CEPA S200
The Risk-based Approach

Presented by
Ertugrul Alp, Ph.D., P.Eng.

February 24, 2004
Toronto, Ontario

ALP & ASSOCIATES Incorporated

Change Agents in Risk Management, Specialists in Risk Assessment

87 Topham Crescent, Richmond Hill, Ontario, L4C 9E9, Canada
Tel: 905-508-2595, Fax: 905-508-2679
E-mail:**Ertugrul.Alp@rogers.com**, Website: **www. ALP-RISK.ca**

Objectives

- Describe
  - Principles of risk-based management
  - How CEPA S200 fits with risk-based management
  - Risk assessment as a tool for meeting and exceeding the regulatory intent
- Provide further thoughts on what the future might bring

Risk and Risk-based Management

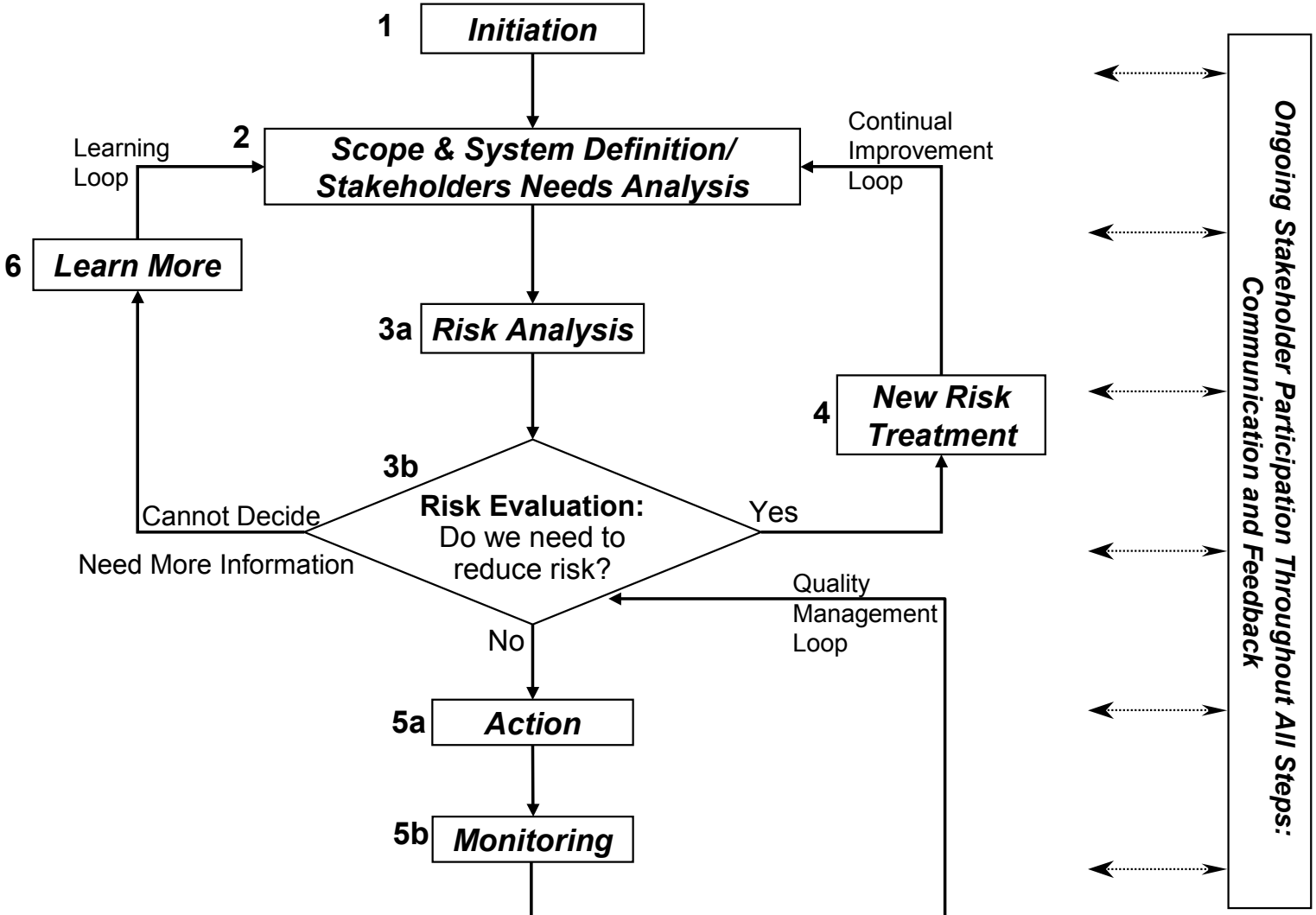
- The concept of risk includes five components:
  - Hazard inherent in an activity otherwise deemed beneficial
  - An undesirable event, which brings out the hazard
  - Adverse consequence of the undesirable event
  - Uncertainty of whether the undesirable event will happen or not (likelihood)
  - Perception about the combination of the above

- We base our decisions on perception.

- Accurate understanding of the inherent hazards, and consequences and likelihood of undesirable events, will lead to:
  - more balanced perceptions;

  and hence to:
  - better decisions in “managing that activity” (synonymous with “managing the risks of that activity”).

Process for Risk-based Management



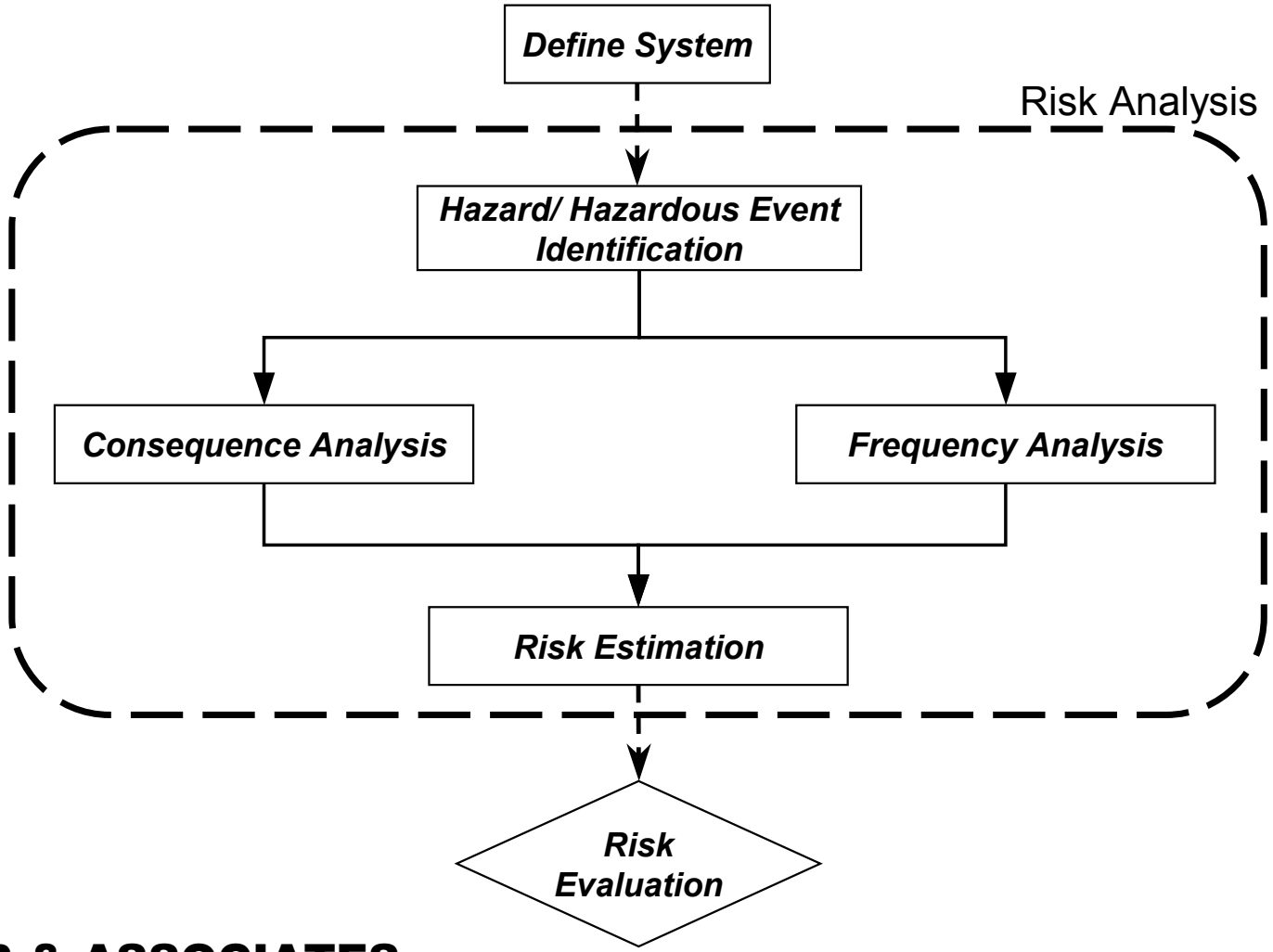
Risk Treatment as Part of Risk-based Management

- For a given "system" (e.g., an industrial plant, with its "risk treatment" practices, including process safety management practices and emergency preparedness)
  - If risk "analysis and evaluation" indicates that the risk is too high, then additional "risk treatment" measures are considered
    - In this context, additional "risk treatment" could include
      - revised operating procedures (prevention),
      - improved design standards (prevention),
      - more stringent emergency response training, including improved emergency response plans (mitigation),
      - etc.

CEPA Section 200 -

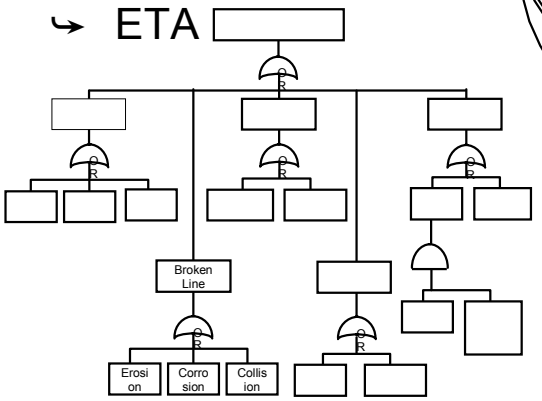
- The focal points of CEPA S200 are:
  - Prevention
  - Emergency response
- The focus, therefore, is on “risk treatment”
- However, that is not all:
  - A “risk analysis and evaluation” tool is incorporated
  - There are “risk monitoring” provisions

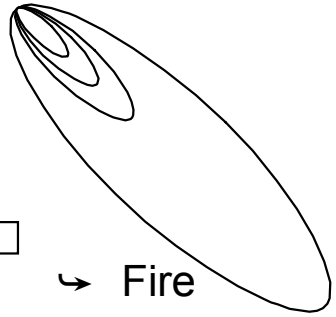
General Framework for Risk Analysis



Typical Risk Analysis and Presentation Tools

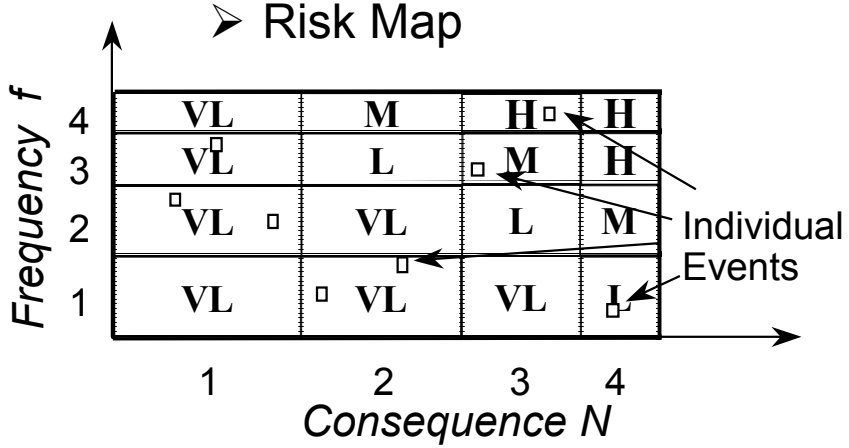
- Hazard/ Hazardous Event Identification
  - Checklist
  - Screening Level
  - What-if
  - HAZOP
  - FMEA
  - …
- Modelling Tools
  - FTA
  - ETA



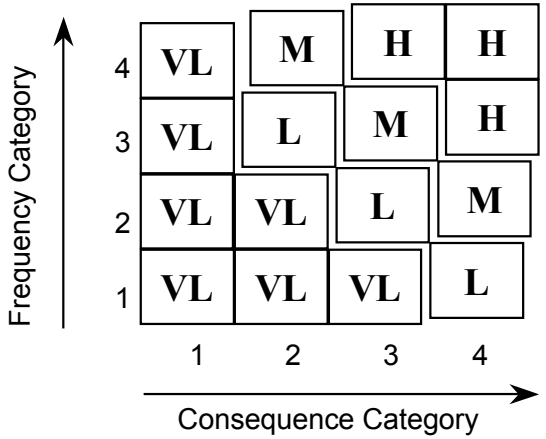


- Fire
- Explosion
- Dispersion

- Risk Map



- Risk Ranking



Risk Analysis Techniques

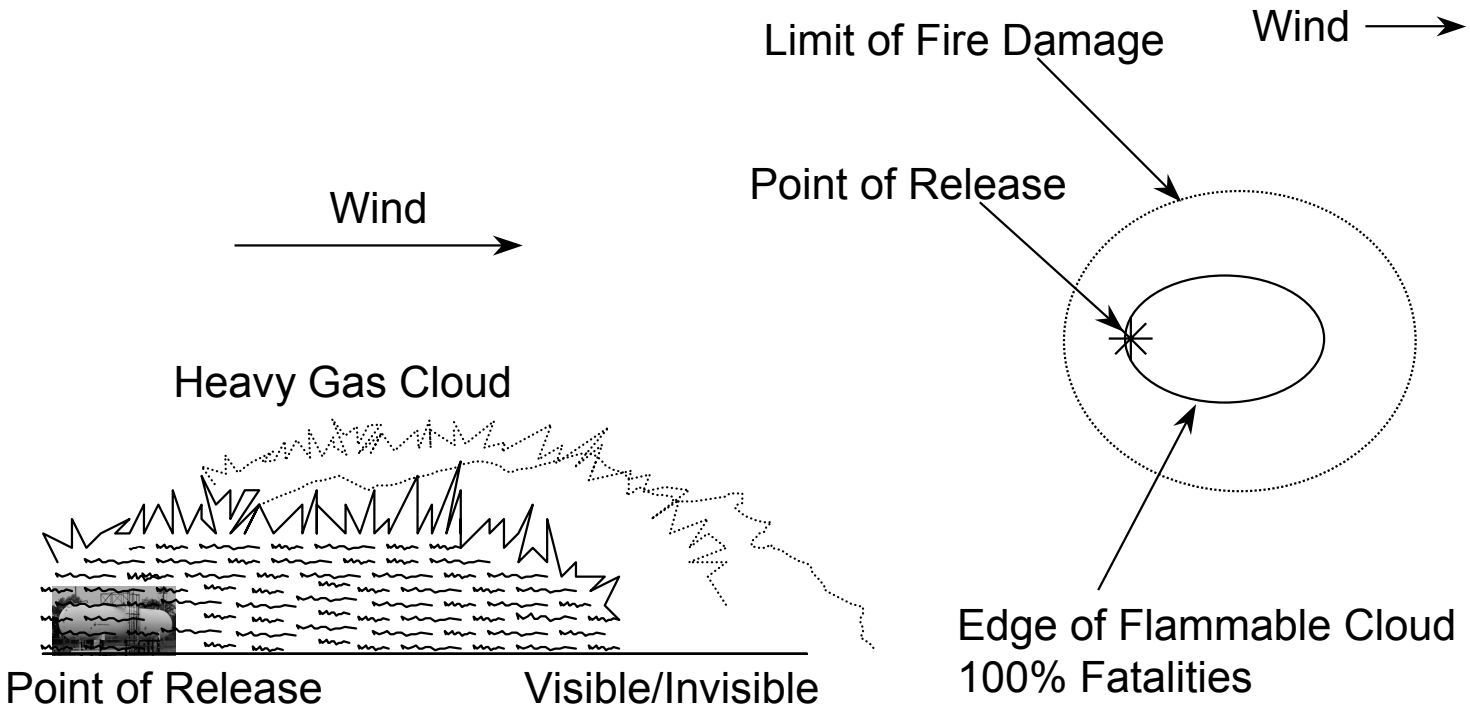
- Risk analysis and evaluation can take place at different levels of detail.
- A ***hierarchy*** of risk analysis tools are available, depending on the requirements at hand:
  - Qualitative Techniques (Checklists, Screening Level Risk Analysis, What If, HAZOP, FMEA, FTA, ETA)
  - Semi-Quantitative (Index/Matrix) Methods
  - Quantitative Risk Analysis (QRA – FTA, ETA, Fire/ Explosion/ Dispersion Modelling, Vulnerability Modelling, Probit Techniques)
- Use of a hierarchical approach saves time and resources while at the same time ensuring systematic coverage of all facilities for significant hazards.
- Often, qualitative techniques such as SLRA, HAZOP, etc., are used in conjunction with semi-quantitative matrix methods for priority setting.

Typical Output from a SLRA - List of Hazardous Events and Their Risk Ranking

					Public			Env.			Empl.			Prod.			Cap.Equ.			Mark.Shr				
Process Section	Process Section	Hazard Id. No.	Hazardous Events	Cause(s)	Frequency	Consequences	Risk	Frequency	Consequences	Risk	Frequency	Consequences	Risk	Frequency	Consequences	Risk	Frequency	Consequences	Risk	Frequency	Consequences	Risk	Safe-guards	Actions
1	Natural Gas Supply	1.1	Fireball and Jet flame from transmission line	Underground pipeline rupture due to corrosion, third party damage with ignition of released gas	1	4	*L*	2	2	*VL*	2	4	*M*	2	3	*L*	2	3	*L*	1	1	*VL*	Work permit system; cathodic protection	
		1.2	Fireball and Jet flame from transmission line	Abovegroud pipeline rupture due to corrosion, third party damage, collision with ignition of gas	1	4	*L*	2	2	*VL*	3	4	*H*	2	3	*L*	2	3	*L*	1	2	*VL*	Cathodic protection	Install collision protection at main gas inlet to plant process area. Improve line labelling and develop unique colour code for piping.
		1.3	Gas release (with traces of H2S)	Upstream failure to treat gas at source	1	2	*VL*	1	2	*VL*	1	2	*VL*	1	3	*VL*	1	1	*VL*	1	1	*VL*		Check possibility of H2S in gas supply
2	Process Steam Supply	2.1	Firebox explosion	Insufficient purge and failure of burner management system	2	1	*VL*	2	1	*VL*	2	4	*M*	2	2	*VL*	2	2	*VL*	2	1	*VL*	Burner management system (fireeye, shut-off interlocks)	
		2.2	Steam drum BLEVE	Material failure	1	1	*VL*	1	1	*VL*	1	3	*VL*	1	2	*VL*	1	2	*VL*	1	1	*VL*	Inspections before installations; NDT testing	

Quantitative Techniques

Burning Gas Cloud Modelling



Actual Situation **Model**

CEPA Section 200

- The risk analysis and evaluation tool incorporated into the CEPA S200
  - Checklist of hazardous materials, with specified threshold quantities
- The threshold quantities provide a basis for evaluating whether an emergency plan is needed for the purposes of the legislation

ALP & ASSOCIATES

ENVIRONMENTAL EMERGENCY REGULATIONS

SCHEDULE 1

(section 2, subsection 3(1), paragraph 4(3)(b), subsection 4(5), paragraphs 5(3)(b) and 6(b) and subsection 8(1))

LIST OF SUBSTANCES

	Column 1	Column 2
CAS Registry Number*	Substance	Minimum Quantity (tonnes)
50-00-0	formaldehyde, solution	6.80
57-14-7	1,1-dimethylhydrazine	6.80
60-29-7	ethyl ether (diethyl ether)	4.50
60-34-4	methylhydrazine (monomethyl hydrazine)	6.80
67-66-3	chloroform (trichloromethane)	9.10
71-43-2	benzene	10.00
74-82-8	methane	4.50
74-83-9	methyl bromide	2.27
74-84-0	ethane	4.50
74-85-1	ethylene	4.50
74-86-2	acetylene	4.50
74-87-3	methyl chloride	4.50
74-88-4	methyl iodide	4.50
74-89-5	methylamine	4.50
74-90-8	hydrogen cyanide (hydrocyanic acid)	1.13
74-93-1	methyl mercaptan	4.50
74-98-6	propane	4.50
74-99-7	methylacetylene (propyne)	4.50
75-00-3	ethyl chloride	4.50
75-01-4	vinyl chloride	4.50

“Risk” versus “Consequence”

- Note:
- Strictly speaking, the Schedule 1 list of substances is more of a “consequence” analysis tool, rather than “risk”
  - It does not include consideration of the frequency of a hazardous event involving the hazardous material on the list

CEPA S200 - Thresholds

- For the derivation of the thresholds, certain consequence (as opposed to risk) criteria were used (Lacoursiere, 2002).
  - These criteria typically consist of a given damage level at 100 m from the event location, e.g.,
    - for toxic gases, IDLH, or Immediately Dangerous to Life and Health concentration in air
    - for explosions, 3 psi overpressure
  - They follow the US EPA Risk Management Program consequence modeling methodologies for establishing thresholds.
- Recommendation:
  - It would be useful for companies to understand these criteria, so that, for substances that may not be on the list,
    - they could do their own risk assessment to establish appropriate thresholds, and
    - develop environmental emergency plans for the protection of the public and the environment

    as part of their efforts of continual improvement, even though there may not be legislative requirements to have such plans.

CEPA S200 – Quality Management and Continual Improvement

- The *inspection* provisions in the regulations provide the basis for *monitoring* their implementation, and are part of the quality management loop.
- *Training* requirements can be considered as additional *risk treatment* measures
- *Testing* requirements can be considered as additional *risk monitoring* measures

  to strengthen the usefulness of the environmental emergency plan.
- While these training and testing requirements provide learning opportunities for emergency personnel, they do not constitute part of the learning loop for decision-making.
  - Training is part of the continual improvement loop.
  - Testing of the plan is part of the quality management loop where deficiencies as compared to the plan are identified and corrected.
  - If, as part of the testing, weaknesses in the plan or in the capabilities of the responders are identified, then the risk evaluation decision diamond will require additional training and modifications to the plan itself through the continual improvement loop.

CEPA S200 – Plan Basis

- The regulations require “the identification of any environmental emergency” to form the basis of the plan.
- Identification of the hazardous substance through the Schedule 1 “check”list is not sufficient for this purpose.
  - Further examination of possible scenarios is needed.
- Recommendation:
  - The hazard/ hazardous event identification methods described earlier in this presentation are likely candidates for this purpose of identifying environmental emergency scenarios to form the basis of the plan.
    - SLRA, HAZOP, What-if, etc.

CEPA S200 – Notification of the public

- The regulations require an environmental emergency plan to include “the measures to be taken to notify members of the public who may be adversely affected by an environmental emergency”.
- This implies knowledge of the extent of the potential impact zones by the company to form the basis of the plan.
- Recommendation:
  - The US EPA RMP scenario definitions and consequence modeling methodology would likely be acceptable for this purpose, given the heavy reliance on this methodology in establishing of the CEPA thresholds.
  - Other, more sophisticated consequence analysis techniques are also available, if improved accuracy is desired.

Further Thoughts

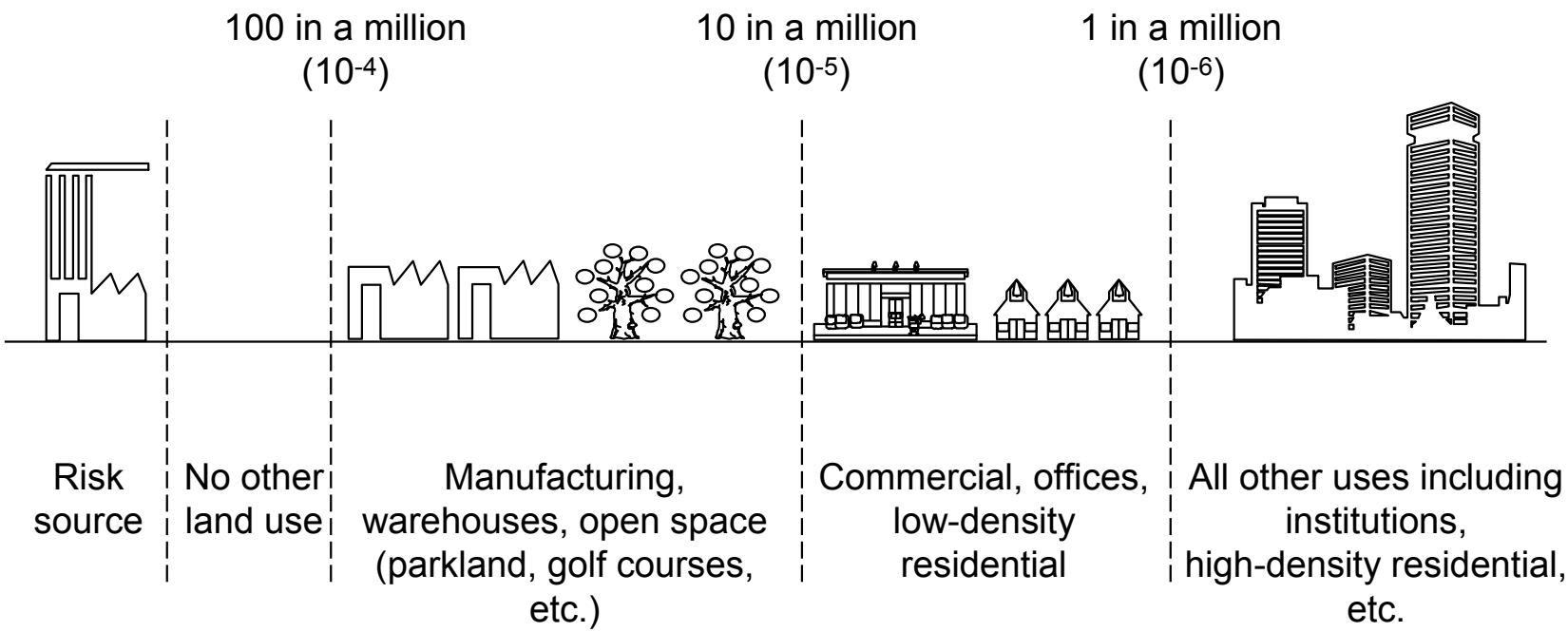
- The prevention provision in the legislation is somewhat new as emergency response plans go.
  - This provision fills a significant gap that existed in Canadian legislation, namely process safety management.
  - The US equivalent of this provision is the OSHA 1992 Process Safety Management regulations.

Further Thoughts - 2

- The CEPA Section 200 regulations include public health and safety as a specific focus.
  - A particular concern with environmental emergencies is the potential presence of members of the public that could be in harms way.
  - Presence of the public, in turn, is a strong function of the land use around the facility.
  - Land use planning is generally controlled by municipalities, under certain environmental guidelines set by the provincial environment ministries regarding different types of industries.
  - Typically, the potential for environmental emergencies originating from a facility that has hazardous materials do not factor into land use planning (unless a municipality has its own - very progressive - by-laws in this regard).
  - This issue seems to be “falling through the cracks” between different jurisdictions,
    - Significant gap within the Canadian legislative framework regarding management of risks to public health and safety.

Example Risk Acceptability Criteria for Land-use Planning

Annual Individual Risk
(chance of fatality per year)



Allowable Land Uses

THANK YOU!

QUESTIONS AND DISCUSSION