating total precipitation, ECCC assumes that 1cm of snowfall is equivalent to 1mm of rainfall. Winter months from November to January have the highest average monthly rainfall rates ranging from 181 to 220mm.

The average monthly snowfalls are greatest in December and January (12cm and 18cm, respectively). These months coincide with the months expected to have the lowest minimum daily temperatures for the period of record.

**Table 3-3: Monthly Average Precipitation the Vancouver Harbour Climate Station (1925-2020)**

| Precipitation Parameter | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rainfall (mm) | 181 | 152 | 148 | 101 | 72 | 61 | 41 | 44 | 76 | 165 | 198 | 220 |
| Snowfall (cm) | 18 | 9 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 12 |
| Total Precipitation (mm) | 211 | 149 | 150 | 104 | 74 | 64 | 44 | 46 | 72 | 167 | 214 | 227 |
| Extreme Monthly Rainfall (mm) | 504 | 312 | 264 | 208 | 175 | 193 | 141 | 146 | 202 | 423 | 420 | 419 |
| Extreme Monthly Snowfall (cm) | 137 | 71 | 68 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 75 |
| Maximum Daily Rainfall (mm) | 135 | 77 | 81 | 61 | 44 | 54 | 74 | 70 | 61 | 122 | 86 | 203 |

## 3.2 Marine Environment – Physical/Chemical

### 3.2.1 Tides, Currents, Circulation

Burrard inlet experiences semi-diurnal tides (two high and two low tides per day) with an average daily height of 3.3 m (Levings et al., 2004). Tidal range measurements extracted from the Vancouver Station adjacent to the Sea Bus Terminal in Burrard Inlet, are summarized in **Table 3-4**. Burrard inlet Currents and circulation within the Burrard Inlet are primarily driven by tidal exchanges and can result in increased current speeds near the constriction of the two Narrows, with maximum current speeds of 3.3 m/s, or 6.5 knots at Second Narrows (CHS, 2020). The Central Harbour is flushed by diurnal and semi-diurnal tides (Rao et al. 2019). Tides entering the Burrard Inlet

**Table 3-4: Tide Range at CHS Station 7735 (Vancouver) in Burrard Inlet (CHS, 2025)**

| Tides | | Water Height (m) Relative to Chart Datum (CD) |
|---|---|---|
| Higher High Water | Large Tide | 5.01 |
| | Mean Tide | 4.47 |
| Mean Water Level | | 3.06 |
| Lower Low Water | Mean Tide | 1.17 |
| | Large Tide | 0.06 |

### 3.2.2 Bathymetry

The bathymetric map reveals shallower depths near the facility to the west, north and east, and gradually getting deeper towards the main channel to the south (**Figure 3-1**). Depths within the study area typically average between 10.7m and 15.0m.

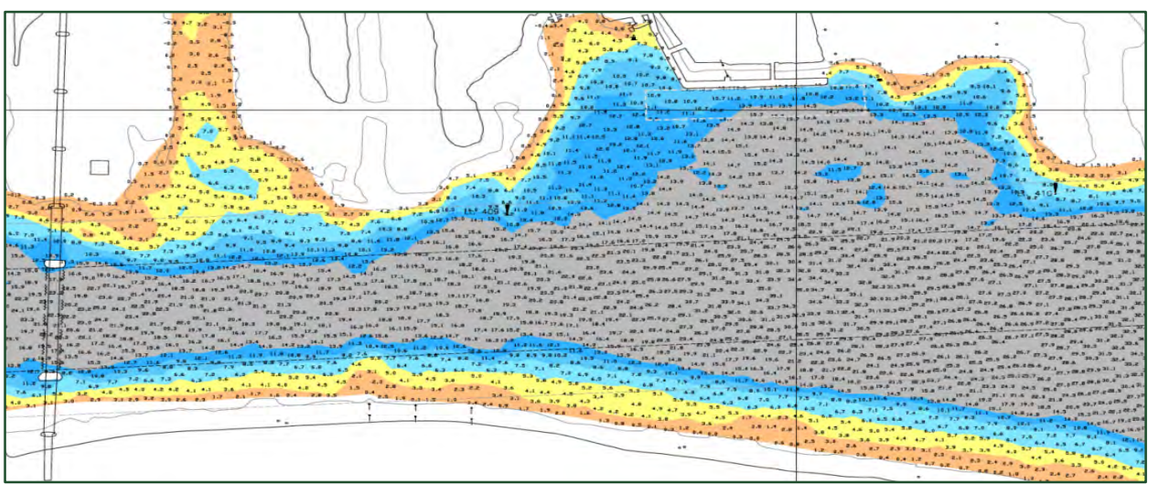


**Figure 3-1: Bathymetry in the Vicinity of the Chemtrade facility**

### 3.2.3 Marine Sediment

#### 3.2.3.1 Sediment Transport and Hydrodynamics

Sediment transport and hydrodynamic modelling indicates the Central Harbour (CH) area is subject to predominant flood tide flows through Second Narrows which may also incorporate Seymour River discharges (Meijers, 2021). It is believed that the Seymour River discharge follows the contours to the the main channel in Burrard Inlet where highest transport velocities have been recorded (Meijers, 2021). In addition to Meijers (2021), other models generated by Harper (2020) and McLaren (1994) describe the Burrard Inlet and the Central Harbour as a dynamic marine environment. Relevant excerpts of key natural variables that influence water and sediment quality near the Chemtrade waterfront from Meijers (2021) and Deltares and TU (2021) are provided below:

- Flows and sediment transport in Burrard Inlet are tide dominated and governed by the topography. Flows are strongly accelerated in constricted areas (First Narrows and Second Narrows), which leads to large velocity differences. Following the velocity field, sediment transport patterns are correspondingly dominated by these topographical restrictions. In the wider basins, flows slow down and form eddies. The model results suggest that these eddies act as sediment sinks.
- The transport patterns in Burrard Inlet are the result of an interplay between different forcing mechanisms, such as tidal currents, wind, and wind waves with variable influence on the sediment pathways.
- The impact of wind and waves on the sediment transport patterns is limited.
- Because the fetch within Burrard Inlet is limited, it is impossible for winds to generate high waves.
- The strongest net transport in Burrard Inlet can be found in Central Harbour. As no transport takes place in Central Harbour during ebb, the net transport is dominated by flood transport.
- Flow moving into the Narrows is too weak to generate significant sediment transport, whereas
- There is considerable transport away from the constriction. This leads to the pattern of net sediment transport. See **Figure 3-2**, below (Meijers, 2021).

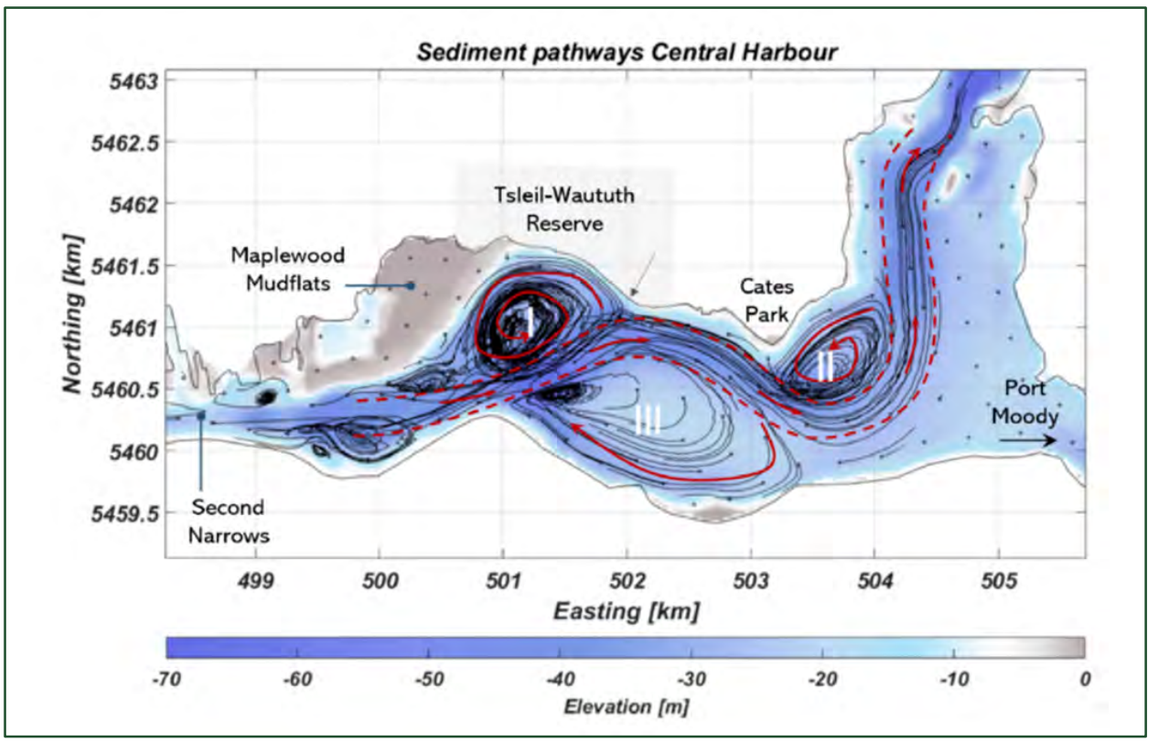



**Figure 3-2: Central Harbour Modelled Pathways**

Research by Li and Hodgins (2004) stated that “the Inner and Central Harbours get flushed as tides move in and out of the inlet”.

- Overall, modelling, and other studies suggest net flows east of Second Narrows resulting in net sediment deposition in lower energy eddies near Chemtrade and eastward. Furthermore, consequences of the relatively high energy environment of Second Narrows were observed

during multiple field sampling events, specifically, variable substrate conditions which ranged from silty sand to a firm compacted (scoured) seabed, the latter where ponar samples could not be obtained.

#### 3.2.3.2 Sediment Chemistry

Prior to a planned dredging program, Hemmera completed an impact assessment on the subtidal environment immediately adjacent to the Chemtrade facility. Sediment samples were collected at select locations within the berth pocket in the water lot lease area and compared to BIWQOs and/or BC WSQGs (**Table 3-5,** Hemmera, 2020).

Sediment samples were analyzed for a number of parameters including total metals and PAHs. Overall, seven of ten metals (arsenic, cadmium, chromium, mercury, nickel, selenium and silver) were below the BIWQOs and/or BC WSQGs thresholds. The remaining three metals including copper, lead, and zinc exceeded the respective guidelines at a minimum of one location (**Table 3-5**). With respect to PAHs, acenaphthylene, benzo(k)fluoranthene, benzo(g,h,i) perylene, Indeno(1,2,3-cd) pyrene and naphthalene were all below applicable BIWQOs and/or BC WSQGs. All remaining PAHs (11 in total) exceeded respective BIWQOs and BC WSQGs at a minimum of one location. Majority of exceedances for metals and PAHs appear to occur immediately east and west of the discharge location.

### 3.2.4 Water Quality

#### 3.2.4.1 Temperature

The BC ENV-derived benchmark dictates that temperature changes “should not exceed ± 1°C from natural ambient background” and that “the natural temperature cycle characteristic of the site should not be altered in amplitude or frequency by human activities”. However, water temperatures in Burrard Inlet show large variations over the year, making it difficult to define a “natural ambient background” temperature.

Compared to the Water Quality Standards for Surface Waters of the State of Washington, maximum water temperatures in Burrard Inlet reach “extraordinary” (≤ 13°C) or “excellent (13-16°C) quality in all sub-basins in fall, winter, and spring. The only exception is found in the surface waters of Indian Arm in spring, where temperatures occasionally reach over 16°C and are classified as “good quality” waters. During summer, maximum surface temperatures in Indian Arm, Port Moody, and Outer Harbour fall into the most impaired temperature category and are classified as “fair” (≥ 19°C), while surface temperatures in Central Harbour and Inner Harbour are of “good” quality (16-19°C).

#### 3.2.4.2 Salinity

The density structure of a receiving water column is a key characteristic that can influence the dispersion of an effluent discharged into a marine environment. Water density is impacted by temperature and salinity, both of which are closely related as they also influence water depth (Bjorklund et al., 2024). A highly stratified water column will typically occur in coastal BC waters due to freshwater runoff from rivers and streams entering the ocean.

A total of 19 tributaries contribute freshwater to the Central Harbour of Burrard Inlet (Rao et al., 2019). Major streams contributing freshwater into the Burrard Inlet include the Capilano River, Lynn Creek, Seymour River, Indian River, and water from the Coquitlam Reservoir (Bjorklund et al., 2024). Freshwater input into the Burrard Inlet from these sources will generally peak twice a year, in conjunction with seasonal events; in the spring with high snowmelt and during winter due to high rainfall (Thomson, 1981). Freshwater via the Fraser River can be a major factor in controlling surface layer properties within the Burrard Inlet, but a broad sill at the southern end of Indian Arm can restrict the exchange of water into the Burrard Inlet (Thomson, 1981).

When freshwater initially enters the ocean, the lower density freshwater floats to the surface while the higher density saltwater lies beneath. As the freshwater travels away from its source, it mixes with the saltwater below, which creates a new layer of low salinity (brackish). The extent of this brackish layer and degree of stratification generally decreases with distance from the source as the layer continuously mixes with the underlying saltwater. For Burrard Inlet, the input of freshwater results in an “estuarine circulation” of water, where there is a new outflow of surface water (brackish) and a new inflow of underlying saline water. Within the Burrard Inlet, the less saline waters (12-20 ppt salinity) tend to flow toward the mouth of Burrard Inlet, while the more saline water (22-30.2 ppt salinity) enter from the Straight of Georgia (Rao et al., 2019). Freshwater which has entered the Burrard Inlet is expected to be retained for approximately six months (Allen, 2017).

### 3.2.4.3 Water Chemistry

Water samples have been historically collected and analyzed for pH, TSS, temperature, residual chlorine, and a full suite of metals, excluding mercury. Intake (influent) water samples were collected between 2010-2017 as part of a trace metals scouting test. It was common for influent metal concentrations (representing Burrard Intake seawater) to exceed effluent concentrations. During the study period (2010-2017), average influent (i.e., intake) concentrations were greater than effluent for parameters such as total hardness (as $CaCO_3$), as well as total concentrations of arsenic, beryllium, boron, calcium, chromium, copper, lithium, magnesium, molybdenum, nickel, potassium, strontium, uranium, and zirconium. With respect to current BIWQOs, total nickel and total copper exceeded their respective guideline values in influent samples.

URS Canada (2012) conducted pore/groundwater sampling and biophysical monitoring at the Chemtrade facility between 2007 and 2010 (**Table 3-5**). Findings suggested that groundwater discharges were not likely to have an adverse effect on the receiving marine environment based on pH buffering capacity of marine waters, benthic community composition, and assessment of contaminant fate.

**Table 3-5: Marine Sediment Chemistry from Chemtrade (Hemmera 2020)**

| Parameters | | Units | BIWQOs | BC WSQG | | 2020 Sediment Test Results & Locations (Hemmera 2020) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Interim Sediment Quality Guideline (Lower) | PEL Probably Effect Level (Upper) | A | B | C | D |
| pH | pH (Lab) | pH units | - | - | - | 8.26 | 8.62 | 8.5[a] | 8.68[a] |
| Metals | Aluminum | mg/kg | - | - | - | 8210 | 7200 | 3790 | 4010 |
| | Antimony | | - | - | - | 0.39 | 0.92 | 0.28 | <0.1 |
| | Arsenic | | 7.24 (max) | 7.24 | 42 | 2.95 | 4.04 | 3.2 | 1.69 |
| | Barium | | - | - | - | 29.9 | 31.2 | 18.4 | 17.4 |
| | Beryllium | | - | - | - | <0.2 | <0.2 | <0.2 | <0.2 |
| | Boron | | - | - | - | 8.4 | 6.3 | 18.7 | 9.5 |
| | Cadmium | | 0.7 (max) | 0.7 | 4.2 | 0.254 | 0.219 | 0.285 | 0.114 |
| | Chromium | | - | 52.3 | 160 | 14.7 | 11.7 | 8.64 | 6.57 |
| | Cobalt | | - | - | - | 5.12 | 5.44 | 2.28 | 2.08 |
| | Copper | | 18.7 (max) | 18.7 | 108 | 23.8 | 42 | 25.3 | 14.3 |
| | Iron | | - | - | - | 17,200 | 17,800 | 8020 | 7490 |
| | Lead | | 30.2 | 30.2 | 112 | 35.1 | 12.4 | 8.63 | 5.52 |
| | Lithium | | - | - | - | 11.9 | 9.58 | 5.33 | 5.58 |
| | Manganese | | - | - | - | 213 | 185 | 86.7 | 112 |
| | Mercury | | 0.13 (max) | 0.13 | 0.7 | <0.05 | <0.05 | <0.05 | <0.05 |
| | Molybdenum | | - | - | - | 2.01 | 1.33 | 4.65 | 0.4 |
| | Nickel | | 30 (max) | 30 | 50 | 11.7 | 9.71 | 25.2 | 5.26 |
| | Selenium | | - | 2 | - | <0.5 | <0.5 | <0.5 | <0.5 |
| | Silver | | - | 1 | 2.2 | 0.127 | 0.072 | 0.069 | 0.058 |
| | Sodium | | - | - | - | 1680 | 2030 | 6460 | 4030 |
| | Strontium | | - | - | - | 80.6 | 157 | 1130 | 907 |
| | Thallium | | - | - | - | 0.071 | 0.074 | <0.05 | <0.05 |
| | Tin | | - | - | - | 0.55 | 0.49 | 0.86 | 0.33 |
| | Titanium | | - | - | - | 621 | 504 | 177 | 169 |
| | Tungsten | | - | - | - | <0.5 | <0.5 | <0.5 | <0.5 |
| | Uranium | | - | - | - | 0.644 | 0.654 | 1.39 | 0.345 |
| | Vanadium | | - | - | - | 44.3 | 39.1 | 14.4 | 15.8 |
| | Zinc | | 124 (max) | 124 | 271 | 50.1 | 129 | 49.5 | 27.8 |
| PAHs | Acenaphthene | mg/kg | 0.00671 | 0.00671 | 0.0889 | 0.015 | 0.012 | 0.011 | <0.005 |
| | Acenaphthylene | | - | 0.00587 | 0.128 | 0.032 | 0.039 | 0.03 | 0.014 |

| Parameters | | Units | BIWQOs | BC WSQG | | 2020 Sediment Test Results & Locations (Hemmera 2020) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Interim Sediment Quality Guideline (Lower) | PEL Probably Effect Level (Upper) | A | B | C | D |
| | Anthracene | | 0.0469 | 0.0469 | 0.245 | 0.1 | 0.11 | 0.088 | 0.033 |
| | Benz(a)anthracene | | - | 0.0748 | 0.693 | 0.18 | 0.22 | 0.49 | 0.046 |
| | Benzo(a)pyrene | | 0.088 | 0.0888 | 0.763 | 0.35 | 0.53 | 0.25 | 0.069 |
| | Benzo(b)fluoranthene | | - | - | - | 0.38 | 0.62 | 0.32 | 0.076 |
| | Benzo(b+j) fluoranthene | | - | - | - | 0.58 | 0.92 | 0.48 | 0.11 |
| | Benzo(g,h,i) perylene | | - | 0.31 | 0.78 | 0.13 | 0.18 | 0.075 | <0.05 |
| | Benzo(k) fluoranthene | | 2.3 | - | - | 0.22 | 0.32 | 0.16 | 0.028 |
| | Chrysene | | 0.108 | 0.108 | 0.846 | 0.31 | 0.34 | 0.64 | 0.097 |
| | Dibenz(a,h) anthracene | | - | 0.00622 | 0.135 | 0.031 | 0.067 | <0.02 | <0.02 |
| | Fluoranthene | | 0.113 | 0.113 | 1.49 | 0.19 | 0.15 | 0.93 | 0.031 |
| | Fluorene | | 0.0212 | 0.0212 | 0.144 | 0.032 | 0.022 | 0.021 | <0.02 |
| | Indeno(1,2,3-cd) pyrene | | - | 0.34 | 0.88 | 0.14 | 0.21 | 0.088 | 0.033 |
| | Methylnaphthalene,1 - | | - | - | - | <0.05 | <0.05 | <0.05 | <0.05 |
| | Methylnaphthalene, 2- | | 0.02 | - | - | 0.022 | <0.02 | <0.02 | <0.02 |
| | Naphthalene | | 0.0346 | 0.0346 | 0.391 | 0.016 | 0.026 | <0.01 | <0.01 |
| | Phenanthrene | | 0.0867 | 0.0867 | 0.544 | 0.16 | 0.11 | 0.088 | 0.017 |
| | Pyrene | | 0.153 | 0.153 | 1.4 | 0.59 | 2.5 | 1.5 | 0.027 |
| | Quinoline | | - | - | - | <0.05 | <0.050 | <0.05 | <0.05 |

**Notes:**
[a] – Due to insufficient sample, 2:1 extraction ratio could not be maintained. Ratio of solution to soil was 4:1.
- = No standard or not analyzed.
Above applicable guidelines

## 3.3 Marine Environment – Biota

### 3.3.1 General Context

Hundreds of species have been recorded in the Burrard Inlet, some of which inhabit the Central Harbour (Rao et al., 2019). A list of species recorded in the Burrard Inlet is provided in Appendix C of the Water quality Assessment and Proposed Objectives for Burrard Inlet: Introduction – Appendices (Rao et al., 2019).

Three sensitive areas exist near Chemtrade including the Seymour River (west), Maplewood Flats (east) and a rockfish conservation area (southeast). The Seymour River flows into the Burrard Inlet approximately 0.5 km west of the plant and contains a fish hatchery that rears and releases anadromous pacific salmon species. Maplewood Flats, a conservation and restoration area on the north shore of the Burrard Inlet, is located approximately 1 km east of Chemtrade. On the south shore of Central Harbour, the DFO has demarcated a Rockfish Conservation Area (i.e., Eastern Burrard Inlet).

### 3.3.2 Macroalgae

A recent study recorded 59 species of macroalgae within the intertidal zone of the Burrard Inlet (Schenk et al., 2025). These species were comprised of algae types including brown (*Phaeophyceae*), green (*Chlorophyta*), and red (*Rhodophyta*).

Common species documented in the Burrard Inlet include: rockweed (*Fucus spp.)*, sea lettuce (*Ulva spp.*), Turkish washcloth (*Mastocarpus papillatus*), sugar kelp (*Laminaria saccharina*), bull kelp (*Nereocystis luetkeana)* and broad iodine seaweed (*Prionitis lyallii*) and five-ribbed kelp (*Costaria costata*; Druehl and Hsiaso 1977, Stantec 2012). At the Maplewood Flats Conservation Area, approximately 125,000 eelgrass shoots were transplanted in the subtidal zone, establishing 1.5 hectares of important marine vegetation habitat. No federally or provincially at-risk marine vegetation species are known occur at the Maplewood Flats (BC ENV, 2018), or in the Burrard Inlet.

### 3.3.3 Invertebrates

More than 100 taxa of invertebrates have been found to inhabit the intertidal and subtidal areas of the Burrard Inlet (Richoux et al., 2006). Invertebrate species found near the Chemtrade facility, particularly at the Maplewood Flats Conservation Area, include acorn barnacles (*Balanus nubilus*), bay mussels (*Mytilus trossulus*), Dungeness and red rock crabs (*Cancer spp.*), sea stars (*Asteroidea spp.*), sea anemones (*Actiniaria spp.*), Pacific oysters (*Crassostrea gigas*), and several clam species (*Venerida spp*.) (Hemmera 2018).

### 3.3.4 Fish

The Central Harbour is important for anadromous salmon that are either out-migrating to the open ocean or are returning to spawn in their freshwater natal streams. Adult salmon have been observed to return to at least 17 streams in the Burrard Inlet (Haggarty, 2001). The Seymour River is among the many watercourses that provide important spawning habitat for salmonids but is also reliant on Seymour River Fish Hatchery and Education Centre. The fish hatchery raises approximately 120,000 coho salmon (*Oncorhynchus kisutch*), 30,000 steelhead (*O. mykiss*), and 350,000 chum salmon (*O. keta*) every year, and 500,000 pink salmon (*O. gorbuscha)* every second year (Seymour Salmonid Society, 2025).

The area adjacent to the Chemtrade facility is used as a migratory corridor and contains temporary holding areas for salmon returning to spawn in freshwater streams. Juvenile salmon from the Seymour River may utilize the Project's shoreline as a temporary holding area before exiting the Burrard Inlet (Hemmera, 2020). The Maplewood Flats Conservation Area contains two streams that contain habitat for coho and chum salmon, and cutthroat trout.

In addition to salmon, 75 other species of fish are known to use the Burrard Inlet (Renyard 1988). Near the Project, the Maplewood Flats Conservation Area provides important and functional eelgrass and mudflat habitat that may be used by various flatfish (*Carangiformes spp.*), lingcod (*Ophiodon elongatus*), rockfish (*Sebastes spp.*), Pacific herring (*Culpea harengus*), and salmonids (*Oncorhynchus spp.*; Hemmera, 2018. Immediately to the south of the Project, the DFO have delineated the Eastern Burrard Inlet rockfish conservation area that provides a number of various rockfish species and lingcod with suitable habitat (DFO, 2025).

### 3.3.5 Marine Mammals

The diversity and abundance of marine mammals, with the exception of harbour seals, in the Burrard Inlet is low. Several marine mammals recorded in the Burrard Inlet may interact with the Project including the sea otter (*Enhydra lutris*), river otter (*Lontra canadensis*), Dall's porpoise (*Phocoenoides dalli*), harbour porpoise (*Phocoena phocoena*), Pacific-white sided dolphin (*Lagenorhynchus obliquidens*), harbour seal (*Phoca vitulina*) and stellar Sea Lion (*Eumetopias jubatus*; Transport Canada, 2016; Butler et al., 2015). Larger species such as grey whale (*Eschrichtius robustus*), humpback whale (*Megaptera novaeangliae*), killer whale (*Orcinus orca*), and the minke whale (*Balaenoptera acutorostrata*) have been occasionally observed in the Burrard Inlet (Transport Canada, 2016) but are uncommon.

### 3.3.6 Species at Risk

A review of SARA-listed aquatic species potentially present in the Central Harbour of Burrard Inlet identified 13 marine species at risk including fish and marine mammals.

Seven SARA listed fish species have the potential to occur in Burrard Inlet (**Table 3-6**). Basking sharks are infrequent in Canadian Pacific waters with only 33 confirmed sightings since 1996 (COSEWIC, 2018). Given there have been no sightings in the Burrard Inlet (DFO, 2010), the likelihood of basking shark to occur in the Project area is low. *Longspine thornyhead*, tope and bluntnose sixgill shark are typically deepwater species caught off the coast of British Columbia and inshore forays are rare COSEWIC, 2007a; COSEWIC, 2007b). Although there are several sightings of bluntnose sixgill shark in Strait of Georgia, there does not appear to be any known occurrences in Burrard Inlet. Green sturgeon is a shallow water species that has been documented in Strait of Georgia, with limited information with respect to the use of Burrard Inlet (COSEWIC, 2004). Given the lack of information, it is assumed the likelihood of occurrence near the Project is low. Although a rockfish conservation area is located immediately to the south of the Chemtrade facility, both yelloweye and rougheye rockfish are deeper water species that associate with hard substrate that is not encountered near the Project area (Love et al., 2002). As such, the likelihood of their occurrences is low.

SARA listed marine mammals that could potentially interact with the Project include the grey whale, harbour porpoise, humpback whale, killer whale and stellar sea lion. Given they are occasionally recorded in Burrard Inlet (Butler et al., 2015; **Table 3-6**). Given the low number of sightings and occurrences in Burrard Inlet, the likelihood of interacting with the Project remains low.

**Table 3-6: Species at Risk in Central Harbour**

| Common name | Scientific Name | Federal Status (SARA) | Likelihood of Occurrence at Project |
|---|---|---|---|
| **Fish** | | | |
| Basking Shark | *Cetorhinus maximus* | Endangered | Low |
| Bluntnose sixgill Shark | *Hexanchus griseus* | Special Concern | Low |
| Longspine Thornyhead | *Sebastolobus altivelis* | Special Concern | Low |
| Green Sturgeon | *Acipenser medirostris* | Special Concern | Low |
| Yelloweye Rockfish | *Sebastes rubberimus* | Special Concern | Low |
| Rougheye Rockfish | *Sebastes aleutianus* | Special Concern | Low |
| Tope | *Galeorhinus galeus* | Special Concern | Low |
| **Marine Mammals** | | | |
| Grey Whale | *Eschrichtius robustus* | Special Concern | Low |
| Harbour Porpoise | *Phocoena phocoena* | Special Concern | Low |
| Humpback Whale | *Megaptera novaeangliae* | Special Concern | Low |
| Killer Whale (transient) | *Orcinus orca (pop. 3)* | Threatened | Low |
| Killer Whale (Resident) | *Orcinus orca (pop. 5)* | Endangered | Low |
| Steller Sea Lion | *Eumetopias jubatus* | Special Concern | Low |

# 4.0 EXISTING CONDITIONS

## 4.1 Marine Environment

### 4.1.1 Water Quality

Water quality data was collected in 2024 from the receiving environment to: (1) characterize existing conditions in the vicinity of the Chemtrade facility, (2) understand the contributions of effluent discharge to Burrard Inlet, and (3) determine if effluent discharge and/or receiving environment meet applicable water quality guidelines/objectives.

The primary goal of the Burrard Inlet Water Quality Objectives (BIWQOs) is to protect and enhance the health of Burrard Inlet's marine and freshwater ecosystems. The Burrard Inlet water quality objectives (BIWQOs) were developed through a collaboration of the Ministry of Environment and Climate Change Strategy (BC ENV), the Ministry of Water, Land and Resources Stewardship (BC WLRS), and Tsleil-Waututh Nation (TWN). The BIWQOs integrate Indigenous knowledge with scientific research to establish water quality standards that reflect both ecological and cultural values. As part of the initiative, short (2021-2025), medium (2025-2050), and long-term (2050-) targets have been set to ensure water quality, sediment quality and aquatic life objectives are met.

#### 4.1.1.1 Study Design/Methodology

The marine water quality study design took into consideration the Marine Monitoring Guidance document (LGL & BC ENV, 2019) and the BC Ministry of Environment's Water and Air Baseline Monitoring Guideline document for Mine Proponents and Operators (BC ENV, 2016). Water sample collection also followed the BC Protocols for Marine Monitoring (BC ENV, 2002a) and BC Field Sampling Manual (BC ENV, 2013).

##### Site Selection and Timing

Considering the dynamic receiving environment, samples were collected over several events in 2024 to better understand potential contributions of the facility (Shutdown vs Operational) and temporal trends. Sampling events occurred during the spring, summer and fall:

- Spring
- Shutdown (April 9 - 12)
- Operations (May 7th - 9th)
- Freshet (May 22nd and 24th)
- Summer (August 6$^{th}$ - 8$^{th}$)
- Fall (5-in-30)
- 1$^{st}$ Event (October 29$^{th}$, November 1$^{st}$ and 5$^{th}$)
- 2$^{nd}$ Event (November 12$^{th}$)

- 3rd Event (November 15th)
- 4th Event (November 26th)
- 5th Event (November 28th)

Water samples were collected from fourteen (14) stations during the first four sampling events (Spring Operations, Spring Freshet, Summer, and the 1st Fall Event (5-in-30). The remaining four Fall events (2nd to 5th in the 5-in-30 period) included sampling at six stations (excluding the effluent station). Information for each station is provided in **Table 4-1**. All stations were selected based on providing sufficient areal coverage from the discharge location in the receiving environment (Figure 4-1). Effluent samples collected at end-of-pipe are characterized in **Section 5.1** (Effluent Characterization).

**Table 4-1: Chemtrade Receiving Environment Sampling Stations**

| Station ID | Zone | UTM | | Rationale |
|---|---|---|---|---|
| | | Easting | Northing | |
| DIS_1 | Discharge | 498928 | 5460523 | Discharge location |
| INT_1 | Intake | 498857 | 5460576 | Source of water for the facility |
| NF_1 | Nearfield | 498827 | 5460517 | Immediately East of effluent discharge |
| NF_2 | | 498885 | 5460523 | |
| NF_3 | | 498984 | 5460524 | Immediately West of effluent discharge |
| NF_4 | | 499034 | 5460527 | |
| MID_1 | Midfield | 498762 | 5460472 | ~50 m out from Nearfield stations |
| MID_2 | | 498855 | 5460475 | |
| MID_3 | | 498944 | 5460477 | |
| MID_4 | | 499037 | 5460480 | |
| MID_5 | | 499132 | 5460489 | |
| FF_1 | Farfield | 498805 | 5460394 | ~50 m out from Midfield stations |
| FF_2 | | 499232 | 5460469 | |
| FF_3 | | 498965 | 5460426 | |




envirochem

206-267 Esplanade W,
North Vancouver, BC V7M1A5
T: 604-986-0233
E: response@envirochem.com

NOTE:
- Aerial image is downloaded from Esri Base Map (2021).
- Original drawing is ANSI full bleed B (11.00 x17.00 Inches) and in colour

SCALE:

0 15 30 60 90 120 m

Scale: 1:3,000

| | | |
|---|---|---|
| Title: Proposed Sediment and Water Quality Sampling Locations | Figure No: 2.1 | Rev. No: 00 |
| Client: Chemtrade Electrochem Inc | Date: July 2024 | |
| Project: Marine Resource Assessment | Project No: 22285 | |
| Site Location: Burrard Inlet, North Vancouver, BC | Drawn: SC | Checked: TW |

Path: C:\Users\Sarah.Clement\OneDrive - Envirochem Services Inc\Documents\ArcGIS\Projects\ChemTrade\ChemTrade.aprx

Sample Collection

Water quality samples were collected using a Van Dorn from three depths (1m below surface, mid water column, and 1m above seabed) and during both high and low tide. An additional sample was collected at the Effluent (i.e., End-of-Pipe) within the facility before being discharged to the marine environment. Samples were transferred into labelled bottles, kept cool and submitted to a CALA accredited analytical lab for analysis. Samples were collected one station at a time to minimize risk of sample contamination. In-situ water quality profile data was also collected at 1 m intervals at each station using a calibrated handheld water quality meter (YSI ProDSS). A multiparameter colorimeter (Hach DR900) was used to measure Chlorine Produced Oxidants (CPOs) at stations. For CPOs, three measurements were taken per station and an average of the three measurements was recorded as the value. Additional information recorded included geographic coordinates, water depth, photographs of sampling device, and general site conditions. All samples were collected by the same experienced technical staff to minimize sampling bias (BC ENV 2013).

#### 4.1.1.2 Lab Analyses

An exhaustive list of parameters were analyzed during the first couple of sampling events including:

- Total and dissolved metals;
- Physical Tests (e.g. total suspended solids (TSS), turbidity, pH, hardness);
- PAHs;
- Microbes (i.e., E.coli, Enterococci, fecal coliforms);
- Absorbable organic halides (AOX);
- Biological Oxygen Demand (BOD);
- Anions & Nutrients (e.g., total ammonia, bromide, chloride, fluoride, nitrate, nitrite, sulfate); and
- Other parameters (i.e., bromate, chlorate, phenols).

After discussions with BC ENV and their subsequent approval, several parameters were reduced (i.e., number of sites) or discontinued from sampling. These parameters were either consistently below detection limits or lacked methodologies that could reliably quantify concentrations in seawater. The list of parameters include:

- Adsorbable organic halides (AOX);
- Biological Oxygen Demand (BOD);
- Bromide/Bromate;
- Nitrate/Nitrite;
- Fecal coliforms, *Enterococci*, and *E.coli*; and
- PAHs.

Apart from PAHs (which were reduced to only the Effluent station), the aforementioned parameters were discontinued and not discussed further in the following sections.

#### 4.1.1.3 Findings

Analytical and in-situ water quality results were screened against the British Columbia Water Quality Guidelines (BCWQGs) for marine waters and the BIWQOs for Central Harbour of the Burrard Inlet. Stations

were grouped into their respective locations (i.e., Near-field, Mid-field, Far-field) for analysis. Water chemistry data and QA/QC laboratory results are provided in **Appendix D**.

The BIWQOs for Central Harbour in the Burrard Inlet and the British Columbia Ambient Water Quality Guidelines (BCWQGs) are summarized in **Table 4-2.**

**Table 4-2: Marine Water Quality Objectives and Guidelines**

| Parameter | Source of Threshold | Threshold |
|---|---|---|
| **In-Situ** | | |
| **Temperature** | BCAWQG | 1°C difference from background |
| **Dissolved Oxygen** | BIWQO CH | 8 mg/L 30-day mean (5-in-30); 5 mg/L instantaneous minimum |
| **pH** | BIWQO CH | 7.7-8.8 pH units |
| **Chlorine Produced Oxidants (CPO)** | BIWQO CH | 3 µg/L |
| **General Parameters** | | |
| **Solids, total suspended [TSS]** | BIWQO CH | 10 mg/L (No increase from the expected natural levels in the ambient background, defined by best available data as 10 mg/L) |
| **Turbidity** | BIWQO CH | 1 NTU (No increase from the expected natural levels in the ambient background, defined by best available data as < 1 NTU (5-in-30)) |
| **Phenols, total (4AAP)** | BIWQO CH | 1 µg/L |
| **Nutrients and Anions** | | |
| **Ammonia, total (as N)** | BC AWQG | pH, temperature and salinity dependant |
| **Chloride** | BCAWQG | ±10% |
| **Chlorate** | BCAWQG | 5 µg/L |
| **Fluoride** | BCAWQG | Acute: 1.5 mg/L |
| **Nitrate (as N)** | BCIWQG | 3.7 mg/L |
| **Total Metals** | | |
| **Antimony, total** | BCWWQG (At III) | 270 µg/L |
| **Arsenic, total** | BIWQO CH | 2.4 µg/L mean (5-in-30, wet season). No more than 20% samples >2.4 µg/L. |
| | BCAWQG | 12.5 µg/L |
| **Boron, total** | BCAWQG | 1200 µg/L |
| **Cadmium, total** | BIWQO CH | 0.12 µg/L mean (5-in-30, wet season). No more than 20% of samples > 1.2 µg/L |
| | BCWWQG | 0.12 µg/L |
| **Chromium, total** | BCWWQG | Cr(Vi): 1.5 µg/L, Cr (VIII): 56 µg/L |
| **Copper, total** | BIWQO CH | 1.3 µg/L mean (5-in-30, wet season). No more than 20% of samples > 1.3 µg/L |
| | BCAWQG | Chronic: 2 µg/L, Acute: 3 µg/L |
| **Lead, total** | BIWQO CH | 2 µg/L mean (5-in-30, wet season). No more than 20% of samples > 2 µg/L |

| Parameter | Source of Threshold | Threshold |
|---|---|---|
| | BCAWQG | Chronic: 2 µg/L, Acute: 140 µg/L |
| **Manganese, total** | BCWWQG | 100 µg/L |
| **Mercury, total** | BIWQO CH | 0.016 µg/L mean (5-in-30, wet season) |
| | BCAWQG | 0.02 µg/L mean when MeHg= 0.5% of THg (5-in-30) |
| **Nickel, total** | BIWQO CH | 0.8 µg/L (mean, 5-in-30, wet season) |
| | BCWWQG | 8.3 µg/L |
| **Selenium, total** | BCAWQG | 2 µg/L mean (5-in-30) |
| **Silver, total** | BCAWQG | Chronic: 0.5 µg/L, Acute: 3.7 µg/L |
| **Vanadium, total** | BCWWQG | 5 µg/L |
| **Zinc, total** | BIWQO CH | 10 µg/L mean (5-in-30, wet season), 55 µg/L maximum |
| | BCAWQG | Chronic: 10 µg/L, Acute: 55 µg/L |
| **Polycyclic Aromatic Hydrocarbons (PAHs)** | | |
| **Acenaphthene** | BIWQO CH | 6 µg/L mean (5-in-30, wet season). |
| **Benzo(a)pyrene** | BIWQO CH | 0.01 µg/L mean (5-in-30, wet season). |
| **Chrysene** | BIWQO CH | 0.1 µg/L mean (5-in-30, wet season). |
| **Fluorene** | BIWQO CH | 12 µg/L mean (5-in-30, wet season). |
| **Naphthalene** | BIWQO CH | 1 µg/L mean (5-in-30, wet season). |
| **Microbiological Parameters[a]** | | |
| ***E.Coli*** | BIWQO CH | ≤200 CFU mean (5-in-30, geometric mean); ≤400 CFU maximum (single sample concentration) |
| ***Enterococci*** | BIWQO CH | ≤35 CFU mean (5-in-30, geometric mean); ≤70 CFU maximum (single sample concentration) |
| **Fecal Coliforms** | BIWQO CH | ≤14 CFU median; ≤10% of results >43 CFU |

**Notes:**
BIWQO CH - Burrard Inlet Water Quality Objectives Central Harbor
BCAWQG - British Columbia Approved Water Quality Guidelines
BCWWQG - British Columbia Working Water Quality Guidelines
BCIWQG - British Columbia Interim Water Quality Guidelines
[a] - Medium-term guidelines: 2025-2050

Water quality parameters were compared against the BIWQOs and BCWQGs, resulting in one of the four following scenarios:

- Parameter concentrations are below the BIWQOs and/or BCWQGs
- Parameter concentrations are typically close to the BIWQOs and/or BCWQGs
- Parameter typically exceeds the BIWQOs/BCWQGs, or
- All parameter concentrations are above the BIWQOs and/or BCWQGs.

Results for parameters with applicable objective/guideline were compared to 100% of the BIWQO/BCWQG. In the event a parameter has both BIWQOs and BCWQGs, the BIWQO would take precedent. All other parameters without guidelines/objectives were plotted accordingly.

Results are summarized below and illustrated in the **Figures 4-2 to 4-7**.

### Metals With Guidelines/Objectives

- Concentrations of antimony, beryllium, cadmium, lead, manganese, silver, and vanadium are all below guidelines/objectives and/or non-detect. Although mercury appears to exceed the BIWQO during operations at Nearfield, Midfield, and Farfield, these concentrations (0.025 µg/L) were below the detection limit. The detection limits were raised due to sample matrix effects, making it difficult to interpret result.
- Chromium, copper, nickel and zinc are mostly below guidelines/objectives with a few exceedances. Chromium only exceeded the BCWQGs at the discharge location (one occasion; 1.66 µg/L). Overall, concentrations of copper and nickel are below the BIWQOs, however several exceedances were noted. Copper exceeded the respective guidelines 100% of the time at the Effluent station, and a couple of occurrences at the Discharge (1 time, Operations only), Intake (2 times, Operations only), Nearfield (2 times, including during Shutdown and Operations, Midfield (2 times, Operations only) and Farfield (1 time, Shutdown only). Similar to copper, nickel exceeded the BIWQOs 100% of the time at Effluent and occasionally during the Operations phase with respect to the Discharge, Intake, Nearfield and Midfield stations. No exceedances were recorded during the Shutdown period. Zinc only exceeded the BIWQOs at the Effluent station (two occasions; 10.9 µg/L and 18.2 µg/L).
- Arsenic, and selenium, appear to exhibit a great deal of variability with concentrations equally above and below applicable guidelines. For arsenic, mean concentrations are typically below the BIWQOs during the Operations phase, while 100% of concentrations are above the BIWQOs during the Shutdown period. With respect to selenium, on the other hand, mean concentrations are below the BCWQGs for all phases (Shutdown vs Operations). However, frequent exceedances (outliers) above the BCWQGs were recorded at all sampling locations (except Farfield; max: 1.99 µg/L) during Operations. No exceedances were noted during the Shutdown period.
- Boron exceeded the BCWQGs 100% of the time at all sampling locations during both Shutdown and Operational phases.
- Overall, concentrations of most metal parameters are similar when comparing Shutdown vs Operations. While some parameters show higher concentrations in one phase compared to the other, the differences are not statistically significant. However, for copper, nickel and zinc, concentrations at the Effluent station are significantly different from those at all other stations.

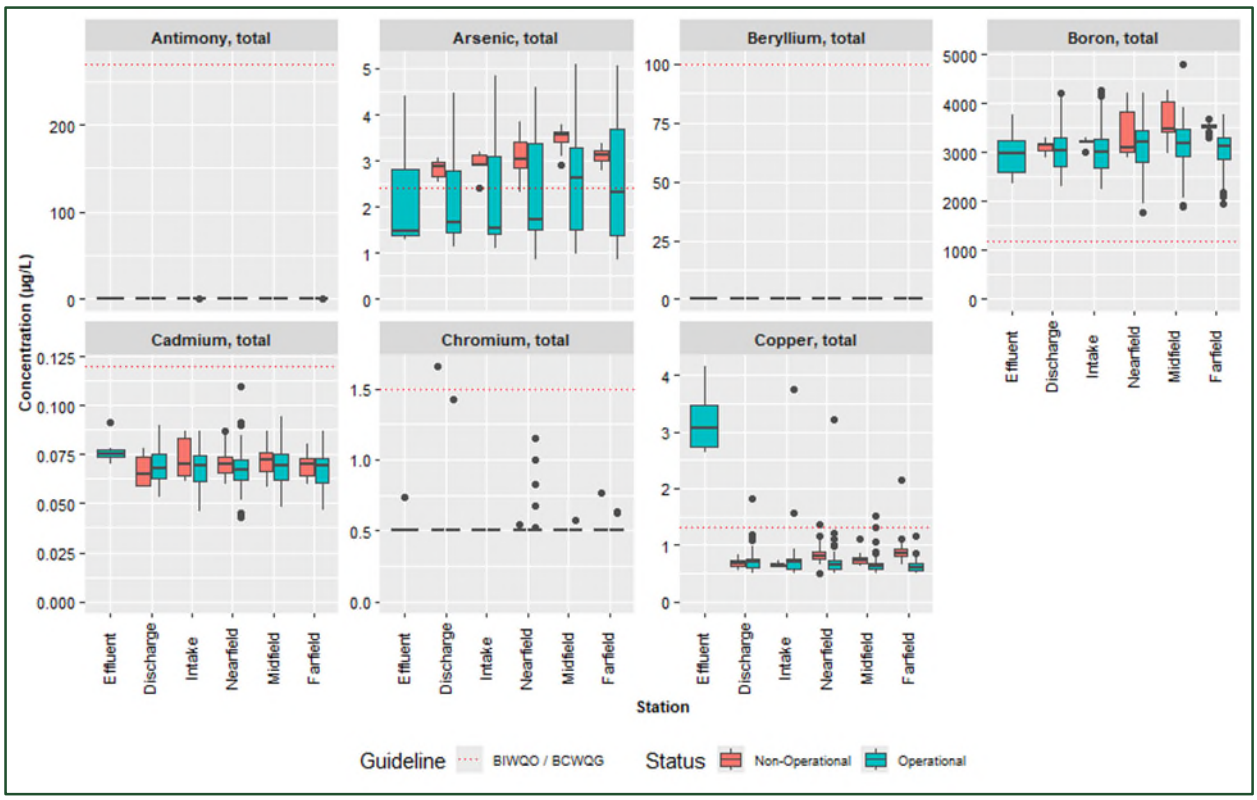



**Figure 4-2: Metals with Guidelines/Objectives**

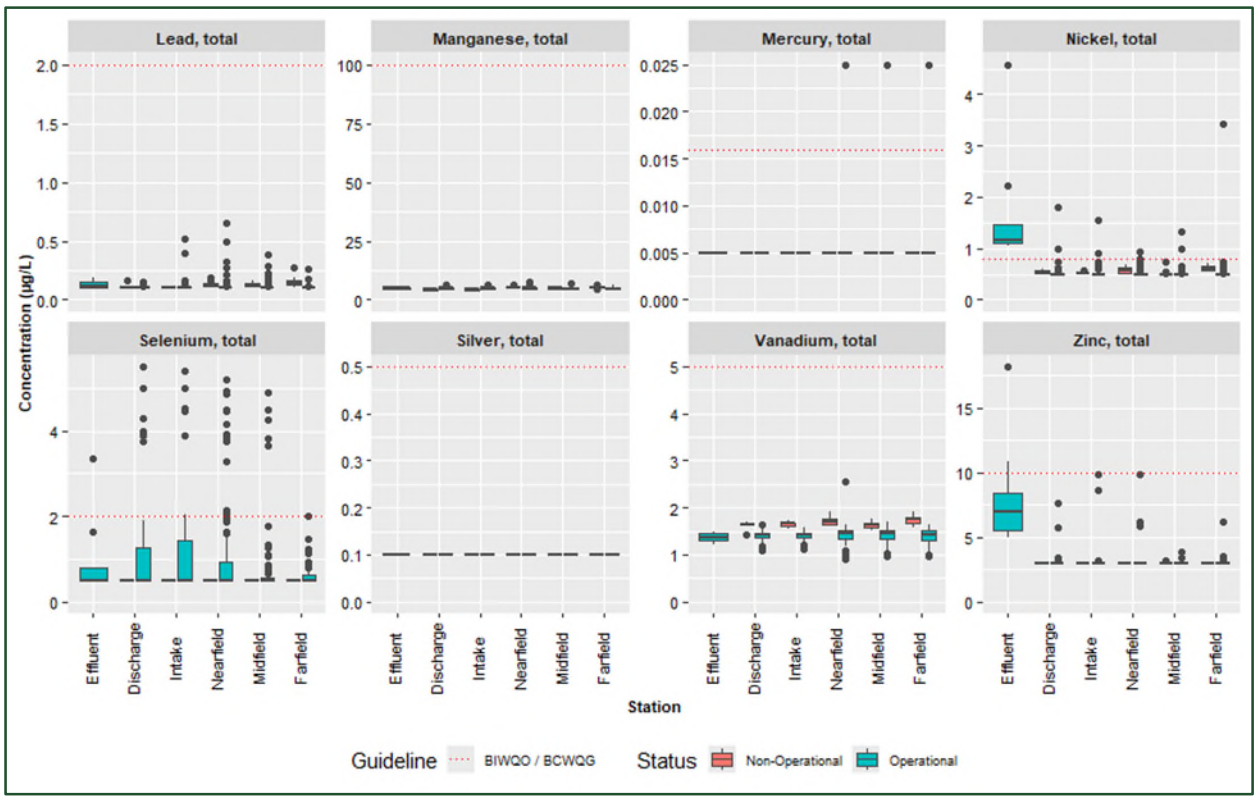



**Figure 4-2: Metals with Guidelines/Objectives, Cont'd**

**Notes**: Mercury values above BIWQOs (0.025 µg/L) were below detection limit. Detection limits were raised due to sample matrix effects.

### Metals Without Guidelines/Objectives

- Concentrations of bismuth, cesium, gallium, rhenium, tellurium, thorium, tin, tungsten, and yttrium were non-detect for all sampling stations.
- Concentrations of thallium and zirconium were non-detect with the exception of one occurrence of thallium at Nearfield (0.052 µg/L) and two occurrences of zirconium (Discharge 0.52 µg/L and Nearfield 1.64 µg/L).
- Although mean concentrations of aluminum, calcium, cobalt, iron, lithium, magnesium, molybdenum, potassium, rubidium, sodium, strontium, sulfur, titanium, and uranium appear to be higher during Shutdown (i.e., non-operational), they are not statistically different than Operations.
- Concentrations of barium and silicon appear to be higher in Operations, though not statistically different than Non-operational.

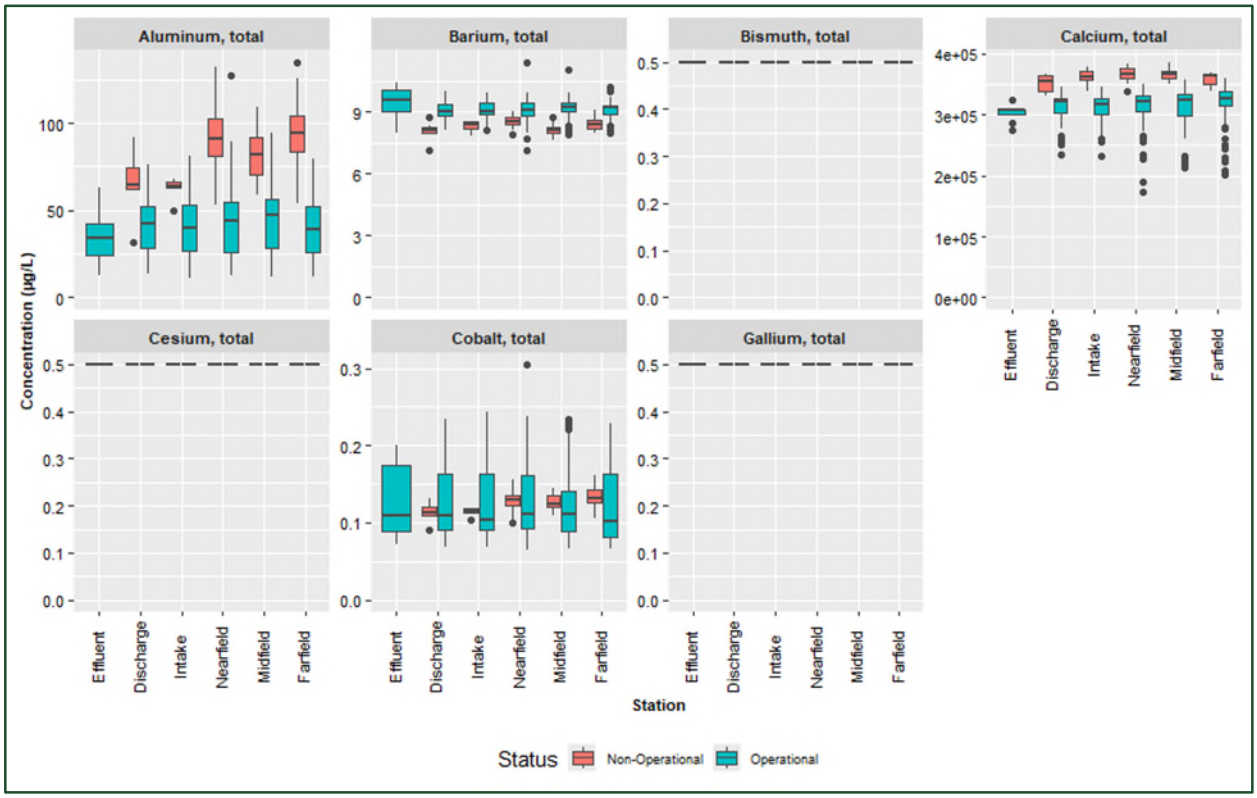



**Figure 4-3: Metals Without Guidelines/Objectives**

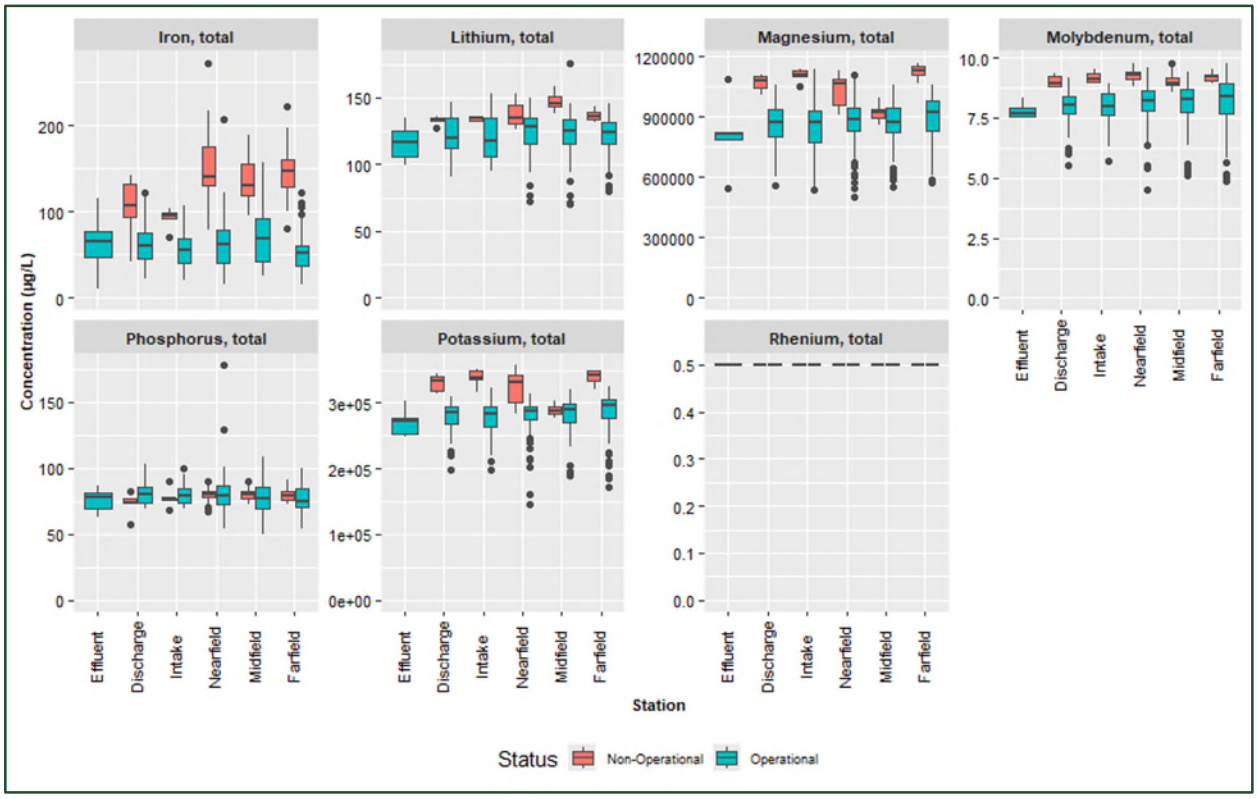



**Figure 4-3: Metals Without Guidelines or Objectives, Cont'd**

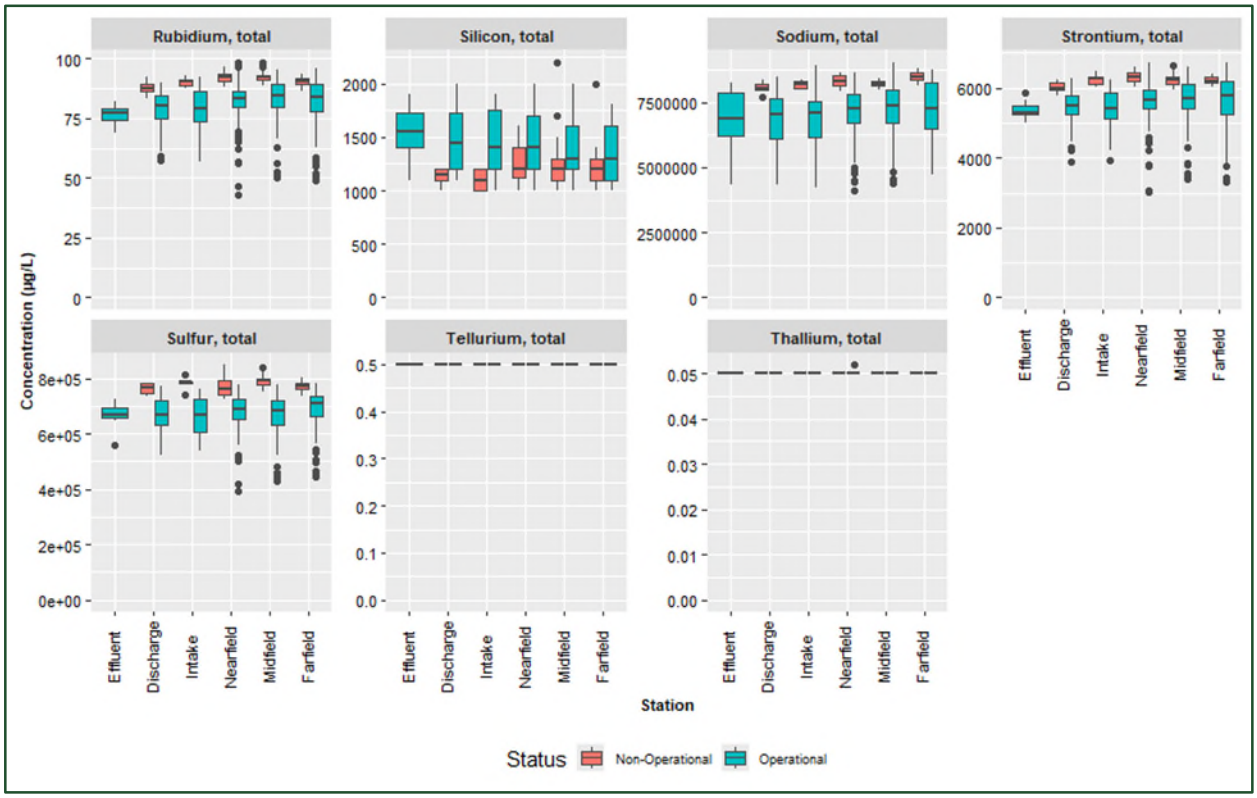



**Figure 4-3: Metals Without Guidelines/Objectives, Cont'd**

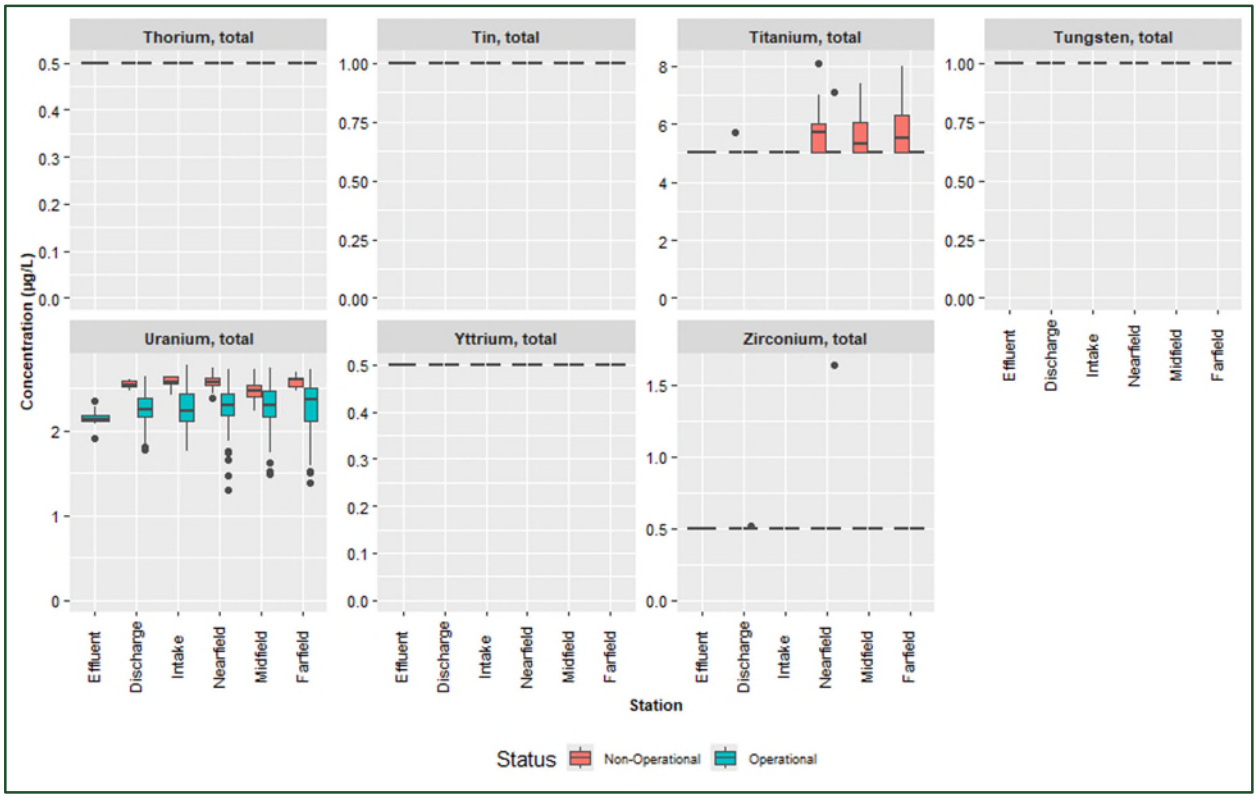



**Figure 4-3: Metals Without Guidelines/Objectives Cont'd**

### Polycyclic Aromatic Hydrocarbons

- Overall, 25 of 28 PAHs were non-detect across all stations (**Figure 4-4**).
- The remaining three PAHs (fluoranthene, 2-methylnaphthalene and pyrene) were mostly non-detect with the exception of one detection for each of the parameters.
- All PAHs were below BIWQOs

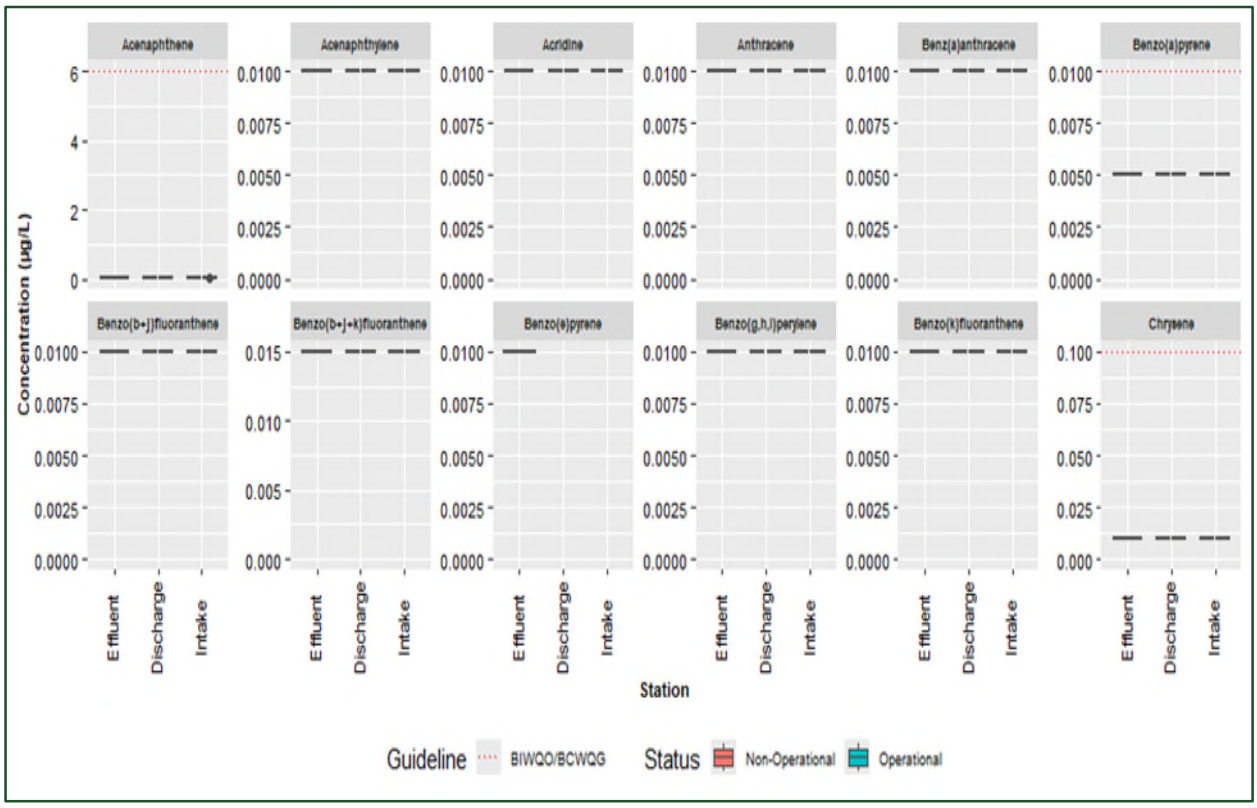



**Figure 4-4: Polycyclic Aromatic Hydrocarbons**

**Note:** Benzo(e)pyrene was only analysed at Effluent.

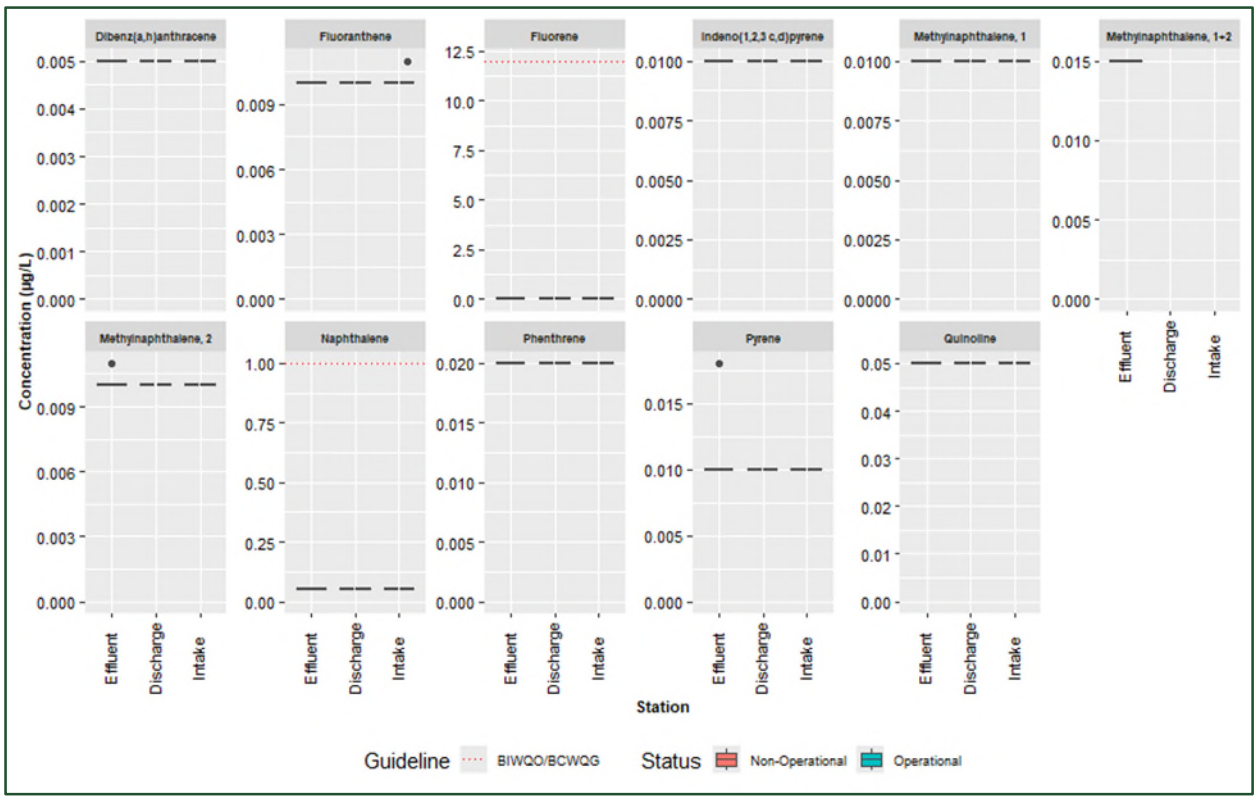



**Figure 4-4: Polycyclic Aromatic Hydrocarbons Cont'd**

**Notes**: Methylnaphthalene, 1+2 was only included as part of summer and 5-in-30 PAH analysis (ALS).

## Nutrients, Ions and Physical Parameters

- Concentrations of bromate were non-detect with the exception of one sample at the Discharge (27.6 mg/L; **Figure 4-5**).
- Nitrite was non-detect for all samples.
- Concentrations of ammonia, bromide, chloride, hardness, and sulfate follow a similar trend among locations with no BIWQO and/or BCWQGs. Mean concentrations for respective parameters were similar but included a number of outliers.
- Concentrations of nitrate are well below BCWQGs (3.7 mg/L) at all stations.
- Mean concentrations of fluoride are below the BCWQGs, but a number of exceedances occurred at Effluent, Discharge, Intake, and Nearfield stations.
- Overall, mean total suspended solids (TSS) were below the BIWQO at all stations. However, several exceedances were noted at Discharge, Nearfield, Midfield and Farfield. The majority of exceedances occurred during the Shutdown period when Chemtrade was not discharging.
- Chlorate and phenols both consistently exceeded their respective BCWQG/BIWQOs (0.005 mg/L and 0.001 mg/L). However, concentrations of phenols were often non-detect but greater than the BIWQOs. Due to chemical interference in marine water, detection limits were increased well above the BIWQO, making interpretation difficult. Chlorate concentrations (Operations) were similar between Effluent, Discharge, and Intake locations, with the exception of one outlier at Discharge (17.9 mg/L).

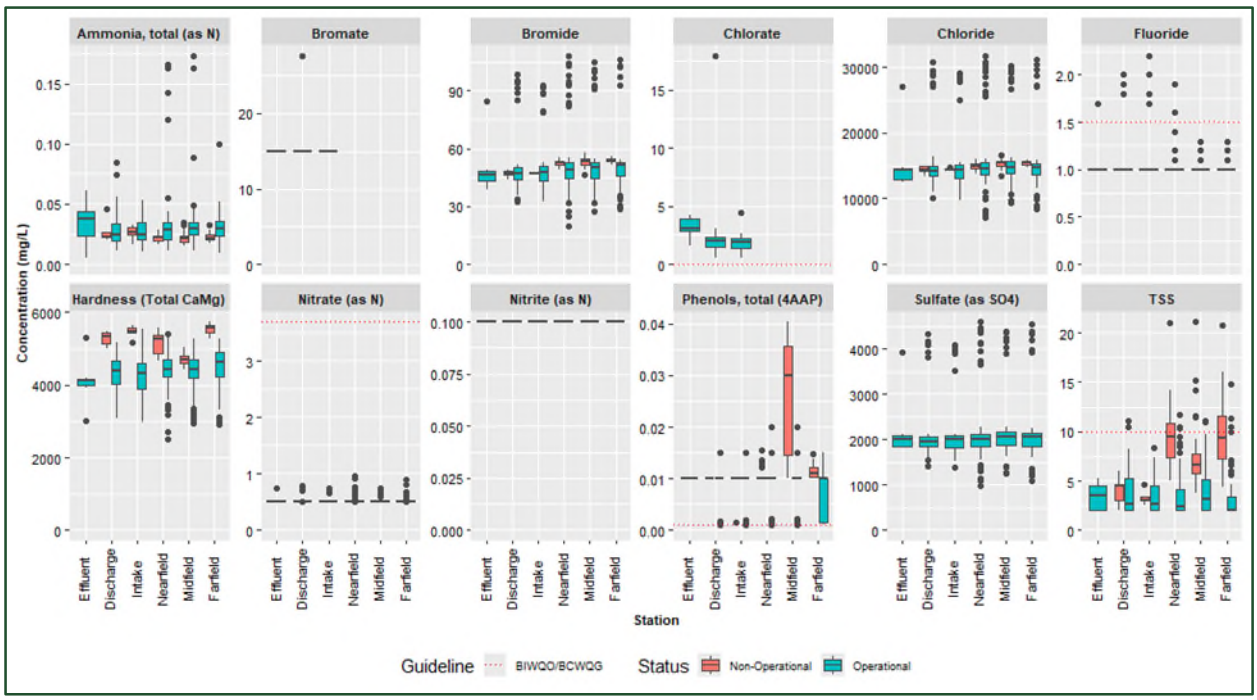



**Figure 4-5: Other Analytes**

**Notes:** Bromate was discontinued after May sampling events. Chlorate, fluoride, nitrate, nitrite, and sulfate were only collected during operational sampling. Bromate and Chlorate were only analysed at Effluent, Discharge and Intake.

### Chlorine Produced Oxidants

- Concentrations of chlorine produced oxidants (CPOs) were similar among locations during Operations but appear to be higher during the Non-operational phase when the facility was not discharging (**Figure 4-6**).
- Overall, save for a couple of occurrences, concentrations of CPOs consistently exceeded the BIWQOs (0.003 mg/L) at all locations.

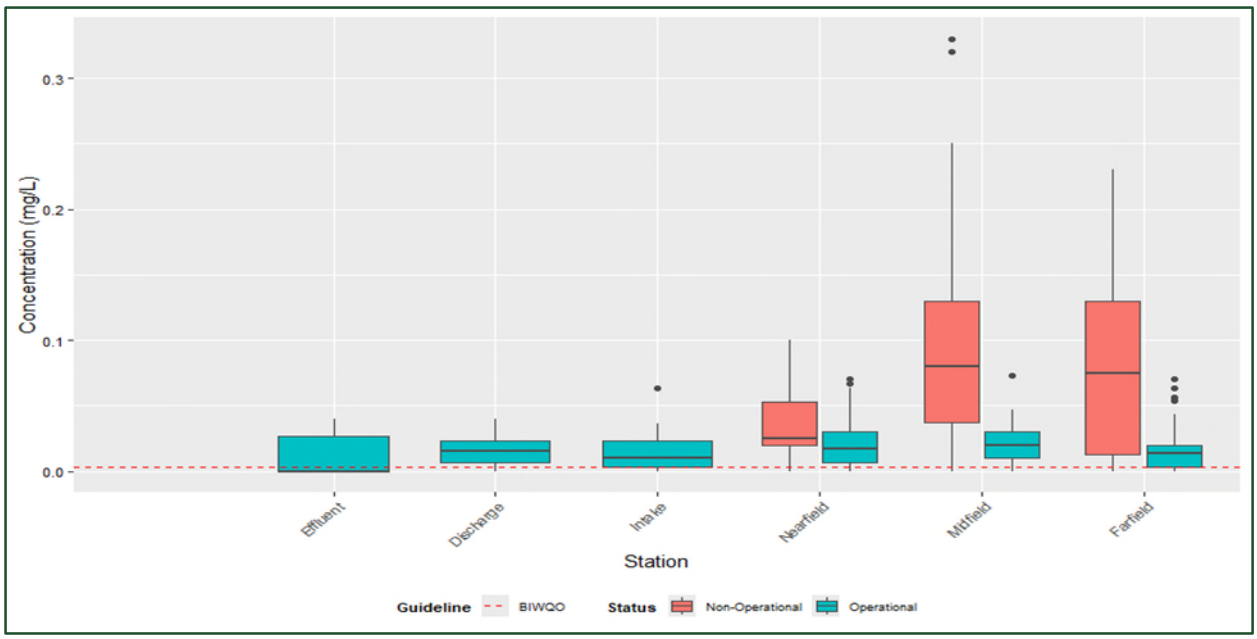



**Figure 4-6: Chlorine Produced Oxidants**

### In-Situ Water Quality

- Concentrations of dissolved oxygen are all above the BIWQO guideline (instantaneous minimum of 5 mg/L), ranging from 5.23 mg/L to 12.2 mg/L (**Figure 4-7**). Although DO appears to be higher during the shutdown period (non-operational), concentrations are not statistically different than concentrations recorded during Operations.
- Values of pH are similar among stations and typically below the lower BIWQO threshold (i.e., 7.7). Some samples had pH values within the BIWQOs, but none above the upper threshold (i.e., 8.8).
- Salinity concentrations range from 13.33 ppt to 28.38 ppt and are not significantly different among locations. For example, salinity at the Farfield stations (little to no interaction with the Chemtrade facility) is similar to values measured at the Nearfield stations.
- Average water temperatures in the receiving environment were similar among stations.

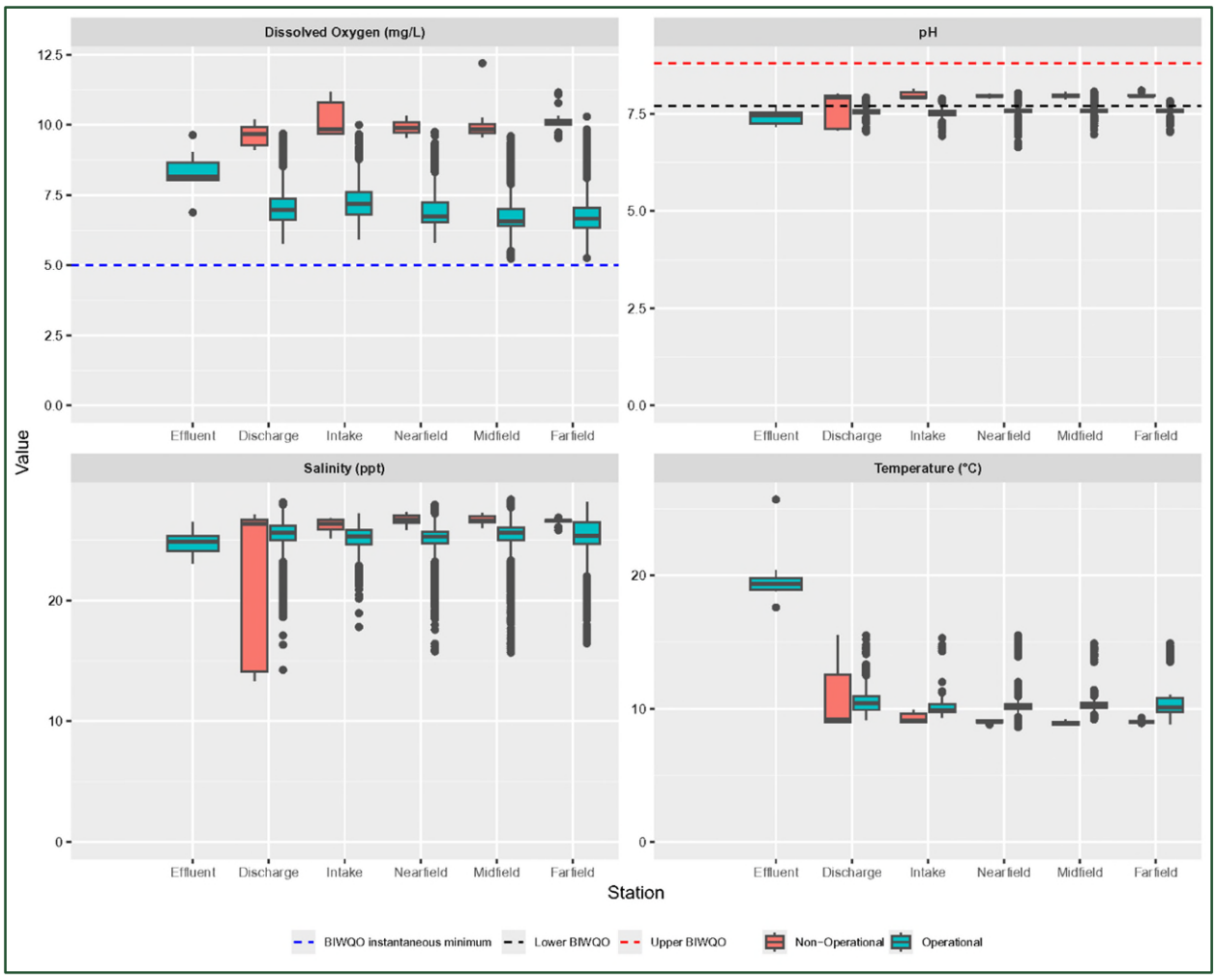



**Figure 4-7: In-Situ Water Quality**

**Notes:** Extreme outliers have been removed from the data set.

### 4.1.2 Sediment Quality

The collection and analysis of aquatic sediments can be used to assess potential effects on aquatic life, as these sediments provide a medium for aquatic macrophytes and habitat for burrowing or sediment feeding invertebrates and demersal fish (LGL & BC ENV 2019). As such, degraded sediment quality can adversely affect both water quality and aquatic life. As contaminants such as metals and organics (e.g., PAHs) can preferentially bind to fine aquatic sediments, characterization of sediment properties is an important media to understand existing aquatic environment conditions.

#### 4.1.2.1 Study Design/Methodology

Sediment quality data was collected from the receiving environment to: (1) characterize existing conditions in the vicinity of the Chemtrade facility, (2) compare sediment samples collected in April and August, and (3) determine if sediment quality meets applicable sediment quality guidelines/objectives.

The sediment quality study design took into consideration the Marine Monitoring Guidance document (LGL & BC ENV 2019) and the BC Ministry of Environment's Water and Air Baseline Monitoring Guideline

Document for Mine Proponents and Operators (BC ENV 2016). Sediment samples were collected following the BC Protocols for Marine Monitoring (BC ENV 2002a) and BC Field Sampling Manual (BC ENV 2013).

#### 4.1.2.2 Sample Collection Timing and Locations

Sediment samples were collected over two sampling events with the intent of comparing sediment quality from April 8-11 and August 8.

Sediment samples were originally proposed to be collected at 14 stations; however, suitable sediment could only be collected at six sites (April) and four sites (August) due to lack of abundance. Sediment was collected from the following stations:

- Non-Operational Sampling (Temporary Plant Shutdown)
- Intake (INT_1)
- Discharge (DIS_1)
- Nearfield (NF_2 & NF_3)
- Midfield (MID_1)
- Farfield (FF_2)
- Operational Sampling
- Intake (INT_1)
- Discharge (DIS_1)
- Midfield (MID_1)
- Farfield (FF_2)

Sample Collection

One composite sample was collected at each sampling station using a Standard Ponar. Each sample consisted of a minimum of three grabs, depending on the amount of available sediment, and then composited into one, well-mixed sample. The fine sediment fraction (i.e., <63 µm silts and clays) were targeted and only the top 2-3 cm collected using appropriate instruments (i.e., stainless steel or plastic, depending on lab analysis). Sufficient sediment was collected to ensure the required minimum amount was collected, placed in a labelled container, and sent to an analytical lab (ALS). Should a sufficient amount of sediment not be collected after five grabs, the station was abandoned. Additional information recorded included: geographic coordinates, water depth, photographs of sampling device and sediment collected, general site conditions, and substrate composition. All field samples were collected by experienced technical staff using consistent methods and sampling effort to minimize biases among stations (BC ENV 2013).

#### 4.1.2.3 Lab Analysis

Sediment quality samples were analysed at a CALA accredited analytical lab (ALS) for a number of parameters including:

- Particle size distribution;
- Total organic carbon (TOC), total carbon (TC), inorganic carbon (IC), carbon (inorganic (IC), as $CaCO_3$ equivalent), organic matter;
- Moisture content;

- Metals including mercury;
- PAHs;
- Total nitrogen, C:N ratio, sulfides;
- Oxidation-reduction potential (ORP);
- Extractable organic halides (EOX);
- Polychlorinated Biphenyls (PCBs); and
- Polychlorinated dibenzo-*p*-dioxins / furans (PBDD/Fs)

#### 4.1.2.4 Findings

Sediment quality results were screened against the British Columbia Working Sediment Quality Guidelines (BCWSQGs) for marine waters and the BIWQOs for Central Harbour of the Burrard Inlet. BIWQOs align with the Lower threshold of the BCWSQG, the Interim Sediment Quality Guidelines (ISQGs). Stations were grouped based on their respective locations (i.e., Near-field, Mid-field, Far-field) for comparisons. Sediment chemistry data and QA/QC laboratory results are provided in **Appendix E**.

The BIWQOs for Central Harbour in the Burrard Inlet and the BCWSQGs are summarized in **Table 4-3**.

**Table 4-3: Sediment Quality Objectives and Guidelines**

| Parameter | Source of Threshold | Threshold |
|---|---|---|
| **Total Metals** | | |
| **Arsenic, Total** | BIWQO CH | 7.24 µg/g max[a] |
| | BCWSQG | PEL: 42 µg/g |
| **Cadmium, Total** | BIWQO CH | 0.7 µg/g max[a] |
| | BCWSQG | PEL: 4.2 µg/g |
| **Chromium, Total** | BCWSQG | ISQG: 52.3 µg/g |
| | | PEL: 160 µg/g |
| **Copper, Total** | BIWQO CH | 18.7 µg/g max[a] |
| | BCWSQG | PEL: 108 µg/g |
| **Lead, Total** | BIWQO CH | 30.2 µg/g max[a] |
| | BCWSQG | PEL: 112 µg/g |
| **Mercury, Total** | BIWQO CH | 0.13 µg/g max[a] |
| | BCWSQG | PEL: 0.7 µg/g |
| **Nickel, Total** | BIWQO CH | 30 µg/g max[a] |
| | BCWSQG | PEL: 50 µg/g |
| **Selenium, Total** | BCSeWQG | 2 µg/g max[b] |
| **Silver, Total** | BCWSQG | ISQG: 1 µg/g |

| Parameter | Source of Threshold | Threshold |
|---|---|---|
| | | PEL: 2.2 µg/g |
| **Zinc, Total** | BIWQO CH | 124 µg/g max[a] |
| | BCWSQG | PEL: 271 µg/g |
| **Polycyclic Aromatic Hydrocarbons (PAHs)** | | |
| **Acenaphthene** | BIWQO CH | 0.00671 µg/g[a] |
| **Acenaphthylene** | BCWSQG | ISQG: 0.00587 µg/g |
| | | PEL: 0.128 µg/g |
| **Anthracene** | BIWQO CH | 0.0469 µg/g[a] |
| **Benz(a)anthracene** | BCWSQG | ISQG: 0.0748 µg/g |
| | | PEL: 0.693 µg/g |
| **Benzo(a)pyrene** | BIWQO CH | 0.088 µg/g[a] |
| **Benzofluoranthene** | BIWQO CH | 2.3 µg/g[a] |
| **Benzo(g,h,i)perylene** | BCWSQG | ISQG: 0.31 µg/g |
| | | PEL: 0.78 µg/g |
| **Chrysene** | BIWQO CH | 0.108 µg/g[a] |
| **Dibenz(a,h)anthracene** | BCWSQG | ISQG: 0.00622 µg/g |
| | | PEL: 0.135 µg/g |
| **Fluoranthene** | BIWQO CH | 0.113 µg/g[a] |
| **Fluorene** | BIWQO CH | 0.0212 µg/g[a] |
| **Indeno(1,2,3-c,d)pyrene** | BCWSQG | ISQG: 0.34 µg/g |
| | | PEL: 0.88 µg/g |
| **Naphthalene** | BIWQO CH | 0.0346 µg/g[a] |
| **2-methylnaphthalene** | BIWQO CH | 0.02 µg/g[a] |
| **Phenanthrene** | BIWQO CH | 0.0867 µg/g[a] |
| **Pyrene** | BIWQO CH | 0.153 µg/g[a] |
| **Total PCBs** | BIWQO CH | $3.74 \times 10^{-6}$ µg/g max[a] |
| **Total PCDDs and PCDFs (PCDD/Fs)** | BIWQO CH | $8.5 \times 10^{-7}$ µg/g max[a] |

**Notes:**
BIWQO CH - Burrard Inlet Water Quality Objectives - Central Harbor
BCWSQG - British Columbia Working Sediment Quality Guidelines
BCSeWQG - British Columbia Selenium Water Quality Guidelines
PEL - Probable Effect Level (Upper)
ISQG - Interim Sediment Quality Guideline (Lower)
PCBs - Polychlorinated Biphenyls
PCDDs - Polychlorinated dibenzo-p-dioxins
PCDFs - Polychlorinated dibenzo-p-furans

| Parameter | Source of Threshold | Threshold |
|---|---|---|
| a = Based on at least 1 composite sample consisting of at least 3 replicates.<br>b = Alert concentration. | | |

Sediment analytical results for each sampling event (April vs August) were compared against the BIWQOs and BCWSQGs, where applicable. Comparisons resulted in the following four scenarios:

- Parameter concentrations are below Lower BCWSQGs/BIWQOs;
- Parameter concentrations are consistently below the Lower BCWSQGs/BIWQOs with the exception of a couple of exceedances;
- Parameter concentrations are mostly below the Lower BCWSQGs/BIWQOs with some concentrations exceeding the Lower and Upper BCWSQGs; or
- Parameter concentrations typically exceed the Lower BCWSQG with some occurrences below.

Findings are summarized and illustrated, below.

### Metals With Guidelines/Objectives

- Concentrations of silver are below the Lower BCWSQGs during both April and August.
- Concentrations of arsenic, chromium, lead, mercury and selenium are consistently below the Lower BCWSQGs/BIWQOs during both April and August with the exception of a couple occurrences (**Figure 4-8**). Seven concentrations (2- arsenic, 1- chromium, 2 – lead, 1- mercury, 1 – selenium) exceeded the Lower BCWSQGs/BIWQOs during August but remained below the Upper BCWSQGs
- Cadmium, nickel and zinc exhibited similar patterns as concentrations were typically below the Lower BCWSQGs, with some exceedances of the Lower and Upper BCWSQGs. Highest concentrations were recorded at the Intake (cadmium and zinc) and the Discharge (nickel).
- Concentrations of copper typically exceeded the Lower BCWSQGs (but below the Upper limits) with some occurrences below the Lower BCWSQGs.
- Although the Intake is closer (distance wise) to the Discharge station, the chemistry of aquatic sediments from the Intake more resembles conditions encountered at the Midfield stations. Overall, the Discharge station generally contains lower concentrations of metals (with guidelines) than the Intake and Midfield stations suggesting the effluent contributions from the facility have negligible effects to the immediate surrounding area.

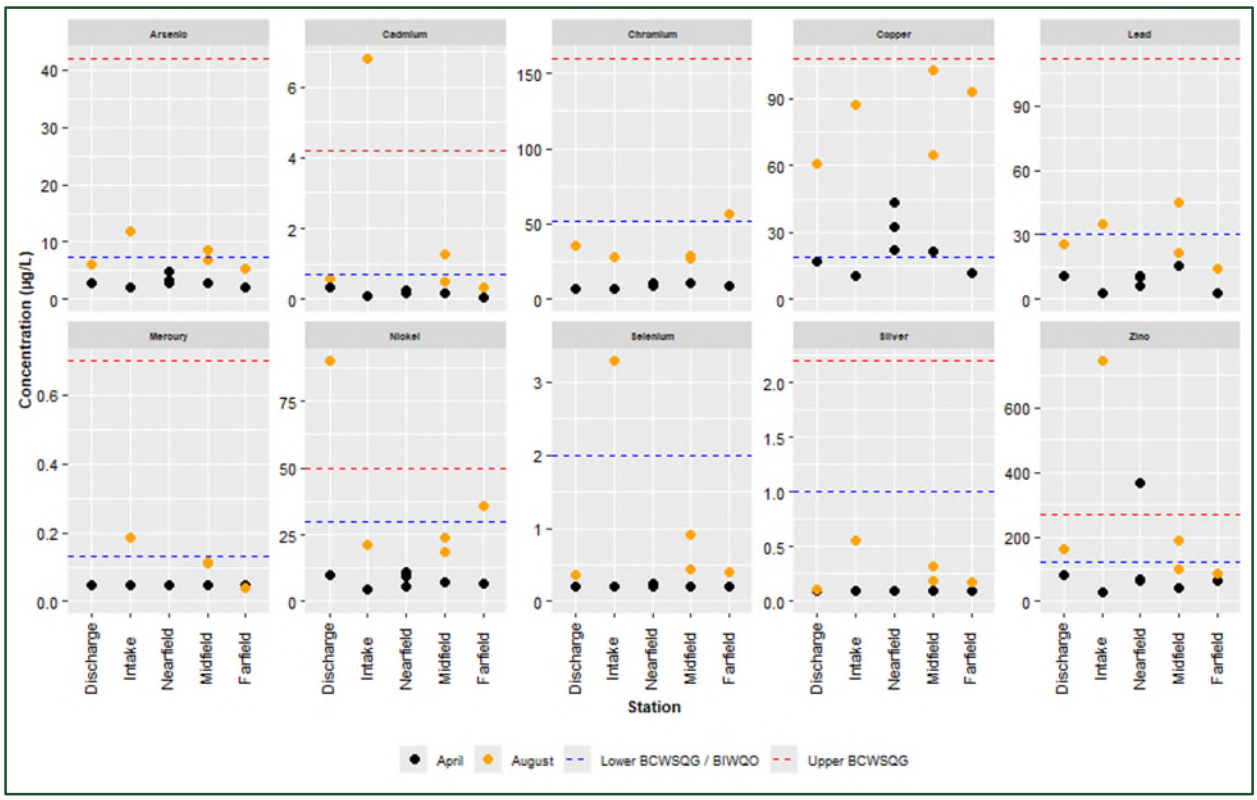



**Figure 4-8: Sediment Chemistry for Metals with Guidelines/Objectives**

## Metals Without Guidelines/Objectives

- With the exception of bismuth, calcium, manganese, sodium, strontium, titanium and tin (where some concentrations were higher in April vs August), all other parameters had consistently higher concentrations in August.
- Irrespective of month sampled, highest concentrations of parameters without guidelines were typically observed at Intake and the Midfield stations (**Figure 4-9**).
- Beryllium was non-detect in April samples but was detected at all stations in August.
- Bismuth and tin were generally non-detect in April and August at all stations.

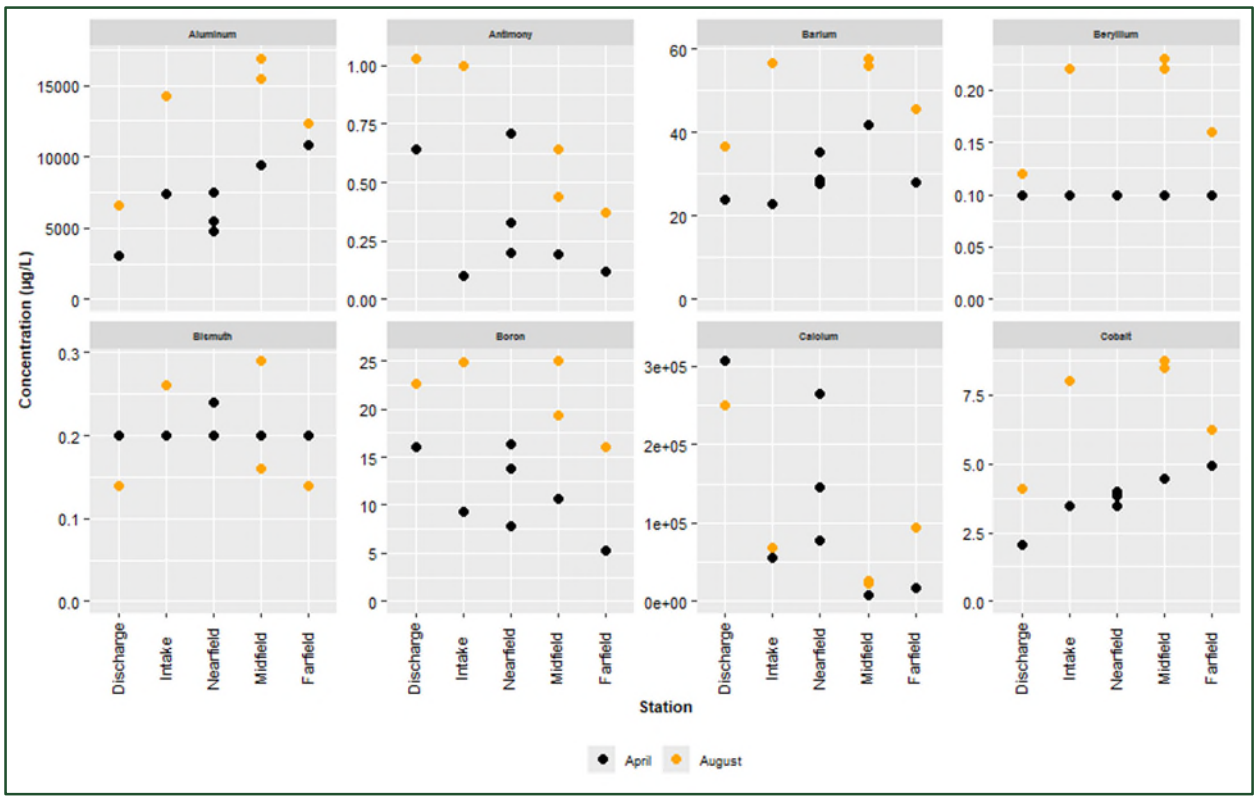



**Figure 4-9: Sediment Chemistry for Metals Without Guidelines/Objectives**

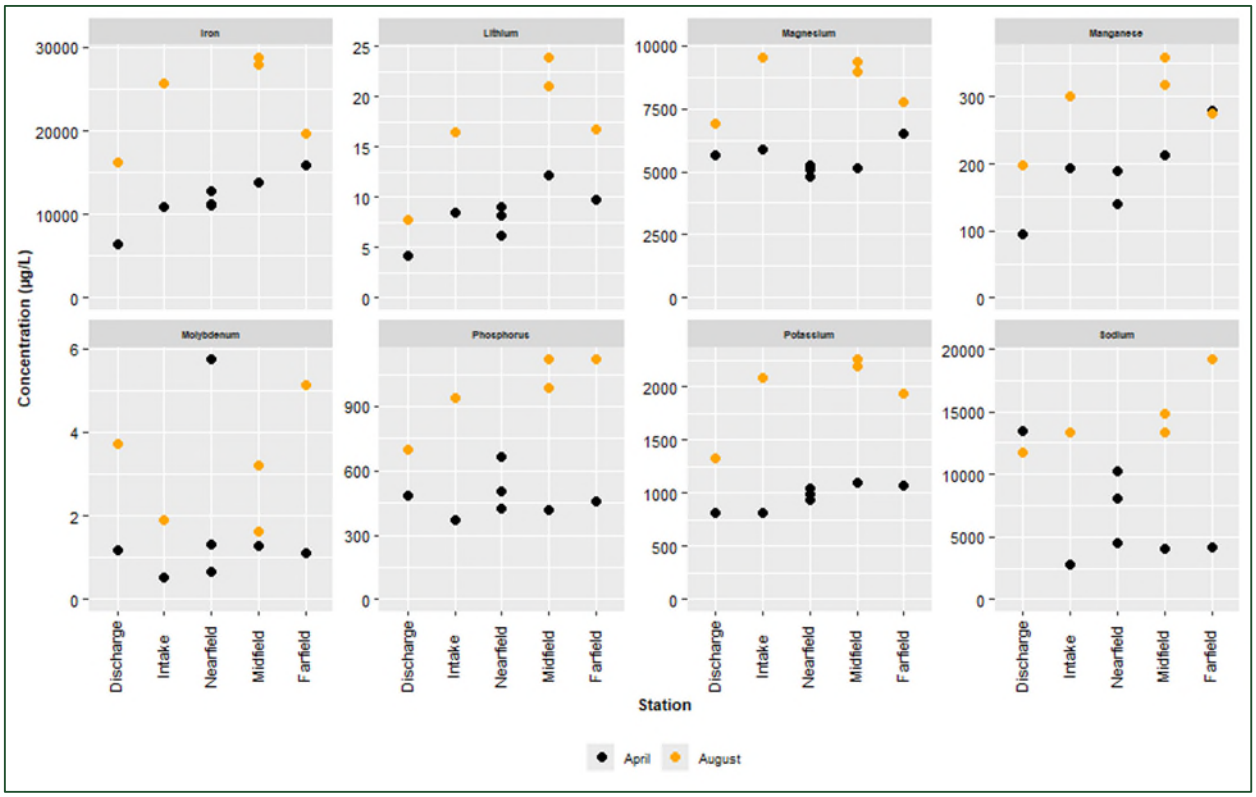



**Figure 4-9: Sediment Chemistry for Metals Without Guidelines/Objectives Cont'd**

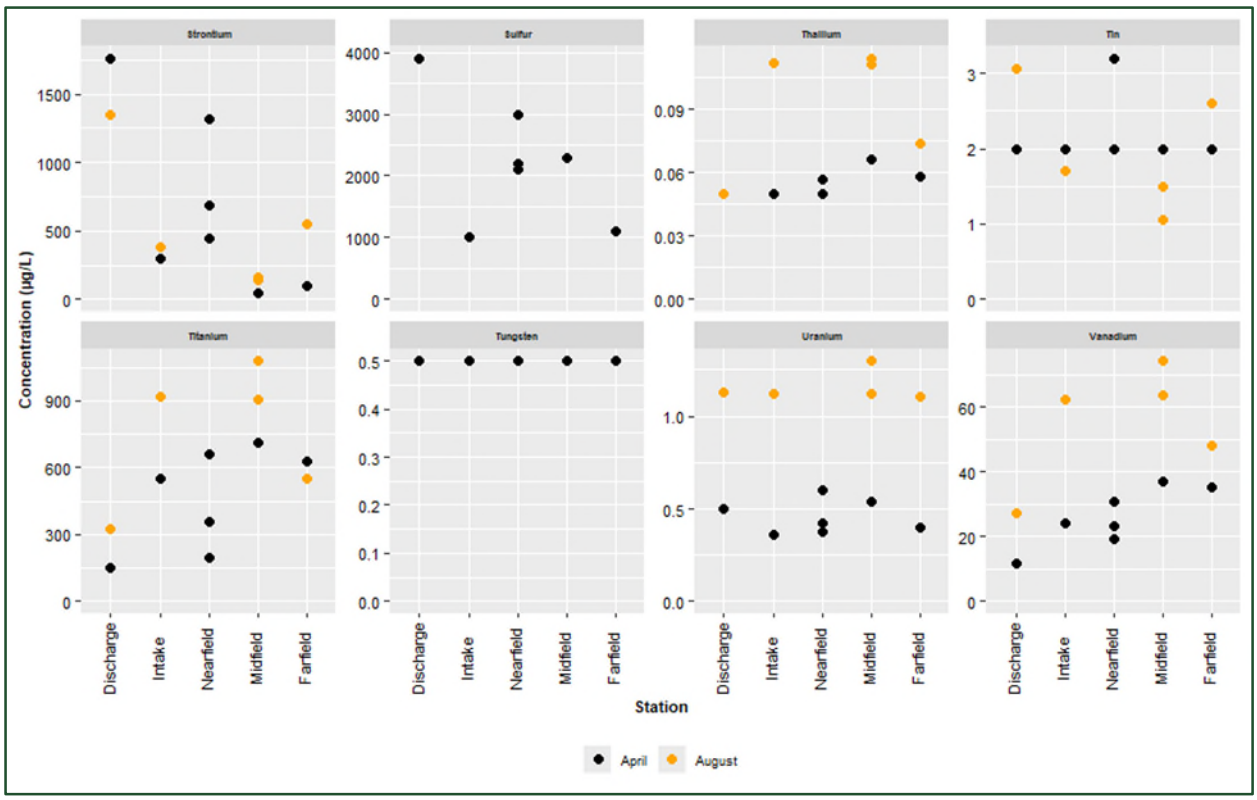



**Figure 4-9: Sediment Chemistry for Metals Without Guidelines/Objectives Cont'd**

**Notes:** Sulfur and tungsten were not included as part of summer (operational) metal analysis.

### Polycyclic Aromatic Hydrocarbons with Guidelines/Objectives

- Concentrations of benzo(k)fluoranthene are below the Lower BCWSQGs/BIWQOs during both sampling events.
- Concentrations of benzo(g,h,i)perylene, indeno(1,2,3-c,d)pyrene, and naphthalene are consistently below the Lower BCWSQGs/BIWQOs during both April and August with the exception of a couple occurrences. Five concentrations (three for naphthalene) exceeded the Lower BCWSQGs/BIWQOs in April and August but remained below the Upper BCWSQGs (**Figure 4-10**).
- Acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, phenanthrene, and pyrene exhibited similar patterns as concentrations were typically near the Lower BCWSQGs, with some exceedances of the Lower and Upper BCWSQGs. Highest concentrations were recorded at the Discharge and Nearfield stations.
- Concentrations of 2-Methylnaphthalene typically exceeded the Lower BCWSQGs (but below the Upper limits) with some occurrences below the Lower BCWSQGs.
- Overall, PAH concentrations appear to be higher in samples collected in August than in April. Data suggests the Discharge and Nearfield stations are generally higher than the remaining stations for all PAHs.

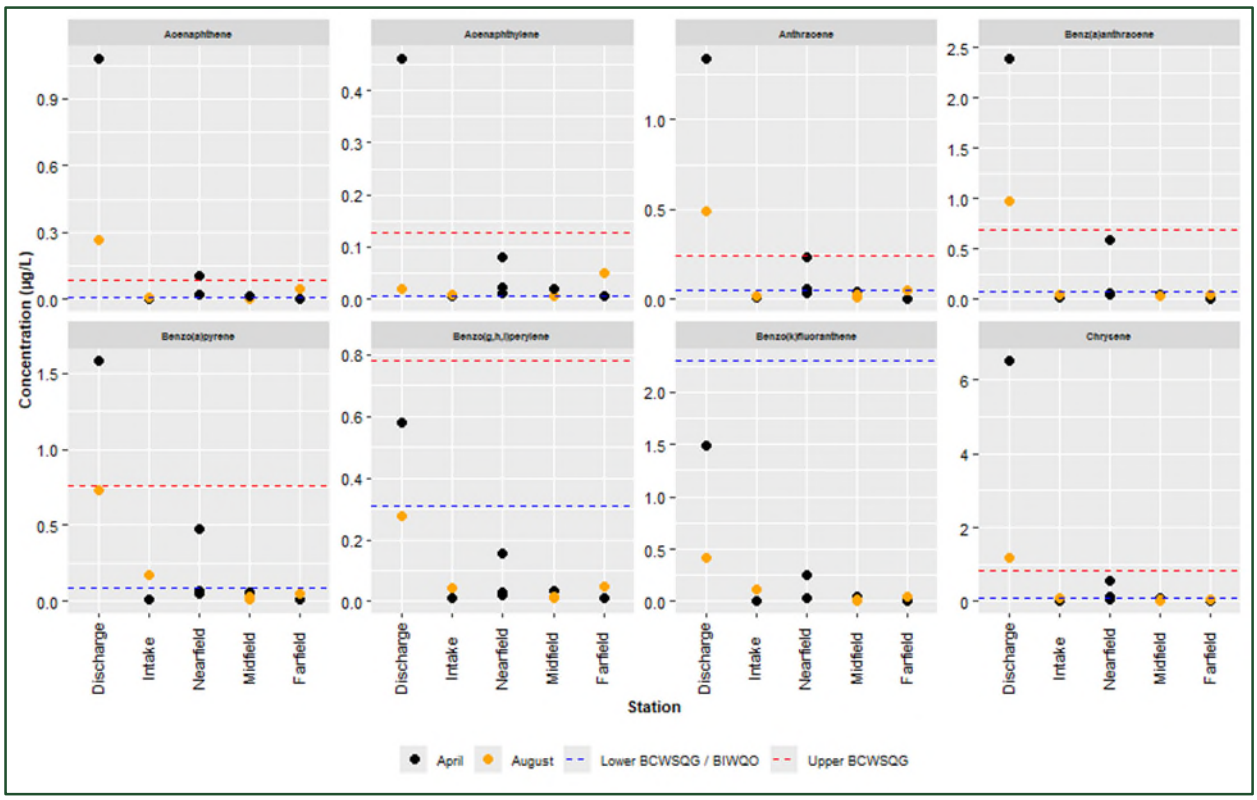



**Figure 4-10: Sediment Chemistry for PAHs with Guidelines/Objectives**

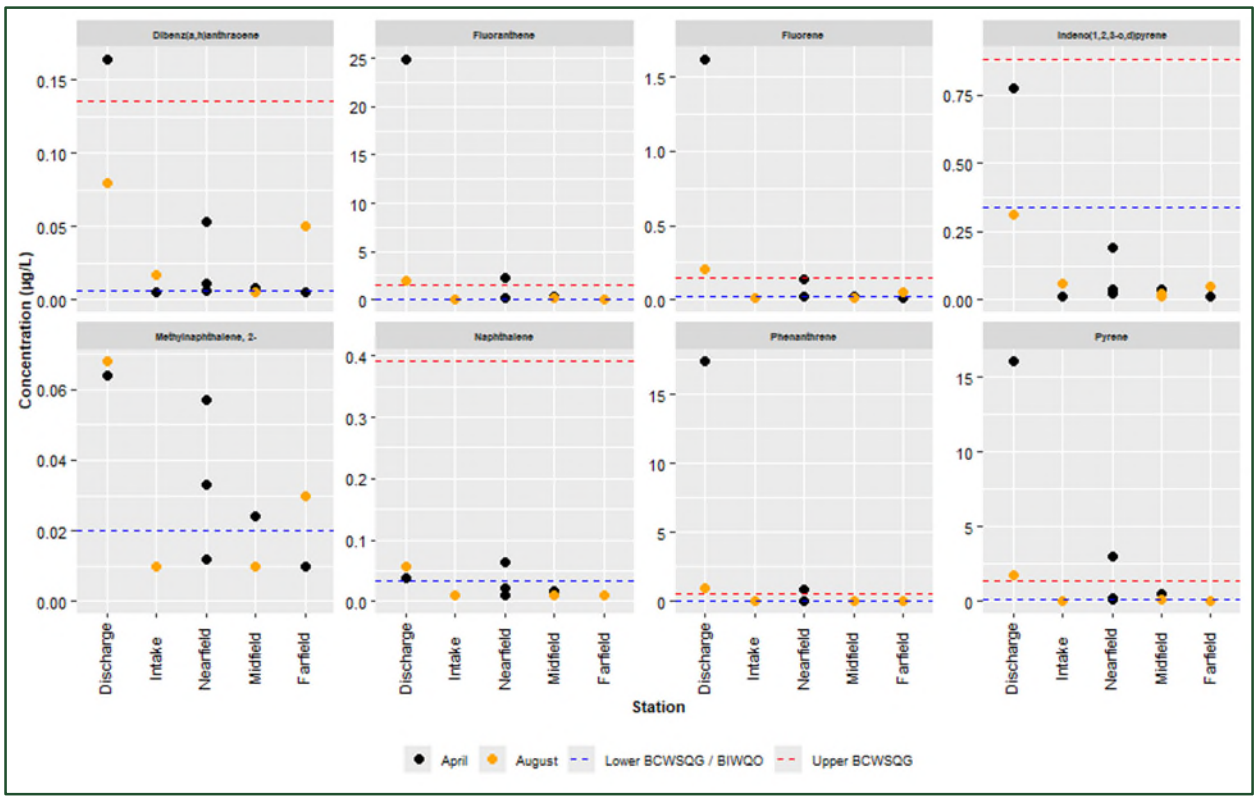



**Figure 4-10: Sediment Chemistry for PAHs with Guidelines/Objectives, Cont'd**

### Polycyclic Aromatic Hydrocarbons without Guidelines/Objectives

- Quinoline was non-detect during both April and August sampling events (**Figure 4-11**).
- Acridine, benzo(b+j)fluoranthene, benzo(b+j+k)fluoranthene, quinoline, B(a)P, IACR (CCME), IACR (coarse), IACR (fine), and total PAH concentrations were generally similar among locations, except at Discharge, where values were typically relatively higher.
- Overall, PAH concentrations appear to be higher at the Discharge and Near-field stations than the remaining locations. This trend does not apply for acridine as Farfield stations were greater than Near-field.

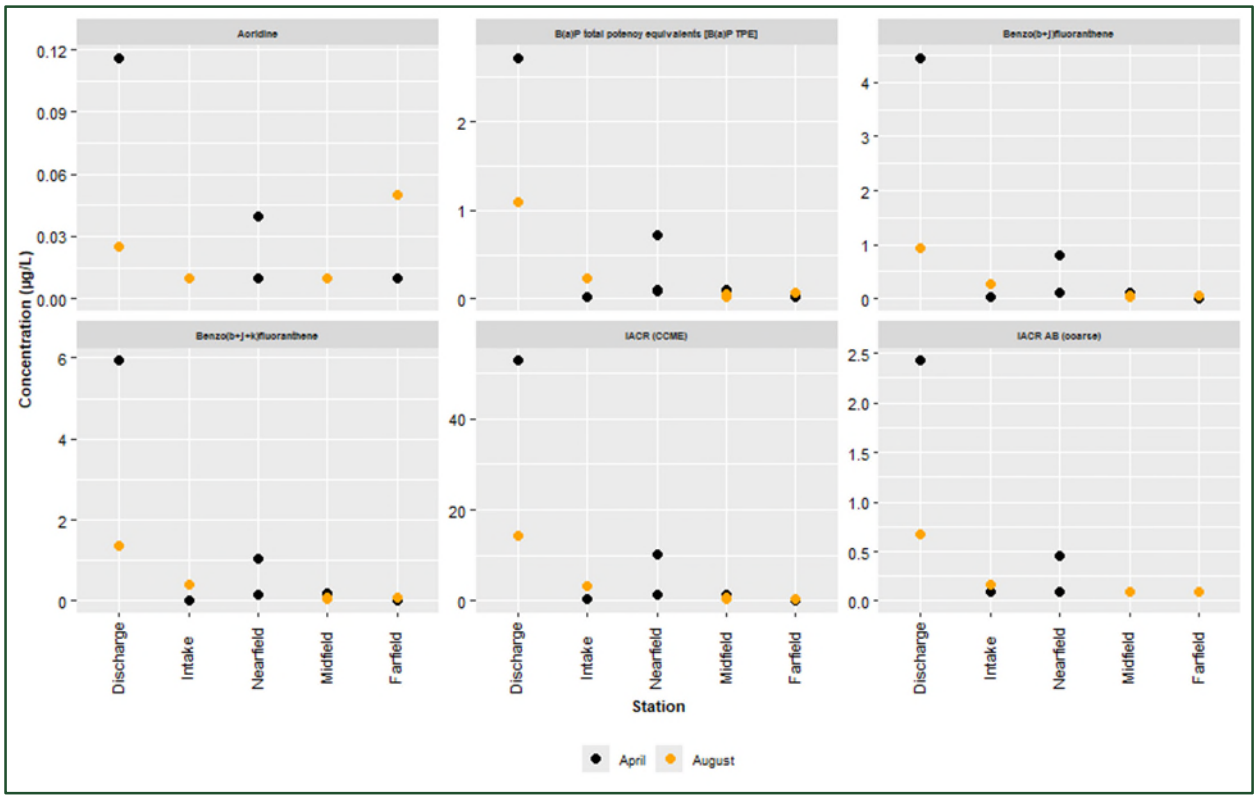



**Figure 4-11: Sediment Chemistry for PAHs with Guidelines/Objectives**

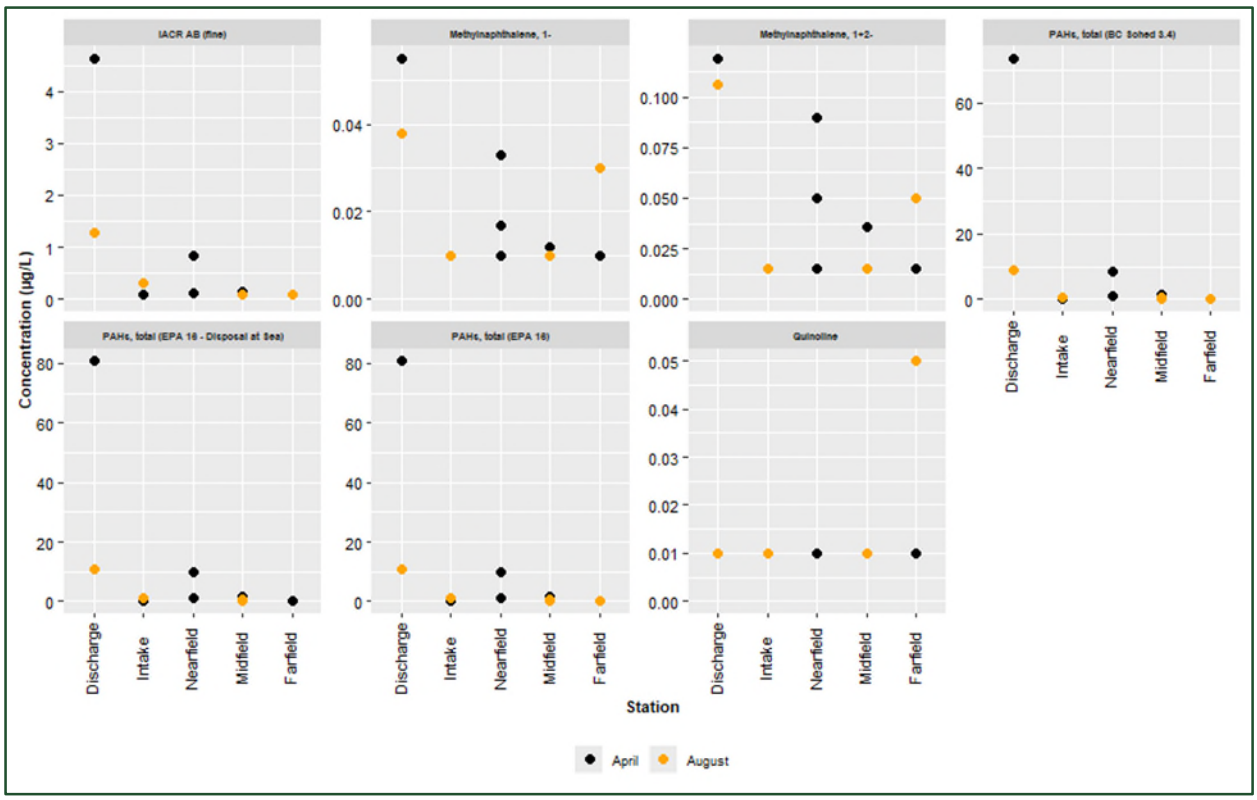



**Figure 4-11: Sediment Chemistry for PAHs without Guidelines/Objectives Cont'd**

**Note:** Detection limit for Quinoline was raised to 0.05 in August for Farfield location only.

## Extractable Organic Halides (EOX)

- Overall, EOX concentrations were non-detect except for an August sample at the mid-field station (**Figure 4-12**).

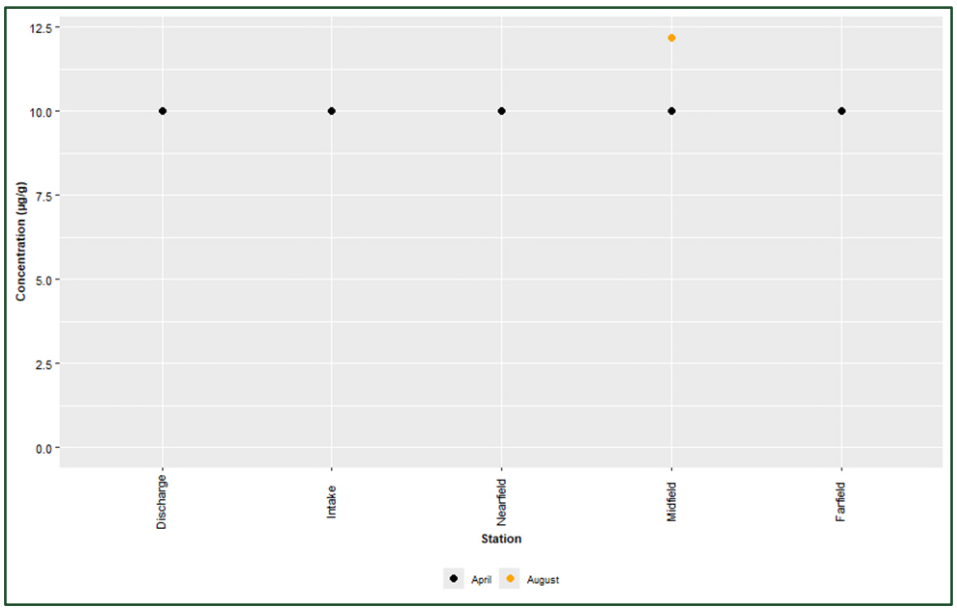



**Figure 4-12: Extractable Organic Halides (EOX)**

### Total Polychlorinated biphenyls (PCBs) and Total Polychlorinated Biphenyls, Dioxins and Furans (PCDD/Fs)

- PCB concentrations are above the BIWQO (3.7 pg/g) for all stations and all samples collected in April and August (**Figure 4-13**).
- The majority of PCDD/F concentrations appear to be above the BIWQO (0.85 pg/g) with the exception of samples collected at INT, MID and FF. Concentrations were highest at DIS both during non-operations (shutdown) and operations.

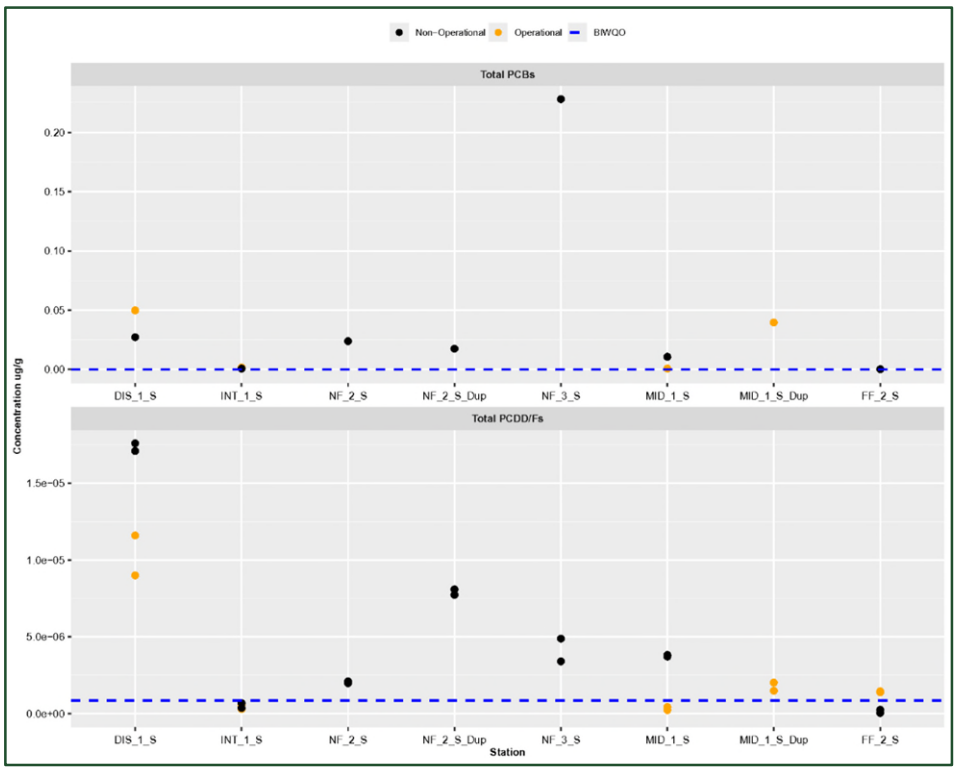



**Figure 4-13: PCBs and PCDD/Fs**

### 4.1.3 Aquatic Biota

A survey of aquatic biota was conducted in front of the Chemtrade facility as part of an effects assessment by Hemmera (2020). The existing mooring berth which includes framing and creosote timber piles also provides suitable habitat for a variety of sessile organisms. Habitat was characterized along six transects immediately to the south of the mooring berth using an underwater camera. Information collected along each transect followed the *Marine foreshore Environmental Assessment Procedure document* (DFO, 2004). Location of transects and extent of survey are provided in **Figure 4-14**. Subtidal habitat consists primarily of fine substrates (silt, sand, mud), shell fragments, and some larger cobbles and boulders (**Figure 4-15A**).




Chemtrade Dredge Support
North Vancouver, BC

**Sediment Sampling and Video Transect Locations**




Legend

- Sediment Sampling Location - Depth of 0.0 m to 0.3 m bgs
- Sediment Sampling Location - Depths of 0.0 m to 0.3 m and 0.6 m to 0.9 m bgs
- Video Transect
- Site Boundary
- Dredge Area
- Property Line

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Contains information licensed under the Open Government Licence - Government of British Columbia
- Site Boundary and Sediment Sampling Locations: 2019 Bathymetry - Volumes, Vancouver Pile Driving, dwg. 8001103-001, 2019
- Aerial Image: ESRI World Imagery
- Inset Basemap: ESRI World Topographic Map

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Hemmera
An Ausenco Company

Chemtrade Electrochem Inc.

Hemmera (2020) noted that species identification was difficult due to low visibility and resolution of collected imagery. Despite these limitations, thirteen species were recorded, including two macroalgae, one microalga, and 10 marine invertebrates (**Table 4-4**).

**Table 4-4: Marine Species documented at the Chemtrade Project Site (Hemmera 2020)**

| Common Name | Scientific Name | Abundance |
|---|---|---|
| **Macroalgae** | | |
| Red macroalgae | Unidentified | ~5% |
| Green macroalgae | Unidentified | ~5% |
| **Microalgae%** | | |
| Diatoms | Unknown species | ~20% |
| **Invertebrates** | | |
| Acorn barnacles | *Balanus glandula* | ~10% |
| Buried anemone | *Anthopleura artemisia* | 1 |
| Dungeness crab | *Metacarcinus magister* | 19 |
| Giant green anemone | *Anthopleura xanthogrammica* | 1 |
| Giant plumose anemone | *Metridium giganteum* | 5 |
| Leather star | *Dermasterias imbricata* | 2 |
| Ochre star | *Pisaster ochraceus* | 1 |
| Orange sea pen | *Ptilosarcus gurneyi* | 2 |
| Sea star, possible[a] blood star | *Henricia leviuscula* | 1 |
| Sea star, possible[a] vermillion star | *Mediaster aequalis* | 1 |

**Notes:**
[a] - Unverified

The majority of organisms documented in the vicinity of the Chemtrade facility are sessile (i.e., anemone, algae, barnacles) and most often associated with hard substrates such as piles and/or coarse substrates (**Figure 4-15**). Motile species such as crab and sea stars were common and widely distributed throughout the study area over a variety of substrates (**Figure 4-15**). Species abundance appeared to be evenly distributed among transects with a limited number of motile species observed. The low abundance of motile organisms (i.e., fish) may have been attributed to poor visibility, short transects i.e., length) and/or their ability to evade a moving piece of equipment.

The biota assemblage recorded at the facility is relatively diverse with low abundance but is representative of the Burrard Inlet and what was also observed at other nearby project sites including Neptune Terminals. Neptune completed a subtidal survey using an ROV in 2018/2019 and recorded similar species and habitat use/preference of biota with higher diversity/abundance observed on hard substrates. The distribution of organisms using sand, mud, shell fragments substrate was considered patchy and predominantly inhabited by motile species.




**Figure 4-15: Species Inventory at Chemtrade Facility Water lot (Hemmera 2020)**

**Notes:** A) subtidal substrate B) pile with acorn barnacles C) Dungeness crab D) giant plumose anemone.

## 4.2 Upland Sources

### 4.2.1 Stormwater and Domestic Sewage Discharges

#### 4.2.1.1 Study Design/Methodology

For the November and December upland sampling events, water samples were collected from 13 sample stations (three [3] septic tanks, nine [9] stormwater, and one [1] effluent), as well as a duplicate sample of one of the stormwater samples to assess the amount of variability resulting from the collection process, and a field blank to ensure quality control and assess contamination from field sources. These locations can be seen in Figure 4-16.

As it relates to domestic sewage sampling point program, there are nine (9) septic holding tanks which gravity discharge domestic sewage to the main effluent line and effluent sampling from 3 of the 9 septic tanks. were selected for the sampling program. This included the Divisional Building, the Engineering / Purchasing Building, and the Maintenance Shop which represent approximately 80-87% (as calculated in

**Table 9-1**) of the total domestic sewage being discharged to the main effluent line. Water samples representing treated effluent from the septic tank were taken from the last chamber of the septic tanks.

The domestic sewage effluent water samples were collected on November 13, 2024, December 13, 2024, and February 13, 2025. Sampling was carried out in general conformance with the "British Columbia Field Sampling Manual for Continuous Monitoring Plus the Collection of Air, Air-Emission Water, Wastewater, Soil, Sediment, and Biological Sample" (Ministry of Environment, 2013). Samples were placed in a cooler on ice and delivered to ALS Environmental Laboratories (ALS) on the same day. ALS is a Canadian Association for Laboratory Accreditation (CALA) certified laboratory.

The selected 9 stormwater water sample locations were determined based on drainage areas which discharge directly to the main effluent line. These stormwater samples were collected on November 13, 2024, and December 13, 2024. Sampling was carried out in general conformance with the "British Columbia Field Sampling Manual for Continuous Monitoring Plus the Collection of Air, Air-Emission Water, Wastewater, Soil, Sediment, and Biological Sample" (Ministry of Environment, 2013). Samples were placed in a cooler on ice and delivered to ALS Environmental Laboratories (ALS) on the same day. ALS is a Canadian Association for Laboratory Accreditation (CALA) certified laboratory.

All stormwater and domestic sewage samples were collected using a swing pole, except for three cases – A13, A35, and A36. Here, the sample bottles were held to the rim of the maintenance hole to collect the water before it dripped into the catchment area. For stations A13 and A35, this was done due to perceived mixing contributions from the effluent, as the storm drains were directly above the main effluent piping. For sample point A36, the catch basin was not deep enough and did not have enough water in the basin to use a swing pole. The effluent was collected with a peristaltic pump that was previously installed on site.




**Figure 4-16: Chemtrade Upstream Sampling Stations**

Stormwater samples were collected during rainfall events only. Rainfall data was collected from Environment Canada Station N Vancouver Wharves (Climate ID 1105669). December had a dryer period leading up to the sampling (**Table 4-5**).

**Table 4-5: Rainfall During and Leading Up to November Sampling Event**

| November Sampling Event | | | | | |
|---|---|---|---|---|---|
| **Date** | **November 9, 2024** | **November 10, 2024** | **November 11, 2024** | **November 12, 2024** | **November 13, 2024** |
| Amount of Rainfall (mm) | 6.0 | 19.2 | 16.6 | 25.8 | 21.2 |
| **December Sampling Event** | | | | | |
| **Date** | **December 9, 2024** | **December 10, 2024** | **December 11, 2024** | **December 12, 2024** | **December 13, 2024** |
| Amount of Rainfall (mm) | 2.0 | 0.0 | 0.0 | 0.6 | 23.4 |

The estimated facility area contributing stormwater to the main effluent is approximately 65,503 $m^2$ (see **Table 4-6**) for calculation breakdown). Most of the Chemtrade property is paved or roofed, which these impervious surfaces create low infiltration and a higher percentage runoff into the storm system.

A runoff coefficient of 0.9 was applied to the stormwater contribution to the effluent to account for infiltration, and rainwater loss due to evaporation in the paved and roofed areas (impervious areas). The portion of the facility is used to store salt; there is no known data available for the runoff coefficient of salt piles, so it was assigned a runoff coefficient of gravel (Santa Fe Watershed Association, 2025). Runoff Coefficients for Different Surfaces).the rainfall contributing to effluent was estimated at approximately 1% of the total effluent on November 13, and December 13, 2024 (**Table 4-7**).

**Table 4-6: Site Runoff Summary**

| Area | Area ($m^2$) | Runoff Coefficient |
|---|---|---|
| Impervious area (concrete or roofs) | 58,729 | 0.9 |
| Salt Pile | 6,774 | 0.5 |

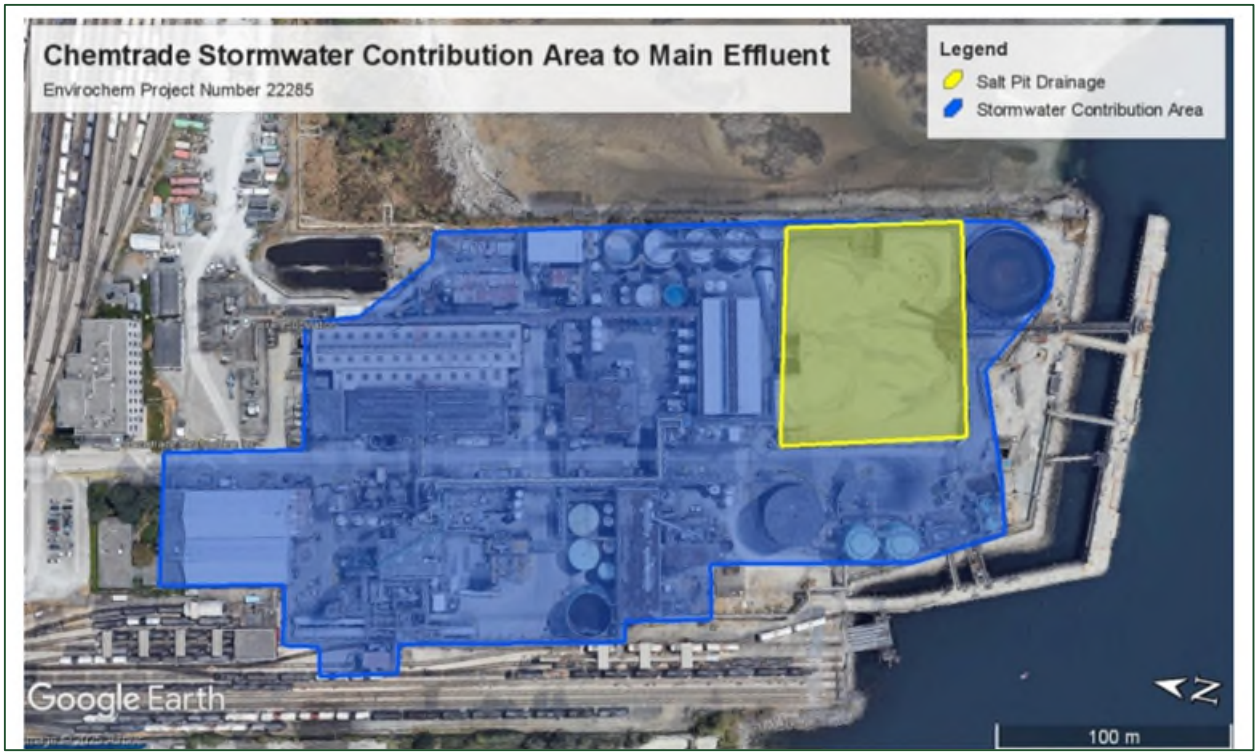



**Figure 4-17: Chemtrade Stormwater Contribution Area to Main Effluent**

**Table 4-7: Estimated Stormwater Contributions to Effluent**

| Date | Daily Rainfall (mm) | Estimated Stormwater Contribution to Effluent (m3) | Effluent Discharge ($m^3$) | Estimated % of Daily Effluent |
|---|---|---|---|---|
| November 13, 2025 | 21.2 | 752.6 | 60,800 | 1.24 |
| December 13, 2025 | 23.4 | 830.7 | 61,400 | 1.35 |

A third sampling event was completed in February 2025 to focus on the domestic sewage and effluent to better understand any potential interferences of stormwater from the November and December events. The February 2025 sampling event was conducted when there was zero precipitation recorded from the previous five days leading up to the sampling event. The Engineering domestic sewage station could not be sampled as it was observed to be dry (see **Figure 4-18** below).

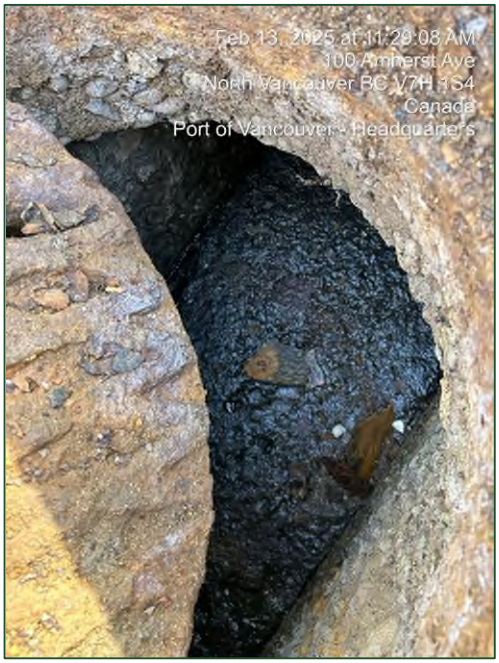



**Figure 4-18: Engineering Domestic Sewage Sample Station Feb 13, 2025**

#### 4.2.1.2 Lab Analysis

The WQOs for freshwater tributaries to Burrard Inlet are in the process of being updated. Given the above, analytical and in-situ water quality results from upland sources were screened against the British Columbia Water Quality Guidelines (BCWQGs) for freshwater in the interim. The British Columbia Ambient Water Quality Guidelines (BCWQGs) are summarized in Table 4-8 **.**

**Table 4-8: Water Quality Guidelines for freshwater**

| Parameter | Source of Threshold | Threshold |
|---|---|---|
| **In-Situ** | | |
| **pH** | BCAWQG | Freshwater 6.5-9 pH units |
| **General Parameters** | | |
| **Solids, Total Suspended [TSS]** | BCAQWG | Dependant on background levels |
| **Turbidity** | BCAQWG | Dependant on background levels |
| **Biochemical oxygen demand (BOD)** | Another Appropriate Threshold - British Columbia Municipal Waste Regulation | 45 mg/L, 130 mg/L |
| **Phenols, total (4AAP)** | BCIWQG | Acute: 50 µg/L |
| **Nutrients and Anions** | | |
| **Ammonia, total (as N)** | BCAQWG | pH and temperature dependant |
| **Chloride** | BCAWQG | 600 mg/L maximum, 150 mg/L 30-day mean |
| **Fluoride** | BCIWQG | Hardness dependant |

| Parameter | Source of Threshold | Threshold |
|---|---|---|
| **Nitrate (as N)** | BCAWQG | 32.8 mg/L maximum, 3 mg/L 30-day mean |
| **Total Metals** | | |
| **Antimony, Total** | BCAWQG | Acute: 250 µg/L |
| | | Chronic: 74 µg/L |
| **Arsenic, Total** | BCAWQG | 5 µg/L |
| **Boron, Total** | BCAWQG | 1.2 mg/L |
| **Cadmium, Total** | BCAWQG | Hardness dependant |
| **Chromium, Total** | BCWWQG | Cr(Vi): 2.5 µg/L, Cr (VIII): 8.9 µg/L |
| **Copper, Total** | BCAWQG | Hardness dependant |
| **Lead, Total** | BCAWQG | Hardness dependant |
| **Manganese, Total** | BCAWQG | Hardness dependant |
| **Mercury, Total** | BCAWQG | 0.00002 mg/L mean when MeHg= 0.5% of THg (5-in-30) |
| **Nickel, Total** | BCAWQG | Hardness dependant |
| **Selenium, Total** | BCAWQG | 2 µg/L mean (5-in-30) |
| **Silver, total** | BCAWQG | 0.12 µg/L |
| **Vanadium, total** | BCWWQG | 60 µg/L |
| **Zinc, total** | BCAWQG | Hardness dependant |
| **Polycyclic Aromatic Hydrocarbons (PAHs)** | | |
| **Acenaphthene** | BCAWQG | 6 µg/L |
| **Benzo(a)pyrene** | BCAWQG | 0.01 µg/L |
| **Fluorene** | BCAWQG | 12 µg/L |
| **Naphthalene** | BCAWQG | Acute: 1 µg/L |
| | | Chronic: 1 µg/L |

**Notes:**
BCAWQG – British Columbia Approved Water Quality Guidelines
BCWWQG – British Columbia Working Water Quality Guidelines
BCIWQG – British Columbia Interim Water Quality Guidelines

The stormwater samples were analyzed for physical parameters, total and dissolved metals, and oil and grease, while the septic tank samples were analyzed for physical parameters and microbiological parameters (**Table 4-9**). The Effluent sample was analyzed for all the parameters.

**Table 4-9: Parameters Analyzed**

| Sampling Station | Domestic Sewage | Stormwater | Effluent |
|---|---|---|---|
| **Parameters Analyzed** | • TSS<br>• pH<br>• BOD | • TSS<br>• pH<br>• Total Metals | • TSS<br>• pH<br>• BOD |

| | | | |
|---|---|---|---|
| | • Fecal Coliforms<br>• *E. coli*<br>• *Enterococcus* | • Dissolved Metals<br>• Mineral Oil and Grease | • Fecal Coliforms<br>• *E. coli*<br>• *Enterococcus*<br>• Total Metals<br>• Dissolved Metals<br>• Mineral Oil and Grease |

#### 4.2.1.3 Findings

Irrespective of the analytical results for the domestic sewage parameters, it is important to be aware that domestic sewage contribution to the effluent is only approximately 0.035% of the effluent discharge and thus the loading contribution to any of the parameters is likely minimal to negligible.

Domestic sewage samples had higher biological and physical results when compared to the effluent prior to discharge to the marine receiving environment. Septic results that exceeded the appropriate threshold can be found in **Table 4-10**.

There was no freshwater BC Approved or Working Water Quality Guideline for E. coli and enterococcus. E. coli and enterococcus exceeded the British Columbia Recreational Water Quality Guidelines (BCRWQG; BC ENV, 2019a) at all septic stations except at Station Septic (A14A) – 8 Maintenance Shop. At station Septic (A14A) – 8 Maintenance Shop, the enterococcus result was reported below the guideline, however it was a non-quantifiable result, and the true result was very likely above the guideline.

TSS and BOD results were compared to the British Columbia Municipal Waste Regulation (BC MWR). At all individual septic stations, effluent did not exceed 10 $m^3$/day, and therefore the BC MWR did not have TSS or BOD limits.

For fecal coliforms, there was no currently available guideline or objective for freshwater. Therefore, the 1992 Canadian Recreational Water Quality Guideline (Health and Welfare Canada, 1992) was used as a reference. At the time of this report, the CRWQG 1992 had been replaced with a newer version where enterococcus was determined to be a better indicator of fecal presence in water, and thus fecal coliforms is not mentioned in the most recent version of the CRWQG.

In summary, POPCs that exceeded the relevant threshold at all tested septic stations were fecal coliforms, enterococcus, and E. coli.

**Table 4-10: Domestic Sewage Summary of Parameters Exceeding Relevant Threshold**

| Domestic Sewage | Septic (A06) – 4 Divisional Building | Septic (A11.1) – 6 Engineering | Septic (A14A) – 8 Maintenance Shop |
|---|---|---|---|
| **November** | E. coli [Q] (BCRWQG), Enterococcus [Q] (BCRWQG), Fecal coliforms [Q] (CRWQG 1992) | E. coli [Q] (BCRWQG), Enterococcus [Q] (BCRWQG), Fecal coliforms [Q] (CRWQG 1992) | E. coli [Q] (BCRWQG), Enterococcus [Q, B] (BCRWQG), Fecal coliforms [Q] (CRWQG 1992) |
| **December** | E. coli [Q] (BCRWQG), Enterococcus [Q] (BCRWQG), Fecal coliforms [Q] (CRWQG 1992) | E. coli [Q] (BCRWQG), Enterococcus [Q] (BCRWQG), Fecal coliforms [Q] (CRWQG 1992) | E. coli [Q] (BCRWQG), Enterococcus (BCRWQG), Fecal coliforms [Q] (CRWQG 1992) |
| **February** | E. coli (BCRWQG), Enterococcus [Q] (BCRWQG), Fecal coliforms [Q] (CRWQG 1992) | NS | E. coli [Q] (BCRWQG), Enterococcus [Q] (BCRWQG), Fecal coliforms (CRWQG 1992) |

**Notes:**
[Q] indicates non-quantifiable result
[B] indicates result is below single sample maximum, but because it is non-quantifiable it may still be greater.

NS indicates station was not sampled.

Irrespective of the analytical results for the stormwater parameters is it important to be aware that the calculated stormwater contribution to the effluent on the dates of sampling was only as high as 1.35% of the effluent discharge and thus the loading contribution to any of the stormwater parameters is likely low to negligible.

A full summary of the stormwater sample results (including non detection results) that exceed the relevant threshold are seen in **Table 4-11** below (**Appendix F**). Metals and pH results were compared to the BCAWQG or BCWWQG for freshwater. TSS results were compared to Chemtrade's current permit limits of 130 mg/L (max) and 20 mg/L (avg.). Effluent results only apply to marine guidelines and were therefore not included in the table.

Note that total aluminum, total mercury, dissolved copper, dissolved lead, dissolved nickel, and dissolved zinc could not be compared to the BCAWQG due to missing parameters needed to be subsequently measured to calculate the guideline.

Note that some results exceeded the relevant guideline but were measured below the detection limit which the true result may be below the guideline (as indicated by the DL superscript in the table).

Note that for most cobalt results that exceeded the guideline, the cobalt guideline may not be acceptable as the hardness was outside of the range suitable for the calculation.

**Table 4-11: Stormwater Summary of Parameters Exceeding either a BIWQO CH, BCAWQG, and/or BCWWQG value**

| Stormwater | Nov 2024 | Dec 2024 |
|---|---|---|
| **SW E (B02) from cb** | Total Suspended Solids (Permit Avg.),<br>Total Cobalt [H] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute),<br>Dissolved Cadmium (BCAWQG Acute and Chronic),<br>Dissolved Iron (BCAWQG Acute) | Total Suspended Solids (Permit Avg.),<br>Total Cobalt [H] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute),<br>Total Silver (BCAWQG Chronic),<br>Dissolved Cadmium (BCAWQG Acute and Chronic) |
| **SW E (B06) from cb** | Total Suspended Solids (Permit Avg.),<br>Total Arsenic (BCAWQG Chronic),<br>Total Cobalt [H] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute) | Total Suspended Solids (Permit Avg.),<br>Total Cobalt (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute) |
| **SW E (B21) from cb** | Total Suspended Solids (Permit Avg.),<br>Total Beryllium[DL] (BCWWQG Chronic),<br>Total Cobalt[DL,H] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute),<br>Total Thallium[DL] (BCAWQG Chronic),<br>Dissolved Cadmium (BCAWQG Acute and Chronic) | Total Suspended Solids (Permit Avg.),<br>Total Beryllium[DL] (BCWWQG Chronic),<br>Total Cobalt[DL] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute),<br>Total Selenium [DL] (BCAWQG Chronic),<br>Total Silver [DL] (BCAWQG Chronic),<br>Total Thallium[DL] (BCAWQG Chronic),<br>Dissolved Cadmium (BCAWQG Acute and Chronic),<br>Dissolved Iron (BCAWQG Acute) |
| **SW middle (A13) to cb** | Total Suspended Solids (Permit Avg.),<br>Total Cobalt [H] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute),<br>Total Silver (BCAWQG Chronic),<br>Dissolved Cadmium (BCAWQG Acute and Chronic) | Total Suspended Solids (Permit Avg.),<br>Dissolved Cadmium (BCAWQG Chronic) |
| **SW middle (A35) to cb** | Total Suspended Solids (Permit Avg.),<br>Total Cobalt [H] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute),<br>Total Silver (BCAWQG Chronic),<br>Dissolved Cadmium (BCAWQG Acute and Chronic) | Total Suspended Solids (Permit Avg.),<br>Total Cobalt [H] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute) |
| **SW middle (A36) to cb** | Total Suspended Solids (Permit Avg.),<br>Total Cobalt [H] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute) | Total Suspended Solids (Permit Avg.),<br>Total Cobalt [H] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute) |
| **SW middle (B26) from cb** | Total Suspended Solids (Permit Avg.),<br>Total Cobalt [H] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute),<br>Dissolved Cadmium (BCAWQG Acute and Chronic) | Total Suspended Solids (Permit Avg.),<br>Total Cobalt [H] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute),<br>Dissolved Cadmium (BCAWQG Acute and Chronic) |
| **SW W (A19) from cb** | Total Suspended Solids (Permit Avg.),<br>Total Cobalt [H] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute),<br>Dissolved Cadmium (BCAWQG Acute and Chronic) | Total Suspended Solids (Permit Avg.),<br>Total Cobalt [H] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute),<br>Dissolved Cadmium (BCAWQG Acute and Chronic) |
| **SW W (A31) from cb** | Total Suspended Solids (Permit Avg.),<br>Total Cobalt [H] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute),<br>Total Silver (BCAWQG Chronic),<br>Total Thallium (BCAWQG Chronic) | Total Suspended Solids (Permit Avg.),<br>Total Cobalt [H] (BCAWQG Chronic),<br>Total Iron (BCAWQG Acute) |

**Notes:**
[DL] indicates result was below the detection limit.
[H] indicates calculation made for objective was below the specified range of hardness.

## 4.3 Effluent

### 4.3.1 Composition

As per the simplified process control diagram in **Figure 4-19** (**Appendix G**), the effluent sources combine together at various locations along the main effluent pipe prior to discharging to the Burrard Inlet via a single outfall. Effluent is comprised of the collection of water from three sources for the Chemtrade facility including: (1) domestic sewage, (2) Burrard Inlet, and (3) stormwater (**Figure 4-19**). The vast majority of

effluent consists of non-contact cooling water from the Burrard Inlet (97.3%), while the remaining is made up with stormwater (0.29%) and various chlor-alkali processes (2.37%), and domestic sewage (0.01%).

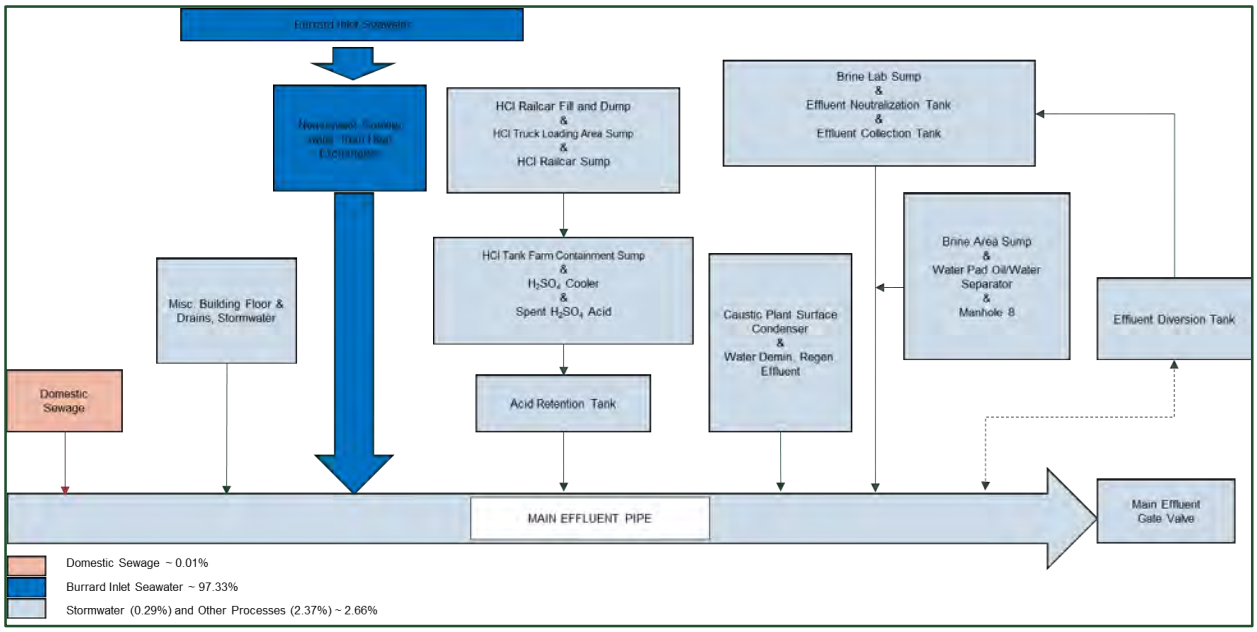



**Figure 4-19: Key Sources of Effluent to Main Effluent Pipe and Burrard Inlet**

### 4.3.2 Quantity

The quantity of effluent discharged from the Chemtrade facility was contingent on whether the facility was operational or in shutdown mode. During operations, volumes of effluent discharged ranged between 58,500 $m^3$ and 66,000 $m^3$, while discharge was considerably reduced during shutdown to 100 and 700 $m^3$ during the 2024 field program **Table 4-12**. Although these discharge measurements are only specific to the field program, overall Chemtrade's effluent discharge remains 99% compliant with the permitted limit (90,000 $m^3$).

**Table 4-12: Chemtrade Effluent Discharge Volume (1000 $m^3$) in 2024.**

| Sampling Date | Season | Chemtrade Discharge of Effluent into Burrard Inlet (1000 $m^3$) |
|---|---|---|
| April 9, 2024 | Spring (Shutdown) | 0.7 |
| April 10, 2024 | | 0.1 |
| April 11, 2024 | | 0.4 |
| April 12, 2024 | | 0.6 |
| May 7, 2024 | Spring (Operations) | 63.4 |
| May 8, 2024 | | 62.7 |
| May 9, 2024 | | 62.9 |
| May 22, 2024 | Spring (Freshet) | 61.4 |
| May 24, 2024 | | 61.9 |
| August 6, 2024 | Summer | 66.0 |
| August 7, 2024 | | 59.7 |

| Sampling Date | Season | Chemtrade Discharge of Effluent into Burrard Inlet (1000 $m^3$) |
|---|---|---|
| August 8, 2024 | | 59.6 |
| October 29, 2024 | Fall / 5-in-30 | 59.3 |
| November 1, 2024 | | 60.1 |
| November 5, 2024 | | 60.8 |
| November 12, 2024 | | 60.5 |
| November 15, 2024 | | 58.5 |
| November 26, 2024 | | 61.7 |
| November 28, 2024 | | 62.4 |

### 4.3.3 Quality

Effluent samples were collected concurrently with the marine receiving environment sampling program during spring (three events), summer (one event) and fall (five events) in 2024. Samples were submitted to an accredited CALA laboratory for analyses (refer to **Section 4.1.1.2** for the list of parameters) and subsequently compared to applicable objectives (BIWQO) and/or guidelines (BC WQG).

Results for parameters with applicable objective/guideline were compared to 100% of the BIWQO/BCWQG. In the event a parameter has both BIWQOs and BCWQGs, the BIWQO would take precedent. Effluent comparisons are provided in **Section 4.1.1.3** (**Figure 4-2, Figure 4-4** to **Figure 4-7**) and resulted in one of the four following scenarios:

- Parameter concentrations are below the BIWQOs and/or BCWQGs
- Parameter concentrations are typically close to the BIWQOs and/or BCWQGs
- Parameter typically exceeds the BIWQOs/BCWQGs, or
- All parameter concentrations are above the BIWQOs and/or BCWQGs.

All other parameters without guidelines/objectives were plotted accordingly (**Figure 4-3 to Figure 4-5**).

#### Metals With Guidelines/Objectives

- Concentrations of antimony, beryllium, cadmium, chromium, lead, manganese, mercury, silver, and vanadium are all below guidelines/objectives and/or non-detect in effluent samples.
- Even though there are some exceedances, mean concentrations of arsenic, selenium and zinc are below guidelines/objectives.
- Boron, copper and nickel exceeded the BCWQGs 100% of the time in effluent samples.

#### Metals Without Guidelines/Objectives

- Concentrations of all 28 metals (without guidelines and/or objectives) analysed from the effluent samples were not significantly different than concentrations measured from other stations.

#### Polycyclic Aromatic Hydrocarbons

- Overall, 26 of 28 PAHs were non-detect in effluent samples.
- The remaining two PAHs (2-methylnaphthalene and pyrene) were mostly non-detect with the exception of one detection for each parameter.
- All PAHs were below BIWQOs

Other Analytes

- Concentrations of bromate and nitrite were non-detect in all effluent samples.
- Concentrations of ammonia, bromide, chloride, hardness, nitrite and sulfate follow a similar trend among locations with no BIWQO and/or BCWQGs. Mean concentrations for respective parameters were similar but included a number of outliers.
- In addition to TSS, concentrations of nitrate were well below BCWQGs.
- Although mean concentrations of fluoride are below the BCWQGs, several exceedances were recorded in effluent samples.
- Chlorate and phenols both consistently exceeded their respective BCWQG/BIWQOs (0.005 mg/L and 0.001 mg/L). However, concentrations of phenols were often non-detect but greater than the BIWQOs. Due to chemical interference in marine water, detection limits were increased well above the BIWQO, making interpretation difficult. Chlorate concentrations appear to be higher in effluent but are not significantly different than concentrations recorded at the other stations.

Chloride Produced Oxidants

- Overall, apart from a couple of occurrences, concentrations of CPOs consistently exceeded the BIWQOs in effluent samples.

In-situ Water Quality

- Concentrations of dissolved oxygen are all above the BIWQO guideline. Although DO appears to be higher in the effluent samples, concentrations are not statistically different than concentrations recorded at other stations.
- Overall, pH and salinity in effluent samples were similar to those recorded at the other sampling stations. Although pH is on the lower end of the BIWQO range (7.7-8.8), pH values were similar to those recorded at all the other sampling stations.
- Water temperature in effluent samples (17.6 to 25.7 $^{o}$C) were significantly different than water temperatures recorded in the receiving environment (8.6 to 15.5 $^{o}$C).

### 4.3.4 Permit Performance

Since 2010, Chemtrade has conducted continuous effluent monitoring for selected chemical parameters to ensure compliance with their active effluent discharge permit (BC ENV #18). Water samples have been analyzed for pH, total suspended solids (TSS), temperature, residual chlorine, and a full suite of metals (excluding mercury). From 2015 to present, parameters such as temperature and total residual chlorine have consistently demonstrated full compliance, with no recorded incidents of exceedance. Other parameters including pH, TSS, total copper, and total nickel have shown high compliance rates (over 97% compliance), while compliance for total zinc was approximately 90%.

### 4.3.5 Toxicity

Effluent toxicity testing has been conducted as part of ongoing effluent monitoring under the current discharge permit (BC ENV #18). Quarterly toxicity testing carried out between 2018 and 2023 revealed that all 96-hour LC50 acute toxicity tests using Threespine stickleback exposed to undiluted (raw) effluent resulted in 100% survival. On two occasions (2 out of 26 tests in total) during this period, alternative species (i.e., rainbow trout and Pacific topsmelt) were tested due to unavailability of stickleback. Both species also demonstrated 100% survival when exposed to undiluted effluent under the same 96-hour LC50 conditions.

Additionally, bacterial luminescence (Microtox) tests were conducted concurrently with the fish toxicity tests. Exposure to undiluted effluent for 5 and 15 minutes resulted in no significant inhibition of light production by the test organism, with IC50 values indicating >99% of baseline luminescence was maintained. These results suggest that, despite the presence of some effluent constituents that exceed water quality standards (e.g., BIWQOs), both lower trophic level organisms and higher-level test species (such as fish) show no signs of acute lethality even when exposed to undiluted, end-of-pipe effluent.

The testing period also captures seasonal variations, which influence both the composition and concentration of effluent constituents. Nevertheless, the data suggests the tested organisms are resilient to these temporal fluctuations in effluent quality. Furthermore, the implication is that, once discharged into Burrard Inlet, the effluent undergoes additional dilution due to the hydrodynamic conditions, particularly within the Initial Dilution Zone (IDZ; see Section 5.3). As a result, the constituents originating from Chemtrade's effluent are expected to pose a low risk to the surrounding biota that inhabit the discharge area, whether on a permanent or temporary basis.

# 5.0 PARAMETERS OF CONCERN

The complete effluent discharge profile of Chemtrade is intricate, where process water is comprised of multiple different effluent streams. Burrard inlet seawater is used as non-contact cooling water from the heat exchangers representing approximately 97% of the effluent discharge. Domestic sewage is discharged directly to the main effluent after primary settling. The main effluent pipe collects runoff from storm drains, floor drains, the railcar sites, and the acid retention tank. Caustic plant surface condenser and water demineralization regeneration effluent also discharges directly to the effluent.

## 5.1 Screening Approach

The POC Screening Assessment applied the steps outlined in the provinces *Defining Parameters of Concern for Effluent Discharge Authorization Applications* guidance document (BC ENV 2024):

- Step 1: Is the parameter detectable in untreated effluent?
- Step 2: Is the parameter a special case parameter?
- Step 3: Is there an objective or guideline or another appropriate threshold?
    - Burrard Inlet Water Quality Objectives (BC ENV & TWN 2024);
    - British Columbia Approved Water Quality Guidelines (BC WLRS 2025a);
    - British Columbia Working Water Quality Guidelines (BC WLRS 2025b);
    - Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 1999);
    - Other appropriate benchmarks.
- Step 4: Does the parameter exceed 0.8x the objective or guideline?
    - Comparing untreated effluent data with 0.8x the objectives, guidelines or other appropriate benchmark.
- Step 5: Can the POPC be excluded from consideration as a POC?
- Refining the POPCs list with scientifically justified and fully documented rationale to generate a final list of POCs.

The results of the POC screening is detailed in **Appendix H**.

## 5.2 Screened POCs for Assessment

After following the steps outlined in *Defining Parameters of Concern for Effluent Discharge Authorization Applications* guidance document (BC ENV, 2024), the following parameters have been screened as Parameters of Concern:

- Temperature
- Copper;
- Nickel;
- Zinc;
- Cadmium;
- Chlorate;
- pH.

These POCs were carried forward for further analysis in the Impact Assessment (Section 7.0).

# 6.0 INITIAL DILUTION ZONE DELINEATION

When effluent is discharged into a receiving aquatic environment, the *Environmental Management Act* recognizes that the receiving water's capacity to dilute the effluent is a critical consideration. Proponents are expected to apply best management practices to minimize waste and prevent or mitigate harmful effects. Additionally, appropriate waste treatment technologies should be implemented prior to considering the use of an Initial Dilution Zone (IDZ). According to the Ministry of Environment and Climate Change Strategy's *Technical Guidance 11*: "*The IDZ is the three-dimensional zone around a point of discharge where mixing of the effluent and receiving environment water occurs. An IDZ does not encompass the entire extent of mixing, as the effluent plume may continue to disperse beyond the IDZ boundary before achieving complete mixing with the receiving environment. At the edge of the IDZ, the effluent should not cause chronic toxicity in the receiving environment*".

Through evaluation of the current effluent discharge outfall configuration, it was determined that conventional modelling software such as CORMIX is not designed to handle complexities of vertical (e.g., Chemtrade facility outfall) versus more common horizontal outfall discharges. Furthermore, computational fluid dynamic (CFD) modelling was discounted as it is used to predict dilution characteristics before construction (installation). Additionally, CFD would require an extremely onerous amount of field data. Overall, a simplified, yet defensible approach was applied to estimate the size of the IDZ for POCs.

## 6.1 Thermal IDZ

Marine temperature data collected as part of the 2024 field sampling program were used to assess the operational characteristics of Chemtrade's diffuser, verify modelled dilution estimates, and identify the IDZ boundary (Integrated, 2025). Temperature measurements were taken at 14 sampling stations representing near-field, mid-field, and far-field zones, as well as from intake and effluent points. Data were collected at three depths (i.e., surface, mid, and bottom) at approximately 1-meter intervals during both ebb and flood tides. Far-field temperature data were used to determine ambient conditions. On average, the effluent temperature was approximately 10°C higher than that of the receiving environment. The estimated boundary of the IDZ encompassed a 30-meter radius from the outfall, with an approximate vertical extent of 15 meters (**Figure 6-1 and Figure 6-2**).

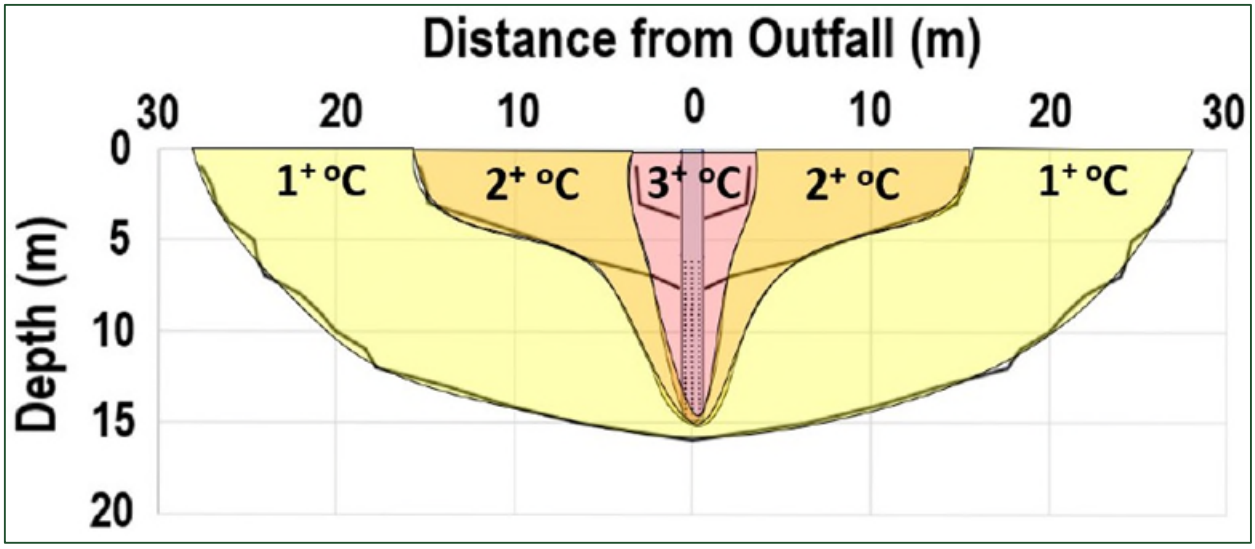



**Figure 6-1: Approximate Initial Dilution Zone Cross-Section for Water Temperature (Integrated 2025 – Appendix I).**




**Figure 6-2: Approximate Initial Dilution Zone Boundary (Integrated 2025 – Appendix I).**

Within the IDZ, the immediate area around the diffuser (~ 3 meters) exhibited temperatures about 3°C above ambient; at a distance of >3 to 15 meters, the temperature was approximately 2°C above ambient; while, between 15 and 30 meters, the temperature difference was approximately 1°C above ambient (Figure 6-1). The only sampling location that showed a temperature (maximum) increase of more than 1°C above ambient throughout the water column was the discharge point (DIS_1) (Figure 4-1). At this location, temperatures typically ranged from a maximum of 1.5°C above ambient at an 11-metre depth to approximately 3.5°C above ambient near the surface. Temperatures at the near-field station (e.g., NF_2 and NF_3) and the mid-field station (e.g., MID_3), located approximately 50 m from the diffuser, are

comparable, with maximum temperature increases of about 0.7 °C above ambient throughout the water column.

Based on the effluent temperature (~10°C greater than ambient) the estimated dilution ratio of the volume of ambient water to discharge water within this 3-dimensional zone is roughly 5:1. A volumetric mass-balance principle was applied to estimate the approximate ratio of the ambient water volume to the discharge water volume at the edge of the IDZ, which resulted in a ratio of 9:1. This means that approximately 10% of the water present where the water temperature is one degree higher than the ambient temperature is comprised of nine-parts ambient water with a temperature of 10°C and one-part effluent with a temperature of 20°C. This ratio of 9 parts ambient water to 1 part effluent was also applied to estimate the concentration of parameters of concern (POCs) at the edge of the IDZ (**Section 6.1.2**).

## 6.2 Chemical IDZ

The estimated dilution ratio of 9:1 (ambient to effluent) at the boundary where the temperature is 1°C above ambient was applied to predict residual chlorine concentrations and other select POCs (pH, copper, nickel, zinc) (Integrated, 2025).

Typical effluent total residual chlorine concentrations of approximately 0.015 mg/L (15 µg/L) would be diluted to about 1.5 µg/L, which is below the approved BCWQG of 3 µg/L. For pH, the predicted value was 0.1% lower than the measured value. For copper, the prediction underestimated the measured value by approximately 30%. Nickel predictions were only 3% lower than measured values, while zinc concentrations were the same in both predicted and measured results. Overall, these values indicate that the 9:1 dilution ratio is relatively accurate in predicting the concentration POCs at the edge of the IDZ.

Mass balance calculations were used to estimate Chemtrade's discharge contributions to the receiving environment (Burrard Inlet). For this analysis, empirical field data for identified POCs at the intake (influent), effluent, and far-field locations were combined with flow data over a tidal cycle. To estimate the Second Narrows' flow, the mass balance method used data summarized in Wu et al (2019). By applying this information in conjunction with flood tide data, it was estimated that Chemtrade contributes less than one-tenth of one percent of the copper already present in the incoming tide (i.e., an even smaller contribution was estimated for iron and nickel). The contribution from Chemtrade's discharge represents a very small proportion/percentage of the overall concentrations observed in Burrard Inlet.

# 7.0 IMPACT ASSESSMENT

The potential for adverse environmental effects associated with Chemtrade's effluent discharge was assessed utilizing the following information:

- Existing conditions (**Section 4.0**)
- Parameters of Concern (**Section 5.0**)
- Initial Dilution Zone (**Section 6.0**)

The receiving environment impact assessment considered water quality predictions within and at the edge of the IDZ. The IDZ represents the outer boundary of the discharge within which mixing of the effluent and the receiving environment occurs and in which the water quality can exceed the applicable BIWQOs or BCWQGs (i.e., DIS_1). The boundary location (edge) is then used as a receiving environment sampling location to confirm the water quality objectives are being met and where the effluent should not cause chronic toxicity in the receiving environment (i.e., NF_2, NF_3 and MID_3). Whole effluent toxicity test

results (Section 4.3.5) conducted over multiple years is also considered in the assessment of potential effects.

## 7.1 Assessment of Potential Effects

### 7.1.1 Potential Thermal Effects

Increases in temperature, particularly those driven by climate change, can trigger cascading physical and chemical changes in the marine environment. These effects are rarely isolated and typically interact with other variables such as dissolved oxygen, pH, nitrogen, and salinity, which themselves may fluctuate with temperature (Harley et al., 2006; CCME, 1999). As such, temperature must be considered in the context of broader ecosystem dynamics. Historically, studies on temperature effects have focused on individual species, often overlooking the influence of associated abiotic factors. For example, elevated temperatures can cause stronger thermal stratification and deepen the thermocline, thereby limiting the upwelling of cooler, nutrient-rich waters (Roemmich & McGowan, 1995). Although species-level studies do not always translate into community-level predictions (Harley et al., 2006), they have revealed critical biological responses to temperature changes such as impacts on photosynthesis, respiration, spawning, behaviour, and the uptake of toxic substances. At the cellular level, elevated temperatures can damage proteins, alter membrane fluidity, and impair organ function (Hochachka & Somero, 2002). Susceptibility to temperature shifts is often species-specific and depends on life stage (ontogeny).

Temperature influences the distribution, abundance, and timing of life cycle events for various marine organisms. For instance, temperature is known to act as a spawning trigger for some species, yet others (e.g., some phytoplankton) remain unaffected, potentially disrupting trophic synchrony, such as the match between larval production and food availability (Philippart et al., 2003). As temperature increases, species will redistribute based on their thermal tolerance and adaptive capacity (Lubchenco et al. 1993). Effects are particularly pronounced on primary and secondary producers, invertebrates, and sedentary species. This can indirectly affect juvenile fish and seabirds by reducing prey availability. Conversely, marine mammals, which travel long distances and have broader thermal tolerances, are less likely to be affected by localized temperature changes.

Integrated (2025) predicted that the effluent plume within the defined Initial Dilution Zone (IDZ) will remain within ±1°C of ambient conditions at a distance of 30 metres from the discharge outfall. Within the IDZ, minor thermal elevations are anticipated; however, these increases are expected to be transient and limited in spatial extent (i.e., within the 30 m IDZ). The predicted temperature change is well within the natural variability observed in Burrard Inlet.

Given the small, localized change in water temperature at or near the edge of the IDZ, the design of the IDZ, and the absence of critical marine habitat, no adverse effects to aquatic or wildlife receptors are expected provided that effluent temperatures remain compliant with the BIWQO at the IDZ boundary.

### 7.1.2 Potential Chemical Effects

#### Copper

The revised WQOs for Burrard Inlet aim to protect both aquatic life and human health, particularly through the safe consumption of finfish and shellfish (Braig et al., 2024). Although copper is naturally present in the environment and natural processes can lead to occasional exceedances of water quality standards, the primary source of copper in aquatic environments is anthropogenic activity. Copper enters the aquatic

environment through atmospheric deposition, stormwater runoff, and wastewater discharges (CCME, 1999). In Burrard Inlet, the major pathways of copper introduction include stormwater and discharges from marine vessels (Braig et al., 2023). Copper exists in multiple chemical forms, and its speciation is influenced by environmental factors such as pH, water hardness, salinity, concentrations of bicarbonate, carbonate, phosphates, organic matter, suspended solids, and the presence of other metals. For example, higher concentrations of carbonates and organic complexing agents can reduce copper toxicity, while co-occurrence with zinc or nickel may increase toxicity due to synergistic interactions.

The dissolved form of copper is considered the most bioavailable and toxic to aquatic organisms (Braig et al., 2023). Copper is known to cause neurotoxic effects in fish. In juvenile Coho salmon, exposure to 5–20 µg/L over a 3-hour period impaired olfactory function (McIntyre et al., 2012). Acute toxicity (96h LC50) in juvenile Coho has been reported at concentrations ranging from 13.8 to 31.9 µg/L, depending on fish size (Buhl & Hamilton, 1990). Sandahl et al. (2004) also found significant impairment of olfaction in Coho juveniles, with a 50% reduction observed at 10 µg/L and a 90% reduction at 20 µg/L. The olfactory system is crucial for key behaviors such as predator avoidance (Hirvonen et al., 2000), food location (Hara, 2006), and homing and reproduction (Groot et al., 1986; Hasler & Scholz, 1983; Waring et al., 1996). Copper also negatively affects invertebrates, which can lead to reduced abundance, increased mortality, and behavioral changes. In a study using the shore crab (*Carcinus maenas*), significant effects on cellular and neurotoxic endpoints were observed only at a copper concentration of 68.1 µg/L following a 7-day exposure (Brown et al., 2004). The risk of copper-induced olfactory or neurological effects in juvenile salmonids within the project area is considered low. The BIWQO for copper is 1.3 µg/L, which is considerably lower than other reported concentrations associated with observed toxicity as summarized from the scientific literature. Notably, the BIWQO is also aligned with the federal initiative to protect Southern Resident Killer Whales, representing the most protective benchmark currently available.

Copper was screened as a parameter of concern (POC) using a wider range of historical data (2019-2024). Based on empirical data (2024), the concentration in effluent samples (2.95 µg/L) exceeded the BIWQO. Empirical water quality data from 2024 revealed only occasional exceedances of the BIWQO for copper in the marine environment. Namely, during the operational phase, copper concentrations exceeded the BIWQO in 1 of 47 samples (2%) at both DIS_1 and MID_3 stations. No exceedances were recorded at NF_2 or NF_3 stations. On average, copper concentrations (0.73 µg/L) at DIS_1, within the IDZ, are below the BIWQO. Furthermore, copper levels decline further at the near-field (NF_2 = 0.71 µg/L; NF_3=0.65 µg/L) and mid-field (MID_3 = 0.63 µg/L) stations.

Within, and at the edge of the IDZ, copper concentrations are below BIWQOs, thus no adverse effects to aquatic and/or wildlife receptors are expected.

### Nickel

Like copper, nickel is an essential element, but it can be toxic at high concentrations. Anthropogenic activities contribute significantly to increased nickel loadings. Various industrial processes, such as metal smelting, release nickel into marine environments via wastewater and stormwater runoff, while atmospheric deposition results from the combustion of fossil fuels. In Burrard Inlet, the major sources of nickel include combined sewer and stormwater outfalls, particularly those discharging through False Creek (Rao et al., 2021a).

In aquatic organisms, nickel is absorbed through the gills, where it can impair gas exchange, disrupt ion regulation, and induce oxidative stress. Its toxicity can be mitigated by increased water hardness (e.g., higher concentrations of $Mg^{2+}$ and $Ca^{2+}$), as well as elevated pH and salinity (Rao et al., 2021a).

Nickel toxicity varies by species. For example, the 96-hour median lethal concentration (LC50) for topsmelt (*Atherinops affinis*) was reported at 26,560 µg/L, while the most sensitive chronic effect during a 40-day exposure had a threshold of 4,270 µg/L (Hunt et al., 2002). For abalone (Haliotis rufescens; mollusc), the 48-hour median effective concentration (EC50) for larval development was 145.5 µg/L, and the chronic value for juvenile growth during a 22-day exposure through metamorphosis was 26.43 µg/L (Hunt et al., 2002).

Chronic toxicity estimates for 17 European marine species revealed variable sensitivity. Diadema antillarum was the most sensitive, showing effects (EC10) at 2.9 µg/L, whereas other sea urchin species, such as *Paracentrotus lividus* and *Strongylocentrotus purpuratus*, had EC10 values of 139 and 355 µg/L, respectively (DeForest & Schlekat, 2013). Among crustaceans, the mysid (*Americamysis bahia*) had an EC10 of 17 µg/L. In contrast, fish species like the sheepshead minnow (*Cyprinodon variegatus*) and topsmelt silverside were among the least sensitive, with EC10 values of 20,760 µg/L and 3,599 µg/L, respectively.

The BIWQO for nickel was developed based on the BC Working Water Quality Guidelines, which originally recommended a threshold of 8.3 µg/L. However, recent studies have reported frequent exceedances in sediment and tissue samples from the Burrard Inlet. To address concerns regarding nickel deposition in sediments and bioaccumulation in aquatic organisms, 10 years of water quality monitoring data collected by Metro Vancouver were analyzed. Following the BC Ministry of Environment methodology which involved setting the objective at 20% above the 95th percentile of observed data, a more conservative WQO of 0.8 µg/L was proposed (Rao et al., 2021a). This updated value is not only protective of aquatic life but also supports improvements in water and sediment quality and helps reduce the risk of long-term accumulation in biota.

Nickel concentrations in Chemtrade effluent samples exceeded the BIWQO, and as such, nickel was carried forward as a parameter of concern (POC). Occasional exceedances were observed for nickel in the marine environment during the operational phase. At DIS_1, nickel exceeded the BIWQO in just over 4% of samples (2 of 47), although this station is located within the IDZ. No exceedances were recorded at NF_3 or MID_3 stations, and only one exceedance occurred at NF2 (1.89%, or 1 of 53 samples). However, average concentrations at DIS_1 (0.56 µg/L), as well as at near-field (NF_2=0.54 µg/L and NF_3=0.53 µg/L) and mid-field (MID_3=0.53 µg/L) stations were below the BIWQOs and are expected to remain below the objectives.

Sediment chemistry in the vicinity of the Chemtrade facility displayed low concentrations of nickel (Figure 4-8) suggesting limited nickel deposition in sediments and low risk of accumulation in aquatic biota.

Within, and at the edge of the IDZ, nickel concentrations are below BIWQOs, thus no adverse effects to aquatic and/or wildlife receptors are expected.

### Zinc

Zinc enters marine environments primarily through stormwater runoff. Once in the water column, zinc tends to bind to suspended particles, which subsequently settle and deposit in the sediment. As a result, benthic marine invertebrates are particularly vulnerable to zinc exposure through sediment contact. In Burrard Inlet, the dominant sources of zinc loading include combined sewer overflows, stormwater discharges, ore handling operations at Vancouver Wharves, landfill leachate, and provincially authorized effluent discharges (Rao et al., 2021b).

Zinc occurs in various chemical species depending on environmental factors such as pH, salinity, and the presence of other ions. Its bioavailability and toxicity are strongly influenced by its speciation, with the free ionic form ($Zn^{2+}$) being the most toxic to aquatic organisms. Between 2007 and 2016, Metro Vancouver water monitoring data indicated mean zinc concentrations in Burrard Inlet ranged from below 1 µg/L to 23 µg/L across all sampling locations. Occasional exceedances were observed, particularly in 2007 at the Outer Harbor South location (Rao et al., 2021b).

Toxicological studies have demonstrated zinc's effect on marine invertebrates at relatively elevated concentrations compared to the BIWQO or historic concentrations observed in the inlet. In the amphipod *Corophium volutator*, a 20% reduction in lifespan was observed at a concentration of 600 µg/L, while exposure to 800 µg/L resulted in approximately a 25% reduction in growth. These elevated concentrations were also associated with reduced maturity and fertility (Conradi & Depledge, 1999).

Environmental risk limits for zinc have been developed in the Netherlands as part of both international and national environmental quality standards. The supporting documentation includes data on multiple marine algal and invertebrate species, with reported chronic toxicity thresholds ranging from 10 to 2,700 µg/L for algae and 10 to 1,000 µg/L for invertebrates (Bodar, 2007). These values highlight the wide variability in species sensitivity to zinc exposure in marine environments.

It is interesting to note that zinc is also widely used in personal care products and industrial applications, including sunscreens, antimicrobial agents, and anticorrosive products. The demand for zinc oxide nanoparticles (ZnO NPs) is growing, as well as their accumulation in coastal areas, prompting increased research on their environmental effects (Yung et al., 2014). Zinc nanoparticles have been shown to affect reproductive and survival outcomes in marine organisms. For example, in *Acartia tonsa*, 7-day exposures to ZnO NPs resulted in an EC20 of 143 µg/L for reproduction and 112 µg/L for survival. *Artemia salina* displayed greater tolerance, with 24- and 96-hour LC50 values of 100 mg/L. In *Oryzias melastigma*, exposure to 4 and 40 mg/L of ZnO for 96h impaired oxidative stress responses (Yung et al., 2014).

Zinc was carried forward as a POC despite empirical effluent quality data showing that its average concentration (8.1 µg/L) was below the BIWQO, except during the fall sampling event, when it reached 10.9 µg/L. Zinc concentrations at station DIS_1 (3.18 µg/L), located within the IDZ, as well as at near-field stations NF_2 (3.05 µg/L) and NF_3 (3.07 µg/L), and mid-field station MID_3 (3.01 µg/L), were all below the BIWQO of 10 µg/L. These concentrations were also consistent with historically observed levels in Burrard Inlet.

Sediment chemistry in the vicinity of the Chemtrade facility generally displayed concentrations of zinc below lower effect levels (124 ug/g; **Figure 4-8**) suggesting limited zinc accumulation in sediments and no clear association with effluent.

Within, and at the edge of the IDZ, zinc concentrations are below BIWQOs, thus no adverse effects to aquatic and/or wildlife receptors are expected.

### Cadmium

Cadmium poses a risk to human health due to its genotoxic (LeNoble et al., 2019) and carcinogenic properties. It accumulates in the liver and kidneys of fish and, when consumed by humans, can cause both acute and chronic toxicity due to its potential for biomagnification in the food chain. Cadmium has also been shown to transform normal epithelial cells into carcinogenic cells (Sharma et al., 2015).

While cadmium is found in various man-made products, its primary source in Burrard Inlet remains uncertain. Most permitted dischargers in the area comply with effluent limits (typically 0.2 µg/L). However, stormwater runoff and combined sewer overflows are potential pathways for cadmium to enter the marine environment. Improper disposal of cadmium-containing products, such as batteries, may also contribute to elevated levels (LeNoble et al., 2019).

Cadmium does not persist in the water column; instead, it tends to bind to particles and accumulate in sediments. Its mobility and bioavailability are influenced by physicochemical factors such as pH, water hardness, salinity, and the concentration of suspended solids. Increased cadmium mobility and toxicity are associated with lower pH, lower hardness, low salinity, and reduced suspended particulate matter (LeNoble et al., 2019).

Generally, cadmium can adversely affect marine aquatic life, particularly during early developmental stages. For instance, in the copepod *Acartia tonsa*, egg viability was reduced by 50% at just 1.94 µg/L, while a concentration of 64.4 µg/L was needed to reduce adult survival by 50% (Pavlaki et al., 2016). In flatfish (*Psetta maxima*), a 50% reduction in hatchability was observed at 112.3 µg/L (Mhadbbi et al., 2010). Red seabream (*Pagrus major*) showed a 50% reduction in survival after short-term exposures (24–48 hours) at concentrations of 9.8 and 6.6 mg/L, respectively (Cao et al., 2009).

Even when effects at the individual level are not immediately apparent, cadmium has been shown to cause genotoxicity, typically mediated by oxidative stress. Reactive oxygen species (ROS) generated during exposure can damage DNA and lead to cell apoptosis (Pavlaki et al., 2016).

Empirical data from 2024 show that the effluent concentration (0.08 µg/L) was below the BIWQO of 0.12 µg/L. Upon reaching station DIS_1, the concentration decreased to 0.07 µg/L and remained relatively stable at the near-field stations NF_2 and NF_3 (both 0.07 µg/L), as well as at the mid-field station MID_3 (0.07 µg/L).

Sediment chemistry in the vicinity of the Chemtrade facility generally displayed concentrations of cadmium below the sediment BIWQO (0.7 µg/g; **Figure 4-8**) suggesting limited cadmium accumulation in sediments and no clear association with effluent.

Given that effluent cadmium concentrations are predicted to remain below the BIWQOs both within and at the edge of the IDZ, no adverse effects to aquatic or wildlife receptors are anticipated.

### Chlorate

Chlorate is produced industrially and, according to a 1985 report by Environment Canada, approximately 64% of its production was used by the pulp and paper industry, primarily for pulp bleaching. Chlorate is highly water-soluble (95.7 g/100 mL at 20 °C; Robbins et al., 1942), does not readily adsorb to sediments or food particles, and has a low potential for bioaccumulation (Warrington et al., 2002).

During the 1980s, pulp and paper mill effluents caused a noticeable decline in *Fucus vesiculosus* populations in the Baltic Sea, raising environmental concerns (Lehtinen et al., 1988). At that time, chlorate concentrations in effluent were measured at 53 mg/L, with concentrations in the receiving environment estimated around 500 µg/L. Long-term mesocosm studies (6 months) on *F. vesiculosus* identified a NOEC of 5 µg/L (Rosemarin et al., 1986; Lehtinen et al., 1988). These and other studies on brown algae informed the British Columbia Ministry of Environment in establishing a water quality guideline for chlorate at 5 µg/L.

Although research on chlorate's effects on marine organisms remains limited (Warrington et al., 2002), some studies suggest higher tolerance to chlorate. For example, short-term exposure (70 hours) to 400 µg/L significantly inhibited photosynthesis in *F. vesiculosus* (Van Wijk & Hutchinson, 1995). Reported NOECs for other macroalgae include 100 µg/L for *Hormosira banksii* (Neptune's necklace) and 1000 µg/L for *Ecklonia radiata* (leather kelp) (Toxicos, 2007 a,b). Mysid shrimp can tolerate up to 1000 µg/L (US EPA), while fish species such as rainbow trout and sheepshead minnow have reported tolerances up to 10,000 mg/L and 48,000 mg/L, respectively (US EPA, 2007; BC ENV, 2002b; Van Wijk & Hutchinson, 1995).

The toxicity and environmental fate of chlorate are closely linked to ambient nitrate concentrations. Macroalgae are particularly sensitive to chlorate because they are unable to distinguish it from nitrate, both compounds compete for the same binding sites. Moreover, chlorate is a substrate for nitrate reductase, resulting in the formation of chlorite, a highly reactive oxidizing agent (Youngblut et al., 2016). Nitrate availability directly influences the expression and activity of nitrate reductase and thus the extent of chlorate reduction to chlorite. Consequently, nitrate levels in both experimental and natural systems are critical in determining chlorate toxicity.

For instance, nitrate concentrations below 5 µg/L in Bass Strait, Australia, characterize the area as nitrogen-limited (Gibbs et al., 1986). Similarly, large rivers and coastal waters in British Columbia are generally nitrogen-limited, with nitrate concentrations often too low to saturate or induce nitrate reductase (Warrington et al., 2002).

At the Chemtrade site, mean chlorate concentrations in effluent (3.18 mg/L) were higher than at discharge (1.47 mg/L), with all measured values exceeding the BCWQG of 5 µg/L. (Note: BIWQOs for chlorate have not been established). Chlorate concentrations were not directly measured at near- or mid-field stations, but applying a 9:1 dilution ratio at the edge of the Initial Dilution Zone (IDZ), and assuming no additional sources, yields an estimated concentration of 0.318 mg/L, which still exceeds the BCWQG.

Importantly, nitrate levels in the marine receiving environment were typically below detection limits, with occasional detections under 1 mg/L (i.e., less than 10%; see **Figure 4-5**), well below the BC WQG of 3.7 mg/L. This low nitrate availability suggests limited potential for nitrate reductase activity, thereby reducing the likelihood of chlorate being converted into the more toxic chlorite form.

While chlorate is not predicted to meet the BC WQG at the edge of the IDZ, the low nitrate concentrations, the modest chlorate levels outside the IDZ, poor habitat quality, low species abundance, and consistent no toxicity effects results from ongoing whole effluent acute and chronic toxicity testing, the potential for adverse effects on aquatic or wildlife receptors associated with chlorate is considered unlikely.

### pH

Hydrogen ion concentration, expressed as the negative logarithm of its chemical activity in solution (pH), is relatively stable in marine environments globally, typically ranging from 7.5 to 8.5. This stability is primarily due to the high salinity of seawater, which provides strong buffering capacity and limits pH fluctuations (CCME, 1999). The origin of pH in aquatic systems can be traced to the absorption of atmospheric carbon dioxide, which reacts with water to form carbonic acid. This acid subsequently dissociates into hydrogen ions, bicarbonate, and carbonate ions. Therefore, an increase in atmospheric carbon dioxide leads directly to an increase in hydrogen ion concentration, resulting in ocean acidification (Bjorklund et al., 2024).

Coastal marine environments are more susceptible to pH fluctuations than open ocean waters due to their proximity to anthropogenic activities. Inputs such as industrial effluents, wastewater, and nutrient-rich

freshwater runoff can elevate carbon dioxide concentrations and alter buffering capacity, resulting in local acidification. Although typical pH variation in these regions does not exceed ±1unit, ongoing climate change is expected to exacerbate these fluctuations and lead to continued and intensified acidification.

Ocean acidification has both direct and indirect consequences for marine life. Reduced pH levels can impair calcification, survival, and growth in aquatic organisms. Additionally, acidification can increase the solubility and toxicity of certain metals and alter other chemical dynamics such as ammonia speciation. Bivalve larvae are among the most sensitive organisms to acidification, particularly during early shell formation, which is critical for survival and development. Research has shown that initial shell formation is highly pH-sensitive (Waldbusser et al., 2013), and further vulnerability occurs during metamorphosis to juvenile stages (Talmage and Gobler, 2011). Although adult bivalves also experience impaired calcification under low pH conditions (Gazeau et al., 2007; Thomsen et al., 2010), they are generally less sensitive than larval stages, as emphasized by Waldbusser and Salisbury (2014).

Fish are affected by acidification through both physiological and neurological mechanisms. Increased hydrogen ion concentration can result in acid buildup within tissues, which must be eliminated to maintain homeostasis. This process requires energy, which is then diverted from other essential biological functions such as feeding, growth, and protein maintenance (Bjorklund et al., 2024). Reduced pH has been associated with decreased post-hatch survival and larval growth in inland silversides. Furthermore, low pH in combination with low oxygen has been shown to have additive negative effects on this species, while in Atlantic silversides the combination produced synergistically harmful outcomes (Depasquale et al., 2015; Gobler and Baumann, 2016).

According to 2024 empirical data, the pH of effluent discharged into Burrard Inlet was below 7.7, the lower limit set by the BIWQO. This is consistent with historical data collected by Chemtrade from 2019 to the present, which shows pH values ranging from 7.1 to 7.47.

Seasonal variations were observed in the marine environment, with pH values meeting the BIWQO at all depths during spring and summer at both DIS_1 and MF_3 stations (recorded at 7.8). However, pH values below the BIWQO were recorded in the fall, including during the 5-in-30 sampling events across all depths. During the 5-in-30 event at DIS_1, surface waters tended to be slightly elevated (7.3) compared to deeper layers (7.6). A similar pattern was observed for near- and mid-field (surface 7.5 vs deeper layers 7.6). Note that same seasonal and depth related patterns were observed at far-field stations, in the summer pH was above the BIWQO at all depths while in the fall (and the 5-in-30 sampling), pH was consistently below the BIWQO. For example, during the 5-in-30 sampling, surface pH at far-field was 7.3 while nearfield was at 7.5.

Despite these seasonal fluctuations, the risk to aquatic organisms with narrow pH tolerance ranges appears to be low under current discharge conditions, thus no adverse effect associated with minor changes in pH is expected.

Within, and at the edge of the IDZ, pH is within the range reported in BIWQOs, thus no adverse effects to aquatic and/or wildlife receptors are anticipated.

## 7.2 Mitigation Measures

As described in **Section 2.4** (Effluent Controls), specific instrumentation is used at the facility to monitor flow rates as well as release small/controlled amounts of chlorinated city water to control biological growth

in the seawater used for non-contact cooling. A target of 0.3 mg/L $Cl_2$ is maintained in the cooling water system.

Effluent in the main effluent pipe is dechlorinated using sodium bisulfite solution to reduce the effluent chlorine below the permit limit of 0.2 mg/L. Typical values for residual chlorine are 0.01 mg/L or lower before being discharged to the Burrard Inlet. This is continuously monitored by automated Oxidation-Reduction Potential (ORP) measurements and tied directly to the effluent gate. Thus, if the ORP were to exceed a set level, the main effluent gate closes and diverts effluent to the effluent diversion tank until an acceptable level is met. In addition, the effluent line has continuous monitoring for Total Suspended Solids (TSS) and pH. Similar to how chlorine is monitored, there are preset triggers for TSS and pH, which close the main effluent gate and send effluent to the effluent diversion tank until acceptable levels are met. Thus, this monitoring system helps ensure compliance with the effluent permit limits for Residual Chlorine, TSS and pH.

There is no effluent treatment processes specific to metals given the bulk of elevated concentrations are sourced from the marine receiving environment and the identified contributions from other likely sources do not warrant supplemental treatment.

As described in Section 9.0, domestic Sewage at the facility is managed through nine (9) septic holding tanks, which gravity discharge domestic sewage to the main effluent line. Five (5) of the nine (9) of the septic tanks have a hydraulic retention time greater than 2 days. Two (2) of the nine (9) septic tanks have a hydraulic retention time of less than 2 days (The Engineering/Purchasing septic tank, and the Maintenance Shop septic tank). One of the nine (9) septic tanks is presumed to have a greater than 2-day retention time (the Barge Dock Building Septic tank), and the last one (1) of the nine (9) septic tanks has an unknown retention time. The 2-day retention time is set by the BC MWR and is important for solids to settle out prior to discharge and helps promote pathogen reduction. All nine of these septic stations are pumped out three times a year as part of maintenance and to manage septic generation.

There are three (3) septic holding tanks on-site that do not discharge to the effluent and are pumped out on a biweekly basis.

## 7.3 Characterization of Residual Effects

The impact assessment evaluated the interaction of discharged effluent from the Chemtrade facility with the marine receiving environment (Burrard Inlet CH) and the potential risk of adverse effects (acute and/or chronic) on environmental receptors (see **Section 4.0**, Existing Conditions).

Overall, the impact assessment indicates that pollution as defined by the EMA is unlikely to occur as a result of effluent discharged from the existing Chemtrade outfall discharge. This conclusion is based on the evaluation of empirical receiving water and sediment quality specific to screened POCs as well as consideration of noted uncertainties (**Section 6.0**). The weight of evidence used to support the conclusion of no residual effects is summarized, below:

- Adverse effects are not expected on aquatic life or result in impairment of other receiving environment uses identified for the area including wildlife and public health. This conclusion is based on assessment of predicted POC thermal and chemical changes within and at the edge of the defined IDZ.
- No effect of the discharge is expected to result in adverse effects to wildlife or people consuming fish from Burrard Inlet because no change in effluent quality is anticipated and concentrations

of parameters associated with bioaccumulation/biomagnification within or at the edge of the IDZ are not predicted to increase.

- Whole effluent at the point of discharge is not expected to be acutely lethal to aquatic life and conditions within/at the edge of the IDZ would likewise not be expected to be acutely lethal, or result in chronic effects, to aquatic life. This is based on multiple acute/chronic toxicity tests completed over multiple years as part of compliance monitoring under Chemtrade's active provincial discharge permit.
- The observed variability in sediment quality (associated with POCs) in the vicinity of the Chemtrade facility is not associated with the effluent discharge. Rather, the noted variability is more likely associated with regional inputs facilitated by sediment transport mechanisms in Burrard Inlet and Central Harbour (**Section 3.2.3.1**).

Based on findings from the impact assessment, none of the screened POCs (thermal, chemical) are expected to result in either acute or chronic effects to environmental receptors or other users of Burrard Inlet. Thus, no residual effects are expected.

## 7.4 Confidence and Uncertainty

Like all scientific results and conclusions, effect predictions are subject to uncertainty. Uncertainty can stem from various factors such as assumptions and limitations inherent in the data, the extent of current knowledge of the system under study, the collective biology of a species/biota, natural variability, resilience to change, and the effectiveness of mitigation measures. The following points were noted as contributing to some level of uncertainty:

- ***Data availability.*** There is limited data available to assess the existing conditions in the receiving marine environment (i.e., Burrard Inlet) in close proximity to Chemtrade's effluent diffuser. The current conditions were assessed based on data collected over a five-month period in 2024, which included both shutdown and operational phases. Despite a relatively detailed spatial survey design (i.e., 14 locations across three zones, near-field, mid-field, and far-field and multiple depths) the dataset still represents only a one-year snapshot. While seasonal variations are captured, the data does not account for interannual variability, which can depend on a range of factors (e.g., precipitation, temperature, flow, tides, etc.).
- ***Initial Dilution Zone (IDZ).*** An IDZ is typically defined prior to a facility's commissioning and diffuser installation. However, the Chemtrade facility began operating in 1957 (i.e., long before the release of the BC Ministry of Environment and Climate Change Strategy's Technical Guidance 11 on Development and Use of Initial Dilution Zones in Effluent Discharge Authorizations, April 2019; BC ENV 2019b). Additional challenges may exist with using an appropriate model (i.e., Computaional Fluid Dynamics) to account for Chemtrade's current unconventional design (i.e., multiple discharge parts and varying discharge rates).
- ***IDZ Model Limitations.*** Although the dilution ratio method provides a reasonable estimate of chemical, physical, and biological constituent concentrations at the boundary where the temperature is 1 °C above ambient, it has limitations. Specifically, the data required to establish and calibrate a computational fluid dynamics (CFD) model is highly complex and resource intensive. Such modeling is typically performed during the initial design phase to predict dilution characteristics prior to the construction of a diffuser or facility. Establishing ambient water temperature is also challenging and it depends on data availability but also on how "ambient temperature" is defined. To establish the dilution ratio using thermal data, the model assumed

uniform mixing at the boundary. However, in reality, mixing is more complex and influenced by volumetric flow and dynamic mixing characteristics. For instance, interactions between two sources, such as heat exchange or loss to surrounding water, were not considered in the model.

- ***Defining Ambient or Natural Water Temperature.*** Ambient temperature in the IDZ model was determined using empirical measurements taken during the 2024 field sampling program. As a result, the available temperature data is limited. However, the *Burrard Inlet Water Quality Objectives* (BIWQOs) also acknowledge challenges in defining "natural" temperature conditions and recommend the use of current temperature measurements, as described in Bjorkland et al. (2023).
- **Ambient Chlorate Data:** chlorate data is only available for the intake (influent; INT_1), effluent (EFF) and discharge (DIS_1) stations. While the intake water quality data suggests elevated ambient concentrations of chlorate, supplemental sampling at near-, mid-, and far-field stations would confirm this assumption. Despite this data gap , the overall conclusions of the chlorate assessment are unlikely to change, given that the effluent has consistently passed both acute and chronic whole effluent toxicity tests.
- ***Limited Biota Data.*** There is limited data available related to biota around the facility. Although surveys were conducted (Hemmera 2020), identification was difficult due to low visibility and resolution of collected imagery. However, given the small/localized IDZ, additional biota surveys would not likely change effect predictions.
- ***Interactions between Water Quality Parameters.*** Interactions among measured water quality parameters and their additive, synergistic, or antagonistic effects are not expected to result in adverse effects exceeding those estimated using the BI WQOs and/or BC Water Quality Guidelines (WQGs).

# 8.0 PROPOSED FOLLOW-UP MONITORING

Based on historical performance and the recent 2024 sampling, a modified effluent monitoring program is proposed. Combined with existing permit 18 arrangements, the program would be comprised of scheduled sampling events. Ultimately the program will provide an ongoing basis to demonstrate plant discharge conformance with relevant regulatory conditions to protect the Burrard Inlet receiving environment. The recommended effluent monitoring framework is summarized in **Table 8-1** immediately below (changes indicated in red font).

**Table 8-1: Recommended Effluent Permit Conditions**

| Parameter | Permit Limit | Frequency |
|---|---|---|
| pH | Minimum: 6 pH units<br>Maximum: 9 pH units | Daily |
| Total Suspended Solids (TSS) | Average: 20 mg/L<br>Maximum: 130 mg/L | Daily |
| Temperature | 32°C | Daily |
| Chlorine Produced Oxidants (CPOs)* | Average: 0.2 mg/L<br>Maximum: 1 mg/L | Daily (Effluent) |
| Total Copper | 0.02 mg/L | Quarterly |
| Total Nickel | 0.02 mg/L | Quarterly |
| Total Zinc | 0.02 mg/L | Quarterly |

| Parameter | Permit Limit | Frequency |
|---|---|---|
| Toxicity, Threespine Stickleback** | 50% survival | Semi-Annual |
| **Notes:**<br>*Previously Residual Chlorine<br>**includes Top Smelt and Inland Silverside based on availability at time of testing (see **section 2.6**) | | |

It is also recommended that monitoring be discontinued at location E206291 (surface Burrard Inlet pH and Residual Chlorine) and the Asbestos Pond.

# 9.0 MANAGEMENT PLANS

## 9.1 Infiltration Pond Closure Plan

The infiltration pond closure plan (May 2025) outlines the proposed work plan to remove the two-cell infiltration pond that was a remnant of the historical process operations. The closure plan is summarized below - please see **Appendix C** for the complete version.

The ponds received wash water with entrained asbestos fibers which were generated periodically during maintenance activities in the cell house. Historically this material was removed from the ponds periodically and placed in the nearby asbestos landfill. Historical sampling of the berms around the ponds indicate small amounts of asbestos fibres, and the berms and material at the bottom of the pond are assumed to be contaminated with asbestos fibres. As a consequence of asbestos being insoluble in water, the fibres will have very limited migration and will be entrained in the shallow soils beneath the pond.

It is anticipated that decommissioning of the ponds would take place over a two to three month period once a closure date has been selected. This would entail draining the ponds, deconstructing the ponds, disposing of the contaminated materials and subgrade testing and confirming that remediation goals had been achieved.

None of the samples taken have contained asbestos at greater than 1% (by weight) of asbestos fibre, so the waste asbestos will likely not be classified as a hazardous substance. If materials at the bottom of the pond contain >1% asbestos they will be handled as hazardous waste.

With regards to other potential contaminants, Arsenic and Copper have been detected in the berm soils at levels above commercial/industrial use, but below hazardous waste criteria. This is consistent with other soil samples in this area and is not from the asbestos wash water. The metal concentrations in the ground water samples closest to the ponds as compared to CSR marine aquatic life standards are all within those standards.

One groundwater well is proposed to be installed in the centre of the former pond area to assess groundwater chemistry, as confirmation of post-remedial groundwater quality. The ponds are in the middle of an operational site with an active groundwater monitoring program in place. Removing the asbestos ponds will not add any new source of contamination, any materials assessed during the decommissioning of the ponds as exceeding CSR limits for industrial/commercial sites will be removed and disposed of offsite.

At the conclusion of the pond decommissioning the residual exposure risk to humans of the ecology will be assessed through a Protocol 13: Screening level assessment.

# 10.0 SEWAGE DISPOSAL

There are twelve (12) septic tank locations at Chemtrade that receive domestic sewage. Nine (9) are flow thru gravity systems and discharge to the effluent main line through primary treatment (i.e. gravity settling), while three are holding tanks and are pumped out by a vacuum truck on a routine basis. A map of all the domestic sewage locations on site can be found in **Appendix J**.

The Chlor-Alkali Plant discharges an average of approximately 40,000 – 65,000m3 of effluent every day based on daily discharge data from 2023 – 2024, and the contribution of domestic sewage is very small (less than 0.035%). See below for a detailed breakdown for a typical day shift. Where sites have a range of employees, calculations were used from the median value of that range (i.e. if the range was 4-5 persons, 4.5 was used in the calculation; **Table 10-1**).

**Table 10-1: Domestic Sewage Septic Tank Summary**

| Domestic Sewage Site | Approximate # of Employees that Utilize Site per day | **Low Daily Flow Estimate ($m^3$/day) | *Average Estimated Daily flow ($m^3$/day) | **High Flow High Estimate ($m^3$/day) | Discharges to Main Effluent (Yes/No) |
|---|---|---|---|---|---|
| 1 – Procor Trailer | 6 | 0.45 | 0.6 | 0.75 | No (holding tank) |
| 2 – Lunch Room | 10 | 0.75 | 1 | 1.25 | No (holding tank) |
| 3 – Project Trailers | 4-5 | 0.3375 | 0.45 | 0.5625 | No (holding tank) |
| 4 – Divisional Building | 20-30 | 1.875 | 2.5 | 3.125 | Yes |
| 5 – Grassed Courtyard | 8 | 0.6 | 0.8 | 1 | Yes |
| 6 – Engineering / Purchasing | 20 | 1.5 | 2 | 2.5 | Yes |
| 7 – Soap Box | Seldom (0-1) | 0.0375 | 0.05 | 0.0625 | Yes |
| 8 – Maintenance Shop | 10 | 0.75 | 1 | 1.25 | Yes |
| 9 – Inplant Office | 6 | 0.45 | 0.6 | 0.75 | Yes |
| 10 – Caustic Building | Seldom (0-1) | 0.0375 | 0.05 | 0.0625 | Yes |
| 11 – Steam Plant | 1 | 0.075 | 0.1 | 0.125 | Yes |
| 12 – Barge Dock Building | Seldom (0-1) | 0.0375 | 0.05 | 0.0625 | Yes |
| Total Domestic Sewage Contribution to Effluent Discharge (related to above Sites 4 through 12) | 65-78 | 5.4 $m^3$/day | 7.2 $m^3$/day | 8.9 $m^3$/day | - |

**Notes:**
***0.1 $m^3$/day/person, as per Discharge Flow Rate Estimation Methods in the Waste Discharge Permit Application for the Metro Vancouver Sewer Use Bylaw No. 299, 2007
**0.075-0.125$m^3$/day/person, as per Sewerage Standard Practice Manual Version 3, 2014

Note that does not include the nightshift. It is estimated that between 10 to 12 staff work on the Chemtrade site during the nightshift. A detailed breakdown of the locations of the domestic sewage sites that the nightshift staff use could not be determined. Therefore, assuming if all staff utilized a domestic sewage site that discharged to the main effluent, it would typically contribute between 1-1.2 m3/day.

Typical estimated daily flow of the domestic sewage component in the main effluent system is 8.2 m3/day (as per **Table 10-2**). The nightshift was calculated with an average of 11 people on site.

**Table 10-2: Domestic Sewage Flowrates Over a 7-day Week**

| Shift Type | Daily Flow Low Estimate of Domestic Sewage Effluent Contribution ($m^3$/day) | Typical Estimated Daily flow of Domestic Sewage Effluent Contribution ($m^3$/day) | Daily Flow High Estimate of Domestic Sewage Effluent Contribution ($m^3$/day) |
|---|---|---|---|
| Weekday: Dayshift (5 of 7 days a week) | 5.4 | 7.2 | 8.9 |
| Weekday: Nightshift (5 of 7 days a week) | 0.8 | 1.1 | 1.4 |
| Weekday: Total (5 of 7 days of a week) | 6.2 | 8.3 | 10.3 |
| Weekend: Dayshift (2 of 7 days a week) | 0.8 | 1.1 | 1.4 |
| Weekend: Nightshift (2 of 7 days a week) | 0.8 | 1.1 | 1.4 |
| Weekend: Total (2 of 7 days a week) | 1.6 | 2.2 | 2.8 |
| Daily Average Over a Typical 7-day Week | 4.9 | 6.6 | 8.2 |

On weekends, it is estimated between 10-12 people work at the Chemtrade facility on the day and night shifts. Therefore, assuming all staff utilize a domestic sewage location that discharges to the main effluent, the typical estimated daily flow would be between 2-2.4 m3/day on weekends assuming 11 staff per shift with 0.1 m3/day/person.

According to BC ENV and Section 7 of the IRT, sewage discharge (i.e. domestic sewage) may only be included in the effluent permits if the sewage discharge is combined with subject effluent and is <10 % of that combined flow as per Section 5(1) (b) of the Municipal Waste Regulation (MWR). Based on the assessment of the daily maximum flow provided above less than 0.035% of the overall permitted effluent flow rate is attributable to domestic sewage and thus an MWR registration is not required and domestic sewage is acceptable to continue to be part of the BC ENV effluent permit.

BC ENV has also indicated under Section 7 of the IRT that if less than 10 m3/day of sewage is discharged, septic tanks may be considered acceptable and are expected to meet the requirements in Section 39 of MWR. Thus, based on the daily high flow rate estimate of 8.2 m3/day in **Table 10-2**, this is less than 10 m3/day and thus septic tanks are accepted and Chemtrade is expected to meet the following requirements of Section 39 of the MWR:

- *39 (1)* In designing a wastewater facility using a septic tank, a qualified professional must ensure that all of the following requirements are met:
- (a)the tank has a hydraulic capacity of at least 2 days' minimum detention time at the design maximum daily flow;
- (b)the tank is fitted with an effluent filter, a screen or an equivalent measure to protect pumps and prevent discharge of solids and floatables;
- (c)the tank is accessible for pump out.(2)A director may waive the requirement set out in subsection (1) (b) in respect of small, remote, seasonal discharges to water.

**Table 10-3** below provides an estimate of the hydraulic retention time for septic tanks 3 to 12 which discharge to the main line effluent line except for septic tanks 9 and 12 as drawings were not available to confirm their volume capacity. The results indicate that there are two septic tanks with an estimated

hydraulic retention time of less than 2 days. It is our understanding that the septic system original installation dates back to 1957 and many domestic septic systems have been allowed to operation under older rules until upgrades are required to the septic systems. Chemtrade could conduct additional analysis to confirm the peak flows of septic tanks 6 and 8, and if determined necessary discuss timelines and options to improve the hydraulic retention time to 2 days which may include increasing the capacity of the septic tanks or restricting the flow through strategies like using water-efficient fixtures.

With regard to septic tanks 1 to 3, these are holding tanks and thus the requirement for a retention time of two (2) days does not apply.

**Table 10-3: Domestic Sewage Septic Tank Estimated Hydraulic Retention Time**

| Domestic Sewage Site | Approx # of Employees that Utilize Site per day | * Daily High Flow Estimate ($m^3$/day) | Estimated Size of Tank ($m^3$) | Estimated Hydraulic Retention Time (days) | Discharges to Main Effluent (Yes/No) |
|---|---|---|---|---|---|
| 1 – Procor Trailer | 6 | 0.75 | Not Available | Not Applicable | No (holding tank) |
| 2 – Lunch Room | 10 | 1.25 | Not Available | Not Applicable | No (holding tank) |
| 3 – Project Trailers | 4-5 | 0.625 | Not Available | Not Applicable | No (holding tank) |
| 4 – Divisional Building | 20-30 | 3.75 | 9.91 | 2.642 | Yes |
| 5 – Grassed Courtyard | 8 | 1 | 3.03 | 3.03 | Yes |
| 6 – Engineering / Purchasing | 20 | 2.5 | 1.89 | 0.756 | Yes |
| 7 – Soap Box | Seldom (0-1) | 0.125 | 2.21 | 17.68 | Yes |
| 8 – Maintenance Shop | 10 | 1.25 | 1.76 | 1.408 | Yes |
| 9 – Inplant Office | 6 | 0.75 | Not Available | Not Available | Yes |
| 10 – Caustic Building | Seldom (0-1) | 0.125 | 4.23 | 33.84 | Yes |
| 11 – Steam Plant | 1 | 0.125 | 4.23 | 33.84 | Yes |
| 12 – Barge Dock Building | Seldom (0-1) | 0.125 | 2.14** | 17.12** | Yes |

**Notes:**
*Daily High Flow Estimate is based multiplying the upper number of employees x 0.125$m^3$/day/person (which is the high flow estimate as per Sewerage Standard Practice Manual Version 3, 2014)
**No septic tank height available, assuming 1m tank height.
Septic tank hydraulic retention time is less than 2 days

Based on Envirochem's site tour of the facility in September of 2024, available information and discussions with staff, the septic tanks are accessible for pump-out and are on a once every two weeks pump out schedule for septic holding tanks 1 to 3 and a once a quarter pump out schedule for septic tanks 4 to 12. Available drawings dating back to 1957 indicate that effluent filter (i.e., septic system filter, outlet filter, effluent screen) were not installed at the outlet of the septic tanks 4 to 12. This is likely due to the fact that this was not a requirement when the septic tanks were installed. Again, many domestic septic systems have been allowed to operation under older rules until upgrades are required to the septic systems.

The purpose of the effluent filter is to reduce the potential for carry over of solids from the septic tank and help reduce clogging of the downstream effluent line. In Chemtrade's case this is achieved through the quarterly pump-out schedule which minimizes the accumulations of solids which can cause carry over.

Regardless, Chemtrade should discuss whether this requirement to install effluent filters can be deferred.

### Available Records:

Sample pump out records for the septic tanks are provided in **Appendix J**. A copy of available design drawings for the sewage treatment facility which date back to 1957 are also provided in **Appendix J**.

Lastly, although Fecal coliforms, E. coli and Enterococcus are PPOCs attributable to both the Burrard Inlet and Chemtrade's domestic sewage, the contribution of domestic sewage to the effluent flow is minimal (<0.035%). In the BC ENV letter dated August 2, 2024, BC ENV approved the removal of these bacteria parameters from the methods package sampling program and POC assessment process. The results being that these parameters are not POCs attributable to Chemtrade and thus no changes to the monitoring plan are being recommended at this time.

### Good Industry Practice:

Where feasible good industry practice for industrial operations located within a city involve directing domestic sewage to the municipal sewer system. In the case of Chemtrade, the distance of the municipal sewer system from the site, and the numerous onsite septic systems presences some design, operational and financial challenges to redirect domestic sewage to the District of North Vancouver sewer line.

## 11.0 CLOSURE

We trust this report meets your requirements at this time. If you have any questions or comments regarding this report, please contact the undersigned.

Yours truly,

**Envirochem Services Inc.**

***Written By:***



Ben Grant, B.Sc., P. Chem., BC-CESCL
Environmental Scientist



Harrison Tadey, B.Sc.
Aquatic Biologist



Jason Casselman, M.Sc., R.P.Bio
Senior Fisheries Biologist

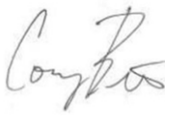


Patricija Marjan, PhD
Senior Aquatic Biologist

***Reviewed By:***



Tony Di Nino, M.Eng., P.Eng., EP(CEA & EMSLA), COR
Senior Manager and Partner



Cory Bettles, M.Sc., R.P.Bio, FP-C
Biology Group Lead, Senior Biologist

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# Chemtrade Electrochem Facility

## Screening Level Flood Assessment

**Prepared by:**

**Northwest Hydraulic Consultants Ltd.**
30 Gostick Place
North Vancouver, BC V7M 3G3
Tel: 604.980.6011
www.nhcwater.com

**Prepared for:**

**Chemtrade Electrochem Inc.**
100 Amherst Ave
North Vancouver, BC V7H 1T9

August 7, 2025
Final Report, Rev. 0

NHC Reference No. 3009713

## DOCUMENT TRACKING

| Date | Revision No. | Reviewer | Issued For |
|---|---|---|---|
| 2025-07-31 | Draft R0 | E. Wang | Client review |
| 2025-08-05 | Draft R1 | E. Wang | Client review |
| 2025-08-06 | Draft R2 | E. Wang | Client review |
| 2025-08-07 | Final R0 | E. Wang | Final |

**Report prepared by:**

Sophia Eugeni, MASc, EIT
Hydrotechnical engineer

Connor Hayden, EIT
Coastal engineer
Coastal analysis

**Report reviewed by:**

Jason Kindrachuk, MEng, PEng
Hydrotechnical engineer

Edwin Wang, MEng, PEng
Principal

NHC File Path: \\mainfile-van\Projects\Active\3009713 Electrochem FHA\97_Reporting\20250807 3009713 Chemtrade Screening Level Flood Assessment Final R0.docx

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# APPENDICES

Appendix A Site Photographs

# 1 INTRODUCTION

Chemtrade Electrochem Inc. (Chemtrade) is proposing facility modifications to improve safety of chlorine manufacturing, storage, and loading systems as part of its Vision 2030 project (Chemtrade, 2025). The site is in the jurisdiction of both the District of North Vancouver (DNV) and Vancouver Fraser Port Authority (VFPA; Figure 1.1). The property description is:

*LOT 5 EXCEPT: PART SUBDIVIDED BY PLAN LMP40923; DISTRICT LOTS 193 AND 611 GROUP 1 NEW WESTMINSTER DISTRICT PLAN 17801. VPC V-1381(4) PCL "A" LAND 550,284 SQ.FT. PCL "B" WATER 217,766 SQ.FT. V-1381(5) WATER 21,399 SQ.FT. E.P. LMP400035.*

The property is within the DNV's Creek Hazard Development Permit Area (DPA) due to potential flooding from the Seymour River. As required by DNV under SPE 106 and 107, a Flood Hazard Assessment (FHA) is needed to evaluate coastal and river flood hazard in relation to the proposed facility modifications. Flood hazards at the site include:

- Overbank flooding from the Seymour River, approximately 450 m to the west.
- Coastal flooding from Burrard Inlet to the south.
- Potential tsunami inundation originating from distant seismic events.

These risks may be influenced by geomorphic processes such as bank erosion, sediment and debris movement.

Chemtrade is in the process of preparing a rezoning application for submission to DNV. The proposed plant modifications include a chlorine condensing tower, liquid chlorine railcar loading building, emergency ventilation system, and hypo storage and destruction system. Planned changes are located near the centre of the project site.

This FHA serves as a preliminary, screening-level assessment of riverine and coastal flood levels to support planning of the plant modifications and submission of the rezoning application. Further assessment will be needed as the project advances.

This assessment follows the guidance in EGBC's *Legislated Flood Assessments in a Changing Climate in BC* (EGBC, 2018) and the *Flood Hazard Area Land Use Management Guidelines* (MLNFRORD, 2018), and aligns with the framework for a Class 2 FHA, applicable where moderate loss potential exists in flood-prone areas.




**Figure 1.1 Project site location.**
**Black dashed line shows approximate divide between DNV and VFPA jurisdiction (Google Satellite, 2024).**

# 2 BACKGROUND

The following sections provide background information for the study, including the assumptions and limitations of the analysis.

## 2.1 Flood Construction Level

Flood Construction Level (FCL) refers to the minimum elevation that the underside of a floor system or any flood-sensitive building components should be constructed to mitigate flood damage, as defined in the *Flood Hazard Area Land Use Management Guidelines* (MLNFRORD, 2018).

Preliminary FCL values are provided in this report based on modelled flood levels for select riverine and coastal flood hazard scenarios, with a freeboard allowance applied per provincial guidance. These values are intended to support flood-resilient site planning and should be refined as the project advances.

## 2.2 Reference Information

Relevant background and reference information for this FHA is summarized below:

- Creek Hydrology, Floodplain Mapping and Bridge Hydraulic Assessment (KWL, 2014)
- North Shore Sea Level Rise Risk Assessment and Adaptive Management Strategy (Final Report) (KWL, 2021)
- Flood Assessment Study North Vancouver (NHC, 2010)
- Tsunami Hazard to North and West Vancouver, British Columbia (Clague and Orwin, 2005)
- District of North Vancouver Official Community Plan, including Creek Hazard Development Permit Areas (DNV, 2021)
- EGBC Legislated Flood Assessments in a Changing Climate in BC, Version 2.1 (EGBC, 2018)
- Flood Hazard Area Land Use Management Guidelines (MLNFRORD, 2018)
- Professional Practice Guidelines – Flood Mapping in BC (APEGBC, 2017)

## 2.3 Site Visit

NHC (Sophia Eugeni, EIT, Connor Hayden, EIT, and Jason Kindrachuk, PEng) conducted a site visit on April 9, 2025, led by Chemtrade (Drew Somerville, PEng). NHC reviewed the general site layout and shoreline features. No survey or data collection was conducted, and existing infrastructure was not assessed. NHC also visited the Seymour River at the Dollarton Highway and Mt. Seymour Parkway bridge crossings because of their potential to affect flooding at the site if blocked by debris or sediment during floods. Observations from the site visit are provided in Section 3.1 and Appendix A.

## 2.4 Assumptions and Limitations

NHC's understanding of the proposed modifications is based on the overview document provided to NHC by Chemtrade (Chemtrade, 2025), and on-site discussions (April 9, 2025) with Drew Somerville (Chemtrade).

This study is subject to the general limitations outlined below. These should be carefully reviewed prior to the use of the information provided in this report:

- The hydrologic analysis and hydraulic models informing this study are based on data sets which have inherent uncertainty and are limited by the accuracy of the available input data, model resolution, model capabilities, and assumptions.

- Details of the proposed facility modifications have not been developed. The assessment represents generalized flood levels on the site, which are intended to be used for planning purposes.
- Reasonable efforts have been made by NHC to QA/QC the data and model outputs; however, there may be some discrepancies in the data and software that have not been identified.
- The analysis presented in this report is limited by the level of detail included in the Digital Elevation Model (DEM). The hydraulic model is based on bare-earth LiDAR data and generalized topography by the Underhill Geomatics site survey (Underhill Geomatics Ltd., 2025). Local effects on flood conveyance due to interactions with site features (such as rail cars, existing buildings and process equipment) were not included in the analysis.
- No bathymetric data was available for the Seymour River. While LiDAR is typically collected at low flows, the lack of bathymetric data resulted in the model terrain conservatively estimating the channel to be higher than expected. This conservatively reduces the simulated conveyance capacity of the Seymour River.
- Channel and overbank geometry used in the models are assumed to be fixed and are based on a snapshot in time corresponding to when the data was collected.
- No calibration/validation data was available for the hydraulic model.
- Residual risk (i.e., greater than that shown in this report) exists. A more extreme event, or sequence of events (e.g., larger recurrence interval; debris or sediment blockages; channel avulsion) could result in higher flood levels and greater flood inundation than that mapped.
- The exposure of existing infrastructure (e.g., buildings, process equipment) to the assessed flood levels was not reviewed as part of this assessment.
- Other potential hazards, such as groundwater influence, geotechnical issues, local flooding due to stormwater, dam breach, and wildfire risk were not included in this assessment.

## 2.5 Vertical Datum

Unless otherwise stated, all elevations in this project are reported in the Canadian Geodetic Vertical Datum of 1928 (CGVD28) datum.

LiDAR data from GeoBC was transformed from CGVD2013 to CGVD28 using a Vertical Datum Transformations difference grid (Government of Canada, 2022).

In both the hydraulic and the coastal model DEMs, the following formula was used to convert elevations from Chart Datum (CD) to CGVD28, using CHS benchmark M08C9006 (Government of Canada, 2025):

$$Elev_{CGVD28} = Elev_{CD} - 3.0\ m$$

## 2.6 Digital Elevation Model

The DEM used for hydraulic modelling was based on 1 m LiDAR data (Government of British Columbia, 2016), supplemented 10 m bathymetry data in the Burrard Inlet (CHS, 2024), and site survey data (Underhill Geomatics Ltd., 2025). The DEM represents a bare-earth surface, with buildings and other above-ground features removed during processing.

The DEM does not have bathymetric data for Seymour River, and the LiDAR data was nearly 10 years old at the time of model development. As a result, the channel capacity may be slightly underestimated, but is considered suitable for this study.

# 3 SITE DESCRIPTION

The Chemtrade plant is located on the north shore of the Burrard Inlet, approximately 450 m east of the Seymour River (Figure 1.1). The site is exposed to river flood hazards from the Seymour River, and coastal flood hazards from the Burrard Inlet. The following sections describe the project site, the Seymour River and Burrard Inlet within the context of this flood assessment.

## 3.1 Project Site

The project site (Figure 3.1) is a low-gradient industrial site, generally sloping from north (El. 3.8 m) to south (El. 3.4 m), and includes a mix of paved surfaces, rail spurs, buildings, and gravel parking areas.

Notable features based on NHC's site visit are summarized below.

- **Localized ponding:** Ponding at low points in some areas due to blocked storm drains (Photo 3.1).
- **Below-grade pond feature**: At the northwest corner of the site, there is a below-grade pond feature (outlined in blue in Figure 3.1).
- **Railyard and tank cars**: Along the western face of the property (Photo 3.2) and running east to west along the center.

- **Salt storage area**: The southeast corner of the site serves as a location for salt storage (Photo 3.3), surrounded by concrete blocks that would influence flow paths and wave interactions.
- **Retaining wall:** The western neighbouring property has a large retaining wall feature (outlined in green in Figure 3.1) along the southwest face of the project site. This feature serves as a barrier, preventing conveyance through the site boundary at this location.
- **Equipment at grade:** Pipes and electrical equipment in many areas are located at or just above the ground elevations (Photo 3.5). Various curbs and barriers were present, which would influence flow paths.
- **Shoreline condition:** The site shoreline is protected with riprap and concrete armour units (Photo 3.6). The riprap on the east side of the site is steeper and included launched armour stones. A pile-supported dock is located along the south and part of the west side of the site.

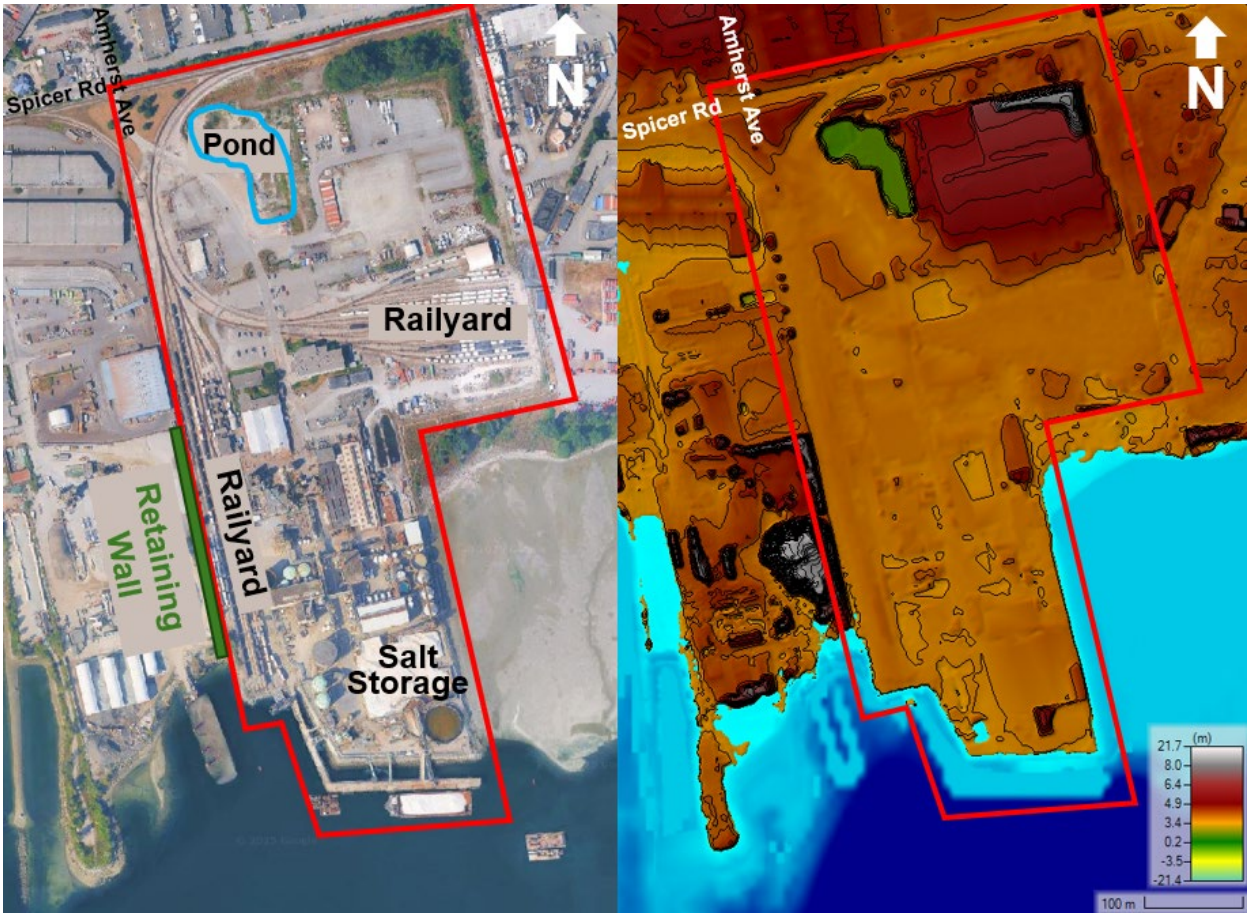



**Figure 3.1 Site overview, with notable features labelled.**
**(Left: Google Satellite, Right: Bare-Earth DEM, with 0.5 m contours)**




**Photo 3.1 Example of localized ponding.**



**Photo 3.2 Railyard and tank cars.**



**Photo 3.3 Salt Storage Location.**



**Photo 3.4 Retaining wall along the west face of site, within the neighbouring property.**




**Photo 3.5 Examples of existing equipment on site.**

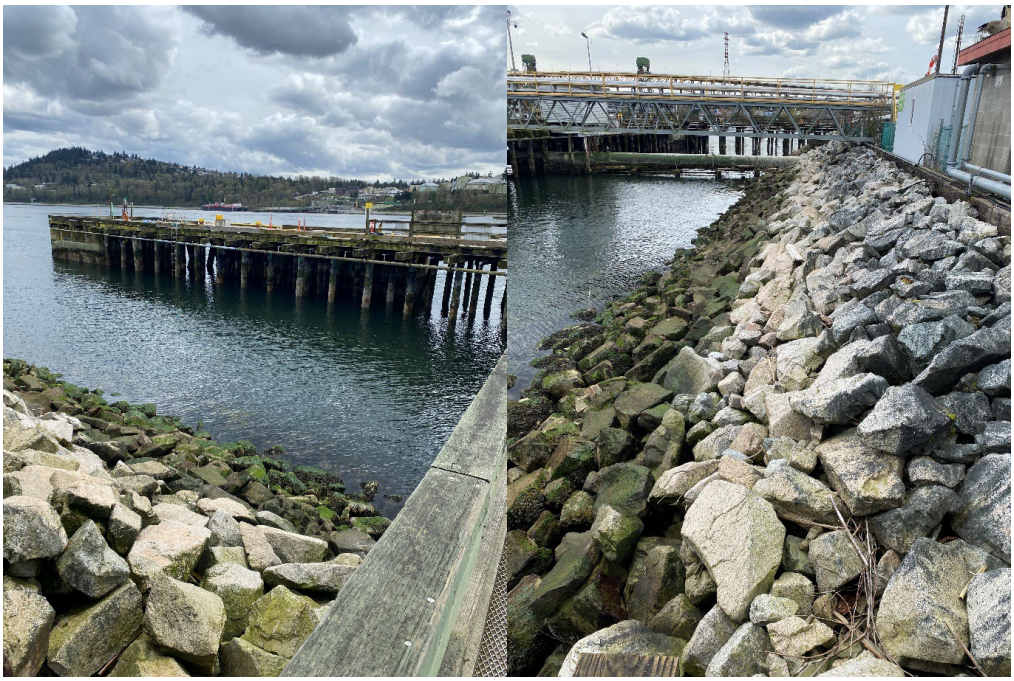


**Photo 3.6 Site shoreline and dock.**

## 3.2 Seymour River

The Seymour River (Figure 3.2) has a watershed area of 185 km$^2$, which drains the southern slopes of the Pacific Ranges from an elevation of 1727 m at Cathedral Mountain to sea level at Burrard Inlet. The river is regulated by Seymour Falls Dam at the south end of Seymour Lake, approximately 16 km upstream from the river mouth at Burrard Inlet.

Downstream from Seymour Lake, Seymour River flows within a relatively confined bedrock canyon surrounded by undeveloped forest, until it reaches the lower gradient channel near its outlet. Development along the shores of the river is on this reach, beginning roughly 3.5 to 3.8 km upstream from the river mouth. The channel is less confined within this reach, however, the bed remains coarse, with boulders, cobble, gravel, and sand, lacking signs of substantial deposition or aggradation. Several bridges cross the channel along this lower reach; these bridges may provide locations prone to obstruction or blockage during a flood.

On December 7, 2014, a rockslide occurred within the canyon, temporarily blocking the river less than 1 km upstream of urban development. Although not directly affecting the project site, this event does reinforce the expectation that debris can be sourced downstream of Seymour Falls Dam and may play a role in flooding of the lower Seymour River by blocking sections of the river.

## 3.3 Burrard Inlet

The project site is located on the north shore of Burrard Inlet, approximately 750 metres east of the Second Narrows. This portion of the inlet is relatively sheltered, with wave and surge exposure limited by the narrowing at the First and Second Narrows. Under current conditions, the site is not expected to be inundated by high tide. However, the nearshore portion of the site may experience some wave run-up during elevated water levels. Future sea level rise may increase the potential for flooding due to combined effects of tides and wave activity, as discussed in Section 5.3.

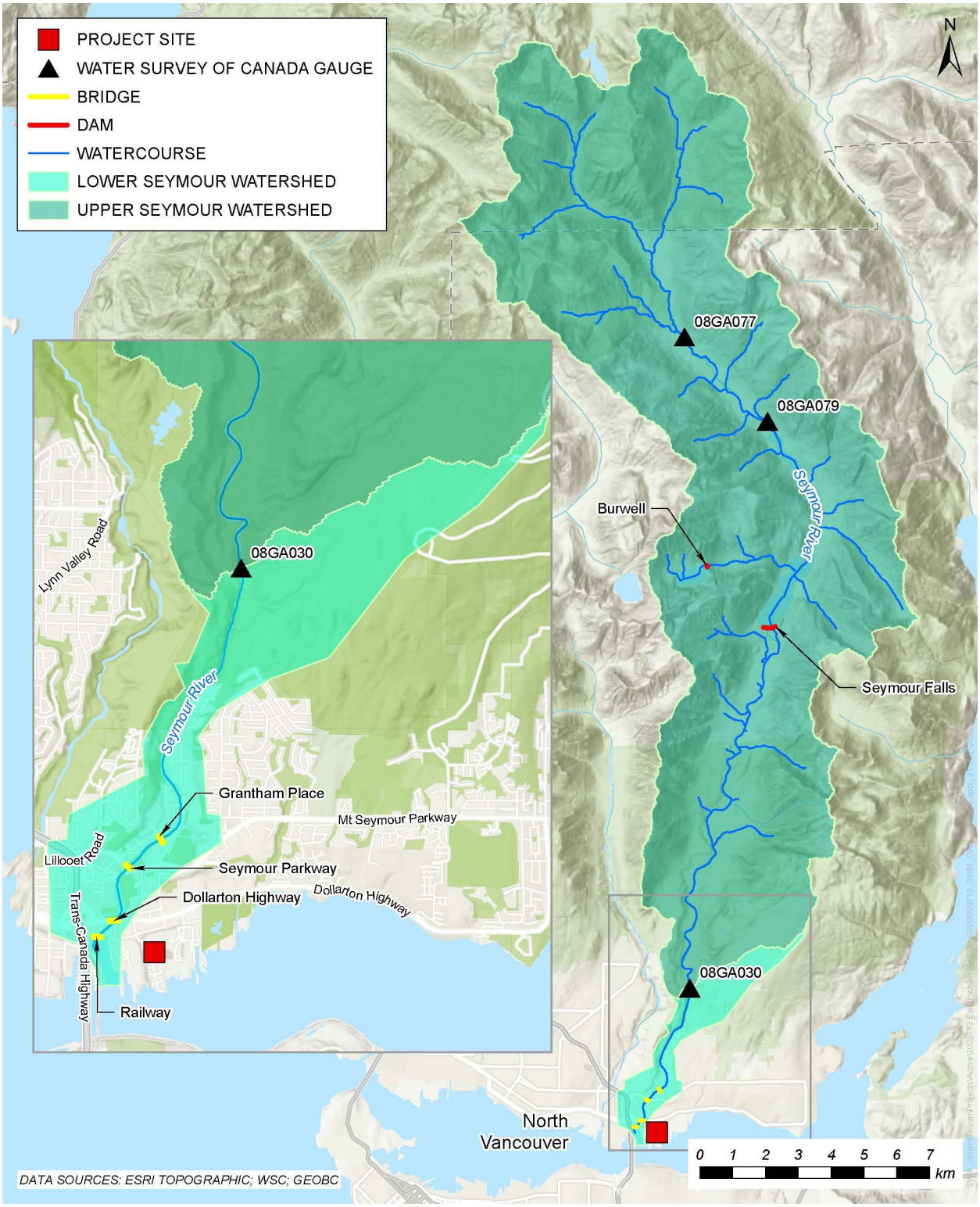



**Figure 3.2 Seymour River watershed.**

# 4 SEYMOUR RIVER FLOOD HAZARD ASSESSMENT

The project site is subject to flood hazards due to overbank flooding from the Seymour River. Sediment and debris transport and deposition within the river system can block the main channel, reducing the channel capacity and increasing the extent of flooding on the floodplain. To evaluate the exposure of the site to river flood conditions, NHC developed a hydraulic model of the Seymour River. The hydrologic and hydraulic analysis is detailed in the following sections.

## 4.1 Seymour River Hydrology and Climate Change Analysis

The Seymour River watershed has a total drainage area of 185 $km^2$ to the mouth of the river (KWL, 2014). Within the watershed is the Water Survey of Canada (WSC) gauge *Seymour River near North Vancouver* (WSC ID: 08GA030), which has a contributing area of 179 $km^2$ and a period of record from 1928 – present (94 years). Flow is partially regulated by the Seymour Falls Dam; however, the dam is not expected to provide significant attenuation during floods.

NHC conducted a single-station flood frequency analysis using data from the Seymour River WSC gauge. The results were then scaled by area to represent flows at the mouth of the river.

To account for the effect of climate change on peak flows, NHC applied an adjustment factor to the historical flow estimates. The adjustment factors are based on previous hydrologic modelling work by NHC for Metro Vancouver, representing end-of-century climate projections.

Discharge estimates at the mouth of the Seymour River are summarized in Table 4.1. The design discharge adopted for this assessment is 994 $m^3/s$, which represents the peak instantaneous discharge for the 0.5% Annual Exceedance Probability (AEP[1]) event, including a 37% allowance for climate change.

[1] The Annual Exceedance Probability (AEP) represents the probability that a specified event magnitude will be met or exceeded in any given year, and is the inverse of the return period (e.g., 0.5% AEP = 200-year return period). For this study, the term *return period* is not used because it is often misinterpreted to mean that the event only occurs once in the specified period; however, the event can occur in any given year.

**Table 4.1 Discharge summary by AEP for Seymour River**

| Annual Exceedance Probability (AEP) | Seymour River near North Vancouver (WSC Station 08GA030) | Seymour River at the mouth[a] | Climate Adjustment Factor | Seymour River Discharge at the mouth, including climate change |
|---|---|---|---|---|
| | Peak Instantaneous Discharge ($m^3/s$) | Peak Instantaneous Discharge ($m^3/s$) | End-of-Century Projections | Peak Instantaneous Discharge ($m^3/s$) |
| 20% | 369 | 388 | 1.43 | 554 |
| 10% | 431 | 453 | 1.43 | 647 |
| 2% | 570 | 599 | 1.40 | 838 |
| 1% | 630 | 662 | 1.39 | 920 |
| **0.5%** | 691 | 726 | 1.37 | **994** |

**Notes:**

a. The discharge area was scaled from WSC Station 08GA030, including the entire watershed area upstream of the mouth of the Seymour River.

## 4.2 Hydraulic Model Development

NHC developed a two-dimensional (2D) hydraulic model of the Seymour River using HEC-RAS software (v.6.6). HEC-RAS is a numerical modelling software developed by the US Army Corps of Engineers that is commonly applied for river and floodplain studies.

The model domain is shown in Figure 4.1. Steady-state inflows were applied at the upstream boundary. A constant water level representing higher high water large tide (HHWLT) plus an allowance for sea level rise was applied at the downstream boundary. Lateral boundaries were added on the east and west edges of the model to allow flow to leave the model domain, where appropriate.

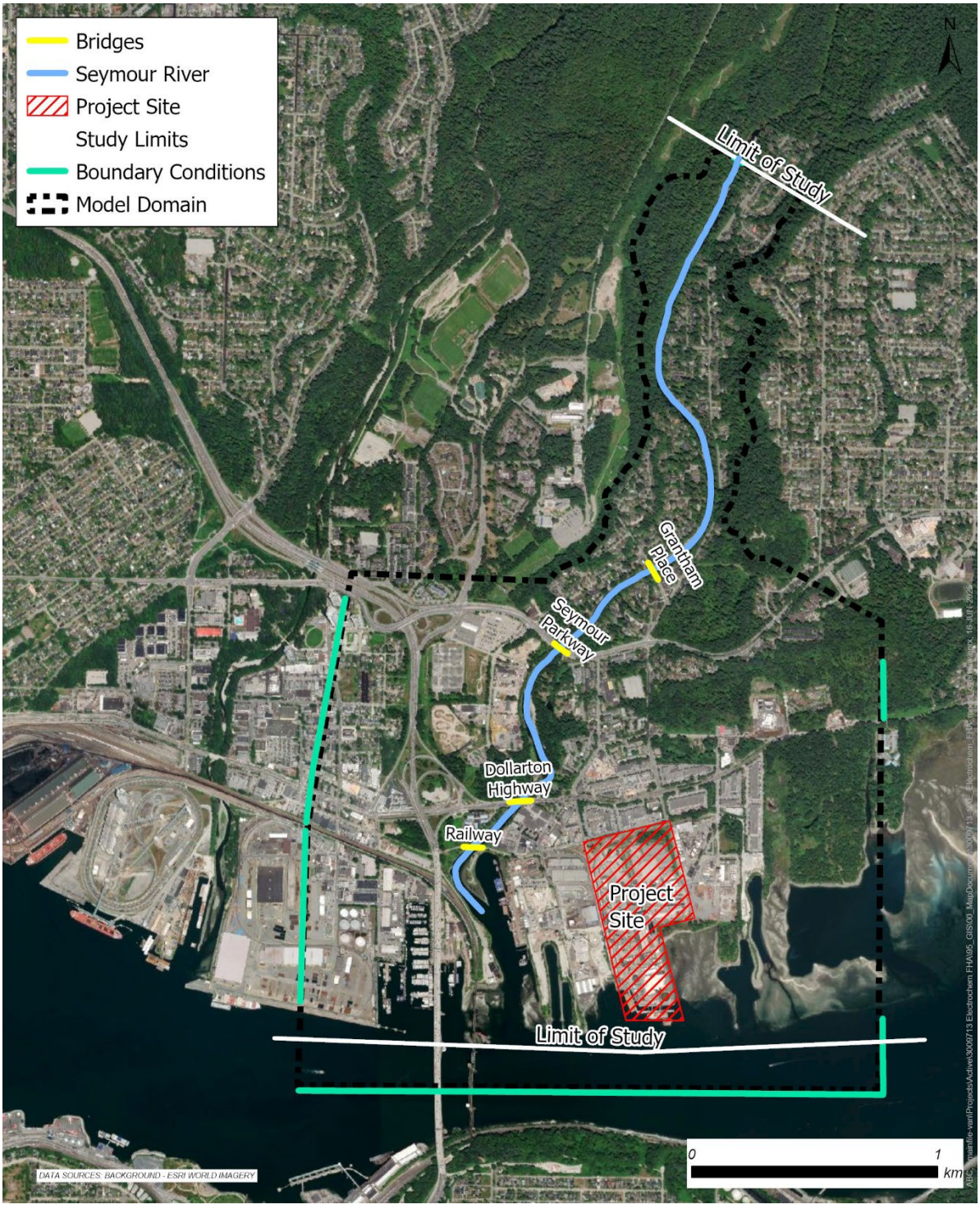



**Figure 4.1 Seymour River 2D hydraulic model layout.**

Debris and sediment accumulation at the Seymour River bridges upstream of the project site have the potential to influence the flood hazard at the site by causing water to spill over the floodplain. To assess the flood extents and depths under various bridge blockage scenarios, NHC developed three model configurations:

1. No bridge blockage.
2. Dollarton Highway Bridge blocked.
3. Mt Seymour Parkway Bridge blocked.

For Scenarios 2 and 3, the DEM was modified to fully block the bridge openings, which represents a conservative condition.

## 4.3 Hydraulic Model Results

The results from Scenarios 1 to 3 are shown in Figure 4.2 through Figure 4.4 respectively.

In Scenario 1 (no bridge blockages) and Scenario 3 (Mt Seymour Parkway bridge blocked), the Seymour River overtops Mt Seymour Parkway east of the river. Overland flow then moves east over Riverside Drive, continues south across Dollarton Highway, and enters the site from its northern and eastern boundaries. Flooding in Scenario 2 (Dollarton Highway bridge blocked) follows similar overland flow patterns to Scenarios 1 and 3, but also receives additional flow into the site from its northwestern boundary due to overtopping of the Dollarton Highway.

Depths across the site under the governing scenario (Scenario 2, Dollarton Highway bridge blocked) are shown in Figure 4.5. Comparisons of the water surface profiles along Amherst Avenue for each scenario are shown in Figure 4.6.

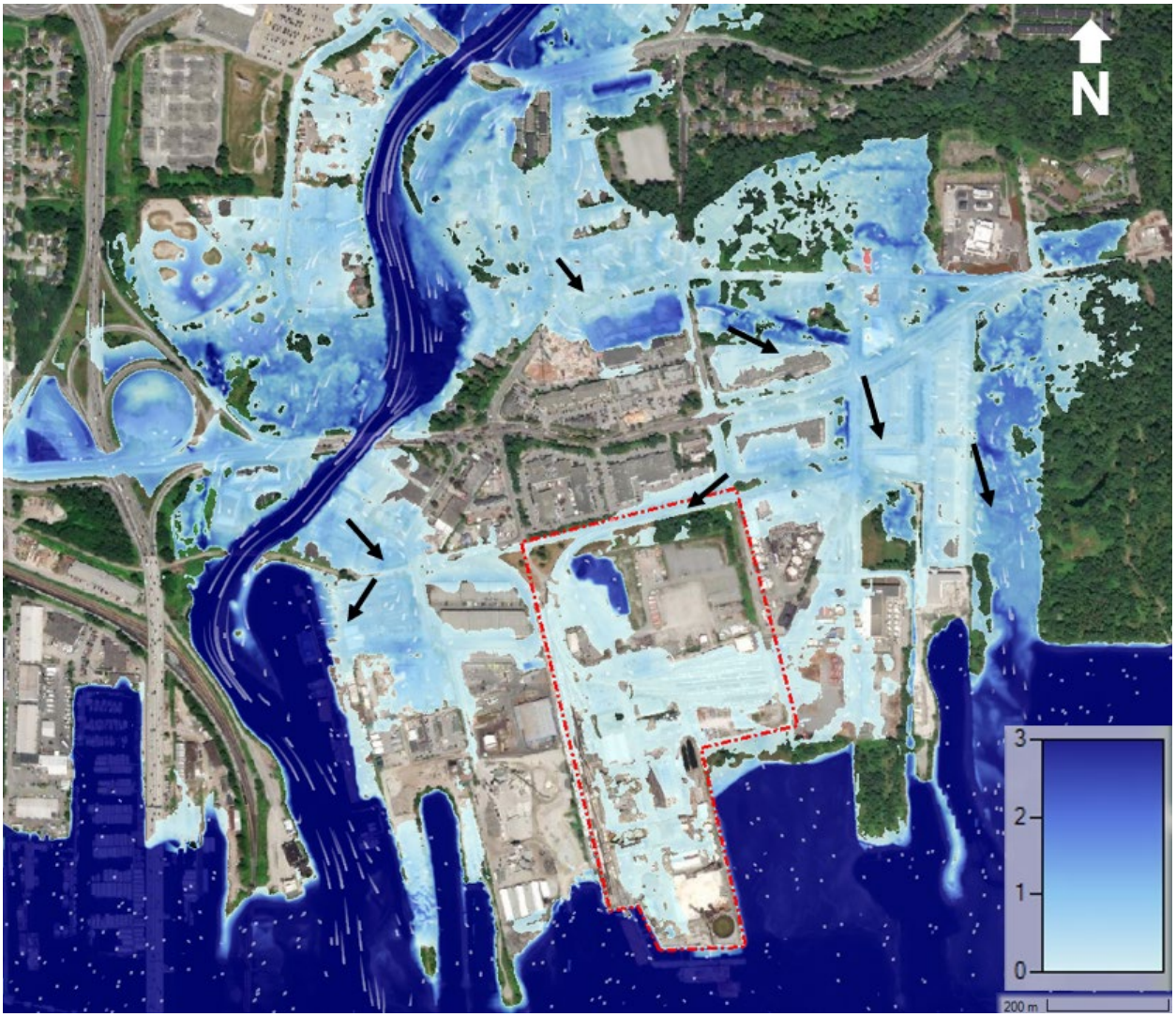



**Figure 4.2 Simulated flood depths across the site for Scenario 1.**
**Scenario 1: No bridge blockage; 0.5% AEP event including climate change.**

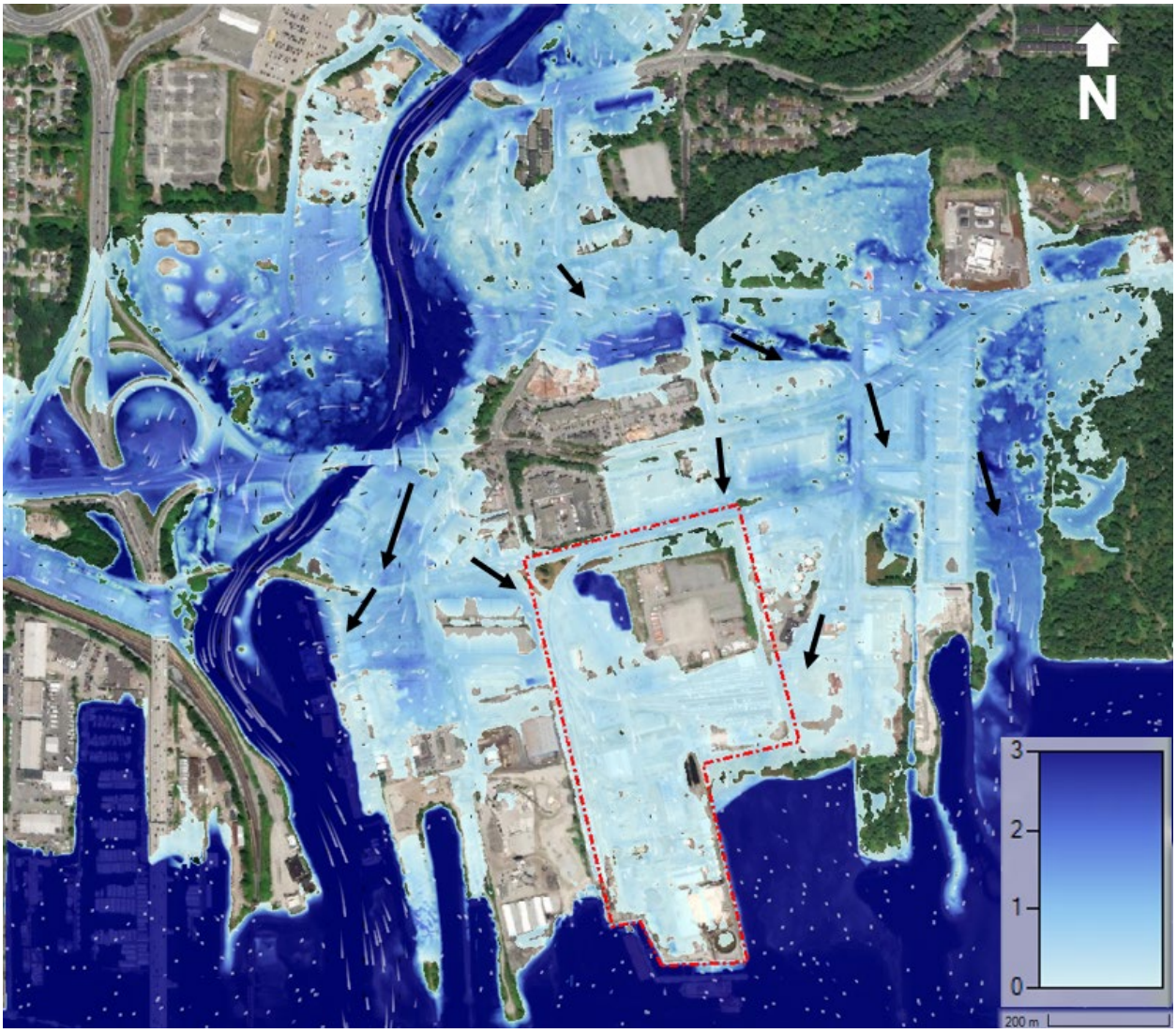



**Figure 4.3 Simulated flood depths across the site for Scenario 2.**
**Scenario 2: Dollarton Bridge blockage; 0.5% AEP event including climate change.**

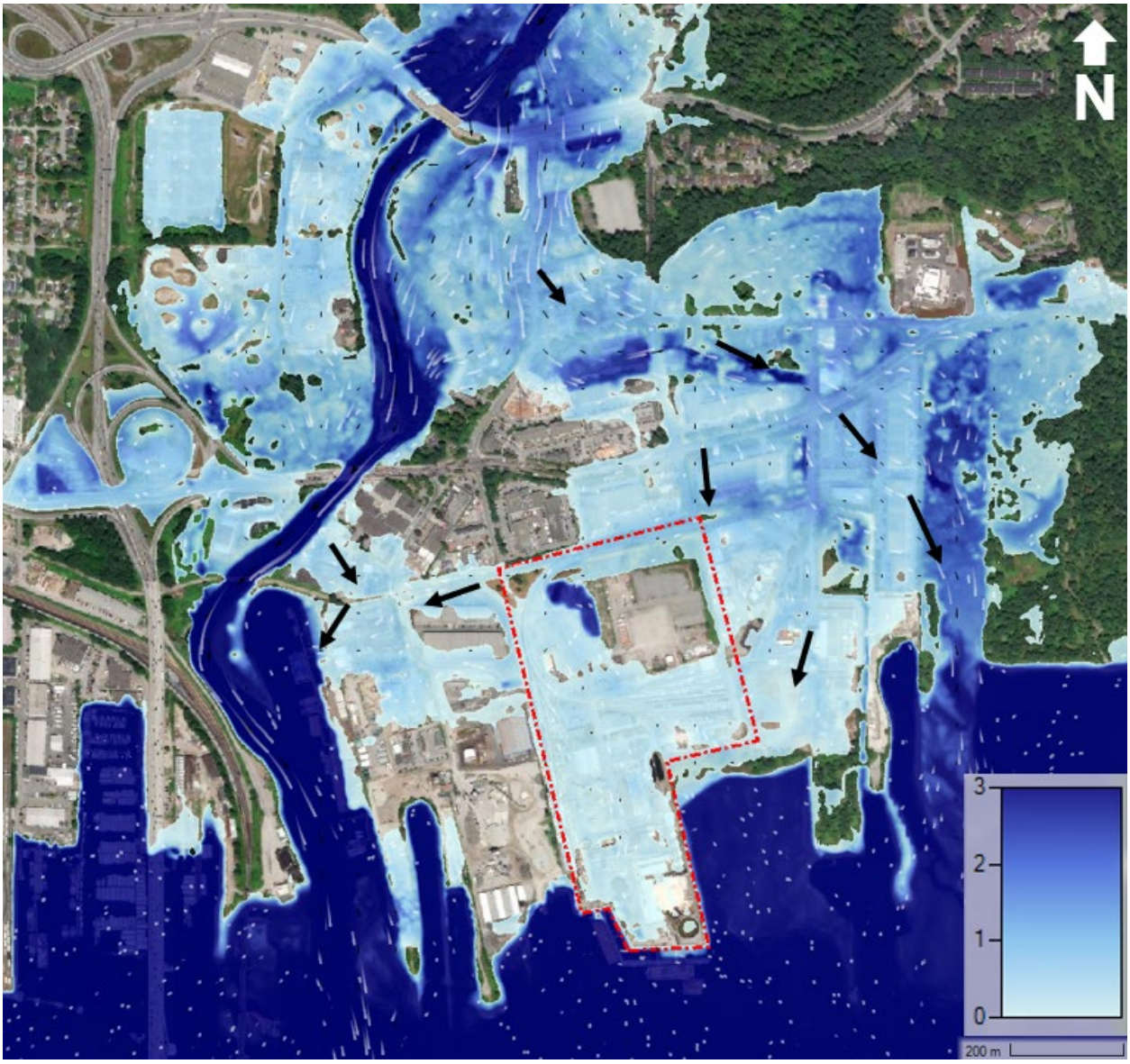



**Figure 4.4 Simulated flood depths across the site for Scenario 3.**
**Scenario 3: Mt. Seymour Bridge blockage; 0.5% AEP event including climate change.**

On average, flood depths on the site are 0.1 to 0.3 m for Scenario 1, and 0.3 to 0.5 m for Scenarios 2 and 3. The highest flood levels are produced by Scenario 2, where the modelled blockage of the bridge opening causes more flow to enter the site from the northwest.

Note that the DEM used in the model is bare-earth, and therefore the results do not account for local flow patterns around obstructions such as buildings, curbs, or barriers.

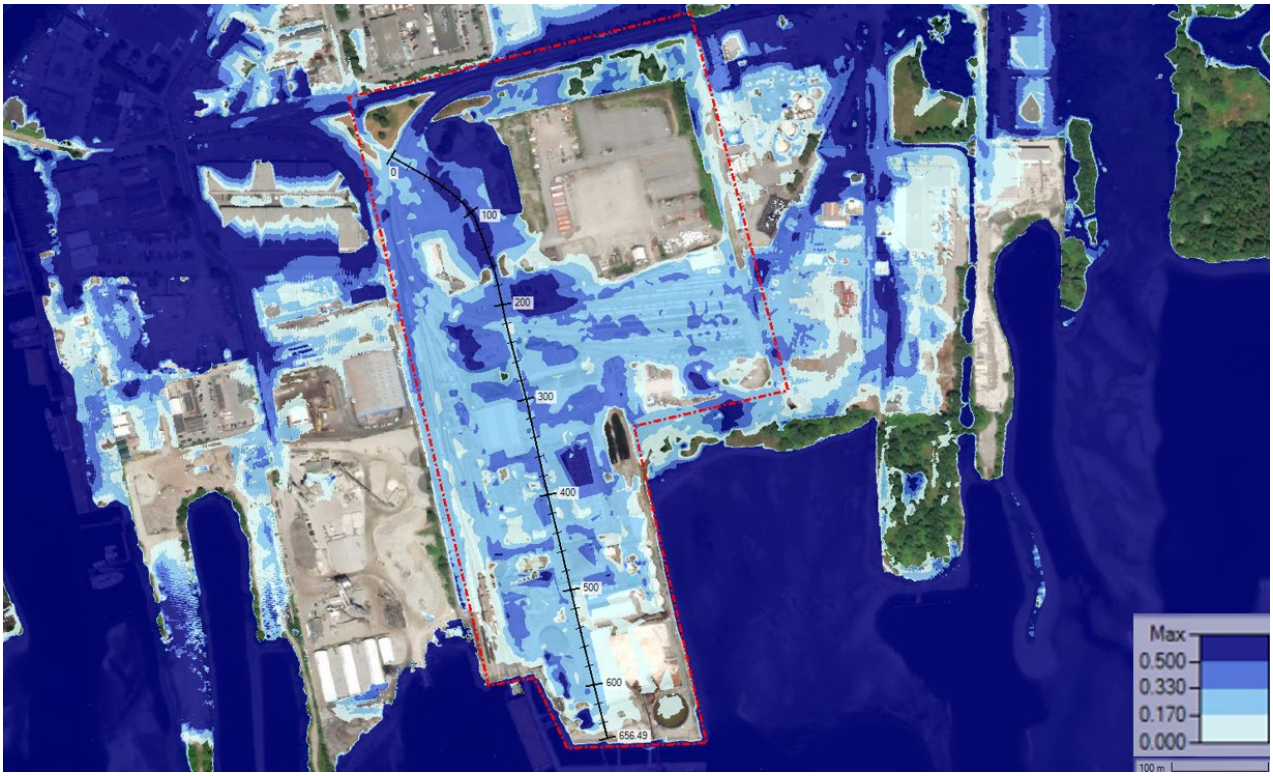



**Figure 4.5 Simulated flood depths across the site for Scenario 2, with profile line. The black line shows the location of the profile presented in Figure 4.6.**

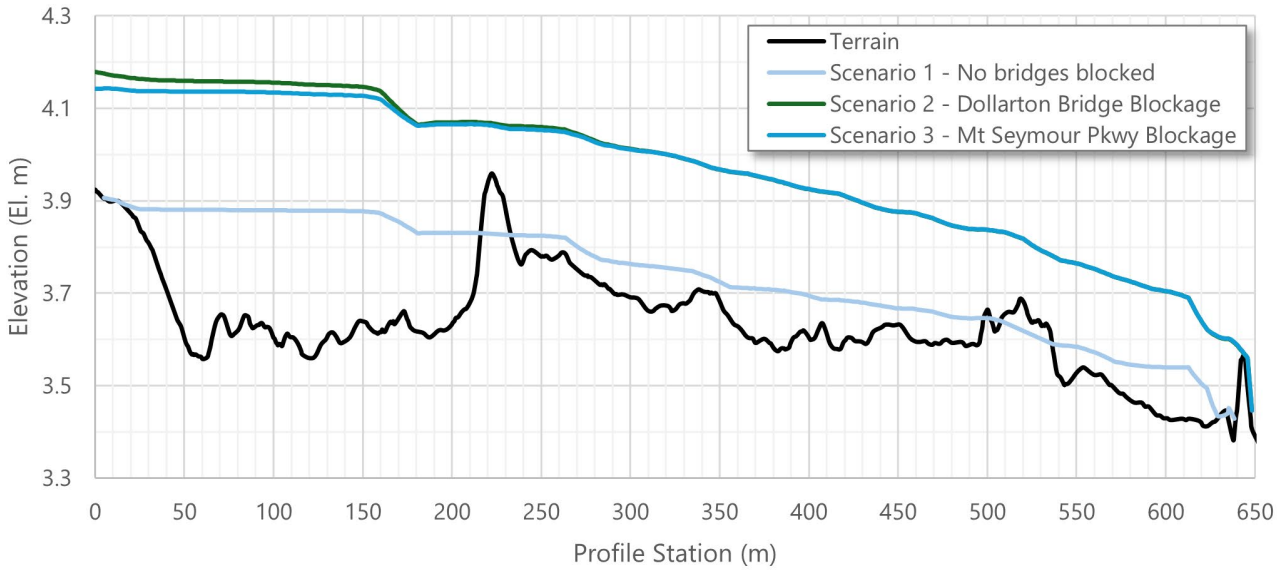



**Figure 4.6 Water surface elevation profiles along Amherst Ave for Scenarios 1 to 3. (0.5% AEP event including climate change). Profile is from north (left) to south (right).**

# 5 COASTAL FLOOD HAZARD ASSESSMENT

Coastal flooding can damage shoreline infrastructure and property. To reduce this risk, a coastal FCL is defined, typically based on a 0.5% AEP event and adjusted for projected sea level rise (SLR) and vertical land movement over the intended design life of the project. The coastal FCL for this site is determined using the joint probability method outlined in the BC Ministry of Environment's Climate Change Adaptation Guidelines (2011b) and updated by BCMFLNRORD (2018). Figure 5.1 summarizes the contributing parameters, which include:

- 0.5% AEP total water level (tide and storm surge),
- Projected sea level rise over the intended design life of the project,
- Regional land movement (uplift or subsidence),
- Corresponding wave effects, and
- Freeboard.

These components are described in the following sections.

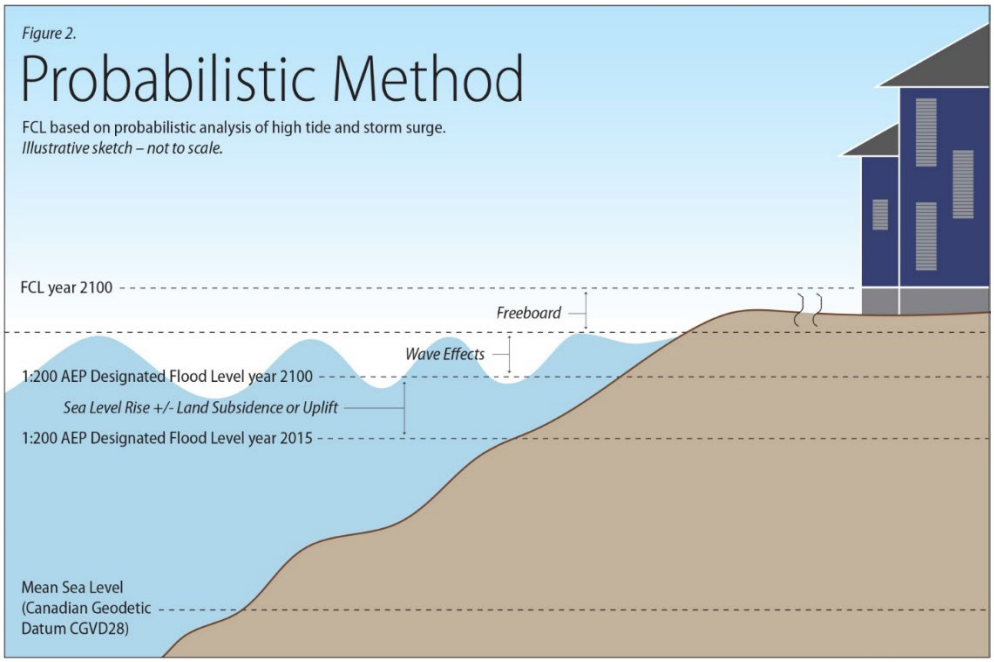



**Figure 5.1 FCL based on probabilistic analysis (Government of BC, 2018).**

Figure 5.2 provides an overview of the study site and the locations of key reference stations relevant to the coastal analysis, including the Point Atkinson meteorological station (ECCC ID: 1106200), and tide gauge stations at Point Atkinson (Canadian Hydrographic Service ID: 7795) and Vancouver (Canadian Hydrographic Service ID: 7735).

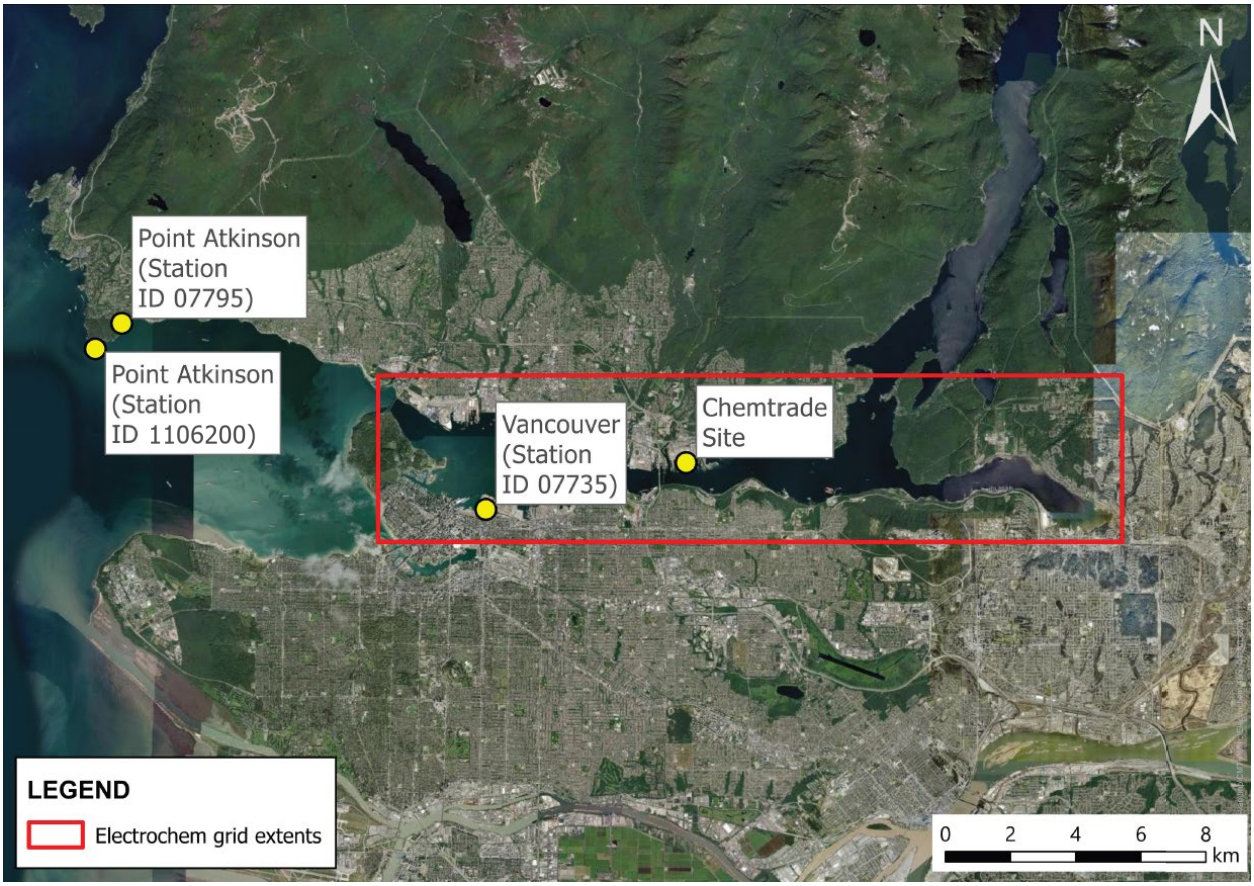



**Figure 5.2 Study site and key reference stations used in coastal analysis.**

The following sections investigate the coastal storm hazards at the site. Additionally, a high-level review of tsunami hazard is included to acknowledge its potential contribution to overall coastal flood risk, although it is not a primary focus of this assessment.

## 5.1 Total Water Levels (Tide and Surge)

Tides and storm surge are the primary contributors to coastal water level variability. Tides are predictable, periodic changes caused by gravitational forces, while storm surges are temporary increases in water level driven by wind and atmospheric pressure during storms.

Tide datums published by the Canadian Hydrographic Service (CHS) were used to characterize local tide conditions. The Vancouver water level station (CHS Station ID 07735), located approximately 13 km west of the study site, was selected as the reference location, as it is the closest station with available published tidal datums. Table 5.1 summarizes key tide datums at Vancouver, shown relative to both chart datum (CD) and CGVD28.

**Table 5.1 Tide datums at Vancouver CHS water level station (Station ID 07735)**

| Description | Water Surface Elevation (m, chart datum) | Water Surface Elevation (El. m, CGVD28[1]) |
|---|---|---|
| Higher high water, large tide (HHWLT) | 5.0 | 2.0 |
| Higher high water, mean tide (HHWMT) | 4.5 | 1.5 |
| Mean water level (MWL) | 3.1 | 0.1 |
| Lower low water, mean tide (LLWMT) | 1.2 | -1.8 |
| Lower low water, large tide (LLWLT) | 0.1 | -2.9 |

**Notes:**
1. Benchmark M08C9006 at Vancouver (Station ID 07735) was used to calculate the conversion of -3.0 m from chart datum (CD) to CGVD28.

To estimate extreme water levels, the joint probability method was applied to long-term tide and storm surge records (1950–2024) from the Point Atkinson water level station, located approximately 13 km west of the Vancouver CHS station. Design water levels developed for Point Atkinson were translated to the Vancouver CHS station by comparing tidal elevations between the two locations and applying a location-specific offset to account for differences in local tidal characteristics. Table 5.2 summarizes the resulting design water levels at the Vancouver CHS station for selected return periods.

**Table 5.2 Design water levels at Vancouver CHS water level station (Station ID 07735)**

| Annual Exceedance Probability (AEP) | Water Level (El. m, CGVD28) |
|---|---|
| 20% | 2.51 |
| 10% | 2.58 |
| 2% | 2.72 |
| 1% | 2.77 |
| 0.5% | 2.82 |

## 5.2 Relative Sea Level Rise

Relative sea level rise (RSLR) accounts for both global sea level rise and vertical land movement at the site. Global sea level is projected to rise due to climate change, primarily from thermal expansion of ocean water and melting land-based ice. Vertical land motion, such as regional uplift or subsidence, affects how sea level changes relative to land.

RSLR projections were obtained from the Canadian Climate Data Portal (Climatedata.ca, accessed May 2025), which provides data based on CMIP6 projections and the Canadian crustal velocity model (Environment and Climate Change Canada et al., 2025; Robin et al., 2020). For

estimating the year-2100 FCL, the 83rd percentile of the SSP5-8.5 scenario was used, corresponding to 0.84 metres, in accordance with ClimateData.ca guidance for conservative, risk-informed planning.

## 5.3 Designated Flood Level

As part of the FCL approach, the Designated Flood Level (DFL) represents the still water component of extreme coastal flood conditions, excluding wave effects and freeboard. The DFL is defined as the sum of the 0.5% AEP total water level and the adopted RSLR allowance. It does not include wave effects or freeboard. It reflects the projected still water elevation associated with extreme coastal water levels under future sea level conditions. At the site, the coastal DFL is El. 3.66 m. To determine the coastal FCL, wave run-up is added to the DFL, followed by freeboard. Wave run-up estimation is presented in the following section.

## 5.4 Wave Run-Up

Waves contribute significantly to coastal flood levels and must be considered when determining the FCL. Wave run-up is the maximum vertical extent of wave uprush on a beach or structure above the DFL. Following provincial guidance, wave run-up is characterized using the two percent exceedance value ($R_{2\%}$), representing the elevation exceeded by approximately one in 50 waves during a storm event.

The project site is located east of the Second Narrows in Vancouver Harbour and is exposed to locally generated wind waves and vessel wakes, both of which can contribute to shoreline wave run-up. In this assessment, wind-generated waves were evaluated using a combination of wind analysis and numerical wave modelling. Vessel-generated wakes were not explicitly included, as they are considered minor compared to wind-wave and water level contributions during extreme storm events. Where relevant, wake-related impacts may be addressed through operational measures or port regulations.

### 5.4.1 Design Wind Conditions

Historical wind data from the Environment and Climate Change Canada Point Atkinson meteorological station (Station ID# 1106200, 1996–2025) were analyzed to characterize wind conditions that generate waves at the site in the Vancouver Harbour. The dataset consists of hourly wind observations based on 2-minute averages, which aligns with standard ECCC reporting and provides a consistent basis for storm wind analysis.

Point Atkinson is located approximately 17 km west of the site, in an exposed area near the entrance to Burrard Inlet. Its offshore location and orientation relative to the project site make it a suitable reference for prevailing wind conditions that influence wave generation, although westerly winds may be slightly overestimated due to open-water exposure.

Winds at Point Atkinson predominantly come from the east and west, so both directions were included in the assessment. Extreme value analysis was applied to determine design wind speeds for various return periods (Table 5.3).

**Table 5.3 Design wind speeds based on Point Atkinson (2-minute average, hourly data)**

| Annual Exceedance Probability (AEP) | Easterly Wind Speed (m/s) | Westerly Wind Speed (m/s) |
|---|---|---|
| 10% | 20.8 | 21.6 |
| 2% | 22.1 | 24.3 |
| 0.5% | 23.3 | 26.7 |

While provincial guidance recommends assessing wave effects in combination with the 0.5% AEP, it does not explicitly define the return period of the associated storm event. Applying a 0.5% AEP wave event together with a 0.5% AEP water level is considered overly conservative, as the joint probability of both extremes occurring simultaneously is low.

To address this, two design scenarios were evaluated for each wind direction (east and west):

- 0.5% AEP water level with 2% AEP wind
- 2% AEP water level with 0.5% AEP wind

This approach allows for independent consideration of extreme water level and wind conditions while avoiding overestimation of flood risk due to compounding low-probability events. Evaluating both scenarios for each direction supports a balanced assessment of wave effects consistent with screening-level guidance for coastal flood hazard planning.

Both scenarios produced similar wave heights, with the 0.5% AEP wind scenario resulting in wave heights less than 10 cm greater than the 2% AEP wind case. However, the scenario with the higher water level (0.5% AEP water level + 2% AEP wind) produced greater inundation overall, due to the elevated baseline water level. As such, this scenario was selected as the representative condition for assessing coastal flood hazard at the site.

### 5.4.2 Design Wave Conditions

The SWAN (Simulating WAves Nearshore) model was used to simulate offshore wave generation and nearshore transformation. It accounts for key physical processes such as wave growth, refraction, shoaling, and breaking (Booij et al., 2004). The model has a resolution of 50 m and covers the extents shown in Figure 5.3. The model domain was selected to capture the full fetch extents for dominant wind directions, allowing for complete wave development at the site. Topobathymetric data used in the model were compiled from multiple sources as described in Section 2.6.

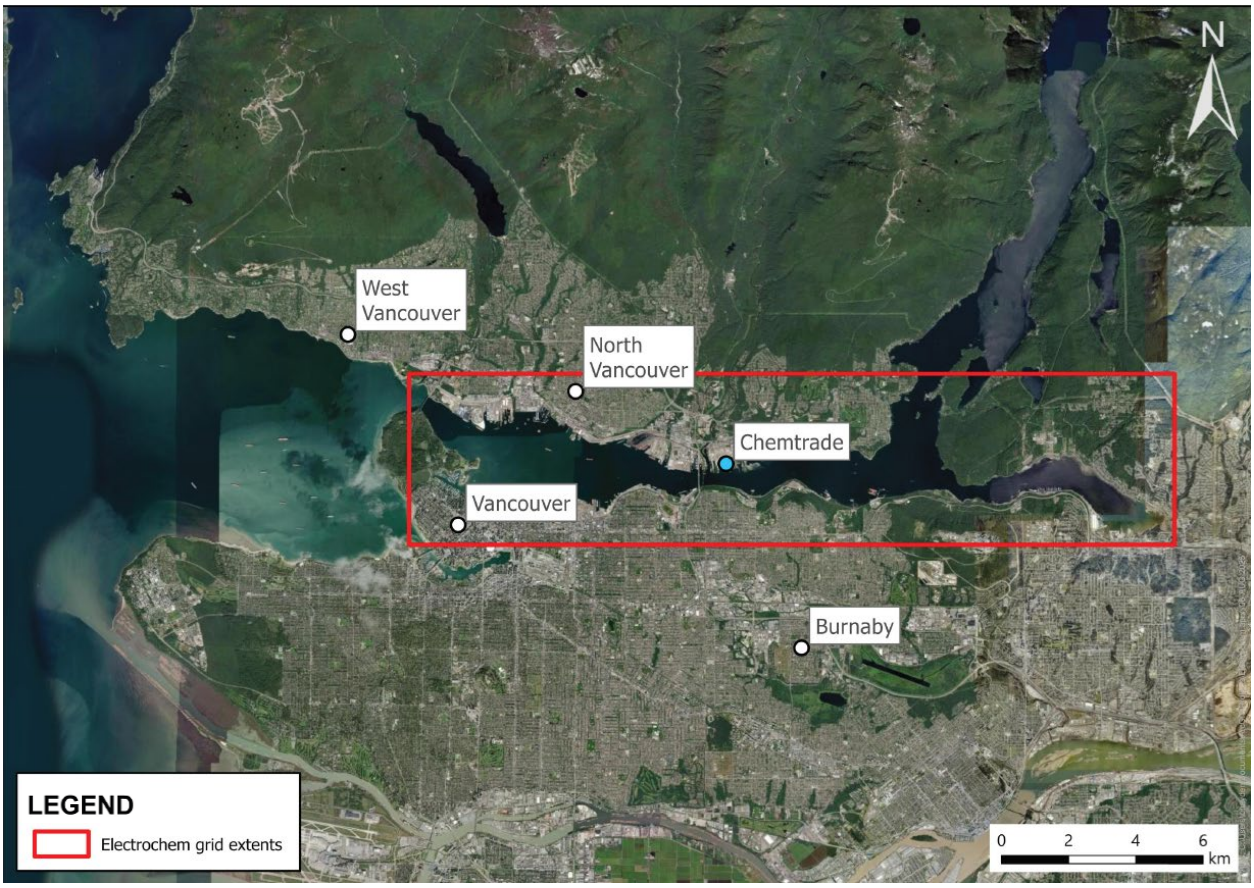



**Figure 5.3 Chemtrade wave model extents.**

Design wind conditions were applied as input to the wave model simulations. Figure 5.4 and Figure 5.5 present model results near the project site for the scenario combining 2% AEP wind with 0.5% AEP water level, under westerly and easterly wind conditions, respectively. Zoomed in model results at the project site are shown in Figure 5.6. The significant wave heights are shown with colour shading, and mean wave directions are shown with black vectors.

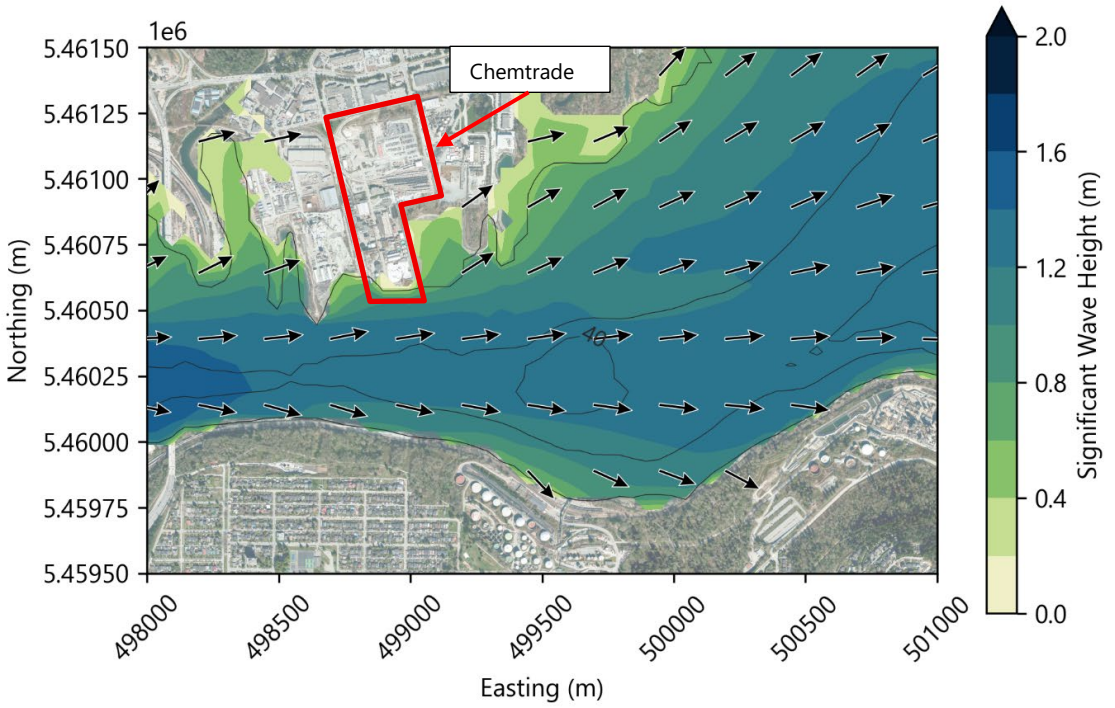



**Figure 5.4 SWAN model results for 2% AEP westerly event during a 0.5% AEP water level.**

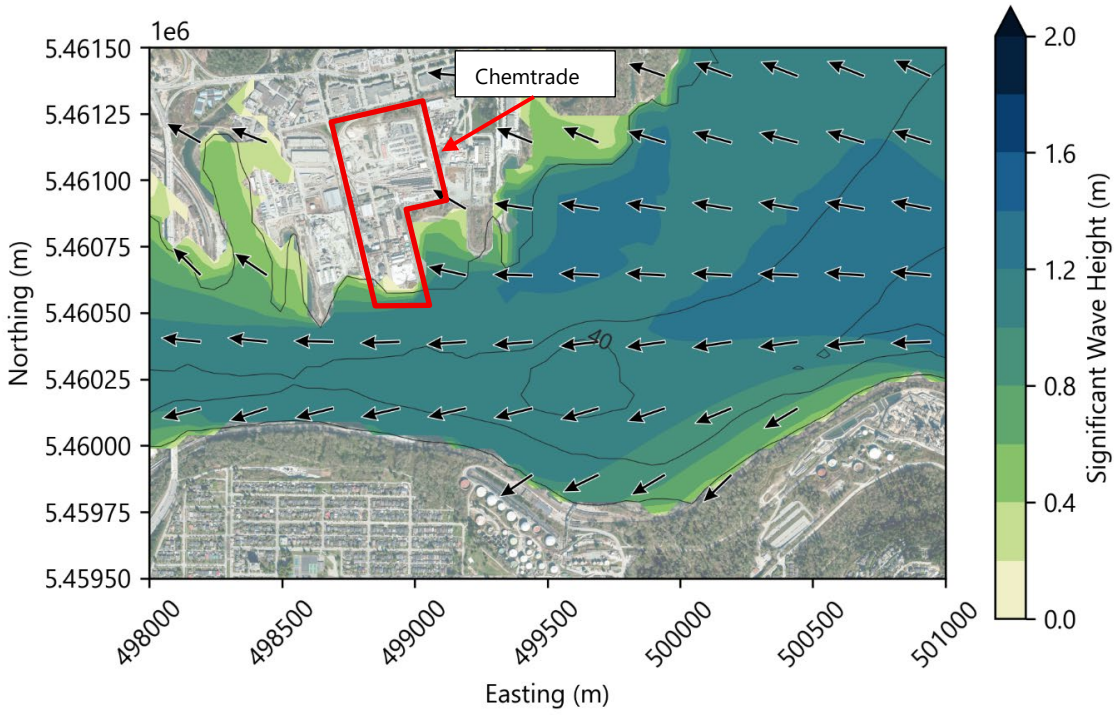



**Figure 5.5 SWAN model results for 2% AEP easterly event during a 0.5% AEP water level.**

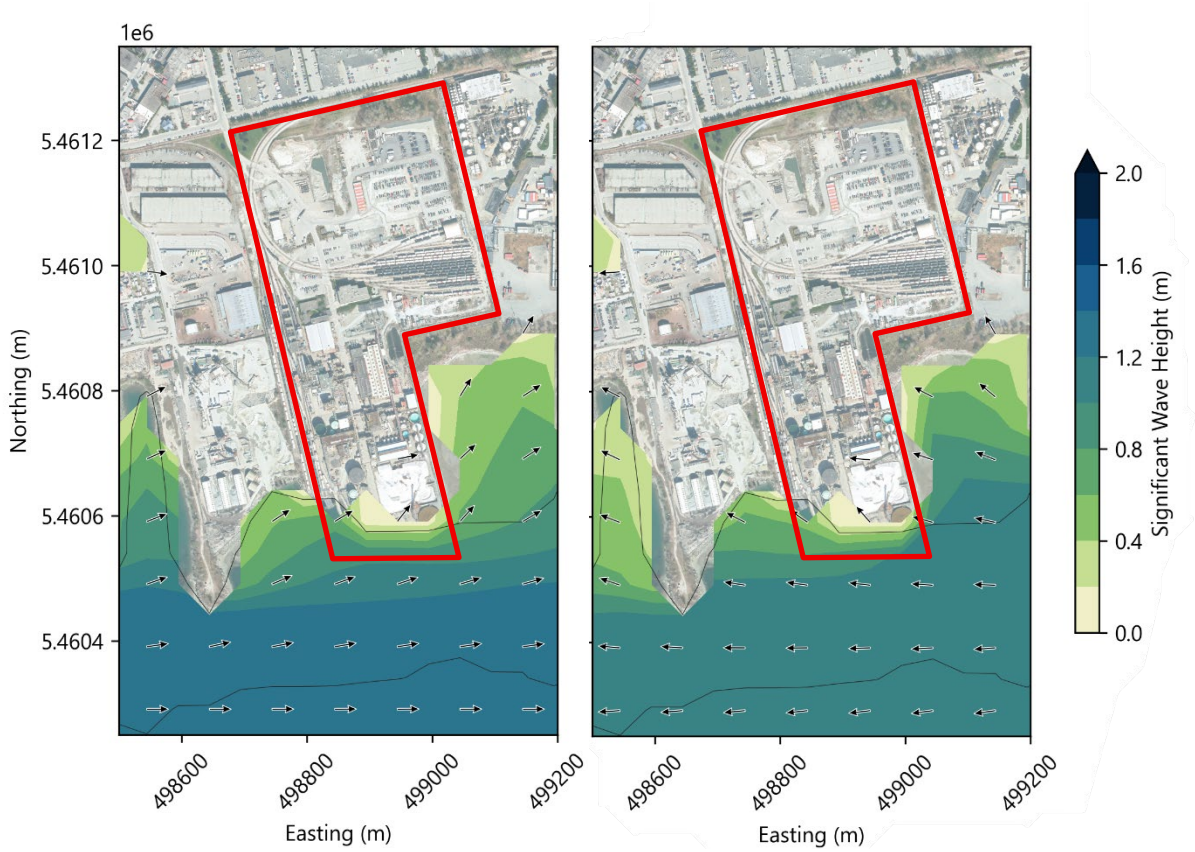



**Figure 5.6 Zoomed in SWAN model for the design events: westerly (left), easterly (right).**

The easterly wind scenario results in greater significant wave heights near the site. This is due to the eastern side being more directly exposed to developed waves, while the western side is partially sheltered by the neighbouring property. As a result, easterly waves are expected to govern wave run-up at the site.

Nearshore wave conditions were extracted from the models – specifically significant wave height (Hs) and peak wave period (Tp) – are summarized in Table 5.4.

**Table 5.4 Nearshore Wave Conditions from SWAN model**

| Wind Direction | Significant Wave Height, Hs (m) | Peak Wave Period, Tp (s) |
|---|---|---|
| E | 1.1 | 3.9 |
| W | 0.7 | 4.3 |

### 5.4.3 Wave Run-Up Analysis

The DFL for the site is El. 3.66 m, based on the 0.5% AEP total water level with sea level rise included (Section 5.3). Existing site elevations range from approximately El. 3.6 to 3.8 m, and no regrading is currently proposed. Under this scenario, only the lowest-lying portions of the site are inundated, with maximum still water depths of up to 0.06 m. The majority of the site remains above water under design conditions.

Where inundation does occur, wave heights are depth-limited. Following (Kamphuis, 2000), the maximum wave height in shallow water is approximately 0.78 times the local water depth, which yields a maximum wave height of about 0.05 m.

Larger waves are expected in the nearshore zone, particularly under easterly wind conditions. However, as waves propagate inland across shallow, partially inundated areas, they become depth-limited and lose energy rapidly. Beyond approximately 30 m from the shoreline, wave heights are expected to be less than 0.05 m, and wave energy contributes minimally to the overall flood hazard at the site. However, infrastructure located within this wave-affected zone may be subject to localized wave loading and splash or run-up effects. Structures located within this area should consider wave-resilient design and may warrant elevated FCLs or additional freeboard relative to inland portions of the site.

It is important to note that this estimate is sensitive to RSLR. If sea level exceeds the 0.84 m projection used for year-2100, greater inundation depths and higher wave heights could occur further inland, increasing coastal hazard exposure at the site.

## 5.5 Tsunami Hazard Assessment

Tsunamis are long-period waves generated by sudden displacements of water due to tectonic, volcanic, or landslide activity. While the BC coast has experienced tsunami events in the past, the Flood Hazard Area Land Use Management Guidelines (MLNFRORD, 2018) consider the Strait of Georgia to have low tsunami hazard.

To confirm that coastal storms govern over tsunamis at this site, a literature review was conducted with a focus on Vancouver Harbour. Past studies (Clague and Orwin, 2005; Leonard et al., 2014) indicate that tsunami inundation in North Vancouver may reach El. 1.6 to 2.6 m (0.5% to 0.01% AEP), and up to El. 3.1 m under rare events (<0.01% AEP). These studies also note no tsunami hazard for areas above El. 3.1 m CGVD28.

At the site, typical ground elevations range from El. 3.6 to 3.8 m, and the DFL is El. 3.66 m - both of which exceed the maximum tsunami levels reported in the literature. Therefore, tsunamis do not govern flood levels at the site under current conditions.

It is noted, however, that these tsunami scenarios do not incorporate RSLR. If sea levels rise, as projected under climate change (e.g., 0.84 m by the year 2100), the same tsunami events could result in greater inland inundation. For example, a wave reaching El. 3.1 m today could reach El. 3.94 m under projected RSLR, potentially impacting areas that are currently above the estimated hazard extent. While such compound scenarios remain uncertain and low probability, they may warrant consideration in future site planning or risk management beyond this screening-level study.

# 6 FLOOD CONSTRUCTION LEVELS

Both the Seymour River and Burrard Inlet pose flood risks to the subject property. Based on the screening-level modelling and site conditions, the flood construction levels (FCLs) shown on Figure 6.1 and summarized below are recommended to guide site planning. The mapped FCLs represent the governing flood mechanism (riverine or coastal), and include freeboard as described in the sections below.

## 6.1 Riverine FCL

The recommended riverine FCL is based on the 0.5% AEP event with climate change, assuming full blockage of the Dollarton Bridge (Scenario 2), plus a freeboard allowance. The simulated peak water level across the site ranges from El. 3.6 to 4.2 m. Applying a freeboard of 0.3 m (APEGBC, 2017), the recommended riverine FCL ranges from El. 3.9 to 4.5 m.

## 6.2 Coastal FCL

The recommended coastal FCL is based on the 0.5% AEP total water level with climate change and wave effects, plus a freeboard allowance. Two coastal FCL approaches are taken to reflect spatial variation in wave exposure across the site:

1. Infrastructure within the primary coastal wave effect zone (within approximately 30 m of the shoreline), where wave loading and run-up effects are expected to be most significant; and
2. Infrastructure outside of this zone, where wave heights are generally smaller but localized wave effects may still occur, depending on inundation depth and site-specific features.

The wave contribution to the FCL in both areas is influenced by local ground elevation, shoreline configuration, and flood depth. Table 6.1 summarizes the recommended FCLs for these two zones under current sea level rise assumptions, and using a 0.6 m freeboard. Site-specific wave effects for infrastructure within the primary coastal wave effect zone would need to be assessed depending on the location of the proposed facility modifications.

**Table 6.1 Coastal FCL Value**

| Component | Coastal Wave Effect Zone | Outside Wave Effect Zone |
|---|---|---|
| Design Flood Level (0.5% AEP) (m, CGVD28) | 2.82 | 2.82 |
| RSLR for the year 2100 (m) | 0.84 | 0.84 |
| Wave Effects (m) | Site-specific | 0.05 |
| Freeboard | 0.6 | 0.6 |
| **Coastal FCL (m, CGVD28)** | **4.26 m + site-specific wave effect** | **4.31** |

## 6.3 Consolidated FCL

Figure 6.1 shows the recommended FCLs for the site. The values shown represent the higher of the riverine and coastal FCLs as described above, and delineate the boundary for the primary coastal wave effect zone. The FCLs are intended to be used to inform preliminary planning of the facility modifications, and should be confirmed in future stages.




**USE AND LIMITATIONS OF MAP:**

1. Flood levels and extents shown on this map were developed to support a screening level flood assessment for **Chemtrade Electrochem Inc.**, and are for planning purposes only. Once locations for facility modification are finalized, flood elevations should be confirmed. For infrastructure located within the designated Coastal Wave Effect Zone, site-specific wave analysis will be required. The use of this map is subject to the assumptions and limitations described in the accompanying report (NHC 2025).
2. Users must note the dates of base mapping, aerial photography, river surveys and issue of mapping relevant to dates of development in the map area. Subsequent developments or changes within the floodplain or channel (natural or constructed) will affect flood levels and render site-specific map information obsolete.
3. Other sources of water, roads, railways or other barriers can restrict water flow and affect local flood levels. As well, obstructions such as debris, flooding in surrounding areas, channel deposition, groundwater or other phenomena can cause flood levels to exceed those indicated on the map.
4. This map does not indicate legal survey boundaries. The site survey (Underhill Geomatics Ltd., 2025) should be referenced to identify property location, and ground elevations.

CHEMTRADE

nhc
northwest hydraulic consultants




- FLOW DIRECTION
- PROJECT STUDY AREA
- FLOOD CONSTRUCTION LEVEL (FCL)
- COASTAL WAVE EFFECT ZONE
- DESIGN FLOOD EXTENT

*DATA SOURCES: ESRI WORLD IMAGERY; ESRI TOPOGRAPHIC*

*SCALE - 1:4,000*

0 50 100 150 m

N

*Coordinate System: NAD 1983 CSRS UTM ZONE 10N*
*Units: METRES; Vertical Datum: CGVD28*

*Job: 3009713* | *Date: 31-JUL-2025*

# *SCREENING LEVEL FLOOD ASSESSMENT PRELIMINARY FLOOD CONSTRUCTION LEVELS*

*FIGURE 6.1*

SWM. \\mainfile-van\Projects\Active\3009713 Electrochem FHA\95_GIS\3009713_SWM_FCLMapping.aprx

# 7 SUMMARY AND RECOMMENDATIONS

This screening-level flood assessment reviews the riverine and coastal exposure at the Chemtrade Electrochem facility to inform planning and design decisions for future facility modifications. The following recommendations are provided:

1. **Flood Construction Levels (FCLs):** The recommended FCLs for the site range between El. 4.3 m and El. 4.7 m, which reflect the higher of the riverine and coastal flood levels, including climate change. To determine the applicable FCL at a specific location, two options are available. The method should be determined by the professional responsible for design:
   - Use the higher of the two bounding isolines (conservative approach), or
   - Use linear interpolation between isolines based on the location of the structure. The selected method should be determined by the professional responsible for design.
2. **Infrastructure Placement:** Proposed infrastructure should be situated above the FCL, including building floors, process, mechanical and electrical systems. If parts of the infrastructure are below the FCL, they must be designed to withstand river and wave forces, and should consider the potential for local scour and erosion. Adherence to the FCL and consideration of hydrodynamic forces is particularly important for high-consequence sites (e.g., those involving chemicals), where structural failure could have serious impacts.
3. **Storage and Containment:** Storage of flood-damageable goods, including chemicals, tanks, or process equipment below the applicable FCL must be secured to avoid damage, release or mixing with floodwaters.
4. **Flow Paths and Risk Transfer:** As part of detailed design, assess whether proposed changes may alter overland flow patterns or increase velocities through constrained areas. Avoid unintentionally transferring flood risk to other parts of the site or adjacent properties.
5. **Emergency Management Planning:** Chemtrade should incorporate flood preparation and response into the site's emergency management plan, including consideration for site access limitations during extreme events. NHC's hydraulic modelling shows that off-site roadways would be inundated during flood events, preventing site access and egress.

Chemtrade has yet to finalize the design and locations of the proposed facility modifications. As the proposed changes become more defined, the flood assessment should be revisited to confirm FCLs and evaluate local flood, wave, and hydrodynamic considerations.

Note that existing infrastructure has not been assessed by NHC as part of this work; Chemtrade should review elevations of existing flood-sensitive infrastructure relative to the proposed FCLs to define the potential exposure and inform mitigation planning, where appropriate.

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# APPENDIX A

## SITE PHOTOGRAPHS

# SITE PHOTOGRAPHS



Photo 1: Chemtrade site, some water ponding in low paved areas



Photo 2: Exposed industrial pipes

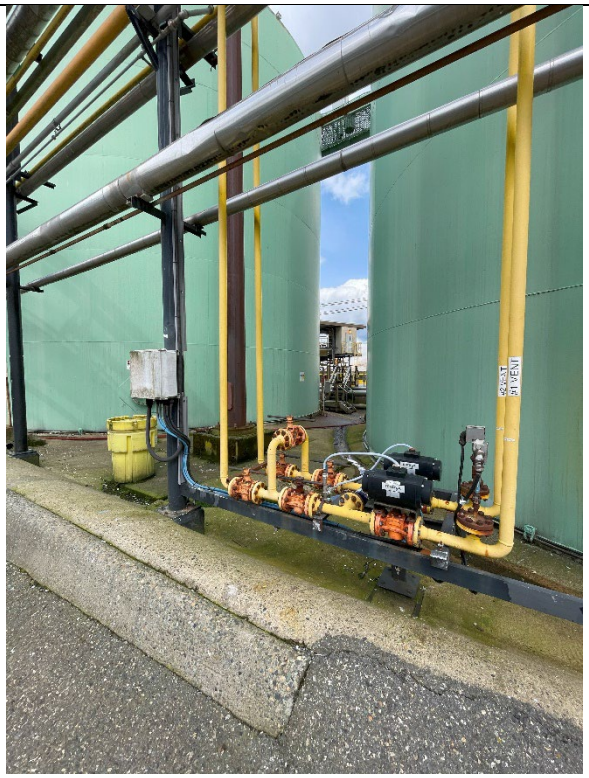


Photo 3: Exposed near-ground level equipment beyond containment barrier



Photo 4: Rail yard west boundary

| | |
|---|---|
|  |  |
| Photo 5: South boundary of the site, bordering Burrard Inlet | Photo 6: East boundary of the site, bordering Burrard Inlet |
|  |  |
| Photo 7: Dollarton Highway bridge crossing | Photo 8: Mt Seymour Parkway Bridge crossing |

301 – 3999 Henning Drive, Burnaby, BC, Canada V5C 6P9
T 604-988-2508 W www.bkl.ca E sound@bkl.ca

July 15, 2025

File: 4446-25A-R0

Chemtrade Electrochem Inc.
100 Amherst Avenue
North Vancouver, BC V7H 1T9

Attention: Drew Somerville, P.Eng.

Dear Drew:

**Re: Chemtrade Vision 2030**
**Noise Review**

## Introduction

The Chemtrade facility is located at 100 Amherst Ave in North Vancouver and is proposing upgrades at the site to be completed in 2030 (the Project). As described in the project overview document ("CAR 241033 – Project Overview R0"), the project includes a series of proposed upgrades at the North Vancouver facility to improve the safety of the existing chlorine manufacturing, storage, and railcar loading processes and reduce the total liquid chlorine on site.

As part of the approvals process for the upgrades, the District of North Vancouver (DNV) has requested a rezoning application for the Project including a review of potential noise issues associated with the Project. The intent of this document is to support the rezoning application and provide documentation suitable for submission to the DNV.

## Site Description

The existing Chemtrade site is located at 100 Amherst Ave, North Vancouver, and includes liquid chlorine production, storage, and transportation preparation systems. The site is located within an industrial area, approximately 700m to the east of the Second Narrows Bridge with Burrard Inlet bordering the site to the south. Noisy activities associated with the current site include regular rail movements of materials on and off site and various mechanical services equipment associated with processing and movement of chemical supplies on site. This mechanical noise includes the operation of pumps, ventilation equipment, and pressure release from areas such as the steam plant.

The site and surrounding area are provided in Figure 1.




*Figure 1: Project Site and Surrounding Area*

## Inventory of Receptors

Currently, the site is bounded to the east and west by other industrial facilities and the site and adjacent properties are zoned **Employment Zone – Industrial (EZ-I)**. To the north, the land is zoned as **Comprehensive Development Zone 18 (CD18)** and there are existing commercial operations in this area. To the south, the site is bound by Burrard Inlet. The closest residential receptors are located approximately 150 metres north of the site property line, across Dollarton Highway. Most of the site equipment is located approximately 300 metres south of the northern site property boundary.

The Official Community Plan from the District of North Vancouver indicate that additional residential zoned land could be located to the north of the Project in the future, however, these areas are further away from the Project than the existing residential receptors. Therefore, no future receptors have been included in the analysis.

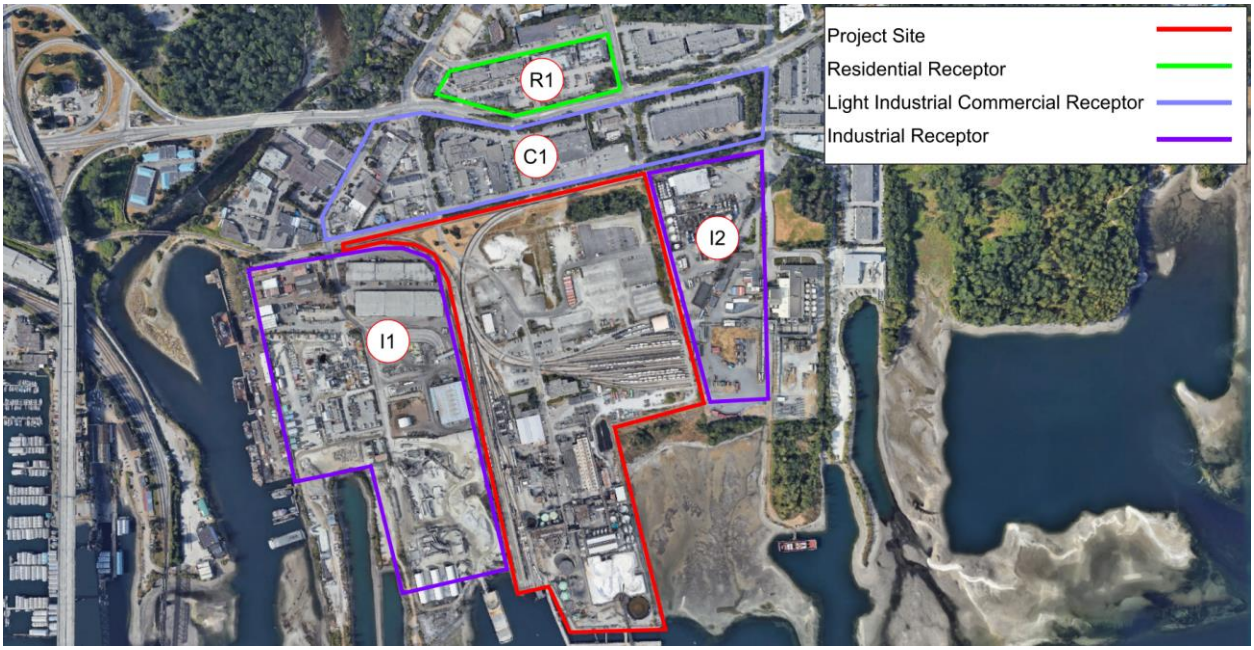



*Figure 2: Map of Neighbourhood Receptors*

## Proposed Project

The project overview document lists the following proposed upgrades for the Project:

- Chlorine condensing tower
- Liquid chlorine railcar loading building;
- Emergency ventilation system; and
- Hypo storage and destruction system.

The majority of these changes will be located on the west side of the site near the existing plant area.

## District of North Vancouver Requirements

The request from the DNV relating to noise is summarised below:

> Please provide a preliminary letter from a QEP demonstrating that the proposal is consistent with the Noise Regulation, Bylaw 7188, will not adversely impact any surrounding uses or significantly increase the existing noise associated with operation of the facility. A further detailed report would be required at the Building Permit stage.

For the building permit stage and based on the DNV request, we understand the following is required:

- Evaluation of Project noise levels against the DNV Bylaw 7188;
- Establishing the existing noise environment in the vicinity of the site. This will be established through both unattended 48-hour measurements and on-site attended measurements; and

- Providing a high-level commentary on whether the Project changes are expected to significantly increase the noise from the site. This will include identifying which activities or equipment are the dominant noise sources on the existing site and how noise levels are expected to change with the Project.

This document aims to fulfil this request.

## Noise Regulation Bylaw

Within DNV, noise is regulated by the Noise Regulation Bylaw 7188 (the Bylaw), issued August 14, 2000.

The Bylaw states the following:

> 3. Noise Regulation
> No person, including an owner or occupier of real property, shall make or cause, or permit to be made or caused, any noise or sound which disturbs or tends to disturb the quiet, peace, rest, enjoyment, comfort, or convenience of the neighbourhood or of persons in the vicinity or which exceeds the Sound Levels prescribed in this bylaw.
>
> 5. Objectionable Noises or Sounds
> Without limiting the generality of section 3, the following noises or sounds are believed by the Council to be objectionable or liable to disturb the quiet, peace, rest, enjoyment, comfort or convenience of individuals or the public and are prohibited:
> . . .
> f) any noise that exceeds the following Sound Level set out below:
>
> > i) any Continuous Sound that exceeds the following Sound Levels at the Point of Reception:
> >
> > | | | |
> > |---|---|---|
> > | a. | In a Quiet Zone during the Day | 55 |
> > | b. | In a Quiet Zone during the Night | 45 |
> > | c. | In an Activity Zone during the Day | 60 |
> > | d. | In an Activity Zone during the Night | 55 |
> >
> > (ii) any Non-Continuous Sound that exceeds the following Sound Levels at the Point of Reception:
> >
> > | | |
> > |---|---|
> > | a. during the Day | 80 |
> > | b. during the Night | 75 |
>
> 6. Location of Point of Reception
> Measurement of Sound Levels shall be made:
>
> (a) in the case of noises or sounds in a highway, public park or other public place, from a Point of Reception not less than 5 meters from the noises or sounds; and
>
> (b) in all other cases, from a Point of Reception not on the Premises upon which the source of the noises or sounds is located.

The Bylaw also allows an exemption for emergency response or repair of public utilities.

The Bylaw provides the following descriptions:

> "Activity Zone" means any part of the District not within the Quiet Zone;
>
> "Continuous Sound" means any noises or sound continuing for a period of, or periods totaling three minutes or more of any fifteen-minute period, but excludes a Construction Noise;
>
> "Day" means the period of time from 07:00 to 20:00 on each week day or Saturday; and from 09:00 to 20:00 on a Sunday or Statutory Holiday;
>
> "Night" means the period of time from 20:00 on the one day to 07:00 on the next, and from 20:00 on one day to 09:00 on the next day when the latter is on Sunday or a Statutory Holiday;
>
> "Non-continuous Sound" means any noises or sounds other than a Continuous Sound and a Construction Noise;
>
> "Point of Reception" means the place where a Meter is located to measure the Sound Level from a source of noises or sounds;
>
> "Quiet Zone" means any part of the District in a residential zone as shown in the District of North Vancouver Zoning Bylaw and all highways adjoining such land in such zones; except for a highway activity which also adjoins land in the Activity Zone, in which case the boundary between the Activity Zone and the Quiet Zone is the centreline of the highway;
>
> "Sound Level" means the Meter reading or recording in decibels using "A" weighted network at the slow response setting of the Meter;

Based on the above and considering the zoning of the adjacent properties, the applicable noise criteria for the Project as outlined in Table 1.

*Table 1: Applicable Noise Criteria at Receptors*

| Receptor Type | Continuous Sound (dBA) | | Non-Continuous Sound (dBA) | |
|---|---|---|---|---|
| | Day | Night | Day | Night |
| Quiet Zone (R1) | 55 | 45 | 80 | 75 |
| Activity Zone (I1, I2, C1) | 60 | 55 | | |

## Site Measurements

To comment on the existing noise associated with the operation of the facility and the existing noise environment, we conducted a series of noise measurements near and at the site.

## Unattended Measurements

BKL visited the Chemtrade facility on April 22, 2025. Two unattended noise monitors were deployed at the site for a period of 48 hours. The monitoring locations are shown in Figure 3.




*Figure 3: Unattended Noise Measurement Locations*

Location 1 was positioned approximately 50 metres to the south of the northern property line of the site. A 01dB DUO, a Class 1 sound level meter (SLM), was used as the measurement device.

Location 2 was positioned at the western boundary of the property, approximately 50 metres to the west of facility. A 01dB Fusion, a Class 1 sound level meter (SLM), was used as the measurement device.

Both SLMS were field calibrated before and after the measurement period.

Table 2 below summarizes the results of our 48-hour measurement period. The time periods were defined to be consistent with the Bylaw; the average daytime (Ld) levels cover the period from 7am to 8pm Monday to Saturday and the average night-time (Ln) levels cover the period from 8pm to 7am.

*Table 2: 48-Hour Measurement Results*

| | **Day 1 – April 22-23** | | **Day 2 – April 23-24** | |
|---|---|---|---|---|
| | **$L_d$** | **$L_n$** | **$L_d$** | **$L_n$** |
| Location 1 | 62 dBA | 56 dBA | 62 dBA | 59 dBA |
| Location 2 | 60 dBA | 54 dBA | 62 dBA | 56 dBA |

The measurements indicate that the daytime levels were higher than the night-time levels and that the noise levels were similar day to day. On average, the daytime noise levels were approximately 5 dB higher than the night time levels for both locations.

The dominant noise sources at each location based on our observations and recorded data appear to be:

- Location 1
  - Non-project noise including noise from adjacent industrial sites and general traffic noise
  - Rail movements
- Location 2
  - Condensing tower
  - Liquefaction building
  - Rail movements
  - Adjacent industrial site noise

The 24-hour time history plots of the measurement results have been appended to this report.

## Attended Measurements

While visiting the Chemtrade facility on April 22, 2025, and again on April 24, 2025, BKL conducted a series of short-term attended measurements to capture representative noise level for various project site sources and activities. The noise sources of note were initially identified by client discussion.

All on-site measurements were conducted with a Class 1 SLM, that was field calibrated before use. Measurements were captured throughout the site, adjacent to noise generating sources. Multiple measurements were captured for each source, with varied setback distances (typically ranging from 5 to 20 metres), and measurement durations ranged from 30 to 60 seconds.

We note that while we were on site, other areas not initially identified by the client were observed as being objectively loud, within the context of the project site.

The key noise generating activities identified at the site are as follows:

1. MCC building (plant air dryer, air compressor, dry storage);
2. Steam plant (air compressor);
3. Hypo / Process area;
4. Refrigeration / Liquefaction building;
5. Rail areas including the unloading/loading area, and the long-term rail storage;
6. Condensing tower;
7. Caustic house; and
8. Transformers.

The relative position of the noise sources are shown below in Figure 4. We also measured noise from the rail loading process; however, it was not a notable source of noise for the project site when compared to other site activities, consisting mainly of a short burst of impact wrench noise before the fluid hoses are affixed to the rail cars. The fluid transfer process itself was inaudible.

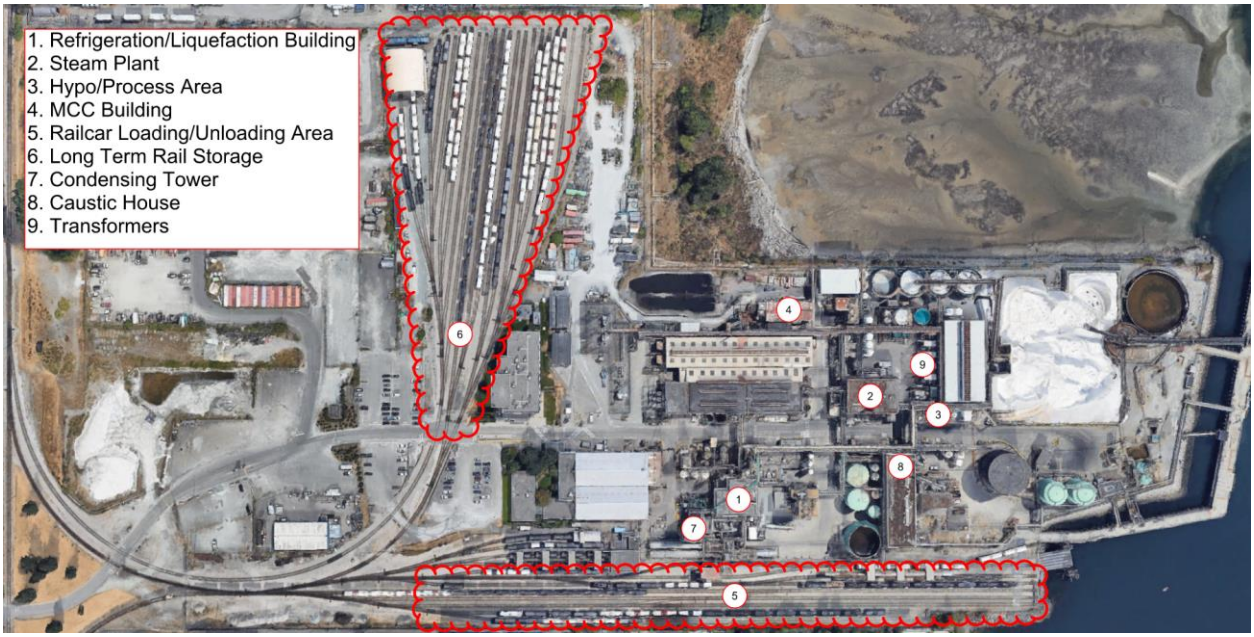



*Figure 4: Noise Generating Areas throughout the Project Site*

Table 3 summarizes the relevant noise measurement data, activity, measurement distance as well as the setback distance to boundary.

*Table 3: Summary of Noise Levels and Distance from Project Boundary*

| Equipment / Area Measured | Measurement Details | | Distance to Boundary [m] | | |
|---|---|---|---|---|---|
| | Distance [m] | $L_{eq}$ [dBA] | North | East | West |
| Condensing Tower | 15 | 71 | 330 | 300 | 60 |
| Liquefaction Building | 5 | 86 | 350 | 290 | 85 |
| Steam Plant | 5 | 89 | 425 | 285 | 160 |
| MCC Building | 10 | 76 | 410 | 210 | 210 |
| Caustic House | 5 | 87 | 480 | 335 | 190 |
| Transformers | 10 | 79 | 475 | 300 | 215 |
| Hypo Area | 5 | 84 | 500 | 330 | 210 |

## Existing Noise Levels

The noise sources at the site can generally be classified into two groups:

1. Stationary plant equipment; and
2. Rail movements.

Our findings indicate that the current site noise sources that are dominant at the site boundary can be summarized as shown in Table 4:

*Table 4: Dominant Site Noise Sources at Site Boundaries*

| | Dominant Noise Sources |
|---|---|
| North Boundary | Rail movements and plant equipment including the liquefaction building, and steam plant |
| West Boundary | Rail movements and plant equipment including condensing tower, liquefaction building, and steam plant |
| East Boundary | Plant equipment including MCC building and steam plant |

In general terms, the plant equipment operates continuously at the site 24 hours a day, seven days a week, whereas the rail activity associated with loading the materials is not constant and varies day to day. The rail operating times for a given day depend on the facility intake and output schedule. However, as per the definition of the Bylaw, all plant and rail noise sources can be considered continuous noise sources as the duration of the activities is greater than 3 minutes.

When there are rail movements on the site, noise generated by rail activity can be considered the overall dominant noise source at both the west and north boundary.

As noted earlier in the report, there is a contribution to the existing soundscape in the area due to non-project site sources, such as the neighbouring industrial sites and nearby road traffic.

## Potential for Project to Increase Noise Levels

The potential for the Project to influence the existing noise levels in the area is a function of the expected change in noise from the Project activity as well as the existing noise sources in the area. The proposed changes at the site for the Project as it relates to noise are summarized in Table 5 below.

*Table 5: Description of Activities with Potential to Increase Noise*

| Activity | Description | Change in noise | Contribution at site boundary |
|---|---|---|---|
| Addition of a railcar loading building | Method of rail loading will be the same, the change is the addition of a building. | Building could provide some screening to the west and east boundaries. | As rail loading is not a dominant noise source at any site boundary, no significant change to noise levels is expected with the addition of a loading building. |

| Activity | Description | Change in noise | Contribution at site boundary |
|---|---|---|---|
| New condenser tower – relocated condensers and preliquifier | Four new condensers and a preliquefier will replace existing units. The equipment will be located approximately 30 m north of existing condensing tower. The relocated components are sealed shell and tube heat exchangers, and the associated compressors will remain within the condensing tower. | The heat exchangers are not expected to be a new source of project noise. | We understand from communications with the client team that the new condensers and preliquifier are closed heat exchanger systems, and are not expected to be significant noise sources. Existing compressors located within the current condensing tower will continue to be used, and unmoved, and as such no increase in noise at any site boundary is anticipated |
| Emergency ventilation system | A new ventilation system to be added, which will include a scrubber discharge stack. The ventilation will be required only in an emergency. | New discharge stack will introduce a new noise source to the site. The new source is 55m from the closest boundary to the west. | The ventilation will only be required in an emergency so will not be constant noise source. Should ventilation be required, it will be as a continuous noise source for approximately 14 hours and is expected to contribute at the site boundaries when in operation. We understand from client communications that the ventilation process is not a planned activity, and it unlikely to ever occur due to numerous project precautions and safety measures. |
| New hypo storage and destruction system | Additional hypo storage tanks to be added near the existing caustic house building, and a new destruction system to be added. The destruction system will be used in emergency situations, and twice a year during planned activities. | New storage tanks will not be a source of noise. The destruction system will comprise of four 25 hp process pumps. The destruction system will be located 560 m away from the north boundary, and 70 m away from the west boundary | Based on the capacity of the process pumps, the noise from the pumps is not expected to exceed the Bylaw criteria at any site boundary or impact the existing noise levels significantly. We understand from client communications that the destruction system is scheduled to operate twice a year for 24 hours at a time, and for 48 hours in event of an emergency. |

To summarize the potential noise impacts from the Project:

- The addition of the rail building is not expected to change the site boundary noise levels;
- The relocated condensers and preliquifier are not expected to change noise levels at site boundaries, as the primary noise generating equipment (condensers) are remaining unchanged and unmoved;
- The emergency vent system may exceed the noise limits outlined in the Bylaw at the site boundaries. However, it's important to note that ventilation will only occur in the event of an emergency. Based on our discussions with the client, such situations are highly unlikely to arise;
- Based on the capacity provided for the pumps, the destruction system pumps are not expected to exceed the Bylaw criteria or change noise levels at the site boundaries.

## Conclusions

Our review of the existing noise from the site indicates that the rail movement on the site are the dominant noise source.

With regards to the proposed changes associated with the Project:

- The addition of the rail load out building, relocated condensers and preliquifier are not anticipated to change the noise levels at the site boundaries;
- Emergency ventilation has the potential to increase the noise level at the site boundaries and exceed the Bylaw criteria when in use, however, this will only occur in a unlikely emergency situation; and
- The destruction system pumps are not expected to exceed the Bylaw or increase noise levels at any site boundary.

We trust this information is satisfactory at this time.

Sincerely,

**BKL Consultants Ltd.**
per:

Liam Reitsma, EIT
Acoustical Consultant
reitsma@bkl.ca

Brigette Martin, P.Eng.
Acoustical Consultant
martin@bkl.ca

Enclosures: 24 Hour Time History Plots for Measurement Locations

# Location 1 - North Site Boundary

| | | | |
|---|---|---|---|
| Project ID: | 4446-25A | Address: | 100 Amherst Ave, North Vancouver, BC V7H 1T9 |
| Start Date: | April 22, 2025 | Instrument: | 01dB DUO |
| Start Time: | 14:00 | Serial No: | 12788 |
| Duration: | 48 hours | Measured by: | LR & SW |

**Location Description**

The microphone was located 1.8 m above the ground.

**Ambient Noise Description**

The dominant noise source was the railway and surrounding operational noise.

**Environmental Conditions**

The weather was sunny throughout measurement.

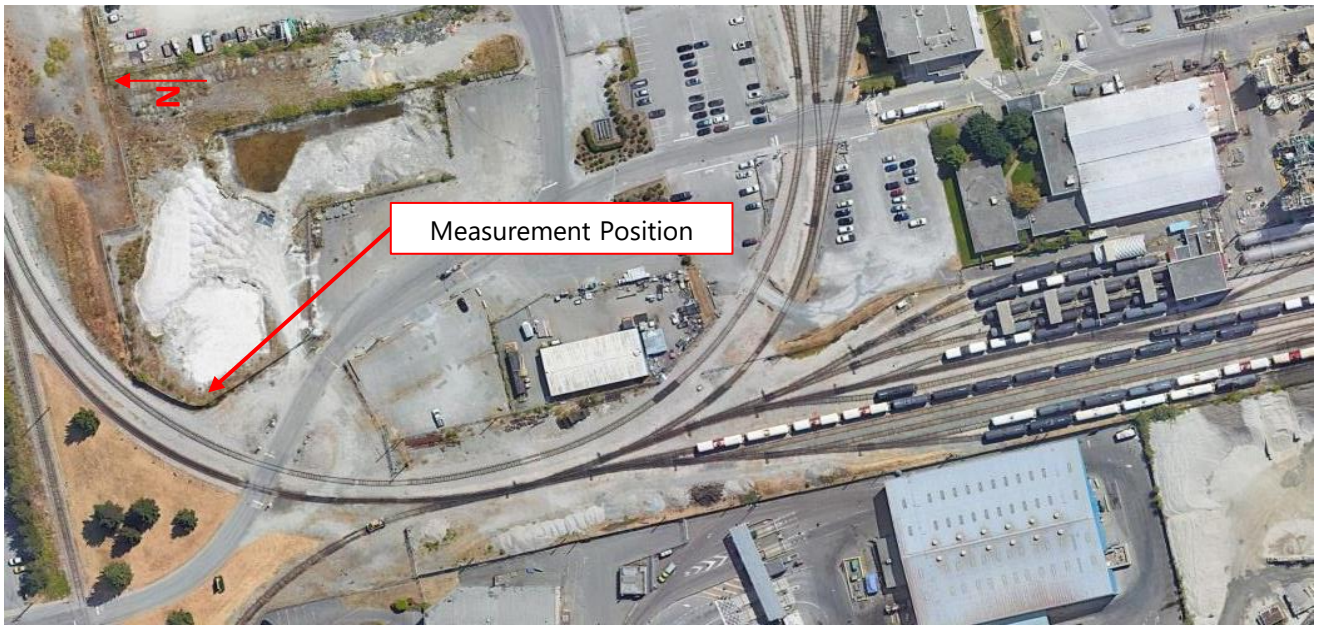
**Purpose of Monitoring Location**

This monitoring location is representative of the current environmental noise condition near Spicer Rd and Amherst Ave.



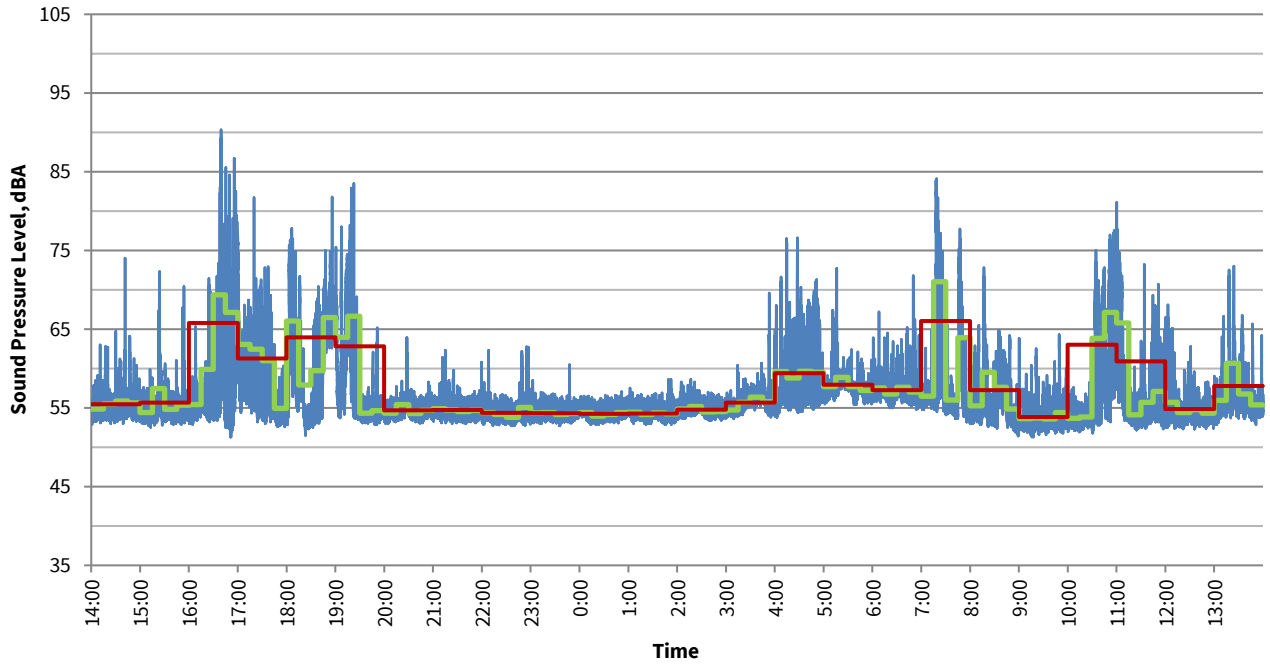






# Location 1 - North Site Boundary - Day 1

The graph below shows the measured, and calculated time histories beginning on April 22, 2025

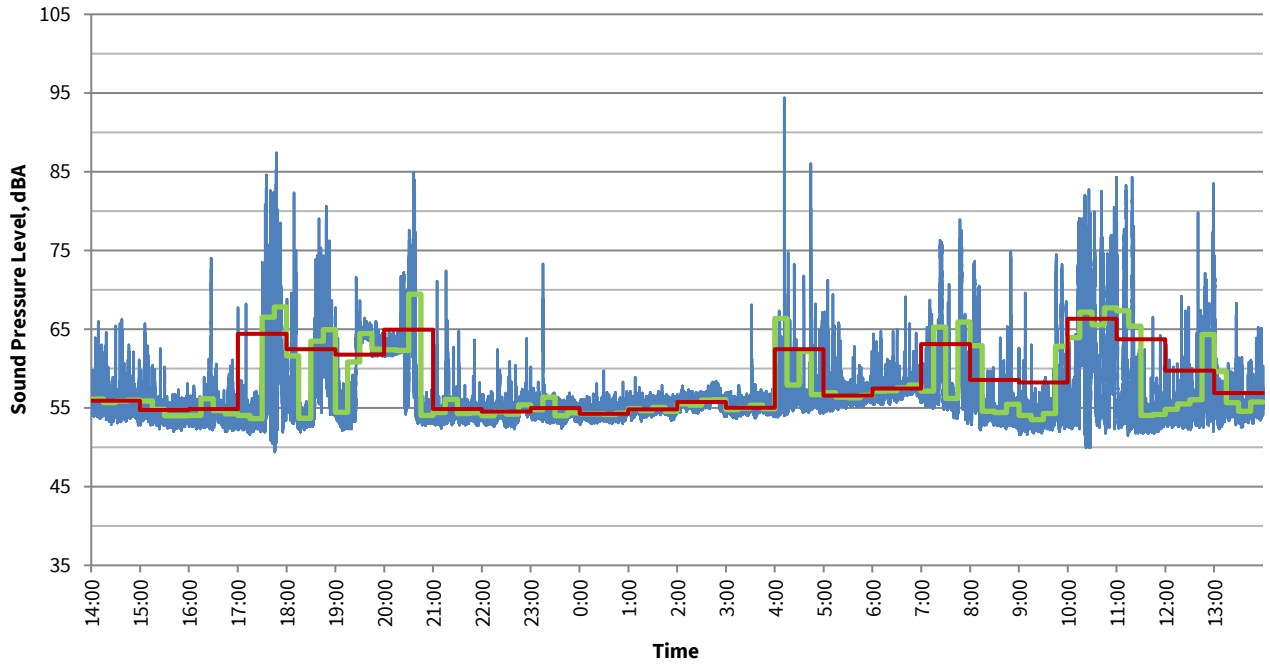



Hourly Interval Report starting at April 22, 2025
All Sound Pressure Levels presented in dBA

| Date | Time | Duration | $L_{eq}$ | $L_{max}$ | $L_{min}$ | $L_1$ | $L_5$ | $L_{10}$ | $L_{50}$ | $L_{90}$ | $L_{99}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | - | 24:00:00 | 60 | 90 | 51 | 71 | 65 | 59 | 55 | 54 | 53 |
| Apr 22 | 14:00:00 | 1:00:00 | 55 | 74 | 53 | 61 | 58 | 56 | 55 | 54 | 53 |
| Apr 22 | 15:00:00 | 1:00:00 | 56 | 72 | 53 | 64 | 57 | 56 | 55 | 54 | 53 |
| Apr 22 | 16:00:00 | 1:00:00 | 66 | 90 | 51 | 77 | 69 | 65 | 56 | 54 | 52 |
| Apr 22 | 17:00:00 | 1:00:00 | 61 | 82 | 53 | 71 | 67 | 65 | 57 | 54 | 53 |
| Apr 22 | 18:00:00 | 1:00:00 | 64 | 82 | 52 | 73 | 69 | 67 | 58 | 53 | 53 |
| Apr 22 | 19:00:00 | 1:00:00 | 63 | 84 | 53 | 75 | 68 | 65 | 55 | 54 | 53 |
| Apr 22 | 20:00:00 | 1:00:00 | 55 | 64 | 53 | 58 | 56 | 56 | 54 | 54 | 53 |
| Apr 22 | 21:00:00 | 1:00:00 | 55 | 62 | 53 | 58 | 56 | 56 | 54 | 54 | 53 |
| Apr 22 | 22:00:00 | 1:00:00 | 54 | 63 | 53 | 59 | 56 | 55 | 54 | 53 | 53 |
| Apr 22 | 23:00:00 | 1:00:00 | 54 | 61 | 53 | 56 | 56 | 55 | 54 | 54 | 53 |
| Apr 23 | 0:00:00 | 1:00:00 | 54 | 57 | 53 | 56 | 56 | 55 | 54 | 54 | 53 |
| Apr 23 | 1:00:00 | 1:00:00 | 54 | 59 | 53 | 56 | 56 | 55 | 54 | 54 | 53 |
| Apr 23 | 2:00:00 | 1:00:00 | 55 | 59 | 53 | 57 | 56 | 56 | 55 | 54 | 54 |
| Apr 23 | 3:00:00 | 1:00:00 | 56 | 70 | 54 | 58 | 57 | 57 | 56 | 54 | 54 |
| Apr 23 | 4:00:00 | 1:00:00 | 59 | 77 | 54 | 68 | 65 | 62 | 56 | 55 | 54 |
| Apr 23 | 5:00:00 | 1:00:00 | 58 | 73 | 55 | 63 | 59 | 59 | 58 | 56 | 56 |
| Apr 23 | 6:00:00 | 1:00:00 | 57 | 72 | 55 | 62 | 59 | 58 | 57 | 56 | 55 |
| Apr 23 | 7:00:00 | 1:00:00 | 66 | 84 | 53 | 79 | 72 | 68 | 56 | 54 | 53 |
| Apr 23 | 8:00:00 | 1:00:00 | 57 | 73 | 51 | 67 | 61 | 59 | 55 | 53 | 52 |
| Apr 23 | 9:00:00 | 1:00:00 | 54 | 64 | 51 | 59 | 56 | 55 | 53 | 52 | 52 |
| Apr 23 | 10:00:00 | 1:00:00 | 63 | 78 | 52 | 74 | 70 | 67 | 54 | 53 | 52 |
| Apr 23 | 11:00:00 | 1:00:00 | 61 | 81 | 52 | 73 | 68 | 62 | 55 | 53 | 53 |
| Apr 23 | 12:00:00 | 1:00:00 | 55 | 68 | 52 | 60 | 57 | 56 | 54 | 53 | 53 |
| Apr 23 | 13:00:00 | 1:00:00 | 58 | 73 | 53 | 69 | 61 | 59 | 55 | 54 | 53 |

# Location 1 - North Site Boundary - Day 2

The graph below shows the measured, and calculated time histories beginning on April 23, 2025




Hourly Interval Report starting at April 23, 2025
All Sound Pressure Levels presented in dBA

| Date | Time | Duration | $L_{eq}$ | $L_{max}$ | $L_{min}$ | $L_1$ | $L_5$ | $L_{10}$ | $L_{50}$ | $L_{90}$ | $L_{99}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | - | 24:00:00 | 60 | 94 | 49 | 72 | 64 | 62 | 55 | 53 | 52 |
| Apr 23 | 14:00:00 | 1:00:00 | 56 | 66 | 53 | 62 | 59 | 57 | 55 | 54 | 54 |
| Apr 23 | 15:00:00 | 1:00:00 | 55 | 66 | 52 | 60 | 57 | 56 | 54 | 53 | 53 |
| Apr 23 | 16:00:00 | 1:00:00 | 55 | 74 | 52 | 59 | 57 | 56 | 54 | 53 | 53 |
| Apr 23 | 17:00:00 | 1:00:00 | 64 | 87 | 49 | 76 | 70 | 64 | 54 | 52 | 51 |
| Apr 23 | 18:00:00 | 1:00:00 | 62 | 82 | 52 | 72 | 68 | 66 | 57 | 53 | 53 |
| Apr 23 | 19:00:00 | 1:00:00 | 62 | 72 | 52 | 66 | 65 | 65 | 62 | 53 | 53 |
| Apr 23 | 20:00:00 | 1:00:00 | 65 | 85 | 53 | 76 | 71 | 65 | 62 | 54 | 53 |
| Apr 23 | 21:00:00 | 1:00:00 | 55 | 72 | 52 | 62 | 56 | 55 | 54 | 53 | 53 |
| Apr 23 | 22:00:00 | 1:00:00 | 55 | 64 | 52 | 58 | 56 | 56 | 54 | 53 | 53 |
| Apr 23 | 23:00:00 | 1:00:00 | 55 | 73 | 52 | 61 | 56 | 55 | 54 | 54 | 53 |
| Apr 24 | 0:00:00 | 1:00:00 | 54 | 60 | 53 | 56 | 56 | 55 | 54 | 54 | 53 |
| Apr 24 | 1:00:00 | 1:00:00 | 55 | 59 | 53 | 57 | 56 | 56 | 55 | 54 | 54 |
| Apr 24 | 2:00:00 | 1:00:00 | 56 | 58 | 54 | 58 | 57 | 57 | 56 | 55 | 54 |
| Apr 24 | 3:00:00 | 1:00:00 | 55 | 68 | 54 | 57 | 56 | 56 | 55 | 54 | 54 |
| Apr 24 | 4:00:00 | 1:00:00 | 62 | 94 | 54 | 67 | 59 | 57 | 55 | 55 | 54 |
| Apr 24 | 5:00:00 | 1:00:00 | 57 | 71 | 54 | 61 | 58 | 57 | 56 | 55 | 55 |
| Apr 24 | 6:00:00 | 1:00:00 | 57 | 69 | 55 | 62 | 59 | 58 | 57 | 56 | 56 |
| Apr 24 | 7:00:00 | 1:00:00 | 63 | 79 | 53 | 76 | 71 | 64 | 56 | 55 | 54 |
| Apr 24 | 8:00:00 | 1:00:00 | 59 | 75 | 52 | 70 | 65 | 60 | 54 | 53 | 53 |
| Apr 24 | 9:00:00 | 1:00:00 | 58 | 75 | 52 | 71 | 63 | 57 | 54 | 53 | 52 |
| Apr 24 | 10:00:00 | 1:00:00 | 66 | 84 | 50 | 77 | 74 | 71 | 59 | 53 | 52 |
| Apr 24 | 11:00:00 | 1:00:00 | 64 | 84 | 52 | 77 | 68 | 61 | 54 | 53 | 52 |
| Apr 24 | 12:00:00 | 1:00:00 | 60 | 84 | 52 | 71 | 64 | 61 | 54 | 53 | 53 |
| Apr 24 | 13:00:00 | 1:00:00 | 57 | 74 | 52 | 69 | 59 | 57 | 55 | 54 | 53 |

# Location 2 - West Site Boundary

| | | | |
|---|---|---|---|
| Project ID: | 4446-25A | Address: | 100 Amherst Ave, North Vancouver, BC V7H 1T9 |
| Start Date: | April 22, 2025 | Instrument: | 01dB FUSION |
| Start Time: | 14:00 | Serial No: | 14045 |
| Duration: | 48 hours | Measured by: | LR & SW |

**Location Description**

The microphone was located 2 m above the ground.

**Ambient Noise Description**

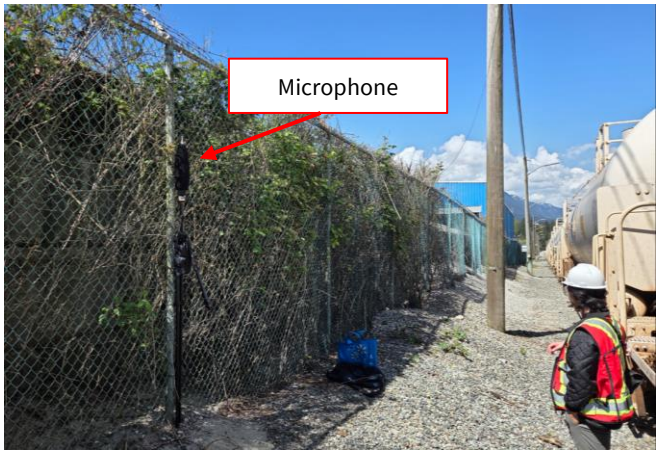
The dominant noise source was the surrounding operational noise.

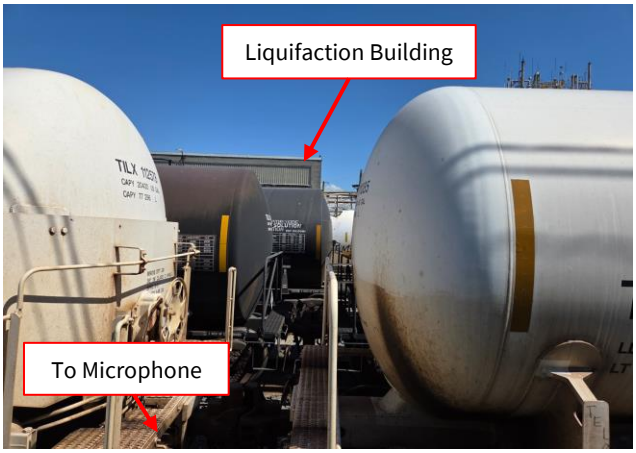
**Environmental Conditions**

The weather was sunny throughout measurement.

**Purpose of Monitoring Location**

This monitoring location is representative of the current environmental noise conditions adjacent to the west port property line.

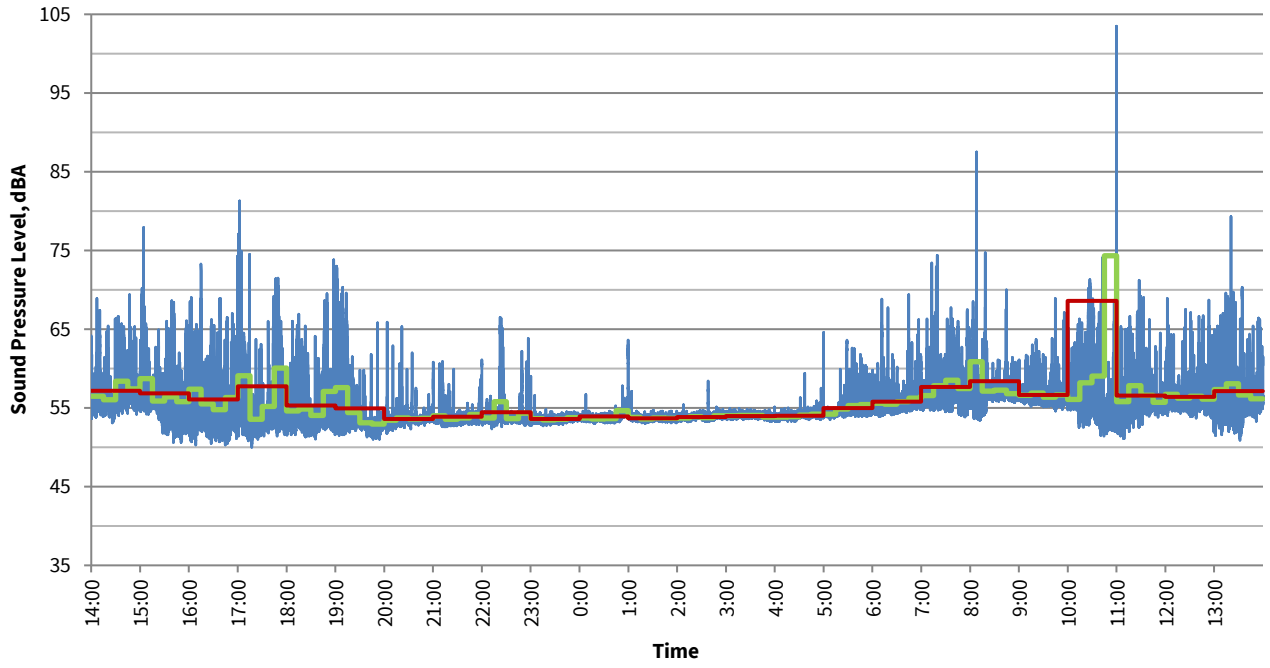





# Location 2 - West Site Boundary - Day 1

The graph below shows the measured, and calculated time histories beginning on April 22, 2025

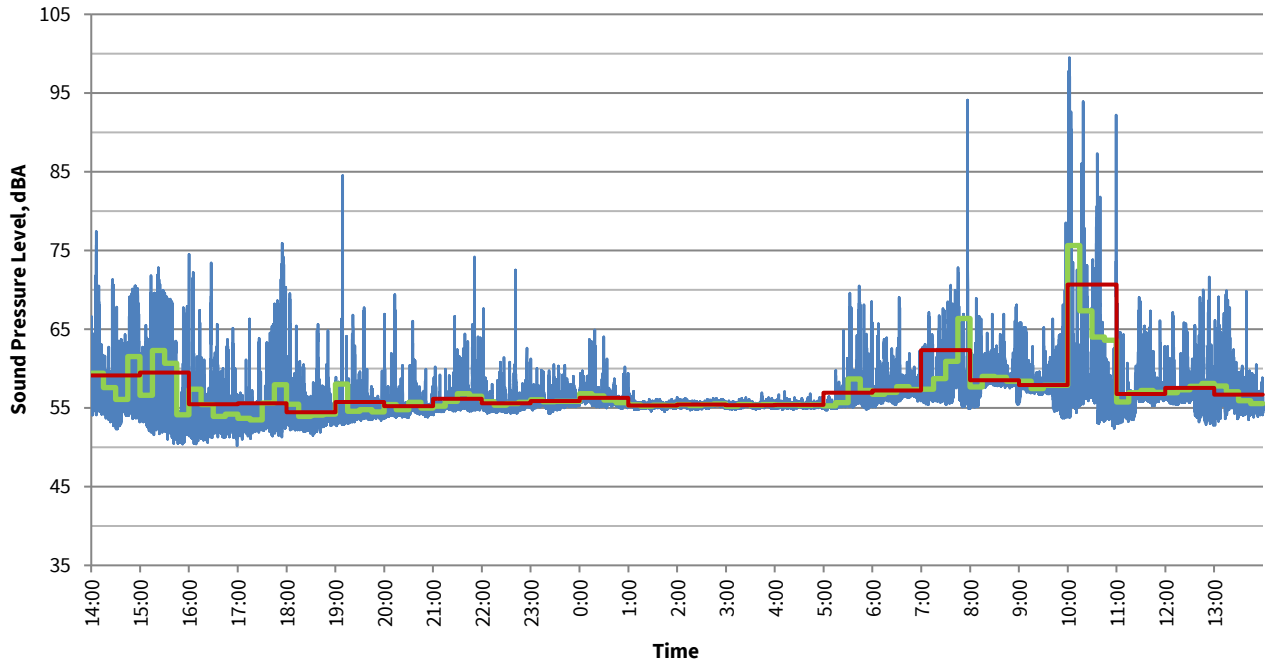



Hourly Interval Report starting at April 22, 2025
All Sound Pressure Levels presented in dBA

| Date | Time | Duration | $L_{eq}$ | $L_{max}$ | $L_{min}$ | $L_{1}$ | $L_{5}$ | $L_{10}$ | $L_{50}$ | $L_{90}$ | $L_{99}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | - | 24:00:00 | 58 | 104 | 50 | 64 | 58 | 57 | 54 | 53 | 52 |
| Apr 22 | 14:00:00 | 1:00:00 | 57 | 69 | 53 | 64 | 61 | 59 | 56 | 55 | 54 |
| Apr 22 | 15:00:00 | 1:00:00 | 57 | 78 | 51 | 66 | 61 | 58 | 55 | 53 | 52 |
| Apr 22 | 16:00:00 | 1:00:00 | 56 | 73 | 50 | 66 | 62 | 58 | 53 | 52 | 51 |
| Apr 22 | 17:00:00 | 1:00:00 | 58 | 81 | 50 | 68 | 64 | 59 | 53 | 52 | 51 |
| Apr 22 | 18:00:00 | 1:00:00 | 55 | 74 | 51 | 65 | 59 | 57 | 53 | 52 | 52 |
| Apr 22 | 19:00:00 | 1:00:00 | 55 | 73 | 51 | 65 | 57 | 55 | 53 | 52 | 52 |
| Apr 22 | 20:00:00 | 1:00:00 | 54 | 66 | 52 | 56 | 54 | 54 | 53 | 53 | 52 |
| Apr 22 | 21:00:00 | 1:00:00 | 54 | 61 | 53 | 58 | 55 | 54 | 54 | 53 | 53 |
| Apr 22 | 22:00:00 | 1:00:00 | 54 | 67 | 52 | 62 | 56 | 55 | 54 | 53 | 53 |
| Apr 22 | 23:00:00 | 1:00:00 | 54 | 59 | 53 | 55 | 54 | 54 | 54 | 53 | 53 |
| Apr 23 | 0:00:00 | 1:00:00 | 54 | 64 | 53 | 57 | 55 | 54 | 54 | 53 | 53 |
| Apr 23 | 1:00:00 | 1:00:00 | 54 | 57 | 53 | 54 | 54 | 54 | 54 | 53 | 53 |
| Apr 23 | 2:00:00 | 1:00:00 | 54 | 58 | 53 | 54 | 54 | 54 | 54 | 54 | 53 |
| Apr 23 | 3:00:00 | 1:00:00 | 54 | 55 | 53 | 55 | 54 | 54 | 54 | 54 | 54 |
| Apr 23 | 4:00:00 | 1:00:00 | 54 | 59 | 53 | 55 | 54 | 54 | 54 | 54 | 53 |
| Apr 23 | 5:00:00 | 1:00:00 | 55 | 65 | 54 | 59 | 57 | 56 | 54 | 54 | 54 |
| Apr 23 | 6:00:00 | 1:00:00 | 56 | 69 | 54 | 61 | 58 | 57 | 55 | 55 | 54 |
| Apr 23 | 7:00:00 | 1:00:00 | 58 | 74 | 54 | 65 | 62 | 60 | 56 | 55 | 54 |
| Apr 23 | 8:00:00 | 1:00:00 | 58 | 88 | 53 | 63 | 59 | 58 | 56 | 55 | 54 |
| Apr 23 | 9:00:00 | 1:00:00 | 57 | 69 | 55 | 62 | 59 | 57 | 56 | 56 | 55 |
| Apr 23 | 10:00:00 | 1:00:00 | 69 | 104 | 51 | 67 | 62 | 60 | 55 | 53 | 52 |
| Apr 23 | 11:00:00 | 1:00:00 | 57 | 79 | 51 | 65 | 60 | 57 | 55 | 53 | 52 |
| Apr 23 | 12:00:00 | 1:00:00 | 56 | 69 | 52 | 64 | 58 | 57 | 56 | 55 | 54 |
| Apr 23 | 13:00:00 | 1:00:00 | 57 | 79 | 51 | 66 | 61 | 58 | 55 | 53 | 52 |

# Location 2 - West Site Boundary - Day 2

The graph below shows the measured, and calculated time histories beginning on April 23, 2025




Hourly Interval Report starting at April 23, 2025
All Sound Pressure Levels presented in dBA

| Date | Time | Duration | $L_{eq}$ | $L_{max}$ | $L_{min}$ | $L_1$ | $L_5$ | $L_{10}$ | $L_{50}$ | $L_{90}$ | $L_{99}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | - | 24:00:00 | 60 | 100 | 50 | 66 | 60 | 58 | 55 | 54 | 52 |
| Apr 23 | 14:00:00 | 1:00:00 | 59 | 77 | 52 | 69 | 66 | 61 | 56 | 54 | 53 |
| Apr 23 | 15:00:00 | 1:00:00 | 60 | 73 | 50 | 69 | 67 | 65 | 54 | 52 | 51 |
| Apr 23 | 16:00:00 | 1:00:00 | 55 | 75 | 50 | 64 | 58 | 56 | 53 | 52 | 51 |
| Apr 23 | 17:00:00 | 1:00:00 | 56 | 76 | 51 | 65 | 58 | 55 | 53 | 53 | 52 |
| Apr 23 | 18:00:00 | 1:00:00 | 54 | 70 | 52 | 60 | 57 | 56 | 54 | 53 | 52 |
| Apr 23 | 19:00:00 | 1:00:00 | 56 | 85 | 53 | 59 | 56 | 55 | 54 | 54 | 53 |
| Apr 23 | 20:00:00 | 1:00:00 | 55 | 69 | 54 | 59 | 57 | 56 | 55 | 54 | 54 |
| Apr 23 | 21:00:00 | 1:00:00 | 56 | 74 | 54 | 61 | 59 | 57 | 55 | 55 | 55 |
| Apr 23 | 22:00:00 | 1:00:00 | 56 | 73 | 54 | 60 | 57 | 56 | 55 | 55 | 55 |
| Apr 23 | 23:00:00 | 1:00:00 | 56 | 61 | 54 | 58 | 57 | 56 | 56 | 55 | 55 |
| Apr 24 | 0:00:00 | 1:00:00 | 56 | 65 | 55 | 60 | 58 | 57 | 56 | 55 | 55 |
| Apr 24 | 1:00:00 | 1:00:00 | 55 | 57 | 55 | 56 | 56 | 56 | 55 | 55 | 55 |
| Apr 24 | 2:00:00 | 1:00:00 | 55 | 56 | 55 | 56 | 56 | 56 | 55 | 55 | 55 |
| Apr 24 | 3:00:00 | 1:00:00 | 55 | 57 | 55 | 56 | 56 | 56 | 55 | 55 | 55 |
| Apr 24 | 4:00:00 | 1:00:00 | 55 | 57 | 55 | 56 | 56 | 56 | 55 | 55 | 55 |
| Apr 24 | 5:00:00 | 1:00:00 | 57 | 71 | 55 | 66 | 60 | 57 | 56 | 55 | 55 |
| Apr 24 | 6:00:00 | 1:00:00 | 57 | 69 | 55 | 62 | 59 | 58 | 57 | 56 | 55 |
| Apr 24 | 7:00:00 | 1:00:00 | 62 | 94 | 55 | 67 | 64 | 62 | 57 | 56 | 55 |
| Apr 24 | 8:00:00 | 1:00:00 | 59 | 69 | 55 | 63 | 60 | 60 | 58 | 56 | 55 |
| Apr 24 | 9:00:00 | 1:00:00 | 58 | 79 | 54 | 63 | 60 | 59 | 57 | 55 | 54 |
| Apr 24 | 10:00:00 | 1:00:00 | 71 | 100 | 52 | 76 | 66 | 60 | 56 | 54 | 53 |
| Apr 24 | 11:00:00 | 1:00:00 | 57 | 69 | 53 | 64 | 58 | 58 | 56 | 54 | 54 |
| Apr 24 | 12:00:00 | 1:00:00 | 58 | 72 | 53 | 65 | 61 | 59 | 57 | 54 | 53 |
| Apr 24 | 13:00:00 | 1:00:00 | 57 | 70 | 53 | 64 | 59 | 58 | 56 | 55 | 54 |

ISL Engineering and Land Services
201-3999 Henning Drive, Burnaby, BC V5C 6P9




# Archaeological Overview Assessment for Chemtrade Electrochem Safety Upgrades, North Vancouver, BC

Sḵwx̱wú7mesh Úxwumixw Archaeological Investigation Permit SNAIP 25-0150

Stó:lō Heritage Investigation Permit SHIP 2025-114

səlílwətaʔɬ Cultural Heritage Investigation Permit TWN-25146-25075

xʷməθkʷəy̓əm Heritage Research/Investigation Permit MIB-2025-071-AOA-PFR

Chemtrade Electrochem Inc

100 Amherst Ave, North Vancouver BC, V7H 1T9

Final Report

September 2025



ISL Engineering and Land Services Ltd. Is an award-winning full-service consulting firm dedicated to working with all levels of government and the private sector to deliver planning and design solutions for transportation, water, and land projects.

Proudly certified as a leader in quality management under Engineers and Geoscientists BC’s OQM Program from 2014 to 2021.

# Credits

| | |
|---|---|
| Project Manager | Carling Reid, BA |
| Field Director | Ryan Sagabarra, BA, RPCA |
| Archaeologists | Carling Reid |
| First Nation Archaeological Field Representatives | **sə̓ lílwətaʔɬ (Tsleil-Waututh Nation)**<br>Darrell Gus<br><br>**Sḵwx̱wú7mesh Úxwumixw (Squamish Nation)**<br>Aaron Skye<br>Trevor McDiarmid |
| Report Author | Caitlin Thurley, MSc<br>Carling Reid |
| Technical Reviewer | Ryan Sagarbarria<br>Katie Sperry, MA |

# Management Summary

At the request of Chemtrade Electrochem Inc. (Chemtrade), ISL Engineering and Land Services Ltd. (ISL) conducted an archaeological overview assessment (AOA) in support of the Chemtrade Safety Upgrades Project (the Project) in North Vancouver, BC. The Project involves safety improvements at Chemtrade's chlor-alkali manufacturing plant on the north shore of Burrard Inlet at 100 Amherst Ave (the Study area, Figure 1).

Based on a review of the Consultative Areas Database, maintained by the British Columbia Ministry of Indigenous Relations and Reconciliation, ISL understands the Study area falls within the area of interest for the following First Nations and First Nation organizations: xʷməθkʷəy̓ əm (Musqueam), Sḵwx̱wú7mesh Úxwumixw (Squamish Nation), Stó:lō[1] , and səlilwətaɬ (Tsleil-Waututh) Nation (MIRR 2025).

The objectives of the AOA were to: ascertain previously identified archaeological sites pertinent to the Study area; identify and assess archaeological potential in the Study area; evaluate, and if necessary, recommend further archaeological investigations and/or mitigations (e.g., archaeological impact assessment) or precautionary measures in the case of unanticipated archaeological materials (e.g. chance find protocols). The AOA followed the British Columbia Archaeological Impact Assessment Guidelines[2] and Archaeological Overview Assessments Guidelines[3] , and was conducted under the Archaeological Investigation Permit SNAIP 25-0150, Stó:lo Heritage Investigation Permit SHIP 2024-114, sḵwx̱wú7mesh Cultural Heritage Investigation Permit TWN-25146-25075, and xʷməθkʷəy̓əm Heritage Research/Investigation Permit MIB-2025-071-AOA-PFR.

A preliminary field reconnaissance (PFR) was conducted on June 3rd, 2025, by Carling Red (ISL), Ryan Sagarbarria (ISL), Darrell Gus (sə lílwətaʔɬ), Aaron Skye (Sḵwx̱wú7mesh Úxwumixw), and Trevor McDiarmid (Sḵwx̱wú7mesh Úxwumixw). xʷməθkʷəy̓ əm and Stó:lō Research and Resource Management Centre were contacted to participate; they deferred participation to other groups.

Based on the results presented in this AOA, we consider the Proposed Components 1 through 3 within the Study Area to have low archaeological potential, and we provide the following archaeological recommendations for consideration:

- ISL recommends that a Project-specific chance find protocol (CFP) be developed by a qualified archaeologist and presented to contractors before undertaking subsurface ground-altering activities (i.e., in areas of low archaeological potential). This will guide the appropriate procedures should archaeological materials/belongings or suspected archaeological materials/belongings be encountered while an archaeologist is not on site.

- If future ground-altering activities are proposed in the northern portion of the Study Area, particularly along or north of the historic 1792 shoreline, additional archaeological assessment will be required due to the elevated potential for intact cultural material in those areas.

- Should unanticipated HCA-protected archaeological material/belongings be encountered (e.g., stone artifacts, Ancestral Remains, unusual objects, shell deposits, and/or other features of possible cultural value) during construction activities, stop all ground-disturbing activities in the vicinity (approximately 30 m) of the find/feature and notify a professional archaeologist, the Archaeology Branch of British Columbia, and First Nation groups or organizations of the discovery. An HCA Site Alteration Permit (Section 12.4) is required before any land alterations can occur within an archaeological site, whether previously known, or unexpectedly found.

[1] Represented by the Stó:lō Research and Resource Management Centre on archaeological matters
[2] Available at: archaeological_impact_assessment_guidelines.pdf (gov.bc.ca)
[3] Available at: Microsoft Word - AOA_Guidelines_2023 (gov.bc.ca)

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# 1.0 Introduction

At the request of Chemtrade Electrochem Inc. (Chemtrade), ISL Engineering and Land Services Ltd. (ISL) conducted an archaeological overview assessment (AOA) in support of the Chemtrade Safety Upgrades Project (the Project), in North Vancouver, BC. The Project involves safety improvements at Chemtrade's chlor-alkali manufacturing plant on the north shore of Burrard Inlet at 100 Amherst Ave (the Study area) and is aimed at reducing the volume of liquid chlorine stored on-site and implementing safety systems to manage potential releases during the loading process.

The AOA is based on the *British Columbia Archaeological Impact Assessment Guidelines*[1] and *Archaeological Overview Assessments as General Land Use Planning Tools – Provincial Standards and Guidelines*[2], and includes the following objectives:

- Review and identify previous studies and registered archaeological sites[3] pertinent to the Study area;
- Identify and assess archaeological potential in the Study area; and
- Evaluate and recommend, if necessary, further archaeological investigations (e.g., archaeological impact assessment, chance find protocols).

# 2.0 Project Development Information

The Project involves a series of safety upgrades at Chemtrade's chlor-alkali manufacturing plant, which is bordered by industrial developments to the east, west, and north, and by tidal mudflats to the south (Figure 1).

The planned work includes three (3) proposed components: the construction of a new enclosed Chlorine Loading Railcar Station Building, the installation of a new Liquefier Tower and EVS Skid (Proposed Component 1; Figure 2), and the development of a new EVS Waste Hypo Storage Tank Farm (Proposed Component 2; Figure 2). Both components will involve shallow excavation and the installation of micropile foundations, which are currently in the design phase.

The Chlorine Railcar Building will have a footprint of approximately 38 meters (m) by 17 m. Excavation for this building will be 46 m by 17 m to a depth of 0.9 m, with localized excavation reaching 3.0 m where a sump pit and rail scale will be installed. The Liquefier Tower will have an L-shaped foundation with a footprint of approximately 13 m by 17 m. Excavation for this building will be 15 m by 17 m to a depth of 0.9 m. The Hypo Tank Farm will have a footprint of approximately 42 m by 16 m. Excavation for this building will be 46 m by 17 m to a depth of 0.8 m. All three structures will be reinforced using micropiles, consisting of approximately 75 mm diameter holes drilled to a depth of 12 m and filled with grout.

Additionally, there are plans to demolish an old cell house down to the slab. A trench approximately 1.2 metres deep, 1.2 metres wide, and 6 metres long will also be excavated along the southeast side of the building to access existing drainage piping. In addition, four to six small footings (each measuring approximately 0.3 x 0.3 x 0.3 metres) will be installed along the west side of the building (Proposed Component 3; Figure 2).

[1] Available at: archaeological_impact_assessment_guidelines.pdf (gov.bc.ca) (Archaeology Branch 1998)

[2] Available at: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/archaeology/forms-publications/aoa_guidelines.pdf (Archaeology Branch 2023)

[3] Archaeological sites are locations with the identifiable physical remains (materials, features or deposits related to settlement and land use) of human activity. These remains (e.g., stone and bone belongings/artifacts, habitation structures) in BC are associated with pre-contact and post-contact time periods, whereas historical sites are attributed to post-contact Euro Canadian remains but may also include Indigenous belongings/artifacts.

## 2.1 Potential Activities within the Study Area

Proposed Project land-altering activities that may interact with yet-to-be-identified archaeological sites or deposits can include but are not limited to, the following:

- Excavation and removal of sediments below the existing ground surface;
- Upgrades to subsurface utilities (e.g., sewer, storm, and water services) and associated infrastructure (e.g., lawn basins, water meter); and
- Earthworks (e.g., landscaping, leveling, fill placement).

These activities have the potential to impair and remove contextual information necessary for interpreting archaeological site function and age; they also expose and disturb cultural deposits and features; and damage belongings/artifacts of as-yet-identified archaeological sites. These impacts on archaeological sites are irreversible and permanent (Davis et al. 2004; Williams et al. 2002).

## 2.2 Regulatory Legislation

### Heritage Conservation Act

The *Heritage Conservation Act* (HCA) is the primary Provincial legislation regulating interactions between individuals, communities, organizations, and corporations with heritage resources. Under the HCA, all archaeological sites on provincial Crown or private land that predate A.D. 1846 are automatically provided protection.

The Archaeology Branch (Ministry of Forests) is responsible for regulating the HCA, issuing HCA permits, maintaining a recorded archaeological site database (the Provincial Heritage Register), and managing referrals from various development agencies. *Heritage Conservation Act* permits are required for archaeological inspections and investigations with the intent to locate an archaeological site under Section 12.2 and for modification or interaction with heritage sites under Section 12.4.

Types of heritage sites protected automatically under section 12.1 of the HCA include:

- Archaeological sites (intact or disturbed);
- Burials with archaeological or historical value;
- Indigenous rock art sites with archaeological or historical value;
- Ship and aircraft wrecks (including modern vessels) after two or more years.

Additional heritage sites may be afforded protection under Sections 9 and 11.1 of the HCA if they are designated with historical or heritage significance. These sites typically include historical residences, places of worship, community centers, and parks.

### Municipal By-laws

Historical sites that are not afforded protection under the HCA may be protected within municipal bylaws under the authority of the BC Local Government Act (Government of British Columbia 2015). Historical heritage sites are given heritage designations by municipal by-laws and identified in Community Heritage Registers (CHRs), the Provincial Heritage Register (PHR), and/or the Canadian Register managed by Parks Canada.

### First Nation Heritage Permitting and Policies

Some First Nations groups and organizations have developed Nation-specific heritage policies and permitting systems around archaeological management, treatment of belongings/artifacts, and cultural places. In general, these policies provide oversight and guidance around archaeological work within each respective First Nations' territory so that cultural protocols are observed when conducting assessments, particularly around Ancestral Remains, spiritual locations, traditional-use sites, and other heritage resources.

# 3.0 Methodology

Archaeological overview assessments are developed through a combination of research (i.e., reviewing First Nations land-use patterns, past environmental history, and known heritage site locations) and professional judgment, identifying areas likely to contain archaeological sites. The methods employed for the Project are outlined below.

## 3.1 Documentary Research

A thorough review of relevant and accessible data sources, including but not limited to:

- Existing records, including the B.C. Archaeological Site Inventory (maintained by the Archaeology Branch, and accessible using the Remote Access to Archaeological Data [RAAD] application, part of the PHR), legal land survey records, and other pertinent records and inventory files (Ministry of Forests, Province of British Columbia 2025b);
- Previous archaeological investigations that overlap or are near the Study area (Ministry of Forests, Province of British Columbia 2025a);
- Relevant information from published and unpublished sources, such as local and regional history (e.g., the Canadian Register of Historic Places (Parks Canada 2025) and District of North Vancouver Community Heritage Register (District of North Vancouver 2020), prehistory, and ethnography;
- Relevant paleoecological, geomorphological, and pedological studies to assess past environmental conditions that may have influenced cultural adaptations; and
- Available historical aerial photographs (University of British Columbia 2025), historical charts, and orthographic maps (e.g., for assessing the potential for past human use.

## 3.2 First Nation Engagement

First Nations groups and/or organizations whose interests overlap the Study area were identified using the publicly available Consultative Areas Database (CAD) maintained by the BC Ministry of Indigenous Relations and Reconciliation (Ministry of Indigenous Relations and Reconciliation (MIRR) 2025). These identified groups and/or organizations were contacted regarding this AOA, and heritage permits were requested from those with heritage permitting systems. Groups and organizations without heritage permitting were provided AOA notification letters and invited to share knowledge that could inform the archaeological potential assessment and provide comments on the Study area and/or the Project.

The purpose of engaging First Nations is to share information on the Project scope and intent of the Study, as well as compile knowledge regarding the location, distribution, and significance of known archaeological sites, which may facilitate reconstructing and/or confirming settlement patterns, site function, land use, and subsistence practices.

## 3.3 Preliminary Field Reconnaissance

A preliminary field reconnaissance (PFR) was conducted to visually examine the Study area  to search for surficial archaeological materials and features and to refine the potential assessment of the Study area, as identified during the background review of the AOA. A PFR presents an opportunity for data collection related to past land use, disturbances, micro-topography, and natural resources. Observational data is collected through field notes, photography, and GPS data points, recorded with a handheld GPS device (e.g., Garmin GPSMAP 65S).

## 3.4 Archaeological Potential

For this report, the term “archaeological potential” refers to locations and their likelihood of containing archaeological deposits or features. Archaeological potential ratings for areas are generally based on comparative analysis of known recorded archaeological sites, cultural practices, and locational characteristics (e.g., geological / terrain / micro topographical features, distance to water features, slope, age of forest cover, aspect, soil drainage, etc.) that typically correspond with archaeological site formation (Comer et al. 2013; Kroll et al. 1991; Nakoinz et al. 2016).

In general, most locations in the Lower Mainland are considered to have some potential to contain archaeological sites (deposits or features) and are given an archaeological potential rating between “low” to “high” based on the possibility of the proposed project interacting with archeological site deposits. An exception to this assumption is buildings or infrastructure that have fully excavated the substrata below terrestrially available surfaces (i.e., underground parking or tunnel entrances).

It should be noted that assigning archaeological potential does not identify exact archaeological site locations, but rather delineates areas where there is the likelihood of sites to be present and observable through standard archaeological investigation methods (e.g., subsurface tests, archaeological monitoring).

# 4.0 Results

The following sections provide the results of our documentary research, First Nation engagement, and archaeological potential assessment for the Study area.

## 4.1 Documentary Research

### 4.1.1 Biophysical Characteristics

Characteristics that combine biological and physical features, such as vegetation, hydrography, relief, climate, raw materials (i.e., stone), and others, are reviewed to better understand the interactions between people and the natural landscape. Reviewing these characteristics provides an understanding of potential past land use and natural resource availability in a localized area. Additional characteristics, including access to freshwater, sheltered areas, and availability of mammals and plant species found in specific locations, can correspond to archaeological site formation and influence the density, distribution, variety, and potential significance of archaeological sites.

The Study Area is located within the District of North Vancouver, British Columbia. This area of southern British Columbia lies within the Western Cordillera region of North America, a region characterized by a complex system of mountains, plateaus, fjords, lakes, and alluvial valleys. Burrard Inlet, a shallow-sided coastal fjord, is the major coastal physiographic feature of the British Columbia Lower Mainland and home to the City of Vancouver's primary port, which is the largest port in Canada.

Burrard Inlet is oriented west to east from Point Atkinson on the Strait of Georgia, Salish Sea, to Port Moody at its eastern extent, and is about 25 kilometres (km) long. Its calm waters are protected from the open ocean, making it an ideal area for human habitation. Today, Burrard Inlet is heavily industrialized, with some residential and commercial use on the shoreline. Most activity is related to the port, including railyards, terminals for container and bulk cargo ships, grain elevators, and oil refineries (Armitage 2001).

The Study area is situated in an industrial neighbourhood, located south of Dollarton Highway, approximately 394 m east of the Seymour River (Figure 1). The property is situated directly on the Burrard Inlet shoreline; an area that would have supported a range of traditionally harvested marine resources, including butter clam, horse clam, whelk, and native Pacific oyster, resident fish, eelgrass and kelp beds, as well as a variety of wading birds. The Study area is approximately 3-9 metres above sea level (masl).

#### Paleoclimate

Glaciation and climate have been dominating aspects of shaping the terrain of British Columbia. During the last glacial maximum, the Cordilleran Ice Sheet, which covered almost all of British Columbia, likely covered the Study Area with up to two (2) km of ice (Clague et al. 2011). Sedimentary records of lacustrine sediments demonstrate that deglaciation began around 13,000 years before present (BP). Pollen analysis demonstrates that Douglas fir became increasingly common. At this time, summer temperatures were slightly warmer than present by around 3 degrees Celsius, with winter conditions slightly cooler than today (Millennia Research Limited 1997). After 7,000 BP, the climate of BC became cooler, with greater precipitation, which increased forest area and lake levels. The climate stabilized to modern levels of approximately 4,500-3,000 BP.

These paleoclimatic fluctuations would have had significant influences on local populations and, therefore, their cultural remains. It was around this climate stabilization period that western redcedar trees became more populous on the West Coast (Hebda 1999). By 5,000 BP, these climate conditions also provided ideal conditions for salmonid populations, another essential resource for the indigenous people of the Northwest Coast (Waples et al. 2008). Stabilization of sea levels also allowed for greater population sedentism, with sites being occupied for longer, and therefore becoming more visible in the archaeological record.

## Geological Formation

Reviewing geological formations within the Study area provides additional insight into when the areas may have been terrestrially available for occupation, as well as identifying localized natural resources that may have drawn populations to inhabit and use an area.

### BEDROCK

Bedrock geology consists of consolidated rock, typically beneath surface materials. Exposed bedrock can be seen on some mountaintops, along rocky coastlines, in stone quarries, and on plateaus. Often, these visible exposures of bedrock are called outcrops. Outcrops can be exposed through natural processes such as erosion or tectonic uplift. Determining the depth and type of bedrock helps describe the natural history of a region. Studying bedrock geology can offer clues about the extent of glacial coverage during the Ice Age, trace the formation of ancient mountain ranges, and identify rock formations that share a common origin and distribution.

The bedrock geology within the Study area is characterized by the Nanaimo Group (uKN_M), dating to the Upper Cretaceous period (around 85 to 65 million years ago). The Nanaimo Group consists of sandstone, mudstone, carbonaceous siltstone, conglomerate, and coal. This bedrock has high chert and quartz content, both of which are materials used in the production of chipped stone tools (Hamblin et al. 2014; Mustard 1994; Andrefsky Jr. 2005).

### SURFICIAL

Surficial geology, also referred to as Quaternary geology, refers to the unconsolidated geologic materials lying on top of the bedrock. By describing the texture, composition, chemistry, stratigraphy, three-dimensional geometry, and morphologic expression of these sediments, geologists attempt to reconstruct how the landscape of British Columbia has evolved through repeated glacial and interglacial states in the last 2.6 million years.

Detailed study of surficial materials can help distinguish agents of erosion, transport, and deposition (water, wind, ice, gravity), quantify the physical conditions under which landforms developed, and thereby document past paleogeographic elements and depositional systems. Such paleogeographic reconstructions have predictive value, enabling geologists to extrapolate interpretations based on surface data into the subsurface and laterally into unknown areas. They are particularly useful in the search for mineral and aggregate deposits, suitable construction sites, and natural hazard mitigation.

The surficial geology in the Study area is primarily characterized by littoral and nearshore sediments, which encompass sand and gravel deposits of varying thickness. These sediments have been formed through a variety of geological processes, including sheet sands, deltas, and extensive beach formations, both in marine and glaciomarine environments. Their composition, which is typically sand, silt, clay, and gravel, is shaped by the dynamic interaction of geological, hydrological, and environmental forces, such as wave action, tides, currents, and local topography. Littoral and nearshore sediments provide vital habitats for marine and aquatic organisms and act as natural buffers, dissipating wave energy and safeguarding coastlines from erosion.

## Ecology

### BIOGEOCLIMATIC CLASSIFICATION

Examining the ecological classification of the Study area can provide details about available resources that populations would have sought out and used (i.e., flora and fauna). It can also help identify possible archaeological site types based on available resources and how they are gathered and processed.

The Study area is within the Coastal Western Hemlock Dry Maritime (CWHdm) biogeoclimatic subzone, one of the most productive zones in British Columbia for overall biomass (Green et al. 1994; Jones et al. 1978). The climate is characterized by relatively dry, warm summers and rainy, mild winters. The mean annual precipitation ranges from 1,340 mm to 2,400 mm (Green et al. 1994). The current flora of the area is a combination of native and non-native species. Western hemlock (*Tsuga heterophylla*) is the dominant forest cover for this zone and is typically accompanied by western redcedar (*Thuja plicata*) and Douglas-fir (*Pseudotsuga menziesii*). The understory is

primarily composed of salal (*Gaultheria shallon*), red huckleberry (*Vaccinium parvifolium*), and several moss species that make up the ground cover (Green et al. 1994; Meidinger et al. 1991). Trees and plants have a long, deep history of use and stewardship by Indigenous peoples (Turner 1979; Turner 1999; Turner 2014).

Animal species of subsistence and cultural importance that would have been found in the Study Area in the past include large mammals such as black bear (*Ursus americanus*) and mule deer (*Odocoileus hemionus*). Various bird species, including waterfowl and eagles, would also have been common. Burrard Inlet serves as a significant source of fish, particularly salmon, with 5five species migrating through the inlet and into freshwater sources.

In addition to the sustenance value, many of these animals have long been valued for their fur, hides, bones, antlers, and feathers, which have been, and in some cases continue to be, used in the creation of textiles, tools, and other cultural items. Certain species (e.g., bears, wolves, eagles) are valued for cultural and spiritual reasons by local cultures. While many of these faunae are no longer found in the area due to urbanization, their bones, when identified in archaeological sites, provide useful data about past environments and human resource acquisition and use.

#### WATERWAYS

Waterways are essential natural and cultural resources, regardless of whether their physical expressions are present, altered, or lost. Rivers, creeks, and estuaries not only offer freshwater sources but also serve as vital elements for sustenance through activities such as fishing and hunting game animals, and the procurement of raw materials for technology. They play a significant role as natural territorial delineators and function as travel routes, highlighting their overall significance in both environmental and cultural contexts.

Seymour River, located approximately 394 m west of the Study area, was traditionally used by Indigenous peoples for fishing and providing other marine resources, including salmon, clams, and crabs (Matthews 2011). Additionally, the Study area partially overlaps with the 1792 pre-contact shoreline of the Burrard Inlet, as mapped by the Tsleil-Waututh Nation using historical and archaeological data (Tsleil-Waututh First Nation 2025a). Proposed Component 1 partially overlaps with the shoreline, while Proposed Components 2 and 3 are located beyond the 1792 shoreline within the Burrard Inlet (Figure 3). This shoreline represents the extent of the shoreline before significant colonial and industrial alteration. Saltwater fish, shellfish, and sea mammals would have been available nearby in the Burrard Inlet. For Indigenous peoples, these species have long provided food and raw materials such as hide, bone, antlers, and horn for manufacturing clothing, tools, and other artifacts/belongings. Salmon, in particular, are a keystone species and have held enduring importance not only as a food source, but also for their ceremonial and social significance within Ancestral and contemporary coastal First Nations. Birds were traditionally hunted for sustenance, and their feathers remain important for ceremonial regalia and other social and cultural purposes.

### 4.1.2 First Peoples' Land Use

#### ETHNOGRAPHIC SETTING

A review of ethnographic information offers context regarding the types of archaeological sites that might be encountered within the Study area. The following section is intended to place archaeological resource potential within the Study area into a cultural context. This summary is not intended to represent a comprehensive overview of lifeways or landscape use, nor can it adequately reflect the traditional culture as it was known in the past and experienced today by descendant communities. It is important to acknowledge that many available ethnographies written during the 19th and 20th centuries have inherent source biases as they are products or observations by non-community members and may not depict accurate or thorough representations of these communities and cultures. Local detailed ethnographic reports are available from Barnett (1938; 1955), Carlson (2001), Duff (1952), Harris (1994), Hill-Tout (1905), Lamb (1960), Maud (1978a; 1978b), Morin (2015), and Suttles (1951; 1987; 1990a; 1990b). In addition to the above-mentioned sources, some Nations provide their independent publications or sources expanding the stories and views, see Musqueam Indian Band (2025b; 2025a), Squamish Nation (2025), Stó:lō Nation (2025), and Tsleil-Waututh Nation (2025c; 2025b).

The Study area lies within the traditional territory of the səlilwətaɬ (Tsleil-Waututh Nation), Sḵwx̱wú7mesh Úxwumixw (Squamish Nation), Stó:lō, and xʷməθkʷəy̓əm (Musqueam Indian Band). These Nations are part of the 23-language-speaking groups historically referred to as the 'Coast Salish,' a term that does not reflect the individuality of these communities and their respective languages. xʷməθkʷəy̓əm and səlilwətaɬ are speakers of the Downriver hən̓q̓əmin̓əm̓ language, used throughout the Lower Mainland and down through the Fraser River delta (Musqueam First Nation 2025b; Tsleil-Waututh First Nation 2025c). Stó:lō Nation are speakers of Upriver Halq'eméylem, used throughout the Lower Mainland and up the Fraser River and its tributaries to Sawmill Creek (known as 5 Mile Creek) above Yale, BC (Stó:lō Research & Resource Management Centre 2025; Stó:lō Service Agency 2025). Sḵwx̱wú7mesh Úxwumixw speaks Sḵwx̱wú7mesh sníchim, an independent language, though also part of the greater Salishan language family (Barnett 1955; Suttles 2004; Suttles 1990b; Squamish First Nation 2025). Sḵwx̱wú7mesh sníchim is spoken from the present-day cities of Metro Vancouver, north through Howe Sound, and up to Whistler, BC.

For these groups, aquatic resources represent a major staple, with fishing being a primary social and economic driver in the region (Morin 2015; Efford et al. 2023; Stewart 1977; Barnett 1955; Suttles 1990a; Suttles 1990b; Suttles 2004). Five (5) species of salmon (sockeye, coho, pink, chum, and chinook) are available within the waters of the Salish Sea and are an essential part of local diets (Efford et al. 2023). Traditionally, salmon was eaten fresh and smoked or dried to keep over winter (Carlson 2001; Duff 1952; Morin 2015; Stewart 1977), and continues to be an important food resource and holds cultural and spiritual value (Bennett et al. 2018). The importance of salmon is underlined by the predominance of their recovery within archaeological assemblages across the Lower Mainland (Efford et al. 2023; Ham 1982; Patton et al. 2019). Other important fish species documented within site assemblages included herring, sturgeon, and eulachon (Barnett 1955; Patton et al. 2019).

Fishing methods were highly varied and carefully adapted to local environmental conditions and targeted species. These technologies, including reef nets in saltwater environments, dip nets during spawning season, harpoons, leisters, spears, baskets, and weirs (Barnett 1955; Hill-Tout 1978a; Hill-Tout 1978b, 197; Stewart 1977; Suttles 1990a; Suttles 2004), reflect deep ecological knowledge passed down through generations. Traditional harvesting technologies, such as dip netting and weirs, continue to be practiced today despite efforts of colonial governments in the 19$^{th}$ and 20$^{th}$ centuries to extinguish Indigenous rights (Atlas et al. 2021). Additional important maritime resources included mollusks and crustaceans, harvested during tidal rotations, as well as sea birds and sea mammals (Hill-Tout 1978a; Hill-Tout 1978b; Efford et al. 2023). Mollusks are one of the most archaeologically visible marine species, and shell-bearing cultural sediments can often be found in coastal settlements. This culture-bearing sediment offers a stratigraphic record of sequential cultural shell depositions that can be used to decipher dietary preference and seasonal variation in food consumption. It also provides soil conditions known to preserve organic materials and belongings (Ames et al. 1999; Borden 1970; Ham 1982; Morin 2015).

Alongside maritime and aquatic resources, terrestrial subsistence strategies also played an important role and continue to be a traditional food source. The hunting and trapping of terrestrial animals provided, and in many cases still provide, meat for food, bones for tools, and hide for clothing and ceremonial use (Barnett 1955; Hill-Tout 1978a; Hill-Tout 1978b). Notable species include elk, deer, and bear (Barnett 1955; Hill-Tout 1978a; Hill-Tout 1978b; Khahtsahlano et al. 1955). The utilization of terrestrial subsistence strategies is visible in the faunal assemblages recovered from archaeological sites across southwestern B.C. (Driver 1993; Ham 1982, 198; Morin 2015; Stewart 1996).

Native plants have long held a wide range of uses and continue to be important for food, medicine, and cultural practices. Edible species, such as strawberries and wild carrots,  and medicinal plants, such as devil's club and stinging nettle, have been, and continue to be, gathered (Turner et al. 1971). Plant management strategies varied depending on the resource. Western redcedar is an especially important tree species (Zahn et al. 2018). Some of its uses include weaving bark to make clothing or baskets, harvesting planks to build longhouses or shelters, and carving canoes, masks, and other regalia (Moss 2011; Stewart 1977; Suttles 1990a; Suttles 1990b; Suttles 2004).

Indigenous communities have a deep understanding of the local environment and often take an active role in shaping the landscape to increase yields and ease resource collection. Examples of this include but are not limited to plant

cultivation, forest gardening, controlled burning, and mariculture (Lyons et al. 2021; Lepofsky 2005; Boyd 1999; Suttles 1990a; Suttles 1990b; Suttles 2004). The visibility of these modifications in the archaeological record ranges from prominent features like clam gardens, tidal traps, and fish weirs to subtle manifestations such as controlled burning and forest gardening (Armstrong et al. 2021; Lyons et al. 2021; Lepofsky et al. 2021; White 1975).

Settlement patterns included seasonal movement between villages and centered around an intimate understanding of the environment and available flora and fauna. Villages or settlements were strategically positioned at key resource procurement locations and/or had access to multiple environs (Ames et al. 1999; Hill-Tout 1978a; Hill-Tout 1978b). Village sites in the lower mainland have been predominantly recorded near the shore, where canoes could be easily beached and marine resources could be easily accessed. Villages were also often located near the mouth of streams to have access to fresh water sources. The houses in these villages were commonly rectangular cedar plank houses oriented parallel to the shore, frequently in a single row (Ham et al. 1986; Ham et al. 1986; Hill-Tout 1978a; Hill-Tout 1978b; Stewart 1977; Suttles 1990a; Suttles 1990b; Suttles 2004). Plank houses were designed for easy expansion, accommodating growing families by providing increased space as needed. Communities lived in more permanent villages during the winter and moved to smaller summer villages during prime resource-gathering months (Barnett 1955; Tsleil-Waututh First Nation 2025c). To further utilize the summer abundance, smaller temporary structures were frequently built within the community's foraging radius to support hunting, trapping, and resource gathering activities (Morin 2015).

People used a variety of tools as part of their daily activities, like resource harvesting. Belongings such as chipped lithic tools and ground stone, bone, and shell technologies are often found in archaeological sites. Types of chipped stone tools are tied to available material and can be limited due to local bedrock conditions offering only small quantities of suitable rock for knapping (Andrefsky Jr. 2005; Hamblin et al. 2014; Mustard 1994; Morin 2015; Reimer 2012). Belongings made of these materials are commonly identified through the archaeological record and provide valuable information on settlement patterns and subsistence practices.

### First Nation Place Names and Traditional Use Sites

Reviewing available First Nation place names can provide archaeological information about the potential use of the area and can also provide insight into the range of possible activities that may have taken place in the general location. The identification of archaeological sites and interpretation of archaeological potential is added by reviewing place names and their potential use/activities.

It should be noted that place names are based on oral traditions and may not reflect fixed geographical locations but instead speak to general landscapes or activity areas. Multiple spellings are also common due to varying translations or dialects.

A summary of First Nations place names and land use areas recorded in the region of the Study area is summarized in Table 1.

Table 1: First Nation Place Names within Approximately 2 km of the Study Area

| Place Name | Description | Distance from Study Area | Reference |
|---|---|---|---|
| Xepxápayay | Resource meaning “cedar tree” | 1.24 km south | (Carlson 2001) |
| kan-ul-cha Kwa-hul-cha xá7elcha | Lynn Creek and Lynn Lake | 1.5 km east | (Morin 2015; Khahtsahlano et al. 1955; Kwi Awt Stelmexw et al. 2025) |
| Ḵ’iyáx̱n | Seasonal Village; Meaning: fence. Location: Burrard Reserve IR #3 | 1.86 km northeast | (Kwi Awt Stelmexw et al. 2025) |

| Place Name | Description | Distance from Study Area | Reference |
|---|---|---|---|
| Átsenach | Seasonal Village; Meaning: bay. Location: Burrard Reserve IR #3 | 1.86 km northeast | (Kwi Awt Stelmexw et al. 2025) |
| Tat-ose | Meaning: Facing Out. Location: Burrard Reserve IR #3 | 2.1 km northeast | (Morin 2015) |
| Sel̓íl̓wet(ulh) | Seasonal Village, meaning belonging to sel̓íl̓wet. Possibly derived from slíl, which means 'piled up mountain goat blankets; a bunch of woven blankets; anything valuable. Location: Burrard Reserve IR #3 | 2 km northeast | (Kwi Awt Stelmexw et al. 2025) |
| chay-chul-wuk chechilkok ch'ích'elxwi7k̲w chichelxwiqw | Seymour Creek; Meaning: head | 2 km northwest | (Khahtsahlano et al. 1955; Kwi Awt Stelmexw et al. 2025; McHalsie, 2001) |

* Note: This table was created from publicly available sources and represents only a portion of known place names within the region.

### 4.1.3 Archaeological Record

#### Previous Archaeological Studies

A review of relevant previous archaeological studies can provide insight into the types of archaeological sites (i.e., habitation, lithic scatters, etc.) that can be found within a Study area. Past assessments can also provide valuable corresponding data (i.e., associated landforms and contextual information) that can help inform the archaeological potential of an area. A summary of archaeological studies reviewed for this AOA is provided below in Table 2.

Table 2: Archaeological Studies Conducted in the Vicinity of the Study Area

| Type | Previous Archaeological Study | Year of Assessment | HCA Permit No. | Distance from Study Area | Comment |
|---|---|---|---|---|---|
| AIA | Report on Archaeological Impact Assessment of Department of Highways Construction Projects in Southwest British Columbia | 1978 | 1978-0002 | 167 km north | Duff T. and Brolly R.P. (1978) study outlined the results from the 1978 Highways Salvage Survey in the Southwestern portion of B.C. |
| PFR | The Evaluation of Archaeological Sites in the Greater Vancouver Regional District: Proposals for Management. | 1978 | 1978-0006 | 1,329 m northeast | Ham et. al. (1978) conducted a study to determine the status of known archaeological sites within the Greater Vancouver Regional District. During this study, sites DhRr-20 and DhRr-27 were visited. It was determined that DhRr-20 was untouched and DhRr-27 had been destroyed. |
| AIA | Archaeological Survey and Excavation in Squamish Territory | 1989-1998 | 1990-0032 | 825 m southeast | On behalf of the Squamish Nation, Arcas Consulting Archaeologists Ltd. conducted |

| Type | Previous Archaeological Study | Year of Assessment | HCA Permit No. | Distance from Study Area | Comment |
|---|---|---|---|---|---|
| | | | | | a study on the potential archaeological site within the Squamish traditional territory. DhRs-312, a fighting weir, located in the mud flats along the north shore of the Burrard Inlet, was identified during this study. |
| AIA | Archaeological Impact Assessment Port Metro Vancouver Proposed Improvements, Part 1 North Vancouver, B.C. | 2010 | 2009-0406 | 1,291 m west | I.R. Wilson Consultants, on behalf of MMM Group Ltd., conducted an AIA for the proposed improvements to Port Metro Vancouver facilities in North Vancouver in the vicinity of Lynn Creek. No archaeological or cultural heritage resources were identified within the Study area. |
| AIA | Archaeological Impact Assessment Port Metro Vancouver Proposed Improvements, Part 2 North Vancouver, B.C. | 2012 | 2009-0406 | 1,291 m west | Part 2 of the AIA, involving testing and monitoring of inaccessible areas, was completed over 15 days by a two-person crew using machine excavation. No archaeological or cultural heritage resources were found, and no further study is recommended for the Port Metro Vancouver project. |
| AIA | 60L091 North Vancouver Hydro Upgrade | 2019 | 2016-0403 | 1,385 m northwest | Subsurface testing. Report Unavailable. |
| AIA | North Shore Innovation District 2420-2468 Dollarton Highway - Archaeological Overview Assessment | 2019 | 2018-0465 | 1,216 m northeast | Inlailawatash (2019) conducted an AIA of a proposed North Shore Innovation District development in North Vancouver. DhRr-587 was identified consisting of four tools and four pieces of debitage. The report is currently unavailable. |

### Registered Archaeological Sites

A review of the PHR indicates the Study area does not overlap with any previously registered archaeological sites. There are eight (8) pre-1846 archaeological sites within 2 km of the Study area. A summary description of recorded archaeological sites is provided below, Table 3.

Table 3: Registered Archaeological Sites within 2 km of the Study Area

| Borden No. | Site Type | HCA Permit(s) No. | Distance and Direction from Study Area | Comment |
|---|---|---|---|---|
| DhRs-801 | Precontact, Cultural Material, Surface, Lithics | 2007-0282 | 0.79 km northeast | This site, originally identified in 2007, consisted of a dacite lithic and was left in situ. In 2019, it was revisited and crews concluded that the belonging was misidentified as cultural and came from fill material that consists of arrogate (crushed basalt) and that DhRs-801 is situated within a sill zone. |
| DhRs-312 | Precontact, Subsistence Feature, Fishing, Fishing Weir | 1990-0032 | 0.89 km southeast | This site is located in the intertidal mudflats along the north shore of the Burrard Inlet and consists of a fishing weir made up of 289 stakes in a rectangular shape. |
| DhRr-587 | Precontact, Cultural Material, Subsurface, Lithics | 2018-0465 | 1.22 km northeast | This site consists of four (4) tools and four (4) pieces of debitage, all made with fine-grained volcanic material. |
| DhRr-27 | Precontact, Cultural Material, Subsurface, Cultural Shell Deposit | 1978-0002, 1978-0006 | 1.32 km east northeast | This site consists of cultural deposits, but at the time of recording (1978), it had been disturbed and is only present around the telephone pole. |
| DhRs-1388 | Precontact, Cultural Material, Surface and Subsurface, Shell Midden | Non-Permit | 1.25 km southeast | Cultural shell deposits were observed in the cut bank of a bluff overlooking Burrard Inlet about 50 cm below the surface of the bluff. |
| DhRr-895 | Precontact, Cultural Material, Surface, Lithics | 2018-0282 | 1.275 km south-southeast | One (1) fine-grained volcanic platform-remnant bearing debitage was collected from the surface within the intertidal zone. |
| DhRr-927 | Precontact, Cultural Material, Surface, Cultural Shell Deposit; Precontact, Cultural Material, Surface, Lithics; Precontact, Cultural Material, Surface, Fire-Altered Rock | Non-Permit | 1.63 km southeast | Eight (8) pieces of Fire-Altered Rock and one (1) lithic made of a medium-grained volcanic material were observed on the surface and left in situ. Additionally, two (2) cultural shell deposits were observed. |
| DhRr-20 | Precontact, Cultural Material, Subsurface, Cultural Shell Deposit; Precontact, Earthwork Feature, Mound; Postcontact, Human Remains, Cemetery | 1978-0002, 1978-0006 | 1.74 km northeast | This site consists of cultural shell deposits, an Ancestral burial, cultural mounds, and a historical cemetery. |
| DhRr-230 | Precontact, Cultural Material, Surface, Lithics | 2007-0282 | 1.6 km southeast | One (1) basalt cobble showing evidence of flaking was observed on the surface and left in situ. This site is located in the intertidal zone. |

### 4.1.4 Historical Land Use

The landscape within and surrounding the Study Area has been significantly altered by post-Contact activities and developments. These activities would have included land-clearing and land-filling, primarily related to forestry and the development of the land for various types of infrastructure, such as the construction of roads and housing, and industrial-related activities (e.g., mills). These types of activities and land development carried out in the post-Contact period alter the natural landscape, and have significant potential to impact archaeological sites and materials.

In 1916, Robert Dollar, owner of the Canadian Robert Dollar Company Limited, purchased a 75-acre site along the Burrard Inlet, establishing a long-standing sawmill (Woodward-Reynolds 1943). Quickly, a community around the mill was built, and the area became known as Dollarton. When the mill first opened, the only way to access it was by boat. A year later, a road opened, connecting Dollarton to the rest of North Vancouver.

Throughout the twentieth century, post-contact development activities and urbanization of the North Shore landscape continued to expand, particularly with the construction of the original Second Narrows Bridge in 1925 and the Lion's Gate Bridge in 1938 (Armitage 2001). Urbanization of the North Shore of Burrard Inlet has had a significant impact on the stream basins such as Lynn Creek and Seymour River.

#### Registered Historical Sites

A review of the PHR, CRHP, and DNVHR indicates that there is one (1) registered historical site within 1 km of the Study area, consisting of a residential home. Table 4 summarizes the details of the historical sites.

Table 4: Registered Historical Sites within 1 km of the Study Area

| Borden No. | Details | Distance and Direction from Study Area | Protection Register |
|---|---|---|---|
| DhRs-894 | Log Residence: 2263 Old Dollarton Highway, North Vancouver | 0.37 km northeast | District of North Vancouver Heritage Register |

### 4.1.5 Ancillary Data

#### Historical Aerial Photography Review

A comparative visual analysis of historical aerial photography for the Study Area was conducted using aerial photographs obtained from the University of British Columbia Geographical Information Centre and online publicly available sources. The emphasis on identifying changes and alterations over time was noted and considered when reviewing the archaeological potential of the Study Area.

Aerial photos for the Study Area were examined for 1926, 1940, 1954, 1963, 1969, 1974, 1987, 1991, 1996, and 2002[4]. Due to commercial copyright, aerial photographs cannot be shared, and therefore, the visual descriptions and comparisons are summarized in Table 5.

Table 5: Historical Aerial Photograph Results

| Date of Historical Aerial Photographs | Noted Observations | Reference Number |
|---|---|---|
| 1926 | There is very little development within the vicinity of the Study area; there is a long, thin structure associated with the construction of a | BA 22:103 |

[4] Aerial photography is captured at a variety of heights, and at different resolutions, which can limit the ability to identify certain changes to the landscape.

| Date of Historical Aerial Photographs | Noted Observations | Reference Number |
|---|---|---|
| | channel for access to the wharf located to the west of the Study area that stretches from the northern treed area to the southern intertidal zone. The southern Study area is located in the intertidal zone and the northern portion is located in a treed area next to the intertidal. | |
| 1940 | No significant changes were noted within the Study area | BC 197:31 |
| 1946 | No significant changes were noted within the Study area. Although there is a more defined development of the constructed wharf access channel to the west. | A10399:109, A10399-110 |
| 1949 | The majority of the Study area remains unchanged; there is more road construction, and a few buildings are located in the north portion of the Study area. There is also another water channel construction just east of the western channel, bordering the Study area. | BC 728:101, BC 1870:2 |
| 1954 | No significant changes were noted within the Study area. | BC 728:100 |
| 1963 | The southern Study area has been developed, including leveling, and fill has been added. Buildings have been erected within the southern Study area, including a large industrial facility and associated open space located in the northern and eastern portions of the Study area. The nearby wharf access channels have been more clearly defined and built up. Roads have been constructed along the northern, eastern, and western borders of the Study area. The intertidal zone located along the southeastern border remains unchanged. | BC 5059:239, BC5050:240 |
| 1969 | More industrial buildings have been constructed inside the industrial complex in the southern portion of the Study area, along with a dock along the southern border of the industrial facility. | BC 5059:240, BC 5325:199 |
| 1974 | No significant changes were noted within the Study area. | BC5573:0229, BC5573:0230 |
| 1979 | More buildings have been constructed in the central-west portion of the Study area (expanding the southern industrial facility northward). There is also increased industrial and commercial development (buildings, fill deposits) to the east and west of the Study area. | BC79047:0068, BC79047:0067 |
| 1984 | Buildings have been constructed along the northeast border of the Study area, and the buildings in the central-west portion have been further developed, and a walled parking lot was added. | A26511:100, A26511:99 |
| 1990 | No significant changes were noted within the Study area. | 15BCB90108:14, 15BCB90108:13 |
| 1996 | No significant changes were noted within the Study area. | 30 BCC96082:98, 30 BCC96082:99 |
| 2002 | A building has been constructed to the north of the parking lot (in the northwest portion of the Study area). No other significant changes were noted within the Study area. | SRS 6600:104, SRS 6600:105 |
| 2009 | Large parking lots have been constructed in the northeastern and northwestern portions of the Study area. In the southeastern portion of the Study area, a railway yard housing rail cars has been constructed with track lines that cross northwest across the Study area. Further rail lines have been constructed along the western border (oriented north-south) of the Study area. Fences have been erected around the south and east borders of the Study area, and the grassy berm/edge bordering the southeastern intertidal zone has been further defined. More buildings have been constructed in the northwestern and central portions of the Study area. | SRS 7987-313 |

| Date of Historical Aerial Photographs | Noted Observations | Reference Number |
|---|---|---|
| 2016 | The majority of the buildings in the northwestern and central portions of the Study area have been removed, and the parking lot in the northeastern portion has been partially removed. The eastern and western borders of the central-west parking lot have been removed. Some of the buildings in the southern industrial facility area have also been removed. A building associated with the southeastern rail yard has been constructed just north of the rail car storage lines. | BCD16421:916, BCD16421:917 |

### Geotechnical Boreholes

The Study area was subjected to a subsurface geotechnical investigation study in 2022 by PGL Environmental Consultants (PGL Environmental Consultants 2022). The subsurface testing involved 39 tests (BH01 to BH39M-S/D) with depths ranging from 3 m below surface (dbs) and up to 24.4 m dbs. Tests were completed using a solid stem auger and sonic vibratory core.

Boreholes BH06 and BH07 are located approximately 25 m west, and BH24 and BH15 are 36 m southeast of the Proposed Component 1. Generally, these boreholes found that sediments consisted of road base, overlaying coarse-grained SAND. Borehole BH35 is located approximately north of the Proposed Component 2. BH35 sediments consist of asphalt and coarse sand. A summary of the borehole stratigraphy can be found in Table 6.

Table 6: Geotechnical Boreholes

| Borehole | Stratigraphy (Metres below the surface [mbs]) | Method |
|---|---|---|
| BH06 | 0-0.05 m road base. 0.05-3 m: loose, moist, medium to coarse-grained grey SAND with some gravel | Solid Stem Auger |
| BH07 | 0-0.05 m road base. 0.05-3 m: loose, moist, medium to coarse-grained grey SAND with some gravel (increased to medium to coarse-grained gravel below 1.2 m. | Solid Stem Auger |
| BH14M/SV14 | 0-0.05 m asphalt. 0.05-0.3 m road base. 0.3-0.5 m loose, moist, medium to coarse-grained brown GRAVEL and SAND with trace silt, cobbles, and asphalt (fill). 0.5-3 m loose, moist, grey GRAVEL and SAND with some silt and trace cobbles. 3-5m loose, wet, coarse-grained brown SAND with trace silt. 5-6 m loose, wet, grey GRAVEL and SAND with some cobbles | Sonic Vibratory Core |
| BH15 | 0.05 m asphalt. 0.05-.03 m road base. 0.3-2.3 m- loose, moist medium to coarse-grained grey GRAVEL and SAND with trace silt and cobbles and some seashells. 2.3-3.5 m loose, moist medium to coarse-grained grey SAND with travel gravel. 3.5-6 m loose, wet, medium to coarse-grained reddish-brown GRAVEL and SAND with some cobbles. 6-7.4 m loose, moist, medium to coarse-grained grey SAND with trace sand. 7.4-9 m loose, wet, medium to coarse-grained grey GRAVEL and SAND with some cobbles. 9-21 m loose, moist, medium to coarse-grained grey SAND. | Sonic Vibratory Core |
| BH35 | 0-.05 m asphalt. 0.05-4.5 m loose, moist, medium to coarse-grained grey SAND with trace seashell fragments (no seashell fragments below 2.5m) | Solid Stem Auger |

## 4.2 First Nation Permitting and Engagement

The Study area lies within the traditional territory of the xʷməθkʷəy̓ əm (Musqueam Indian Band), Sḵwx̱wú7mesh Úxwumixw (Squamish Nation), Stó:lō Nation, and sḥílwətaʔɬ (Tsleil-Waututh Nation) (Ministry of Indigenous Relations and Reconciliation (MIRR) 2025).

Table 7 lists the First Nation Groups and organizations contacted as part of this AOA and includes heritage permits that were applied for and issued for the Project, along with any comments provided on the permit applications or Notice of Intent letters.

Table 7: First Nation Groups and Organizations Engaged

| First Nations | Engagement Method | Heritage Permit No. | Comments |
|---|---|---|---|
| sə́ lílwətaʔɬ (Tsleil-Waututh Nation) | Heritage permit issued 2025-04-25 | TWN-25146-25075 | Participated in PFR fieldwork. |
| Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) | Heritage permit issued 2025-05-28 | SNAIP 25-0150 | Participated in PFR fieldwork. |
| Stó:lō Research and Resource Management Centre | Heritage permit issued 2025-04-22 | SHIP 2025-114 | Deferred fieldwork to other Nations. |
| xʷməθkʷəy̓ əm (Musqueam Indian Band) | Heritage permit issued 2025-05-23 | MIB-2025-071-AOA-PFR | Deferred fieldwork to other Nations. |

## 4.3 Preliminary Field Reconnaissance

A PFR was conducted on June 3rd, 2025, by Carling Reid (ISL), Ryan Sagarbarria (ISL), Darrell Gus (sə́ lílwətaʔɬ), Aaron Skye (Sḵwx̱wú7mesh Úxwumixw), and Trevor McDiarmid (Sḵwx̱wú7mesh Úxwumixw). The purpose of the field visit was to refine and evaluate the archaeological potential identified during the background research within the Study area. Observations were also made regarding the likely extent of disturbance within the Study area resulting from past land use and development (Figure 4).

During the PFR, the Study area was visually inspected for areas with archaeological potential and evidence of archaeological deposits. Obvious archaeological materials and/or features were visually sought, including stone tools and debitage (waste from the production, maintenance, and use of stone tools), CMTs, mounds, trails, bone and charred plants, rock art, architectural remains, such as cabins, and other obvious cultural remains. Select photographs of the Study area are provided in Appendix A: Photographs 1 to 7.

No archaeological belongings/materials were observed on the surface of the Study area in areas that were surveyed during the PFR. Additionally, due to extensive disturbance and landscape modification, no areas of elevated archaeological potential were identified within the areas proposed for development (i.e., the three [3] project components). A summary of the field observation and archaeological potential for the Study area is provided below.

### TERRAIN

The Study area is relatively flat and lacks any prominent or defining topographic features. Much of the original terrain has been significantly altered or obscured due to ongoing industrial development (Appendix A: Photograph 1). As a result, no original landforms are visible, and the natural landscape has been replaced by graded surfaces, compacted fill, and built infrastructure. The southern Study area, which includes Proposed Components 1 through 3, is located within the intertidal zone that has been significantly filled and levelled above the Burrard Inlet (Appendix A: Photograph 2).

### VEGETATION

Due to the extensive industrial development within the Study area, natural vegetation has been largely removed or suppressed. The current vegetation is minimal and consists primarily of managed or opportunistic species, including patches of grass, groundcover such as ivy, and a limited number of ornamental deciduous trees, shrubs, and bushes.

DISTURBANCE

The Study area has been subject to various disturbances as a byproduct of industrialization. Disturbances include logging, leveling, and filling above the intertidal of the Burrard Inlet and industrial paving throughout most of the property, in the majority of the Study area. Installation of subsurface utilities (sump pumps), industrial installations associated with the plant activities, and railway tracks are present in the Study area (Appendix A: Photographs 3-6). The Study area has been extensively developed, and no natural landforms are present.

## 4.4 Archaeological Potential

As described in Section 3.4, our archaeological potential assessment is based on the results of the documentary research and considers the likelihood of encountering as-of-yet undiscovered archaeological resources within the Study area. This AOA examined known conditions like the distance to previously registered archaeological sites; proximity and translations of available First Nations place names; and environmental characteristics conducive to site formations and their expression on the landscape. In addition, we reviewed the extent of previous land alterations and disturbances in conjunction with the proposed Project.

The Study area has undergone extensive disturbance since the 1960s, including significant infilling activities in the southern portion within the Burrard Inlet. Additional site maintenance, such as landscaping and utility installation, has further altered the original land surface. These cumulative impacts, along with artificial terrain modification and the presence of fill material, contribute to an overall assessment of low archaeological potential within the existing project footprint.

This conclusion is supported by the following factors:

- Widespread accumulation of fill observed throughout the Study area in historical aerial imagery;
- Distance from previously registered archaeological sites;
- Extensive ground disturbance and terrain alteration over several decades.

Given these conditions and the limited depth of planned excavations, the likelihood of encountering intact archaeological materials, features, or deposits is considered low for all current development components. A summary of each is provided below:

- **Proposed Component 1:** Although the footprint partially overlaps with the mapped 1792 shoreline, subsurface conditions observed in borehole BH15 consist primarily of sand with trace seashell fragments—typical of natural foreshore sediments rather than cultural deposits. Excavation for the Chlorine Railcar Station Building will generally extend to a depth of approximately 0.9 m, with localized excavation reaching up to 3.0 m for the installation of a sump pit and rail scale. While these deeper excavations slightly increase the potential for encountering deeply buried archaeological materials, the natural composition of the soils within this previously buried intertidal zone indicates a low likelihood of their presence.
- **Proposed Component 2:** This component also involves shallow excavation to approximately 0.8 m below the surface. The nearest borehole (BH35) similarly shows only trace seashell fragments, again consistent with foreshore conditions and not indicative of archaeological deposits.
- **Proposed Component 3:** Involves the demolition of an existing building down to the slab, the excavation of a trench along the southeast side to access existing drainage infrastructure, and the installation of four to six small footings on the west side of the building. The trench is located within the footprint of existing utilities, and both the planned trench and footings lie outside the mapped extent of the historic shoreline.

The proposed components are assessed to have low archaeological potential based on current development plans and subsurface conditions. However, the archaeological potential increases in the northern portion of the Study area, particularly along and north of the historic 1792 shoreline, where future ground-altering activities may warrant additional assessment due to the greater likelihood of encountering intact cultural material.

It should be noted that a potential rating of low should not be considered no potential for archaeological sites or deposits within the Study area. Locations assessed as having low potential can still interact with unknown archaeological sites, as human behavior can be random and unpredictable, forming sites in unconventional locations. Archaeological site types in low-potential areas can include but are not limited to temporary campsites, expedient isolated resource processing sites, and low-density artifact scatters. Additionally, archaeological sites/deposits can be present in disturbed/altered settings and are also protected under the HCA.

## 5.0 Evaluation and Discussion

Based on the documentary research and known conditions of the Study area, the results and management recommendations of this AOA are limited by several factors, which are discussed below. Notwithstanding this assessment of archaeological potential, following the methods described herein produces a replicable and reliable basis for providing heritage management recommendations to guide further archaeological work.

- The magnitude of effects on the Study area from the construction of the industrial area and the depth of disturbance is relatively unknown outside the available imagery databases (i.e., Google Earth).
- Limited information on First Nations' traditional use sites is readily available, and additional information may aid in the rating of archaeological potential.
- Additional sources, such as regional geo-environmental, ethnobotanical, or palaeogeomorphology, depths, and provenance of imported fill, may be useful for refining archaeological site potential but are not readily available or known to the authors.

## 6.0 Recommendations

Based on the results presented in this AOA, we consider the current Proposed Components 1 through 3 within the Study Area to have a low archaeological potential rating. No further archaeological assessment work is recommended for these Projects as it is currently proposed. It should be noted that archaeological sites can be unearthed in any setting, including heavily developed or previously disturbed areas, and that the HCA protects all archaeological sites regardless of disturbance.

However, should future ground-altering activities be proposed in the northern portion of the Study area, particularly along or north of the historic 1792 shoreline, additional archaeological assessment will be required due to the elevated potential for intact cultural material in those areas.

As a precautionary measure, ISL recommends a chance find protocol (CFP) and that it be presented to contractors before undertaking subsurface ground-altering activities (i.e., in areas of low archaeological potential). This will guide the appropriate procedures should archaeological materials or suspected archaeological materials be encountered while an archaeologist is not on site.

Should unanticipated HCA-protected archaeological material be encountered (e.g., stone belongings/artifacts, Ancestral Remains, unusual objects, and/or features of possible cultural value) during construction activities, stop all ground-disturbing activities in the vicinity (approximately 30 m) of the find/feature and notify a professional archaeologist, the Archaeology Branch, and First Nation groups or organizations of the discovery. An HCA site alteration permit (Section 12.4) is required before any land alterations can occur within any archaeological site, whether previously known or unexpectedly found.

## 7.0 Closure

Please note that management recommendations, options, and comments presented herein are solely those of ISL Engineering and Land Services Ltd., and do not necessarily reflect opinions or policies held by the client or proponent, First Nations, or the Archaeology Branch. This report was prepared for Chemtrade and was prepared without prejudice to Indigenous Rights, Title, and Interests, and any use or conclusions of this report and its findings by third parties are the responsibility of such parties.

Should you have any questions regarding the information presented here, please do not hesitate to contact Ryan Sagarbarria at 604.629.2696 or rsagarbarria@islengineering.com.

Sincerely,
**ISL Engineering and Land Services Ltd.**





Carling Reid, BA
Archaeologist

Ryan Sagarbarria, BA, RPCA,
Heritage Manager, Archaeologist

## 8.0 Distribution List

- Archaeology Branch
- Chemtrade Electrochem Inc
- sə̓lílwətaʔɬ
- Sḵwx̱wú7mesh Úxwumixw
- Stó:lo Research and Resource Management Centre
- xʷməθkʷəy̓əm
- ISL Engineering and Land Services Ltd.

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TITLE

# PERMIT AREA OVERVIEW MAP

PROJECT

ARCHAEOLOGICAL OVERVIEW ASSESSMENT FOR CHEMTRADE SAFETY UPGRADES

CLIENT

CHEMTRADE ELECTROCHEM INC

DATA SOURCES

- Topographic Map:Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, USGS
- Contains information licensed under the Open Government License: GeoBC
- Archeology Data: Government of British Columbia, BC Archaeology Branch, Ministry of Forests, Lands, B.C. Data Catalogue

PROJECTION

NAD 1983 CSRS UTM Zone 10N

0 180 360

1:15,000 Meters

| | |
|---|---|
| FIGURE | 1 |
| DATE | 2025-04-10 |
| PROJECT NO. | 34205 |
| AUTHOR | vklassen |

Document: \\192.168.4.94\elc\Shared\GIS\Projects\34205_CTE_Safety_Upgrades_AOA\34205_CTE_Safety_Upgrades_AOA.aprx - 34205_f1_PermitArea_11x17_land




LEGEND

- Permit Area
- Previously Registered Archaeological Site
- Legacy Archaeological Site
- Previously Registered Historical Site
- Watercourse
- Permanent Water Body
- Intermittent Water Body
- Property Parcels
- Proposed Component

TITLE

**MIDRANGE LOCATION MAP**

PROJECT

ARCHAEOLOGICAL OVERVIEW ASSESSMENT FOR CHEMTRADE SAFETY UPGRADES

CLIENT

CHEMTRADE ELECTROCHEM INC

DATA SOURCES

- Topographic Map:VFPA, Esri, CGIAR, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community
- Contains information licensed under the Open Government License: GeoBC
- Archeology Data: Government of British Columbia, BC Archaeology Branch, Ministry of Forests, Lands, B.C. Data Catalogue

PROJECTION

NAD 1983 CSRS UTM Zone 10N

0 100 200

1:8,000 Meters

| | |
|---|---|
| FIGURE | 2 |
| DATE | 2025-04-10 |
| PROJECT NO. | 34205 |
| AUTHOR | vklassen |

Document: \\192.168.4.94\aic\Share\GIS\Projects\34205_CTE_Safety_Upgrades_AOA\34205_CTE_Safety_Upgrades_AOA.aprx - 34205_f2_Midrange_11x17_land

498500
499000
5461000
5460500

River Seymour
Burrard Inlet
SEYMOUR CREEK 2
Charles St
unnamed lane
Amherst Ave
Spicer Rd
Riverside Dr W
Harbour Rd
Pre-Contact Shoreline (1792)

Proposed Component 1
Proposed Component 2
Proposed Component 3

N

LEGEND
- Photograph Location
- Permit Area
- Survey Tracks
- Historical Shoreline
- Historical Stream
- Permanent Water Body
- Intermittent Water Body
- Property Parcels
- Project Component

TITLE
**DETAILED RESULTS MAP**

PROJECT
ARCHAEOLOGICAL OVERVIEW ASSESSMENT FOR CHEMTRADE SAFETY UPGRADES

CLIENT
CHEMTRADE ELECTROCHEM INC

DATA SOURCES
- Topographic Map:Esri, CGIAR, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, International Boundary Commission, Maxar
- Contains information licensed under the Open Government License: GeoBC
- Archeology Data: Government of British Columbia, BC Archaeology Branch, Ministry of Forests, Lands, B.C. Data Catalogue

PROJECTION
NAD 1983 CSRS UTM Zone 10N

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1:3,396 Meters

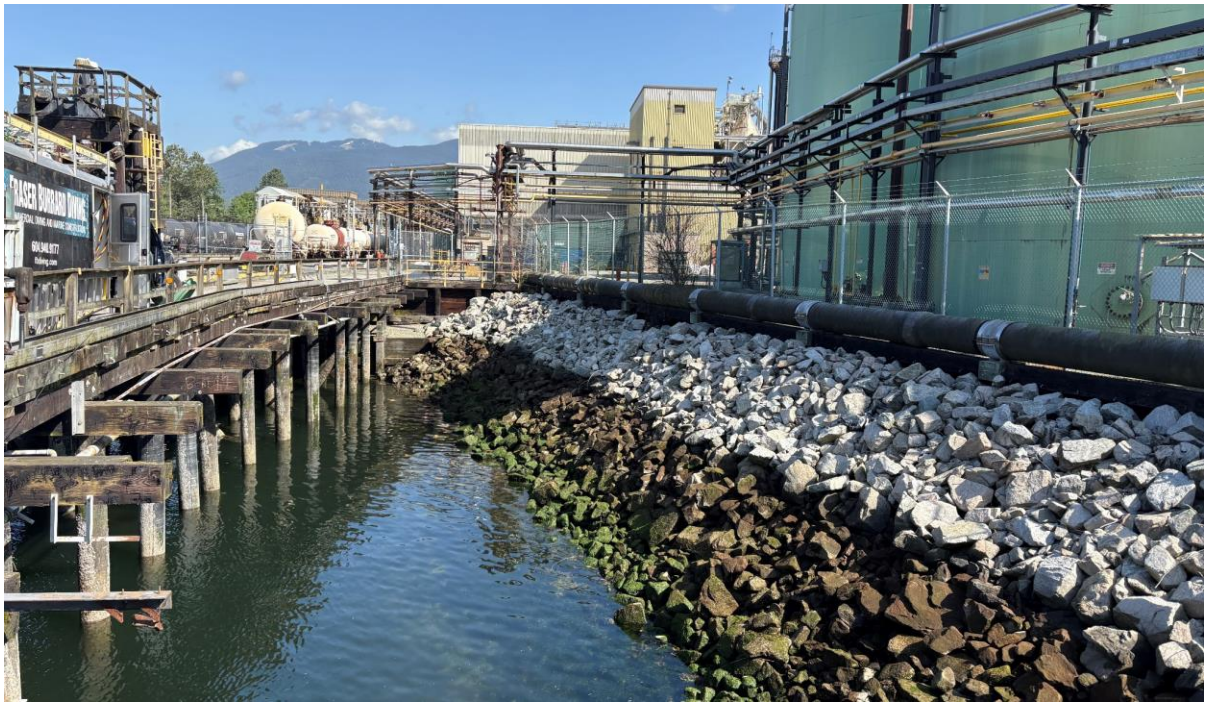
| | |
|---|---|
| FIGURE | 3 |
| DATE | 2025-06-19 |
| PROJECT NO. | 34205 |
| AUTHOR | vklassen |

Document: Q:\Projects\34205_CTE_Safety_Upgrades_AOA\34205_CTE_Safety_Upgrades_AOA.aprx - 34205_f3_Results_11x17_land

# APPENDIX A
Photographs



Photograph 1 View north of the Study area. The Study area has been subject to infill and industrial development, altering the original terrain.



Photograph 2 View north showing the infilled Burrard inlet.



Photograph 3 View north to Proposed Component 2 located in the southern portion of the Study area that has been subject to filling activities.




Photograph 4 View west to the Proposed Component 2 located showing industrial development.

Photograph 4



Photograph 5 View north to the Proposed Component 1 showing previous development.




Photograph 6 View northwest to the Proposed Component 1 showing current railway developments.

# CHEMTRADE ELECTROCHEM INC.
# 100 AMHERST AVENUE, NORTH VANCOUVER

Transportation Impact Assessment (TIA)


Jason Yuen, EIT
Transportation Engineer-in-Training
Author

Kristen Machina, P.Eng.
Senior Transportation Engineer
Reviewer


PERMIT TO PRACTICE:
Number 1001432

Prepared For: Chemtrade Electrochem Inc.
Date: November 17, 2025
Our File No: 3958.B01


WATT VANCOUVER
380 – 825 Homer Street
Vancouver, BC V6B 2W2
778-309-1253

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## 1.0 INTRODUCTION

WATT Consulting Group (WATT) is retained by Chemtrade Electrochem Inc. to prepare a Traffic Impact Assessment (TIA) for 100 Amherst Avenue in North Vancouver for the District of North Vancouver (District), regarding the Vision 2030 project.

The TIA forms part of the rezoning application and reviews all transportation-related impacts with the proposed development.

## 1.1 The Site Today

The site spans from south of Spicer Road to the District's boundary, between Amherst Avenue and Riverside Drive. The remaining of the site continues past the District's boundary into the Vancouver Fraser Port Authority's (VFPA) land. The site is bounded by industrial use to the west, north, and east, with rail tracks to the north and west. The site connects directly to the Burrard Inlet to the south.

The site location is illustrated in **Figure 1**.

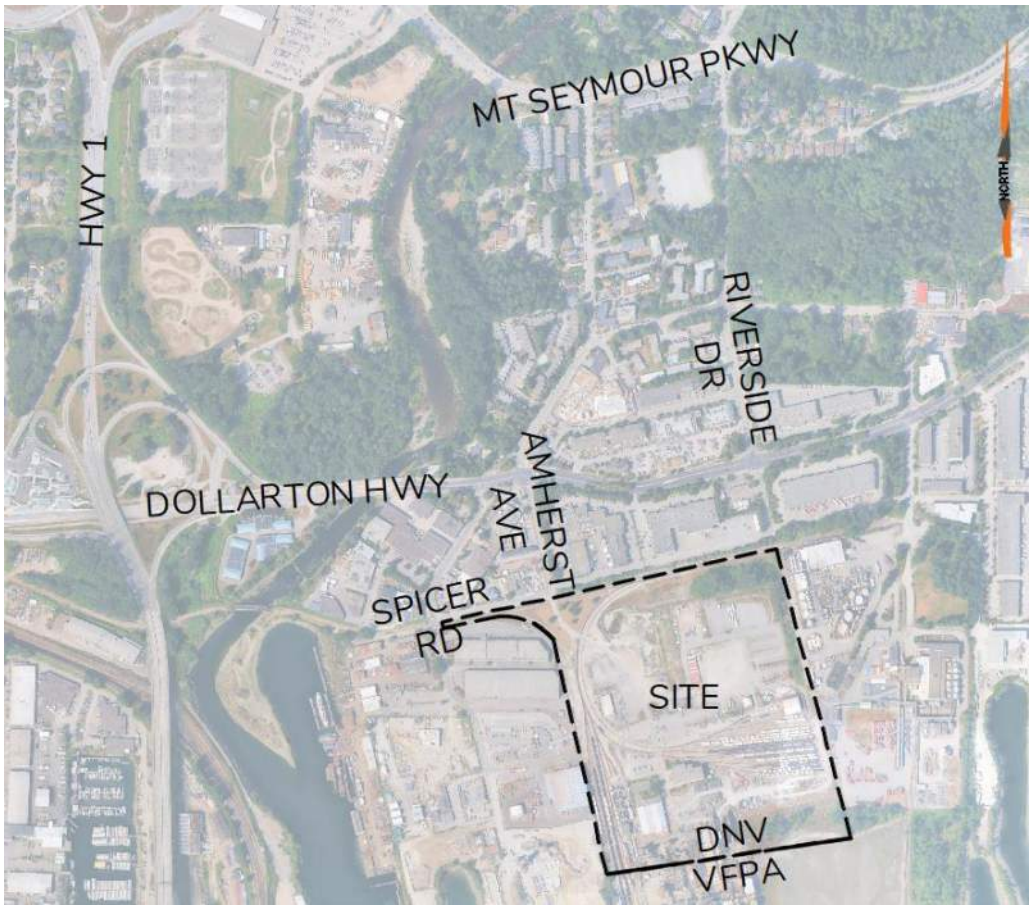



Figure 1 - Site Location

## 1.2 Objectives

This report is provided as part of the rezoning application being submitted to the District. The report contains the following:

- An overview of the proposed development.
- An overview of the transportation context in the vicinity of the site, including vehicular, pedestrian, cycling, and transit facilities.
- A review of truck route to/from the site from the nearest controlled highway access and any proposed safety improvements.
- An assessment of the trip generation and off-street parking of the proposed development.
- A review of the existing vehicular and rail site accesses.
- A review of on-site vehicle circulation, waste collection vehicle operations, and fire truck operations.
- A review of parking and loading space provision on-site
- An assessment of possible Transportation Demand Management (TDM) in coordination with the applicant.
- A review of applicable community plans for any changes to the nearby transportation network.

## 1.3 Proposed Development

The proposed use will remain unchanged from the existing use. The chemical processing equipment will be relocated from the VFPA's land to District's land. Facility upgrades are planned alongside the relocation. The changes to the site include upgrades to the liquid chlorine production, storage, and transportation preparing systems including four new site modifications:

1. Chlorine Condensing Tower,
2. Liquid Chlorine Railcar Loading Building,
3. Emergency Venting System, and a
4. Hypo Storage and Destruction System.

The existing vehicle access and pedestrian access points at the intersection of Amherst Avenue & Spicer Road and the existing rail access will be maintained and remain unchanged. No other access points are proposed. The proposed modifications to the site are expected to be completed by 2028.

# 2.0 TRANSPORTATION CONTEXT

## 2.1 Road Network

The subject site is on **Amherst Avenue**, which is a north-south local road under the jurisdiction of the District. Amherst Avenue extends from Spicer Road in the south to Dollarton Highway in the north, where it continues north as Old Dollarton Road beyond Dollarton Highway. Amherst Avenue has a two-lane cross-section, with one through lane in each direction. Sidewalks are provided on both sides of the road. Amherst Avenue is not part of the bike network and no cycling facilities are provided. On-street parking is available on both sides of the road.

The nearby area consists of two major roadways that leads to the site:

**Dollarton Highway** is an east-west arterial road under the jurisdiction of the District. Dollarton Highway continues from Main Street in the west to Mount Seymour Parkway in the east, where it continues as Deep Cove Road. Near Amherst Avenue, Dollarton Highway has a four-lane cross-section, with two through lanes in each direction. Auxiliary turn lanes are provided at major intersections, including Amherst Avenue. Cyclist facilities and sidewalks are provided as part of the Multi-Use Pathway (MUP). On-street parking is not permitted.

**Spicer Road** is an east-west local road under the jurisdiction of the District. Spicer Road extends from Charles Street in the west to Amherst Avenue in the east. Spicer Road has a two-lane cross-section, with one through lane in each direction. Sidewalk is provided on the north side of the road. Spicer Road is not part of the bike network and no cycling facilities are provided. On-street parking is available on both sides of the road.

## 2.2 Transit Network

**Table 1** summarizes the transit routes in the site vicinity. The development is served by four bus routes, which provide connections to transit exchange and town centres such as Phibbs Exchange, Downtown Vancouver, and Deep Cove. Existing bus stops are located on Dollarton Highway and Old Dollarton Road, which are within 600 metres (8-minute walk).

**Table 1 - Existing Transit Services**

| Route | Direction | Walking Distance | Service Frequency (Peak Hours) |
|---|---|---|---|
| *211 – Seymour / Phibbs Exchange / Burrard Station | East/West | 600 m | 15-25 min |
| 212 – Deep Cove / Phibbs Exchange | East/West | 600 m | 30 min |
| 214 – Blueridge / Phibbs Exchange / Burrard Station | East/West | 600 m | 20-25 min |
| 215 – Indian River / Phibbs Exchange | East/West | 600 m | 15 min |

*Peak hour service only

## 2.3 Cycling Network

Dollarton Highway, which is the major roadway that leads to the site, is part of the District's bike route, located one block from the site. The bike route on Dollarton Highway can be accessed through Amherst Avenue, which is currently not part of the bike route and does not have cycling facilities. West of Amherst Avenue, the bike route is provided through a shared roadway with vehicles with bike route guide signs. It connects bike users towards Main Street and the City of North Vancouver. East of Amherst Avenue, the bike route is provided through an off-street MUP. It connects bike users towards Deep Cove.

According to Bikeway Map published by the District (**Appendix A**), cycling improvements can be expected in the site vicinity. There are a number of proposed off-street bike routes, including along an extension of Spicer Road between Amherst Avenue and Riverside Drive East, along an extension of Spicer Road connecting to Railway Street, along an extension of Riverside Drive West south of Spicer Road, and along Seymour River Place and across Maplewood Farm for connection to Mount Seymour Parkway. There are also a number of proposed on-street bike routes, including along Amherst Avenue, along Old Dollarton Road, along Dollarton Highway east of Old Dollarton Road, and along Riverside Drive north of Windridge Drive. These improvements would allow for additional cycling connections in the region and provide a better riding experience for cyclists.

## 2.4 Pedestrian Environment

Sidewalks are provided on both sides of Amherst Avenue and Dollarton Highway and on the north side of Spicer Road. Crosswalks are located on all legs of Dollarton Highway & Amherst Avenue.

## 2.5 Truck Route

According to the "Dangerous Goods Route" map published by the District (**Appendix B**), the truck route from the nearest controlled highway access is Highway 1 at Main Street / Dollarton Highway (Exit 23A/B). To access the site from the highway exit, the truck route continues onto Dollarton Highway before turning right onto Amherst Avenue, which leads directly into the site.

As there are no gaps in the truck route between the site and the nearest highway exit/entrance, no safety improvements are proposed.

## 3.0 PROPOSED DEVELOPMENT

The site plans are provided in **Appendix C**. The proposed modifications on-site are shown in **Figure 2**. The transportation-related elements of the proposed site plan are summarized in **Table 2**.

**Table 2 - Development Program**

| Site Element | Details |
|---|---|
| **Facility Modifications** | 1. Chlorine Condensing Tower<br>2. Liquid Chlorine Railcar Loading Building<br>3. Emergency Ventilation System<br>4. Hypo Storage and Destruction System |
| **Vehicular Access** | No change. |
| **Vehicle Parking** | No change. |
| **Truck Loading** | No change. |
| **Rail Access** | No change. |
| **Rail Loading** | No change, except relocated the chlorine loading into the proposed Liquid Chlorine Railcar Loading Building. |
| **Bicycle Access** | No change. |
| **Bicycle Parking** | No change. |
| **Pedestrian Access** | No change. |

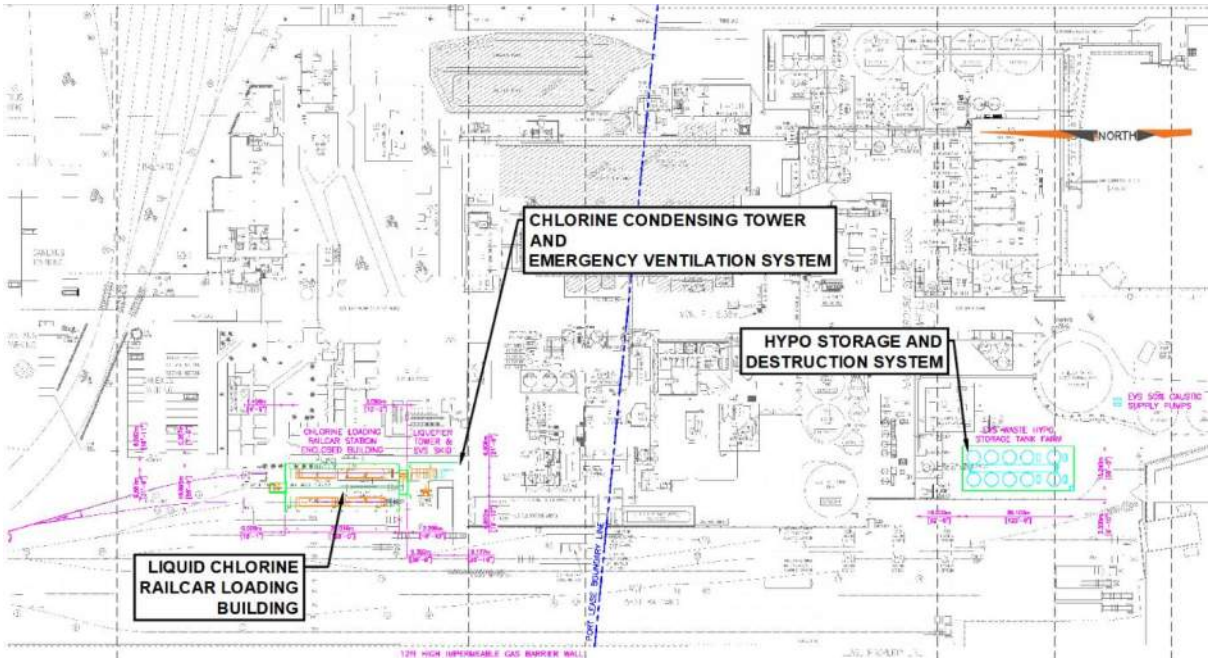



Figure 2 - Proposed Modifications

## 4.0 TRAFFIC VOLUMES

The increased equipment and processes on-site will be operated and maintained with the existing plant personnel. The applicant has confirmed this will not result in increased vehicular (passenger cars and trucks) and railcar traffic compared to the existing conditions.

Therefore, the traffic on Dollarton Highway and Trans-Canada Highway will not be affected with the proposed development. The same can be said for at-grade railway crossings near the site, which include Charles Street, Riverside Drive West, and Amherst Avenue.

## 5.0 SITE ACCESS REVIEW

Access to the site is unchanged from the existing conditions, located at the intersection of Amherst Avenue & Spicer Road.

## 6.0 TRAFFIC CIRCULATION

The existing and future loading spaces for vehicles and loading locations for railcars are provided in **Appendix D**.

### 6.1 Vehicles

The vehicle circulation was reviewed to confirm the functionality on-site. The proposed modifications are not in conflict of the drive aisle or any vehicle movements at the loading spaces or fire access locations, as identified by the applicant. Therefore, no impact on the existing swept paths for all vehicle types at all the loading spaces are expected due to the modifications.

### 6.2 Rail

The rail circulation was reviewed to confirm the functionality on-site. The existing chlorine railcar loading location will be relocated slightly east, in the proposed Liquid Chlorine Railcar Loading Building. However, the number of rail tracks on-site will remain unchanged. The new location will see similar setting to the existing location in terms of rail length and distance from the rail switches. Therefore, minimal impacts to the rail operations are expected due to this modification. No other impact to the rail operation and/or loading is expected.

## 7.0 PARKING & LOADING

The proposed modifications are being completed for process safety improvements only and are not intended for areas of warehouse, manufacturing, and storage involving additional personnel. Therefore, no additional parking and/or loading are required compared to existing conditions based on the Zoning Bylaw.

## 8.0 TDM MEASURES

A number of potential Transportation Demand Management (TDM) measures can be incorporated into the development to encourage personnel to travel via sustainable, non-auto modes. This can, in turn, reduce the number of vehicle trips and improve the capacity and queueing at the nearby intersections in the long-term horizon.

In reference to the District's policy titled "Alternative Vehicle Parking Rates", **Table 3** are some TDM measures for consideration to promote the use of sustainable transportation modes for personnel on-site.

**Table 3 - Potential TDM Measures**

| TDM Measures | Example |
|---|---|
| Secured Bicycle Parking | Provide secure bicycle parking. |
| Walking Improvements | Provide safe, attractive, and direct off-site connections for pedestrians linking building entrances with public sidewalks, transit stops, and key destinations. |
| Multimodal Wayfinding Signage | Provide multimodal wayfinding signage that can withstand weather elements (e.g., wind, rain) in key locations so that residents and visitors can easily locate transportation facilities such as bike parking and bike maintenance facilities. |

## 9.0 RELEVANT COMMUNITY PLANS

A review of applicable community plans has been conducted for any changes to the nearby transportation network.

The following policies were included in *Maplewood Local Plan, 2002*:

- Policy 5.1.4 – Develop public access on the spit at the mouth of the Seymour River with new viewing opportunities.
- Policy 5.1.6 – Future industrial or commercial developments on the waterfront should be people-friendly and provide for public access opportunities.
- Policy 9.3.3 – Fashion better public access to the waterfront by working with Industry to effect more public access to industrial sites and to the industrial waterfront where safety allows opportunities for viewing platforms. Opening up closed street ends and re-creating historic street ends should all be considered.

Most of the accesses to the waterfront are private under existing conditions. These policies indicate that public access near the waterfront will likely be developed in the future via the nearby roadways.

The *Maplewood Village Transportation Study Update, 2017* recommends extending Spicer Road between Amherst Avenue and Riverside Drive, with sidewalk on the north side and an urban trail on the south side. It further explains that this new connection could be added in the long term with redevelopment or following changes to local rail infrastructure. The urban trail provides cycling and pedestrian connections and may connect to a future crossing of the Seymour River. The recommended transportation network is shown in **Figure 3**.

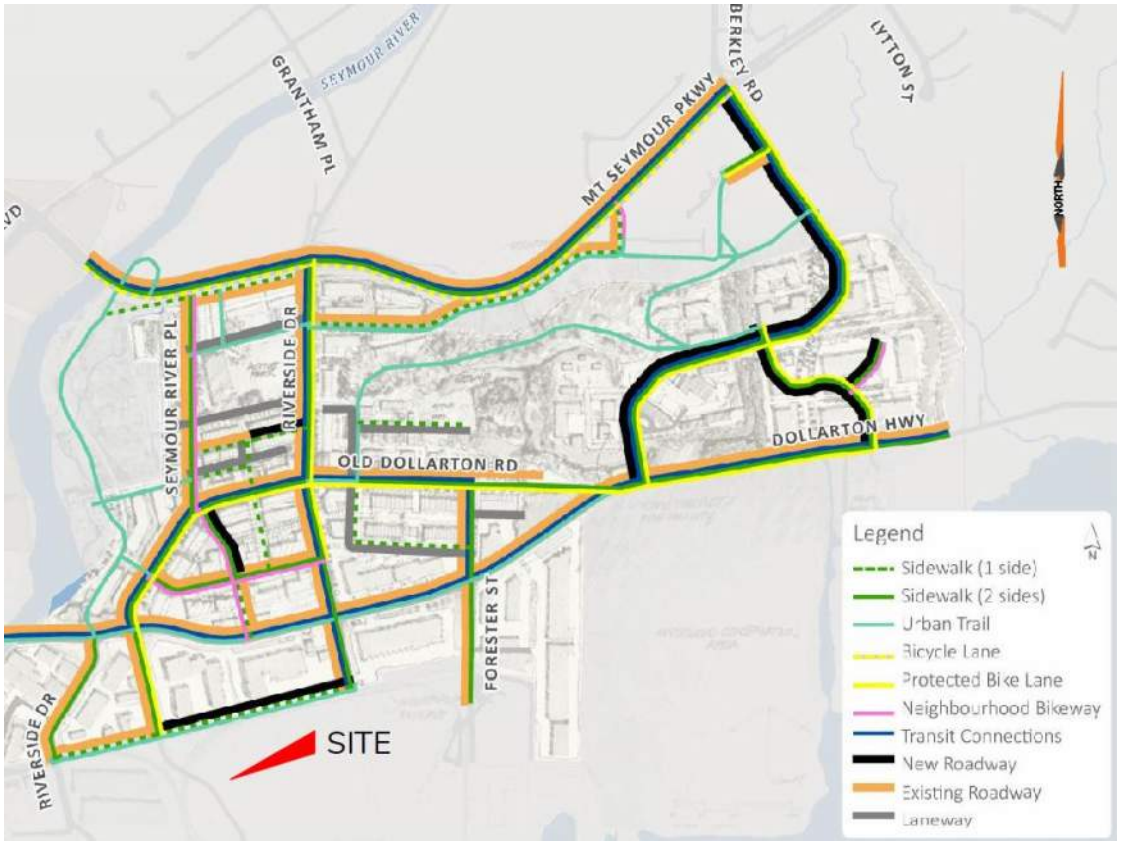



Figure 3 - Recommended Transportation Network

The *Maplewood Village Function Design Report, 2018* has provided a recommended cross-section of Amherst Avenue between Spicer Road and Dollarton Highway with improvements to on-street parking and a dedicated northbound right turn lane at Dollarton Highway. The Amherst Avenue Plan is shown in **Figure 4**.

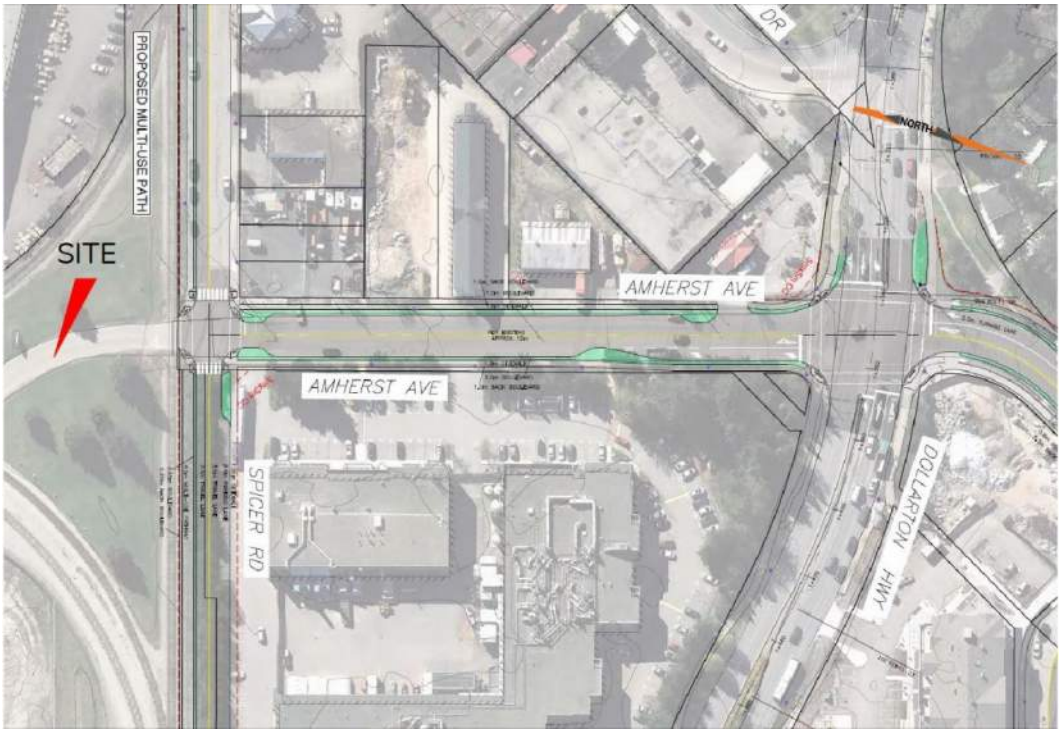
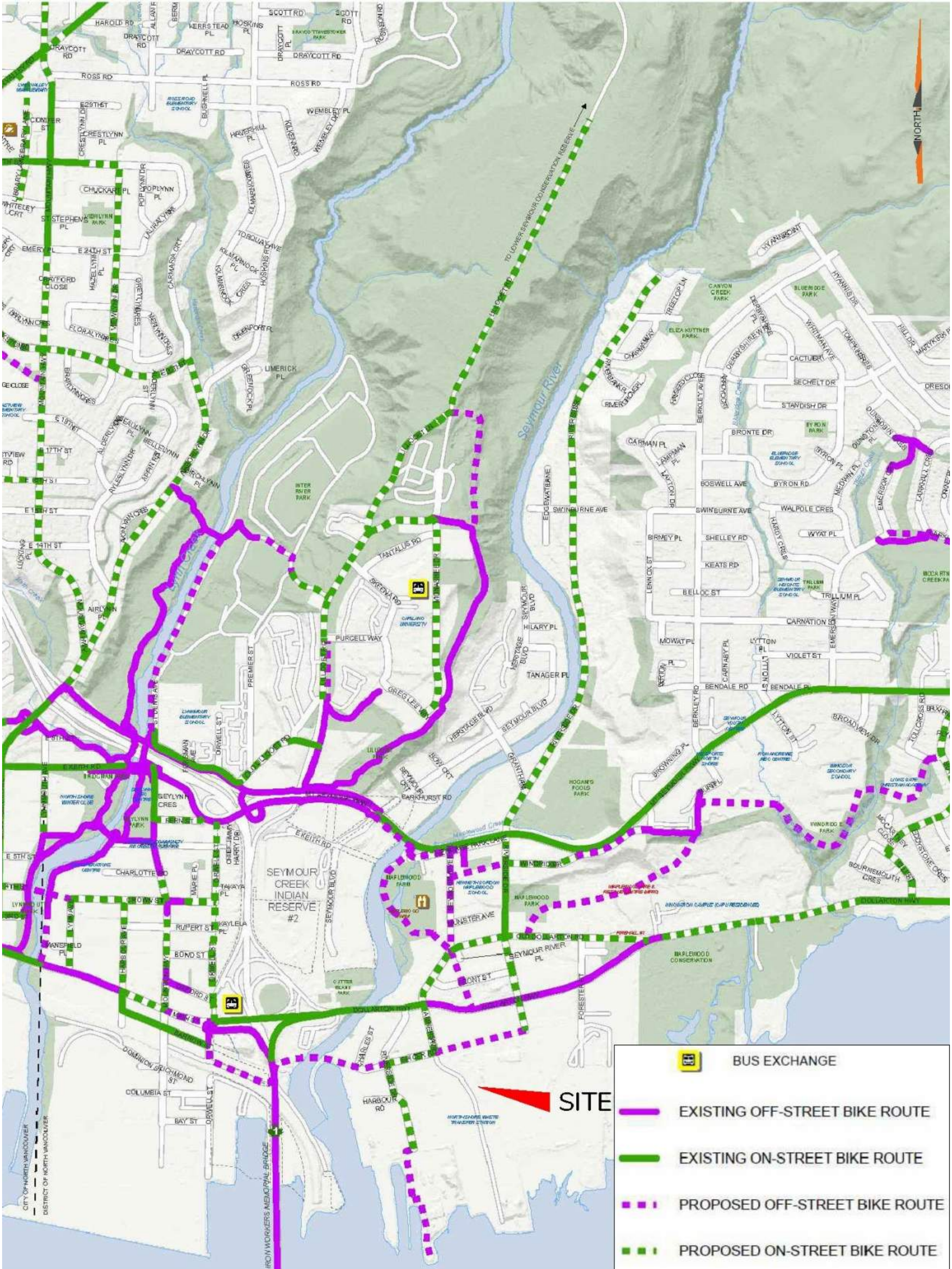



**Figure 4 - Amherst Avenue Plan**

## 10.0 CONCLUSIONS

- The proposed use will remain unchanged from the existing use. The chemical processing equipment will be relocated from the VFPA's land to District's land and a series of facility upgrades are planned.
- There will be no increase in vehicular (passenger car and trucks) and railcar traffic compared to the existing conditions. Therefore, no impacts to the traffic conditions on Dollarton Highway and Trans-Canada Highway, and the at-grade railway crossings at Charles Street, Riverside Drive West, and Amherst Avenue.
- Access to the site is unchanged from the existing conditions, located at the intersection of Amherst Avenue & Spicer Road.
- No impact on the existing swept paths for all vehicle types at all the loading locations are expected.
- No impacts to the rail operations are expected due to these modifications.
- No additional parking and/or loading are anticipated.
- Potential TDM measures that could be incorporated into the development includes secured bicycle parking, walking improvements, and multimodal wayfinding signage.
- The *Maplewood Local Plan, 2002* suggests public access near the waterfront will likely be developed in the future via the nearby roadways.
- *Maplewood Village Transportation Study Update, 2017* and *Maplewood Village Function Design Report, 2018* recommend an extension of Spicer Road between Amherst Avenue and Riverside Drive to provide pedestrian and cycling connections, and a future cross-section for Amherst Avenue.

# APPENDIX A: BIKEWAY MAP


NORTH
SITE
BUS EXCHANGE
EXISTING OFF-STREET BIKE ROUTE
EXISTING ON-STREET BIKE ROUTE
PROPOSED OFF-STREET BIKE ROUTE
PROPOSED ON-STREET BIKE ROUTE
SEYMOUR CREEK INDIAN RESERVE #2
Seymour River
TO LOWER SEYMOUR CONSERVATION RESERVE
IRON WORKERS MEMORIAL BRIDGE
CITY OF NORTH VANCOUVER
DISTRICT OF NORTH VANCOUVER
DOLLARTON HWY
ROSS RD
DRAYCOTT RD
BENDALE RD
BROADVIEW DR
PURCELL WAY
TANTALUS RD
MAPLEWOOD CONSERVATION
HOGAN'S POOLS PARK
INTER RIVER PARK

# APPENDIX B: DANGEROUS GOODS ROUTE

# DANGEROUS GOODS ROUTES

MAIN ROUTE
ALTERNATE ROUTE
MUNICIPAL BOUNDARY

DISTRICT OF NORTH VANCOUVER

Capilano Lake
Grouse Skyride
Nancy Greene Way
Capilano Rd
Montroyal Blvd
DISTRICT OF WEST VANCOUVER
Edgemont Blvd
Ridgewood Dr
Queens Rd
Lonsdale Ave
29th St
William Ave
Lynn Valley Rd
To Seymour Dam
Rice Lake
Mountain Hwy
Lillooet Rd
To Horseshoe Bay
Marine Dr
To Vancouver via Lions Gate Bridge
CITY OF NORTH VANCOUVER
Grand Blvd
Berkley Rd
Deep Cove
Deep Cove Rd
Mt Seymour Pkwy
Keith Rd
3rd St
Fern St
Main St
Riverside Dr
Amherst Ave
Dollarton Hwy
To Vancouver via Iron Workers Memorial Bridge
Burrard Inlet
Indian Arm

PUBLISHED: MAY 5, 2025
0 500 1,000 meters
SCALE: 1:35,000

**DISCLAIMER AND TERMS OF USE**

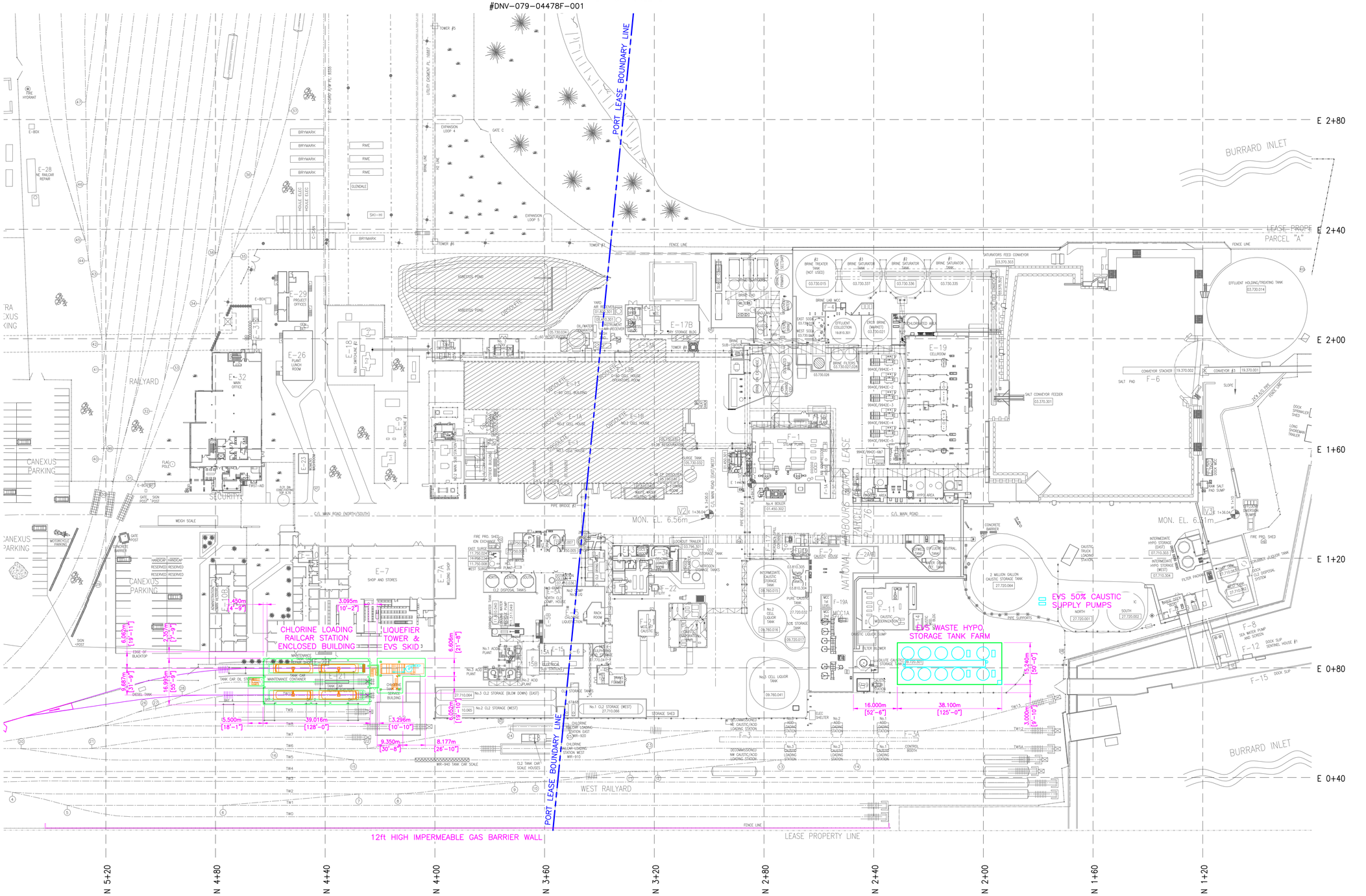
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# APPENDIX C: SITE PLAN

LEGAL DESCRIPTION:

LOT 5 EXCEPT: PART SUBDIVIDED BY PLAN LMP40923, DISTRICT LOTS 193 AND 611 GROUP 1, NEW WESTMINSTER DISTRICT, PLAN 17801

PORT METRO VANCOUVER TENANCY AGREEMENT
#DNV-079-04478F-001




REFERENCE DRAWINGS

REFERENCE DESIGN STANDARDS

**PRELIMINARY NOT FOR CONSTRUCTION**
DATE: 17 April 2025

**ISSUED FOR REVIEW**
DATE: 17 April 2025

| ISSUE No. | DyMonYr | ISSUE | DR. | CH. | APP. |
|---|---|---|---|---|---|
| A | 17APR25 | ISSUED FOR REVIEW | CK | – | – |

MG Engineering Inc.
Vancouver & Gibsons, BC

VISION 2030
OVERALL PROJECT
PLOT PLAN – 1A

| SCALE | | | |
|---|---|---|---|
| NONE | DSN | | |
| | DR | – | – |
| | CH | | |
| | APP | | |

MG ENG. DWG. No. D-333224-SITEV2030-001 ISSUE A

CHEMTRADE
CHEMTRADE CHLOR-ALKALI FACILITY
North Vancouver BC Canada

CLIENT DWG. No. ISSUE

17 April 2025

# APPENDIX D: LOADING LOCATIONS

LEGAL DESCRIPTION:

LOT 5 EXCEPT: PART SUBDIVIDED BY PLAN LMP40923, DISTRICT LOTS 193 AND 611 GROUP 1, NEW WESTMINSTER DISTRICT, PLAN 17801

PORT METRO VANCOUVER TENANCY AGREEMENT
#DNV-079-04478F-001

fire/ rescue access point

back at security booth

sodium bisulphite storage truck unloading

sludge truck for hauling removal

waste and recycling

stores deliveries

HCL truck loading

liquid nitrogen truck unloading

liquid CO2

Caustic truck loading

Bulk chlorine railcar loading

Sulfuric acid railcar unloading

HCL railcar loading

PORT LEASE BOUNDARY LINE

BURRARD INLET

RAILYARD

CANEXUS PARKING

SECURITY

CHLORINE LOADING STATION ENCLOSED BUILDING

TOWER & EVS SKID

SUBSTATION YARD

E-29 PROJECT OFFICES

E-32 MAIN OFFICE

E-26 PLANT LUNCH ROOM

E-28 MC RAILCAR REPAIR

E-7 SHOP AND STORES

E-17B BRY STORAGE BLDG

E-18 MER CELL HOUSE

E-1 MER CELL HOUSE

E-1A MER CELL HOUSE

E-9 MER CELL HOUSE

E-19 CELLROOM

F-1 STEAM PLANT

F-2 CAUSTIC TRUCK LOADING STATION

F-4 BRINE LAB MCC

F-6 SALT PAD

F-8 SEA WATER PUMP AND SCREEN

F-12 DOCK SLIP SENTINEL HOUSE #1

F-15 DOCK SLIP

2 MILLION GALLON CAUSTIC STORAGE TANK 27.728.064

EVS SO2 CAUSTIC SCRUBBER PUMPS

CAUSTIC WASTE HYPO STORAGE TANK FARM

SATURATORS FEED CONVEYOR 03.370.303

CONVEYOR STACKER 03.370.002

CONVEYOR #3 03.370.001

SALT CONVEYER FEEDER 03.370.305

EFFLUENT HOLDING/TREATING TANK 03.736.014

EFFLUENT COLLECTION 79.655.305

BRINE FILTER 03.736.027.005

BRINE SATURATOR TANK 03.736.335

BRINE SATURATOR TANK 03.736.336

BRINE SATURATOR TANK 03.736.337

BRINE TREATER TANK CHEMT LICED 03.736.005

NO.4 BOILER 61.430.300

E 2+80

E 2+40

E 2+00

E 1+60

E 1+20

E 0+80

E 0+40

N 5+20

N 4+80

N 4+40

N 4+00

N 3+60

N 3+20

N 2+80

N 2+40

N 2+00

N 1+60

N 1+20

12ft HIGH IMPERMEABLE GAS BARRIER WALL

LEASE PROPERTY LINE

FENCE LINE

REFERENCE DRAWINGS

REFERENCE DESIGN STANDARDS

REFERENCE ONLY
NOT FOR CONSTRUCTION
DATE: 17 April 2025

ISSUED FOR REVIEW
DATE: 17 April 2025

| ISSUE No. | DyMonYr | ISSUE | DR. | CH. | APP. |
|---|---|---|---|---|---|
| A | 17APR25 | ISSUED FOR REVIEW | CK | - | - |

MG Engineering Inc.
Vancouver & Gibsons, BC

PROJECT_NAME

TITLE_LINE_1
OVERALL PROJECT
PLOT PLAN - 3A

| SCALE | | | |
|---|---|---|---|
| SCALE UNO | DSN | DESIGNED_BY | DD_MON_YY |
| | DR | DRAWING_BY | DD_MON_YY |
| | CH | CHECKED_BY | DD_MON_YY |
| | APP | APPROVED_BY | DD_MON_YY |

MG ENG. DWG. No. MG_DWG_NUMBER ISSUE 00

CHEMTRADE
CHEMTRADE CHLOR-ALKALI FACILITY
North Vancouver BC Canada

CLIENT DWG. No. CLIENT_DRAWING_NUMBER ISSUE 00

LAST PLOT: DD_MON_YY

THE CORPORATION OF THE DISTRICT OF NORTH VANCOUVER

DEVELOPMENT PERMIT 24.0

This Development Permit is issued by The Council for The Corporation of the District of North Vancouver to Canadian Occidental Petroleum Ltd. for the development of Lot 5, Block H, District Lot 611, Plan 17801, N.H.B. W/L lease V1381(5), 1988 sq. m., subject to the following conditions :

1. The property shall be developed in compliance with the engineering plan (Appendix 24.0A).

2. A building construction security deposit of $2,000 in the form of cash or an irrevocable letter of credit satisfactory to the Director of Financial Services shall be submitted prior to the issuance of a building permit.

3. An engineer, registered in British Columbia, satisfactory to the Director of Development, shall be retained to oversee the construction of the demisting filters.

4. Construction shall commence within two years from the date of issuance of this permit, or the permit shall lapse.

J. M. Baker
Mayor

W. H. Eglestone
Municipal Clerk

Dated this 29th day of January , 1985.

THE CORPORATION OF THE DISTRICT OF NORTH VANCOUVER

DEVELOPMENT PERMIT 26.0

This Development Permit is issued by The Council for The Corporation of the District of North Vancouver to Canadian Occidental Petroleum Ltd. for the development of Lot 5, Block H, District Lot 611, Plan 17801, N.H.B. W/L lease V1381(5), 1988 sq. m., subject to the following conditions :

1. The property shall be developed in compliance with the attached site and engineering plans (Appendices 26.0A to 26.0D).

2. Submission of a revised plan for a spill containment system which has the ability to accommodate as much of the total tank volume as physical plant limitations will allow prior to issuance of a building permit for the storage tanks.

3. A building construction security deposit of $8,000 in the form of cash or an irrevocable letter of credit satisfactory to the Director of Financial Services shall be submitted prior to the issuance of a building permit.

4. An engineer, registered in British Columbia, satisfactory to the Director of Development, shall be retained to oversee the construction of the storage tanks.

5. Construction shall commence within two years from the date of issuance of this permit, or the permit shall lapse.

A/ Mayor

Municipal Clerk

Dated this 12th day of February, 1985.

PROPERTY BOUNDARIES
CANADIAN OCCIDENTAL
PETROLEUM LTD.
NORTH VANCOUVER, B.C.

FREEHOLD BOUNDARIES ——————
LEASEHOLD BOUNDARIES —— – ——
FENCED PROPERTY ——x——x——
60 KV POWER LINES ——+——+——

FORESTER STREET
MOHAWK OIL
ERCO
RIVERSIDE DRIVE
NO. 1 60 KV LINE
NO. 2 60 KV LINE
DISPOSAL AREA
DOLLARTON HIGHWAY
FRONT STREET
CNR PROPERTY
NO. 2 60 KV LINE
LANE
PRUFCOAT
AMHERST
RIVERSIDE
SPICER
SOLD 1970
HARBOUR RD
CITY WATER METERING PIT
HARBOUR HEAD LINE
BURRARD INLET

THIS IS APPENDIX "A"
TO DEVELOPMENT PERMIT 16.0
ISSUED BY THE CORPORATION OF THE DISTRICT OF NORTH VANCOUVER
Feb 12/75 — DATE
H. V. Eggleston — MUNICIPAL CLERK

DEC 20 1994

| No. | REVISIONS | BY | DATE |
|---|---|---|---|
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |

| No. | REVISIONS | BY | DATE |
|---|---|---|---|
| 1 | REDRAWN | JCM | 6-6-73 |
| 2 | UPDATED | DM | 4-2-75 |
| 3 | ADDED COLLEGE HILL AREA | RDK | DEC 76 |
| 4 | UPDATED | DDP | 6/7/81 |
| 5 | ADDED RETAINING WALL | RGS | 18/12/84 |
| 6 | | | |

| | | | |
|---|---|---|---|
| D | | | |
| C | | | |
| B | | | |
| A | | | |
| ISSUE No. | DESCRIPTION | | DATE |

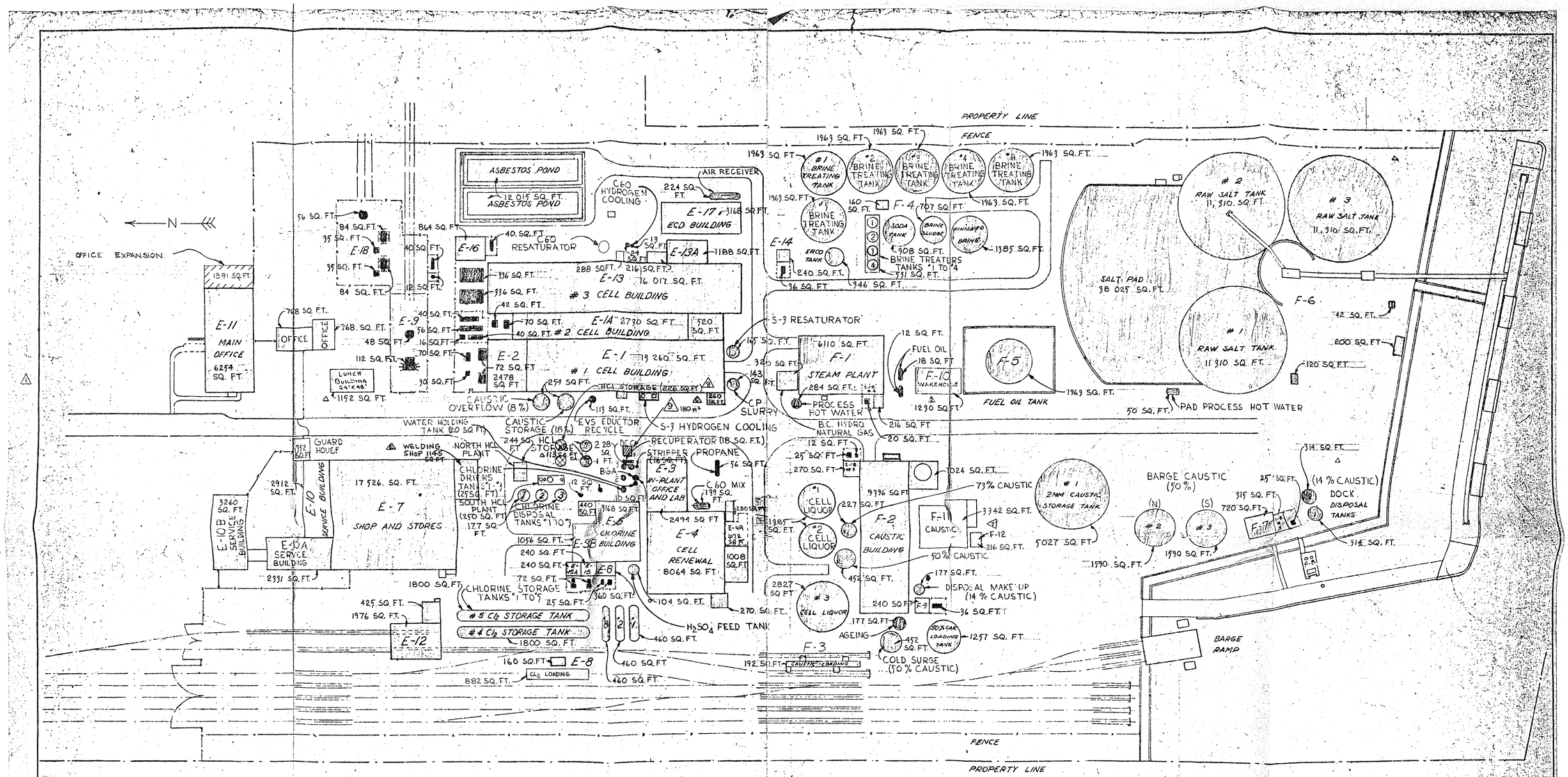
CANADIAN OCCIDENTAL PETROLEUM LTD.
NORTH VANCOUVER, B.C.

CHG. No.
W. O. No.
BLDG No.

MADE BY ____ SCALE 1" = 150'
TRACED BY ____ DATE
CHECKED BY ____ APPROVED

DWG. A-5060-VV

PROPERTY BOUNDARIES




## APPROXIMATE PLANT AREA - SQUARE FEET

| | EXISTING | THIS PROPOSAL | PROPOSED |
|---|---|---|---|
| TOTAL SQ.FT. - BUILDINGS | 128380 | +180 | 128560 |
| " " " - ELECTRICAL | 2290 | | 2290 |
| TOTAL SQ. FT. - TANKS | 7458 | +226 | 76707 (9) (HCL STORAGE ADDITION) |
| TOTAL SQ. AREA COVERED | 207151 SQ.FT. (4) (1) | | 207557 |

TOTAL PROPERTY AREA - 3 472 726 SQ.FT. - NOTE: 192 500 SQ. FT. DISPOSAL AREA NOT INCLUDED
12 017 " " " ASBESTOS POND " "
38 025 " " " SALT PAD " "
882 " " " TRACK SCALE " "

THIS IS APPENDIX "A"
TO DEVELOPMENT PERMIT 26 0
ISSUED BY THE CORPORATION OF THE DISTRICT OF NORTH VANCOUVER
Feb. 13/85 — M. H. Taylor
DATE — MUNICIPAL CLERK

DEC 2 0 1984

| ISSUE NO | DESCRIPTION | DATE |
|---|---|---|
| D | | |
| C | | |
| B | | |
| A | | |

| NO. | REVISIONS | BY | DATE |
|---|---|---|---|
| 9 | PLANT AREA REV | DDP | 82/07/16 |
| 8 | INCLUDES OFFICE EXP. | RSS | 81/10/82 |
| 7 | DEMISTER ADDITION | PTT | 81/12/18 |
| 6 | | | |
| 5 | | | |
| 4 | | | |
| 3 | | | |
| 2 | | | |
| 1 | | | |

| NO. | REVISIONS | BY | DATE |
|---|---|---|---|
| 9 | TANK & ACID AREA | EVE | MAY 1/76 |
| 8 | ADD F-10 & F-11A | JRS | 10 MAY 76 |
| 7 | ADD F-11 & 12 | DP | 24 AUG 77 |
| 6 | ADD F-9 & F-11B | DP | 7 SEPT 80 |
| 5 | PLANT AREA ADDED | DDP | 81/10/81 |
| 4 | PLANT AREA REV | JDE | 82-02-10 |

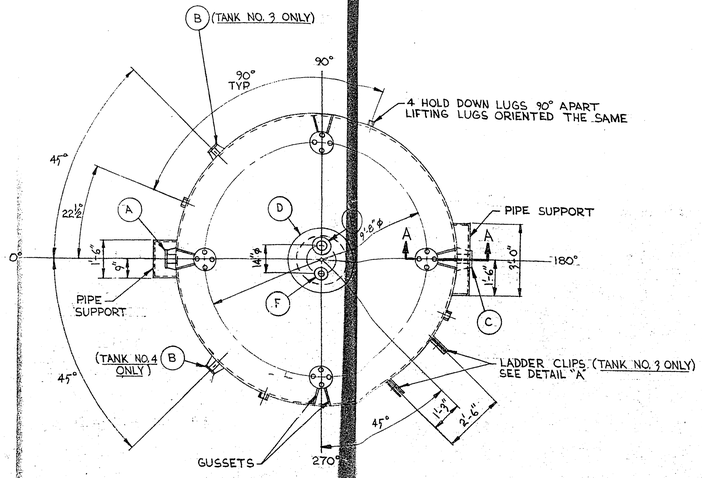
CANADIAN OCCIDENTAL PETROLEUM LTD.
NORTH VANCOUVER, B.C.

CHG. NO.
W. O. No.
BLDG No.

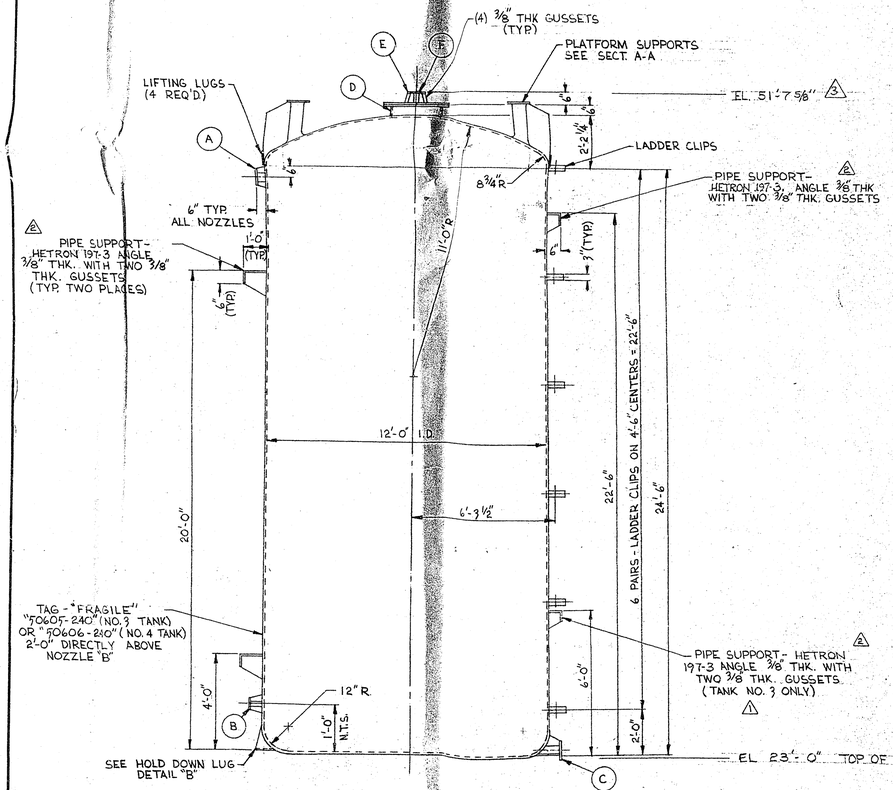
MADE BY J.E. MASO SCALE 1" = 50'
TRACED BY DATE JUNE 7, 1973
CHECKED BY APPROVED

DWG. A-5122-KV

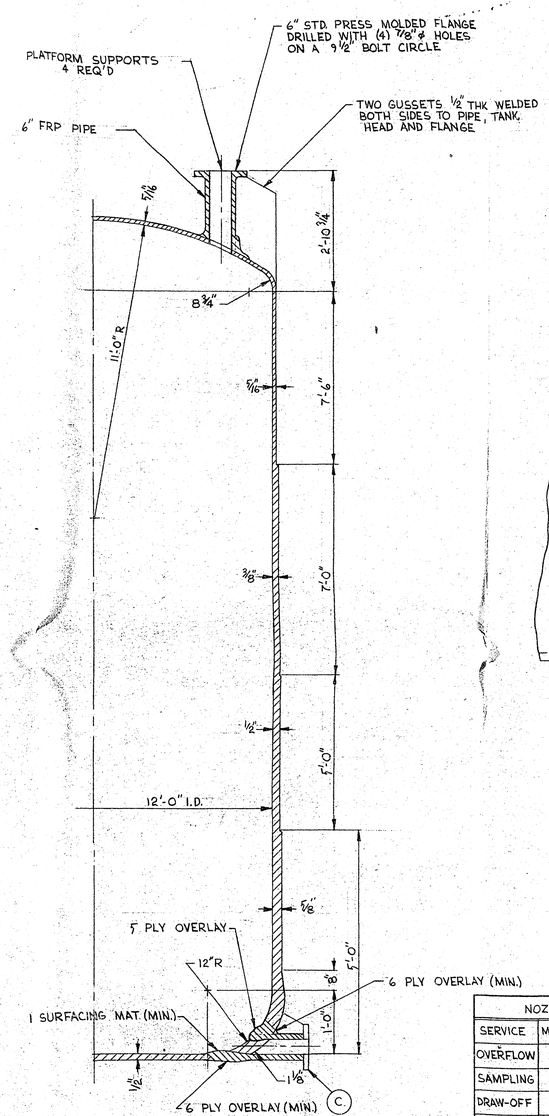
PLANT, BUILDINGS AND EQUIPMENT LAYOUT



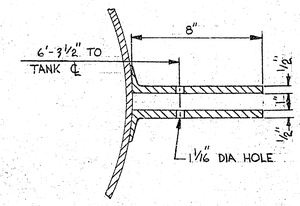

ORIENTATION PLAN



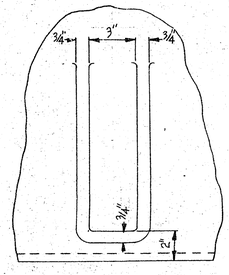

HCL STORAGE TANKS - NO. 3 (50605-240) AND NO. 4 (50606-240) - ELEVATION SCALE: 3/8" = 1'-0"

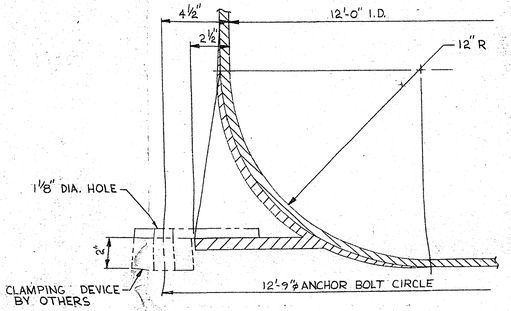



SECTION A-A SCALE: N.T.S.




DETAIL A - LADDER CLIP (TANK NO. 3 ONLY) SCALE: N.T.S.




DETAIL B - HOLD DOWN LUG SCALE: 3" = 1'-0"

| NOZZLE SCHEDULE | | | | |
|---|---|---|---|---|
| SERVICE | MARK | SIZE | FLANGE THICKNESS | GUSSETT'D |
| OVERFLOW | A | 4" | 7/8" | YES |
| SAMPLING | B | 2" | 11/16" | YES |
| DRAW-OFF | C | 4" | 7/8" | YES |
| MANHOLE | D | 24" | 5/8" | NO |
| VENT | E | 4" | 7/8" | YES |
| FILL | F | 2" | 11/16" | YES |
| | | | | |
| | | | | |
| | | | | |

NOTES:

1) FABRICATOR TO FOLLOW AND CONFORM TO HOOKER SPECS. 50601 AND EW-76
2) LINER LAMINATE - 2 - C GLASS VEIL, 2 - 1½ OZ. MAT
3) STRUCTURAL LAMINATE - HAND LAY-UP HETRON 197-3
4) RESIN - HETRON 197-3 WITH U.V. 9 INHIBITOR ON FINAL PLY (2 VEILS)
5) ALL FLANGES TO BE HAND LAY-UP (EXCEPT PLATFORM SUPPORTS) 150# ANSI WITH OVERLAY, BOLT HOLES TO STRADDLE ℄
6) MANHOLE GASKET TO BE NEOPRENE
7) BOTH TANKS TO BE HYDROSTATICALLY TESTED (AS PER HOOKER SPEC. 50601) PRIOR TO DELIVERY.

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

THIS IS APPENDIX "C" TO DEVELOPMENT PERMIT 26.0 ISSUED BY THE CORPORATION OF THE DISTRICT OF NORTH VANCOUVER
Feb 13/85 DATE — H. M. Eagleston MUNICIPAL CLERK

RECEIVED OCT 25 1984 PLANNING DEPT

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| NO | REVISIONS | APP. | DATE |
|---|---|---|---|
| | | | |

| NO | REVISIONS | APP. | DATE |
|---|---|---|---|
| 1 | PIPE SUPPORT ADDED | DDP | 85/04/26 |
| 2 | RESIN CHG'D FROM DERAKANE 411 | RGS | 84/10/5 |
| 3 | ADDED TNK. ELEVATIONS | RGS | 84/10/22 |

DRAWN BY D. PARSONS DATE 82-02-02
CHECKED BY DDP DATE 82-02-02
APPROVED [illegible] DATE 82-02-02
SCALE AS NOTED

CANADIAN OCCIDENTAL PETROLEUM LTD. INDUSTRIAL CHEMICALS DIVISION — CANADIAN OXY

BLDG. NO. — DWG A-5384-VV

HCL STORAGE TANKS - NO. 3 (50605-240) AND NO. 4 (50606-240)

M.H. #6

30"

10"

Z

Existing 6" P.V.C.

Proposed 2" pump discharge line

Proposed 4" drain

Fire Hose House

Existing 8" P.V.C.

Existing 12" sewer

Proposed relocation 6" P.V.C.

Proposed 4" drain

C.O.

EXISTING EYEWASH, SHOWER DRAIN LINE (3")

Proposed Sump 12'x 20'x 6' deep

Existing 6" P.V.C.

Pump

North Acid Plant

Cap existing drain

C.O.

C.O.

Proposed 2" line (OVERHEAD)

South Acid Plant

Existing 6" P.V.C. DRAIN

To existing HCL STORAGE TANKS

6"

Disposal Pump

PROPOSED 6" PVC RELOCATION

12" DIA. FRP COLLECTION POTS TO EXTEND 2'-0" ABOVE GRADE (TYP. 3 PLACES)

6" PVC SEWER LINE TO SLOPE OPPOSITE TO EXISTING (THIS SECTION ONLY)

$Cl_2$ Disposal Tanks

COLLECTION TRAY

C.O.

Proposed 4" drain

4" (APPROX. LOCATION)

EXISTING EMERGENCY SHOWER AND EYE WASH

1½" FROM CHLORINE BUILDING

1" POLYETHYLENE FROM $Cl_2$ STORAGE TANKS (OBSOLETE)

Existing 6" P.V.C.

C.O.

2½" PVC DRAIN

SUMP

15" SEWER FROM CHLORINE BUILDING (APPROX LOCATION)

## SITE PLAN

Proposed catch basin

Edge of asphalt

30" SEWER (EXISTING) W 5+70.2

Proposed 4" drain

2½" PVC DRAIN TO CELL HOUSE SUMP

10" SEAWATER (EXISTING) W 5+78.7

Tank #4 W 5+84.75

Proposed Acid Storage Tanks

Tank #3

DATUMN: 22'-0"
TOT. EL. 51'-7¾" (TYP.)

2'-0" APPROX.

15" VITRIFIED SEWER

S 19+18.89

Overhead pipe supports

Tank #2 W 5+84.75

Existing Acid Storage Tank

S 19+31.38

Tank #1

Vent Scrubber

Existing HCL pump base

EMERGENCY SHOWER AND EYEWASH TO BE RELOCATED APPROX. 2'-3" WEST

SHOWER RELOCATED

RELOCATED SUPPORT

1½"

EXISTING SUPPORT

Control Room

FROM $Cl_2$ BUILDING

2½"

15" SEWER

1'0" typ. Proposed Curb

El. 23.00

Existing grade El. 21.75

Tank Base #4

Tank Base #2

Proposed Sump

El. 17.00

SECTION 1

THIS IS APPENDIX "D"
TO DEVELOPMENT PERMIT 26.0
ISSUED BY THE CORPORATION OF THE DISTRICT OF NORTH VANCOUVER
Feb. 2/82 — W. H. Eglinton
DATE — MUNICIPAL CLERK

RECEIVED
OCT 25 1984
PLANNING DEPT

**PRELIMINARY**

MAY - 4 1981

| NO. | DESCRIPTION | BY | CHKD | APPD. | DATE |
|---|---|---|---|---|---|
| 2 | GENERAL | DDP | RGS | JDE | 82-02-08 |
| 1 | Revised spill capacity | AK | | | 01-05-81 |

REVISIONS

CANADIAN OCCIDENTAL PETROLEUM LTD.

HCL SPILL CONTROL

PROPOSED GENERAL ARRANGEMENT

CRIPPEN CONSULTANTS - NORTH VANCOUVER, B.C.

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — R. J. MacDONELL

| | |
|---|---|
| DESIGNER R.S.S. | SCALE: 1/4" = 1'0" |
| DRAWN AK | DATE: 12 Feb. 81 |
| CHECKER | CONTRACT NO.: 16826 |
| PROJECT MGR. | DRAWING NO.: D1 |
| MGR. ENGINEERING | REV. NO. 1 |

CAN. OXY. DWG. NO A-5394-W

THE CORPORATION OF THE DISTRICT OF NORTH VANCOUVER

DEVELOPMENT PERMIT 26.1

This Development Permit 26.1 is issued by the Council for The Corporation of the District of North Vancouver to Canadian Occidental Petroleum Ltd. for the development of Lot 5, Block H, District Lot 611, Plan 17801, N.H.B. W/L lease V1381(5), 1988 sq. m., and amends Development Permit 26.0 by :

1. deleting condition #2.

M Baker
Mayor

G M Warwick
Municipal Clerk

DATED this 5 day of March, 1985.

| COUNCIL AGENDA/INFORMATION | | |
|---|---|---|
| ☐ In-Camera | Date: _____ | Item # _____ |
| ☐ Regular | Date: _____ | Item # _____ |
| ☐ Info Package | Date: _____ | Item # _____ |
| ☐ Agenda Addendum | Date: _____ | Item # _____ |

| Dept. Manager | Director | Municipal Manager |
|---|---|---|

# The Corporation of the District of North Vancouver

# REPORT TO COUNCIL

October 5, 1998
File: 3060-20/8.93

**AUTHOR**: Doug Allan, Senior Development Planner

**SUBJECT**: **DEVELOPMENT PERMIT FOR SUBDIVISION – CANADIAN OCCIDENTAL PETROLEUM LTD. (AMHERST AVENUE)**

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**RECOMMENDATION**:

THAT:

1. Council issue Development Permit 414.0;

2. Repeal "Highway Reservation Agreement 2, 1979" (Bylaw 5190); and

3. The Mayor and Clerk be authorized to execute the necessary documents to enter into a new Highway Reservation Agreement for the realignment of Dollarton Highway and the possible extension of Riverside Drive south to the Vancouver Port Corporation lands.

**REASON FOR REPORT**:

Prior to the approval of a subdivision for Canadian Occidental Petroleum Ltd. (COPL), Council must consider the issuance of a development permit. Council is also required to repeal a Highway Reservation Agreement Bylaw adopted in 1979 and enter into a new agreement.

**SUMMARY**:

COPL has applied to subdivide a portion of its lands included within the rezoning application from the lands lying south of the CNR rail right-of-way. As the subject lands are situated within a designated development permit area, Council must consider the issuance of a development permit pursuant to S. 920(1)(a) of the Municipal Act prior to the issuance of an Approval-in-Principle for the subdivision.

In addition, a Highway Reservation Agreement registered in 1979 for the realignment of Dollarton Highway over a portion of lands owned by COPL to the east of Riverside Drive East must be repealed and a new Agreement allowing for a wider right-of-way executed.

**BACKGROUND**:

In 1992, COPL applied to subdivide its vacant lands lying north of the plant and extending up to Front Street into two lots situated on either side of the existing CNR rail right-of-way. The land lying north of the rail right-of-way involves a portion of the lands included in the rezoning application. The subdivision application has been on hold pending resolution of the zoning issues.

**EXISTING POLICY**:

1. Municipal Act:

   Section 920 prohibits the subdivision of land within a development permit area unless Council first issues a development permit.

2. Maplewood OCP:

   The Maplewood OCP designates the subject lands as a development permit area for protection of the natural environment, the protection of development from hazardous conditions and for the design of industrial development.

**ANALYSIS**:

1. The Proposal:

   Pursuant to the Municipal Act, the Company has applied for a development permit as a prerequisite to subdivision approval. The subdivision will create two new lots on either side of the CNR rail right-of-way from the existing parent parcel Lot 5. The proposed lot line follows the north boundary of the right-of-way. The northern parcel to be created involves a portion of the lands included within the rezoning application and is approximately 7.6 hectares (18.8acres) in area including lands to be dedicated and reserved for various road purposes. The gross area of the parcel south of the rail right-of-way is approximately 16.6hectares (41.07acres), inclusive of lands to be reserved for road purposes. Development Permit 414.0 is included as Attachment A.

   The subdivision will separate the "Developable Lands" north of the rail right-of-way from the "Plant Lands" to the south and will facilitate registration of the Restrictive Covenants required under the Implementation Agreement. As these covenants will establish the limits on chlorine storage/shipping conditions at the plant, it is imperative that the subdivision be approved to enable registration in conjunction with the registration of the Implementation Agreement.

2. Highway Reservation Agreements:

In addition to issuance of a development permit, there is a Highway Reservation Agreement registered over a portion of the Company's lands east of Riverside Drive East in 1979. The agreement provides, in very general terms, for a 20m (66ft.) wide right-of-way for the realignment of Dollarton Highway. However, the current realignment plan calls for a 30m (100ft.) wide right-of-way. In order to implement the present alignment, it will be necessary for Council to repeal Bylaw 5190 which authorized Council to enter into the Highway Reservation Agreement in 1979 and pass a motion to authorize the Mayor and Clerk to execute the necessary documentation to enter into a new Highway Reservation Agreement. The new agreement will also identify the lands required for the remainder of the Dollarton Highway realignment as well as the construction of Riverside Drive East south to the CNR property and make provision for the possible future extension of Riverside Drive East south to the Vancouver Port Corporation lands. As far as the access to the VPC lands is concerned, there is no intention to construct any road at this time. Rather, the lands are reserved such that access can be provided if and when it is deemed necessary.

In addition to reserving the lands for highway purposes, the agreement will include a restriction prohibiting the Company from placing any buildings or structures within the identified alignments, although there are existing B.C. Hydro towers in place at this time which may remain until such time as it is necessary to construct a road. The preparation of this agreement is underway.

**Timing/Approval Process**:

It is crucial that the development permit for subdivision be issued to enable the subdivision approval-in-principle to proceed in conjunction with the registration of the Restrictive Covenants under the Implementation Agreement.

**Business Plan**:

- **Environmental Impact**:

  This development permit facilitates the impending subdivision of the Company's lands into two parcels but does not involve the actual development of land. Any future development projects on the "Development Lands" will require that a development permit be issued which will establish specific conditions respecting the protection of the natural environment, the protection of development from hazardous conditions and for the form and character of commercial/industrial development.

Doug Allan,
Senior Development Planner

da/

Attachment

A – Development Permit 414.0

| REVIEWED WITH: | REVIEWED WITH: | REVIEWED WITH: | REVIEWED WITH: |
|---|---|---|---|
| ❑ Communications | ❑ Finance | External Agencies: | Advisory Committees: |
| ❑ Env. Protection | ❑ Fire Services | ❑ Recreation Commission | ❑ _____ |
| ❑ Human Resources | ❑ Legislative Services | ❑ Library Board | ❑ _____ |
| ❑ Eng. Public Works | ❑ Land | ❑ Health Dept. | ❑ _____ |
| ❑ Eng. Admin. | ❑ Permits & Licenses | ❑ RCMP | |
| ❑ Eng. Parks | ❑ Planning | ❑ Other: _____ | |
| | ❑ Social Planning | | |

## THE CORPORATION OF THE DISTRICT OF NORTH VANCOUVER

### DEVELOPMENT PERMIT 414.0

This Development Permit 414.0 is hereby issued by the Council for The Corporation of the District of North Vancouver to Canadian Occidental Petroleum Ltd. in respect of Lot 5, Block H, District Lots 193 and 611, Plan 17801 (PID: 007-254-067) to facilitate the subdivision of the subject lot to create:

a) a 7.6hectare (18.8 acre) parcel lying north of the C.N.R. rail right-of-way; and

b) a 16.6 hectare (41.07 acre) parcel lying south of the C.N.R. rail right-of-way.

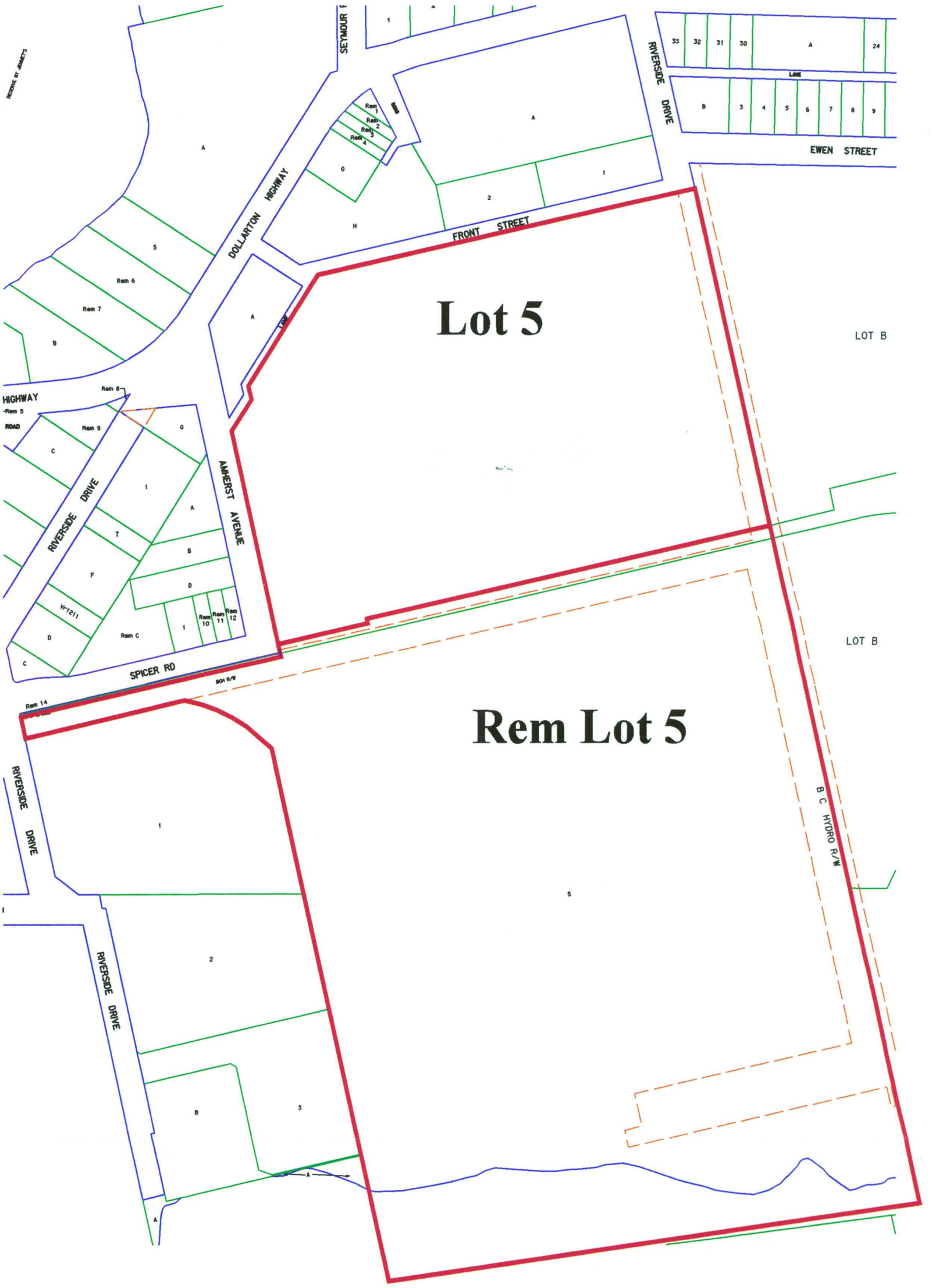
pursuant to Section 920(1)(a) as shown on the attached plan (Appendix 414.0A).

Mayor

Municipal Clerk

Dated this day 19th of October , 1998.

Document No: 137684




**APPENDIX "A"**
**TO DEVELOPMENT PERMIT 414.0**

COUNCIL AGENDA/INFORMATION

| | | |
|---|---|---|
| ☐ In-Camera | Date: _____ | Item # _____ |
| ☐ Regular | Date: _____ | Item # _____ |
| ☐ Info Package | Date: _____ | Item # _____ |
| ☐ Agenda Addendum | Date: _____ | Item # _____ |

Dept. Manager | Director | Municipal Manager

# The Corporation of the District of North Vancouver

REPORT TO COUNCIL

October 9, 1998
File: 3060-20/8.93

**AUTHOR:** J. Irwin Torry, Manager of Community Planning

**SUBJECT:** REZONING APPLICATION FOR CANADIAN OCCIDENTAL PETROLEUM LTD, BYLAW NO. 7023

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## RECOMMENDATIONS:

**It is recommended that Council:**

1. **Reconsider the Design Guidelines contained in Exhibit 5 and confirm acceptance of these guidelines for registration against Title by a Section 219 Covenant;**
2. **Amend Bylaw 7023 at second reading by:**
   (a) **deleting clauses 4B73(2) and (3) and renumbering 4B73(4) and (5) to 4B73(2) and (3)**
   (b) **deleting clauses 4B80(2) and (3) and renumbering 4B80(4) and (5) to 4B80(2) and (3).**

   **and then giving Bylaw 7023 second reading;**
3. **Issue Development Permit 414.0 for the purpose of facilitating a future subdivision pursuant to Section 920 of the Municipal Act (Exhibit 8);**
4. **Repeal the former Highway Reservation Bylaw No. 2, 1979 (Bylaw 5190) and abandon the accompanying Highway Reservation Agreement *(Exhibit 9);* and**
5. **Authorize the Mayor and Clerk to execute the necessary documents to enter into a new Highway Reservation Agreement for the realignment of Dollarton Highway and the possible extension of Riverside Drive east to the south to Vancouver Port Corporation lands, as illustrated in *Exhibit 10*.**

## *REASON FOR REPORT:*

This report:

1. responds to the issues raised at the August 25, 1998 Public Hearing;
2. forwards the design guidelines to Council for reconsideration and approval for registration against title of the development lands;

3. proposes a minor amendment to the landscaping requirements in parking areas in both CD18 and CD 19 Zones of Bylaw 7023 to ensure compatibility with the design guidelines;
4. proposes issuance of a development permit pursuant to Section 920(1)(a) of the Municipal Act to facilitate the subdivision of Lot 5 into two parcels to allow the registration of the Restrictive Covenant pursuant to the Implementation Agreement, which limits the fixed tank storage on Canadian Occidental Petroleum lands;
5. recommends repealing the former Highway Reservation Bylaw and Agreement for a realigned Dollarton Highway;
6. recommends Mayor and Council be authorized to execute a new Highway Reservation Agreement respecting Dollarton Highway and a possible southerly extension of Riverside Drive East to the Vancouver Port Corporation lands; and
7. outlines all of the steps necessary to proceed with this proposal.

***BACKGROUND:***

On May 21, 1998, Council closed the Public Hearing on Bylaw 7008 and returned the Bylaw to the Council meeting of May 25, 1998. On May 25, 1998 Council abandoned Bylaw 7008 and instructed staff to prepare a revised Bylaw for Council's consideration on June 1, 1998.

On June 1, 1998, Council introduced Bylaw 7023 and held a Public Hearing on June 16, 1998. The Hearing was adjourned to August 25, 1998 and then closed following public submissions that same evening.

**ANALYSIS:**

**1. Issues raised at the August 25, 1998 Public Hearing**

(a) Type and level of insurance carried by Canadian Occidental Petroleum Ltd.

In a letter dated August 31, 1998, Canadian Occidental Petroleum Ltd. advised that the company carries $300,000,000 in U.S. funds of liability insurance. *(Exhibit 1)*;

(b) Differences in traffic numbers being presented to Council

The Manager of Engineering Services report dated August 24, 1998 (circulated to Council on August 25, 1998) addresses the differences *(Exhibit 2);*

(c) What mechanisms are available to the District to ensure that what is presented by the applicant in the guidelines and architectural drawings may be enforced by the District?

In a letter dated October 2, 1998, Lidstone, Young, Anderson recommends that the design guidelines be registered by way of a Covenant under Section 219 of the Land Title Act *(Exhibit 3)*;

(d) To what extent may the District require a business to carry insurance commensurate with the level of risk of the operation?

Lidstone, Young, Anderson, in a letter dated October 2, 1998 advise that the District does not have the express power to require a business to carry insurance commensurate with the level of risk of the operation. The solicitor also advises that although the developer may voluntarily enter into an agreement with the District it has been their experience that developers have no incentive to voluntarily enter into such agreements *(Exhibit 3)*;

(e) What are the District's rights respecting expropriation?

In the same October 2, 1998 letter, Lidstone, Young, Anderson provide a paper prepared by their firm which deals with the expropriation process, compensation, disturbance, costs and related matters;

(f) Provide the rationale for the phasing of the construction of a realigned Dollarton Highway

In a report dated September 10, 1998, the Manager of Engineering Services provides a coloured phasing plan which illustrates the years of construction and rationale for the phases *(Exhibit 4);*

(g) How we address the concerns regarding underground parking and the potential impacts on water flows to the Maplewood mudflats?

With input from the Environmental Protection Officer, the Design Guidelines include a requirement under Section 4.5 Landscaping and Environmental Standards which stipulates that:

*"The proponent will be responsible for determining geotechnical conditions, including but not necessarily limited to studies dealing with stormwater and groundwater management. All development applications shall include a comprehensive storm and groundwater management analysis prepared by a Professional Engineer with the appropriate experience. All water management analysis must include detailed strategies for reducing peak flow impacts during storm events, reducing the pollution associated with stormwater runoff and maintaining regional groundwater tables. The result of these analyses will be included as conditions in development permits." Design Guidelines included as Exhibit 5.*

(h) Specific development concerns regarding semi-trailer truck access; provision of indigenous landscape elements and Project 2000 design considerations.

(i) Section 4.3 of the Design Guidelines – Access, Parking/Loading and Circulation specifies under the loading subsection that:

*"The design of parking and loading areas must achieve a fine balance between functional and aesthetic objectives. Northwoods envisions a broad mix of service vehicles, from large vans to semi-trailors. Traffic routes should be adequate for their intended use, achieve proper manoeuvring within the boundaries of each site, while maintaining landscape cluster zones as described in Open Space objectives."*

(ii) Section 4.5 of the Design Guidelines – Landscaping and Environmental Standards requires:

*"Liaison with District Parks staff is encouraged in the selection of plant material, which is based upon the use of indigenous species requiring low maintenance. A list of appropriate plants to be used is provided in this document for such reference purposes."*

(iii) The Design Guidelines dealing with Building Related Objectives (Section 5.0) specify that:

*"projects incorporating 'Green' building technologies are strongly encouraged and will receive special recognition in the approval process. We suggest that documents such as the "C-2000 Program for Advanced Commercial Buildings" available from the Federal government be reviewed and evaluated for this purpose."*

(i) Include emergency preparedness considerations in the design guidelines.

Given the proximity of this employment centre to chemical manufacturing facilities, the Design Guidelines stipulate that:

*"recommended features for buildings include provisions for building air tightness, refuge areas, ventilation shut-off mechanisms and chemical alarm systems. The Co-ordinating Registered Professional shall provide an assurance that these features have been installed and inspected in accordance with good practice."*

(j) Incorporate, if possible, techniques into the design guidelines which reduce the potential for birds flying into large glass panels and windows in new buildings.

The consultant was not able to identify specific techniques to prevent birds from flying into glass panels.

(k) Does the Risk Assessment for Sterling Pulp Chemicals result in any changes to the risk contours developed for Canadian Occidental Petroleum Ltd.?

In a report dated October 8, 1998, Arthur D. Little Incorporated concluded that:

*"Considering all this information and the previous results for the CanOxy site, our best estimate of the cumulative impacts of the two operations is that the $10^{-5}$ per year contour is likely to move from the middle of the Mohawk Lubricants site slightly outward to place it closer to the northern boundary of the site. It also appears that there will be no or minimal impact on the placement of the $10^{-6}$ per year contour. Thus, there is no significant effect attributable to cumulative impacts in the area of the proposed development". (Refer to Exhibit 6).*

## 2. Design Guidelines for the Northwoods Business Park

The design guidelines *(Exhibit 5)* for Northwoods Business Park are based upon an environmentally sensitive approach to development where the importance of maintaining the existing forested character along both sides of Dollarton Highway as the predominant image for this employment centre is paramount.

Specific sections of the guidelines were modified to address concerns regarding ground water flows to the Maplewood Conservation area, preservation of existing trees and use of indigenous landscape elements, utilization of the C2000 program design considerations and inclusion of emergency preparedness features for all buildings.

The intent is to have these design guidelines registered against the title of the development lands via a Section 219 Covenant once Council has approved the detailed wording of the guidelines.

## 3. Proposed Amendment to the Landscaping Requirements in Parking Areas under Bylaw 7023 *(Exhibit 7)*.

In order to ensure consistency between the zoning regulations and the spirit of the design guidelines, it is recommended that the rigid specifications for landscaping in parking areas contained in the Zoning Bylaw be deleted. This deletion will allow for the retention of clusters of trees or heritage stumps based on tree surveys and the Community Forester's recommendations. This approach will result in a greater retention of native landscaping and reinforces the natural landscape image.

**4. Issuance of a Development Permit to Facilitate the Subdivision of Lot 5 into Two Parcels**

Canadian Occidental Petroleum Ltd. has applied to subdivide a portion of its lands included within the rezoning application from the lands lying south of the CNR rail right-of-way. As the subject lands are situated within a designated development permit area, Council must consider the issuance of a development permit pursuant to S. 920(1)(a) of the Municipal Act prior to the issuance of an Approval-in-Principle for the subdivision. The subdivision will create two new lots with the proposed lot line following the north boundary of the CNR rail right-of-way. The northern parcel to be created involves a portion of the lands included within the rezoning application and is approximately 7.6 hectares (18.8 acres) in area including lands to be dedicated and reserved for various road purposes. The gross area of the parcel south of the rail right-of-way is approximately 16.6hectares (41.07 acres), inclusive of lands to be reserved for road purposes. Development Permit 414.0 is included as Exhibit 8.

The subdivision will separate the "Developable Lands" north of the rail right-of-way from the "Plant Lands" to the south and will facilitate registration of the Restrictive Covenants required under the Implementation Agreement. As these covenants will establish the limits on chlorine storage/shipping conditions at the plant, the approval of the subdivision will enable registration in conjunction with the registration of the Implementation Agreement.

**5. Repealing the Former Highway Reservation Bylaw for a Realigned Dollarton Highway**

In 1979 Council adopted Bylaw 5190 which authorized the municipality to enter into a Highway Reservation Agreement. This agreement provides, in very general terms, for a 20 metre (66 ft.) wide right-of-way for the realignment of Dollarton Highway over a portion of Canadian Occidental's lands east of Riverside Drive East. *(attached as Exhibit 9).*

As the current realignment plans require a 30 metre (100 ft) wide right-of-way and also extends across Lot 5 (located west of Riverside Drive East) it is recommended that Bylaw 5190 be repealed and the accompanying Highway Reservation Agreement be abandoned.

**6. Authorization to Execute a New Highway Reservation Agreement Respecting the Realignment of Dollarton Highway and a Possible Extension of Riverside Drive East to the South to the Vancouver Port Corporation Lands.**

In order to implement the present realignment of Dollarton Highway and ensure Vancouver Port Corporation lands are not land locked, Council is required to

pass a motion authorizing the Mayor and Clerk to execute the necessary documentation to enter into a new Highway Reservation Agreement.

The new agreement will also identify the lands required for the remainder of the Dollarton Highway realignment as well as the construction of Riverside Drive East south to the CNR property and make provision for the possible future extension of Riverside Drive East south to the Vancouver Port Corporation lands. As far as the access to the VPC lands is concerned, there is no intention to construct any road at this time. Rather, the lands are reserved such that access can be provided if and when it is deemed necessary *(illustrated in Exhibit 10).*

In addition to reserving the lands for highway purposes, the agreement will include a restriction prohibiting Canadian Occidental from placing any buildings or structures within the identified alignments, although there are existing B.C. Hydro towers in place at this time which may remain until such time as it is necessary to construct a road.

## 7. Sequence of Steps to Proceed with the Northwoods Business Park

Assuming Council approves the five (5) recommendations in this report, the subsequent sequence of events involves Council:

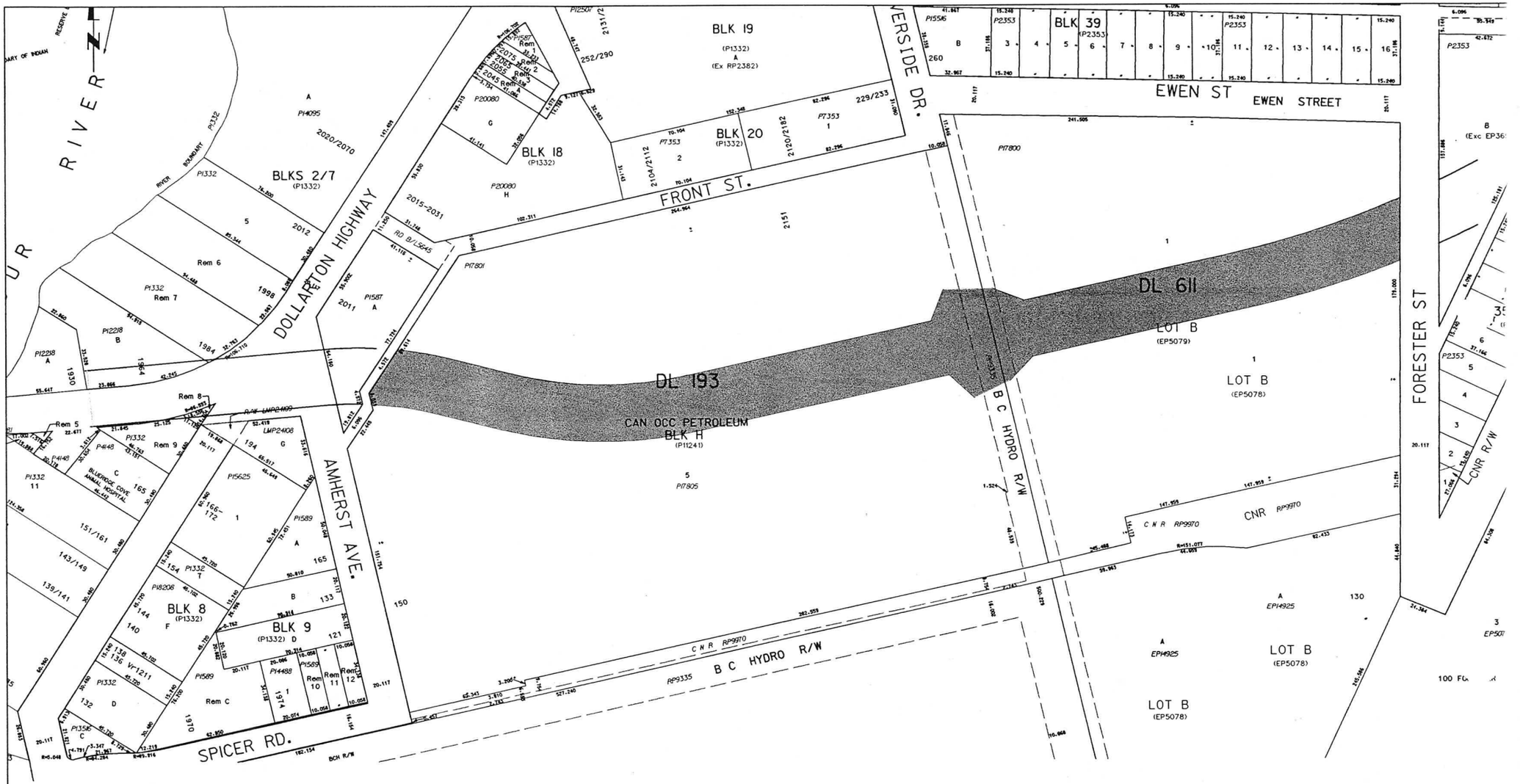
(a) authorizing the Mayor and Clerk to execute the Implementation Agreement and associated Section 219 Covenants for registration against Title via a 219 Covenant;
(b) authorizing the Mayor and Clerk to execute the amended Cost Sharing Agreement;
(c) being notified that the Letter of Credit in the amount of $3,000,000 has been received in an acceptable form by the Director of Financial Services;
(d) approving the subdivision of Lot 5 into two parcels and exempting the proposed Rem of Lot 5 from the minimum frontage as required under Section 944 of the Municipal Act; and
(e) giving third reading, passage and adoption of Bylaw 7023.

J. Irwin Tom,
Manager of Community Planning
Attach.
Exhibits 1 – 10

| REVIEWED WITH: | REVIEWED WITH: | REVIEWED WITH: | REVIEWED WITH: |
|---|---|---|---|
| ❑ Communications | ❑ Finance | External Agencies: | Advisory Committees: |
| ❑ Env. Protection | ❑ Fire Services | ❑ Recreation Commission | ❑ _____ |
| ❑ Human Resources | ❑ Legislative Services | ❑ Library Board | ❑ _____ |
| ❑ Eng. Public Works | ❑ Land | ❑ Health Dept. | ❑ _____ |
| ❑ Eng. Admin. | ❑ Permits & Licenses | ❑ RCMP | |
| ❑ Eng. Parks | ❑ Planning | ❑ Other: _____ | |
| | ❑ Social Planning | | |

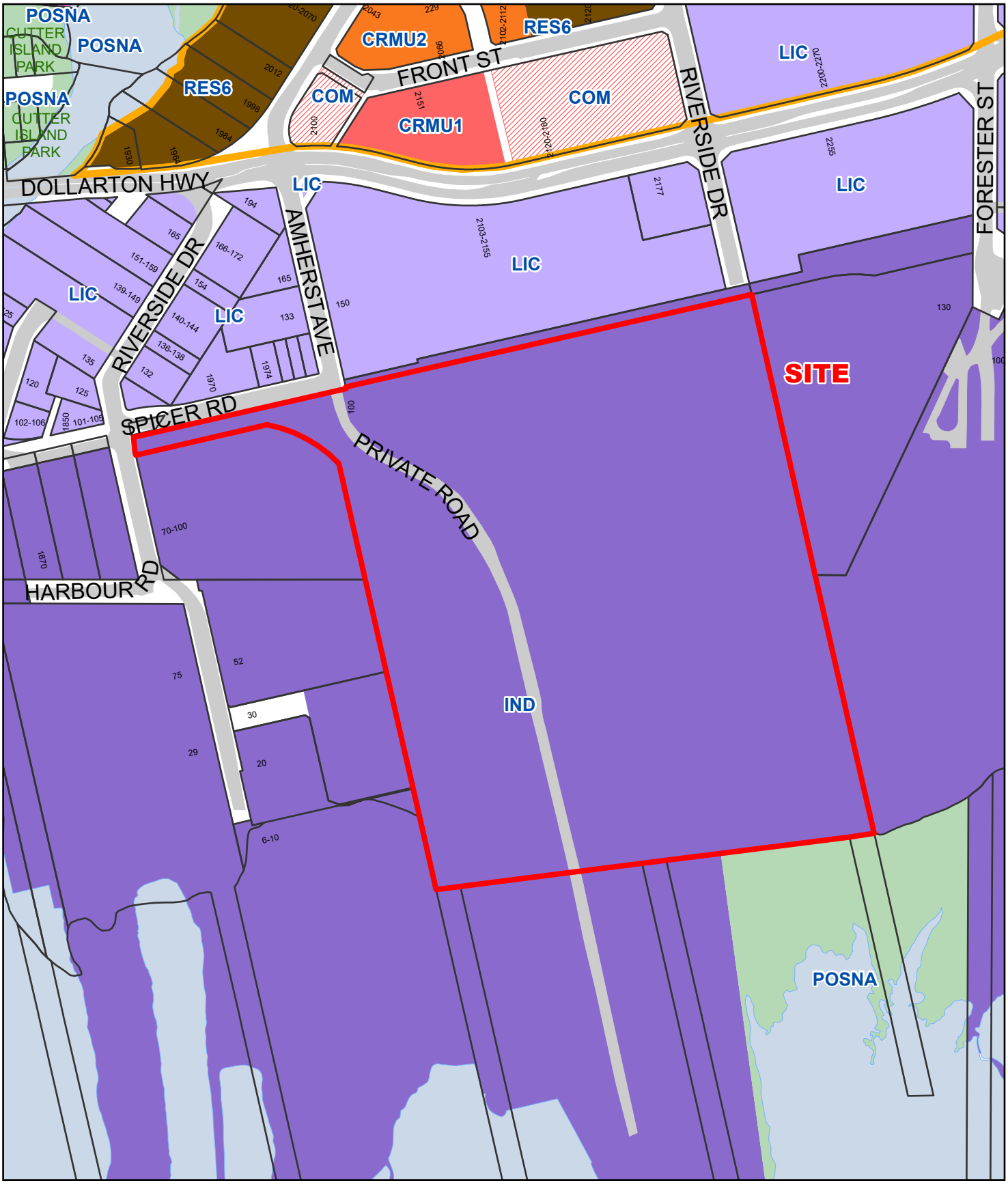
***EXHIBITS:***

1. Canadian Occidental Petroleum Ltd's letter outlining liability insurance
2. Manager of Engineering Services report on differences in traffic numbers
3. Letter from Lidstone, Young, Anderson respecting design control, insurance requirements for businesses operating in the District and the District's rights respecting expropriation
4. Manager of Engineering Services report on the construction schedule for Dollarton Highway realignment
5. Design Guidelines for Northwoods Business Park
6. Arthur D. Little Inc.'s review of the Risk Assessment of Sterling Pulp Chemical's North Vancouver facility, including the seismic analysis/risk assessment of the concentrated hydrochloric acid tank prepared by Hooley & Schubak Ltd.
7. Bylaw 7023
8. Development Permit 414.0
9. Highway Reservation Agreement and Highway Reservation Bylaw No. 2, 1979 (Bylaw 5190)
10. New Highway Reservation Agreement and Alignment for Dollarton Highway and Possible Extension of Riverside Drive to VPC lands




**HIGHWAY RESERVATION AGREEMENT BOUNDARY**

**DOLLARTON HIGHWAY**

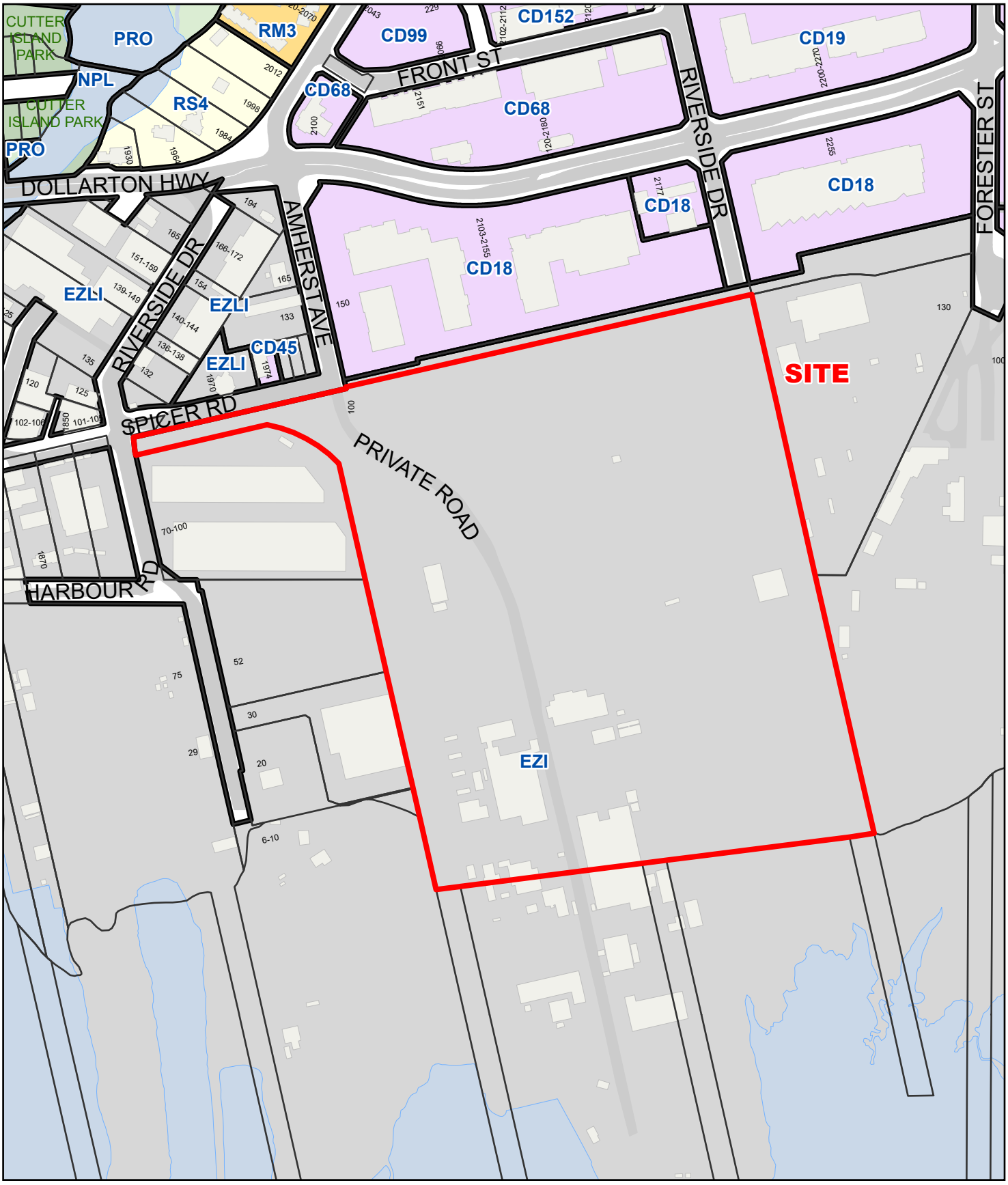



# 100 AMHERST AVE
# OCP CONTEXT MAP

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**Published: October 7, 2025**

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# 100 AMHERST AVE

# ZONING CONTEXT MAP

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**Published: October 7, 2025**

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