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## GREENSCREEN® SUMMARY REPORT

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### DOCUMENT STATUS

v.1

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**REPORT TITLE** | GreenScreen® Version 1.4 Summary Results for Aluminum Diethylphosphinate (CAS #225789-38-8)

**CHEMICAL NAME** | Aluminum Diethylphosphinate

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## **INTRODUCTION**

This report presents the results of a GreenScreen® for Safer Chemicals assessment (version 1.4) for aluminum diethylphosphinate (CAS #225789-38-8) (ToxServices 2019). Thousands of chemicals have undergone GreenScreen® assessments since Clean Production Action published version 1.0 of the GreenScreen® for Safer Chemicals methodology in 2009. Of note, Clariant Plastics and Coatings (Deutschland) GmbH was an early adopter of GreenScreen®. Clariant's aluminum diethylphosphinate was one of the first chemicals to undergo a GreenScreen® assessment, as reflected by this chemical's low GreenScreen® document control number ("GS-4"), which indicates that it was the fourth chemical assessed by ToxServices under CPA's GreenScreen® methodology (ToxServices 2010). This GreenScreen® assessment has been updated over the years to incorporate additional health effects and environmental studies performed on aluminum diethylphosphinate, as well as updates to GreenScreen® assessment methodology.

This summary report reflects the most recent GreenScreen® assessment for aluminum diethylphosphinate completed by ToxServices (ToxServices 2019).

## **OVERVIEW: ALUMINUM DIETHYLPHOSPHINATE**

Aluminum diethylphosphinate is an organophosphorus salt that functions as a flame retardant for engineering plastics such as polyamides, polyesters, and thermoset resins. It has high temperature stability, is insoluble in water and organic solvents, and owes its efficiency to its high phosphorus content (23-24%). Aluminum diethylphosphinate is marketed by Clariant Corp. under tradenames such as Exolit OP 1230, Exolit OP 1240, Exolit OP 930, Exolit OP 935, and Exolit OP 945. These tradename ingredients differ by particle size (5 to 40 µm) and production process variations. Aluminum diethylphosphinate is used on its own in plastics like polyamides and polyesters or thermosets such as epoxy resins. In addition, it is combined with nitrogen-containing and other synergists such as melamine polyphosphate or cyanurate to impart flame retardancy in polymers such as polyamides (Braun et al. 2007, 2008).

## **GREENSCREEN® FOR SAFER CHEMICALS FRAMEWORK**

The GreenScreen® for Safer Chemicals is a chemical screening method designed to identify less hazardous chemicals using a standardized approach that considers both human health endpoints and environmental fate and toxicity endpoints (CPA 2018). A GreenScreen® chemical hazard assessment can identify substances that are inherently less hazardous for humans and the environment, and effectively manages chemical risk by reducing hazard rather than controlling exposure to potentially toxic chemicals.

Under the GreenScreen® for Safer Chemicals (version 1.4) criteria (CPA 2018), chemicals are assessed according to the following six steps (see Appendix A):

1. Identify chemical to assess.
2. Research (collect and review toxicological data and authoritative/screening lists).
3. Classify hazards for 18 endpoints against endpoint-specific criteria.

4. Identify environmental transformation products.
5. Assess environmental transformation products.
6. Assign a GreenScreen Benchmark™ Score.

Each of the 18 hazard endpoints relates to human health effects, aquatic toxicity, or flammability / reactivity. Each hazard endpoint is given a score of Very Low hazard (vL), Low hazard (L), Moderate hazard (M), High hazard (H), or Very High hazard (H).

As shown in Appendix B, Figure B-1, the combination of hazards for the 18 endpoints translates to a GreenScreen Benchmark™ Score, which expresses decreasing hazard with increasing Benchmark scores in following order:

- Benchmark One: Avoid (Chemical of High Concern)
- Benchmark Two: Use (But Search for Safer Substitutes)
- Benchmark Three: Use (But Still Opportunity for Improvement)
- Benchmark Four: Prefer (Safer Chemical)

In addition, chemicals that have insufficient data or data gaps for specific hazard endpoints are assigned a Benchmark™ Score of Unspecified (“U”).

### GREENSCREEN® HAZARD ASSESSMENT RESULTS FOR ALUMINUM DIETHYLPHOSPHINATE

ToxServices assigned aluminum diethylphosphinate a **GreenScreen Benchmark™ Score of 3** (“Use but Still Opportunity for Improvement”) (CPA 2018). This score is based on the following hazard score: **Very High Persistence-P**. As shown in Table 1, below, a data gap (DG) exists for endocrine activity-E. As outlined in GreenScreen® Guidance Section 11.6.2.1 and Annex 5 (Conduct a Data Gap Analysis) (CPA 2018), aluminum diethylphosphinate meets requirements for a GreenScreen® Benchmark Score of 3, despite the hazard data gap. In a worst-case scenario, if aluminum diethylphosphinate were assigned a High score for the data gap endocrine activity-E, or a Very High score for single dose systemic toxicity-STs or single dose neurotoxicity-Ns, it would be categorized as a Benchmark 1 chemical.

#### GreenScreen® Benchmark Score for Relevant Route of Exposure:

As a standard approach for GreenScreen® evaluations, all exposure routes (oral, dermal, and inhalation) are evaluated together, so the GreenScreen® Benchmark Score of 3 (“Use but Still Opportunity for Improvement”) is applicable for all routes of exposure.

**Table 1: GreenScreen® Hazard Summary Table for Aluminum Diethylphosphinate**

Group I Human					Group II and II* Human								Ecotox		Fate		Physical		
C	M	R	D	E	AT	ST		N		SnS*	SnR*	IrS	IrE	AA	CA	P	B	Rx	F
						single	repeated*	single	repeated*										
<i>L</i>	<i>L</i>	<i>L</i>	<i>L</i>	DG	<b>L</b>		<b>L</b>		<b>L</b>	<b>L</b>	<i>L</i>	<b>L</b>	<b>L</b>	<b>L</b>	<b>L</b>	<i>vH</i>	<i>vL</i>	<i>L</i>	<b>L</b>

Note: Hazard levels (Very High (vH), High (H), Moderate (M), Low (L), Very Low (vL)) in *italics* reflect lower confidence in the hazard classification while hazard levels in **BOLD** font reflect higher confidence.

Group II Human Health endpoints differ from Group II\* Human Health endpoints in that they have four hazard scores (i.e., vH, H, M, and L) instead of three (i.e., H, M, and L), and are based on single instead of repeated exposures. Group II\* Human Health endpoints are indicated by an \* after the name of the hazard endpoint or after “repeat” for repeated exposure sub-endpoints. Please see Appendix C for a glossary of hazard acronyms.

## REFERENCES

Braun, U., H. Bahr, H. Sturm, and B. Schartel. 2008. Flame retardancy mechanisms of metal phosphinates and metal phosphinates in combination with melamine cyanurate in glass-fiber reinforced poly(1,4-butylene terephthalate): The influence of metal cation. *Polymers for Adv. Technologies* 19(6):680-692.

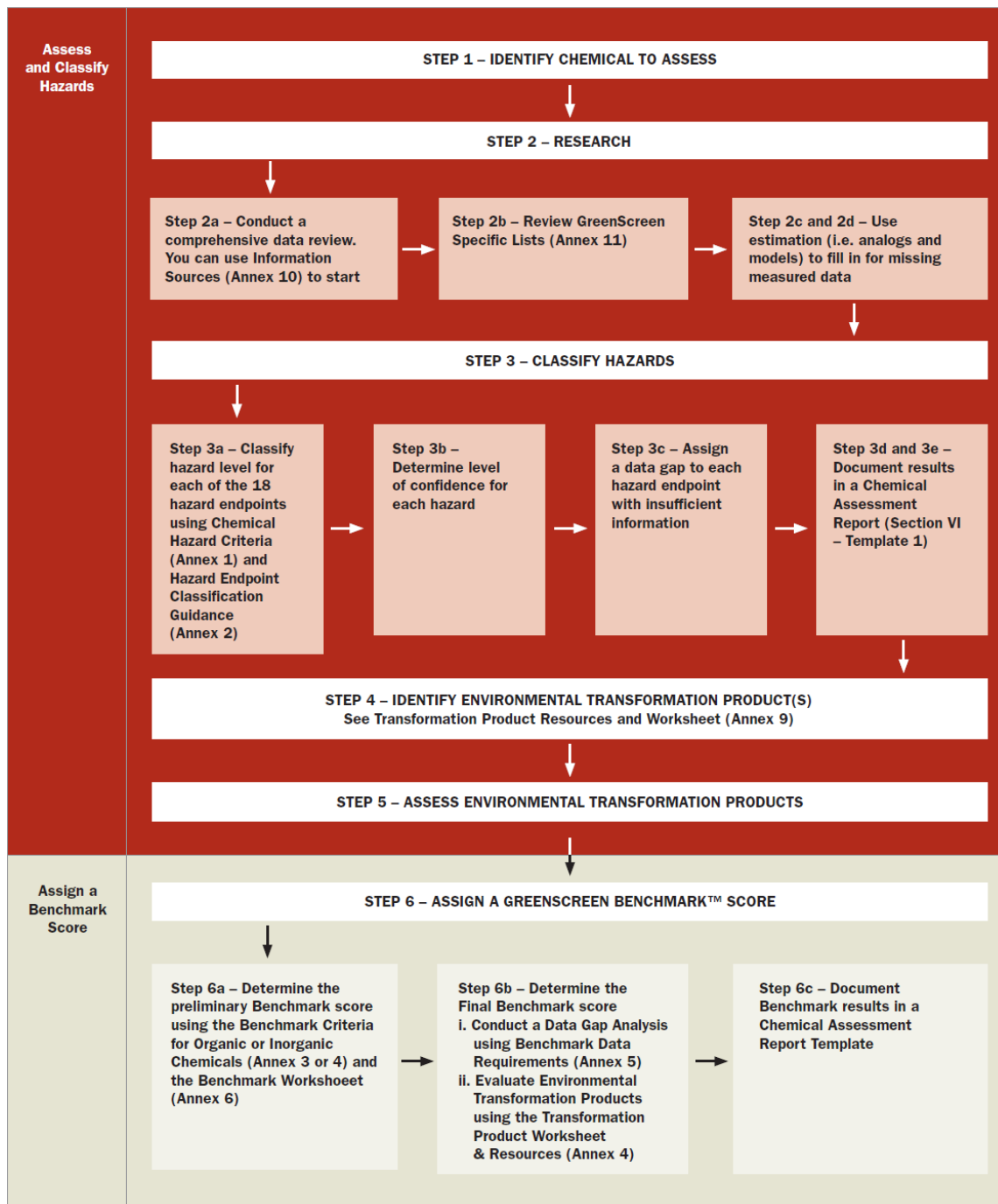
Braun, U., B. Schartel, M. Fichera. 2007. Flame retardancy mechanisms of aluminum phosphinate in combination with melamine polyphosphate and zinc borate in glass-fibre reinforced polyamide 6,6. *Polymer Degradation and Stability* 92(8):1528-1545.

Clean Production Action (CPA). 2018. The GreenScreen® for Safer Chemicals Guidance. Version 1.4 Guidance. Dated January 2018. Available: [https://www.greenscreenchemicals.org/static/ee\\_images/uploads/resources/GreenScreen\\_Guidance\\_v1\\_4\\_2018\\_01\\_Final.pdf](https://www.greenscreenchemicals.org/static/ee_images/uploads/resources/GreenScreen_Guidance_v1_4_2018_01_Final.pdf)

ToxServices. 2010. Aluminum Diethylphosphinate (CAS #225789-38-8) GreenScreen® for Safer Chemicals Assessment. GS-4. Version 1.0. Dated August 15, 2010.

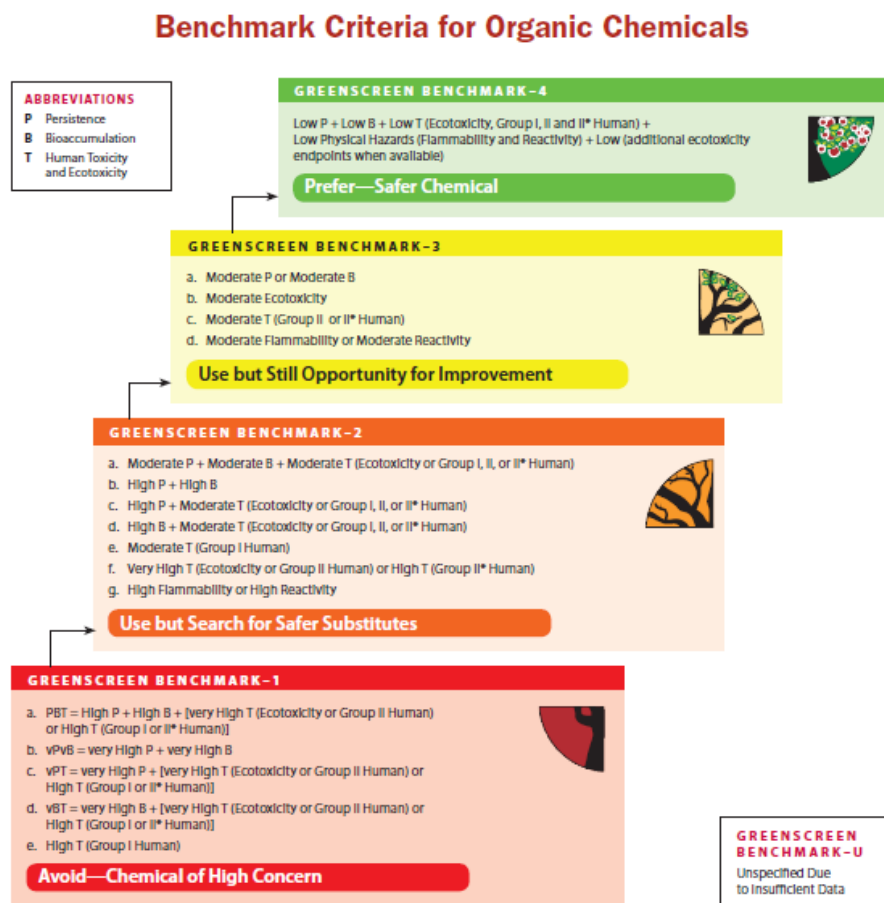
ToxServices. 2019. Aluminum Diethylphosphinate (CAS #225789-38-8) GreenScreen® for Safer Chemicals Assessment. GS-4. Version 1.4. Dated September 11, 2019. Available: <https://database.toxservices.com/>

**APPENDIX A: GREENSCREEN® CHEMICAL ASSESSMENT PROCESS  
(REPRODUCED FROM CPA 2018)**



**APPENDIX B: GREENSCREEN® BENCHMARK TABLE**  
(Reproduced from CPA 2018)

**Figure B-1: GreenScreen® Benchmarks**



See Section 11.6 for instructions.

**Group I Human** includes Carcinogenicity, Mutagenicity/Genotoxicity, Reproductive Toxicity, Developmental Toxicity (incl. Developmental Neurotoxicity), and Endocrine Activity. **Group II Human** includes Acute Mammalian Toxicity, Systemic Toxicity/Organ Effects-Single Exposure, Neurotoxicity-Single Exposure, Eye Irritation and Skin Irritation. **Group II\* Human** includes Systemic Toxicity/Organ Effects-Repeated Exposure, Neurotoxicity-Repeated Exposure, Respiratory Sensitization, and Skin Sensitization. Immune System Effects are included in Systemic Toxicity/Organ Effects. **Ecotoxicity** includes Acute Aquatic Toxicity and Chronic Aquatic Toxicity.

\* For inorganic chemicals, see "Annex 4: Benchmark Criteria for Inorganic Chemicals."

**APPENDIX C: GREENSCREEN® HAZARD BENCHMARK ACRONYMS  
(alphabetical order)**

- (AA) Acute Aquatic Toxicity**
- (AT) Acute Mammalian Toxicity**
- (B) Bioaccumulation**
- (C) Carcinogenicity**
- (CA) Chronic Aquatic Toxicity**
- (D) Developmental Toxicity**
- (E) Endocrine Activity**
- (F) Flammability**
- (IrE) Eye Irritation/Corrosivity**
- (IrS) Skin Irritation/Corrosivity**
- (M) Mutagenicity and Genotoxicity**
- (N) Neurotoxicity**
- (P) Persistence**
- (R) Reproductive Toxicity**
- (Rx) Reactivity**
- (SnS) Sensitization- Skin**
- (SnR) Sensitization- Respiratory**
- (ST) Systemic/Organ Toxicity**