

Amec Foster Wheeler



Canadian Environmental Protection Act (CEPA) – E2 Plans: Environmental Emergencies Management

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CEPA – E2 Regulations

- Part 8 of the Canadian Environmental Protection Act (CEPA), 1999, is dedicated to environmental matters related to emergencies, primarily in response to the 1984 disaster in Bhopal, India, in which 40 tonnes of toxic gas were released. As a result of this release, an estimated 11,000 people died, and over 500,000 people were injured from direct exposure and longer term gas-related disease.
- The original E2 Regulations first came into force on November 18, 2003 and were later amended on December 8, 2011, which was triggered by the terrorist attacks on September 11, 2001 in the US.
- The objective of the currently proposed E2 Regulations, 2016 is to further enhance environmental emergency management in Canada, through the addition of 49 new hazardous substances to Schedule 1.

CEPA – E2 Regulations

- The E2 Regulations made under the Canadian Environmental Protection Act (CEPA), 1999, subsection 200(1), aim to:
 - Enhance the protection of the environment and human health from environmental emergencies by promoting prevention and ensuring preparedness, response and recovery
 - Reduce the frequency and consequences of environmental emergencies caused by uncontrolled, unplanned or accidental releases of toxic or other hazardous substances.
- The E2 Regulations apply to any person who owns or has the charge, management or control of any of the 215 listed substances at a fixed facility.
 - There are currently ~4,700 regulated facilities.
 - Of these ~2,900 are required to prepare, implement, test and update E2 Plans.
 - ~75% of the ~4,700 regulated facilities operate in Ontario (30%), Alberta (25%) and Quebec (20%)

CEPA – E2 Regulations

- Schedule 1 of the E2 Regulations contains a list of substances that, should they enter the environment as a result of an environmental emergency, would be or may be harmful to the environment, its biological diversity or human life or health.
- All the substances on Schedule 1 have at least one emergency hazard characteristic (explosive, flammable, toxic if inhaled or added to an aquatic environment, or carcinogenic)
- Under the E2 Regulations, any person who owns or has the charge, management or control of a listed substance is required to:
 - Identify the substance and place;
 - Prepare an Environmental Emergency plan (E2 Plan);
 - Implement, update and test the E2 Plan annually;
 - Notify of closure or decommissioning;
 - Report environmental emergencies involving regulated substances.

CEPA – E2 Regulations

4(3) The environmental emergency plan must include:

1. the identification of any environmental emergency that can reasonably be expected to occur at the place and that would likely cause harm to the environment or constitute a danger to human life or health, and identification of the harm or danger;
2. a description of the measures to be used to prevent, prepare for, respond to and recover from any environmental emergency identified;
3. a list of the individuals who are to carry into effect the plan in the event of an environmental emergency and a description of their roles and responsibilities;

CEPA – E2 Regulations

- 4(3) The environmental emergency plan must include:
4. the identification of the training required for each of the individuals listed;
 5. a list of the emergency response equipment included as part of the environmental emergency plan, and the equipment's location; and
 6. a description of the measures to be taken by the identified person to notify members of the public who may be adversely affected by an environmental emergency and to inform them of those measures and of what to do in the event of an environmental emergency.

E2 Plan Modelling What Does it Tell Us?

Why Model?:

- To satisfy the requirements of Section 4 of the E2 Regulations, regulated facilities should develop accidental release scenarios for any facility based on any environmental emergency that can reasonably be expected to occur at that place.
- Need to define both a Worst-Case Scenario in which the contents of the largest container on-site are released, and Alternative Scenarios involving the release of lesser amounts of the regulated substance(s)
- Ultimately to determine how far off-site an impact might occur and develop an appropriate response plan.

E2 Plan Modelling Worst Case Scenario

Worst-Case Scenario:

- Risk Management guidance indicates it is a potential accident releasing the greatest quantity of the hazardous substance, held in the largest container and producing the greatest impact distance.
- The impact distance assumes a vapour cloud explosion, with a 1 psi overpressure endpoint and 10% of the vapour cloud participating in the explosion.
- Only passive mitigation measures (ie diked areas, safety walls) are considered.
- Distance modelled using the EPA RMP* Comp software, which is a conservative model that incorporates most challenging weather conditions to determine maximum potential off-site impacts.



E2 Plan Modelling Worst Case Scenario

Example worst-case modelling result



Propane – Worst -Case Scenario using EPA RMP*Comp

Equipment: Railcar

Scenario: Leak of largest inventory (full railcar), vapour cloud explosion to 1 psi overpressure and 10% of the vapour cloud participating in the explosion.

Inventory in USgal (Tonnes): 30,000 (60)
maximum quantity in railcar.

Temperature (deg C): 25

Wind Speed (m/s): 1.5 m/s

Atmospheric Stability : F

Ambient Temp: 25

Ground Temp: 25

Overpressure (1 psi distance): 700 m

E2 Plan Modelling Alternative Case Scenario

Alternative Case Scenario:

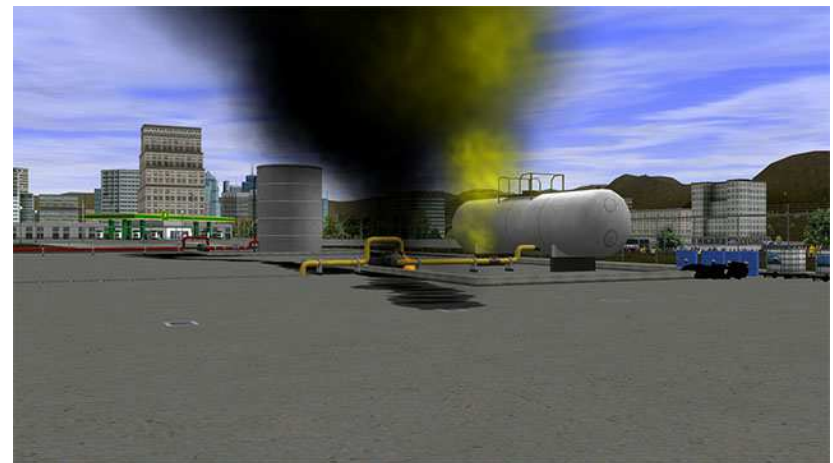
- More likely or probable accidents involving regulated substances;
- Requires a facility-wide review of potential risks and accidents;
- Discussions with site personnel of previous accidents and near misses; and
- Based on these discussions an analysis of potential risks and accidents is undertaken to determine what is the most likely.





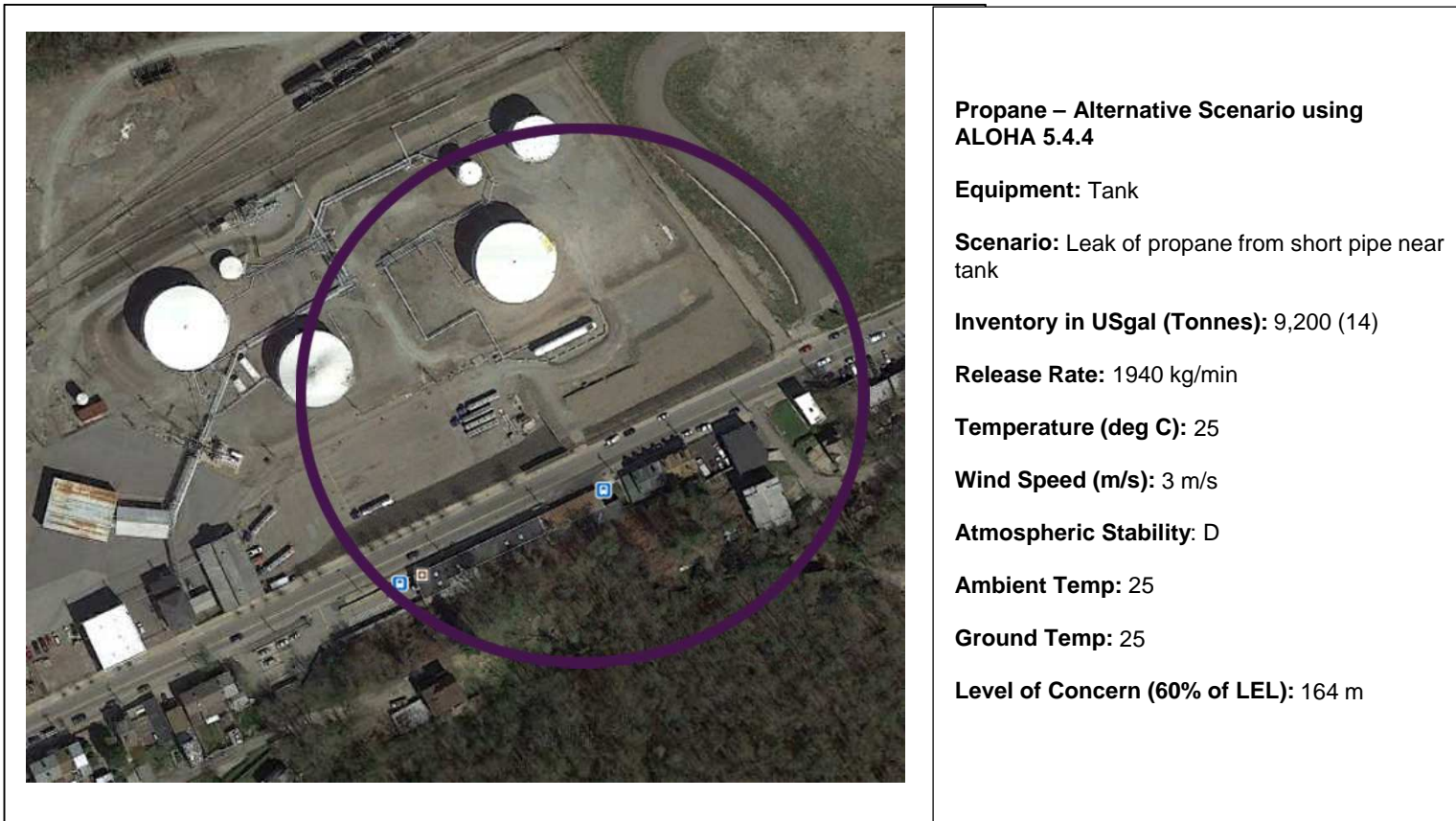
E2 Plan Modelling Alternative Case Scenario

- Passive and active mitigation measures (i.e. safety valves, flares, alarms) can be considered,
- More realistic weather conditions can be used,
- Interconnections, proximity and potential domino effect are taken into account (if applicable),
- More complex models such as USEPA ALOHA or USEPA SLAB are used to determine the impact distances
- Models allows for different release scenarios and weather conditions.
- Types of Alternative Scenarios can include,
 - vessel overflow;
 - relief valve failure;
 - transfer hose coupling failure;
 - process piping failure; and
 - leaks due to corrosion or accidents,



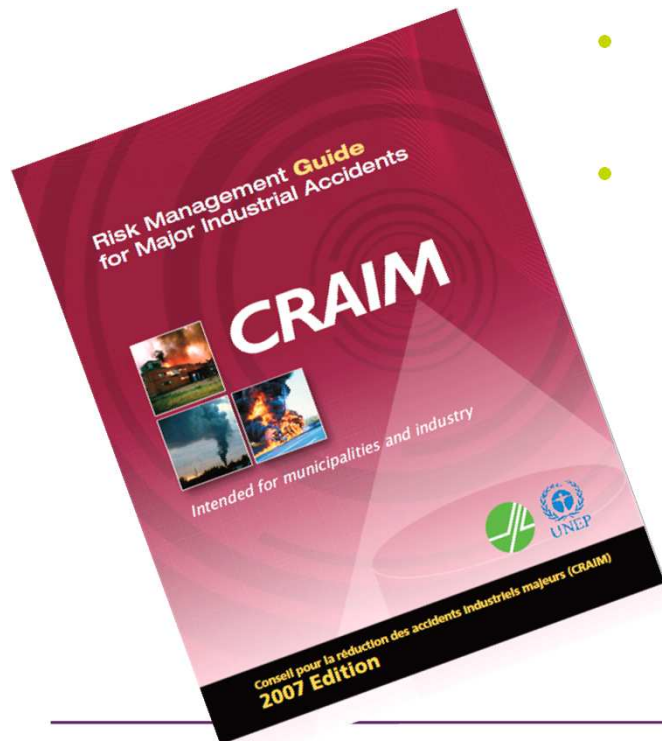
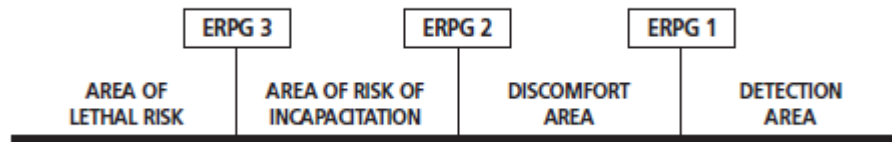
E2 Plan Modelling Alternate Case Scenario

Example alternative case modelling result



What Level of Concern?

Emergency Response Planning Guidelines (ERPG) (by AIHA)



- E2 Planning recommends ERPG2 levels to be used.
- Levels at which “nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms”. For example, ERPG-2 for SO₂ is 3 ppm compared to 0.070 ppm as an ambient air quality criteria (new Canada Wide Standard for 2020).

Impact Zones

Substance	Type of Release	Level of Concern
Liquefied gas (flammable)	Worst-case	Largest container accident, 10% of vapour cloud explosion, impact distance to 1 psi overpressure.
Liquefied gas (flammable)	Alternative-case	Vapour cloud fire (flash fire) with impact distance to lower flammability / explosive limit.
Toxic liquid release	Worst-case/Alternative	Impact distance of a Toxic area vapour cloud, ERPG-2

- For overpressure 1 psi, windows shattering. Other endpoints, such as lower explosive limits or heat radiation can also be used.
- For toxics, Emergency Response and Planning Guide (ERPG) levels are used. ERPG-2 levels are typically used.

E2 Plan Modelling Examples

Substance	Worst-case or Alternative case	Release scenario	Active or Passive Mitigation considered	Level of Concern considered
Hydrochloric Acid	Worst Case	Entire HCl tank released	Passive mitigation, spill contained within a permanent diked area	Impact distance of a Toxic area vapour cloud, ERPG-2
Hydrochloric Acid	Alternative case	Partial released of HCL tank	Passive mitigation, spill contained within a permanent diked area. Active Mitigation, alarms activated and amount of HCL released is limited	Impact distance of a Toxic area vapour cloud, ERPG-2
Propane, Dimethyl ether, Isobutane	Worst Case	Accident involving the largest container	None considered	As per guidance on liquefied gases (flammable and explosive gases) an impact distance of a Vapour cloud explosion with a 1 psi overpressure endpoint, and 10% of the vapour cloud participating
Propane, Dimethyl ether, Isobutane	Alternative case	Hose failure, assuming truck pulling away from filling area while hose is still connected	Active mitigation, safety valves on hose couplings activate limiting the release to material contained within the hose	Vapour cloud fire (flash fire) with impact distance to lower flammability/ explosive limit.
Propane, Dimethyl ether, Isobutane	Alternative case	Tank overfilling or heating causing pressure relief valves to open	Active mitigation are the pressure valves to prevent dangerous pressure levels within the tank, once the safety valves are activated no further mitigation was considered.	Vapour cloud fire (flash fire) with impact distance to lower flammability/ explosive limit.
Propane, Dimethyl ether, Isobutane	Alternative case	Short pipe leak/failure from the 3 inch liquid line coming from the tank or railcar. Caused by an accident (e.g. equipment hitting the pipe, or failure of equipment or valve.	Active mitigation, tanks assumed to be at 80% capacity based on administrative controls.	Flammable vapour cloud using 60% of the lower explosive limit

Testing of E2 Plans

- Testing is required to simulate an emergency situation
- At present, can be desktop or emergency response drills
- For multi-part responses or situations, exercises can be rotated, with part of the test done annually

E2 Modelling

Wrap-Up:

- We do have to deal with worse case and define impacts.
- Scenario development are often the difficult discussions. We are looking for the “unlikely”, but possible.
- Can lead to improved procedures or mitigation.
- Sensitive receptor identification is key. This can change with time!
- Model is not the end point, the response plan is!
- Ensure Action Plan for notification of the Public (in the event of an actual Emergency) is in place, and focuses on reducing the potential for harm to the environment and danger to human life or health.

Proposed Regulation Change (2016 and waiting)



- the addition of 49 new substances to Schedule 1 and amendment of the thresholds for 3 existing substances;
- a clarification of the requirements for exercising an E2 Plan (at least one component for each substance once per year);
- the inclusion of uncontained substances (“not contained in a container system”);
- a definition of a container system;
- clarifications for the requirements regarding public notifications before, during and after an environmental emergency; and
- modifications to reporting requirements including periodic reporting (every 5 years) to ensure an up-to-date database is available for departmental officials and first responders.

Questions?



Thank you !

Chemicals Management Plan Substances – Challenge					
	CAS No.	Name of Substance*		CAS No.	Name of Substance*
1	79-06-1	Acrylamide (2-Propenamide)	11	80-05-7	Bisphenol A (Phenol, 4,4 - (1-methylethylidene)bis-)
2	100-44-7	Benzyl chloride (Benzene, (chloromethyl)-)	12	126-73-8	Phosphoric acid tributyl ester
3	110-49-6	Ethylene glycol monomethyl ether acetate (Ethanol, 2-methoxy-, acetate)	13	1314-62-1	Vanadium pentoxide (Vanadium oxide (V2O5))
4	111-15-9	Ethylene glycol monoethyl ether acetate (Ethanol, 2-ethoxy-, acetate)	14	17540-75-9	Phenol, 2,6-bis(1,1-dimethylethyl)-4-(1-methylpropyl)-
5	732-26-3	Phenol, 2,4,6-tris(1,1-dimethylethyl)-	15	7646-79-9	Cobalt chloride
6	41556-26-7	Decanedioic acid, bis(1,2,2,6,6-pentamethyl-4-piperidiny) ester	16	1344-37-2	C.I. Pigment Yellow 34
7	110-54-3	Hexane	17	1309-64-4	Antimony oxide (Sb2O3)
8	123-31-9	Hydroquinone (1,4-Benzenediol)	18	120-80-9	1,2-Benzenediol
9	68921-45-9	Benzenamine, N-phenyl-, reaction products with styrene and 2,4,4-trimethylpentene	19	72102-55-7	Methylum, [4-(dimethylamino)phenyl]bis[4-(ethylamino)-3-methylphenyl]-, acetate
10	10124-43-3	Sulfuric acid, cobalt(2+) salt (1:1)	20	123-91-1	Dioxane (1,4-Dioxane)

* both the names under the *Transportation of Dangerous Goods Regulations* and the Chemicals Management Plan are provided when available

† tentative; under evaluation

‡ these substances meet the criteria for a corrosive substance as defined by the OECD

|| already in Schedule 1; threshold will be amended to be consistent with other corrosive substances

Chemicals Management Plan Substances – Petroleum Sector Stream Approach					
	CAS No.	Name of Substance*		CAS No.	Name of Substance*
1	101316-57-8	Distillates (petroleum), hydrodesulfurized full-range middle	9	68527-27-5	Naphtha (petroleum), full- range alkylate, butane- containing.
2	64742-80-9	Distillates (petroleum), hydrodesulfurized middle	10	68476-30-2	Fuel oil, no. 2
3	68334-30-5	Fuels, diesel	11	68476-31-3	Fuel oil, no. 4
4	68476-34-6	Fuels, diesel, no.2	12	68553-00-4	Fuel oil, no. 6
5	8002-05-9	Petroleum	13	68476-33-5	Fuel oil, residual
6	128683-25-0	Crude oil (oil sand)	14	64741-47-5	Natural gas condensates [†]
7	64741-86-2	Distillates (petroleum), sweetened middle	15	68919-39-1	Natural gas condensates [†]
8	64741-87-3	Naphtha (petroleum), sweetened	16	64741-48-6	Natural gas (petroleum), raw liquid mix [†]

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Corrosive Substances[‡]					
	CAS No.	Name of Substance*		CAS No.	Name of Substance*
1	10035-10-6	Hydrobromic acid	9	18480-07-4	Strontium hydroxide
2	10034-85-2	Hydroiodic acid	10	17194-00-2	Barium hydroxide
3	7790-93-4	Chloric acid, aqueous solution	11	1310-82-3	Rubidium hydroxide
4	7601-90-3	Perchloric acid	12	21351-79-1	Cesium hydroxide
5	1310-65-2	Lithium hydroxide solution	13	7647-01-0	Hydrochloric acid
6	1310-73-2	Sodium hydroxide solution	14	7697-37-2	Nitric acid
7	1310-58-3	Potassium hydroxide solution	15	7664-93-9	Sulfuric acid
8	1305-62-0	Calcium hydroxide			
Other Substances					
	CAS No.	Name of Substance*			
1	1336-21-6	Ammonium hydroxide			

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