

GreenScreen® Assessment for [Ammonium Polyphosphate (CAS#68333-79-9)]

Method Version: GreenScreen® Version 1.2¹

Verified or Non-Verified²: NON-VERIFIED

Introduction^{3,4,5}

This GreenScreen assessment is based on the information reported in the corresponding chemical hazard profile in “An Alternatives Assessment for the Flame Retardant Decabromodiphenyl ether (DecaBDE) Final Report”³. Additional information on hazard endpoints beyond what was included in the final report was not sought with the exception of reactivity. Hazard classification information for reactivity was supplemented because it is not included in the DfE report but is needed to apply the GreenScreen Benchmark system.

Hazard classification levels reported in the DfE profiles and in this GreenScreen report may differ due to differences between criteria as defined in the DfE “Alternatives Assessment Criteria for Hazard Evaluation”⁴ and the GreenScreen for Safer Chemicals v1.2 methods⁵. Any differences in interpretation are explained and justified in this GreenScreen report.

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Licensed Profiler or Certified Practitioner (specify): N/A	

Confirm application of the *Disclosure and Assessment Rules and Best Practice*⁶: (List any deviations)

Disclosure thresholds applied by DfE are unclear in the DfE report.

¹ Use GreenScreen® Assessment Procedure (Guidance) V1.2

² “NON-VERIFIED” means that Verification Has Not Been Performed on this GreenScreen Assessment

³ An Alternatives Assessment for the Flame Retardant Decabromodiphenyl ether (DecaBDE) Final Report Available at: <http://www.epa.gov/DfE/pubs/projects/decaBDE/deca-report-complete.pdf>; p 4-70

⁴ Available at: http://www.epa.gov/DfE/alternatives_assessment_criteria_for_hazard_eval.pdf, accessed 10/2013.

⁵ Details available at: <http://www.cleanproduction.org/Greenscreen.v1-2.php>, accessed 10/2013.

⁶ See GreenScreen Guidance V1.2 Section 8

Chemical Name (CAS #):

Ammonium Polyphosphate (CAS#68333-79-9)

Also Called:

Polyphosphoric acids, ammonium salts (TSCA Inventory); Ammonium polyphosphate, Ammonium polyphosphates, EINECS 269- 789-9, Polymetaphosphoric acid, ammonium salt, Polyphosphoric acid, ammonium salt,

Tradenames:

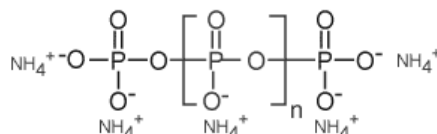
Exolit® AP 422, Exolit® AP 423, Exolit® AP 462, APP (fireproofing agent), Albaplas AP 95, Amgard CL, Amgard MC, Amgard TR, Antiblaze MC, Antiblaze MCM, Budit 3076, Budit 3076DC, Budit 3077, Budit 365, DFP-I, FR-Cros 480, FR-Cros 484, Fire-Trol LCG-R, Flameguard PT 8, Novawhite, Phos-Chek P 30, Phos-Chek P 40, Phos-Chek P 60, Poly-N 10-34-0, Poly-N 11-37-0, Sumisafe, Taien A, Taien H; [Produced by Hoechst as Hostaflam, since 1998 as Exolit® from Clariant:] Hostaflam 423, Hostaflam AP 420, Hostaflam AP 422, Hostaflam AP 462, Hostaflam AP 464, Hostaflam TP-AP 751, Hostaflam TP-AP 752

Suitable analogs or moieties of chemicals used in this assessment (CAS #'s):

No analogs

Chemical Structure(s):

*Note: Include chemical structure(s) of all suitable analogs (and /or moieties) used in the assessment.

**Notes related to production specific attributes⁷:****For Inorganic Chemicals and relevant particulate organics (if not relevant, list NA)****Define Properties:**

1. Particle size (e.g., silica of respirable size): not reported⁸
2. Structure (e.g., amorphous vs. crystalline): not reported
3. Mobility (e.g., water solubility, volatility): not reported
4. Bioavailability: Absorption is not expected for any route of exposure. This inorganic polymer moiety is large with a MW >1,000. Based on professional judgment, it is expected to have limited bioavailability and therefore is not expected to be readily absorbed, distributed or metabolized in the body.

⁷ Note any composition or hazard attributes of the chemical product relevant to how it is manufactured. For example, certain synthetic pathways or processes result in typical contaminants, by-products or transformation products. Explain any differences between the manufactured chemical product and the GreenScreen assessment of the generic chemical by CAS #.

⁸ While ammonium polyphosphate is an inorganic chemical, information to address items 1-3 is not available in the DfE report.

For Polymeric Materials: (delete this section if not a polymeric material)
Identify Monomers and Corresponding Properties

According to the DfE report, “High-molecular ammonium polyphosphate ($n > 50$) with a minimum of water-soluble fractions is being used to an increasing extent in flame retardants (Gard, 2005; Schrödter et al., 2005). These insoluble ammonium polyphosphates are long chain, ionic phosphate polymers with the following molecular formula: $(\text{NH}_4)_k \cdot \text{H}(n+2-k)\text{PnO}(3n+1)$, where n typically can range from 70 (Wanjie International Co., 2007) to $>1,000$ (Pinfa, 2010). Molecular weights (MW) can be as high as 100,000 g/mole and oligomers with a MW $<1,000$ are not expected. The high MW inorganic polymer was assessed as a non-bioavailable material. Prior assessments for similar polyphosphates evaluated the lower, water soluble moieties, which also have application as a flame retardant.”⁹

1. % of Each Monomer
 - a) Monomer 1
 - b) Monomer 2
 - c) Monomer 3
2. Are the monomers blocked? (Y/N)
3. Molecular Weight (MW) of polymeric material
4. % of polymeric material with
 - a) MW <500
 - b) MW $<1,000$
5. % Weight Residual Monomers
6. Solubility/Dispersability/Swellability
7. Particle size
8. Overall charge of polymeric material
9. Identify constituents and residual concentrations of
 - a) Catalysts
 - b) Processing aids
10. Identify any monomers, oligomers, catalysts or processing aids classified as Benchmark 1 according to the hazard identification lists in the GreenScreen List Translator.

Identify Applications/Functional Uses:
(e.g., Cleaning product, TV casing)

1. Flame Retardant

GreenScreen Benchmark Score and Hazard Summary Table:^{10,11,12,13}

Ammonium polyphosphate was assigned a **Benchmark Score of 3** based on moderate skin irritation (Group 2). Because ammonium polyphosphate is an inorganic chemical, persistence is considered only in combination with Group 1, Group 2* and chronic aquatic toxicity endpoints. Ammonium

⁹ An Alternatives Assessment for the Flame Retardant Decabromodiphenyl ether (DecaBDE) Final Report Available at: <http://www.epa.gov/DfE/pubs/projects/decaBDE/deca-report-complete.pdf>; p 4-70

¹⁰ See Appendix A for a glossary of hazard endpoint acronyms

¹¹ See Appendix B for alternative GreenScreen Hazard Summary Table (Classification presented by exposure route)

¹² For inorganic chemicals only, see GreenScreen Guidance V1.2 Section 14.4. (Exceptions for Persistence)

¹³ For Systemic Toxicity and Neurotoxicity, repeated exposure data are preferred. Lack of single exposure data is not a Data Gap when repeated exposure data are available. In that case, lack of single exposure data may be represented as NA instead of DG. See GreenScreen Guidance V1.2 Section 9.3.

polyphosphate could be Benchmark 1 if the data gap for respiratory sensitization was filled with data indicating a high hazard score.

Green Screen Hazard Ratings: [<i>Ammonia polyphosphate</i>]																			
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*										
L	L	L	L	L	L		L		L	L	DG	M	L	L	L	vH	vL	L	L

Note: Hazard levels (Very High (vH), High (H), Moderate (M), Low (L), Very Low (vL)) in *italics* reflect estimated values, authoritative B lists, screening lists, weak analogues, and lower confidence. Hazard levels in **BOLD** font are used with good quality data, authoritative A lists, or strong analogues. 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 exposures instead of repeated exposures.

Environmental Transformation Products and Ratings¹⁴:

Identify feasible and relevant environmental transformation products (i.e., dissociation products, transformation products, valence states) and/or moieties of concern¹⁵

Functional Use	Life Cycle Stage	Transformation Pathway	Environmental Transformation Products	CAS #	Feasible and Relevant?	GreenScreen List Translator Score or GreenScreen Benchmark Score
			Ammonia	7664-41-7	No ¹⁶	LT-P1 (Pharos)
			Phosphate	7722-76-1	No ¹⁵	LT-U (no hazard listings Pharos)

¹⁴ See GreenScreen Guidance V1.2 Section 13

¹⁵ A moiety is a discrete chemical entity that is a constituent part or component of a substance. A moiety of concern is often the parent substance itself for organic compounds. For inorganic compounds, the moiety of concern is typically a dissociated component of the substance or a transformation product.

¹⁶ Ammonia and phosphate are not considered relevant transformation products because they are nutrients; and if formed, would be formed slowly and degraded quickly.

Hazard Classification Summary Section:

For all hazard endpoints:

- **Search all GreenScreen specified lists. Report relevant results either in each hazard endpoint section or attach to the end of the report.**
- **Always indicate if suitable analogs or models were used.**
- **Attach modeling results (See Appendix C).**
- **Include all references either in each hazard endpoint section or at the end of the report.**

Group I Human Health Effects (Group I Human)

Carcinogenicity (C) Score (H, M or L): *L*

Ammonium polyphosphate was assigned a score of LOW for Carcinogenicity based on a low score within the EPA's DfE alternatives assessment. The low designation in both GreenScreen and EPA's alternatives assessment are based on the same measured endpoints. The score was based on expert judgment within EPA's alternatives assessment and therefore is reported in italics within the GreenScreen assessment.

The summary provided within the EPA's alternatives assessment was as follows:

LOW: This polymer is large, with a MW >1,000. It is expected to have few to no residual monomers. Additionally, crosslinking, swellability, dispersability, reactive functional groups, inhalation potential, and hindered amine groups are not expected. Therefore, there is low potential for carcinogenicity based on professional judgment and the SF polymer assessment guidance. No data located.

Mutagenicity/Genotoxicity (M) Score (H, M or L): *L*

Ammonium polyphosphate was assigned a score of LOW for Mutagenicity based on a low score within the EPA's DfE alternatives assessment. The low designation in both GreenScreen and EPA's alternatives assessment are based on the same measured endpoints. The score was based on empirical data (Negative, Ames assay) within EPA's alternatives assessment; however this data was from a secondary source and therefore reported in italics within the GreenScreen assessment.

The summary provided within the EPA's alternatives assessment was as follows:

LOW: This polymer is large, with a MW >1,000. It is expected to have limited bioavailability and therefore has low potential for genotoxicity. Negative, Ames assay, Salmonella Typhimurium TA98, TA100, TA1535, TA1537, TA1538, and E. coli WP2uvrA; with and without metabolic activation.

Reproductive Toxicity (R) Score (H, M, or L): *L*

Ammonium polyphosphate was assigned a score of LOW for Reproductive Toxicity based on a low score within the EPA's DfE alternatives assessment. For reproductive toxicity, EPA's DfE uses numerical data quantifying the hazard associated with the 3 different hazard levels, whereas GreenScreen does not base the hazard score on a numerical rating system but bases classifications on listing under GHS, the EU, and NTP. Therefore the conversion of DfE's developmental and reproductive toxicity conclusions to comparable GreenScreen hazard scores is done on a case by case basis. DfE's low score was based on expert judgment due to the size of the molecule and the limited bioavailability. The score was based on expert judgment within EPA's alternatives assessment and therefore is reported in italics within the GreenScreen assessment.

The summary provided within the EPA's alternatives assessment was as follows:

LOW: This polymer is large, with a MW >1,000. It is expected to have limited bioavailability and therefore has low potential for reproductive effects based on professional judgment and the SF polymer assessment guidance. No data located.

Developmental Toxicity incl. Developmental Neurotoxicity (D) Score (H, M or L): *L*

Ammonium polyphosphate was assigned a score of LOW for Developmental Toxicity based on a low score within the EPA's DfE alternatives assessment. For developmental toxicity, EPA's DfE uses numerical data quantifying the hazard associated with the 3 different hazard levels, whereas Green-Screen does not base the hazard score on a numerical rating system but bases classifications on listing under GHS, the EU, and NTP. Therefore the conversion of DfE's developmental and reproductive toxicity conclusions to comparable GreenScreen hazard scores is done on a case by case basis. DfE's low score was based on expert judgment within EPA's Alternatives assessment and therefore is reported in italics within the GreenScreen assessment.

The summary provided within the EPA's alternatives assessment was as follows:

LOW: This polymer is large, with a MW >1,000. It is expected to have limited bioavailability and therefore has low potential for developmental effects based on professional judgment and SF polymer assessment guidance. No data located.

Endocrine Activity (E) Score (H, M or L): *L*

Ammonium polyphosphate was assigned a score of LOW for Endocrine Activity based on conclusions presented within the EPA's DfE alternatives assessment. This conclusion was based on expert judgment due to the size of the molecule and the ready metabolism. The score was based on expert judgment within EPA's alternatives assessment and therefore is reported in italics within the GreenScreen assessment.

The summary provided within the EPA's alternatives assessment was as follows:

This polymer is large, with a MW >1,000. It is not expected to have endocrine activity due to its poor bioavailability and inability to be readily metabolized in the body based on professional judgment.

Group II and II* Human Health Effects (Group II and II* Human)

Note: Group II and Group II endpoints are distinguished in the v 1.2 Benchmark system (the asterisk indicates repeated exposure). For Systemic Toxicity and Neurotoxicity, Group II and II* are considered sub-endpoints. When classifying hazard for Systemic Toxicity/Organ Effects and Neurotoxicity endpoints, repeated exposure results are required and preferred. Lacking repeated exposure results in a data gap. Lacking single exposure data does not result in a data gap when repeated exposure data are present (shade out the cell in the hazard table and make a note). If data are available for both single and repeated exposures, then the more conservative value is used.*

Acute Mammalian Toxicity (AT) Group II Score (vH, H, M or L): *L*

Ammonium polyphosphate was assigned a score of LOW for Acute Mammalian Toxicity. The low designation for acute mammalian toxicity in both GreenScreen and EPA's alternatives assessment are based on the same measured endpoints. The score was based on empirical data within EPA's Alternatives assessment and therefore is not reported in italics within the GreenScreen assessment.

The summary provided within the EPA's alternatives assessment was as follows:

LOW: This polymer is large, with a MW >1,000. It is expected to have limited bioavailability and therefore is of low potential for acute mammalian toxicity. This low hazard designation is also

supported by a rat oral median lethal dose (LD₅₀) of >2,000 mg/kg, a rat dermal LD₅₀ of >2,000 mg/kg and a 4-hour rat median lethal concentration (LC₅₀) of >5.09 mg/L.

Systemic Toxicity/Organ Effects incl. Immunotoxicity (ST)

(ST-single) Group II Score (single dose: vH, H, M or L): N/A

Ammonium polyphosphate was assigned a score of NOT APPLICABLE (N/A) for Systemic Toxicity/Organ Effects based on single exposure. Data were not provided by EPA on single dose toxicity for systemic toxicity/organ effects. Using GreenScreen criteria, absence of single dose data is not considered a data gap as long as data are available for repeated dose.

DfE evaluates Systemic Toxicity based on repeated exposures. Lack of data for Systemic Toxicity based on a single exposure does not constitute a data gap when data for repeated exposures are available.

(ST-repeat) Group II* Score (repeated dose: H, M, L): *L*

Ammonium polyphosphate was assigned a score of LOW for Systemic Toxicity/Organ Effects based on repeated exposure. The low designation for systemic toxicity/organ effects based on repeated exposure in both GreenScreen and EPA's alternatives assessment are based on the same measured endpoints. The score was based on expert judgment within EPA's alternatives assessment and therefore is reported in italics within the GreenScreen assessment.

The summary provided within the EPA's alternatives assessment was as follows:

LOW: This polymer is large, with a MW >1,000. It is expected to have limited bioavailability; however, because the MW is >10,000, there is the possibility of lung overloading if >5% of the particles are in the respirable range as a result of dust forming operations. No experimental data located.

In addition, this polymer is large, with a MW >1,000. It is expected to have limited bioavailability and therefore has low potential for immunotoxicity based on professional judgment and the SF polymer assessment guidance. No data located.

Neurotoxicity (N)

(N-single) Group II Score (single dose: vH, H, M or L): N/A

Ammonium polyphosphate was assigned a score of NOT APPLICABLE (N/A) for Neurotoxicity based on single exposure. Data were not provided by EPA on single dose toxicity for neurotoxicity. Using GreenScreen criteria, absence of single dose data is not considered a data gap as long as data are available for repeated dose.

DfE evaluates Neurotoxicity based on repeated exposures. Lack of data for Neurotoxicity based on a single exposure does not constitute a data gap when data for repeated exposures are available.

(N-repeat) Group II* Score (repeated dose: H, M, L): *L*

Ammonium polyphosphate was assigned a score of LOW for Neurotoxicity based on a low score within the EPA's DfE alternatives assessment. This conclusion was based on expert judgment due to the size of the molecule and the limited bioavailability. The low designation in both GreenScreen and EPA's alternatives assessment are based on the same measured endpoints. The score was based on expert judgment within EPA's alternatives assessment and therefore is reported in italics within the GreenScreen assessment.

The summary provided within the EPA's alternatives assessment was as follows:

LOW: This polymer is large, with a MW >1,000. It is expected to have limited bioavailability and therefore has low potential for neurotoxicity based on professional judgment and the SF polymer assessment guidance. No data located.

Skin Sensitization (SnS) Group II* Score (H, M or L): L

Ammonium polyphosphate was assigned a score of LOW for Skin Sensitization. This conclusion was based on information reported in chemical data sheet and adequate study details provided. The low designation for skin sensitization in both GreenScreen and EPA's alternatives assessment are based on the same measured endpoints. The score was based on empirical data within EPA's alternatives assessment and therefore is not reported in italics within the GreenScreen assessment.

The summary provided within the EPA's alternatives assessment was as follows:

LOW: Not a skin sensitizer in guinea pigs.

Respiratory Sensitization (SnR) Group II* Score (H, M or L): DG

Ammonium polyphosphate was assigned a score of DATA GAP for respiratory sensitization. This conclusion was made based on no data located.

Skin Irritation/Corrosivity (IrS) Group II Score (vH, H, M or L): M

Ammonium polyphosphate was assigned a score of MODERATE for Skin Irritation/Corrosivity based on tests results provided within the EPA's DfE alternatives assessment which indicates ammonium polyphosphate is slightly irritating in rabbit 24-hour occlusive patch test. This fulfills the guidance of a category 3 Skin Irritation/Corrosivity under GHS. EPA DfE and GS assign different levels for Skin Irritation/Corrosivity. The score was based on empirical data within EPA's alternatives assessment and therefore is not reported in italics within the GreenScreen assessment.

The summary provided within the EPA's alternatives assessment was as follows:

LOW: Mixtures containing primarily ammonium polyphosphate were not irritating to slightly irritating to skin of rabbits.

Eye Irritation/Corrosivity (IrE) Group II Score (vH, H, M or L): L

Ammonium polyphosphate was assigned a score of LOW for Eye Irritation based on tests results provided within the EPA's DfE alternatives assessment which indicates ammonium polyphosphate is not an eye irritant in rabbits. DfE categorizes ammonium polyphosphate as a very low eye irritant which corresponds to a low score under GreenScreen Eye Irritation/Corrosivity. The score was based on empirical data within EPA's alternatives assessment and therefore is not reported in italics within the GreenScreen assessment.

The summary provided within the EPA's alternatives assessment was as follows:

VERY LOW: Mixtures containing primarily ammonium polyphosphate were not irritating to rabbit eyes.

Ecotoxicity (Ecotox)

Acute Aquatic Toxicity (AA) Score (vH, H, M or L): L

Ammonium polyphosphate was assigned a score of LOW for Acute Aquatic Toxicity. The low designation for acute aquatic toxicity in both GreenScreen and EPA's alternatives assessment are based on the same measured endpoints. The score was based on values from estimation software,

professional judgment, and secondary sources within EPA's alternatives assessment and therefore is reported in italics within the GreenScreen assessment.

The summary provided within the EPA's alternatives assessment was as follows:

LOW: Water insoluble polymers with a MW >1,000 that do not contain reactive functional groups and are comprised of minimal low MW oligomers are estimated to have no effects at saturation (NES). These polymers have NES because the amount dissolved in water is not anticipated to reach a concentration at which adverse effects may be expressed. Based on professional judgment, guidance for the assessment of aquatic toxicity hazard leads to a low concern for those materials that display NES. Experimental data are also consistent with this hazard designation.

Chronic Aquatic Toxicity (CA) Score (vH, H, M or L): *L*

Ammonium polyphosphate was assigned a score of LOW Chronic Aquatic Toxicity. The low designation for chronic aquatic toxicity in both GreenScreen and EPA's alternatives assessment are based on the same measured endpoints. The score was based on professional judgment and therefore is reported in italics within the GreenScreen assessment.

The summary provided within the EPA's alternatives assessment was as follows:

LOW: Water insoluble polymers with a MW >1,000 that do not contain reactive functional groups and are comprised of minimal low MW oligomers are estimated to have NES. These polymers have NES because the amount dissolved in water is not anticipated to reach a concentration at which adverse effects may be expressed. Based on professional judgment, guidance for the assessment of aquatic toxicity hazard leads to a low potential for those materials that display NES.

Environmental Fate (Fate)

Persistence (P) Score (vH, H, M, L, or vL): *vH*

Ammonium polyphosphate was assigned a score of VERY HIGH for Persistence. While the EPA's alternative assessment gives ammonium polyphosphate a high rating, the information provided within the DfE report indicates the chemical fulfills the very high hazard score. The very high designation for persistence in both GreenScreen and EPA's alternatives assessment are based on the same measured endpoints. Therefore a very high hazard score was determined for the GreenScreen profile. The score was based on expert judgment within EPA's alternatives assessment and therefore is reported in italics within the GreenScreen assessment.

The summary provided within the EPA's alternatives assessment was as follows:

HIGH: This polymer is large, with a MW >1,000. It is expected to have negligible water solubility and poor bioavailability to microorganisms indicating that biodegradation is not expected to be an important removal process in the environment. Hydrolysis is expected for ammonium polyphosphates, mainly via end-clipping of a monophosphate unit to form monoammonium phosphate. Hydrolysis rates increase with increasing chain lengths, but reach a limit when $n > 50$. Qualitative statements from manufacturers indicate hydrolysis is slow, but increases with prolonged exposure to water and elevated temperatures. Therefore, hydrolysis is not expected to occur at a rate that would greatly reduce the polymeric chain. Furthermore, long-chain ammonium polyphosphates produced for flame retardant applications may be formulated with melamine or other stabilizers that impede hydrolysis. The polymer does not contain functional groups that would be expected to absorb light at environmentally-relevant wavelengths. Evaluation of these degradation values suggest a half-life for the polymer is >180 days.

Bioaccumulation (B) Score (vH, H, M, L, or vL): *vL*

Ammonium polyphosphate was assigned a score of VERY LOW for Bioaccumulation. The low designation for bioaccumulation in EPA's alternatives assessment is equivalent to a very low score in GreenScreen. The score was based on professional judgment and therefore is reported in italics within the GreenScreen assessment.

The summary provided within the EPA's alternatives assessment was as follows:

LOW: This ionic polymer is large, with a MW >1,000. It is expected to have negligible water solubility and poor bioavailability indicating that it will have low potential for bioaccumulation based on professional judgment.

Physical Hazards (Physical)

Reactivity (Rx) Score (vH, H, M or L): *L*

Ammonium polyphosphate was assigned a score of LOW for Reactivity. EPA does not assess reactivity as one of its hazard criteria and, therefore, no data were available in the EPA report. The European Food Safety Authority stated that 'Reaction of ammonium polyphosphate with lipids is not expected to be of concern'¹⁷. Based upon identification by the EU that ammonium polyphosphate is appropriate for food applications and professional judgment, reactivity was assigned as low.

Flammability (F) Score (vH, H, M or L): *L*

Ammonium polyphosphate was assigned a score of LOW for Flammability based on a not flammable description within the DfE report. This conclusion was based on adequate data and is not reported in italics.

References (may be provided under each hazard endpoint or at the end of document)

¹⁷ European Food Safety Authority, Scientific Opinion on the evaluation of the substances currently on the list in the Annex to Commission directive 96/3/EC as acceptable previous cargoes for edible fats and oils, available at: <http://www.efsa.europa.eu/en/efsajournal/doc/2482.pdf>, accessed 9/2013.

**APPENDIX A: Hazard Benchmark Acronyms
(alphabetical order)**

- (AA) Acute Aquatic Toxicity**
- (AT) Acute Mammalian Toxicity**
- (B) Bioaccumulation**
- (C) Carcinogenicity**
- (CA) Chronic Aquatic Toxicity**
- (Cr) Corrosion/ Irritation (Skin/ Eye)**
- (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**

Appendix B
Optional Hazard Summary Table

Exposure Route	GreenScreen Hazard Ratings: [Chemical Name]																			
	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	repeate	single	repeated*										
oral																				
dermal																				
inhalation																				

Appendix C Modeling Results

Attach:

- **EPISuite Results for Chemical Name (CAS #)**
- **ECOSAR Results for Chemical Name (CAS #)**
- **Other**