



Risk Evaluation Determining Whether Environmental Emergency Planning is Required Under the
Environmental Emergency Regulations set under the
Canadian Environmental Protection Act, 1999
(CEPA 1999)

Arsenic Trioxide (CAS #: 1327-53-3)
(Arsenic(III) Oxide)
(Inorganic Arsenic Compounds)
(CEPA 1999 – Schedule 1, #28)

Summary of Risk Evaluation Analysis

The Risk Evaluation Framework (REF), developed by Environment Canada, is applied to chemical substances in order to determine whether or not an environmental emergency (E2) plan should be required. For those substances that are evaluated as requiring an E2 plan, the next step is to determine a threshold quantity for the total quantity of the substance and the maximum storage container size on site. Within the REF, three categories are used to evaluate chemicals and assign threshold quantities. Shown below are the details within the three categories for *arsenic trioxide*:

1. Environment Hazard

(Persistence, Bioaccumulation and Aquatic Toxicity Analysis)

- According to Mackay *et al.* (2003), nickel, chromium, arsenic and cadmium are classified as indefinitely persistent. As a result, *arsenic trioxide* is also classified as indefinitely persistent in the environment.
- No data are available to determine the bioaccumulation potential.
- For aquatic toxicity, it was determined that *arsenic trioxide* was slightly toxic (LC₅₀ at 96 hrs between 10 and 100 mg/L) based on the most sensitive species, fathead minnow (Dyer *et al.*, 1993).

2. Human Hazard

(Inhalation Toxicity and Carcinogenicity Analysis)

- Since, *arsenic trioxide* has vapour pressure below 1.33 kPa at 20°C (HSDB, 2004), there is insufficient vapour from the substance to cause an inhalation problem.
- *Arsenic trioxide* is categorized as a United States Environmental Protection Agency (US EPA) carcinogen with a classification rating of 'A' (Genium, 2003) and as a International Agency for Research on Cancer (IARC) carcinogen with a classification rating of '1' (IARC, 1987).

3. Physical Hazard

(Flammability and Combustibility Analysis)

- *Arsenic trioxide* is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerisation does not occur. *Arsenic trioxide* has a reactivity rating of '0' according to the Fire Diamond. (Genium, 2003).

Flammability and Combustibility Analysis Table

	Value	Vapour Cloud Explosion (Yes/No)	Combustible (Yes/No)	References
Boiling point (°C)	465	No	No	(Genium, 2003; ATSDR, 2000)
Flash point (°C)	non-combustible			(Genium, 2003)

Threshold

The data from the above mentioned categories were used to determine the various environmental/human thresholds. The threshold quantities relate to: carcinogenicity, aquatic toxicity, inhalation toxicity, vapour cloud explosion, combustibility, and reactivity.

The threshold quantity for carcinogenicity is defaulted to 0.22 tonnes, if it meets the following criteria:

- 1) have an IARC rating of 1, 2A or 2B, or have a US EPA rating of A, B1, or B2;
- 2) be persistent in any media for greater than 5 years.

Threshold quantities assigned as a result of aquatic toxicity are based on the following table:

Threshold Quantities Assigned as a Result of Aquatic Toxicity

Criteria	Extremely Toxic	Highly Toxic	Moderately Toxic	Slightly Toxic
Persistence (water)	≥ 6 months	≥ 2 months to < 6 months	N/A	N/A
Bioaccumulation	BCF ≥ 5000 or Log Kow ≥ 5	BCF ≥ 500 to < 5000 or Log Kow ≥ 4 to < 5 (unless BCF < 500)	N/A	N/A
Acute Aquatic Toxicity (96 hrs LC ₅₀ – mg/L)	≤ 0.1	> 0.1 to ≤ 1	> 1 to ≤ 10	> 10 to ≤ 100
Threshold Quantity Tonnes (lbs)	0.22 (500 lbs)	1.13 (2 500 lbs)	4.50 (10 000 lbs)	9.10 (20 000 lbs)

A substance is a candidate for a vapour cloud explosion if its flash point is < 23°C and its boiling point is < 35°C. A substance is considered combustible if its flash point is < 23°C or its boiling point is < 35°C. In accordance with the precautionary principle, the category with the lowest threshold will be used. For further explanation, please refer to the *Implementation Guidelines for Part 8 of the Canadian Environmental Protection Act, 1999 – Environmental Emergency Plans* (<http://www.ec.gc.ca/ee-ue/>).

Conclusion

For *arsenic trioxide* # 28, the E2 hazard threshold was triggered by:

- 1) Aquatic toxicity at 0.22 tonnes;
- 2) Carcinogenicity at 0.22 tonnes.

Therefore, *arsenic trioxide* # 28 is recommended for addition to Schedule 1 of the *Environmental Emergency Regulations* under Part 3 with a threshold quantity of 0.22 tonnes.

References

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