

Aluminum phosphide; CASRN 20859-73-8

Human health assessment information on a chemical substance is included in the IRIS database only after a comprehensive review of toxicity data, as outlined in the [IRIS assessment development process](#). Sections I (Health Hazard Assessments for Noncarcinogenic Effects) and II (Carcinogenicity Assessment for Lifetime Exposure) present the conclusions that were reached during the assessment development process. Supporting information and explanations of the methods used to derive the values given in IRIS are provided in the [guidance documents located on the IRIS website](#).

STATUS OF DATA FOR Aluminum phosphide

File First On-Line 01/31/1987

Category (section)	Assessment Available?	Last Revised
Oral RfD (I.A.)	yes	01/31/1987
Inhalation RfC (I.B.)	not evaluated	
Carcinogenicity (II.)	not evaluated	

I. Chronic Health Hazard Assessments for Noncarcinogenic Effects

I.A. Reference Dose for Chronic Oral Exposure (RfD)

Substance Name — Aluminum phosphide
CASRN — 20859-73-8
Last Revised — 01/31/1987

The oral Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cellular necrosis. It is expressed in units of mg/kg-day. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. Please refer to the Background Document for an elaboration of these concepts. RfDs can also be derived for the noncarcinogenic health effects of

substances that are also carcinogens. Therefore, it is essential to refer to other sources of information concerning the carcinogenicity of this substance. If the U.S. EPA has evaluated this substance for potential human carcinogenicity, a summary of that evaluation will be contained in Section II of this file.

I.A.1. Oral RfD Summary

Critical Effect	Experimental Doses*	UF	MF	RfD
Body weight and clinical parameters	NOAEL: 0.51 mg/kg of food or 0.025 mg/kg/day (phosphine) converted to 0.043 mg/kg/day aluminum phosphide	100	1	4E-4 mg/kg/day
Rat Chronic Oral Study Hackenburg, 1972	LOAEL: none			

*Conversion Factors: Food consumption: 5% bw; molecular weight: AlP/PH₃: x 57.95/34.0 thus, 0.51 mg/kg of food x 0.05 kg food/kg bw/day x 57.95/34.0 = 0.043 mg/kg/day

I.A.2. Principal and Supporting Studies (Oral RfD)

Hackenburg, U. 1972. Chronic ingestion by rats of standard diet treated with aluminum phosphide. *Toxicol. Appl. Pharmacol.* 23(1): 147-158.

Aluminum phosphide pellets and tablets (Phastoxin) are used as fumigants for wheat and other grains (Dieterich et al., 1967). Upon exposure to moisture in the air, they immediately decompose to phosphine gas, with little trace residue of phosphide remaining, which could be lost in handling of the grain.

A chronic feeding study of aluminum phosphide-fumigated chow fed to 30 rats/sex was conducted by Hackenburg (1972). The average concentration was 0.51 mg phosphine/kg food for a 2-year period. At the end of the treatment period, there were no differences between treated and control rats in blood or urine chemistry, or histologic parameters.

The phosphine gas measured in the Hackenburg (1972) study was liberated by decomposition of aluminum phosphide pellets. Acute toxicity data generated (Sax, 1984) suggest that the phosphide moiety contributes the most to the acute toxicity of this compound, as opposed to any deleterious effect due to aluminum cation. The steep slope of the dose-response curve of phosphine gas (Klimmer, 1969) implies that phosphine is extremely hazardous at doses slightly above a NOEL. Therefore, it is appropriate to derive an RfD for aluminum phosphide based upon the RfD for phosphine.

I.A.3. Uncertainty and Modifying Factors (Oral RfD)

UF — After correcting for the molecular weight of aluminum phosphide relative to that of phosphine (57.95/34.00), and by application of an uncertainty factor of 100 (10 for interspecies conversion and 10 for sensitive population), an RfD for aluminum phosphide of 0.00043 (0.00025 mg/kg/day phosphine x 1.70) can be derived.

MF — None

I.A.4. Additional Studies/Comments (Oral RfD)

The ACGIH (1980) has recommended a TLV of 0.3 ppm (0.42 mg/cu.m) for phosphine, based principally upon an epidemiologic study by Jones (1964) where workers were exposed intermittently to about 10 ppm phosphine gas. Based on this TLV, an RfD of 0.0021 mg/kg/day (i.e., 0.42 mg/cu.m x 10 cu.m/day x 5 day/7 day x 0.5/70 kg/10 = 0.0021 mg/kg/day) can be derived. However, an RfD for phosphine of 0.00025 mg/kg/day based on the 2-year rat study by Hackenburg (1972) (described above) has been derived for providing adequate protection against adverse human health effects.

I.A.5. Confidence in the Oral RfD

Study — Medium

Database — Medium

RfD — Medium

The confidence in the study was rated medium because of the moderate number of animals/dose, the extensive methodology employed to assure proper administration of the test compound, and the extensive number of parameters measured; however, only one dose was used. The database was rated medium because the effectiveness and safety of this chemical has been reported through supporting studies. The overall rating for the RfD is, thus, medium.

I.A.6. EPA Documentation and Review of the Oral RfD

Source Document — This assessment is not presented in any existing U.S. EPA document.

Other EPA Documentation — None

Agency Work Group Review — 08/19/1985

Verification Date — 08/19/1985

Screening-Level Literature Review Findings — A screening-level review conducted by an EPA contractor of the more recent toxicology literature pertinent to the RfD for aluminum phosphide conducted in August 2003 identified one or more significant new studies. IRIS users may request the references for those studies from the IRIS Hotline at hotline.iris@epa.gov or 202-566-1676.

I.A.7. EPA Contacts (Oral RfD)

Please contact the IRIS Hotline for all questions concerning this assessment or IRIS, in general, at (202)566-1676 (phone), (202)566-1749 (FAX) or hotline.iris@epa.gov (internet address).

I.B. Reference Concentration for Chronic Inhalation Exposure (RfC)

Substance Name — Aluminum phosphide

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Not available at this time.

II. Carcinogenicity Assessment for Lifetime Exposure

Substance Name — Aluminum phosphide

CASRN — 20859-73-8

This substance/agent has not undergone a complete evaluation and determination under US EPA's IRIS program for evidence of human carcinogenic potential.

III. [reserved]

IV. [reserved]

V. [reserved]

VI. Bibliography

Substance Name — Aluminum phosphide

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VI.A. Oral RfD References

ACGIH (American Conference of Governmental Industrial Hygienists). 1980. Documentation of the Threshold Limit Values, 4th ed. ACGIH, Cincinnati, OH. p. 13-14, 337-338.

Dieterich, W.H., G. Mayr, K. Hild, J.B. Sullivan and J. Murphy. 1967. Hydrogen phosphide as a fumigant for foods, feeds and processed food products. *Residue Rev.* 19: 135-149.

Hackenburg, U. 1972. Chronic ingestion by rats of standard diet treated with aluminum phosphide. *Toxicol. Appl. Pharmacol.* 23(1): 147-158.

Jones, A.T., R.C. Jones and E.Q. Longely. 1964. Environmental and clinical aspect of bulk wheat fumigation with aluminum phosphide. *Am. Ind. Hyg. Assn. J.* 25: 376-379.

Klimmer, O.R. 1969. Contributions to the study of the action of phosphine (PHs). The question of the so-called chronic phosphine poisoning. *Arch. fur Tox.* 24: 164-167.

Sax, N.I. 1984. *Dangerous Properties of Industrial Materials.* Van Nostrand Reinhold Co., Inc., NY. p. 175-179.

VI.B. Inhalation RfC References

None

VI.C. Carcinogenicity Assessment References

None

VII. Revision History

Substance Name — Aluminum phosphide

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Date	Section	Description
10/28/2003	I.A.6.	Screening-Level Literature Review Findings message has been added.

VIII. Synonyms

Substance Name — Aluminum phosphide

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Last Revised — 01/31/1987

- 20859-73-8
- AIP
- Al-Phos
- Aluminum Monophosphide
- Aluminum Phosphide
- Celphos
- Delicia
- Delicia Gastoxin
- Detia
- Detia-EX-B
- Phostoxin
- Phostoxin-A
- Quickphos