# Summary of Initial Risk Assessment Report

# Dimethyl 2,2-dichlorovinyl phosphate; dichlorvos; DDVP

CAS No : 62-73-7

PRTR No of Japan: 350

This substance is assessed based on Guideline for Initial Risk Assessment Version 1.0

## 1. General Information

### 1.1 Physico-chemical properties

| | |
|---|---|
| Appearance | Colorless to yellow-brown liquid |
| Melting point | Less than -60 degC |
| Boiling point | 140 degC (2.7 kPa) |
| Water solubility | 8 g/L (20 degC) |
| Henry's constant | $5.81*10^{-2}$ Pa*$m^3$/mol ($5.74*10^{-7}$ atm*$m^3$/mol) (25degC, measured) |
| Octanol/water partition coefficient (log Kow) | 1.47 (measured), 0.60 (estimated) |
| Soil adsorption coefficient | Koc = 40 (estimated) |

### 1.2 Environmental fate

| | |
|---|---|
| Bioaccumulation | Low bioaccumulative<br>Bioconcentration factor (BCF) : Less than 0.5 (carp), 0.8 (*gnathopogon caerulescens*), measured |
| Biodegradation | Readily biodegradable<br>Considered to be biodegradable substance under both aerobic and anaerobic conditions. |
| Stability in the environment | (In air)<br>Reaction with OH radical:<br>The reaction rate constant is $9.41*10^{-12}$ $cm^3$/molecule-sec. (25 degC, estimated)<br>The half-life is 1-2 days, given OH radical concentration of $5*10^5$-$1*10^6$ molecule/$cm^3$.<br>Reaction with ozone:<br>The reaction rate constant is $3.58*10^{-20}$ $cm^3$/molecule-sec. (25 degC, estimated)<br>The half-life is calculated to be 10 months, given ozone concentration of $7*10^{11}$ molecule/$cm^3$.<br>Reaction with nitrate radical: No data<br>Photodegradation:<br>The photodegradation rate constant is $2.65*10^{-5}$ $sec^{-1}$<br>The half-life when applied on a glass plate in thin-layer (0.67 microg/$cm^2$) is 7 hours.<br>(In water)<br>The hydrolysis half-lives at 37.5 degC are 77 hours at pH 5.4 and 5 hours at pH 8. The half-life is shortened as pH increases. In addition, hydrolysis half-lives at pH 5 are 240 days at 10 degC and 1.66 days at 50 degC. The half-life is shortened as temperature increases. Dimethyl phosphate and dichloroacetaldehyde are expected to be produced by hydrolysis. |

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|---|---|
| Environmental fate | If released to water, dimethyl 2,2-dichlorovinyl phosphate (hereinafter referred to as "DDVP") is expected to be removed mainly by hydrolysis and by biodegradation. Removal of DDVP from water by volatilization is not considered to be an important fate process. |

## 2. Sources of release to the environment

### 2.1 Annual production, import, export and domestic supply in 2002 (ton/year)

| Production | Import | Export | Domestic supply | Remarks |
|---|---|---|---|---|
| 488.3 | 0.5 | -- | 488.8 | |

### 2.2 Uses

Insecticides: isoxathion/DDVP emulsions, diazinon/DDVP emulsions, and others, Insect-fungicides: DDVP/quinoxaline fumigants, home use insecticides, and hygienic insecticides

### 2.3 Release from the industries within the scope of PRTR system (in 2001)

| Release sources | | Air (ton) | Waters (ton) | Soil (ton) | Remarks |
|---|---|---|---|---|---|
| Listed industries | Reported release | 1 | < 0.5 | 0 | Release to rivers: 47.8 tons |
| | Release outside notification | 1 | < 0.5 | 0 | |
| Release outside notification from non listed industry | | 0 | 48 | 426 | |
| Households | | 55 | 0 | 0 | |
| Mobile sources | | -- | -- | -- | |
| Total | | 57 | 48 | 426 | |

### 2.4 Releases from other sources

No information about the substance is available.

### 2.5 Main release route

DDVP is mainly released from "PRTR non-listed industries" and households. DDVP is expected to be released to soil during spray of agricultural chemicals and to the aquatic environments during use of insect fumigants by "non-listed industries". This substance is also expected to be released from household insecticides.

## 3. Exposure Assessment

### 3.1 Measured environmental concentration

| Media | No. of points detected / No. of points measured | No. of samples detected / No. of samples measured | Detection range | 95th percentile | Detection limit | Year of investigation, Institution |
|---|---|---|---|---|---|---|
| Air (microg/$m^3$) | 2/17 | 4/51 | nd-0.013 | 0.010 | 0.000036-0.015 | 1994 Ministry of the Environment |
| River water (microg/L) | 0/672 | -- | nd | -- | 0.5-1.0 | 2002 Ministry of the Environment |
| Drinking water (microg/L) | (purified water) | 0/11 | nd | -- | 0.1 | 2002,2003 Tokyo Metropolitan Government |
| | (tap water) | 0/2 | nd | -- | 0.1 | |
| Food (microg/g) | The average dietary intake of DDVP was surveyed by the market basket method survey*. DDVP was not detected in any samples. Intake of DDVP was derived to be 0.64-2.16 microg/person/day by using the value equal to 20% of the detection limit for each food group. Thus, 2.16 microg/person/day was used for the risk assessment.<br>*Market basket method survey: The dietary intake of the Japanese population was surveyed by the Ministry of Health, Labor and Welfare as part of the National Nutrition Survey. Subsequently, the Ministry of Health, Labour and Welfare conducted a study to determine the dietary intake of DDVP by sampling the foods purchased from markets, based on data from the National Nutrition Survey. | | | | | 1991-1998 Ministry of Health, Labour and Welfare |

nd: Not detected.

For calculation of the 95th percentile, data less than the detection limit are replaced with a value of one half of the detection limit.

### 3.2 Estimated environmental concentration

| Media | Estimated concentration | Description |
|---|---|---|
| Air (microg/$m^3$) | 0.0062 | Calculated by mathematical model / Atmospheric Dispersion Model for Exposure and Risk Assessment (AIST-ADMER) |
| River water (microg/L) | 4.7 | Calculated by mathematical model / Integrated River Model to predict the distribution of chemical concentration ( IRM1 ) |

### 3.3 Estimated environmental concentration in water (EEC)

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|---|---|
| EEC (microg/L) | 0.5 |
| | DDVP was not detected in the survey by the Ministry of the Environment in 2002. The value equal to 1/2 of the detection limit was used for the risk assessment[1)]. |

**3.4 Estimated human intake**

| Intake route | | Concentration used for estimation of intake | Estimated intake (microg/ person/ day) | Estimated intake (microg/ kg-Bodyweight (BW)/ day) |
|---|---|---|---|---|
| Inhalation | Air | 0.010 (microg/$m^3$) | 0.20 | 0.0040 |
| | | The ninety-fifth percentile of measured concentrations surveyed by the Ministry of the Environment in 1994 was used for the risk assessment. | | |
| Oral | Drinking water | 0.05 (microg/L) | 0.1 | 0.002 |
| | | DDVP was not detected (detection limit: 0.1 microg/L) in the survey by Tokyo Metropolitan Government in 2002 and 2003. The value equal to 1/2 of the detection limit was used for the risk assessment. | | |
| | Food | -- (microg/g) | 2.2 | 0.044 |
| | | The average dietary intake of DDVP was surveyed by the market basket method survey*. DDVP was not detected in any samples. Intake of DDVP was derived to be 0.64-2.16 microg/person/day by using the value equal to 20% of the detection limit for each food group. Thus, 2.16 microg/person/day was used for the risk assessment. | | |
| | Subtotal | -- | 2.3 | 0.046 |
| Total route | | -- | 2.46 | 0.049 |

1) This substance is assessed based on the Guideline for Initial Risk Assessment Version1.0. If adequate measured concentrations are available, they are given priority and used as values for risk assessment. If they are not available, an estimated value calculated using a mathematical model is used.

## 4. Hazard assessment

### 4.1 Effects on organisms in the environment

| | Acute or Chronic | Species | Endpoint | Concentration |
|---|---|---|---|---|
| Algae | Chronic | *Selenastrum capricornutum* | 72 hours NOEC<br>Growth inhibition (biomass) | 11.5 (mg/L) |
| Crustacea | Chronic | *Daphnia magna* | 21 days NOEC<br>Reproduction | 0.00012 (mg/L) |
| Fish | Chronic | *Pimephales promelas* | 28 days NOEC<br>Growth | 0.070 (mg/L) |
| Key study | | The data of crustacea (*daphnia magna*) was chosen for the key study because effects were observed at the lowest concentration in the hazard assessment. | | |

### 4.2 Human health toxicity

| Toxicity | Exposure routes | Species | Duration / Dose method | Toxic effects (Key study is underlined) | NOAEL |
|---|---|---|---|---|---|
| Repeated dose toxicity | Inhalation | Rat | 104 weeks | <u>Decreased</u> plasma, <u>brain</u> and RBC <u>ChE activities</u> | 0.05 mg/m$^3$ (equivalent to 0.03 mg/kg/day) |
| | Oral | Dog | 52 weeks<br>Gavage administration | <u>Decreased serum, RBC and brain ChE activities</u> | 0.05 mg/kg/day |
| | Dermal | -- | -- | -- | -- |
| Developmental toxicity | Oral | Rat | Gavage administration beginnig the 1st day of pregnancy, childbirth, and during lactation period for dams, beginning weaning and during lifetime for offsprings | No adverse effects were observed in dams.<br>Dose-dependent behavior disorder was observed in offsprings. | LOAEL:<br>0.97 mg/kg/day |
| Carcinogenicity | Evaluation by IARC : Group 2B (possibly carcinogenic to humans) | | | | |
| Genotoxicity | Positive results in the *in vitro* test without S9, and negative results in most *in vivo* tests. | | | | |

## 5. Risk Assessment

### 5.1 Environmental organisms

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|---|---|---|---|---|---|
| Risk characterization | EEC (microg/L) | NOEC * (mg/L) | MOE (NOEC * /EEC) | Product of uncertainty factors | Conclusion |
| | 0.5 | NOEC: 0.00012 | 0.24 | 10 | Substance of concern |
| | Product of uncertainty factors (UF): Extrapolation from laboratory test (10) = 10 | | | | |
| Recommendation : The value equal to 1/2 of the detection limit was used for the EEC in the risk assessment because DDVP was not detected in any river water samples. Therefore, future measurements of concentrations in the aquatic environment should be taken using a lower detection limit. | | | | | |

NOEC* means NOEC, LOEC, $EC_{50}$, etc.

### 5.2 Human health

#### 5.2.1 Repeated dose toxicity

| Exposure route | Intake (microg/kgBW/day) | NOAEL (mg/kgBW/day) | Risk characterization | | |
|---|---|---|---|---|---|
| | | | MOE | Product of uncertainty factors | Conclusion |
| Inhalation | 0.0040 | 0.03 | 7,500 | 100 | No immediate concern |
| Oral | 0.046 | 0.05 | 1,100 | 100 | No immediate concern |
| Total | 0.049 | 0.03 (inhalation ) | 610 | 100 | No immediate concern |
| Product of uncertainty factors (UF):<br>Each exposure route: Interspecies (10) * Intraspecies (10) = 100 | | | | | |

#### 5.2.2 Reproductive and developmental toxicity

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#### 5.2.3 Carcinogenicity

Risk characterization of carcinogenicity of the substance was not carried out in this assessment.

#### 5.2.4. Recommendation for Human Health

Though the substance is considered to be of no immediate concern for the moment and a low priority for further work, it should be noted that a carcinogenic risk characterization was not conducted in this assessment. The possibility remains that this substance may be carcinogenic to humans.

## 6. Supplement

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