Substance Risk Evaluation for Determining Environmental Emergency Planning under the *Environmental Emergency Regulations* Set under the *Canadian Environmental Protection Act, 1999* (CEPA 1999)

Dioxane
(1,4-Dioxane) (CAS No. 123-91-1)

Risk Evaluation Conclusion:

- **Threshold Quantity of 9.1 tonnes (concentration 1%) due to inhalation toxicity and other considerations**
- **Is a candidate for the *Environmental Emergency Regulations***

1.0 INTRODUCTION

The *Environmental Emergency Regulations*, developed under Part 8 of the *Canadian Environmental Protection Act (CEPA), 1999* (Government of Canada, 2011), establish a list of substances for which fixed facilities must notify Environment Canada that they store or use the substance on-site, by providing notices to Environment Canada, reporting when the substance is released into the environment, and developing an environmental emergency plan (E2 plan) for each substance stored or used at a fixed facility at or above specified threshold quantities.

To determine if a substance is a candidate to be added to the *Environmental Emergency Regulations*, Environment Canada has developed a risk evaluation methodology based on the following hazard categories:

- Physical: flammable and combustible or oxidizing substances, or those having a potential to cause vapour cloud explosions or pool fires.
- Human Health: substances that are toxic by inhalation, are carcinogenic, or are corrosive.
- Environmental Health: substances that are: corrosive, persistent, bioaccumulative, or aquatically toxic.

For more information on the methodology for setting threshold quantities in the Environmental Emergency Regulations, please refer to Environment Canada (2014).

Dioxane (CAS No. 123-91-1) was selected for risk evaluation because it is a substance under the Government of Canada's Chemicals Management Plan (http://www.ec.gc.ca/ese-ees/default.asp?lang=En&xml=2051DAE2-3883-F0F6-D5A9-

E46DBD26BA33) that, if spilled, could be immediately harmful to humans and/or the environment.

Following the risk evaluation, Environment Canada recommends that this substance be proposed for addition to Schedule 1 of the *Environmental Emergency Regulations* at a threshold quantity of 9.1 tonnes.

2.0 SUMMARY OF THE RISK EVALUATION

2.1 Physical Hazard: Flammable, Combustible or Oxidizing Substances

Because dioxane has a flash point of 12.2°C (CHEMINFO, 2008) and has a boiling point of 101.1°C (ATSDR, 2007), this substance presents the possibility of a vapour cloud explosion. Therefore, a threshold of 620 tonnes is set for this substance as a result of its potential for combustibility.

2.2 Physical Hazard: Potential for Pool Fires

It has been demonstrated via the Process Hazard Analysis Software Tools (PHAST) software that dioxane is capable of causing a pool fire at a quantity of 96 tonnes.

2.3 Human Health Hazard: Inhalation Toxicity

Because dioxane has a vapour pressure greater than 10 mmHg (1.33 kPa) at 25°C (Verschueren, 2001), the substance has sufficient volatility to constitute an inhalation danger. Considering an IDLH of 500 ppm (Pohanish, 2008), the threshold quantity for this substance is determined to be 9.1 tonnes for the inhalation toxicity.

2.4 Human Health Hazard: Carcinogenicity

Because dioxane is classified in group 2B of International Agency for Research on Cancer (IARC) (HSDB, 2006) and group B of the EPA (Genium, 2006), and because the substance does not have a half-life longer than five years in any medium, no threshold is set for the carcinogenicity of this substance.

2.5 Human and Environmental Health Hazard: Corrosive Substances

The measured pH is greater than 2 or less than 11.5, and therefore this substance is not considered corrosive and there is no associated threshold with this category.

2.6 Environmental Health Hazard: Persistent, Bioaccumulative, or Aquatically Toxic

Lethal concentration

The acute (short-term) aquatic toxicity for dioxane has been determined to be non-toxic based on studies of the most sensitive species, Fathead minnow (*Pimephales promelas*), with a lethal concentration (LC50 96 hours) of >100 mg/L (GDCh, 1991).

Persistence

Dioxane is classified as being non-persistent in water.

Bioaccumulation
Dioxane is practically non-bioaccumulative.

Threshold
Considering that no data have been gathered for the acute aquatic toxicity, and no modeled data are available for dioxane, therefore, no threshold is set for the environmental risk.

2.7 Assigned Threshold

Following the risk evaluation methodology developed under section 200 of CEPA 1999, the categories (flammability, combustibility, oxidizers, inhalation toxicity, aquatic toxicity, carcinogenicity, corrosiveness, pool fires) having the lowest scientific threshold will be compared against other risk management considerations. For example, the threshold will be compared to other provincial and federal legislation or voluntary programs that may already provide adequate management of the risk from an environmental emergency. Proposed thresholds may also be modified based on policy and other considerations as assessed during the preliminary public consultation period. For more information regarding the determination of thresholds, please refer to the *Implementation Guidelines for the Environmental Emergency Regulations 2011* (Environment Canada, 2011).

Other Considerations
At this time, there are no other considerations to take into account for this substance that would result in an increase or a decrease in the calculated threshold quantity.

Findings
A proposed threshold of 9.1 tonnes is assigned for dioxane based on its assessed inhalation toxicity. The threshold quantity and its respective concentration will not be finalized until after preliminary public consultation.

3.0 CONCLUSION

Information concerning the quantities of dioxane (CAS No. 123-91-1) in use in Canada indicates that the substance exists in commerce. Following the risk evaluation and policy considerations of dioxane and taking into consideration the quantities in use in Canada, Environment Canada recommends that this substance be proposed for addition to Schedule 1 of the *Environmental Emergency Regulations* under CEPA 1999 at a threshold quantity of 9.1 tonnes at a concentration of 1%.

When doing the emergency planning of a substance, it is important to take into consideration not only the most stringent assigned threshold quantity, but all of the other higher-threshold quantities that are noted in association with this substance. Other notable thresholds of concern also determined for this substance are: 96 tonnes for pool fire; 620 tonnes for combustibility.

Even if the quantity of a substance in use is below the threshold quantity indicated in the *Environmental Emergency Regulations*, Environment Canada recommends that emergency planning be applied to this substance in order to minimize, or prevent, any impacts on humans or the environment in the event of a release of the substance.

4.0 REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry). 2007. Toxicological Profile for 1,4-Dioxane. Department of Health and Human Services. Available from: http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=955&tid=199

CHEMINFO (Chemical Profiles Created by CCOHS). 2008. 1,4-Dioxane. Canadian Centre for Occupational Health and Safety. Available from: http://ccinfoweb.ccohs.ca/cheminfo/search.html

Environment Canada. 2011. Implementation Guidelines for the Environmental Emergency Regulations 2011. Available from: http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=1FB6D405-1

Environment Canada. 2014. Summary of Risk Evaluation Framework for Determining Quantity Thresholds and Concentrations for Substances under the Environmental Emergency Regulations Set under the Canadian Environmental Protection Act, 1999 (CEPA 1999). Environment Canada. Available from: http://www.ec.gc.ca/ee-ue/default.asp?lang=En&n=9605FFBD-1

GDCh, 1991. Behret, H. 1,4-Dioxane BUA Report 80. German Chemical Society Gesellschaft Deutscher Chemiker. Verlag, Birkenwaldstrabe. ISBN 3-7776-0600-6. p. 1-70.

Genium. 2006. Material Safety Data Sheet Collection 1,4-Dioxane. Genium group inc. Available from: http://www.hz.genium.com/searchmsds/results/#123911

Government of Canada. 2010. Environment Canada, Health Canada. Final Screening Assessment for 1,4-Dioxane (CAS RN 123-91-3). Available from: http://www.ec.gc.ca/ese-ees/default.asp?lang=En&xml=2051DAE2-3883-F0F6-D5A9-E46DBD26BA33

Government of Canada. 2011. Environmental Emergency Regulations, Canadian Environmental Protection Act, 1999. Environment Canada. Registered on December 8, 2011. Available from: http://www.gazette.gc.ca/rp-pr/p2/2011/2011-12-21/html/sor-dors294-eng.html

HSDB (Hazardous Substances Data Bank). 2006. 1,4-Dioxane CASRN: 123-91-1. United States National Library of Medicine. Available from: http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB

Pohanish, RP. 2008. Sittig`s Handbook of Toxic and Hazardous Chemicals and Carcinogens. 5th Edition. William Andrew Inc. Norwich, NY. ISBN 978-0-8155-1553-1. Volume I. p. 1039-1041.

Verschueren, K. 2001. Handbook of Environmental Data on Organic Chemicals. 4th Edition. John Wiley & Sons, Inc. New York, NY. ISBN 0-471-37490-3. Volume 1. p. 985.

5.0 FURTHER READING

Ketcheson K, Shrives J. 2010. Comparison of Threshold Quantities for Substances with Final AEGL-2 and IDLH Values under CEPA's Environmental Emergency Regulations. In: Proceedings of the Thirty-third Arctic and Marine Oilspill Program Technical Seminar on Environmental Contamination and Response. Environment Canada: Ottawa (ON). pp. 843-861.

U.S. EPA (U.S. Environmental Protection Agency). 1994. List of Regulated Toxic and Flammable Substances and Thresholds for Accidental Release Prevention. Federal Register, 59(20). Document Number 94-1556. 31. Washington (DC). Available from : http://www.gpo.gov/fdsys/pkg/FR-1994-01-31/html/94-1556.htm