

Info Package

Date: *January 4, 2018*



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**

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

SUBJECT: Update on Planning and Management Practices Associated with Chemical Hazard Risk in Maplewood

January 2, 2018

Page 2

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 0.3×10^{-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.

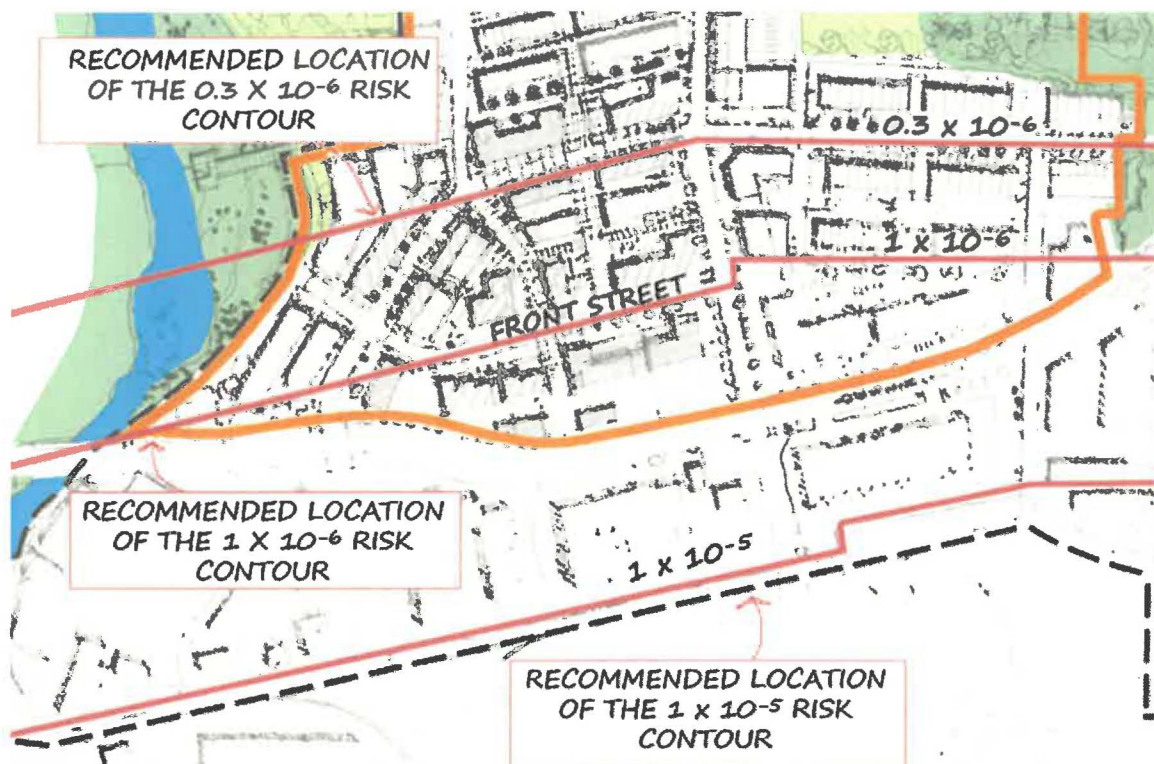


FIGURE 1: Risk Contours in Maplewood Village Centre

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

**SUBJECT: Update on Planning and Management Practices Associated with
Chemical Hazard Risk in Maplewood**

January 2, 2018

Page 3

residential land uses beyond the 10^{-6} contour to the unrestricted land use area and sensitive development beyond the 0.3×10^{-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 weeks 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 0.3×10^{-6} was also established as shown on Figure 1.

**SUBJECT: Update on Planning and Management Practices Associated with
Chemical Hazard Risk in Maplewood**

January 2, 2018

Page 4

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 1×10^{-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

**SUBJECT: Update on Planning and Management Practices Associated with
Chemical Hazard Risk in Maplewood**

January 2, 2018

Page 5

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.

SUBJECT: Update on Planning and Management Practices Associated with Chemical Hazard Risk in Maplewood

January 2, 2018

Page 6

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.

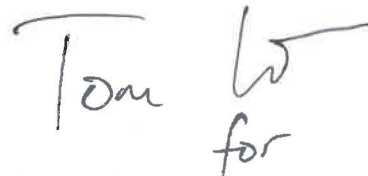
Conclusion:

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



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:					
<input type="checkbox"/> Sustainable Community Dev.	_____	<input type="checkbox"/> Clerk's Office	_____	External Agencies:	
<input type="checkbox"/> Development Services	_____	<input type="checkbox"/> Communications	_____	<input type="checkbox"/> Library Board	_____
<input type="checkbox"/> Utilities	_____	<input type="checkbox"/> Finance	_____	<input type="checkbox"/> NS Health	_____
<input type="checkbox"/> Engineering Operations	_____	<input type="checkbox"/> Fire Services	_____	<input type="checkbox"/> RCMP	_____
<input type="checkbox"/> Parks	_____	<input type="checkbox"/> ITS	_____	<input type="checkbox"/> NVRC	_____
<input type="checkbox"/> Environment	_____	<input type="checkbox"/> Solicitor	_____	<input type="checkbox"/> Museum & Arch.	_____
<input type="checkbox"/> Facilities	_____	<input type="checkbox"/> GIS	_____	<input type="checkbox"/> Other:	_____
<input type="checkbox"/> Human Resources	_____	<input type="checkbox"/> 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.

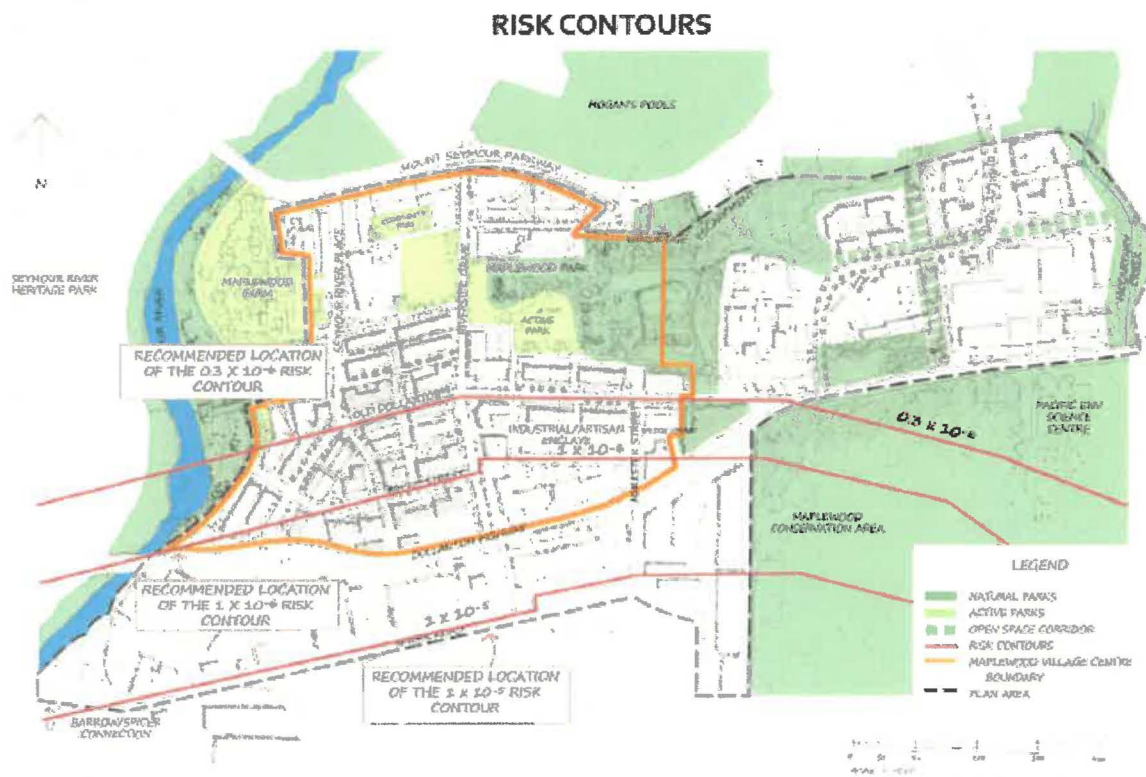
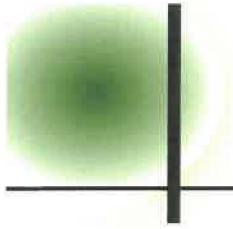


Figure 14: Risk Contours

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.



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 1×10^{-6} and 0.3×10^{-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 1×10^{-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.

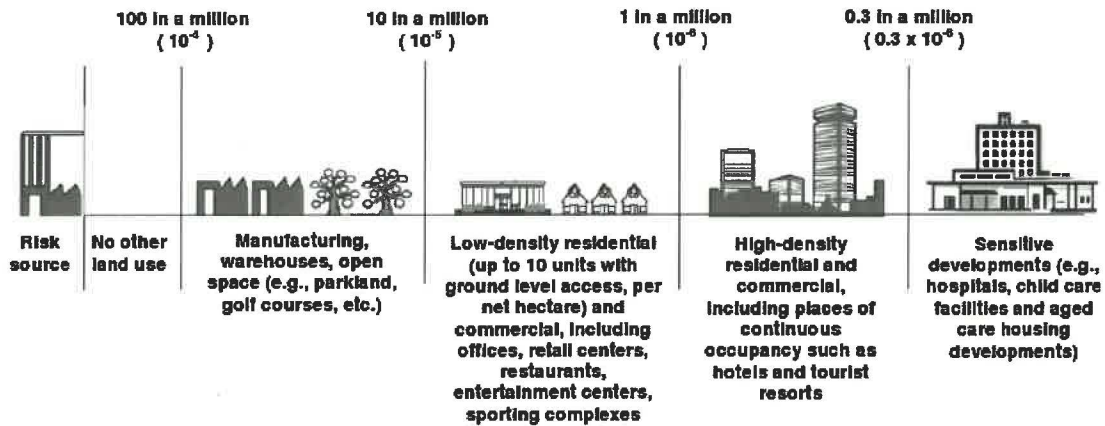
As part of the overall recommendations in my August 8, 2012 report, I included this contour to define the boundary between heavy industrial development (Canexus, Erco, Newalta, etc) and light to medium industries such as repair shops, or fabrication shops which are usually connected close to heavy industry. I would strongly suggest including the 1×10^{-5} line along Spicer Road and continuing it to the east and west as you see fit.

The 1×10^{-6} and 0.3×10^{-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 1×10^{-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 1×10^{-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)

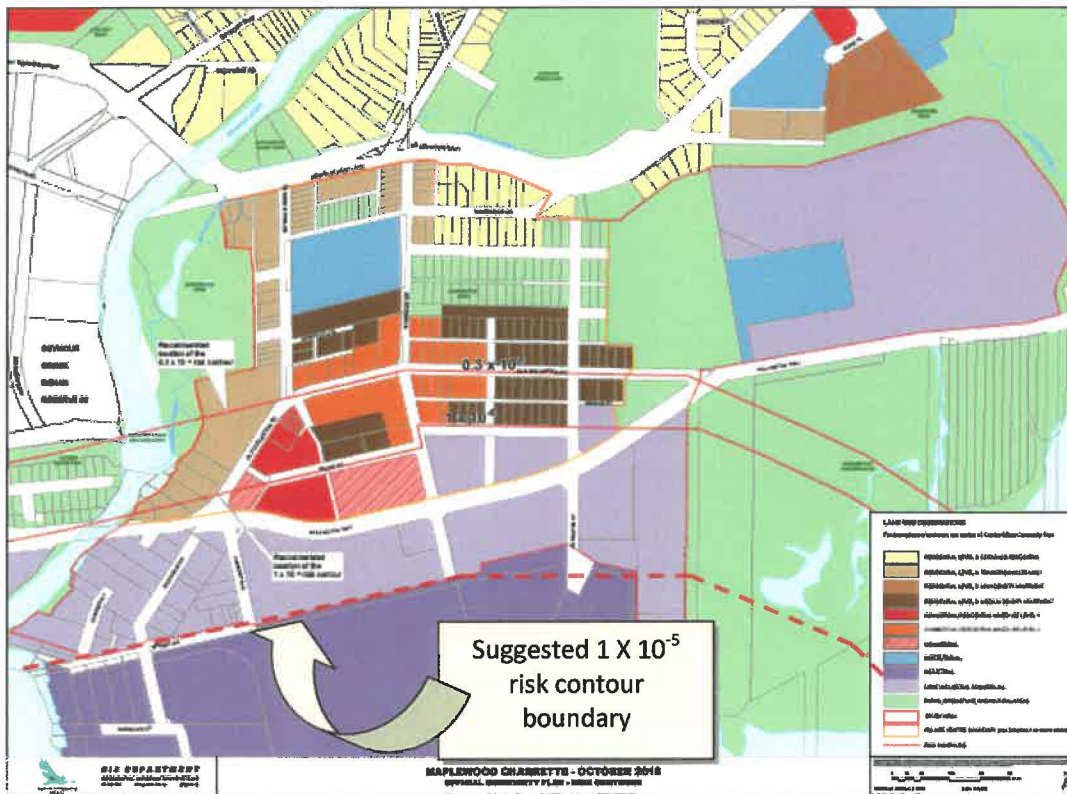
Annual Individual Risk Chance of fatality per year



Allowable Land Uses

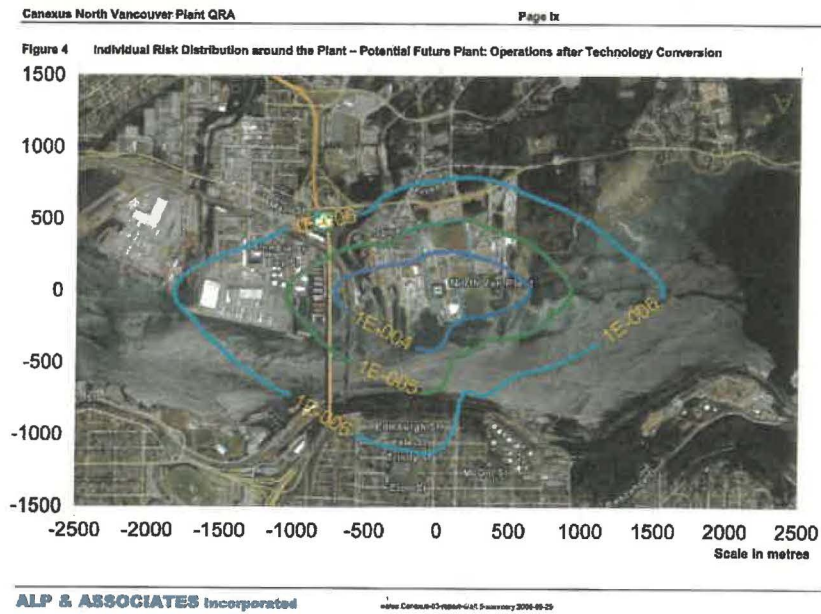
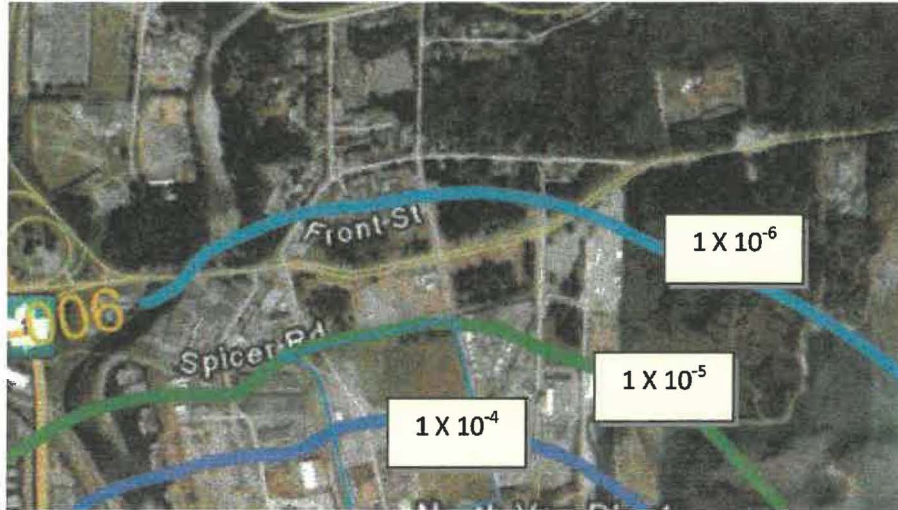
Proposed Risk Acceptable Contours

Maplewood Charrette – October 2016, "Official Community Plan – Risk Contours"



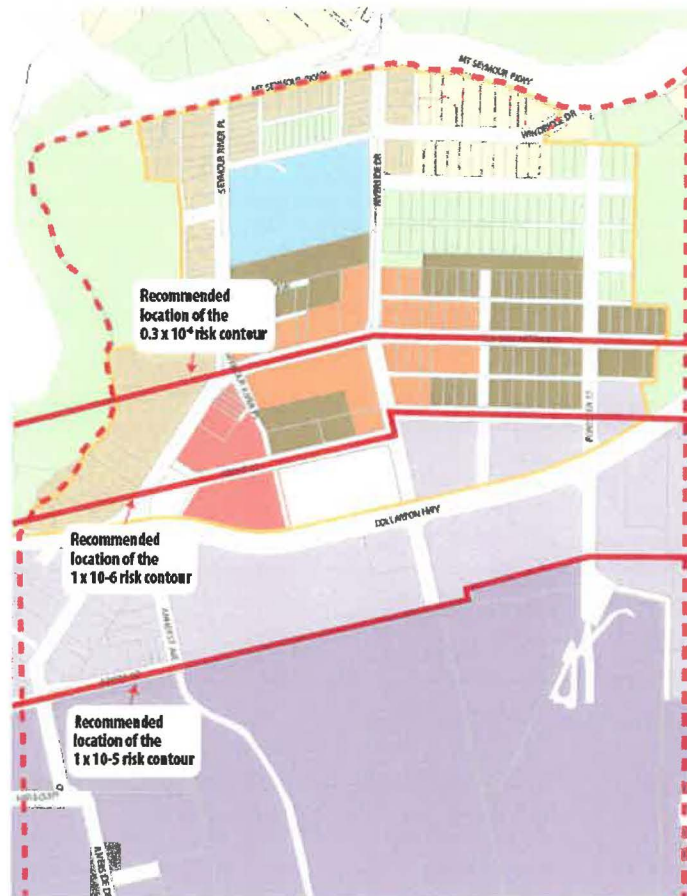
Originally in 2006 a risk assessment was conducted by Alp and Associates showing the risk contours for 1×10^{-5} and 1×10^{-6} to be located as shown below.

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."

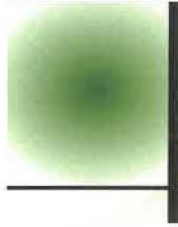


Summary:

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."



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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 (1×10^{-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 1×10^{-5} , Front Street as risk contour 1×10^{-6} and Old Dollarton as the 0.3×10^{-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 1×10^{-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 1×10^{-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 1×10^{-5} and 1×10^{-6} risk contours (New Dollarton and Front Street).
- For any residences between the 1×10^{-5} and 1×10^{-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 1×10^{-5} and 1×10^{-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 1×10^{-5} and 1×10^{-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.

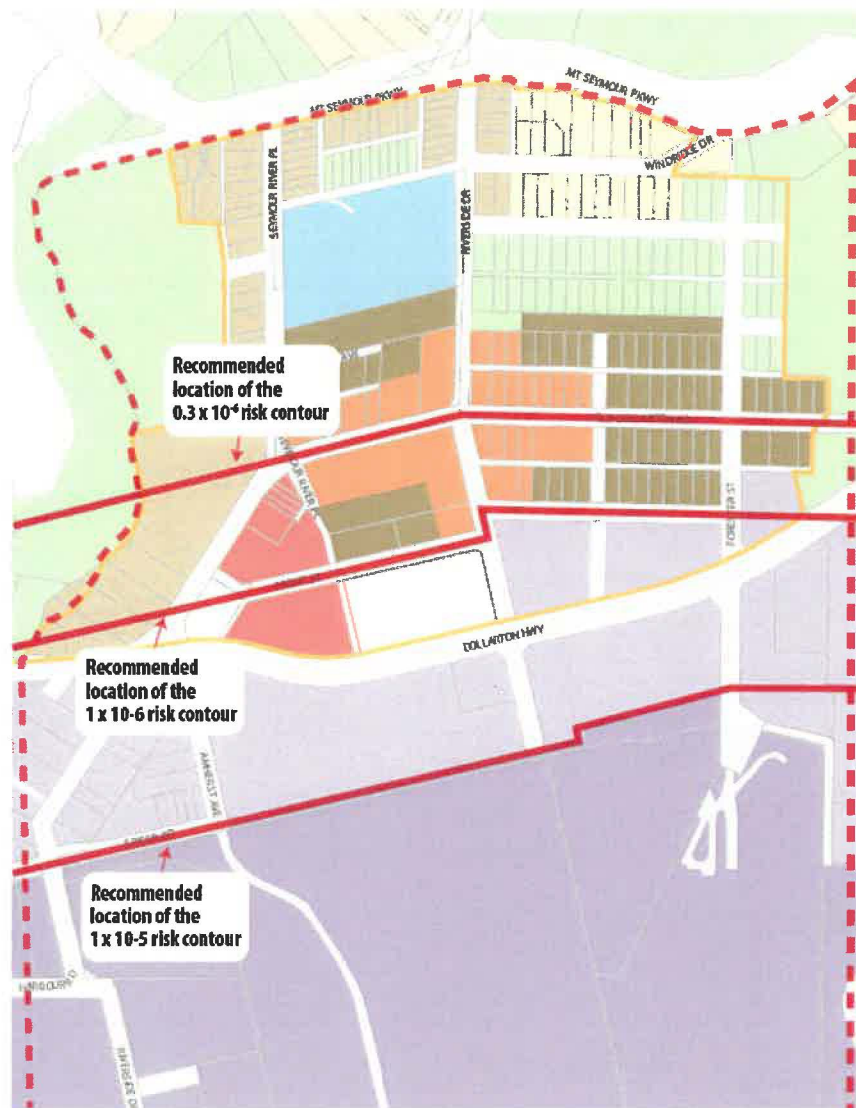
The intention of this report is to assess the proposed development and make recommendations for defining the “Development Permit Area” (DPA) from a risk based land use planning approach. Maintaining a positive relationship between the industrial activities and the residential life style is at the basis 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.





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."**

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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 0.3×10^{-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 1×10^{-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) $1 \text{ acre} = 0.40468 \text{ hectares}$ 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 1×10^{-5} and the 1×10^{-6} risk zones. For anything beyond the 1×10^{-6} risk contour much higher densities are allowed. This applies for the Maplewood residential area and commercial area north of Front Street (the 1×10^{-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 (1×10^{-4} to 1×10^{-5} risk zone) is preferred.*

The second point to consider is the allowable residential densities for the area between 1×10^{-5} and 1×10^{-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 1×10^{-5} and 1×10^{-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 1×10^{-5} . 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 – 3 hours 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 1×10^{-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 1×10^{-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 led 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 1×10^{-5} risk contour and the 1×10^{-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 1×10^{-6} risk contour was moved to Front Street and the 1×10^{-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 4.5×10^{-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.



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