FOREWORD INTRODUCTION

DIBUTYL PHOSPHATE

CAS N°: 107-66-4

SIDS Initial Assessment Report for SIAM 2

(Paris, 4-6 July1994)

Chemical Name: Dibutyl phosphate

CAS No: 107-66-4

Sponsor Country: Japan

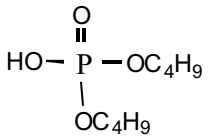
National SIDS Contact Point in Sponsor Country:
Mr. Yasuhisa Kawamura, Ministry of Foreign Affairs, Japan

History: As a high priority chemical for initial assessment, dibutyl Phosphate was selected in the framework of the HPV Programme. At SIAM-2 (July 1994), the conclusion was approved with comments.

Deadline for circulation: March 1994

Date of Circulation: March 1994

SIDS INITIAL ASSESSMENT PROFILE

CAS No.	107-66-4
Chemical Name	Dibutyl phosphate
Structural Formula	

CONCLUSIONS AND RECOMMENDATIONS

It is currently considered of low potential risk and low priority for further work.

SHORT SUMMARY WHICH SUPPORTS THE REASONS FOR THE CONCLUSIONS AND RECOMMENDATIONS

Dibutyl phosphate is stable liquid and the production volume is ca. 6 tonnes /year in 1990 – 1993 in Japan and 150 - 250 tones /year in 1990 in Germany. This chemical is used as a catalyst for cross-linking in the paint industry. This chemical is stable in neutral, acidic or alkaline solution, and is considered as "inherently biodegradable". The life time may be relatively long in the environment.

PECs have been calculated based on several models considering its physico-chemical properties (e.g. molecular weight, water solubility, vapour pressure and partition coefficient). The estimated concentrations were 2.4×10^{-14} mg/l (air), 2.5×10^{-7} mg/l (water), 1.9×10^{-6} mg/kg (soil), 1.5×10^{-6} mg/kg (sediment). PEC_{global} was also calculated as 2.5×10^{-7} mg/l, based on a default scenario.

For the environment, various NOEC and LC_{50} values were gained from test results; LC_{50} = 110 - 130 mg/l (acute fish); EC_{50} = 210 mg/l (acute daphnia); EC_{50} = 92 mg/l (acute algae); NOEC = 66 mg/l (long-term daphnia reproduction). Therefore, the chemical is considered to be slightly toxic to fish. From the lowest chronic toxicity data to daphnia (21 d-NOEC of 66 mg/l, applying an assessment factor of 100 a PNEC of 0.66 mg/l can be estimated. Since the PEC is lower than the PNEC, the environmental risk is presumably low.

No monitoring data at work place and environment have been reported. The chemical is produced in closed system, and no data for consumer use are available. Based on the physico-chemical properties, the total exposed dose indirectly through the environment was estimated as 3.1×10^{-6} mg/man/day. Also, the daily intake through drinking water is estimated as 5.1×10^{-7} mg/kg/day and through fish is calculated as 3.7×10^{-8} mg/kg/day.
No data on occupational exposure are available.

The chemical showed no genotoxic effects in bacteria and chromosomal aberration test *in vitro*.

In a combined repeat dose and reproductive/developmental toxicity screening test, main toxic effects on stomach, bladder and organs related to excretion routes were observed in parental rats. Hepato-toxic effects such as hepatocyte swelled and liver weight increased were also observed. From the view point of reproductive/developmental end-points, there was not any significant effect on fertility or reproductive performance in parental rats. Only a tendency of the decrease in number of live pups was seen at the highest dose (1000 mg/kg/day). The NOEL was 30 mg/kg/day for repeated dose toxicity and 300 mg/kg/day for reproductive toxicity.

The total exposed dose indirectly through the environment was estimated as 3.1×10^{-6} mg/man/day. Also, the daily intake through drinking water is estimated as 5.1×10^{-7} mg/kg/day and through fish is calculated as 3.7×10^{-8} mg/kg/day. For human health, margins of safety by indirect exposure from fish or drinking water are very large. Therefore, the health risk is presumably low.

In conclusion, no further testing is needed at present considering its toxicity and exposure levels.

NATURE OF FURTHER WORK RECOMMENDED

FULL SIDS SUMMARY

CAS NO: 107-66-4		SPECIES	PROTOCOL	RESULTS
PHYSICAL-CHEMICAL				
2.1	Melting Point			- 13 °C
2.2	Boiling Point			190 –260 °C
2.3	Density			No data available
2.4	Vapour Pressure		OECD TG 104	< 7.4 x 10^{-3} Pa at 100 °C
2.5	Partition Coefficient (Log Pow)		OECD TG 107	0.57
2.6 A.	Water Solubility		OECD TG 105	17 g/L at 25 °C
B.	PH			
	PKa		OECD TG 112	2.32 at 25°C
2.12	Oxidation: Reduction Potential			No data available
ENVIRONMENTAL FATE AND PATHWAY				
3.1.1	Photodegradation		AOP Win v 1.86	$T_{1/2}$ = 4.99 y (sensitizer: OH radical)
3.1.2	Stability in Water		OECD TG 111	Stable (pH 4.0, 7.0, 9.0)
3.2	Monitoring Data			No data available.
3.3	Transport and Distribution		Mackay, level III	In Air 2.4E-14 mg/L In Water 2.5E-7 mg/L In Soil 1.9E-6 mg/g In Sediment 1.5E-6 mg/g
3.5	Biodegradation		OECD TG 301C	Not readily biodegradable: 1-3 %, 4% (TOC) and 4 -6% (GC) in 28 days.
			OECD TG 302B	Inherently biodegradable: 9% (7d), 98% (21d).
3.6	Bioaccumulation			No data available
ECOTOXICOLOGY				
4.1	Acute/Prolonged Toxicity to Fish	*Oryzias latipes*	OECD TG 203	LC_{50} (72hr): 110 mg/L
4.2	Acute Toxicity to Aquatic Invertebrates (*Daphnia*)	*Daphnia magna*	OECD TG 202	EC_{50} (24hr): 210 mg/l
4.3	Toxicity to Aquatic Plants e.g. Algae	*Selenastrum capricornutum*	OECD TG 201	EC_{50} (72hr): 92 mg/l NOEC: 100 mg/l
4.5.2	Chronic Toxicity to Aquatic Invertebrates	*Daphnia magna*	OECD TG 202	EC_{50} (21d, Mortality): 28 mg/l EC_{50} (21d, Reproduction): 110 mg/l

CAS NO: 107-66-4		SPECIES	PROTOCOL	RESULTS
	(*Daphnia*)			NOEC (21d, Repro): 66 mg/l
4.6.1	Toxicity to Soil Dwelling Organisms			No data available.
4.6.2	Toxicity to Terrestrial Plants			No data available.
(4.6.3)	Toxicity to Other Non- Mammalian Terrestrial Species (Including Birds)			No data available
TOXICOLOGY				
5.1.1	Acute Oral Toxicity	Rat	OECD TG 401	$LD_{50:}$= 3,200 mg/kg
5.1.2	Acute Inhalation Toxicity			No data available.
5.1.3	Acute Dermal Toxicity			No data available.
5.4	Repeated Dose Toxicity	Rat	OECD Combined Test	NOAEL = 30 mg/kg/day
5.5	Genetic Toxicity In Vitro			
A.	Bacterial Test (Gene mutation)	*S. .typhimurium* *E. coli*	OECD Guidelines No.471 and 472 and Guidelines for Screening Mutagenicity Testing of Chemicals (Japan)	Negative (With metabolic activation) Negative (Without metabolic activation)
B.	Non-Bacterial In Vitro Test (Chromosomal aberrations)	CHL cells	OECD Guideline No.473 and Guidelines for Screening Mutagenicity Testing of Chemicals (Japan)	Negative (With metabolic activation) Negative (Without metabolic activation)
5.6	Genetic Toxicity In Vivo			No data available.
5.8	Toxicity to Reproduction	Rat	OECD Combined Test	NOAEL Parental = 1,000 mg/kg/day NOAEL F1 offspring = 300 mg/kg/day
5.9	Developmental Toxicity/ Teratogenicity	Rat	OECD Combined Test	NOAEL Maternal toxicity = 1,00mg/kg/day NOAEL Teratogenicity = 1,000 mg/kg/day
5.11	Experience with Human Exposure			

SIDS Initial Assessment Report

1. Identity

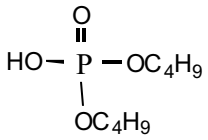
OECD Name: Dibutyl phosphate

Synonym: Dibutyl hydrogen phosphate

CAS Number: 107-66-4

Empirical Formula: $C_8H_{19}O_4P$

Structural Formula:



Degree of Purity: 64 %

Major Impurities: Tributyl phosphate (20 %)
Monobutyl phosphate (16 %)

Essential Additives: No additives

2. Exposure

2.1 General discussion

Dibutyl phosphate is a volatile stable liquid, and the production volume is ca. 6 tonnes/year in 1990 - 1992 in Japan, and 150 - 250 tonnes/year in Germany in 1990. This chemical is used as a catalyst for cross-linking in paint industry (Japan, 100 %), and antistatics for the textile industry (100 - 200 tonnes). Release to the environment may occur at the production site as well as specific industrial use sites. All wastes are treated by incineration. Dibutyl phosphate seems to be released into water and air from its production sites after biological treatment. No specific monitoring data of the chemical is available. This chemical is stable in neutral, acidic or alkaline solutions, and is classified as "not readily biodegradable" but inhererently biodegradable.

2.2 Environmental exposure

a) Biodegradability:

If released into water, this substance is not readily biodegraded (MITI (I), corresponding to the OECD 301C: 1 - 3 % during 28 days based on BOD and 4% on TOC and 4 - 6 % based on GC analysis). However, there is other company data using OECD TG 302B. According to this report, the substance is inherently biodegraded: 0% (3h), 9% (7d), 97% (14d) and > 98% (21d) in COD.

b) Hydrolysis as a function to pH:

The chemical is stable in water at pH 4, 7 and 9 (OECD TG 111).

c) Photodegradability (estimation)

The half-life time of 4.99 years is estimated for the degradation of dibutyl phosphate in air by the reaction with photochemically produced OH radicals. (MITI, Japan).

d) Bioaccumulation:

No data are available.

e) Estimates of environmental fate, pathway and concentration:

The potential environmental distribution of dibutyl phosphate obtained from a generic fugacity model, Mackay level III, under emission scenarios is shown in Table 1. The results show that when dibutyl phosphate is released into water, the majority of the chemical is likely to be distributed into soil and sediment

PECs have been calculated based on several models (MNSEM, CHEMCAN, CHEMFRN) considering its physico-chemical properties (e.g. molecular weight, water solubility, vapour pressure and partition coefficient). The estimated concentrations of MNSEM model were 2.4×10^{-14} mg/l (air), 2.5×10^{-7} mg/l (water), 1.9×10^{-6} mg/kg (soil), 1.5×10^{-6} mg/kg (sediment). PEC_{global} was also caluculated as 2.5×10^{-7} mg/l, based on a default scenario.

No monitoring data at work place and environment have been reported. The chemical is used in closed system, and no data for consumer use are available. Based on the physico-chemical properties, the total exposed dose indirectly through the environment was estimated as 3.1×10^{-6} mg/man/day. Also, the daily intake through drinking water is estimated as 5.1×10^{-7} mg/kg/day and through fish is calculated as 3.7×10^{-8} mg/kg/day.

Global situation:

Method: MNSEM 147S
Input data: Molecular weight: 210.21

Water solubility:	17195 [mg/l]
Vapor pressure:	5.25E-05 [mmHg]
Log Pow:	0.57

Results: Steady state mass and concentration calculated using MNSEM 147S

Air:	2.4E-14 [mg/l]
Water:	2.5E-07 [mg/l]
Soil:	1.9E-06 [mg/kg dry solid]
Sediment:	1.5E-06 [mg/kg dry solid]

Exposure dose

Inhalation of air:	4.5E-10 [mg/day]
Drinking water:	5.1E-07 [mg/day]
Ingestion of fish:	3.7E-08 [mg/day]
meat:	1.4E-12 [mg/day]
milk:	2.2E-12 [mg/day]
vegetation:	2.6E-06 [mg/day]

Total exposure dose: 3.1E-06 [mg/day]

MNSEM 147S is a slightly revised version of MNSEM 145I.
1. addition of air particle compartment to air phase
2. execution of calculation on a spreadsheet program

Table 1. Comparison of calculated environmental concentration using several methods (Japanese environmental conditions are applied to the calculations.)

Model	Air[mg/l]	Water[mg/l]	Soil[mg/kg]	Sediment[mg/kg]
MNSEM	2.4E-14	2.5E-07	1.9E-06	1.5E-06
CHEMCAN2	1.9E-14	2.6E-07	4.4E-08	2.4E-08
CHEMFRAN	1.6E-15	2.6E-07	2.8E-09	2.4E-08

2.3 Consumer Exposure

No data on consumer exposure are available.

2.4 Occupational Exposure

No data on work place monitoring have been reported.

3. Toxicity

3.1 Human Toxicity

a) Acute toxicity

The LD_{50} value of dibutyl phosphate for male rat was reported to be 3,200 mg/kg. No data are available on acute inhalation and acute dermal toxicity. Two reports on irritation tests are available. According to the results, dibutyl phosphate was highly irritating to skin and eyes in rabbit.

b) Repeated dose toxicity

There is only one key study on repeated dose toxicity of dibutyl phosphate. This chemical was studied for oral toxicity in rats according to the OECD combined repeated dose and reproductive/developmental toxicity test [OECD TG 422]. As the study was well controlled and conducted under GLP, it was considered to be a key study. Male and female SD rats were orally administered (gavage) at doses of 0, 30, 100, 300 and 1,000 mg/kg/day. In male rats, the administration period was two weeks prior to mating, 2 weeks of mating and 2 weeks after the completion of mating period. In females, in addition to a maximum four weeks pre-mating and mating period, they were exposed through the pregnant period until day 3 of post delivery. In males receiving 100 mg/kg or more, red urine and blotted fur were observed clinically.
Histopathological examinations revealed epitherial hyperplasia of the bladder mucosa which was frequently associated with mucosal degeneration and ulceration in the 100 mg/kg or more groups. Food consumption was depressed in an early phase of the dosing. At a dose of 300 mg/kg or more, there was a thicked mucosa of non-glandular portion of the stomach caused by epithelial hyperplasia with hyperkeratosis. Some animals showed erosion or ulceration in gastric mucosa including glandular and non-glandular portions. At a dose of 1,000 mg/kg, cecal dilatation was accompanied by mucosal epitherial degeneration. The body weight gain was depressed and some animals died in the 1000 mg/kg groups of both sexes. The changes in the mucosa of the bladder and stomach were also detected in parental females receiving 100 mg/kg or more. The fatal cases were found in the 1000 mg/kg dose group. In the same group, the hepatocyte swelled and the liver weight increased. At a dose of 100 mg/kg or more, the pups all died in some litters at delivery or after the birth. The dams of these litters showed gastric erosion or ulceration, hepatocyte fatty change and cell vacuolation of adrenal cortex. Accordingly, the main toxic effects observed in the repeat dose toxicity test were on the Stomach and the urinary bladder, the organs of dosing and excreting routes, respectively. The liver was also effected. The NOEL of repeat dose toxicity was assumed to be 30 mg/kg/day for both sexes of rat.

c) Reproductive toxicity

Dibutyl phosphate was studied for oral toxicity in rats according to the OECD combined repeated dose and reproductive/developmental toxicity test [OECD TG 422] at doses of 0, 30, 100, 300 and 1,000 mg/kg/day. Although this combined study was designed to investigate reproductive capability in parental generation as well as development in F_1 offspring, parameters to evaluate

developmental toxicity were limited to only body weights at day 0 and day 4 after birth, and autopsy findings at day 4.
Administration of dibutyl phosphate at dosages of 30, 100, 300 or 1,000 mg/kg did not produce any significant effect on fertility or reproductive performance of either sex in parental rats. Regarding developmental toxicity, doses of 300 mg/kg and/or below did not cause any significant effect. At a dose of 1000 mg/kg, there was a decrease of the number of live pups, especially on day 4 of lactation, and of the viability index due to a higher fatal incidence of pups in some litters at or after the birth. Statistically, the decrease of live female pups on day 4 of lactation was significant. In conclusion, there was no reproductive toxic effect on parental males and females even receiving a dose of 1000 mg/kg/day. Regarding developmental toxicity, a tendency of decrease was evidenced in the number of live pups on day 4 of lactation and viability index at 1000 mg/kg dose. The NOEL for pups was assumed to be 300 mg/kg/day.

d) Genetic toxicity

Bacterial test
A Reverse gene mutation assay was conducted in line with Guidelines for Screening Mutagenicity Testing of Chemicals (Japan) and OECD Test Guidelines 471 and 472, using pre-incubation method. This study was well controlled and regarded as a key study.
Dibutyl phosphate showed negative results in *Salmonella typhimurium* TA100, TA1535, TA98, TA1537 and *Escherichia coli* WP2 *uvr*A at concentrations up to 156 ug/plate with or without a metabolic activation system (MHW, 1993).

Non-bacterial test *in vitro*
A Chromosomal aberration test in line with Guidelines for Screening Mutagenicity Testing of Chemicals (Japan) and OECD Test Guideline 473 was conducted using cultured Chinese Hamster lung (CHL/IU) cells. This study was well controlled and regarded as a key study. The maximum concentration of the chemical caused no apparent cytotoxic effect in continuous treatment. In short term treatment, it was set to 0.54 mg/ml because the concentration was equivalent to ca. 10 mM as required in the test guidelines.
Neither structural chromosomal aberrations nor polyproidy were recognized up to a maximum concentration of 3.5 mg/ml under conditions of both continuous treatment and short-term treatment with or without an exogeneous metabolic activation system (MHW, 1998).

in vivo test
No data are available on *in vivo* genotoxic effects.

e) Other human health related information

None

3.2 Ecotoxicity

Dibutyl phosphate has been tested in a limited number of aquatic species (*Selenastrum capricornutum*, *Daphnia magna* and *Oryzias latipes*), under OECD test guidelines [OECD TG 201, 202, 203, and 211]. Acute and chronic toxicity data to test organisms for dibutyl phosphate are summarized in Table 2. No other ecotoxicological data are available. Various NOEC and LC_{50} values were gained from above tests; LC_{50} = 92 mg/l (acute fish); EC_{50} = 210 mg/l (acute daphnia); EC_{50} = 110 mg/l (acute algae); NOEC = 100 mg/l (acute algae), NOEC = 66 mg/l (long-term daphnia reproduction). Therefore, the chemical is considered to be slightly toxic to daphnids and algae and non-toxic to fish. As the lowest chronic toxicity data to daphnia, 21 d-NOEC (reproduction) of Daphnia magna (66 mg/l) were adopted. An assessment factor of 100 is applied. Thus the PNEC of dibutyl phosphate is 0.66 mg/l. Since the PEC is lower than the PNEC, the environmental risk is presumably low.

Table 2. Acute and chronic toxicity data of dibutyl phosphate to aquatic organisms.

Species	Endpoint[*1]	Conc. (mg/L)	Reference
Selenastrum capricornutum (algae)	Biomass: EC_{50} (72h) NOEC	92 mg/L 100 mg/L	MOE, Japan. (1992)
Daphnia magna (water flea)	Imm: LC_{50}(24h) Mor: LC_{50}(21d) Rep: EC_{50}(21d) NOEC(21d)	210 mg/L 28 mg/L 110 mg/L 66 mg/L	
Oryzias latipes (fish, Medaka)	Mor: LC_{50}(24h) Mor: LC_0(48h) Mor:LC50(72h)	130 mg/L 130 mg/L 110 mg/L	

Notes: [*1] Mor; mortality, Rep; reproduction., Imm; immobilisation

4. Initial assessment

Dibutyl phosphate is a stable liquid and the production volume is ca. 6 tonnes/year in 1990 – 1993 in Japan and 150 - 250 tones/year in 1990 in Germany. This chemicals is used as a catalyst for cross-linking in the paint industry. This chemical is stable in neutral, acidic or alkaline solution, and is considered as "inherently biodegradable". The life time may be relatively long in the environment.

PECs have been calculated based on several models considering its physico-chemical properties (e.g. molecular weight, water solubility, vapour pressure and partition coefficient). The estimated concentrations were 2.4×10^{-14} mg/l (air), 2.5×10^{-7} mg/l (water), 1.9×10^{-6} mg/kg (soil), 1.5×10^{-6} mg/kg (sediment). PEC_{global} was also calculated as 2.5×10^{-7} mg/l, based on a default scenario. No monitoring data at the work place or the environment have been reported. The chemical is produced in a closed system, and no data for consumer use are available. Based on the physico-chemical properties, the total exposed dose indirectly through the environment was estimated as 3.1×10^{-6} mg/man/day. Also, the daily intake through drinking water is estimated as 5.1×10^{-7} mg/kg/day and through fish is calculated as 3.7×10^{-8} mg/kg/day. No data on occupational exposure are available.

For the environment, various NOEC and LC_{50} values were gained from test results; 72h LC_{50} = 110 mg/l (acute fish); 24h EC_{50} = 210 mg/l (acute daphnia); 72h EC_{50} = 92 mg/l (acute algae); 21d NOEC = 66 mg/l (long-term daphnia reproduction). Therefore, the chemical is considered to be slightly toxic to fish. As the lowest chronic toxicity data to daphnia, 21 d-NOEC (reproduction) of Daphnia magna (66 mg/l) was adopted. As assessment factor of 100 is applied. Thus the PNEC of dibutyl phosphate is 0.66 mg/l. Since the PEC is lower than the PNEC, environmental risk is presumably low.

The chemical showed no genotoxic effects in bacteria and chromosomal aberration test *in vitro*. In a combined repeat dose and reproductive/developmental toxicity screening test, main toxic effects on stomach, bladder and organs related to excretion routes were observed in parental rats. Hepato-toxic effects such as hepatocyte swelled and liver weight increased were also observed.
From the view point of reproductive/developmental end-points, there was not any significant effect on fertility or reproductive performance in parental rats. Only a tendency of the decrease in number of live pups was seen at the highest dose (1000 mg/kg/day). The NOEL was 30 mg/kg/day for repeated dose toxicity and 300 mg/kg/day for reproductive toxicity. The total exposed dose indirectly through the environment was estimated as 3.1×10^{-6} mg/man/day. Also, the daily intake through drinking water is estimated as 5.1×10^{-7} mg/kg/day and through fish is calculated as 3.7×10^{-8} mg/kg/day. For human health, margins of safety by indirect exposure from fish or drinking water are very large. Therefore, the health risk is presumably low.

5. Overall recommendation and initial assessment

5.1 Conclusion

In conclusion, no further testing is needed at present considering its toxicity and exposure levels.

5.2 Recommendation

6. REFERENCES

Bayer AG, (1987) Unpublished report.

Bayer AG (1988) Unpublished report by Bayer AG (88/042).

Company data : Unpublished company data.

EA, Japan (1992) "Investigation on the Ecotoxicological Effects of OECD High Production Volume Chemicals", Office of Health Studies, Environmental Health Department, Environment Agency, Japan (HPV/SIDS test conducted by EA, Japan)

EA & MITI, Japan (1993) Unpublished Report on Exposure Estimation (HPV/SIDS Test conducted by EA and MITI, Japan).

ECDIN database (1993).

Hardy & Scargill (1959) J. Org. Nucl. Chem., 22, 128-130.

Lyman, W. J., W. F. Reehl and D. H. Rosenblatt (1981) "Handbook of Chemical Property Estimation Method", McGraw Hill Book Co..

MHW, Japan (1993a) Unpublished Report on Combined Repeat Dose and Reproductive/Developmental Toxicity Screening Test of Dibutyl phosphate. (HPV/SIDS Test conducted by MHW, Japan).

MHW, Japan (1993b) Unpublished Report on Mutagenicity Test of Dibutyl phosphate. (HPV/SIDS Test conducted by MHW, Japan).

MITI, Japan (1993) Unpublished Report (HPV/SIDS Test conducted by MHW, Japan. Test was performed in Chemicals Inspection and Testing Institute, Japan)

NIOSH/OSHA, 1981.

Poth, A., Data of the CCR project 156802, Report No. R 4872.

Thyssen, J. (1978) Bayer AG, short report 1.9.1978.

SIDS DOSSIER
(Dibutyl phosphate CAS No. 107-66-4)

Sponsor Country: Japan

DATE: March 2002

SIDS PROFILE

1.01 A.	**CAS No.**	107-66-4
1.01 C.	**CHEMICAL NAME (OECD Name)**	Dibutyl phosphate
1.01 D.	**CAS DESCRIPTOR**	Not applicable in this case
1.01 G.	**STRUCTURAL FORMULA**	$C_8H_{19}O_4P$
	OTHER CHEMICAL IDENTITY INFORMATION	
1.5	**QUANTITY**	In Japan, approx 6 tonnes in 1990 - 1993. In Germany, 150 - 250 tonnes/year in 1990
1.7	**USE PATTERN**	(a) Paint industry (catalyst for cross-linking) 100 % in Japan (b) Plascicizer, hydraulic fluids, and antifoaming agent. (c) Also is used in heat exchange dielectric medium. (d) Antistatics for the textile industry.
1.9	**SOURCES AND LEVELS OF EXPOSURE**	1. Amount released from production site to water is negligible in Japan. All leaks and spills are contained and cleaned up in an appropriate manner, i.e., water treatment or incineration. 8-10 tonnes waste water per year is treated by activated sludge. 2. Information on consumer exposure is unknown.
ISSUES FOR DISCUSSION (IDENTIFY, IF ANY)		

SIDS SUMMARY

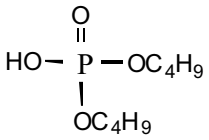
Dibutyl phosphate

CAS NO: 81-11-8		Information	OECD Study	GLP	Other Study	Estimation Method	Acceptable	SIDS Testing Required
STUDY		**Y/N**	**Y/N**	**Y/N**	**Y/N**	**Y/N**	**Y/N**	**Y/N**
PHYSICAL-CHEMICAL DATA								
2.1	Melting Point	Y	N	N	Y	N	Y	N
2.2	Boiling Point	Y	N	N	Y	N	Y	N
2.3	Density	Y	N	N	Y	N	Y	N
2.4	Vapour Pressure	N						Y
2.5	Partition Coefficient	N						Y
2.6	Water Solubility	N						Y
	pH and pKa values	N						N
OTHER P/C STUDIES RECEIVED								
ENVIRONMENTAL FATE and PATHWAY								
3.1.1	Photodegradation	N						Y
3.1.2	Stability in water	N						Y
3.2	Monitoring data	N						N
3.3	Transport and Distribution	N						N
3.5	Biodegradation	N						Y
3.6	Bioaccumulation	N						N
OTHER ENV FATE STUDIES RECEIVED								
ECOTOXICITY								
4.1	Acute toxicity to Fish	N						Y
4.2	Acute toxicity to Daphnia	N						Y
4.3	Toxicity to Algae	N						Y
4.5.2	Chronic toxicity to Daphnia	N						Y
4.6.1	Toxicity to Soil dwelling organisms	N						N
4.6.2	Toxicity to Terrestrial plants	N						N
4.6.3	Toxicity to Birds	N						N
OTHER ECOTOXICITY STUDIES RECEIVED								
TOXICITY								
5.1.1	Acute Oral	Y	N	N	Y	N	Y	Y
5.1.2	Acute Inhalation	N						N
5.1.3	Acute Dermal	N						N
5.4	Repeated Dose	N						Y
5.5	Genetic Toxicity *in vitro*							
	. Gene mutation	N						Y
	. Chromosomal aberration	N						Y
5.6	Genetic Toxicity *in vivo*	N						N
5.8	Reproduction Toxicity	N						Y
5.9	Development / Teratogenicity	N						Y
5.11	Human experience	N						N
OTHER TOXICITY STUDIES RECEIVED								

1. GENERAL INFORMATION

1.01 SUBSTANCE INFORMATION

A.	**CAS-Number**	**107-66-4**
B.	**Name** *(IUPAC name)*	Phosphoric acid, dibutyl ester
C.	**Name** *(OECD name)*	Dibutyl phosphate
D.	**CAS Descriptor**	Not applicable
E.	**EINECS-Number**	203-509-8
F.	**Molecular Formula**	$C_8 H_{19} O_4 P$
G.	**Structural Formula**	



H.	**Substance Group**	Not applicable
I.	**Substance Remark**	
J.	**Molecular Weight**	210.21

1.02 OECD INFORMATION

A.	**Sponsor Country:**	Japan
B.	**Lead Organisation:**	
	Name of Lead Organisation:	Ministry of Health and Welfare (MHW) Ministry of International Trade and Industry (MITI) Environment Agency (EA)
	Contact person:	Yasuhisa Kawamura Director Second International Organization Bureau Ministry of Foreign Affairs
	Address:	2-2-1 Kasumigaseki, Chiyoda-ku Tokyo 100, Japan TEL 81-3-3581-0018 FAX 81-3-3503-3136
C.	**Name of responder**	Same as above contact person

1.1 GENERAL SUBSTANCE INFORMATION

A. Type of Substance

element [ ]; inorganic [ ]; natural substance [ ];
organic [X]; organometallic [ ]; petroleum product [ ]

B. Physical State

gaseous [ ]; liquid [X]; solid **[ ]**

C. Purity 64 % (weight/weight)

1.2 SYNONYMS Dibutyl hydrogen phosphate

1.3 IMPURITIES

(a) Name: Tributyl phosphate
Value: 20 %
(b) Name: Monobutyl phosphate
Value: 16 %

1.4 ADDITIVES None

1.5 QUANTITY

Location	Production(tonnes)	Data
Japan	6	1990-1993
Germany	150 – 250	1991
EC	50 – 100	1991

1.6 LABELLING AND CLASSIFICATION

Labelling None

Classification None

1.7 USE PATTERN

A. General

	Type of Use:	**Category:**
	(a) main industry use	Paint industry
		(Catalyst for crosslinking)
		100 %
	(b) main industry use	Direct use
		Plasticizer
		Hydraulic fluid
		Antifoam agent in ore separation process
		Heat exchange dielectric medium
	(c) main industry use	Antistatics for the textile industry
		(100-200 tonnes/year)
		Varnish and paint (ca. 16 t/year)

Remarks: None

Reference: (a) MITI, Japan
(b) ECDIN Database

B. Uses in Consumer Products None

1.8 OCCUPATIONAL EXPOSURE LIMIT VALUE

1.9 SOURCES OF EXPOSURE

Source: Media of release: Water from a production site
Quantities per media: Negligible small
Remarks: 8-10 tonnes of waste water per year is treated by activated sludge.
Reference: MITI, Japan

1.10 ADDITIONAL REMARKS

A. Options for disposal Incineration

Reference: MITI, Japan

B. Other remarks

Remarks: None

2. PHYSICAL-CHEMICAL DATA

2.1 MELTING POINT

Value:	ca. - 13 °C
Decomposition:	Yes **[ ]** No **[X]** Ambiguous **[ ]**
Sublimation:	Yes **[ ]** No **[X]** Ambiguous **[ ]**
Method:	Unknown
GLP:	Yes **[ ]** No **[ ]** ? **[X]**
Remarks:	None
Reference:	Bayer AG, 1987

2.2 BOILING POINT

Value:	190 - 260 °C
Pressure:	at 1013 hPa
Decomposition:	Yes **[X]** No **[ ]** Ambiguous **[ ]**
Method:	
GLP:	Yes **[ ]** No **[ ]** ? **[X]**
Remarks:	None
Reference:	Company data

2.3 DENSITY (Relative density)

No studies located

2.4 VAPOUR PRESSURE

Value:	< 7.4 x 10^{-3} Pa
Temperature:	100 °C
Method:	calculated **[ ]**; measured **[X]** OECD Test Guideline 104 (Dynamic method)
GLP:	Yes **[X]** No **[ ]** ? **[ ]**
Remarks:	None
Reference:	MITI, Japan (1993)

2.5 PARTITION COEFFICIENT: $\log_{10}P_{ow}$

Log Pow:	0.57
Temperature:	25 °C (Water phase pH 3.2 - 3.3)
Method:	calculated **[ ]**; measured **[X]** OECD Test Guideline 107
GLP:	Yes **[X]** No **[ ]** ? **[ ]**
Remarks:	None
Reference:	MITI, Japan (1993)

2.6 WATER SOLUBILITY

A. Solubility

Value:	17.195 g/l
Temperature:	25 °C
Description:	Miscible**[ ]**; Of very high solubility **[ ]**; Of high solubility **[ ]**; Soluble **[X]**; Slightly soluble **[ ]**; Of low solubility **[ ]**; Of very low solubility **[ ]**; Not soluble **[ ]**
Method:	Unknown
GLP:	Yes **[ ]** No **[ ]** ? **[X]**
Remarks:	
Reference:	Hardy & Scargill (1959)

B. pH Value, pKa Value

pKa value:	2.32
Temperature:	25 °C
GLP:	Yes **[X]**; No **[ ]**; ? **[ ]**
Reference:	MITI, Japan (1993)

2.7 FLASH POINT

Value:	187 °C
Type of test:	Closed cup **[ ]**; Open cup **[X]**; Other **[ ]**
Method:	C. O. C. method
GLP:	Yes **[ ]** No **[X]** ? **[ ]**
Remarks:	None
Reference:	Company data

2.8 AUTO FLAMMABILITY

No studies located

2.9 FLAMMABILITY

Value:	Flame point 188 °C
Results:	Extremely flammable**[ ]**;Extremely flammable - liquified gas**[ ]**; Highly Flammable **[ ]**; Flammable **[ ]**; Non flammable **[ ]**; Spontaneously flammable in air **[ ]**; Contact with water liberates highly flammable gases **[ ]**; Other **[ ]**
Method:	Unknown
GLP:	Yes **[ ]** No **[ ]** ? **[X]**
Remarks:	None
Reference:	Bayer AG

2.10 EXPLOSIVE PROPERTIES

No studies located

2.11 OXIDIZING PROPERTIES

No studies located

2.12 OXIDATION: REDUCTION POTENTIAL

No studies located

2.13 ADDITIONAL DATA

A. Partition co-efficient between soil/sediment and water (Kd)

No studies located

B. Other data

None

3. ENVIRONMENTAL FATE AND PATHWAYS

3.1 STABILITY

3.1.1 PHOTODEGRADATION

Type:	Air **[ ]**; Water **[X]**; Soil **[ ]**; Other **[ ]**	
Light source:	Sun light **[X]**; Xenon lamp **[ ]**; Other **[ ]**	
Light spectrum:		
Relative intensity:		
Spectrum of substance:	epsilon = 7.78 at 300 nm	
Concentration of Substance:		
Estimated parameter for calculation:		
	Quantum yield	0.01
	Concentration	5×10^{-5} M
	Depth of water body	500 cm
	Conversion rate	6.023×10^{20}
Results:	Degradation rate	2.20×10^{-13}mol/l/s
	Half life	4.99 years
Reference	Lyman, W. J., W. F. Reehl and D. H. Rosenblatt, "Handbook of Chemical Property Estimation Method", McGraw Hill Book Co., 1981	

3.1.2 STABILITY IN WATER

Type:	Abiotic (hydrolysis) **[X]**; biotic (sediment)**[ ]**
Half life:	Not hydrolysed at pH 4, 7 and 9
Method:	OECD Test Guideline 111
GLP:	Yes **[X]** No **[ ]** ? **[ ]**
Test substance:	Dibutyl phosphate
Remarks:	None
Reference:	MITI, Japan (1993)

3.1.3 STABILITY IN SOIL

No studies located

3.2 MONITORING DATA (ENVIRONMENT)

No studies located

3.3 TRANSPORT AND DISTRIBUTION BETWEEN ENVIRONMENTAL COMPARTMENTS INCLUDING ESTIMATED ENVIRONMENTAL CONCENTRATIONS AND DISTRIBUTION PATHWAYS

3.3.1 TRANSPORT

No studies located

3.3.2 THEORETICAL DISTRIBUTION (FUGACITY CALCULATION)

Media:	Air-biota [ ]; Air-biota-sediment-soil-water [ ]; Soil-biota [ ]; Water-air [ ]; Water-biota [ ]; Water-soil [ ]

Other [X] (Air-soil-water-sediment)

Method: Fugacity level I [ ]; Fugacity level II [ ]; Fugacity level III [X];
Fugacity level IV [ ]; Other(calculation)[ ];Other(measurement)[ ]

Results: Steady state mass and concentration calculated using MNSEM 147S

Air:	2.4E-14 [mg/l]
Water:	2.5E-07 [mg/l]
Soil:	1.9E-06 [mg/kg dry solid]
Sediment:	1.5E-06 [mg/kg dry solid]

Exposure dose

Inhalation of air:	4.5E-10 [mg/day]
Drinking water:	5.1E-07 [mg/day]
Ingestion of fish:	3.7E-08 [mg/day]
meat:	1.4E-12 [mg/day]
milk:	2.2E-12 [mg/day]
vegetation:	2.6E-06 [mg/day]

Total exposure dose: 3.1E-06 [mg/day]

Remarks: Input data:

Molecular weight:	210.21
Water solubility:	17195 [mg/l]
Vapor pressure:	5.25E-05 [mmHg]
Log Pow:	0.57

MNSEM 147S is a slightly revised version of MNSEM 145I.
1. addition of air particle compartment to air phase
2. execution of calculation on a spreadsheet program

Table 1. Comparison of calculated environmental concentration using several methods (Japanese environmental conditions are applied to the calculations.)

Model	Air[mg/l]	Water[mg/l]	Soil[mg/kg]	Sediment[mg/kg]
MNSEM	2.4E-14	2.5E-07	1.9E-06	1.5E-06
CHEMCAN2	1.9E-14	2.6E-07	4.4E-08	2.4E-08
CHEMFRAN	1.6E-15	2.6E-07	2.8E-09	2.4E-08

Reference: EA & MITI, Japan (1993)

3.4 IDENTIFICATION OF MAIN MODE OF DEGRADABILITY IN ACTUAL USE

No studies located

3.5 BIODEGRADATION

(a)

Type:	aerobic **[X]**; anaerobic **[ ]**
Inoculum:	adapted **[ ]**; non-adapted **[X]**;
Concentration of the chemical:	100 mg/l related to COD **[ ]**; DOC **[ ]**; Test substance **[X]**;
Medium:	water **[ ];** water-sediment **[ ];** soil **[ ];** sewage treatment

	others **[X]** (Japanese standard activated sludge)
Degradation:	Degree of degradation after 28 days 2, 1 and 3 % from BOD 4, 4 and 4 % from TOC analysis 4, 6 and 6 % from GC analysis
Results:	Readily biodeg. **[ ];** Inherently biodeg. **[ ]**; under test condition no biodegradation observed **[X]**, Other **[ ]**
Method:	OECD Test Guideline 301C
GLP:	Yes **[X]** No **[ ]** ? **[ ]**
Test substance:	Dibutyl phosphate
Remarks:	None
Reference:	MITI, Japan (1993)

(b)

Type:	aerobic **[X]**; anaerobic **[ ]**
Inoculum:	adapted **[ ]**; non-adapted **[ ]**;
Concentration of the chemical:	100 mg/l related to COD **[X]**; DOC **[ ]**; Test substance **[ ]**;
Medium:	water **[ ];** water-sediment **[ ];** soil **[ ];** sewage treatment others **[X]** (activated sludge 1 g/l dry weight)
Degradation:	Degree of degradation after 21 days 3 hrs: 0 % 7 days: 9 % 14 days: 97 % 21 days: > 98 %
Results:	Readily biodeg. **[ ];** Inherently biodeg. **[X]**; under test condition no biodegradation observed **[ ]**, Other **[ ]**
Method:	OECD Test Guideline 302B
GLP:	Yes **[X]** No **[ ]** ? **[ ]**
Test substance:	Dibutyl phosphate
Remarks:	None
Reference:	Bayer AG (1988)

3.6 BOD_5,COD OR RATIO BOD_5/COD

No data are available

3.7 BIOACCUMULATION

No studies located

3.8 ADDITIONAL REMARKS None

A. Sewage treatment

B. Other information

4. ECOTOXICOLOGICAL DATA

4.1 ACUTE/PROLONGED TOXICITY TO FISH

(a)

Type of test:	static **[ ]**; semi-static **[X]**; flow-through **[ ]**; other **[ ]** open-system **[X]**; closed-system **[ ]**
Species:	*Oryzias latipes*
Exposure period:	96 hr
Results:	LC_{50} (24h) = 130 mg/l LC_{50} (48h) = 130 mg/l LC_{50} (72h) = 110 mg/l (95% confidence level: 32-350 mg/l) LC_{50} (96h) = 110 mg/l (95% confidence level: 32-350 mg/l) NOEC = LOEC =
Analytical monitoring:	Yes **[ ]** No **[X]** ? **[ ]**
Method:	OECD Test Guideline 203 (1981)
GLP:	Yes **[ ]** No **[X]** ? **[ ]**
Test substance:	Dibutyl phosphate, purity = 97.6 %
Remarks:	A group of 10 fishes were exposed to 5 nominal concentrations (18-180 mg/l) and laboratory water control.
Reference:	EA, Japan (1992)

(b)

Type of test:	static **[X]**; semi-static **[ ]**; flow-through **[ ]**; other **[ ]** open-system **[ ]**; closed-system **[ ]**
Species:	*Brachydanio rerio*
Exposure period:	96 hr
Results:	LC_{50} (24h) = LC_{50} (48h) = LC_{50} (72h) = LC_{0} (96h) = > 10,000 mg/l NOEC = LOEC =
Analytical monitoring:	Yes **[ ]** No **[ ]** ? **[X]**
Method:	Directive 67/548/EEC, C.1 (Draft from 1992)
GLP:	Yes **[X]** No **[ ]** ? **[ ]**
Test substance:	Dibutyl phosphate
Remarks:	Lethargic behavior after 2 hours at a concentration of 100 mg/l
Reference:	Bayer AG (1988)

4.2 ACUTE TOXICITY TO AQUATIC INVERTEBRATES

A. Daphnia

Type of test:	static **[X]**; semi-static **[ ]**; flow-through **[ ]**; other **[ ]**; open-system **[X]**; closed-system **[ ]**
Species:	*Daphnia magna*
Exposure period:	24 hr
Results:	EC_{50} (24h) = 210 mg/l EC_{50} (48h) = NOEC = LOEC =

Analytical monitoring:	Yes **[ ]** No **[X]** ? **[ ]**
Method:	OECD Test Guideline 202 (1984)
GLP:	Yes **[ ]** No **[X]** ? **[ ]**
Test substance:	Dibutyl phosphate, purity: = 97.6 %
Remarks:	20 daphnids (4 replicates; 5 organisms per replicate) were exposed to 5 nominal concentrations (10-100 mg/l) and laboratory water control.
Reference:	EA, Japan (1992)

B. Other aquatic organisms

No studies located

4.3 TOXICITY TO AQUATIC PLANTS e.g. Algae

Species:	*Selenastrum capricornutum* ATCC 22662
End-point:	Biomass **[X]**; Growth rate **[ ]**; Other **[ ]**
Exposure period:	72 hours
Results:	Biomass: EC_{50} (24h) =
	EC_{50} (72h) = 92 mg/l
	NOEC = 100 mg/l ($p < 0.005$)
	LOEC =
Analytical monitoring:	Yes **[ ]** No **[X]** ? **[ ]**
Method:	OECD Test Guideline 202 (1984)
	open-system **[**X**]**; closed-system **[ ]**
GLP:	Yes **[ ]** No **[X]** ? **[ ]**
Test substance:	Dibutyl phosphate, purity = 97.6%
Remarks:	The ED_{50} values were calculated based on 5 nominal concentrations (32-180 mg/l), and DMSO control (5.1 mg/l) and laboratory water control.
Reference:	EA, Japan (1992)

4.4 TOXICITY TO BACTERIA

Type:	Aquatic **[ ]**; Field **[ ]**; Soil **[ ]**; Other **[ ]**
Species:	Activated sludge
Exposure Period:	3 hrs
Results:	EC_{10} (3 hour) =
	EC_{50} (3 hour) = > 10,000 mg/l
	EC_{100} (3 hour) =
Analytical monitoring:	Yes **[ ]** No **[ ]** ? **[X]**
Method:	
GLP:	Yes **[ ]** No **[ ]** ? **[X]**
Test substance:	Dibutyl phosphate
Remarks:	Test for inhibition of oxygen consumption by activated sludge
Reference:	Bayer AG

4.5 CHRONIC TOXICITY TO AQUATIC ORGANISMS

4.5.1. CHRONIC TOXICITY TO FISH

No studies located

4.5.2. CHRONIC TOXICITY TO AQUATIC INVERTEBRATES

Type of test:	static **[ ]**; semi-static **[**X**]**; flow -through **[ ]**; other **[ ]**; open-system **[X]**; closed-system **[ ]**
Species:	*Daphnia magna*
End-point:	Mortality **[X]**; Reproduction rate **[X]**; Other **[ ]**
Exposure period:	21 day
Results:	
Mortality:	LC_{50} (24 h) = 150 mg/l (95% confidence level: 86-390 mg/l) LC_{50} (48 h) = 64 mg/l (95% confidence level: 42-110 mg/l) LC_{50} (96 h) = 43 mg/l (95% confidence level: 27- 75 mg/l) LC_{50} (7 d) = 38 mg/l (95% confidence level: 24- 68 mg/l) LC_{50} (14 d) = 35 mg/l (95% confidence level: 22- 61 mg/l) LC_{50} (21 d) = 28 mg/l (95% confidence level: 18- 44 mg/l) NOEC = LOEC =
Reproduction:	EC_{50} (14 d) = 120 mg/l EC_{50} (21 d) = 110 mg/l NOEC = 66 mg/l ($p < 0.05$) LOEC = 210 mg/l ($p < 0.05$)
Analytical monitoring:	Yes **[ ]** No **[X]** ? **[ ]**
Method:	OECD Test Guideline 202 (1984)
GLP:	Yes **[ ]** No **[X]** ? **[ ]**
Test substance:	Dibutyl phosphate, purity = 97.6 %
Remarks:	40 daphnids (4 replicates; 10 organisms per replicate) were exposed to 5 nominal concentrations (2.1-210 mg/l) and laboratory water control.
Reference:	EA, Japan (1992)

4.6 TOXICITY TO TERRESTRIAL ORGANISMS

4.6.1 TOXICITY TO SOIL DWELLING ORGANISMS

No studies located

4.6.2 TOXICITY TO TERRESTRIAL PLANTS

No studies located

4.6.3 TOXICITY TO OTHER NON MAMMALIAN TERRESTRIAL SPECIES (INCLUDING AVIAN)

No studies located

4.7 BIOLOGICAL EFFECTS MONITORING (INCLUDING BIOMAGNIFICATION)

No studies located

4.8 BIOTRANSFORMATION AND KINETICS IN ENVIRONMENTAL SPECIES

No studies located

4.9 ADDITIONAL REMARKS

None

5. TOXICITY

5.1 ACUTE TOXICITY

5.1.1 ACUTE ORAL TOXICITY

Type :	LD_0 **[ ]**; LD_{100} **[ ]**; LD_{50} **[X]**; LDL_0 **[ ]**; Other **[ ]**
Species/strain:	Rat
Value :	= 3,200 (mg/kg):
Method:	Unknown
GLP:	Yes **[ ]** No **[X]** ? **[ ]**
Test substance:	Dibutyl phosphate, purity: unknown
Remarks:	None
Reference:	NIOSH/OSHA, 1981

5.1.2 ACUTE INHALATION TOXICITY

No studies located

5.1.3 ACUTE DERMAL TOXICITY

No studies located

5.1.4 ACUTE TOXICITY, OTHER ROUTES OF ADMINISTRATION

No studies located

5.2 CORROSIVENESS/IRRITATION

5.2.1 SKIN IRRITATION/CORROSION

Species/strain:	Rabbit
Results:	Highly corrosive **[ ]**; Corrosive **[ ]**; Highly irritating **[X]**; Irritating **[ ]**; Moderate irritating **[ ]**; Slightly irritating **[ ]**; Not irritating **[ ]**
Classification:	Highly corrosive (causes severe burns) **[ ]**; Corrosive caused burns) **[ ]**; Irritating **[X]**; Not irritating **[ ]**
Method:	ear, exposure time 8hr., dose: 500µg/animal, semi-occlusive, post-exposure observation period: 7d.
GLP:	Yes **[ ]** No **[ ]** ? **[X]**
Test substance:	Dibutyl phosphate, purity: unknown
Remarks:	
Reference:	Thyssen, J. (1978)

5.2.2 EYE IRRITATION/CORROSION

Species/strain:	Rabbit
Results:	Highly corrosive **[ ]**; Corrosive **[ ]**; Highly irritating **[ ]**; Irritating **[ ]**; Moderate irritating **[ ]**; Slightly irritating **[ ]**; Not irritating **[ ]**
Classification:	Irritating **[ ]**; Not irritating **[ ]**; Risk of serious damage to eyes **[ ]**
Method:	dose: 100 µl/animal, post-exposure observation period: 7d.

test substance cause corrosion of the cornea

GLP: Yes **[ ]** No **[ ]** ? **[ ]**
Test substance:
Remarks: None
Reference: Thyssen, J. (1978)

5.3 SKIN SENSITISATION

No studies located

5.4 REPEATED DOSE TOXICITY

Species/strain: Rat (Crj:CD(SD))
Sex: Female **[ ]**; Male **[ ]**; Male/Female **[X]**; No data **[ ]**
Route of Administration: oral gavage
Exposure period: Male: 44 days including 14 days before mating
Female: from 14 days before mating to day 3 of lactation
Frequency of treatment: 7 days/week
Post exposure observation period:
Dose: 0, 30, 100, 300 or 1000 mg/kg (10 animals /group)
Control group: Yes **[X]**; No **[ ]**; No data **[ ]**;
Concurrent no treatment **[ ]**; Concurrent vehicle **[X]**; Historical **[ ]**

NOEL: 30 mg/kg/day
LOEL: 100 mg/kg/day
Results: In males receiving 100 mg/kg or more, red urine and blotted fur were observed clinically. Histopathological examinations revealed epitherial hyperplasia of the bladder mucosa which was frequently associated with mucosal degeneration and ulceration in 100 mg/kg or more groups. Food consumption was depressed in an early phase of the dosing. At a dose of 300 mg/kg or more, there was a thicked mucosa of non-glandular portion of the stomach caused by epithelial hyperplasia with hyperkeratosis. Some animals showed erosion or ulceration in gastric mucosa including glandular and non-glandular portions. At a dose of 1,000 mg/kg, cecal dilatation was accompanied by mucosal epitherial degeneration.
The body weight gain was depressed and some animals died in 1000 mg/kg groups of both sexes. The changes in mucosa of the bladder and stomach were also detected in parental females receiving 100 mg/kg or more. The fatal cases were found in the 1000 mg/kg dose group.
In the same group, the hepatocyte swelled and the liver weight increased. At a dose of 100 mg/kg or more, the pups all died in some litters at delivery or after the birth. The dams of these litters showed gastric erosion or ulceration, hepatocyte fatty change and cell vacuolation of adrenal cortex. Accordingly, the main toxic effects observed in the repeat dose toxicity test were on the stomach and the urinary bladder, the organs of dosing and excreting routes, respectively. The liver was also effected. The NOEL of repeat dose toxicity was assumed at 30 mg/kg/day for both sexes rat.
Method: OECD Combined Repeat dose and Reproductive/Developmental Screening Toxicity Test (1992)
GLP: Yes **[X]** No **[ ]** ? **[ ]**
Test substance: Commercial, purity: 62.6 %
Reference: MHW, Japan (1993a)

5.5 GENETIC TOXICITY IN VITRO

A. BACTERIAL TEST

(a)

Type :	Bacterial reverse mutation assay
System of testing:	
Species/strain:	*S. typhimurium* TA 98, TA 100, TA 1535, TA 1537, TA 1538 *E. coli* uvrA
Concentration:	0, 4.882 - 156.2 µg/plate
Metabolic activation:	With **[ ]**; Without **[ ]**; With and Without **[X]**; No data **[ ]**
Results:	
Cytotoxicity conc:	With metabolic activation: 156.2 µg/plate Without metabolic activation: 156.2 µg/plate
Precipitation conc:	
Genotoxic effects:	+ ? - With metabolic activation: **[ ] [ ] [X]** Without metabolic activation: **[ ] [ ] [X]**
Method:	Japanese Guideline for Screening Mutagenicity testing of chemicals
GLP:	Yes **[X]** No **[ ]** ? **[ ]**
Teat substance:	Commercial, purity: 62.6 %
Remarks:	Procedure: Pre-incubation. Plates/test: 3 Activation system: Liver S-9 fraction from Phenobarbital and 5,6-Benzoflavone pretreated male SD rats with NADPH-generating system Media:Histidine selective No. replicates: 2
Reference:	MHW, Japan (1993b)

(b)

Type :	Bacterial reverse mutation assay
System of testing:	
Species/strain:	*S.typhimurium* TA 98, TA 100, TA 1535, TA 1537, TA 1538
Concentration:	Unknown
Metabolic activation:	With **[ ]**; Without **[ ]**; With and Without **[X]**; No data **[ ]**
Results:	
Cytotoxicity conc:	With metabolic activation: µg/plate Without metabolic activation: µg/plate
Precipitation conc:	
Genotoxic effects:	+ ? - With metabolic activation: **[ ] [ ] [X]** Without metabolic activation: **[ ] [ ] [X]**
Method:	
GLP:	Yes **[ ]** No **[ ]** ? **[X]**
Teat substance:	Purity: Unknown
Remarks:	
Reference:	Poth, A.

B. NON-BACTERIAL IN VITRO TEST

Type :	Cytogenetics Assay
System of testing:	Species/strain: Chinese hamster CHL cells

Concentration:	Incubated with 0, 0.06-0.24 mg/ml (-S9) 0, 0.14-0.54 mg/ml (+S9)
Metabolic activation:	With **[ ]**; Without **[ ]**; With and Without **[X]**; No data **[ ]**
Results:	
Cytotoxicity conc:	With metabolic activation: 0.54 mg/ml Without metabolic activation: 0.24 mg/ml
Precipitation conc:	
Genotoxic effects:	+ ? -
	With metabolic activation: **[ ] [ ] [X]**
	Without metabolic activation: **[ ] [ ] [X]**
Method:	Japanese Guideline for Screening Mutagenicity testing of chemicals
GLP:	Yes **[X]** No **[ ]** ? **[ ]**
Test substance:	Commercial, purity 62.6 %
Remarks:	Plates/test:2 Activation system: S-9 fraction from the liver of Phenobarbital and 5,6-Benzoflavone induced male SD derived rats with NADPH-generating system No. replicates: 1
Reference:	MHW, Japan (1993b)

5.6 GENETIC TOXICITY IN VIVO

No studies located

5.7 CARCINOGENICITY

No studies located

5.8 TOXICITY TO REPRODUCTION

Type:	Fertility **[ ]**; One generation study **[ ]**; Two generation study **[ ]**; Other **[X]**
Species/strain:	Rat slc:SD
Sex:	Female **[ ]**; Male **[ ]**; Male/Female **[X]**; No data **[ ]**
Route of Administration:	Oral gavage
Exposure period:	Male: 44 days including 14 days before mating Female: from 14 days before mating to day 3 of lactation.
Frequency of treatment:	7 days/week
Postexposure observation period:	
Premating exposure period:	male: 14 days, female: 14 days
Duration of the test:	
Doses:	0, 30, 100, 300 or 1000 mg/kg (10 /animals /sex/ group)
Control group:	Yes **[X]**; No **[ ]**; No data **[ ]**; Concurrent no treatment **[ ]**; Concurrent vehicle **[X]**; Historical **[ ]**
NOEL Parental :	1000 mg/kg/day
NOEL F1 Offspring:	300 mg/kg/day
NOEL F2 Offspring:	N/A
Results:	Administration of dibutyl phosphate at dosages of 30, 100, 300 or 1000 mg/kg did not produce any significant effect on fertility or reproductive performance of either sex in parental rats. In developmental toxic ity, doses at 300 mg/kg and/or below did not cause any significant effect. At a dose of 1000 mg/kg, there was a tendency of decrease in number of live pups, especially that on day 4 of lactation and viability index due to a higher fatal

	incidence of pups in some litters at or after the birth. Statistically, decreasing in number of live female pups on day 4 of lactation was significant. In conclusion, there was no reproductive toxic effect on parental males and females even receiving 1000 mg/kg/day dose. In developmental toxicity, a tendency of decrease was evidenced in the number of live pups on day 4 of lactation and viability index at 1000 mg/kg dose. The NOEL on pups was assumed at 300 mg/kg/day.
Method:	OECD/SIDS Combined Repeated Dose and Reproductive/ Developmental Toxicity Screening Test
GLP:	Yes **[X]** No **[ ]** ? **[ ]**
Test substance:	Commercial, purity 62.6 %
Remarks:	None
Reference:	MHW, Japan (1993a)

5.9 DEVELOPMENTAL TOXICITY/ TERATOGENICITY

No studies located

5.10 OTHER RELEVANT INFORMATION

A. Specific toxicities

No studies located

B. Toxicodynamics, toxicokinetics

No studies located

5.11 EXPERIENCE WITH HUMAN EXPOSURE

None

6. REFERENCES

Bayer AG, (1987) Unpublished report.

Bayer AG (1988) Unpublished report by Bayer AG (88/042).

Company data : Unpublished company data.

EA, Japan (1992) "Investigation on the Ecotoxicological Effects of OECD High Production Volume Chemicals", Office of Health Studies, Environmental Health Department, Environment Agency, Japan (HPV/SIDS test conducted by EA, Japan)

EA & MITI, Japan (1993) Unpublished Report on Exposure Estimation (HPV/SIDS Test conducted by EA and MITI, Japan).

ECDIN database (1993).

Hardy & Scargill (1959) J. Org. Nucl. Chem., 22, 128-130.

Lyman, W. J., W. F. Reehl and D. H. Rosenblatt (1981) "Handbook of Chemical Property Estimation Method", McGraw Hill Book Co..

MHW, Japan (1993a) Unpublished Report on Combined Repeat Dose and Reproductive/Developmental Toxicity Screening Test of Dibutyl phosphate. (HPV/SIDS Test conducted by MHW, Japan).

MHW, Japan (1993b) Unpublished Report on Mutagenicity Test of Dibutyl phosphate. (HPV/SIDS Test conducted by MHW, Japan).

MITI, Japan (1993) Unpublished Report (HPV/SIDS Test conducted by MHW, Japan. Test was performed in Chemicals Inspection and Testing Institute, Japan)

NIOSH/OSHA, 1981.

Poth, A., Data of the CCR project 156802, Report No. R 4872.

Thyssen, J. (1978) Bayer AG, short report 1.9.1978.