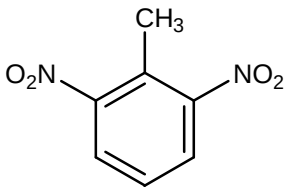
9	CAS No.: 606-20-2	Substance: 2,6-Dinitrotoluene

Chemical Substances Control Law Reference No.: 3-446 (Dinitrotoluene)

PRTR Law Cabinet Order No.*: 1-200 (Dinitrotoluene)

Molecular Formula: $C_7H_6N_2O_4$ Structural formula:

Molecular Weight: 182.13



*Note: No. in Revised Cabinet Order enacted on October 1, 2009

1. General information

The aqueous solubility of this substance is 182 mg/L (20°C), the partition coefficient (1-octanol/water) (log K_{ow}) is 2.10, and the vapor pressure is 2.87×10^{-4} mmHg (=0.0383 Pa) (20°C). The biodegradability (aerobic degradation) is characterized by a BOD degradation rate of 0% (as dinitrotoluene), and bioaccumulation is thought to be nonexistent or low (as dinitrotoluene). The substance does not have any hydrolyzable groups.

Dinitrotoluene is designated as a Type II and Type III Monitoring Chemical Substance under the Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substances, and a Class 1 Designated Chemical Substance under the Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management (PRTR Law). Almost all dinitrotoluene is used as a raw material for toluenediamine, while other uses include as raw materials for explosives and dyestuffs. The production and import quantity of dinitrotoluene in fiscal 2005 was 130 t. The production and import category under the PRTR Law was ≥100 t.

---

2. Exposure assessment

Total release to the environment in fiscal 2008 under the PRTR Law was approximately 23 t, of which approximately 0.68 t, or 3% of overall releases, was reported releases. The major destination of reported releases was public freshwater bodies. Besides this, 14 t was transferred to sewage. The only source of release was the chemical industry. Including non-reported releases, releases to water bodies are estimated to have been the greatest. A multi-media model used to predict the distribution into each medium in the environment indicated that in regions where the largest quantities were estimated to have been released to the environment and public freshwater bodies, the proportions distributed to water bodies and sediment would be 78.2% and 15.7%, respectively, whereas for regions where the largest quantities were estimated to have been released to the atmosphere, the proportions distributed to water bodies and sediment would be 78.5% and 15.7%, respectively.

The predicted maximum exposure to humans via inhalation, based on general environmental atmospheric data, was around 0.0086 μg/m^3. Meanwhile, the mean value of atmospheric concentration estimated from reported releases (as dinitrotoluene) to the atmosphere under the PRTR Law was a maximum of 0.022 μg/m^3.

The predicted maximum oral exposure was estimated to be less than 0.0204 μg/kg/day based groundwater and food data. Meanwhile, oral exposure was more than 0.0044 μg/kg/day and less than 0.02 μg/kg/day based on the maximum value for river concentration calculated from reported releases (as dinitrotoluene) to public freshwater bodies under the PRTR Law, and actual food data. The risk of exposure to this substance by intake from an environmental medium via food is considered slight based on estimates of oral exposure using estimated concentrations in fish species.

The predicted environmental concentration (PEC), which indicates exposure to aquatic organisms, was reported to be generally less than 0.0014 μg/L for freshwater bodies and, and less than 0.0014 μg/L for seawater. The river

concentration estimated using reported releases (as dinitrotoluene) based on the PRTR Law was a maximum of 1.1 μg/L.

---

3. Initial assessment of health risk

Hematological effects of this substance may produce methemoglobin. Sings and symptoms of poisoning via the inhalation or oral routes include blue lips, finger nails and skin, headache, dizziness, nausea, confusion, convulsions and unconsciousness. Transdermal absorption may cause similar signs and symptoms.

As sufficient information was not available on the carcinogenicity of the substance, an initial assessment was conducted on the basis of information on its non-carcinogenic effects.

With regard to oral exposure to the substance, a LOAEL of 4 mg/kg/day (for splenic extramedullary hematopoiesis) obtained from mid-term and long-term toxicity tests in dogs was divided by 10 due to the short test periods and was further divided by 10 as is always the case with a LOAEL. 0.04 mg/kg/day derived was identified as its‘ non-toxic level*’. As for inhalation exposure, it’s ‘non-toxic level*’ could not be identified.

The predicted maximum exposure via the oral route was approximately less than 0.02 μg/kg/day when intakes of groundwater and food were assumed. The MOE was greater than 40 when calculated from the ‘non-toxic level*’ of 0.04 mg/kg/day and the predicted maximum exposure divided by 10 due to the need to convert the ‘non-toxic level*’ obtained from the animal experiments to a human equivalent dose followed by division by 5 due to the carcinogenicity of the substance. Health risk associated with oral exposure to the substance could not be identified. On the other hand, based on releases of dinitrotoluene into public water bodies reported under Japanese PRTR for FY2008 indicating its concentrations in receiving river water from its major sources, the maximum exposure was calculated to be 0.0044 μg/kg/day. When this was included in the maximum exposure through food intakes, the total oral exposure would be 0.0044 μg/kg/day and above to less than 0.02 μg/kg/day, and when calculated from this, for reference, the MOE would be 40 to 180. Failure of risk identification would be attributable to relatively high detection limits for food. However, exposure to the substance through food intakes from the environment was estimated minor, and, thus, estimation of its exposure under lower detection limits would not be required when the MOE is also taken into consideration.

With regard to inhalation exposure to the substance, the absence of information available on ‘non-toxic levels*’ and exposure concentrations did not allow for a health risk assessment. For reference, its ‘non-toxic level*’ for oral exposure, if 100% absorption were assumed, would be equivalent to its ‘non-toxic level*’ of 0.13 mg/m^3 for inhalation exposure. The MOE would be 300 when calculated from the ‘non-toxic level’ of 0.13 mg/m^3 and the predicted maximum concentration of 0.0086 μg/m^3 in the ambient air. The maximum annual average concentration in the ambient air around its major sources of emissions was calculated to be 0.22 μg/m^3 based on releases of dinitrotoluene into the air reported under Japanese PRTR for FY2008. Even if the substance were assumed to account for all of dinitrotoluene emissions, the MOE would be 120. Therefore, collection of information would not be required to assess health risk from inhalation exposure to this substance in the ambient air.

Information of toxicity				Exposure assessment		Result of risk Exposure assessment			Judgment
Exposure Path	Criteria for risk assessment	Animal	Criteria for diagnoses (endpoint)	Exposure medium	Predicted maximum exposure quantity and concentration				
Oral	‘Non-toxic level * ’ 0.04 mg/kg/day	Dogs	Splenic extramedullary hematopoiesis	Drinking water /Food	— μg/kg/day	MOE	—	×	(○)
				Groundwater/Food	< 0.02 μg/kg/day	MOE	> 40	×	
Inhalation	‘Non-toxic level * ’ — mg/m^3	—	—	Ambient air	0.0086 μg/m^3	MOE	—	×	(○)
				Indoor air	— μg/m^3	MOE	—	×	×

Non-toxic level *

- When a LOAEL is available, it is divided by 10 to obtain a level equivalent to NOAEL.
- When an adverse effect level for the short-term exposure is available, it is divided by 10 to obtain a level equivalent to an adverse effect level for the long-term exposure.

---

4. Initial assessment of ecological risk

With regard to acute toxicity, the following reliable data were obtained: a 48-h EC_{50} of 2,190 μg/L for growth inhibition in the green algae *Pseudokirchneriella subcapitata*, a 96-h LC_{50} of 5,000 μg/L for the crustacean *Americamysis bahia*, a 96-h LC_{50} of 18,500 μg/L for the fish species *Pimephales promelas* (fathead minnow), and a 48-h EC_{50} 6,700 μg/L for developmental inhibition in the sea urchin *Arbacia punctulata*. Accordingly, based on these acute toxicity values and an assessment coefficient of 100, a predicted no effect concentration (PNEC) of 22 μg/L was obtained.

With regard to chronic toxicity, the following reliable data were obtained: a 72-h NOEC of 5,000 μg/L for growth inhibition in the green algae *P. subcapitata*, a 21-d NOEC of 60 μg/L for reproductive inhibition in the crustacean *Daphnia magna*, a 41-d NOEC of 129 μg/L for growth inhibition in the fish species *Oryzias latipes* (medaka), and a 7-d NOEC of less than 1,600 μg/L for reproductive inhibition in the polychaete *Dinophilus gyrociliatus*. Accordingly, based on these chronic toxicity values and an assessment coefficient of 10, a predicted no effect concentration (PNEC) of 6 μg/L was obtained. The value of 6 μg/L obtained from the chronic toxicity to the crustacean was used as the PNEC for this substance.

The PEC/PNEC ratio for both freshwater bodies and seawater was less than 0.0002. Accordingly, further work is thought to be unnecessary at this time. Further, the river concentration estimated using reported releases (as dinitrotoluene) based on the PRTR Law was 1.1 μg/L, and the ratio of this to PNEC exceeded 0.1. However, reported emissions under the PRTR Law are the value for a mixture of isomers, and when taking into consideration the percentage content of each dinitrotoluene isomer in standard products, the estimated value for river concentration of 2,6-dinitrotoluene becomes a maximum of 0.22 μg/L and ecological risk is considered low.

Hazard assessment (basis for PNEC)			Assessment coefficient	Predicted no effect concentration PNEC (μg/L)	Exposure assessment		PEC/ PNEC ratio	Judgment based on PEC/PNEC ratio	Assessment result
Species	Acute/ chronic	End point			Water body	Predicted environmental concentration PEC (μg/L)			
Crustacean *Daphnia magna*	Chronic	NOEC reproductive inhibition	10	6	Freshwater	<0.0014	<0.0002	○	○
					Seawater	<0.0014	<0.0002		

---

5. Conclusions

	Conclusions		Judgment
Health risk	Oral exposure	Though a risk characterization cannot be determined, there would be little necessity of collecting information.	(○)
	Inhalation exposure	Though a risk characterization cannot be determined, there would be little necessity of collecting information.	(○)
Ecological risk	No need of further work at present.		○

［Risk judgments］ ○: No need for further work ▲: Requiring information collection
■: Candidates for further work ×: Impossibility of risk characterization
(○) : Though a risk characterization cannot be determined, there would be little necessity of

collecting information.

（▲）: Further information collection would be required for risk characterization.