Environment Canada Environnement Canada

Implementation Guidelines for the *Environmental Emergency Regulations*

2011

Canada

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1.0 Purpose of the Implementation Guidelines

The Implementation Guidelines for the *Environmental Emergency Regulations* ("the Implementation Guidelines") are intended for the use of any person[1] who owns or has the charge, management, or control of a substance listed in Schedule 1 of the *Environmental Emergency Regulations* ("the E2 Regulations"). Such persons are referred to as regulatees. These Implementation Guidelines include the 2011 amendments made to the E2 Regulations.

The Implementation Guidelines are designed to help you, as a regulatee, better understand what E2 Regulations requirements are and how to comply with them. This document will provide clarification and guidance on important questions such as the following.

- Do the E2 Regulations apply to me?
- How do I calculate on-site substance quantities and container capacity?
- What are the benefits of E2 planning?
- Do I need to prepare an E2 plan?
- How do I prepare an E2 plan? What should it include?
- How do I notify the Minister that I have the charge, management or control of an E2 substance?
- How does Environment Canada evaluate chemical substances for environmental emergency hazards?
- What happens if I fail to comply with the E2 Regulations?

Other helpful information is provided in tables, graphics and references, located mostly in the appendices below:

- Appendix 1 – useful references for preparing an E2 plan
- Appendix 2 – information to be included in E2 notices, reports and certification
- Appendix 3 – list of substances regulated under the E2 Regulations
- Appendix 4 – Environment Canada contact information for submissions under the E2 Regulations
- Appendix 5 – Calculation of substance quantity on site, substance quantity within a mixture, and maximum container capacity
- Appendix 6 – flow chart detailing the new propane exception
- Appendix 7 – notification and reporting of environmental emergencies under section 201 of the *Canadian Environmental Protection Act, 1999* (CEPA 1999)
- Appendix 8 – checklist helping in the preparation of an E2 plan
- Appendix 9 – summary of Environment Canada's Risk Evaluation Framework (REF); the REF is used by the Department to determine the level of environmental emergency risk posed by a substance, and to calculate the regulated threshold for the substance

[1] The term "person" may refer to a company, an individual or a government body.

IMPORTANT: The Implementation Guidelines are intended to provide contextual information on the E2 Regulations as amended in 2011 and CEPA 1999. They do not replace CEPA 1999 or the E2 Regulations. Regulatees should refer to CEPA 1999 at http://laws-lois.justice.gc.ca/eng/acts/C-15.31/ and the E2 Regulations at http://laws-lois.justice.gc.ca/eng/regulations/SOR-2003-307/FullText.html to ensure they are in compliance with the law. Some provisions of CEPA 1999 and the E2 Regulations have been quoted for convenience of reference only and have no official sanction. Should any inconsistencies be found between the Implementation Guidelines and CEPA 1999 or the E2 Regulations, then CEPA 1999 and the E2 Regulations shall prevail.

For further information with respect to these guidelines or the E2 Regulations, please refer to Environment Canada's notification website at https://cepae2-lcpeue.ec.gc.ca Common issues are discussed on the website.

2.0 Environmental Emergency Authorities under Part 8 of CEPA 1999

This section provides information on the authorities granted under the *Canadian Environmental Protection Act*, *1999* (CEPA 1999), and under the E2 Regulations.

The goal of the Government of Canada is to achieve "the highest level of environmental quality for all Canadians," as stated in the Preamble to the *Canadian Environmental Protection Act*, *1999*. CEPA 1999, paragraph 2(1)(*a*.1) also requires the Government of Canada to "take preventive and remedial measures to protect, enhance and restore the environment."

Part 8 of CEPA 1999 on environmental emergencies (sections 193 to 205) provides various authorities to address the **prevention** of, **preparedness** for, **response** to and **recovery** from environmental emergencies caused by uncontrolled, unplanned or accidental releases, and to reduce any foreseeable likelihood of releases of toxic or other hazardous substances listed in Schedule 1 of the E2 Regulations.

In investigating various measures to increase the safety and security of Canadians in the event of an environmental emergency, the Government of Canada has identified sections 199, 200 and 200.1 of Part 8 as important tools. These sections allow the Government of Canada to require the preparation of environmental emergency plans (E2 plans) for toxic or other hazardous substances. The primary objective for requiring environmental emergency planning under sections 199, 200 and 200.1 is to have the appropriate risk management practices adopted and implemented to reduce the potential risks associated with the manufacture, storage and use of toxic and other hazardous substances in Canada.

Schedule 1 of the E2 Regulations contains a list of substances that, should they enter the environment as a result of an environmental emergency, may be harmful to the environment, its biological diversity or human life or health. Minimum quantities have been established for these substances at or above which the Minister may require notice of identification of the substance and place, as well as preparation of E2 plans under the E2 Regulations.

There are strict penalties for failing to comply with the provisions of CEPA 1999 or its regulations. In sections 272 to 274, Part 10 (Enforcement) outlines various offences and penalties for contraventions of provisions of CEPA 1999 or its regulations, for knowingly or negligently providing false or misleading information, or for causing intentional or reckless damage to the environment or showing wanton or reckless disregard for the lives or safety of other persons and leading to the risk of death or harm to persons.

3.0 Benefits of E2 Planning

Environmental emergency planning is not just about compliance with the E2 Regulations. For today's modern enterprise, effective planning for emergency events is an essential part of good business management.

When E2 planning is properly developed and implemented, benefits to the environment, human health and industry ensue. An industry-wide study[2] conducted by the Center for Chemical Process Safety (CCPS) of the American Institute of Chemical Engineers confirms that E2 planning provides measurable benefits by

- **saving lives and reducing human injury**;
- **reducing property damage costs**, preventing the sometimes extreme costs of a major industrial incident;
- **shortening business interruptions**, which can be four times as costly as the property damage mentioned above;
- **lessening loss of market share**, which continues after an incident until the company's production and reputation are restored;
- **lowering litigation costs**, which are unavoidable after an incident and can total five times the cost of the regulatory fines;
- **reducing incident investigation costs**, as well as corrective actions can cost millions of dollars; and
- **reducing regulatory penalties**.

E2 planning also provides non-measurable benefits by

- greatly **reducing the risk of catastrophic events**, resulting in less severe incidents, which
  - **engages employees** at all levels by increasing morale, loyalty and retention;
  - **reduces concerns within the local community**; and
  - **helps regulators understand your facility's credibility and unique considerations**; and
- **improving your corporate image;** and
- **enhancing your lenders' confidence**, thus promoting capital expansion.

An important step in E2 planning is the analysis of all kinds of risks found during the handling, storage, production process use or disposal of any hazardous materials. When the proper measures to eliminate or mitigate these risks are implemented, other benefits follow:

- **Productivity increases while production and maintenance costs decrease**, due to the correction of unproductive processes and the adherence to effective and well-timed maintenance procedures.
- **Lower insurance premiums** may be obtained when meticulous emergency planning is implemented to prevent minor incidents and greatly reduce major incidents.

[2] CCPS Business Case Study: http://www.aiche.org/ccps/corporate/businesscase.aspx.

4.0 E2 Regulations – Am I regulated?

This section is designed to help you determine whether the E2 Regulations apply to you. It explains E2 Regulations compliance requirements and exceptions. You can use the **Quick Reference** diagram in this section to help identify which E2 Regulations requirements apply to you.

For further guidance on some specific E2 Regulations issues, Environment Canada has created a "**common issues**" information section that contains a set of frequently asked questions (FAQs) and answers at https://cepae2-lcpeue.ec.gc.ca.

Who is subject to the E2 Regulations?

The E2 Regulations apply to any person who owns or has the charge, management or control of a listed substance that :

- is at or above the quantity set out in column 3 of Schedule 1 of the E2 Regulations at any time during a calendar year; or
- is at a quantity greater than zero and is stored in a container that has a maximum capacity equal to or exceeding the threshold quantity for that substance .(See subsection 3(1) of the E2 Regulations).

4.1 Application of the E2 Regulations

Requirement for an E2 plan

You must prepare, implement and test an **E2 plan** if:

1. your facility has a substance listed in column 1 of Schedule 1 of the E2 Regulations (except for substances in paragraph 4(1)(*b*) of the E2 Regulations) and:
   - the total quantity of the substance on site equals or exceeds the threshold size (listed in column 3 of Schedule 1); **and**
   - the substance is stored in a container that has a maximum capacity equal to or above the threshold stipulated;

OR

2. your facility has a substance in column 1 of Part 1 of Schedule 1 and is a component in a mixture, other than a mixture that is a substance set out in column 1 of Schedule 1, and
   - the mixture is in a quantity that is equal to or exceeds 4.5 tonnes, and
   - the mixture is in a storage container that has a maximum capacity equal to or exceeding 4.5 tonnes

Requirement for a notice of identification of substance and place

You must submit to the Minister a **notice of identification of substance and place** if, at your facility,

- the total quantity of the substance on site equals or exceeds the threshold quantity; **or**
- the substance is in a quantity that is greater than zero and is stored in a container with a maximum capacity equal to or above the threshold.

To calculate substance quantities and container capacity, please see Appendix 5.

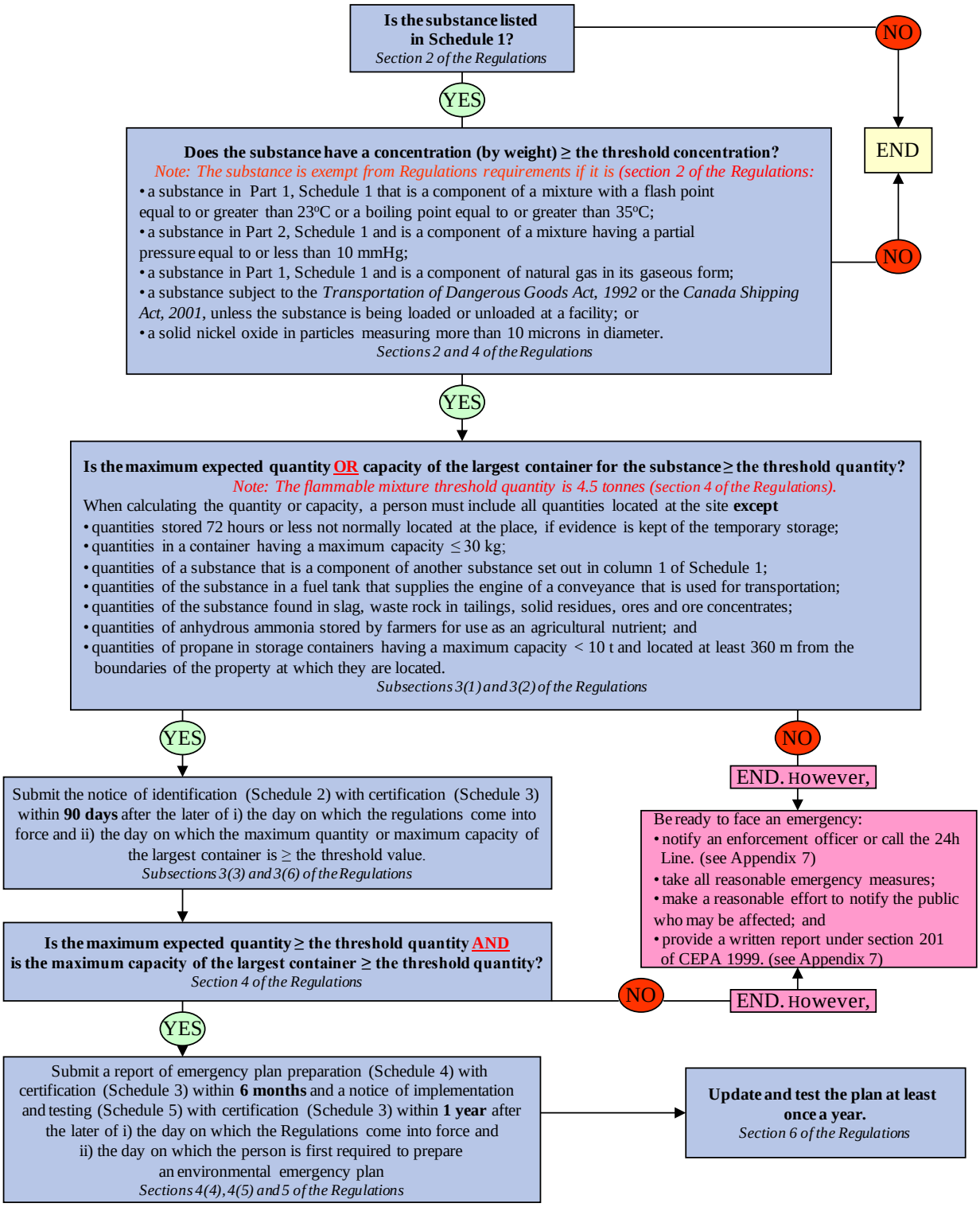
The E2 Regulations apply to the substances listed in parts 1, 2 and 3 of Schedule 1 of the Regulations. These substances may be present either in their pure form, or in mixtures in which the substance's concentration is equal to or greater than the applicable concentration set out in column 2 of Schedule 1. Please see the exceptions of section 2 of the E2 Regulations.

The substances in Schedule 1 of the E2 Regulations are considered hazardous for their flammability, inhalation toxicity, aquatic toxicity, persistence, bioaccumulation and carcinogenicity or a combination of these criteria. In order to determine the threshold quantity, all criteria were taken into account and the lowest threshold quantity was used. Please see **Appendix 9**.

IMPORTANT: So you do not meet the criteria for creating an emergency plan?
Environment Canada strongly recommends that you create an emergency plan voluntarily, even if you are not obliged to do so by the requirements of the E2 Regulations.

For an easier understanding of the E2 Regulations, consult the **Environmental Emergency Regulations – Quick Reference** diagram below. The diagram summarizes the steps you need to take for compliance. Note, however, that the E2 Regulations remain the official document with respect to securing full compliance.

Environmental Emergencies Regulations – Quick Reference



4.2 E2 Regulations Requirements

4.2.1 Notices / Reports / Certification

The E2 Regulations require that the information in Appendix 2 of the Implementation Guildelines be sent to the Minister. This information is required to inform the Minister that E2 plans prepared by regulatees contribute to the management of risks to the environment and human health from CEPA1999-regulated hazardous and toxic substances. Note, however, the actual environmental emergency plans themselves prepared under the E2 Regulations are not submitted to Environment Canada unless requested.

Environmental emergency plans must be readily accessible to the individuals who are to carry out the plan in the event of an environmental emergency as stated in section 6(2) of the Regulations. If regulated substances are kept at unmanned facilities that are subject to the Regulations, a copy of the plan need not be held at the place itself. However, in such cases, Environment Canada recommends that a sign be posted at unmanned facilities indicating the telephone number to call in case of an emergency.

E2 regulatees may be required to submit to the Minister the different types of notices, reports and certification described below.

1. Notice of identification of substance and place (Schedule 2 of the E2 Regulations)

Regulatees are required to identify the quantity and location of the substances, as well as the maximum capacity of the single largest container in which each substance is stored.

Regulatees must file the notice within **90 days** after the later of

(i) the day on which the Regulations come into force; and

(ii) the day on which the quantity first equals or exceeds the threshold quantity for any substance(s) set out in Schedule 1 of the E2 Regulations; or the day on which the maximum capacity of the single largest container in which the substance is stored first equals or exceeds the threshold quantity for any substance(s) as set out in Schedule 1 of the E2 Regulations.

In relation to this notice, the regulatee **must also notify** the Minister of:

- Within 60 days after
  - **any change to the information** submitted in the notice of identification of substance and place regarding the identification of the place, ownership, responsible manager, etc.; or
  - **any increase of 10% or more** in the maximum quantity of a substance previously reported.

- Within 90 days after
  - any decrease, for 12 consecutive months, **below the threshold quantity** set out for a substance in column 3 of Schedule 1, of the substance located at the place; or
  - any decrease, for 12 consecutive months, **below the maximum capacity** of the largest container in which the substance is stored set out for the substance in column 3 of Schedule 1.

- Within at least 30 days before, or as soon as feasible in the case of extraordinary circumstances such as fire, major accident, vandalism, natural disaster or terrorism (Schedule 6 of the E2 Regulations)
  - the **closure or decommissioning of the facility or place**

2. **Report on the E2 plan preparation** (Schedule 4 of the E2 Regulations)
   This report provides information on the prepared E2 plan.

   The report must be submitted within **6 months** after the later of
   i) the day on which the E2 Regulations come into force; and
   ii) the day on which both the quantity of the substance and maximum capacity of the single largest container in which the substance is stored first equal or exceed the threshold quantity for that substance as set out in Schedule 1 of the E2 Regulations.

3. **Notice of implementation and testing** (Schedule 5 of the E2 Regulations)
   This notice states that the implementation and testing of the E2 plan have been completed.

   The notice must be filed within **one year** after the later of
   i) the day on which the E2 Regulations come into force; and
   ii) the day on which both the quantity of the substance and maximum capacity of the single largest container in which the substance is stored first equal or exceed the threshold quantity for that substance as set out in Schedule 1 of the E2 Regulations.

4. **Signed certification** (Schedule 3 of the E2 Regulations)
   This certification must be sent to the appropriate Environment Canada regional office at the same time as the person is submitting the other information required by the E2 Regulations.

IMPORTANT: Do you own several facilities? You must submit separate notices, reports and certifications for each facility.

Environment Canada requests that a paper copy of submitted notices or reports along with a signed certification be sent to the appropriate Environment Canada regional office

(see Table 2 in Appendix 4 for contact information). To fill in the paper copy, regulatees may use Environment Canada's online database to print off the electronic submission forms. Information submitted electronically is not official until the paper copy and the signed certification are received and verified by the appropriate regional office.

Protecting confidential information.

In accordance with section 313 of CEPA 1999, any person submitting information to the Minister under this Act is entitled to submit, with their information, a written request that the information be treated as confidential.

Information for which a request for confidentiality has been made shall not be disclosed by the Minister except in accordance with sections 315, 316 or 317 of CEPA 1999.

4.2.2 Quantity Calculation Exceptions

The E2 Regulations specify exceptions when determining the total quantity of the substance(s) that is located at a place or facility, whether in storage or in use. The exceptions, found in subsection 3(2) of the Regulations, cover the following circumstances:

- quantities of the substance that are temporarily stored for 72 hours or less in a container that is not normally located at the place, if the person keeps evidence during the temporary storage period of the date the substance was received;
- quantities of the substance in a container that has a maximum capacity of 30 kg or less;
- quantities of the substance when it is a component of another substance set out in column 1 of Schedule 1;
- quantities of the substance in a fuel tank that supplies the engine of a conveyance that is used for transportation;
- quantities of the substance that are found in slag, waste rock in tailings, solid residues, ores and ore concentrates;
- quantities of anhydrous ammonia and ammonia solution set out in column 1 of Part 2 of Schedule 1 and bearing CAS registry number[3] 7664-41-7, that are stored by a farmer and used as an agricultural nutrient by the farmer; and
- the quantity of propane set out in column 1 of Part 1, Schedule 1 bearing CAS registry number 74-98-6, that is in a storage container that has a maximum capacity of less than 10 t (tonnes) and is located at a distance of at least 360 m (metres) from the boundaries of the property limit on which it is located.

[3] CAS information is the property of the American Chemical Society and any use or redistribution, except as required in supporting regulatory requirements and/or reports to the government when the information and the reports are required by law or administrative policy is not permitted without the prior, written permission of the American Chemical Society.

4.2.3 Propane Exception Applicability

A **new exception** for quantities of propane (Schedule 1, Part 1, CAS registry number 74-98-6) stored in a container of less than 10 t and located at least 360 m from the property boundary is added to the Regulations.

For this provision to apply, two criteria must be fulfilled:

1. The maximum capacity of the container storing the propane must be less than 10 t;
2. The shortest distance between the edge of the container (or the edge of each container for multiple containers found at a facility) and the property boundary is equal to or greater than 360 m.

If both criteria are met, the quantity of propane found in the container(s) is excluded from the calculation of the total quantity of propane at the facility.

A flow chart can be found in **Appendix 6** that provides guidance on determining the applicability of the propane exception.

5.0 E2 Plans

This section will help you determine whether you need to prepare an E2 plan under the E2 Regulations and what the requirements of such an E2 plan are. A **checklist** is provided to help you with the details of preparing your E2 plan.

Who should prepare an E2 plan?

Under the E2 Regulations, an E2 plan is required of any person who owns or has the charge, management or control of any of the regulated substances, listed in Schedule 1, at or above specified threshold quantities and stored in a container that has a maximum capacity equalling or exceeding the specified quantities for that substance.

In order to prevent duplication of efforts, regulatees may satisfy E2 plan requirements by using an existing environmental emergency plan that has been prepared on a voluntary basis, either for another government or under another act of Parliament. Where such a plan does not meet all the requirements identified within the E2 Regulations, the plan must be amended to meet the remainder of those requirements. All notices, reports and forms for this E2 plan must be sent to the Minister.

5.1 Requirements of an E2 Plan

The E2 Regulations set out the required elements that regulatees need to include in an E2 plan but the Regulations do not prescribe the form to be used for this plan.

◆ Appendix 1 provides a **list of references** that may be used when preparing an E2 plan. The references cover prevention, preparedness, response and recovery. Regulatees may prepare a plan in the form that makes the most sense for their organization.

◆ Appendix 8 contains a **checklist** that will help regulatees identify the elements that need to be included in the E2 plan.

5.1.1 E2 plan requirements in the Regulations

Subsection 4(2) of the E2 Regulations presents the following factors that **must be** considered in preparing an E2 plan:

(*a*) the properties and characteristics of the substance and the maximum expected quantity of the substance at the place at any time during a calendar year;
(*b*) the commercial, manufacturing, processing or other activity in relation to which the plan is to be prepared;
(*c*) the characteristics of the place where the substance is located and of the surrounding area that may increase the risk of harm to the environment or of danger to human life or health;

and
(*d*) the potential consequences from an environmental emergency to the environment and on human life or health.

Subsections 4(3)(*a*) to 4(3)(*g*) of the E2 Regulations require an E2 plan prepared under the E2 Regulations **to include** the following elements:

(*a*) a description of the factors considered under subsection 4(2) of the E2 Regulations;
(*b*) 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;
(*c*) a description of the measures to be used to prevent, prepare for, respond to and recover from any environmental emergency identified in paragraph 4(3)(*b*) of the E2 Regulations (above);
(*d*) a list of the individuals, identified by name or position, who are to carry out the plan in the event of an environmental emergency, and a description of their roles and responsibilities;
(*e*) the identification of the training required for each of those individuals;
(*f*) a list of the emergency response equipment included as part of the E2 plan, and the equipment's location; and
(*g*) the measures to be taken by the person to notify, prior to, during and after an environmental emergency, those members of the public who may be adversely affected by an environmental emergency, and to inform them of the measures taken and what they need to do in the event of an environmental emergency.

Subsection 5(1) of the E2 Regulations specifies that a person who prepares an E2 plan referred to section 4 or 7 **must** implement and test the E2 plan.

◆ Environment Canada believes that senior-level commitment to the environmental emergency planning measures identified is critical, both at the corporate level and at the facility concerned.

◆ Environment Canada strongly recommends that persons preparing an E2 plan include community and interest groups as well as local, provincial and federal emergency response authorities in the development and preparation of the plan and also share the content of the plan with these organizations.

5.2 Content of an E2 Plan

An E2 plan is critical for preparedness and response.

Although the primary goal of preparing and implementing an E2 plan is to prevent emergencies from occurring, planning is critical for preparedness and response activities if an emergency does occur.

When an E2 plan needs to be prepared, implemented and tested, regulatees may prepare this plan in the form that makes the most sense for their organization. The complexity of E2 plans may vary depending upon the circumstances, but regulatees need to consider some basics factors:

- The E2 plan must be **site-specific**.
- A **single** E2 plan may deal with one or more substances but **must address the full range of hazards** present on the site, including any environmental emergency that can reasonably be expected to occur (natural disasters, severe weather conditions, etc.) as well as the elements of prevention, preparedness, response and recovery.
- The plan should **include site plots** and material safety data sheets (**MSDSs**) for each substance for additional information.
- **Records** of annual testing and annual updates must be **kept at the facility** with the E2 plan.
- **Site-specific training** must be included in the E2 plan.

To satisfy the requirements of section 4 of the E2 Regulations, regulatees should develop accidental release scenarios for any facility based on any environmental emergency that can reasonably be expected to occur at that place. For this reason, **regulatees should focus on defining 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). High-consequence events such as Buncefield[4] and Danvers[5] incidents are important and the lessons learned need to be considered.

For more information about worst-case scenarios and alternative scenarios, see the Risk Management Guide for Major Industrial Accidents, available from the Major Industrial Accidents Reduction Council (MIARC 2007). In addition, Appendix 1 provides a list of references that may be used when preparing an E2 plan, as well as several software tools to assist in the calculations of impact distances.

[4] http://www.buncefieldinvestigation.gov.uk/index.htm.

[5] a) http://www.mass.gov/; b) http://www.mass.gov/dep/danfindg.htm; and c) http://www.csb.gov/newsroom/detail.aspx?nid=33.

E2 plan development: prevention, preparedness, response and recovery

Prevention, preparedness, response and recovery are the **four main elements** involved in E2 plan development. Below are some general concepts associated with each of these main elements.

Prevention

Environmental emergencies can be averted or their severity limited by identifying in advance their probable frequency, and potential consequences and impacts.

Preventing environmental emergencies begins with evaluating the risks associated with the regulated substance(s) being used by the regulatee. Studying past emergencies at the regulatee's site and at similar sites in Canada allows for a more accurate prediction of the range of potential scenarios, including worst-case scenarios. This understanding is critical to assessing a facility's capabilities and resources for dealing with a crisis.

"Acute risk" is often defined as the product of the frequency and severity of accidental releases. In risk-generating operations, an active prevention program can concentrate on either the frequency parameter or the severity parameter, or address both. Reducing either of these separate risks reduces overall risk.

The severity of an accidental release is addressed through both active and passive mitigation. An example of **active mitigation** is the use of water curtains around process vessels to knock down harmful atmospheric releases. **Passive mitigation** includes spill containment, such as dykes and catch basins, around tanks. The frequency of accidental releases can be controlled through standard operating procedures and management systems that consider process design and operation.

Prevention is essential for reducing the frequency and severity of environmental emergencies. Through preventive action, problems can be anticipated, corrective action taken and risks managed to avoid environmental damage. The most effective risk management practices combine prevention activities with appropriate preparedness and response. Analyses of insurance claims show that implementing an appropriate risk management program (RMP) in advance is far less expensive than dealing with the human health problems and environmental damage in the area surrounding a facility following an emergency.

Success Stories – Industry Prevention

- The quantity of the substance on site was reduced, or very large tanks were replaced by tanks of a smaller and less hazardous size.
- Less hazardous alternatives were substituted for highly hazardous substances.
- A less hazardous energy source was adopted (e.g. electric boiler replaces a gas boiler).
- More reliable technologies and automated substance feed into the processes were adopted.
- Substance concentration was reduced to decrease the radius of the risk area.

Prevention refers not only to mitigation measures such as maintenance and spill containment; it also refers to the management systems used for process design and operation, training and smooth facility operation.

To prevent process-related injuries and accidents, process industries in Canada use chemical process safety management (PSM). PSM is the application of management principles and systems to the identification, understanding and control of process hazards.

PSM was developed by the Center for Chemical Process Safety (CCPS), a division of the American Institute of Chemical Engineers (AIChE). An adaptation of this methodology can be found in the book *Process Safety Management* (Canadian Society for Chemical Engineering 2002). A similar discussion on PSM is also included in the 2007 MIARC guide. These sources of information and other references are listed in Appendix 1.

PSM programs are designed to address such key elements as

- risk assessment;
- facility design and construction to specific standards;
- preventive maintenance checks and programs;
- maintenance of effective operating procedures and facility documentation;
- operator competence assurance;
- processes and procedures to ensure that changes in design, service or staff are effectively managed and that impacts on operations are minimized;
- incident investigation and analysis to minimize recurrence; and
- assessment of compliance to standards.

Typically, a PSM program documents issues surrounding the management of process risk, management of change and management of human factors, among others. This PSM program complements traditional health and safety programs and applicable federal/provincial legislation. It is recommended that regulatees develop a comprehensive framework based on the PSM program elements listed above, and discussed in the references cited. This approach is advisable even if some PSM elements may be less applicable than others, given on the nature and degree of the potential hazards involved. Each element should be duly considered before the framework developer assumes it is not applicable.

Success Stories – Industry Preparedness

- Warning sirens were installed at the plant.
- Procedures were established to stop emergency ventilation in the event of major leak (to reduce the distance of impact).
- Response and training teams were created.
- Updated facility equipment was installed, and safer and more reliable technologies (e.g. magnetic sealless pump) were adopted.

Preparedness

In preparing an E2 plan, it is important to involve key people—particularly first responders and representatives of potentially affected stakeholder groups in and around a regulatee's facility. Such consultation enhances the level and effectiveness of preparedness.

When preparing the E2 plan, you should fill identified gaps, upgrade equipment, expand staff, increase communication with and among neighbouring facilities, community officials, public safety agencies, etc. The communication of risk to surrounding communities is an essential component of both prevention and preparedness activities.

Ensuring public safety during and following an environmental emergency is an essential component of preparedness. In preparing an E2 plan, therefore, it is critical that you communicate the plan to members of the public so that they know what to do in an environmental emergency. Communication of this nature can help dispel undue community fears over imagined risks that are not present, and reassure people that any real risks that are present are under proper control.

A regulatee must identify and make available adequate capabilities and resources to enable responders to safely respond to the full range of potential emergencies. Preparedness planning should recognize that, depending on the significance and possible escalating nature of particular events, a facility's capabilities and resources to effectively respond may prove to be inadequate.

Required resources and equipment could be obtained through arrangements or mutual aid agreements with other industries and outside agencies. Under mutual aid agreements, organizations that lack the resources to respond effectively to emergencies on their own can collaborate with other companies to the mutual benefit of all parties. Various types of mutual aid agreements exist. They can involve companies in the same vicinity or, where the distance between an accident location and the party responsible for responding is considerable, in the same local region. These agreements can be effective in improving response, reducing costs and administrative burdens, and avoiding overlap and duplication.

Such agreements are encouraged and should be formalized in writing with all parties as signatories. The participation of each facility in annual exercises associated with such agreements can be considered as fulfilling the testing requirement of the E2 plan for each facility for the purposes of the E2 Regulations. A copy of the mutual aid exercise and the results of the exercise must be kept on site for no less than 5 years, as per the annual testing requirement of the E2 Regulations.

A template for a mutual aid agreement can be found in Annex E of the CAN/CSA-Z731-03 *Emergency Preparedness and Response* standard (see Appendix 1 for full reference). However, it should be noted that mutual aid agreements do not address prevention or recovery aspects. For this reason, participation in a mutual aid agreement in itself does not fulfill the requirement for preparing and implementing an E2 plan under the E2 Regulation.

Preparedness measures should identify all activities essential to ensuring a high degree of readiness for a prompt and effective response to an environmental emergency. Periodic drills and exercises as well as effective training for key personnel in and around the regulatee's facility provide the means of testing the facility's resources and equipment and also raising local awareness. Equipment needed during an emergency should be readily available and regularly maintained and tested. An inventory of equipment currently available on and off site, along with the quantity and location, must be included in the plan and made accessible to responders.

An E2 plan must be tested and updated annually so that changes within the facility are integrated into the plan. By implementing effective prevention measures (such as risk management programs that address all probable emergency situations), persons preparing and implementing an E2 plan can determine the necessary level of preparedness for each situation. Updating an E2 plan annually involves more than checking telephone numbers: it considers any changes in the process or substances; any new level of toxicity hazard; or any new development in the softwares used. The public should be informed about these updates.

Response

Response to an environmental emergency is intended to include all aspects of managing the emergency situation until the emergency phase of the event is considered over. These needs can vary greatly in scope, depending on the nature and magnitude of the emergency.

Effective emergency response includes, but is not limited to:

- quick activation of the emergency plan;
- adequate resource mobilization;
- rapid assessment of the probable path and impacts of the emergency;
- proper notification of the emergency to first responders and affected parties, including alerting and warning the public;
- maintenance of communication systems between stakeholders;
- evacuating, confining and accounting for personnel and members of the public present at a facility's site, if needed; and
- adequate reporting.

Quick and effective response relies on sound planning and pre-established partnerships. Effective emergency response calls for co-operation between industries, communities, local organizations and government through partnerships formed before emergencies occur. Such partnerships can be strengthened through the regular testing of the E2 plan with all of those involved. Communication from the facility to off-site agencies, to the public and among responders is important and necessary for a coordinated and successful response effort.

Recovery

"Recovery" refers to the restoration of any part of the environment damaged by or during the emergency. Recovery affects both the operating entity itself and the surrounding community. The issue of recovery is best managed through discussions among all involved parties to

assess the damage and agree on a restoration plan. The level of environmental restoration is determined by many factors, such as the size, persistence and toxicity of a release. Therefore, recovery of an area to its natural state is not always possible. Thus, restoration plans are situation-specific and would need to be defined in terms of acceptability to affected stakeholders.

Recovery from an environmental emergency involves activities and programs designed to return the surrounding environment to a safe and acceptable condition. The general objective of the recovery portion of an E2 plan should be to provide sufficient direction to reduce impacts to the environment and to minimize the recovery time from a particular incident.

The regulatee in consultation with public authorities should initiate recovery processes as soon as possible, striving for a rapid recovery from environmental damage. Those leading the recovery effort must be aware that rapid response without assessing the risks associated with the recovery effort can lead to increased damage and longer recovery times for the environment. The recovery process can either begin during response or can be initiated in stages until normal operations are restored. Planning for the recovery phase during the prevention, preparedness and response process will improve recovery time and reduce impacts on the environment.

Factors such as the extent of damage and the availability and commitment of personnel, resources and finances all determine how long the recovery process will take. It is important to establish a pre-planned capability to recover and undertake swift damage assessments, because the longer the recovery takes, the higher the ultimate cost.

Four suggested steps to assessing damage in a recovery situation are as follows:

1. Determine the extent of the damage and provide appropriate communication to all relevant parties, including the public.
2. Develop a system to bring in the proper resources, including people, at the right time.
3. Work with outside resources to support recovery.
4. Organize the community resources necessary for people recovering from an emergency situation.

5.3 Testing an E2 plan

The E2 Regulations require that you update and test your E2 plan at least once each calendar year. You are required to keep a record of the results of these annual updates and tests with the plan at a location that is readily available to those involved with the response efforts for a period of at least five years beginning on the day the record is made.

Tests and exercises are a simulation of a possible emergency that can reasonably be expected to occur at the facility. This testing must be performed annually. Testing of the E2 plan

indicates whether the facility can adequately deal with the scenario that is presented in the exercise.

Initial testing should include informing those affected that a test is being planned. This warning will enable responders and participants to react in the proper manner through adequate pre-planning. However, once the skills and knowledge have been acquired, the scenario can be tested without participants' prior knowledge. When designing an exercise, the planners should reinforce any previous training. The test must be simple enough that available resources are adequate, but difficult enough to be challenging. It must also provide maximum lessons learned, including post-exercise evaluation and corrective action, if necessary. An exercise should also be cost-effective.

The type of exercise chosen depends on its purpose, the availability of resources, and the limitations of conducting exercises that apply to the location of operations. Exercises can be either administrative or operational:

- Administrative exercises are usually held in a conference room environment and can be tabletop or synthetic. Synthetic exercises are pre-programmed exercises in which all participants use computers.

- Operational exercises range from those in which only communications are tested to major or full-blown exercises. A major exercise is similar in content to a tabletop exercise except that it is intended to provide a realistic simulation of an emergency response, and all the required resources are actually deployed.

Facilities can take part in mutual aid exercises or in exercises run by industry associations, but these exercises must include their sites and should test their facilities' E2 plan.

E2 Regulations require that an E2 plan be updated and tested at least once each calendar year. Environment Canada recognizes that a full-blown, operational emergency response exercise may not be achievable every year. Therefore, facilities may conduct a full-blown test at least once within a five-year period but must respect the yearly testing requirement by testing different component(s) of their E2 plan at least once each calendar year.

Environment Canada recommends that an appropriate exercise design process be composed of the following four main steps:

1. planning the annual exercise;
2. conducting the exercise;
3. evaluating and reporting on the outcomes; and
4. correcting and updating the E2 plan.

When a facility's plan identifies more than one listed substance, a good approach might be to address all the flammables as one group and all the other hazardous substances as another in the plan. For example, testing could focus on the flammables during the first year, and the

hazardous substances the following year. The documentation for the prevention, preparedness, response and recovery activities required for each group would be done separately. The principal objective is to ensure that all aspects of the plan are fully evaluated over the five-year testing cycle. Further information on testing and exercising of E2 plans can be found in some of the suggested references in Appendix 1.

When is an E2 plan considered to be implemented?

An E2 plan is considered implemented when it has been written and is operational to the point where the regulatee submitting the notice can expect to successfully deal with all aspects of an environmental emergency.

5.4 Location of E2 Plan Documentation

In order to comply with the E2 Regulations, you must keep, readily available for the individuals who are responsible for carrying out the E2 plan, the following documents**:**

- A copy of the E2 plan in the event of the environmental emergency. A copy must also be available at the work place if the E2 substance (s) is located at that place.
- The records of annual updates to the E2 plan and of the tests performed to determine the adequacy of the plan. These records of the updates and tests to the E2 plan must be stored with the E2 plan for at least 5 years beginning on the date that the record is made.

By definition, the E2 plan for a substance must contain four sections: prevention, preparedness, response and recovery. These sections may be within different binders, but all the information that completes the E2 plan must found together.

6.0 Notification of Environmental Emergencies

According to section 193 of CEPA 1999, an environmental emergency means:

(*a*) an uncontrolled, unplanned or accidental release, or release in contravention of regulations or interim orders made under this Part [Part 8 of CEPA 1999], of a substance into the environment; or
(*b*) the reasonable likelihood of such a release into the environment.

Section 201 of CEPA 1999 requires that, when an environmental emergency occurs in respect of any of the substances listed on Schedule 1 of the E2 Regulations, any person who owned or had the charge, management or control of the substance immediately before the environmental emergency, or any person who caused or contributed to the environmental emergency, shall, as soon as possible, notify an enforcement officer or any other person designated by regulation and provide a written report.

For the purposes of section 201 of CEPA 1999,

- a **verbal notification** is to be made as soon as possible in the circumstances to the authorities identified in the ***Release and Environmental Emergency Notification Regulations***[6] (Notification Regulations) under CEPA 1999, which provide the regulated community and the public with the telephone number of the 24-hour authorities operating for the respective province or territory to which notifications are to be made; and
- a **written report** should be made as soon as possible under the circumstances to the relevant authorities.

Information on what a written report must include and to whom it must be sent can be found in section 9 of the E2 Regulations and in **Appendix 7**. Appendix 7 also provides a recommendation on information to be included in the verbal notification and the telephone numbers to call when a release or an environmental emergency occurs.

A person that is required to notify Environment Canada must take all reasonable measures consistent with the protection of the environment and public safety, including preventing, mitigating or recovering from any negative effects on the environment or on human life or health. The person must make a reasonable effort to notify any member of the public who may be adversely affected by the environmental emergency.

[6] http://laws.justice.gc.ca/eng/regulations/SOR-2011-90/FullText.html.

7.0 Access to Submitted Notices

7.1 Public Access

Information on facility location is available to the public under the "search E2 database" section of the Environmental Emergencies website at https://cepae2-lcpeue.ec.gc.ca. However, in order to comply with existing federal legislation related to confidential business information and national security considerations, some detailed information about chemical substances, such as the exact quantities and location of the chemicals, is not available on the website. In concert with the Canadian Security Intelligence Service (CSIS), steps have been taken to manage the sensitive information provided in the notices in a way that does not place Canadians at risk through access to such information by potential criminal or terrorist elements.

7.2 Access for First Responders

To the extent that such access is legally permissible, and on a need-to-know basis only, first responders may request Public Safety Authority to access sensitive Environmental Emergencies database information that is classified for either confidential business or national security reasons. First responders may obtain this access by registering under the "Public Safety Authorities**"** section of the Environmental Emergencies website at https://cepae2-lcpeue.ec.gc.ca.

8.0 Compliance and Enforcement

Environment Canada evaluates the accuracy and completeness of the notices and reports submitted under the E2 Regulations. This evaluation assists the Department in determining:

- whether the regulatee must submit E2 plan reports and notifications; and
- when the regulatee must submit E2 plan reports and notifications; and
- whether Environment Canada should refer possible situations of non-compliance to enforcement officers for investigation.

As part of an ongoing monitoring process, Environment Canada may request that copies of E2 plans be submitted to the Department for review. Such action will help Environment Canada determine whether departmental guidance on environmental emergency planning is adequate and being properly interpreted. An ongoing auditing of E2 plans is also necessary to assess the effectiveness of the E2 plans in protecting Canadians' safety and security.

Investigation of possible non-compliance

Enforcement officers apply the Compliance and Enforcement Policy for CEPA 1999 when verifying compliance with the E2 Regulations. This policy sets out the range of possible responses to alleged violations: warnings, directions, environmental protection compliance orders (EPCOs), ticketing, ministerial orders, injunctions and prosecution, as well as environmental protection alternative measures (EPAMs). The Compliance and Enforcement Policy for CEPA 1999 can be accessed at http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=5082BFBE-1

For the purposes of enforcing the E2 Regulations under section 218 of CEPA 1999, enforcement officers are authorized to enter places and inspect E2 plans and any other relevant record in order to confirm compliance with the E2 Regulations.

When an enforcement officer discovers an alleged violation, the officer will choose the appropriate enforcement action based on the following factors:

- Nature of the alleged violation: This includes the consideration of how serious the harm or potential harm is, what the reason of the alleged violation is, whether this is a repeated occurrence and whether attempts have been made to conceal information or otherwise subvert the objectives and requirements of the CEPA 1999.
- Effectiveness in achieving the desired result with the alleged violator: The desired result is compliance with the CEPA 1999, within the shortest possible time and with no further occurrence of violation. Factors to be considered include:

- the violator's history of compliance with the CEPA 1999 and, if applicable, with regulations by a provincial, territorial or Aboriginal government that are deemed, by order in council, to be equivalent to those under the Act;
- willingness to co-operate with enforcement officers;
- evidence of corrective action already taken; and
- the existence of enforcement actions under other statutes by other federal authorities or by provincial, territorial or Aboriginal governments as a result of the same activity.

- Consistency in enforcement: Enforcement officers strive to achieve consistency in their responses to alleged violations. Accordingly, officers consider how similar previous situations were handled when deciding what enforcement action to take.

9.0 Summary of the Risk Evaluation Framework

This section introduces the evaluation methodology that Environment Canada has developed and is using to evaluate the properties of chemical substances that would prove hazardous in the event of an environmental emergency, and to calculate the threshold quantity for substances listed in Schedule 1 of the E2 Regulations.

The Risk Evaluation Framework (REF) is designed to:

- evaluate the risk posed by a substance to the environment and human health;
- determine the need to add this substance to Schedule 1 of the E2 Regulations, based on the risk evaluation results obtained; and
- calculate the minimum quantity (the threshold) for substances listed in Schedule 1 of the E2 Regulations.

Section 200 of CEPA 1999 is the authority that allows the Governor in Council to make regulations establishing a list of substances that, should they enter the environment as a result of an environmental emergency, might be harmful to the environment, or to human life or health. Section 200 also gives the Governor in Council the authority to prescribe a minimum quantity for these substances.

In 2003, when the E2 Regulations were published, the REF had not yet been developed. As a result, the substances in Schedule 1 (parts 1 and 2) were adopted from the Major Industrial Accidents Reduction Council (MIARC). These thresholds, therefore, were not generated by the REF. The rationale for the MIARC list focused almost entirely on human health and safety criteria (MIARC 2002; J.P. Lacoursière Inc. 2002). The first amendment to the E2 Regulations added substances from the Toxic Substances List (CEPA 1999), and other substances of concern.

The regulated list is not a static one. Environment Canada continues to assess CEPA 1999 substances and other substances of concern (reactives, pesticides, petroleum, biologics, etc.) for possible inclusion in the E2 Regulations. As part of this ongoing process, substances may be added to or removed from Schedule 1 of the E2 Regulations, or thresholds may be adjusted if new data show such adjustments to be warranted.

Please see **Appendix 9** for examples of these calculations.

APPENDIX 1

SUGGESTED REFERENCES
FOR
ENVIRONMENTAL EMERGENCIES PREVENTION, PREPAREDNESS AND RESPONSE MEASURES
AND
THE DEVELOPMENT OF E2 PLANS

General

1. Organisation for Economic Co-operation and Development (OECD). *OECD Guiding Principles for Chemical Accident Prevention, Preparedness and Response: Guidance for Public Authorities, Industry (including Management and Labour), Communities and Other Stakeholders.* Paris: OECD, 2002. Available through the OECD Chemical Accident Prevention, Preparedness and Response website at www.oecd.org/env/accidents.

Emergency Management

2. Canadian Standards Association (CSA). *Emergency Planning for Industry: A National Standard of Canada* (CAN/CSA-Z731-95). Toronto: CSA, 1995. This document can be ordered from CSA International at 1-800-463-6727 or from their website at www.csa-international.org.

3. Canadian Standards Association (CSA). *Emergency Preparedness and Response: A National Standard of Canada* (CAN/CSA-Z731-03). Toronto: CSA, 2003. This document can be ordered from CSA International at 1-800-463-6727 or from their website at www.csa-international.org.

4. National Fire Protection Association (NFPA). *NFPA 1600: Standard for Disaster/Emergency Management, 2007 Edition*. Quincy, Massachusetts: NFPA, 2007. This document can be ordered from the NFPA at 1-800-344-3555 or from their website at http://catalog.nfpa.org.

5. United Nations Environment Programme (UNEP). *APELL, Awareness and Preparedness for Emergencies at a Local Level: A Process for Responding to Technological Accidents*. Paris: UNEP, 1988. This document (ISBN 9280711830) can be ordered from UNEP's on-line bookshop at www.EarthPrint.com.

Process Safety / Risk Management

6. American Petroleum Institute (API). *Recommended Practice 750, Management of Process Hazards*. Washington, D.C.: API, 1990. This document is available from API in Washington, D.C. (at 202-682-8000 or at its website at www.api.org).

7. Major Industrial Accidents Council of Canada (MIACC). *Hazardous Substances Risk Assessment: A Mini-Guide for Municipalities and Industry*. Ottawa, Ontario: MIACC, *1994*.

8. Canadian Society for Chemical Engineering (CSChE). *Process Safety Management*, 3rd Edition. Ottawa: CSChE, 2002 (ISBN 0-920804-96-9).

9. Canadian Society for Chemical Engineering (CSChE). *Site Self-Assessment Tool*. Ottawa: CSChE, 1999.

10. Major Industrial Accidents Reduction council (MIARC). MIARC 2007. Risk Management Guid for Major Industrial Accidents Intended for muicipalities and industry, Montréal. This document is currently available in both French and English at: www.craim.ca

11. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) – *Process Safety Management (PSM) standards*. All standards are available from OSHA at www.osha.gov/SLTC/processsafetymanagement/index.html.

12. U.S. Environmental Protection Agency (EPA). *Areal Locations of Hazardous Atmospheres (ALOHA)*. This software, as well as associated documentation is available from the US EPA website at www.epa.gov/OEM/content/cameo/aloha.htm

13. U.S. Environmental Protection Agency (EPA). *General Guidance on Risk Management Programs for Chemical Accident Prevention (40 CFR Part 68)* (EPA-555-B-04-001). Washington, D.C.: U.S. EPA, 2000. This document is available from the EPA website at http://www.epa.gov/osweroe1/content/rmp/rmp_guidance.htm#General

14. U.S. Environmental Protection Agency (U.S. EPA). *RMP*Comp™ Modelling Program for Risk Management Plans*. RMP*Comp™ is a free computer program that can be used to complete the off-site consequence analyses for the substances that originate from the U.S. Environmental Protection Agency's Risk Management Program list. This software can be downloaded from http://www.epa.gov/oem/content/rmp/rmp_comp.htm

APPENDIX 2

NOTICES OF IDENTIFICATION OF SUBSTANCE AND PLACE, OF IMPLEMENTATION AND TESTING OF E2 PLANS, AND OF CLOSURE AND DECOMMISSIONING

AND

REPORT ON THE PREPARATION OF E2 PLANS

AND

CERTIFICATION

(Schedules 2, 3, 4, 5 and 6 of the *Environmental Emergency Regulations*)

Appendix 2 presents schedules 2, 3, 4, 5 and 6 of the *Environmental Emergency Regulations* (E2 Regulations). These schedules contain information regarding the notification, reporting and certification requirements of the E2 Regulations.

The E2 Regulations require that the information in Appendix 2 be sent to the Minister. To submit your information, please go to https://cepae2-lcpeue.ec.gc.ca/.

SCHEDULE 2 OF THE E2 REGULATIONS
(Subsections 3(1), (4) and 4(1))

INFORMATION TO BE SUBMITTED IN THE NOTICE OF IDENTIFICATION OF SUBSTANCE AND PLACE

1. Place where one or more substances are located:

(*a*) a description of the place or the facility name (if applicable), civic address and location by latitude and longitude; and

(*b*) the names, position titles, e-mail addresses (if any), telephone numbers and fax numbers (if any) of the contact person and their alternate.

2. Head office (if different from above):

(*a*) name and address; and

(*b*) the names, position titles, e-mail addresses (if any), telephone numbers and fax numbers (if any) of the contact person and their alternate.

3. For each substance located at the place:

(*a*) the name of the substance;

(*b*) the CAS registry number;

(*c*) the United Nations (UN) number (if applicable);

(*d*) the maximum expected quantity of the substance at any time during the calendar year;

(*e*) the maximum capacity of the largest container in which the substance is stored;

(*f*) the maximum expected quantity of the mixture (if applicable); and

(*g*) the concentration of the substance within the mixture (if applicable).

SCHEDULE 3 OF THE E2 REGULATIONS
(Subsections 3(6), 4(5) and 5(2))

CERTIFICATION

I hereby certify that the information provided with respect to Schedule ____ to the *Environmental Emergency Regulations* is accurate and complete.

_____
(*Signature of the person or duly authorized representative*)

Name (*please print*): _____

Title: _____

Date: _____

SCHEDULE 4 OF THE E2 REGULATIONS
(Subsections 4(4) and 7(3))

INFORMATION TO BE SUBMITTED IN THE REPORT REGARDING THE PREPARATION OF AN ENVIRONMENTAL EMERGENCY PLAN

1. Place where one or more substances are located:

(*a*) a description of the place or the facility name (if applicable), civic address and location by latitude and longitude; and

(*b*) the name of each substance.

2. Use of prior plans:

(*a*) indicate whether the environmental emergency plan was based on a plan prepared on a voluntary basis;

(*b*) indicate whether the environmental emergency plan was based on a plan prepared for another government and provide particulars, if applicable; and

(*c*) indicate whether the environmental emergency plan was based on a plan prepared under another Act of Parliament and provide particulars, if applicable.

3. Local-level involvement:

(*a*) give the name of the local authorities, community or interest groups that have been involved in the plan's development, if any; and

(*b*) identify whether the plan or its relevant parts were made available to the appropriate local authorities (such as police and fire departments) that may be involved in an emergency response.

4. Information for each substance covered by an environmental emergency plan:

(*a*) the name, CAS registry number and UN number (if applicable) of the substance; and

(*b*) the nature of activities at the place where the substance is located.

5. The date on which the preparation of the environmental emergency plan or an amendment to the plan referred to in subsection 7(2) was completed.

6. The location of the environmental emergency plan if it is different from the place where one or more substances are located.

SCHEDULE 5 OF THE E2 REGULATIONS
(Subsection 5(1))

INFORMATION TO BE SUBMITTED IN THE NOTICE OF THE IMPLEMENTATION AND TESTING OF AN ENVIRONMENTAL EMERGENCY PLAN

1. Place where one or more substances are located:

(*a*) a description of the place or the facility name (if applicable), civic address and location by latitude and longitude; and

(*b*) the name of each substance.

2. The implementation and testing of the environmental emergency plan for the substances mentioned in section 1:

(*a*) the date of testing; and

(*b*) the list of all local authorities, community or interest groups, if any, that have been involved in the testing of the plan.

SCHEDULE 6 OF THE E2 REGULATIONS
(*Subsection 3(5.1)*)

INFORMATION TO BE SUBMITTED IN THE NOTICE OF CLOSURE OR DECOMMISSIONING

1. Place where one or more substances are located:

(*a*) a description of the place or the facility name (if applicable), civic address and location by latitude and longitude;

(*b*) the name of each substance;

(*c*) the quantity of each substance remaining at the place or facility; and

(*d*) the names, position titles, e-mail address (if any), telephone numbers and fax numbers (if any) of the contact person and their alternate.

2. The closing or decommissioning date for the facility or place.

3. A description of the measures taken to prevent and to respond to an environmental emergency when the facility or place closes or is decommissioned.

APPENDIX 3

SCHEDULE 1 OF
THE *ENVIRONMENTAL EMERGENCY REGULATIONS*

List of Substances in Alphabetical Order

Background

During the development of the 2003 version of the *Environmental Emergency Regulations* (E2 Regulations), the list of hazardous chemicals developed by the Conseil pour la réduction des accidents industriels majeurs (CRAIM) was selected as the best starting point for the Regulations. CRAIM had prepared a list of toxic and hazardous substances based on different sources, such as MIACC's List 1 and List 2, as well as the U.S. Environmental Protection Agency's Risk Management Program (RMP) list. Some of the nomenclature used in the original CRAIM list was modified to match those names most commonly used, as listed under the *Transportation of Dangerous Goods Act, 1992* (TDGA). The TDGA list was not adopted in its entirety for the Regulations: its threshold quantities were intended to capture smaller quantities of transported substances that were considered too small to capture at the storage and chemical facilities covered by the E2 Regulations.

At the time of the publication of the original E2 Regulations in 2003, a total of 16 substances declared toxic under CEPA 1999 were included in Schedule 1 of the Regulations. Environment Canada made a commitment to stakeholders to evaluate 49 CEPA substances before publishing amendments to the E2 Regulations. Some of these CEPA 1999 substances are "classes of substances" that include several sub-compounds; consequently, a total of 94 substances were evaluated for possible inclusion in Schedule 1 of the E2 Regulations.

Based on the results of the evaluation of these substances, 30 substances and classes of substances and their respective thresholds are being added to Schedule 1 of the 2011 version of the E2 Regulations. Further, the regulated community requested that three substances of concern (acetic acid, ammonium nitrate and styrene) be evaluated for possible addition to Schedule 1 of the E2 Regulations. Environment Canada completed its evaluation and is adding these three substances to Schedule 1. Therefore, a total of 41 substances (33 substances and classes of substances representing different forms of the core 33 substances) and their respective thresholds have been added to Schedule 1 of the E2 Regulations.

Environment Canada has developed a rationale for the inclusion of the original 174 substances listed in Schedule 1 of the E2 Regulations. The justification for the specified threshold quantities is found in Rationale for the Development of a List of Regulated Substances under CEPA Section 200 and their Threshold Quantities. This document can be found on Environment Canada's Environmental Emergencies website at http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=8BA5E950-1.

The Chemical Abstracts Service registry numbers[7] (CAS registry numbers) are the main identifier for the regulated substances found in the E2 Regulations. The use of these numbers, as well as the classification of the regulated substances according to their physical properties,

[7] CAS Information is the property of the American Chemical Society and any use or redistribution, except as required in supporting regulatory requirements and/or reports to the government when the information and the reports are required by law or administrative policy is not permitted without the prior, written permission of the American Chemical Society

was necessary for greater public understanding and clear communication. The United Nations identification numbers (UN numbers) have been removed from the E2 Regulations; however, they will remain referenced in Appendix 3 of the Implementation Guidelines. Periodic review and re-evaluation of the regulated list will be undertaken by Environment Canada for a continuous enhancement of the protection of the environment and human health.

Schedule 1 of the Regulations

(*Section 2, subsections 3(1), (2) and (5), 4(1) and 7(1)*)

List of Substances

IMPORTANT

In the Implementation Guidelines, Schedule 1 substances are listed in alphabetical order and UN Number is added to the list.
In the E2 Regulations, Schedule 1 substances are listed in order of CAS registry number.

Part 1
Substances Likely to Explode

	Column 1		Column 2	Column 3	
#	Name of Substance	CAS Registry Number	Concentration (% by weight)	Minimum Quantity (tonnes)	UN Number
1	acetaldehyde	75-07-0	1	4.50	1089
2	acetylene	74-86-2	1	4.50	1001
3	ammonium nitrate (in liquid form)	6484-52-2	81	20.00	1942, 2067-2072, 2426
4	ammonium nitrate (in solid form)	6484-52-2	60	20.00	1942, 2067-2072, 2426
5	ammonium perchlorate	7790-98-9	1	3.40	1442
6	benzene	71-43-2	1	10.00	1114
7	bromotrifluoroethylene	598-73-2	1	4.50	2419
8	1,3-butadiene	106-99-0	1	4.50	1010
9	Butane	106-97-8	1	4.50	1011
10	1-buten-3-yne (vinyl acetylene)	689-97-4	1	4.50	no number
11	*cis*-2-butene (2-butene-cis)	590-18-1	1	4.50	1055
12	*trans*-2-butene (2-butene-trans)	624-64-6	1	4.50	1055
13	1-butene (alpha-butylene)	106-98-9	1	4.50	1012
14	2-butene	107-01-7	1	4.50	1055
15	*tert*-butylamine (2-amino-2-methylpropane)	75-64-9	1	150.00	1125
16	butylene (butene)	25167-67-3	1	4.50	1012
17	carbonyl sulphide (carbon oxysulfide)	463-58-1	1	4.50	2204
18	chlorine monoxide (dichlorine oxide)	7791-21-1	1	4.50	no number
19	2-chloropropane (isopropyl chloride)	75-29-6	1	4.50	2356
20	1-chloropropene (1-chloropropylene)	590-21-6	1	4.50	no number
21	2-chloropropene (2-chloropropylene)	557-98-2	1	4.50	2456
22	cyanogen	460-19-5	1	4.50	1026
23	cyclohexane	110-82-7	1	550.00	1145
24	cyclopropane	75-19-4	1	4.50	1027
25	dichlorosilane	4109-96-0	1	4.50	2189
26	difluoroethane (1,1-difluoroethane)	75-37-6	1	4.50	1030

	Column 1		Column 2	Column 3	
#	Name of Substance	CAS Registry Number	Concentration (% by weight)	Minimum Quantity (tonnes)	UN Number
27	1,1-difluoroethylene (vinylidene fluoride)	75-38-7	1	4.50	1959
28	dimethyl ether (methyl ether)	115-10-6	1	4.50	1033
29	dimethyl sulphide	75-18-3	1	150.00	1164
30	dimethylamine	124-40-3	1	4.50	1032 & 1160
31	2,2-dimethylpropane	463-82-1	1	4.50	2044
32	ethane	74-84-0	1	4.50	1035 & 1961
33	ethyl chloride	75-00-3	1	4.50	1037
34	ethyl ether (diethyl ether)	60-29-7	1	4.50	1155
35	ethyl mercaptan	75-08-1	1	4.50	2363
36	ethyl nitrite	109-95-5	1	4.50	1194
37	ethylacetylene	107-00-6	1	4.50	2452
38	ethylamine	75-04-7	1	4.50	1036 & 2270
39	ethylbenzene	100-41-4	1	7000.00	1175
40	ethylene	74-85-1	1	4.50	1038 & 1962
41	gasoline (motor fuel)	86290-81-5	1	150.00	1203
42	gasoline (unleaded)	8006-61-9	1	150.00	1203
43	hydrogen	1333-74-0	1	4.50	1049 & 1966
44	hydrogen peroxide	7722-84-1	52	3.40	2015
45	isobutane	75-28-5	1	4.50	1969
46	isobutylene (2-methylpropene)	115-11-7	1	4.50	1055
47	isopentane (2-methylbutane)	78-78-4	1	4.50	1265
48	isoprene	78-79-5	1	4.50	1218
49	isopropylamine	75-31-0	1	4.50	1221
50	liquefied natural gas	8006-14-2	1	4.50	1972
51	methane	74-82-8	1	4.50	1971 & 1972
52	methyl formate	107-31-3	1	4.50	1243
53	2-methyl-1-butene	563-46-2	1	4.50	2459
54	3-methyl-1-butene	563-45-1	1	4.50	2561
55	methylacetylene (propyne)	74-99-7	1	4.50	1060
56	methylamine	74-89-5	1	4.50	1061
57	naphtha	8030-30-6	1	50.00	1268
58	1,3-pentadiene	504-60-9	1	4.50	no number
59	*n*-pentane (pentane)	109-66-0	1	4.50	1265
60	*cis*-2-pentene (beta-cis-amylene)	627-20-3	1	4.50	no number
61	*trans*-2-pentene (trans-beta-amylene)	646-04-8	1	4.50	no number
62	1-pentene	109-67-1	1	4.50	1108
63	propadiene	463-49-0	1	4.50	2200
64	propane	74-98-6	1	4.50	1978 & 1075
65	propylene	115-07-1	1	4.50	1077
66	silane	7803-62-5	1	4.50	2203
67	sodium chlorate	7775-09-9	10	10.00	1495
68	styrene	100-42-5	10	4.50	2055
69	tetrafluoroethylene	116-14-3	1	4.50	1081

	Column 1		Column 2	Column 3	
#	Name of Substance	CAS Registry Number	Concentration (% by weight)	Minimum Quantity (tonnes)	UN Number
70	tetramethylsilane	75-76-3	1	4.50	2749
71	toluene	108-88-3	1	2500.00	1294
72	trichlorosilane	10025-78-2	1	4.50	1295
73	trifluorochloroethylene (chlorotrifluoroethylene)	79-38-9	1	4.50	1082
74	trimethylamine	75-50-3	1	4.50	1083 & 1297
75	vinyl chloride	75-01-4	1	4.50	1086
76	vinyl ethyl ether (ethyl vinyl ether)	109-92-2	1	4.50	1302
77	vinyl fluoride	75-02-5	1	4.50	1860
78	vinyl methyl ether	107-25-5	1	4.50	1087
79	vinylidene chloride	75-35-4	1	4.50	1303
80	xylenes	1330-20-7	1	8000.00	1307

Part 2
Substances Hazardous When Inhaled

	Column 1		Column 2	Column 3	
#	Name of Substance	CAS Registry Number	Concentration (% by weight)	Minimum Quantity (tonnes)	UN Number
1	acetic acid	64-19-7	95	6.80	2789, 2790
2	acrolein	107-02-8	10	2.27	1092
3	acrylonitrile	107-13-1	10	9.10	1093
4	acryloyl chloride (acrylyl chloride)	814-68-6	10	2.27	no number
5	allyl alcohol	107-18-6	10	6.80	1098
6	allyl chloride	107-05-1	10	9.10	1100
7	allylamine	107-11-9	10	4.50	2334
8	ammonia, anhydrous	7664-41-7	10	4.50	1005
9	ammonia solution	7664-41-7	20	9.10	2073 & 2672
10	arsenic trichloride (arsenous trichloride)	7784-34-1	10	6.80	1560
11	arsine	7784-42-1	1	0.45	2188
12	bis(chloromethyl) ether [dichlorodimethyl ether]	542-88-1	1	0.45	2249
13	boron trichloride	10294-34-5	10	2.27	1741
14	boron trifluoride	7637-07-2	10	2.27	1008
15	boron trifluoride dimethyl etherate	353-42-4	10	6.80	2965
16	bromine	7726-95-6	10	4.50	1744
17	carbon disulphide	75-15-0	10	9.10	1131
18	carbon monoxide	630-08-0	10	6.80	1016
19	chlorine	7782-50-5	10	1.13	1017
20	chlorine dioxide	10049-04-4	1	0.45	no number
21	chloroform (trichloromethane)	67-66-3	10	9.10	1888
22	chloromethyl methyl ether (methyl chloromethyl ether)	107-30-2	10	2.27	1239
23	chloropicrin (trichloronitromethane)	76-06-2	10	2.27	1580
24	chlorosulphonic acid	7790-94-5	10	2.27	1754
25	crotonaldehyde	4170-30-3	10	9.10	1143
26	cyanogen bromide	506-68-3	10	4.50	1889
27	cyanogen chloride	506-77-4	10	4.50	1589
28	cyclohexylamine	108-91-8	10	6.80	2357
29	diborane	19287-45-7	10	1.13	1911
30	1,2-dichloroethane (ethylene dichloride)	107-06-2	10	6.80	1184
31	dichloromethane (methylene chloride)	75-09-2	1	9.10	1593
32	dimethyldichlorosilane (dichlorodimethylsilane)	75-78-5	10	2.27	1162
33	1,1-dimethylhydrazine	57-14-7	10	6.80	1163
34	epichlorohydrin	106-89-8	10	9.10	2023
35	ethylene chlorohydrin (2-chloroethanol)	107-07-3	10	4.50	1135
36	ethylene oxide	75-21-8	10	4.50	1040
37	ethylenediamine	107-15-3	10	9.10	1604

	Column 1		Column 2	Column 3	
#	Name of Substance	CAS Registry Number	Concentration (% by weight)	Minimum Quantity (tonnes)	UN Number
38	ethyleneimine	151-56-4	10	4.50	1185
39	fluorine	7782-41-4	1	0.45	1045
40	formaldehyde, solution	50-00-0	10	6.80	1198 & 2209
41	furan	110-00-9	10	2.27	2389
42	hydrazine	302-01-2	10	6.80	2029
43	hydrochloric acid	7647-01-0	30	6.80	1789
44	hydrofluoric acid	7664-39-3	50	0.45	1790
45	hydrogen bromide (hydrobromic acid)	10035-10-6	10	1.13	1048 & 1788
46	hydrogen chloride, anhydrous	7647-01-0	10	2.27	2186 & 1050
47	hydrogen cyanide (hydrocyanic acid)	74-90-8	10	1.13	1051 & 1613 & 1614
48	hydrogen fluoride, anhydrous	7664-39-3	1	0.45	1052
49	hydrogen selenide	7783-07-5	1	0.22	2202
50	hydrogen sulphide	7783-06-4	10	4.50	1053
51	iron pentacarbonyl	13463-40-6	10	1.13	1994
52	isobutyronitrile	78-82-0	10	9.10	2284
53	isopropyl chloroformate	108-23-6	10	6.80	2407
54	ketene	463-51-4	1	0.22	no number
55	mercury	7439-97-6	NA	1.00	2809
56	methyl bromide	74-83-9	10	2.27	1062
57	methyl chloride	74-87-3	10	4.50	1063
58	methyl chloroformate	79-22-1	10	2.27	1238
59	methyl iodide	74-88-4	10	4.50	2644
60	methyl isocyanate	624-83-9	10	4.50	2480
61	methyl mercaptan	74-93-1	10	4.50	1064
62	methyl thiocyanate	556-64-9	10	9.10	no number
63	methylacrylonitrile	126-98-7	10	4.50	3079
64	methylhydrazine (monomethyl hydrazine)	60-34-4	10	6.80	1244
65	methyltrichlorosilane	75-79-6	10	2.27	1250
66	nickel carbonyl	13463-39-3	1	0.45	1259
67	nitric acid	7697-37-2	80	6.80	2031 & 2032
68	nitric oxide (nitrogen monoxide)	10102-43-9	10	4.50	1660
69	nitrogen dioxide	10102-44-0	10	1.13	1067
70	osmium tetroxide	20816-12-0	1	0.22	2471
71	perchloromethyl mercaptan	594-42-3	10	4.50	1670
72	perchloryl fluoride (trioxychlorofluoride)	7616-94-6	10	6.80	3083
73	peroxyacetic acid (peracetic acid)	79-21-0	10	4.50	3107
74	phenol	108-95-2	10	9.10	1671 & 2312 & 2821

	Column 1		Column 2	Column 3	
#	Name of Substance	CAS Registry Number	Concentration (% by weight)	Minimum Quantity (tonnes)	UN Number
75	phosgene	75-44-5	1	0.22	1076
76	phosphine	7803-51-2	10	2.27	2199
77	phosphorus oxychloride	10025-87-3	10	2.27	1810
78	phosphorus trichloride	7719-12-2	10	6.80	1809
79	phosphorus, white	7723-14-0	NA	1.00	2447
80	piperidine	110-89-4	10	6.80	2401
81	propionitrile	107-12-0	10	4.50	2404
82	*n*-propyl chloroformate (propyl chloroformate)	109-61-5	10	6.80	2740
83	propylene oxide	75-56-9	10	4.50	1280
84	propyleneimine	75-55-8	10	4.50	1921
85	stibine	7803-52-3	10	2.27	2676
86	sulphur dioxide	7446-09-5	10	2.27	1079
87	sulphur hexafluoride (sulfur hexafluoride)	2551-62-4	10	9.10	1080
88	sulphur tetrafluoride	7783-60-0	10	1.13	2418
89	sulphur trioxide	7446-11-9	10	4.50	1829
90	sulphuric acid, fuming (oleum)	8014-95-7	NA	4.50	1831
91	tetraethyl lead	78-00-2	10	2.27	1649
92	tetramethyl lead	75-74-1	10	4.50	no number
93	tetranitromethane	509-14-8	10	4.50	1510
94	thionyl chloride	7719-09-7	10	6.80	1836
95	titanium tetrachloride	7550-45-0	10	1.13	1838
96	toluene diisocyanate	26471-62-5	10	4.50	2078
97	toluene-2,4-diisocyanate	584-84-9	10	4.50	2078
98	toluene-2,6-diisocyanate	91-08-7	10	4.50	2078
99	*trans*-crotonaldehyde	123-73-9	10	9.10	1143
100	trimethylchlorosilane (chlorotrimethylsilane)	75-77-4	10	4.50	1298
101	vinyl acetate	108-05-4	10	6.80	1301

Part 3
Other Hazardous Substances

	Column 1		Column 2	Column3	
#	Name of Substance	CAS Registry Number	Concentration (% by weight)	Minimum Quantity (tonnes)	UN Number
1	arsenic	7440-38-2	10	0.22	1558
2	arsenic acid	7778-39-4	10	0.22	1553, 1554
3	arsenic pentoxide	1303-28-2	10	0.22	1559
4	arsenic trioxide (arsenic(III) oxide)	1327-53-3	10	0.22	1561
5	cadmium chloride	10108-64-2	10	0.22	no number
6	cadmium oxide	1306-19-0	10	0.22	no number
7	cadmium sulphate (cadmium sulfate)	10124-36-4	10	0.22	no number
8	cadmium sulphide (cadmium sulfide)	1306-23-6	10	0.22	no number
9	chromic acid	7738-94-5	10	0.22	1463, 1755
10	chromium trioxide	1333-82-0	10	0.22	1463, 1755
11	3,3'-dichlorobenzidine	91-94-1	1	1.13	no number
12	naphthalene (in liquid form)	91-20-3	10	4.5	2304
13	nickel acetate	373-02-4	10	0.22	no number
14	nickel ammonium sulphate (nickel ammonium sulfate)	15699-18-0	10	0.22	no number
15	nickel carbonate	3333-67-3	10	0.22	no number
16	nickel chloride	7718-54-9	10	0.22	no number
17	nickel nitrate [nickel(II) nitrate]	13138-45-9	10	0.22	2725
18	nickel(II) nitrate, hexahydrate	13478-00-7	10	0.22	2725
19	nickel oxide	1313-99-1	10	0.22	no number
20	nickel(II) sulphate (nickel(II) sulfate)	7786-81-4	10	0.22	no number
21	nickel sulphate, hexahydrate (nickel(II) sulphate, hexahydrate)	10101-97-0	10	0.22	no number
22	nonylphenol (mixed isomer)	25154-52-3	10	1.13	no number
23	*p*-nonylphenol	104-40-5	10	1.13	no number
24	4-tert-nonylphenol	84852-15-3	10	1.13	no number
25	potassium chromate	7789-00-6	10	0.22	no number
26	sodium arsenate, dibasic	7778-43-0	10	0.22	1685
27	sodium arsenate, dibasic, heptahydrate	10048-95-0	10	0.22	1685
28	sodium arsenite	7784-46-5	10	0.22	1686, 2027
29	sodium chromate	7775-11-3	10	0.22	no number
30	sodium dichromate	10588-01-9	10	0.22	no number
31	tetrachloroethylene (perchloroethylene, Perc)	127-18-4	1	1.13	1897
32	tetrachloromethane (carbon tetrachloride)	56-23-5	1	0.22	1846
33	tributyl tetradecyl phosphonium chloride (TTPC)	81741-28-8	10	0.22	no number
34	trichloroethylene (TCE)	79-01-6	1	1.13	1710

APPENDIX 4

REGIONAL CONTACT INFORMATION

FOR

SUBMISSION OF NOTICES, REPORTS AND CERTIFICATION UNDER SCHEDULES 2, 3, 4 AND 5 OF THE *ENVIRONMENTAL EMERGENCY REGULATIONS*

IDENTIFICATION OF SUBSTANCE AND PLACE; CERTIFICATION; PREPARATION OF THE E2 PLAN; IMPLEMENTATION AND TESTING OF THE E2 PLAN

Province	Regional Environment Canada Office
Newfoundland and Labrador	Environmental Emergencies – Atlantic Region Environment Canada 45 Alderney Drive, 15th floor, Queen Square Dartmouth, Nova Scotia B2Y 2N6 Fax: 902-426-9709
Prince Edward Island	Environmental Emergencies – Atlantic Region Environment Canada 45 Alderney Drive, 15th floor, Queen Square Dartmouth, Nova Scotia B2Y 2N6 Fax: 902-426-9709
Nova Scotia	Environmental Emergencies – Atlantic Region Environment Canada 45 Alderney Drive, 15th floor, Queen Square Dartmouth NS B2Y 2N6 Fax: 902-426-9709
New Brunswick	Environmental Emergencies – Atlantic Region Environment Canada 45 Alderney Drive, 15th floor, Queen Square Dartmouth NS B2Y 2N6 Fax: 902-426-9709
Quebec	Environmental Emergencies / Urgences Environnementales – Quebec Region Environment Canada 105 McGill Street, 4th floor Montréal QC H2Y 2E7 Fax: 514-496-1157
Ontario	Environmental Emergencies – Ontario Region Environment Canada 4905 Dufferin Street Downsview ON M3H 5T4 Fax: 416-739-4953

Province	Regional Environment Canada Office
Manitoba	Environmental Emergencies – Prairie and Northern Region Environment Canada Rm 200, 4999-98 Avenue, NW Edmonton AB T6B 2X3 Fax: 780-495-3173
Saskatchewan	Environmental Emergencies – Prairie and Northern Region Environment Canada Rm 200, 4999-98 Avenue, NW Edmonton, Alberta T6B 2X3 Fax: 780-495-3173
Alberta	Environmental Emergencies – Prairie and Northern Region Environment Canada Rm 200, 4999-98 Avenue, NW Edmonton, Alberta T6B 2X3 Fax: 780-495-3173
British Columbia	Environmental Emergencies – Pacific and Yukon Region Environment Canada 201-401 Burrard Street Vancouver BC V6C 3S5 Fax: 604-666-1140
Yukon	Environmental Emergencies – Pacific and Yukon Region Environment Canada 201-401 Burrard Street Vancouver, British Columbia V6C 3S5 Fax: 604-666-1140
Northwest Territories	Environmental Emergencies – Prairie and Northern Region Environment Canada Rm 200, 4999-98 Avenue, NW Edmonton, Alberta T6B 2X3 Fax : 780-495-3173

Province	**Regional Environment Canada Office**
Nunavut	Environmental Emergencies – Prairie and Northern Region Environment Canada Rm 200, 4999-98 Avenue, NW Edmonton, Alberta T6B 2X3 Fax: 780-495-3173

APPENDIX 5

DETERMINATION OF CONTAINER CAPACITY AND SUBSTANCE QUANTITY

Introduction

Appendix 5 provides guidance on how to **calculate:**

- **the maximum capacity of the single largest container** in which the substance is stored; and
- **the total quantity** of the substance on site.

Appendix 5 also shows how the E2 Regulations apply to pure substances and mixtures for both above-mentioned calculations.

Before you start calculating the quantities of a substance on your site, you first need to verify if your substance(s) is captured by the exclusion in section 2 of the E2 Regulations, which states:

> 2. For the purposes of the definition "substance" in section 193 of the Act, the list of substances consists of the substances set out in column 1 of Schedule 1 in their pure form or in a mixture that has a concentration equal to or greater than the applicable concentration set out in column 2 but **does not include**
>
> (*a*) a substance set out in column 1 of Part 1 of Schedule 1 that is a component of a mixture that has a flash point equal to or greater than 23°C or a boiling point equal to or greater than 35°C;
> (*b*) a substance set out in column 1 of Part 2 of Schedule 1 when the substance is a gas or a liquid that is a component of a mixture and the partial pressure of the substance is equal to or less than 10 mm of mercury;
> (*c*) a substance set out in column 1 of Part 1 of Schedule 1 that is a component of natural gas in its gaseous form;
> (*d*) a substance that is subject to the *Transportation of Dangerous Goods Act, 1992*, or the *Canada Shipping Act, 2001*, unless the substance is being loaded or unloaded at a facility; and
> (*e*) solid nickel oxide in particles that measure more than 10 microns (µm) in diameter.

The threshold quantity and concentration for each regulated substance are listed in Appendix 3 of the Implementation Guidelines. You must first verify whether the **threshold concentration** applies to you. If yes, then you determine whether the total quantity of each regulated substance at the place, or the maximum capacity of the container in which the substance is stored is equal to or greater than, the listed threshold quantity. If the substance quantity or the maximum capacity exceeds the listed threshold quantity, the regulatee must comply with the E2 Regulations for that substance.

IMPORTANT: Note that, in the E2 Regulations,

- the threshold quantity for each substance listed is based on its pure form;
- if a mixture is identified by a CAS registry number listed in Schedule 1 of the E2 Regulations, it must be considered a substance, not a mixture; and

- if the substance is a pure substance under Part 1, Part 2 or Part 3 of Schedule 1 of the E2 Regulations, the weight of the substance, in tonnes, must be used to determine the quantity of substance.

1. Maximum Capacity of the Largest Container

Maximum Capacity

The maximum capacity of the largest container is determined by the maximum quantity of the substance required to fill the container to 100% capacity. No consideration is given to the administrative controls to limit the quantity within the tank, or to industrial standards for maximum design capacity and therefore are not acceptable for calculating the maximum capacity of the container.

This approach differs from a risk management program (RMP) process, which allows for administrative controls of the maximum container capacity. Environment Canada chose this approach after accidents occurred in which containers were inadvertently filled above the allowable limit. For example, on a hot day in Quebec in the summer of 2005, a propane tank was filled over the provincial limit. The hot temperatures caused expansion and a leak in the tank's bleeder valve, which led to an explosion.

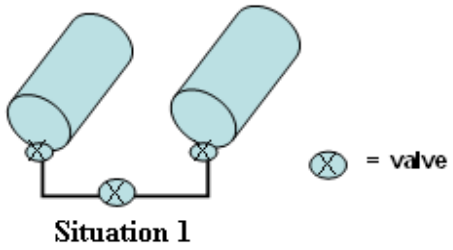
Thus, it is unacceptable to:

- **use the safety level** to calculate the maximum capacity of the container; or
- **take into account administrative controls** in determining the largest quantity.

Maximum Capacity of Interconnected Tanks

If interconnected containers each have one or more shut-off valves, then each segregated container is considered a separate container, because a leak in one container will not release the entire contents of all the interconnected containers.

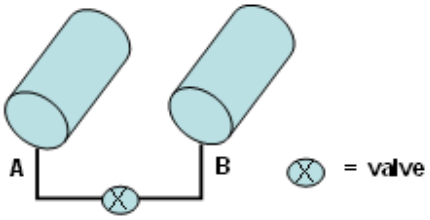
If there are no shut-off valves between the interconnected containers, then one must consider the entire quantity within that system (including pipes) to be one single large container. By the same token, closed-loop systems must also be treated as a single process or a single container.



Situation 1

In situation 1, it is possible to isolate each tank due to the location of the valve.

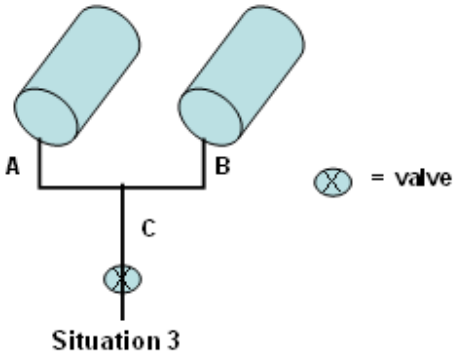
To determine the maximum capacity of the largest container in situation 1, you should take into account the capacity of the largest tank **without** including the capacity of the connected pipes. Therefore, you must consider the tank with the largest capacity to determine the worst-case scenario.



Situation 2

In situation 2, it is possible to isolate each tank due to the location of the valve.

To determine the maximum capacity of the largest container in situation 2, you should take into account the capacity of the largest tank **and** the capacity of the pipes connected between the tank and the valve. Therefore, you must consider the tank with the largest capacity and the relevant pipes (A or B) to determine the worst-case scenario.



Situation 3

In situation 3, due to the location of the valve, it is impossible to isolate either of the tanks if you have a leak on a pipe between the valve and the tanks.

To determine the maximum capacity of the largest container in situation 3, you should take into account the capacity of the **two** tanks **and** the capacity of the pipes connected between the tanks and the valve. Therefore, you must consider these two tanks with the relevant pipes (A, B and C) as a single system when evaluating the worst-case scenario.

In calculating a worst-case accident scenario, you must consider the potential release of the greatest possible quantity of the substance, from the largest container, for which the impact distance is the greatest. Environment Canada, like the U.S. EPA, advises that, in calculating the worst-case scenario for an accidental release, you should use the contents of the largest container (U.S. EPA 2009).

2. Maximum Quantity of a Substance on Site

The "**maximum quantity of a substance"** means more than the quantity found in a single container. Rather, it means the maximum quantity of a substance found during the calendar year in all the storage places and processes, including pipes, that are within the borders of the facility.

Volume to Weight Conversion

Often the capacity of the container is expressed in volume (e.g. litres, cubic metres or U.S. gallons). To calculate the maximum quantity and capacity of a substance stored in a container, the volume must be converted into weight (tonnes) by using the density of the substance. This allows for comparison with the threshold quantity indicated in the E2 Regulations. The density is generally available in the product's MSDS.

Below are examples provided in order to help determine the maximum quantity of a pure substance. Please note that specific **exceptions** exist in subsection 3(2) of the E2 Regulations.

2.1 Calculation of the Quantity of a Pure Substance

Pure Substances – Part 1

Example 1

A pure substance implies that the concentration of cyclohexane, in this example, is in its purest form. Therefore, the concentration is over 1% and closer to 100% purity.

In E2 Regulations: Cyclohexane (CAS #: 110-82-7); Column 2: minimum concentration 1%;
Column 3: threshold quantity 550 t

Quantities of cyclohexane at a site:

- 4 tanks each filled with a total quantity of 180 t (maximum capacity of each tank is 200 t);

- one tank filled with 54 t (maximum capacity of 60 t); and
- an additional 10 t found in the process stream.

Calculation determining the total tonnage of cyclohexane at the site:
(Number of tanks × quantity in tanks) + Additional quantity on site =
(4 tanks × 180 t per tank) + (1 tank × 54 t) + 10 t in process =
(720 t) + (54 t) + (10 t) = 784 t

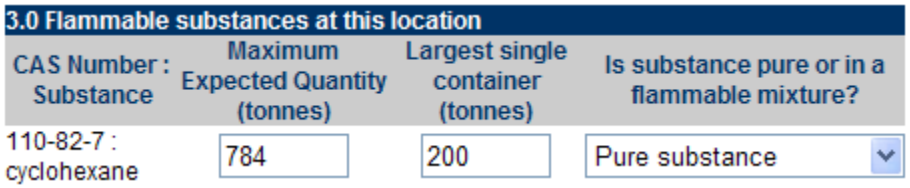
E2 website reporting
Compare the column 3 threshold for cyclohexane with the quantities found at the site.

Maximum capacity of single largest container = 200 t
200 t (at site) < 550 t (in E2 Regulations)

Total quantity on site = 784 t
784 t (on site) ≥ 550 t (in E2 Regulations)

In this example, a notice of identification and place (Schedule 2) and Certification (Schedule 3), must be submitted because only one criterion was met.

The following example shows how the information would be reported using Environment Canada's online notification.



3.0 Flammable substances at this location			
CAS Number : Substance	Maximum Expected Quantity (tonnes)	Largest single container (tonnes)	Is substance pure or in a flammable mixture?
110-82-7 : cyclohexane	784	200	Pure substance

Figure 1: Example of an online notification using the above example for cyclohexane

Example 2
In E2 Regulations: Benzene (CAS #: 71-43-2); Column 2: minimum concentration 1%; Column 3: threshold quantity 10 t

Quantities of benzene at a site:
- 3 tanks each filled with a total quantity of 90 000 L (maximum capacity of each tank is 100 000 L);
- one tank filled with 450 L (maximum capacity of 500 L); and
- an additional 1000 L found in the process stream.

Calculation determining the total tonnage of benzene at the site:
The volume of benzene must be converted from litres into tonnes using the density of the substance. Knowing that the density of benzene is 0.879 kg/L, the following equations can be used to determine the total quantity of the substance on site.

(Number of tanks × quantity in tanks) + additional quantity on site =
(3 tanks x 90 000 L per tank) + (1 tank × 450 L) + 1000 L in process =
(270 000 L) + (450 L) + (1000 L) = 271 450 L

Total quantity (litres) × density (kg/L) =

$$271\,450\ L \times \left(0.879 \frac{kg}{L}\right) \times \left(\frac{1\,t}{1000\ kg}\right) = 238.6\ t$$

Calculated maximum capacity of the single largest container:
The largest container at 100 000 L would also require conversion from litres to tonnes.

$$100\,000\ L \times \left(0.879 \frac{kg}{L}\right) \times \left(\frac{1\,t}{1000\ kg}\right) = 87.9\ t$$

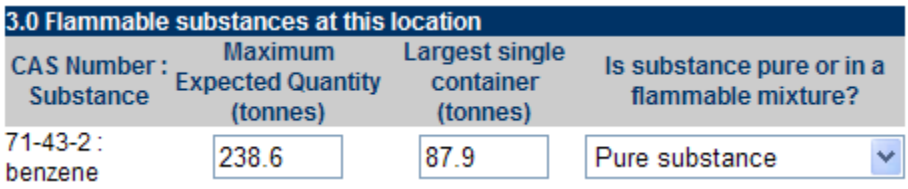
E2 website reporting:
Compare column 3 threshold for benzene with quantities found at the site.

Maximum capacity of single largest container = 87.9 t
87.9 t (at site) ≥ 10 t (in E2 Regulations)

Total quantity on site = 238.6 t
238.6 t (at site) ≥ 10 t (in E2 Regulations)

In this example, a notice of identification of substance and place (Schedule 2), certification (Schedule 3), the report of preparation (Schedule 4), and the notice of implementation and testing of an E2 plan (Schedule 5), must be submitted.

The following example shows how the information would be reported using Environment Canada's online notification.



3.0 Flammable substances at this location			
CAS Number : Substance	Maximum Expected Quantity (tonnes)	Largest single container (tonnes)	Is substance pure or in a flammable mixture?
71-43-2 : benzene	238.6	87.9	Pure substance

Figure 2: Example of an online notification using the above example for benzene

Pure Substances – Part 2

Example 3

In E2 Regulations: Allylamine (CAS #: 107-11-9); Column 2: minimum concentration 10%; Column 3: threshold quantity 4.5 tonnes

Quantities of allylamine at a site:

- 1 tank filled with a total quantity of 1700 US gallons (maximum capacity of tank is 2000 US gallons);

Calculation determining the total tonnage of allylamine at the site and the maximum capacity:
The volume of allyamine must be converted from US gallons into tonnes using the density of the substance. Knowing that the density of allylamine is 0.760 kg/L, and that one US gallon equals 3.7854 L, the following equations can be used to determine the total quantity of the substance on site.

$$Maximum\ Capacity = 2{,}000\ US\ gal \times \left(\frac{3.7854\ L}{1\ US\ gal}\right) \times \left(\frac{0.760\ kg}{1\ L}\right) \times \left(\frac{1\ t}{1000\ kg}\right) = 5.75\ t$$

$$Quantity = 1{,}700\ US\ gal \times \left(\frac{3.7854\ L}{1\ US\ gal}\right) \times \left(\frac{0.760\ kg}{1\ L}\right) \times \left(\frac{1\ t}{1000\ kg}\right) = 4.89\ t$$

E2 website reporting:
Compare column 3 threshold for allyamine with quantities found at the site.

Maximum capacity of single largest container = 5.75 t
5.75 t (at site) ≥ 4.5 t (in E2 Regulations)

Total quantity on site = 4.89 t
4.89 t (at site) ≥ 4.5 t (in E2 Regulations)

In this example, a notice of identification of substance and place (Schedule 2), certification (Schedule 3), the report of preparation (Schedule 4), and the notice of implementation and testing of an E2 plan (Schedule 5), must be submitted.

The following example shows how the information would be reported using Environment Canada's online notification.

3.0 Hazardous substances at this location

CAS Number : Substance	Maximum Expected Quantity (tonnes)	Largest single container (tonnes)	Concentration (%)
107-11-9 : allylamine (concentration 10% or greater)	4.89	5.75	100

Figure 3: Example of an online notification using the above example for allylamine

Example 4

In E2 Regulations: Sulphur dioxide (CAS #: 7446-09-5); Column 2: minimum concentration 10%; Column 3: threshold quantity 2.27 t

Quantities of sulphur dioxide at a site:

- 1 tank filled to 80% capacity (maximum capacity of tank is 20 000 US gallons);

Sulphur dioxide is stored under pressure in the liquefied state.

Calculation determining the total tonnage of sulphur dioxide at the site and the maximum capacity:

The density must be used to determine the total quantity of substance on site. Knowing that the density of sulphur dioxide is 1.430 kg/L and that one US gallon equals 3.7854 L, the quantity of sulphur dioxide, in tonnes, can be calculated:

$$Maximum\ Capacity = 20{,}000\ US\ gal \times \left(\frac{3.7854\ L}{1\ US\ gal}\right) \times \left(\frac{1{,}430\ kg}{1\ L}\right) \times \left(\frac{1\ t}{1000\ kg}\right) = 108.3\ t$$

Filled to 80% capacity: $0.80 \times 20\ 000 = 16\ 000\ US\ gallons$

$$Quantity = 16{,}000\ US\ gal \times \left(\frac{3.7854\ L}{1\ US\ gal}\right) \times \left(\frac{1{,}430\ kg}{1\ L}\right) \times \left(\frac{1\ t}{1000\ kg}\right) = 86.6\ t$$

E2 website reporting:

Compare column 3 threshold for sulphur dioxide with quantities found at the site.

Maximum capacity of single largest container = 108.3 t
108.3 t (at site) ≥ 2.27 t (in E2 Regulations)

Total quantity on site = 86.69 t
86.6 t (at site) ≥ 2.27 t (in E2 Regulations)

In this example, a notice of identification of substance and place (Schedule 2), certification (Schedule 3), the report of preparation (Schedule 4), and the notice of implementation and testing of an E2 plan (Schedule 5), must be submitted.

The following example shows how the information would be reported using Environment Canada's online notification.

3.0 Hazardous substances at this location			
CAS Number : Substance	Maximum Expected Quantity (tonnes)	Largest single container (tonnes)	Concentration (%)
7446-09-5 : sulphur dioxide (concentration 10% or greater)	86.6	108.3	100

Figure 4: Example of an online notification using the above example for sulphur dioxide

Pure Substances – Part 3

Example 5

In E2 Regulations: Trichloroethylene (CAS #: 79-01-6); Column 2: minimum concentration 1%; Column 3: threshold quantity 1.13 t

Quantities of trichloroethylene at a site:

- 2 tanks each filled with a total quantity of 3000 L (maximum capacity of each tank is 3800 L);
- one tank filled with 50 L (maximum capacity of 65 L); and
- an additional 500 L found in the process stream.

Calculation determining the total tonnage of trichloroethylene at the site:

The volume of trichloroethylene must be converted from litres into tonnes using the density of the substance. Knowing that the density of trichloroethylene is 1.46 g/cm^3, the following equation can be used to determine the total quantity of the substance on site.

(Number of tanks × quantity in tanks) + additional quantity on site =
(2 tanks × 3000 L per tank) + (1 tank × 50 L) + 500 L in process =
(6000 L) + (50 L) + (500 L) = 6550 L

Total quantity (litres) × density (g/cm^3) =

$$6550\ L \times \left(\frac{1000\ cm^3}{1\ L}\right)\left(1.46\frac{g}{cm^3}\right) \times \left(\frac{1\ kg}{1000\ g}\right) \times \left(\frac{1\ t}{1000\ kg}\right) = 9.563\ t$$

Calculated maximum capacity of the single largest container:

The largest container at 3800 L would also require conversion from litres to tonnes.

$$3800\ L \times \left(\frac{1000\ cm^3}{1\ L}\right)\left(1.46\frac{g}{cm^3}\right) \times \left(\frac{1\ kg}{1000\ g}\right) \times \left(\frac{1\ t}{1000\ kg}\right) = 5.548\ t$$

E2 website reporting:
Compare column 3 threshold for trichloroethylene with quantities found at the site.

Maximum capacity of single largest container = 5.548 t
5.548 t (at site) ≥ 1.13 t (in E2 Regulations)

Total quantity on site = 9.563 t
9.563 t (at site) ≥ 1.13 t (in E2 Regulations)

In this example, a notice of identification of substance and place (Schedule 2), certification (Schedule 3), the report of preparation (Schedule 4), and the notice of implementation and testing of an E2 plan (Schedule 5), must be submitted.

2.2 Calculation of the Quantity of a Substance in a Mixture

Mixtures – Part 1

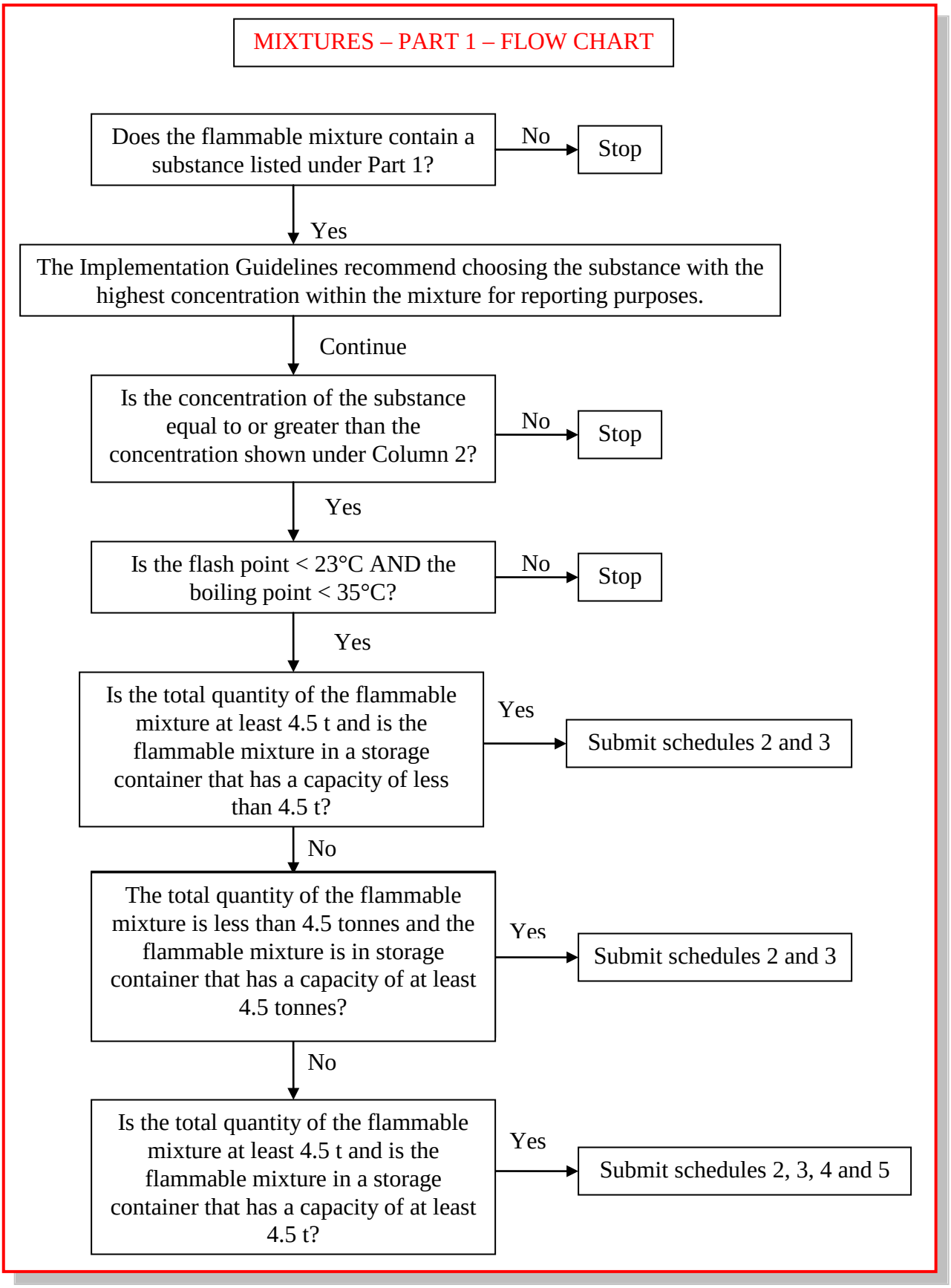
The volatility of a substance is taken into account by the flash point and boiling point criteria. "Flash point" is defined as the lowest temperature at which a substance gives off sufficient vapour to form an ignitable mixture with air near its surface or within a vessel.

If the chemical has a flash point of less than 23°C and a boiling point of less than 35°C, then the substance is capable of causing a vapour cloud explosion. If the substance does not have a flash point, or if the substance sublimes, or decomposes, below the cut-off temperatures, then the substance will not be considered flammable or combustible. A mixture is considered non-flammable when either the flash point or boiling point does not meet the flammability criteria described above. For this reason, a non-flammable mixture that includes a substance found in Part 1 of Schedule 1 is excluded from the E2 Regulations.

The threshold quantity for a vapour cloud explosion is set at 4.5 t (metric tonnes) (10 000 lbs) because, in the event of an explosion, this quantity would result in an approximate overpressure of 3 pounds per square inch (psi) at a distance of 100 m (J.P. Lacoursière 2002). The calculation is performed using the TNT model with Process Hazard Analysis Software Tools (PHAST) software.

Gasoline and natural gas are exceptions found in Schedule 1 of the E2 Regulations since they are composed of several substances. In the context of the E2 Regulations, these listed substances are to be considered as single pure substances.

The following example illustrates how the calculations are performed for substances within mixtures under Part 1. It is recommended that one still consider creating an E2 plan to deal with any emergencies related to this mixture, even if the substance is not subject to the E2 Regulations.


MIXTURES – PART 1 – FLOW CHART
Does the flammable mixture contain a substance listed under Part 1?
No
Stop
Yes
The Implementation Guidelines recommend choosing the substance with the highest concentration within the mixture for reporting purposes.
Continue
Is the concentration of the substance equal to or greater than the concentration shown under Column 2?
No
Stop
Yes
Is the flash point < 23°C AND the boiling point < 35°C?
No
Stop
Yes
Is the total quantity of the flammable mixture at least 4.5 t and is the flammable mixture in a storage container that has a capacity of less than 4.5 t?
Yes
Submit schedules 2 and 3
No
The total quantity of the flammable mixture is less than 4.5 tonnes and the flammable mixture is in storage container that has a capacity of at least 4.5 tonnes?
Yes
Submit schedules 2 and 3
No
Is the total quantity of the flammable mixture at least 4.5 t and is the flammable mixture in a storage container that has a capacity of at least 4.5 t?
Yes
Submit schedules 2, 3, 4 and 5

Mixtures – Part 2

The partial pressure of the regulated substance within the mixture must be measured or estimated and documented. If the substance within the mixture has a partial pressure less than 10 millimetres of mercury, or 10 mmHg (133 kPa), the substance within the mixture is excluded for the purpose of the E2 Regulations.

However, if the substance in the mixture has a partial pressure greater than 10 mmHg, the mass of the regulated substance within the mixture must be determined and used to calculate the total quantity of regulated substance on site and the capacity of the largest container.

Example 6

In E2 Regulations: Hydrochloric acid (CAS #: 7647-01-0); Column 2: minimum concentration 30%; Column 3: threshold quantity 6.80 t

Hydrochloric Acid on Site				
Capacity Container (tonnes)	**Concentration (%)**	**Total Quantity (tonnes)**	**Calculations**	**Subject to E2 Regulations?**
8	20	100	1) Compare concentration: 20% at site < 30% in E2 Regs	No Stop
5	35	8	1) Compare concentration: 35% at site ≥ 30% in E2 Regs 2) Compare total quantity: (35/100) × 8 t = 2.8 t 2.8 t at site < 6.8 t in E2 Regs 3) Compare capacity container: (35/100) × 5 t = 1.75 t 1.75 t at site < 6.8 t in E2 Regs	No Stop
8	35	20	1) Compare concentration: 35% at site ≥ 30% in E2 Regs 2) Compare total quantity: (35/100) × 20 t = 7.0 t 7.0 t at site ≥ 6.8 t in E2 Regs 3) Compare capacity container: (35/100) × 8 t = 2.8 t 2.8 t at site < 6.8 t in E2 Regs	Yes Submit schedules 2 and 3
20	35	8	1) Compare concentration: 35% at site ≥ 30% in E2 Regs 2) Compare total quantity: (35/100) × 8t = 2.8 t 2.8 t at site < 6.8 t in E2 Regs 3) Compare capacity container: (35/100) × 20 t = 7.0 t	Yes Submit schedules 2 and 3

Hydrochloric Acid on Site				
Capacity Container (tonnes)	**Concentration (%)**	**Total Quantity (tonnes)**	**Calculations**	**Subject to E2 Regulations?**
			7.0 at site ≥ 6.8 t in E2 Regs	
21	38	19	1) Compare concentration 38% at site ≥ 30% in E2 Regs 2) Compare total quantity: (38/100) × 19 t = 7.22 t 7.22 t at site ≥ 6.8 t in E2 Regs 3) Compare capacity container: (38/100) × 21 t = 7.98 7.98 at site t ≥ 6.8 t in E2 Regs	Yes Submit schedules 2, 3, 4 and 5

Example 7

In E2 Regulations: Ammonia, solution (CAS #: 7664-41-7); Column 2: minimum concentration 20%; Column 3: threshold quantity 9.10 tonnes

Quantities of ammonia, solution at a site:

- 5 tanks each filled with a total quantity of 8 t (maximum capacity of each tank is 10 t); and
- concentration at site is 25%.

Calculation determining the total tonnage of ammonia at the site and the maximum capacity:

$Total\ quantity\ of\ mixture = 5 \times 8 = 40 t$

But the mixture is not pure; it is at 25%. Therefore, the following equation should be used:

Quantity of regulated substance = Quantity of mixture × Concentration (%) of regulated substance

$Quantity\ of\ ammonia = 40\ t\ mixture \times 25\% = 10\ t$

$Total\ capacity\ of\ \text{sin}\,gle\ l\,\text{arg}\,est\ container = 5 \times 10 = 50\ t$

$50\ t \times 25\% = 12.5\ t$

E2 website reporting:

Compare column 3 threshold for ammonia, solution with quantities found at the site.

Maximum capacity of single largest container = 12.5 t

12.5 t (at site) ≥ 9.10 t (in E2 Regulations)

Total quantity on site = 10 t
10 t (at site) ≥ 9.10 t (in E2 Regulations)

In this example, a notice of identification of substance and place (Schedule 2), certification (Schedule 3), the report of preparation (Schedule 4), and the notice of implementation and testing of an E2 plan (Schedule 5), must be submitted.

The following example shows how the information would be reported using Environment Canada's online notification.

3.0 Hazardous substances at this location

CAS Number : Substance	Maximum Expected Quantity (tonnes)	Largest single container (tonnes)	Concentration (%)
7664-41-7 : ammonia solution (concentration 20% or greater)	10	12.5	25

Figure 5: Example of an online report using the above example for ammonia solution

Example 8

In E2 Regulations: Ammonia, solution (CAS #: 7664-41-7); Column 2: minimum concentration 20%; Column 3: threshold quantity 9.10 t

Quantities of ammonia, solution at a site:

- 1 tank filled with a total quantity of 16 t (maximum capacity of each tank is 20 t); and
- the concentration at the site is 44%.

<u>Calculation determining the total tonnage of ammonia, solution at the site and the maximum capacity:</u>

$Total\ quantity\ of\ mixture = 16\ t$

But the mixture is not pure; it is at 44%. Therefore, the following equation should be used:

Quantity of regulated substance = Quantity of mixture × Concentration (%) of regulated substance

$Quantity\ of\ ammonia = 16\ t\ mixture \times 44\% = 7.04\ t$

$Total\ capacity\ of\ \text{sin}\,gle\ l\,\text{arg}\,est\ container = 20\ t$

$20\ t \times 44\% = 8.8\ t$

<u>E2 website reporting:</u>

Compare column 3 threshold for ammonia, solution with the quantities found at the site.

Maximum capacity of single largest container = 8.8 t
8.8 t (at site) < 9.10 t (in E2 Regulations)

Total quantity on site = 7.04 t
7.04 t (at site) < 9.10 t (in E2 Regulations)

In this example, the quantity of substance on site does not exceed the threshold quantity indicated in column 3 of Schedule 1 for this substance. Moreover, the largest container (8.8 t) is also smaller than the threshold quantity mentioned above. Therefore, no notice has to be submitted.

Example 9

In E2 Regulations: Hydrochloric acid (CAS #: 7647-01-0); Column 2: minimum concentration 30%; Column 3: threshold quantity 6.80 t

Quantities of Hydrochloric acid at a site:

- 1 tank filled with a total quantity of 40 000 L (maximum capacity is 50 000 L); and
- the concentration at site is 31%.

Calculation determining the total tonnage of Hydrochloric acid at the site and the maximum capacity:

The quantity of the mixture, in tonnes, must first be determined by taking into account the density of the mixture. If the density of Hydrochloric acid equals 1.16 kg/L, then the quantity of the mixture in tonnes is:

$$\text{Quantity of mixture} = 40\,000\ \text{L} \times \frac{1.16\ \text{kg}}{\text{litre}} \times \frac{1\ \text{tonne}}{1000\ \text{kg}} = 46.4\ \text{tonnes}$$

$$\text{Maximum capacity of mixture} = 50\,000\ \text{L} \times \frac{1.16\ \text{kg}}{\text{litre}} \times \frac{1\ \text{tonne}}{1000\ \text{kg}} = 58.0\ \text{tonnes}$$

The maximum possible weight of the pure substance must now be calculated. The solution of 31% hydrochloric acid (HCl) is composed of 69% water and 31% hydrogen chloride. We are interested in the hydrogen chloride part of the solution.

$$\text{Quantity of HCl} = 46.4\ \text{tonnes} \times 31\% = 14.4\ \text{tonnes}$$

$$\text{Maximum capacity of HCl} = 58\ \text{tonnes} \times 31\% = 18.0\ \text{tonnes}$$

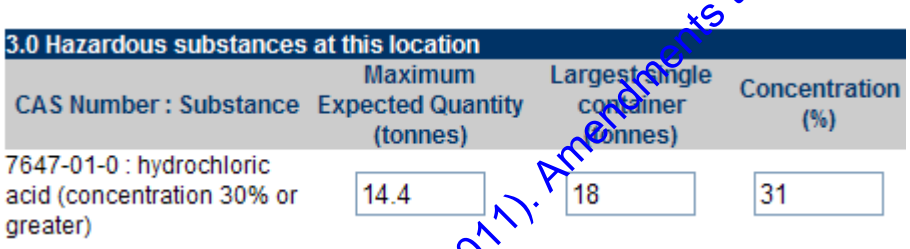
E2 website reporting:
Compare column 3 threshold for hydrochloric acid with quantities found at the site.

Maximum capacity of single largest container = 18 t
18 t (at site) ≥ 6.80 t (in E2 Regulations)

Total quantity on site = 14.4 t
14.4 t (at site) ≥ 6.80 t (in E2 Regulations)

In this example, a notice of identification of substance and place (Schedule 2), certification (Schedule 3), the report of preparation (Schedule 4), and the notice of implementation and testing of an E2 plan (Schedule 5), must be submitted.

The following example shows how the information would be reported using Environment Canada's online notification.



3.0 Hazardous substances at this location			
CAS Number : Substance	Maximum Expected Quantity (tonnes)	Largest single container (tonnes)	Concentration (%)
7647-01-0 : hydrochloric acid (concentration 30% or greater)	14.4	18	31

Figure 6: Example of an online report using the above example for hydrochloric acid

Mixture – Part 3

Example 10

In E2 Regulations: Nickel acetate (CAS #: 373-02-4); Column 2: minimum concentration 10%;
Column 3: threshold quantity 0.22 t

Nickel Acetate on Site				
Capacity Container (tonnes)	**Concentration (%)**	**Total Quantity (tonnes)**	**Calculations**	**Subject to E2 Regulations?**
8	5	100	1) Compare concentration: 5% at site < 10% in E2 Regs	No Stop
1.5	12	1	1) Compare concentration: 12% at site ≥ 10% in E2 Regs 2) Compare total quantity: (12/100) × 1 = 0.12 0.12 at site < 0.22 in E2 Regs	No Stop

Nickel Acetate on Site				
Capacity Container (tonnes)	**Concentration (%)**	**Total Quantity (tonnes)**	**Calculations**	**Subject to E2 Regulations?**
			3) Compare capacity container: (12/100) × 1.5 = 0.18 0.18 at site < 0.22 in E2 Regs	
0.5	35	1	1) Compare concentration: 35% at site ≥ 10% in E2 Regs 2) Compare total quantity: (35/100) × 1 = 0.35 0.35 at site ≥ 0.22 in E2 Regs 3) Compare capacity container: (35/100) × 0.5 = 0.175 0.175 at site < 0.22 in E2 Regs	Yes Submit schedules 2 and 3
1	35	0.5	1) Compare concentration: 35% at site ≥ 10% in E2 Regs 2) Compare total quantity: (35/100) × 0.5 = 0.175 0.175 at site < 0.22 in E2 Regs 3) Compare capacity container: (35/100) × 1 = 0.35 0.35 ≥ 0.22 in E2 Regs	Yes Submit schedules 2 and 3
1	38	1	1) Compare concentration 38% at site ≥ 10% in E2 Regs 2) Compare total quantity: (38/100) × 1 = 0.38 0.38 at site ≥ 0.22 in E2 Regs 3) Compare capacity container: (38/100) × 1 = 0.38 0.38 as site ≥ 0.22 in E2 Regs	Yes for schedules 2, 3, 4 and 5

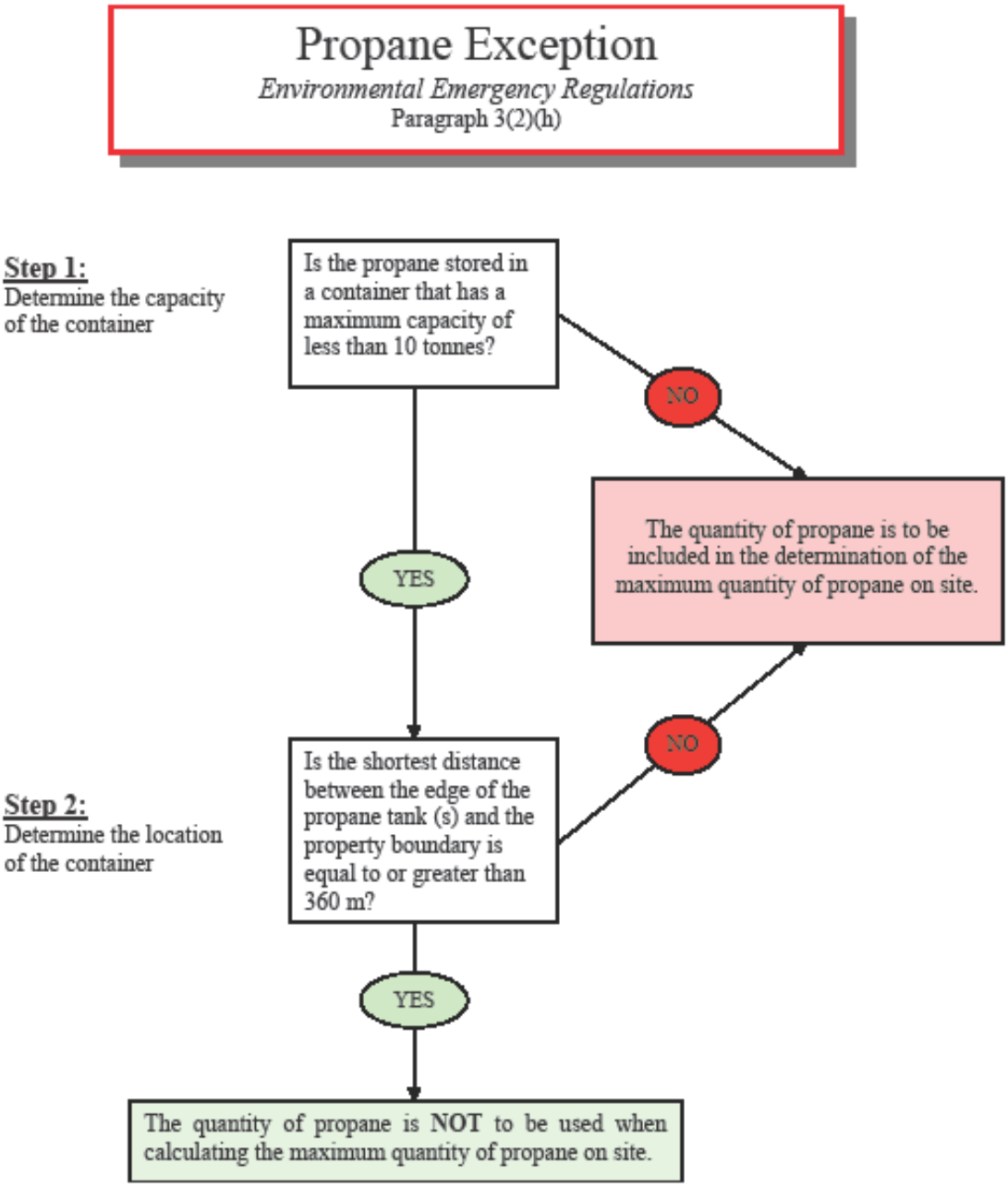
References

J.P. Lacoursière Inc. 2002. Rationale for the Development of a List of Regulated Substances under CEPA Section 200 and their Threshold Quantities. Prepared for Environment Canada, National Program Directorate, Environmental Emergencies Branch, Ottawa. Project No. P00092. Available at http://www.ec.gc.ca/ceparegistry/documents/regs/e2_rationale/toc.cfm.

U.S. EPA (2009) United States Environmental Protection Agency, Office of Solid Waste and Emergency Response, Risk Management Program Guidance For Offsite Consequence Analysis, EPA 550 B-99-009, March 2009. Available at : http://www.epa.gov/oem/docs/chem/oca-chps.pdf.

APPENDIX 6

FLOW CHART FOR THE PROPANE EXCEPTION


Propane Exception
Environmental Emergency Regulations
Paragraph 3(2)(h)
Step 1:
Determine the capacity of the container
Is the propane stored in a container that has a maximum capacity of less than 10 tonnes?
NO
YES
The quantity of propane is to be included in the determination of the maximum quantity of propane on site.
Step 2:
Determine the location of the container
Is the shortest distance between the edge of the propane tank (s) and the property boundary is equal to or greater than 360 m?
NO
YES
The quantity of propane is NOT to be used when calculating the maximum quantity of propane on site.

APPENDIX 7

NOTIFICATION AND REPORTING OF ENVIRONMENTAL EMERGENCIES UNDER SECTION 201 OF CEPA 1999

Reporting of Environmental Emergencies under Section 201 of CEPA 1999

Section 9(1) of the E2 Regulations states:

> When an environmental emergency occurs in respect of a substance set out in column 1 of Schedule 1, the person who is designated for the purpose of paragraph 201(1)(*a*) of the Act, to be provided with a written report is the Regional Director of the Environmental Enforcement Division of the Enforcement Branch of the Department of the Environment in the region where the environmental emergency occurs.

The written report information requirements are in the list below and the designated person to whom you should provide this information can be found in column 3 of Table 1.

Written Report

The following information must be included in the written report:

a) the name, civic address and telephone number of the person who owns or has the charge, management or control of the substance released
b) the date, time and location of the release
c) the name and CAS registry number of the substance released
d) the quantity of the substance released or, if the quantity cannot be determined, an estimate of the quantity
e) the identification of the container from which the substance was released and a description of its condition
f) the location of the release and description of the potential negative effects on the environment or on human life or health
g) a description of the circumstances and of the cause of the release (if known) and of the measures taken to mitigate any negative effects on the environment or on human life or health
h) the identification of all persons and agencies notified as a result of the release
i) all measures taken or planned to be taken to prevent similar releases

For verbal notification, the schedule Notification of Release or Environmental Emergency of the *Release and Environmental Emergency Notification Regulations* provides telephone numbers set out in column 3 of this schedule and in column 2 in Table 1 below.

In order for Environment Canada to fully comprehend the details surrounding an environmental emergency incident, Environment Canada recommends that a verbal notification include the following information:

Verbal Notification

a) the reporting person's name, and the telephone number at which the person can be immediately contacted
b) the name of the person who owns or has the charge, management or control of the substance immediately before the environmental emergency
c) the date and time of the release
d) the location of the release
e) the name/CAS registry number of the substance released
f) the estimated quantity of the substance released
g) the means of containment (from which the substance was released) and a description of its condition
h) the number of deaths and injuries resulting from the environmental emergency
i) the surrounding area/environment affected and potential impact of the release (mobility of release and weather or geographic conditions at the site)
j) a brief description of the circumstances leading to the release
k) the cause of the release (if known)
l) details of the actions taken or further actions contemplated (to contain, recover, clean up and dispose of the substance involved)
m) the names of agencies notified or on-scene
n) other pertinent information

Table 1: NOTIFICATION AND REPORTING OF ENVIRONMENTAL EMERGENCIES

Column 1 Province	Column 2 Verbal Notification 24-hour telephone line*	Column 3 Written Report Designated Person
Newfoundland and Labrador	**709-772-2083** or **1-800-563-9089** (Telephone number accessible only within the Atlantic provinces)	Regional Director Environmental Enforcement Directorate Atlantic Region Environment Canada Queen Square 45 Alderney Drive Dartmouth NS B2Y 2N6 Fax: 902-426-7924

Column 1 Province	Column 2 Verbal Notification 24-hour telephone line*	Column 3 Written Report Designated Person
Prince Edward Island	**902-426-6030** or **1-800-565-1633** (Telephone number accessible only within the Atlantic provinces)	Regional Director Environmental Enforcement Directorate Atlantic Region Environment Canada Queen Square 45 Alderney Drive Dartmouth NS B2Y 2N6 Fax: 902-426-7924
Nova Scotia	**902-426-6030** or **1-800-565-1633** (Telephone number accessible only within the Atlantic provinces)	Regional Director Environmental Enforcement Directorate Atlantic Region Environment Canada Queen Square 45 Alderney Drive Dartmouth NS B2Y 2N6 Fax: 902-426-7924
New Brunswick	**902-426-6030** or **1-800-565-1633** (Telephone number accessible only within the Atlantic provinces)	Regional Director Environmental Enforcement Directorate Atlantic Region Environment Canada Queen Square 45 Alderney Drive Dartmouth NS B2Y 2N6 Fax: 902-426-7924
Quebec	**514-283-2333** or **1-866-283-2333** (Telephone number accessible only within the province of Quebec)	Regional Director Environmental Enforcement Directorate Quebec Region Environment Canada 105 McGill Street (3rd floor) Montréal QC H2Y 2E7 Fax: 514-496-2087

Column 1 Province	Column 2 Verbal Notification 24-hour telephone line*	Column 3 Written Report Designated Person
Ontario	**416-325-3000** or **1-800-268-6060** (Telephone number accessible only within the province of Ontario)	Regional Director Environmental Enforcement Directorate Ontario Region Environment Canada 845 Harrington Court Burlington ON L7N 3P3 Fax: 905-333-3952
Manitoba	**204-944-4888** (Collect call outside Winnipeg)	Regional Director Environmental Enforcement Directorate Prairie and Northern Region Environment Canada Twin Atria Building 4999-98th Avenue, Room 200 Edmonton AB T6B 2X3 Fax: 780-495-2451
Saskatchewan	**1-800-667-7525**	Regional Director Environmental Enforcement Directorate Prairie and Northern Region Environment Canada Twin Atria Building 4999-98th Avenue, Room 200 Edmonton AB T6B 2X3 Fax: 780-495-2451
Alberta	**780-422-4505** or **1-800-222-6514** (Telephone number accessible only within the province of Alberta)	Regional Director Environmental Enforcement Directorate Prairie and Northern Region Environment Canada Twin Atria Building 4999-98th Avenue, Room 200 Edmonton AB T6B 2X3 Fax: 780-495-2451

Column 1 Province	Column 2 Verbal Notification 24-hour telephone line*	Column 3 Written Report Designated Person
British Columbia	**1-800-663-3456**	Regional Director Environmental Enforcement Directorate Pacific and Yukon Region Environment Canada 201-401 Burrard Street (4th floor) Vancouver BC V6C 3S5 Fax: 604-666-9059
Yukon	**867-667-7244**	Regional Director Environmental Enforcement Directorate Pacific and Yukon Region Environment Canada 201-401 Burrard Street (4th floor) Vancouver BC V6C 3S5 Fax: 604-666-9059
Northwest Territories	**867-920-8130**	Regional Director Environmental Enforcement Directorate Prairie and Northern Region Environment Canada Twin Atria Building 4999-98th Avenue, Room 200 Edmonton AB T6B 2X3 Fax: 780-495-2451
Nunavut	**867-920-8130**	Regional Director Environmental Enforcement Directorate Prairie and Northern Region Environment Canada Twin Atria Building 4999-98th Avenue. Room 200 Edmonton AB T6B 2X3 Fax: 780-495-2451

* This information is from the *Release and Environmental Emergency Notification Regulations*, SOR/2011-90.

Appendix 8

CHECKLIST TO PREPARE AN E2 PLAN

Subsections 4(2), 4(3) and 5(1)

Checklist to Prepare an E2 Plan		
Subsection or paragraph of the E2 Regulations		**Ask Yourself**
		Which substances at the facility are regulated?
	☐	Does this facility have any regulated substances that are not included in the facility's E2 plan?
	☐	Are by-products from a fire or a chemical reaction that are substances on the E2 list identified in the E2 plan?
4(3)(*a*)		Consideration of the following factors covered under **subsection 4(2)** in the facility's E2 plan
4(2)(*a*)		*Properties and characteristics of the substance and the maximum expected quantity of the substance:*
	☐	Is the information on the properties and the characteristics of the substances complete (e.g. pH, vapour pressure, solubility, explosiblity, flammability, toxicity, corrosivity…)?
	☐	Are there material safety data sheets (MSDSs) for the substances?
	☐	Are all MSDS sections completed?
	☐	Are they up to date? (max. 3 years old)
4(2)(*b*)		*Activities for which the plan was prepared (commercial, manufacturing, processing or other):*
	☐	Is the reason this particular substance is used on the site well described?
4(2)(*c*)		*Possiblity that characteristics of the place where the substance is located and characteristics of the surrounding areas could increase risks to the environment or human life or health:*
	☐	Is there a map of the property (facility) and surroundings or a complete description?
	☐	Is there a detailed plan of the installation or a complete description?
	☐	Are they up to date?
	☐	Are the following elements clearly indicated on the plan?
	☐	Emergency exits
	☐	Fire extinguishers
	☐	Location of personal protective equipment
	☐	Location of the dangerous substances
	☐	Is there a plan or procedure to segregate incompatible substances?
	☐	Are outside hazards and possible domino effects identified on the map?
	☐	Are the sensitive areas (hospitals, schools, specific flora…) identified clearly on the map?

	☐	Are the maps up to date?
4(2)(*d*)		*Potential consequences of an environmental emergency and possible scenarios:*
	☐	Has a history of internal accidents been compiled and kept up to date?
	☐	Has a history of external accidents in similar facilities been compiled and kept up to date?
	☐	Which analytical method was used to identify plausible scenarios (*What if*, *HAZOP, fault-tree*, etc.)?
	☐	Who did the analysis?
	☐	Did a multidisciplinary team participate in identifying and evaluating risks? If so, who participated (operators, chemists, engineers, etc.)?
	☐	Is there a process for management of change (as recommanded in PSM or in the MIARC guide)?
	☐	Are the employees aware of the process?
	☐	Is there a procedure for the investigation of accidents?
	☐	Is there a procedure for investigation of near-misses?
	☐	Who participates in these investigations?
		Your worst-case scenario:
	☐	Is a worst-case scenario presented for each toxic substance?
	☐	Is a scenario presented for flammable materials?
	☐	Is the worst-case scenario well described?
	☐	Is it really the worst-case scenario? Does it respond to the definintion from the MIARC guide?
	☐	Which software was used to calculate impact distances (RMP Comp, ALOHA, PHAST, other…)?
	☐	Who did the modelling? Does the person have sufficient knowledge to perform it?
	☐	Are the results consistent with our calculations and experience?
	☐	Do the modelling criteria used correspond with those of the MIARC guide (worst-case conditions)?
	☐	Penalizing weather conditions?
	☐	Duration of leak? (see Table 2.4, p. 36–37 of the MIARC guide 2007)
	☐	Have passive and active mitigation measures been determined? If yes, which ones?
	☐	Is a cartographic representation of the impact areas presented?
	☐	Is there a legend and a scale?
	☐	Are the locations of sensitive human elements (schools, hospitals, seniors' residences, etc.) and environmental elements (lakes, forests, wells, etc...) that may be affected

		clearly shown on the map?
	☐	Surroundings? (urban/rural)
		Alternative scenarios for toxic substances:
	☐	Is an alternative scenario presented for each toxic substance?
	☐	Is the chosen scenario truly representative for each of these substances (site visit, verification of all scenarios to determine whether the chosen one is the best)?
	☐	Is the justification of choices of alternative scenarios (risk evaluation: consequences × probabilities) presented?
	☐	Who did the analysis?
	☐	Was there participation of a multidisciplinary team in identifying the scenarios and risk evaluation?
	☐	Which software was used (RMP Comp, ALOHA, PHAST, etc.)? Is this the best software?
	☐	Who did the modelling? Does the person have sufficient knowledge to perform modelling?
	☐	Are the results consistent with our calculations and experience?
	☐	Do the modelling criteria used correspond with those of MIARC? (worst-case conditions)?
	☐	Have passive and active mitigation measures been determined? If so, which ones? Did they were taken into account?
	☐	Is the predicted duration of the leak realistic?
	☐	Surroundings? (urban/rural)
	☐	Is a cartographic representation of the impact areas presented? Is there a legend and a scale?
	☐	Are the locations of sensitive human elements (schools, hospitals, seniors' residences, etc.) and environmental elements (lakes, forests, wells, etc...) that may be affected clearly shown on the map?
		Alternative scenarios for flammable substances:
	☐	Are the locations of sensitive human elements (schools, hospitals, seniors' residences, etc.) and environmental elements (lakes, forests, wells, etc...) that may be affected clearly shown on the map?
	☐	Is a cartographic representation of the impact areas presented?
	☐	Is there a legend and a scale?
4(3)(*b*)		Identification of any environmental emergency and identification of the harm and danger
	☐	Have you identified all environmental emergencies 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?
	☐	Have you identified all the harm and danger?
4(3)(*c*)		Measures described for every environmental emergency mentioned in 4(3)(*b*)
		Prevention:
		Mitigation measures
	☐	Is there a fire protection system?
	☐	Is it verified regularly?
		Safety Preventive Barriers (examples)
	☐	Is there a regular maintenance program in place?
	☐	Is there a preventive maintenance program?
	☐	Do the maintenance programs reflect the manufacturers' recommendations?
	☐	Are the employees trained?
	☐	Detectors with alarms? (i.e. high-level alarms)
	☐	Are there automatic valves and interlock systems?
	☐	Are equipment and lines clearly identified (color code / ID tags)?
	☐	Others?
		Safety Protective Barriers (examples)
	☐	Safety wall
	☐	Retention basin (good size, watertight, capacity, etc.)
	☐	Sprinklers, deluge system
	☐	Drills (testing of E2 plan)
	☐	Evacuation procedure
	☐	Others?
	☐	Redundancy, quality
	☐	Are barriers verified?
	☐	How often?
	☐	Have they been used when incidents have occurred?
	☐	Were they effective?
		Preparation (EEP, training, exercises):
		Preparation and notification measures
	☐	How are employees notified of a leak or other incident?
	☐	Do they know what the procedure is?
	☐	Do they understand the procedure?
	☐	Are there written procedures for
	☐	- the use of the various barriers?
	☐	- the hazards of the material and substances on the

		site?
	☐	- the processes?
	☐	Is there a mutual aid agreement?
		Response (internal procedure):
	☐	Is there a telephone list with government agencies that must be notified of an emergency? Is Environment Canada's number listed?
	☐	Is there an internal emergency response team?
	☐	Is the team adequately trained?
	☐	If there is no internal team, is there an agreement with a third party to respond in hazmat situations?
	☐	Have the third party's capabilities been evaluated? How?
	☐	Is the response path clearly explained?
	☐	Is there a response diagram?
	☐	Is there someone responsible for managing security and site access during an emergency?
	☐	Is there an investigation following an incident?
	☐	Are there recommendations?
	☐	Are they implemented?
		Restoration or recovery:
	☐	Is there a procedure?
	☐	Does the company have the necessary resources?
	☐	If not, has it made provisions with a partner?
	☐	Have the partner's qualifications and abilities been assessed? How?
	☐	Are the planned measures suited to the location?
	☐	Are they appropriate with regard to the consequences?
4(3)(*d*)		List of the individuals who are to implement the plan in the event of an EE and description of their roles and responsibilities
	☐	Is there a list of the individuals who are to implement the plan in the event of an EE?
	☐	Is there a description of their roles and responsibilities?
	☐	Are the people listed aware that they are on the list?
	☐	Do these people know what their roles and responsibilities are?
	☐	Are the descriptions of the roles and responsibilities clear and complete?
	☐	Is there a chart or a table?
4(3)(*e*)		Identification of the training required for each of the individuals listed under paragraph 4(2)(*d*)
	☐	Is there the identification of the training required for each of the individuals listed under paragraph 4(2)(*d*)?

	☐	Is the training given appropriate and in relation to the roles and responsibilities?
	☐	Have the instructors' qualifications and abilities been verified? How?
	☐	Are the employees satisfied?
	☐	Has training on personal protective equipment been given?
	☐	Does it cover the following:
	☐	- use?
	☐	- maintenance?
	☐	Has training on the detection equipment been given?
	☐	Does it cover the following:
	☐	- use, interpretation of the results?
	☐	- maintenance / calibration?
	☐	Has training on hazardous materials been given? (WHMIS)
	☐	Have the employees understood and absorbed it? (test/exam)
4(3)(*f*)		Emergency response equipment and location of the equipment
	☐	Is a list of the emergency response equipment included?
	☐	Is the location of the equipment indicated?
	☐	Are the locations of the response equipment shown on the plan of the plant?
	☐	Does this equipment seem to be in good condition?
	☐	Is it sufficient and appropriate?
	☐	Does the regular and preventive maintenance program respect the manufacturers' recommendations?
	☐	Are the personnel qualified to maintain this equipment?
	☐	Are the personnel qualified to do the calibration?
4(3)(*g*)		Measures to be taken to notify members of the public
	☐	What are the measures? (see the MIARC guide 2007, Chapter 8)
	☐	Before? (e.g. participation in a joint coordinating committee, information session, posters, information bulletin….)
	☐	During? (e.g. siren, phone etc.)
	☐	After? (e.g. press review, public meeting…)
	☐	How effective are they?
	☐	Have they been tested on a regular basis? If so,
	☐	- when?
	☐	- by whom?
	☐	Is the public aware of this?
	☐	Is there a risk communication program for the public?

	☐	Does the company participate in a local emergency preparedness committee (LEPC) that includes municipality, industry and government representatives, and citizens?
5(1)		Implementation and testing the plan
	☐	Exercises
	☐	Is there a program of exercises, as stipulated in the guidelines or the MIARC guide?
	☐	The exercise program is over a period of how many years?
	☐	Does the level of difficulty increase as the program progresses?
	☐	What kinds of exercises are carried out?
	☐	Do the exercises reflect the facility's reality?
	☐	Are the partners involved? If yes,
	☐	- who are they?
	☐	Is an analysis report written?
	☐	Does it include recommendations?
	☐	Are the recommendations implemented?
	☐	How is the logic of the emergency plan presented? Is it easy to follow and find information?

APPENDIX 9

SUMMARY OF RISK EVALUATION FRAMEWORK METHODOLOGY FOR DETERMINING THRESHOLDS FOR ENVIRONMENTAL EMERGENCY PLANS

Acronyms in the Risk Evaluation Framework

AEGL	acute exposure guideline level
B	bioaccumulation
BAF	bioaccumulation factor
BCF	bioconcentration factor
BLEVE	boiling liquid expanding vapour explosion
CEPA 1999	*Canadian Environmental Protection Act, 1999*
CICADS	Concise International Chemical Assessment Documents
CRAIM / MIARC	Conseil pour la réduction des accidents industriels majeurs / Major Industrial Accidents Reduction Council.
E2	environmental emergency
EPA	United States Environmental Protection Agency
ERPG-2	Emergency Response Planning Guidelines – 2
IARC	International Agency for Research on Cancer
IDLH	immediately dangerous to life or health
K_{ow}	octanol-water partition coefficient
LC_{50}	lethal concentration in air where 50% of test species die
LC_{lo}	lowest reported lethal concentration in air at which death occurred
LD_{50}	median lethal dose where 50% of test species die via any exposure other than air
MIACC	Major Industrial Accidents Council of Canada, now defunct
NFPA	U.S. National Fire Protection Association
OECD	Organisation for Economic Co-operation and Development
P	persistence
PBiT	persistence, bioaccumulation and toxicity
PHAST	Process Hazard Analysis Software Tools
REF	Risk Evaluation Framework
RMP	risk management program
TRI	Toxic Release Inventory
TSMP	Toxic Substances Management Policy

Hazards Evaluated by the Risk Evaluation Framework

To decide whether a substance is potentially hazardous to humans or the environment, the Risk Evaluation Framework (REF) determines whether the substance is:

- a physical hazard; or
- a human hazard; and
- environmental hazard;

In each REF category (environmental, human and physical) a trigger is assigned when certain characteristics of the substance are capable of causing harm to humans and/or the environment. A trigger is a qualifier for an E2 plan if it is accompanied by a threshold quantity. These criteria are listed in Table 1.

Table 1: Summary of Trigger Criteria

Hazard Rating Category	Criterion	Trigger Value
Physical	Vapour cloud explosion	Flash point < 23°C **AND** Boiling point < 35°C
	Reactivity	Based on expert opinion Materials that in themselves are readily capable of detonation or of explosive decomposition or explosive reaction at normal temperatures and pressures This degree should include materials that are sensitive to mechanical or localized thermal shock at normal temperatures and pressures Also potential for boiling liquid expanding vapour explosion (BLEVE); check if the substance has a spill history of causing deaths
Human	Inhalation toxicity (in order of priority)	Final AEGL-02 (30 min) **or** IDLH (30 min) **or** ERPG-2 (1 h) **or** $LC_{50} \times 0.1$ **or** LC_{Lo} **or** $LD_{50} \times 0.01$ **or** $LD_{Lo} \times 0.1$ **IF** Vapour pressure ≥ 10 mm Hg
	Human and animal carcinogenicity	IARC rating: 1, 2A or 2B **or** EPA rating: A, B1 or B2 **AND**

Hazard Rating Category	Criterion	Trigger Value
		Persistence in any media > 5 years
Environmental	Acute aquatic toxicity (96-h LC_{50} for fish in freshwater)	≤ 100 mg/L Persistence and bioaccumulation criteria are used as defaults to drop the threshold, where applicable

Before a chemical is put through the REF, it must meet the following pre-screening criteria:

- Is the chemical in commerce in Canada?
- Are the emergency plans covered by another act of Parliament?
- Are there realistic emergency pathways?

If the chemical is not in commerce in Canada, or if it is covered by another act of Parliament, or if it has no realistic emergency pathways, then the chemical is not recommended for addition to the E2 Regulations.

Descriptions of the REF Criteria

1. Physical Hazard Ratings (Part 1 Substances)

Flammable gases and volatile flammable mixtures are included in Part 1 of Schedule 1 of the E2 Regulations based on their flash point and boiling point, also known as the flammability criteria used by the *Transportation of Dangerous Goods Regulations*.[8] Most flammable substances fulfilling these criteria will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or are easily dispersed in air and will burn readily.

- ***Vapour Cloud Explosion***

The volatility of a substance is taken into account by the flash point and boiling point criteria. "Flash point" is defined as the lowest temperature at which a substance gives off sufficient vapour to form an ignitable mixture with air near its surface or within a vessel.

If the chemical has a flash point less than 23°C and a boiling point less than 35°C, then the substance is capable of causing a vapour cloud explosion. If the substance does not have a flash point, or if the substance sublimes, or decomposes below the cut-off temperatures, then the substance will not be considered flammable or combustible.

According to J.P. Lacoursière (2002), the threshold quantity for a vapour cloud explosion is set at 4.5 t (10 000 lbs) because, in the event of an explosion, this quantity would result in an approximate overpressure of 3 pounds per square inch (psi) at a distance of 100 m. The

[8] http://www.tc.gc.ca/eng/tdg/clear-tofc-211.htm.

calculation is performed using the TNT model with Process Hazard Analysis Software Tools (PHAST) software.

- ***Combustibility***

This category represents substances that have a flash point of less than 23°C or a boiling point of less than 35°C. The equation below calculates the quantity of substance necessary to evaporate 4.5 t within 10 minutes at ambient temperature (25°C) and 1.5 m/s wind speed. The quantity necessary to create the evaporation rate is pooled into an area with a dike 50 cm in height.

The evaporation rate was determined by the following release equation (U.S. EPA 1999):

$$QR = \frac{0.0171 \times (U)^{0.78} \times (MW)^{\frac{2}{3}} \times A \times VP}{T}$$

where: QR = evaporation rate (kg/min)
U = wind speed (m/s)
MW = molecular weight
A = surface area of pool formed by the entire quantity of substance (m^2)
VP = vapour pressure (mmHg)
T = temperature (Kelvin (K); temperature in °C plus 273)

Schedule 1, Part 1 substances that have thresholds above 4.5 t are combustible substances, with a few exceptions.

- ***Reactivity***

The current Table 2 below was slightly modified from the original data provided from the *Defined Degrees of Instability Hazards* of the NFPA (2002). Table 2 shows the criteria for reactivity; however, other factors may come into play such as the potential to cause a boiling liquid expanding vapour explosion (BLEVE) and accidental death histories. Table 2 below is used as a guide for expert opinion.

Table 2: Reactivity

Hazard Description	E2 Trigger
Materials, which in themselves are readily capable of detonation or of explosive decomposition or explosive reaction at normal temperatures and pressures. This degree should include materials that are sensitive to mechanical or localized thermal shock at normal temperatures and pressures.	E2 Plan trigger
Materials that in themselves are capable of detonation or of explosive reaction but that require a strong initiating source or that must be heated under confinement before initiation. This degree should include materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures or that react explosively with water without requiring heat or confinement.	
Materials that in themselves are normally unstable and readily undergo violent chemical change but do not detonate. This degree should include materials that can undergo chemical change with rapid release of energy at normal temperatures and pressures or that can undergo violent chemical change at elevated temperatures and pressures. It should also include those materials that may react violently with water or that may form potentially explosive mixtures with water.	
Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures or that may react with water with some release of energy but not violently.	
Materials that in themselves are normally stable, even under fire exposure conditions, and that are not reactive with water.	

(NFPA 2002)

2. <u>Human Hazard Ratings</u> <u>(Part 2 Substances)</u>

Substances that are considered hazardous when inhaled are included in Part 2 of Schedule 1 of the E2 Regulations based on their toxicity, physical state, vapour pressure and accident history.

- ***Inhalation Toxicity***

The methodology used by CRAIM (2002) when setting inhalation threshold quantities is the same as that used by the U.S. EPA when developing its RMP lists. This methodology takes into consideration the potential of toxic substances to become airborne and disperse, as well as their inhalation thresholds. The REF specifies that a chemical must have a vapour pressure greater than or equal to 10 mmHg (1.33 kPa) before it can be considered for the inhalation toxicity criteria. If a substance has a vapour pressure less than 10 mmHg (1.33 kPa), inhalation toxicity will not apply.

An index of toxicity is used to analyze the inhalation threshold. This index is derived using the physical state and volatility of a substance. By order of precedent as shown in the rationale document (J.P. Lacoursière Inc., 2002), the index of toxicity is associated with the following

parameters, with the final AEGL-02 values added as the highest priority. The example shown below is with IDLH.

1. Final AEGL-02 (30 min) – data is for humans
2. IDLH (30 min) - data is for humans
3. ERPG (1 h) – data is for humans
4. Mammalian data is extrapolated back to the IDLH – data is for humans
   - $LC_{50} \times 0.1$ = estimated IDLH (rat 4 h – preference)
   - LC_{Lo} = estimated IDLH (rat 4 h – preference)
   - $LD_{50} \times 0.01$ = estimated IDLH (rat – preference)
   - $LD_{Lo} \times 0.1$ = estimated IDLH (rat – preference)

$$Index\ of\ \ toxicity = \frac{IDLH}{\frac{1.6 \times (MW)^{0.67}}{T + 273}}$$

Where: MW = molecular weight
T = boiling point in °C
IDLH = immediately dangerous to life and health (g/m^3)

The acute exposure guideline level (final AEGL-02 at 30 min) is the priority level for toxicity rating for humans. AEGL is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape (U.S. EPA, 2008).

The secondary toxicity value used is the immediately dangerous to life and health (IDLH) concentration developed by the National Institute of Occupational Safety and Health (NIOSH, 1994). The IDLH is defined as the maximum airborne concentration from which one could escape within 30 minutes without any escape-impairing symptoms or any irreversible health effects. If no IDLH is found, the *Emergency Response Planning Guidelines (ERPG) -2* (AIHA, 2011) developed for Transport Canada will be used as an equivalent to the IDLH.

The values for the Index of Toxicity are then correlated to the threshold quantities as shown in Table 3. The threshold quantities are based on amounts ranging from those found in a drum (~ 0.22 t) to a tanker truck (9.1 t).

Table 3: Index of Toxicity with Respective Threshold Quantities

Index of Toxicity	Threshold Quantities metric tonnes (lbs)
< 0.01	0.22 (500)
0.01 ≤ to < 0.05	0.45 (1000)
0.05 ≤ to < 0.1	1.13 (2500)
0.1 ≤ to < 0.3	2.27 (5000)
0.3 ≤ to < 1	4.50 (10 000)
1 ≤ to < 10	6.80 (15 000)
≥ 10	9.10 (20 000)

(J.P. Lacoursière Inc. 2002)

- ***Carcinogenicity***

Previously, it was concluded that 10 years was sufficient time for a carcinogenic substance to cause cancer in humans. Due to new evidence, the exposure time for a substance to cause cancer has been lowered to 5 years in accordance with the precautionary principle. It has been shown that an infant is 10 times more at risk than an adult (U.S. EPA, 2005).

The REF uses 2 sets of carcinogenicity ratings established by the International Agency for Research on Cancer (IARC, 1999) and the U.S. EPA (U.S. EPA, 2002) as shown in tables 4 and 5. The IARC or U.S. EPA classifications will only trigger an E2 plan if the substance is persistent in the environment for at least 5 years, or the substance is classified as indefinitely persistent. If these criteria are met, the substance is then assigned a threshold of 0.22 t. If the two classification systems disagree on a chemical's rating, the most conservative assessment is used, and the chemical is rated accordingly.

Table 4: IARC Human and Animal Carcinogenicity Classifications

Descriptor	E2 Trigger
***Group 1*:** - The agent (mixture) is carcinogenic to humans - Sufficient evidence of carcinogenicity in experimental animals	E2 plan trigger
***Group 2A*:** - The agent (mixture) is probably carcinogenic to humans	E2 plan trigger
***Group 2B*:** - The agent (mixture) is possibly carcinogenic to humans - Less than sufficient evidence of carcinogenicity in experimental animals	E2 plan trigger
***Group 3*:** - The agent (mixture or exposure circumstance) is not classifiable as to its carcinogenicity to humans - Evidence of carcinogenicity is inadequate or limited in experimental animals	
***Group 4*:** - The agent (mixture) is probably not carcinogenic to humans - Evidence suggesting lack of carcinogenicity in experimental animals	

(IARC 1999)

Table 5: U.S. EPA Carcinogenicity Classifications

Descriptor	E2 Trigger
Carcinogenic to Humans (A) Compelling evidence of carcinogenicity in animals.	E2 plan trigger
Likely to Be Carcinogenic to Humans (B1) Strong experimental evidence of carcinogenicity in animals.	E2 plan trigger
Suggestive Evidence of Carcinogenicity, but Not Sufficient to Assess Human Carcinogenic Potential (B2) Evidence from animal data is suggestive of carcinogenicity, but is judged not sufficient for a conclusion, e.g. marginal increase in tumours, evidence only in a single study, evidence is limited to tumours in one sex of one species. Further studies would be needed.	E2 plan trigger
Data Are Inadequate for an Assessment of Human Carcinogenic Potential (C) Data are judged inadequate to perform an assessment. This includes lack of pertinent or useful data; evidence is conflicting.	
Not likely to be Carcinogenic to Humans (D) Animal evidence that demonstrates lack of carcinogenic effect in at least two well-designed and well-conducted studies in two appropriate animal species.	

(U.S. EPA, 1986 and 1999, modified)

3. **Environmental Hazard Ratings** (Part 3 Substances)

Part 3 of Schedule 1, referred to as Other Hazardous Substances, **is a new addition** to the list of substances covered by the *Environmental Emergency Regulations*. Substances in Part 3 can be characterized as being persistent, bioaccumulative, carcinogenic to humans or toxic to aquatic organisms.

The Toxic Substances Management Policy (TSMP) of CEPA 1999 uses persistence, bioaccumulation and toxicity (PBT) criteria for determining when an organic chemical is to be considered for virtual elimination in Canada. The virtual elimination of a toxic substance released into the environment, as a result of human activity, requires the ultimate reduction of its releases to the lowest concentration that can be accurately measured, using routine sampling and analytical methods (Environment Canada 1995). TSMP virtual elimination criteria are shown in Table 6.

Table 6: TSMP Criteria for the Selection of Substances for Virtual Elimination

Persistence (half-life)	Bioaccumulation	Toxicity	Predominantly Anthropogenic
Air ≥ 2 days	BAF ≥ 5000 or BCF ≥ 5000 or log K_{ow} ≥ 5.0	CEPA-toxic or CEPA-toxic equivalent	Concentration in environment largely resulting from human activity
Water ≥ 182 days			
Soil ≥ 182 days			
Sediment ≥ 365 days			

(Environment Canada 1995)

- ***Persistence***

Chemical substances that degrade slowly in the environment (i.e. are relatively resistant to biodegradation, hydrolysis and photolysis processes) represent potential environmental problems. Persistence is measured as a half-life, meaning the period it takes the concentration of a substance to be reduced by half, by transformation, in a medium (Environment Canada, 2000). A compound released into the environment has a tendency to partition (i.e. accumulate) into one medium (air, water, soil or sediment) more than another. Partitioning, transport and transformation rates differ in each medium.

The persistence criteria with the highest scores are based on the *Persistence and Bioaccumulation Regulations* (Environment Canada 2000). These are the standards set by CEPA 1999 for substances that should be virtually eliminated from the environment. Those criteria are the same as the U.S. EPA PBT criteria used for the Toxic Release Inventory (TRI), New Substances Evaluation and other EPA programs (U.S. EPA 1999, 1999a). These persistence criteria can be seen in Table 7. The rest of the scale was created by estimating half of the remaining time duration.

Inorganic substances are considered infinitely persistent in the environment since the metal ion (i.e. lead, arsenic) continuously separates from the original substance and forms new compounds within the environment. This implies that the metal ion within inorganic substances does not degrade. No threshold quantity exists for persistence criteria alone; this category is combined with aquatic toxicity for persistence in water.

Table 7: Persistence of Organic Chemicals in the Environment

Air	Water/Soil	Sediment	E2 Trigger
≥ 2 days[a]	≥ 182 days[a]	≥ 365 days[a]	Virtual elimination criteria[a] E2 plan trigger
≥ 1 to < 2 days[b]	≥ 60[b] to < 182 days	≥ 60[b] to < 365 days	E2 plan trigger
≥ 12 h to < 1 day	≥ 30 to < 60 days	≥ 30 to < 60 days	
≥ 6 h to < 12 h	≥ 14 to < 30 days	≥ 14 to < 30 days	
< 6 h	< 14 days	< 14 days	

[a] Environment Canada, 1995.
[b] Or evidence of atmospheric transport to remote regions such as the Arctic (Environment Canada 1995).

- ***Bioaccumulation (BCF / BAF / Log K_{ow})***

Bioaccumulation is the biological accumulation of a substance into various tissues of a living organism. Table 8 shows all three criteria can be used to determine bioaccumulation. There are different ways to estimate the bioaccumulation within an organism:

1) "bioconcentration factor" means the ratio of the concentration of a substance in an organism to the concentration in water, based only on uptake from the surrounding medium (Environment Canada 2000);
2) "octanol-water partition coefficient" means the ratio of the concentration of a substance in an octanol phase to the concentration of the substance in the water phase of an octanol-water mixture (Environment Canada 2000);
3) "bioaccumulation factor" means the ratio of the concentration of a substance in an organism to the concentration in water, based on uptake from the surrounding medium and food (Environment Canada 2000).

Table 6 shows the bioaccumulation criteria used in the REF. Both the highest values for the BCF/BAF and the log K_{ow} are consistent with the CEPA 1999 virtual elimination clause (Environment Canada 2000). The OECD criteria for BCF is ≥ 500, or if BCF/BAF is absent, one uses the log K_{ow} ≥ 4 (OECD 2001). No threshold quantity exists within the REF for bioaccumulation alone; this category is combined with aquatic toxicity.

Table 8: Bioaccumulation of Organic Chemicals in the Environment

BCF/BAF	Log K_{ow}	E2 Trigger
≥ 5000[a]	≥ 5[a]	Virtual elimination criteria[a]; E2 plan trigger
≥ 500 to < 5000	≥ 4 to < 5 (unless BCF < 500)	E2 Plan trigger
≥ 50 to < 500	≥ 3 to < 4	
0 to < 50	≥ 2 to < 3	
--	< 2	

[a] (Environment Canada 1995) (OECD 2001, modified)

- ***Aquatic Toxicity***

Freshwater species toxicity data for fish in Canadian waters are collected for the REF. Acute toxicity is determined using a freshwater fish 96-h LC_{50}. The most sensitive value (lowest value) for a freshwater fish is selected and a robust study is conducted for quality control measures to determine the quality of the laboratory experiment. If the value fails the robust study, then the next most sensitive species is selected. Ground water, drainages, tributaries and rivers can all lead to contamination of a water body. Aquatic toxicity uses the persistence and bioaccumulation criteria to assist in determining the threshold quantity.

Table 9: Acute Aquatic Toxicity Thresholds

Criteria	Extremely Toxic	Highly Toxic	Moderately Toxic	Slightly Toxic
Persistence (P) (water)	P ≥ 6 months	2 months ≤ P < 6 months	N/A*	N/A
Bioaccumulation (BCF) Log K_{ow} (K_{ow})	BCF ≥ 5000 or log K_{ow} ≥ 5	500 ≤ BCF < 5000 or 4 ≤ K_{ow} < 5 (unless BCF < 500)	N/A	N/A
Acute Aquatic Toxicity (AAT) (96 h LC_{50} – mg/L)	0.1 ≤ AAT	0.1 < AAT ≤ 1	1 < AAT ≤ 10	10 < AAT ≤ 100
Threshold Quantity tonnes (lbs)	**0.22 (500 lbs)**	**1.13 (2500 lbs)**	**4.50 (10 000 lbs)**	**9.10 (20 000 lbs)**

*Not applicable

How to Use Table 9

If the substance falls within the range 0.1 mg/L ≤ fish LC_{50} value ≤ 100 mg/L, then the substance is recommended for addition under Schedule 1, Part 3 of the *Environmental Emergency Regulations*, after the quality control robust study has been completed. Furthermore, if the substance meets the categories of persistence or bioaccumulation criteria set out in Table 9, then the threshold defaults to that level. For sample calculations, see Table 10.

Table 10: Example Calculations for Aquatic Toxicity

Value of LC_{50} (mg/L)	Persistence Data	Bioaccumulation Data	Final Threshold (tonnes)
110[1]	P ≥ 6 months	500 ≤ BCF < 5000	No threshold
8[2]	2 months ≤ P < 6 months	No data	1.13
0.01[3]	4 ≤ K_{ow} < 5	2 months ≤ P < 6 months	0.22
50[4]	No data	500 ≤ BCF < 5000	1.13

[1] Value of LC_{50} is over 100 mg/l – considered practically non-toxic.

[2] Threshold is 4.50 t, but persistence criteria drops threshold to 1.13 t.

[3] Threshold is 0.22 t and persistence and bioaccumulation criteria are higher than 0.22 t, therefore take the lowest threshold.

[4] Threshold is 9.10 t, but bioaccumulation data drops the threshold to 1.13 t.

Robust Studies

The reliability of a data point is crucial for the evaluation. For this reason, aquatic toxicity, bioaccumulation and persistence data points are analyzed using a robust study summary created by the OECD. A robust study summary is a series of questions based on information provided in a scientific journal. Thus, for each data point selected as the most sensitive endpoint found in a book or database, the original journal is examined via a robust study summary. Each scientific journal is assigned a Klimisch rating from 1 to 4, where 1 and 2 indicate journals that are experimentally reliable, whereas 3 and 4 are scores indicative of an unacceptable data point.

Standard references that are peer-reviewed such as *The Merck Index, The Condensed Chemical Dictionary, The CRC Handbook of Chemistry and Physics,* the *Beilstein Database*, and international reviews like *Concise International Chemical Assessment Documents (CICADS)* and *Environment Health Criteria* documents should be used as much as possible for data sources.

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