GreenScreen® Chemical Assessment

[*Ammonium Laureth Sulfate (32612-48-9)*]

Method Version: GreenScreen® Version 1.4

Assessment Details[1]:

Assessment Type:	Certified
Assessment Prepared By:	WAP Sustainability, LLC
Assessment Prepared For:	WA Department of Ecology
Date Assessment Completed:	7/3/2023
Assessment Expiration Date:	7/3/2026
Assessor Type: (Licensed GreenScreen Profiler or equivalent, Authorized GreenScreen Practitioner or Unaccredited)	Licensed GreenScreen® Profiler

[1] **Assessment Type**: GreenScreen reports are either "UNACCREDITED" (by unaccredited person), "AUTHORIZED" (by Authorized GreenScreen Practitioner), or "CERTIFIED" (by Licensed GreenScreen Profiler or equivalent);
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GREENSCREEN BENCHMARK™ SUMMARY:

This chemical assessment report includes a GreenScreen Benchmark™ score and results for Ammonium Laureth Sulfate, 32612-48-9 only.

No marketing claims can be made without licensing through Clean Production Action.

GreenScreen Benchmark Score:
Ammonium Laureth Sulfate was assigned a Benchmark Score of 2 ("Use but Search for Safer Substitutes") based on a very high Group II Human health endpoint score (eye irritation). This corresponds to GreenScreen® Benchmark criteria 2f in CPA 2018. Data gaps (DG) exist for endocrine activity and respiratory sensitization. As outlined in CPA (2015) Section 13.2 (Step 8 – Conduct a Data Gap Analysis to assign a final Benchmark score), Ammonium Laureth Sulfate meets requirements for a GreenScreen® Benchmark Score of 2 despite the hazard data gaps. In a worst-case scenario, if Ammonium Laureth Sulfate were assigned a High score for endocrine activity, it would be assigned a score of Benchmark 1.

HAZARD CLASSIFICATION SUMMARY

Table 1. GreenScreen Hazard Summary Table:

GreenScreen Hazard Summary Table for Ammonium Laureth Sulfate																			
Group I Human					**Group II and II* Human**									**Ecotox**		**Fate**		**Physical**	
Carcinogenicity	**Genotoxicity/Mutagenicity**	**Reproductive Toxicity**	**Developmental Toxicity**	**Endocrine Activity**	**Acute Toxicity**	**Systemic Toxicity**		**Neurotoxicity**		**Skin Sensitization***	**Respiratory Sensitization***	**Skin Irritation**	**Eye Irritation**	**Acute Aquatic Toxicity**	**Chronic Aquatic Toxicity**	**Persistence**	**Bioaccumulation**	**Reactivity**	**Flammability**
						single	repeat*	single	repeat*	*	*								
L	**L**	**L**	**L**	DG	**L**	**L**	**L**	*M*	*L*	**L**	DG	**H**	*vH*	**H**	**H**	**L**	**vL**	*L*	**L**

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 in the hazard classification. Group II Human Health endpoints differ from Group II* Human Health endpoints in that Group II Human Health endpoints 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. Group II* Human Health endpoints are indicated by an * after the name of the hazard endpoint or after "repeat" for repeated exposure sub-endpoints.

SCOPE OF ASSESSMENT

Chemical Name (CASRN): Ammonium Laureth Sulfate (32612-48-9)

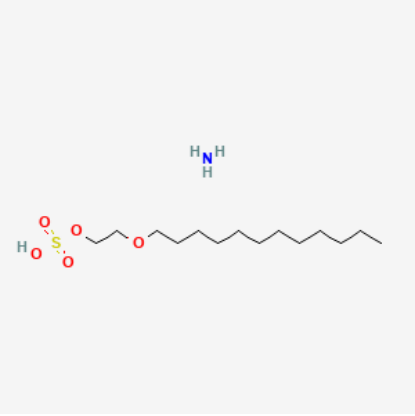
Also Called (List Synonyms):

NIH 2023
Ammonium lauryl ether sulfate
Ammonium laureth-5 sulfate
Azane;2-dodecoxyethyl hydrogen sulfate
Ammonium laureth-7 sulfate
Ammonium laureth-9 sulfate
Ammonium laureth-12 sulfate
Sodium lauryl sulfate 48-50%
Sodium lauryl sulfate 28.0-30.0%
PEG-5 lauryl ether sulfate, ammonium salt
PEG-7 lauryl ether sulfate, ammonium salt
PEG-9 lauryl ether sulfate, ammonium salt
PEG-12 lauryl ether sulfate, ammonium salt
PEG-(1-4) lauryl ether sulfate, ammonium salt

ECHA 2023
Alpha-sulfo-omega-(dodecyloxy)-poly(oxy-1,2-ethanediyl), ammonium salt
Ammonium laureth sulfate (INCI)
Ammonium laureth sulfate ethoxylated 3EO
Ammonium lauryl
Ammonium lauryl ether sulfate
Ammonium lauryl ether sulfate 3EO
Azane; 2-dodecoxyethyl hydrogen sulfate

Chemical Structure:

PubChem 2023



Suitable analogs or moieties of chemicals used in this assessment (CASRN(s)):

ECHA 2023
The alkyl ether sulfates (AES) reported within the category show similar structural, physico-chemical, environmental and toxicological properties. The approach of grouping different AES for the evaluation of their effects on human health and the environment was also made by the Danish EPA (2001) and HERA (2003), supporting the read-across approach between structurally related AES.

Chemical Structure(s) of suitable analog(s) and/or moieties:

Alcohols, C12-14 (linear, even-numbered), ethoxylated, sulfates, ammonium salts, <2.5 mol EO (EC number: 939-575-6)

Alcohols, C-12-14, ethoxylated, sulfates, sodium salts (68891-38-3)

Identify potential applications/functional uses of the chemical:

PubChem 2023
1. Used as a foaming and cleansing agent in shampoos and cleaners
2. Used in cosmetics as a surfactant
3. Used in auto products
4. Used in commercial/institutional cleaning products
5. Used inside the home in cleaning products
6. Used in personal care products
7. Used in pet care products

Table 2. Environmental Transformation Products Summary

Life Cycle Stage	Transformation Pathway	Environmental Transformation Product	CAS #	Feasible (Yes or No)	Relevant (Yes or No)	GreenScreen List Translator Score or GreenScreen Benchmark Score
End of life		Inorganic sulphate		Y	N	
End of life		Carbon dioxide		Y	N	
End of life		Water		Y	N	

Alkyl ether sulfates (AES) are reported to be readily biodegradable and are expected to undergo extensive environmental biodegradation. Complete biodegradation of AESs will yield CO2, H2O, and sulfate anions. As stated in CPA 2018 guidance 11.4.3.b. Transformation products of chemicals that degrade rapidly and completely (i.e., ultimate biodegradation) are unlikely to form persistent biodegradation intermediates and are therefore not considered relevant.

HERA 2004
There are 3 starting routes of AES degradation which all seem to occur: i) ω-/β-oxidation of the alkyl chain, ii) enzymatic cleavage of the sulphate substituent leaving an alcohol ethoxylate, iii) cleavage of an ether bond in the AES molecule producing either the alcohol (central cleavage) or an alcohol ethoxylate and an oligo(ethylene glycol) sulphate (Swisher 1987, Steber and Berger 1995). The subsequent degradation of the resulting intermediates encompasses oxidation of the alcohol to the corresponding fatty acid (itself then degraded via ß-oxidation) or degradation of the alcohol ethoxylate (via central cleavage or degradation from either end of the molecule) or degradation of the oligo(ethylene glycol) sulphate. The ultimate biodegradability of alcohol ethoxylates is well established (Swisher 1987, Holt et al. 1992) and glycol ether sulphates have also been shown to be fully degradable by mixed cultures forming inorganic sulphate and carbon dioxide (Griffith et al 1986, White and Russell 1988). The conclusion that AES degradation will not produce any recalcitrant metabolite is in line with the experimental findings on AES in the "Test for detecting recalcitrant metabolites" (Gerike and Jasiak 1986). In addition, Yoshimura et al (1982) reported test data showing that the (fish) toxicity of AES decreases in the course of AES degradation.

Health Canada 2019
Complete biodegradation of AESs will yield CO2, H2O, and sulfate anions (Paulo et al. 2017), which are not expected to pose an ecological risk. On the basis of available biodegradation studies, the three AESs are expected to undergo extensive environmental biodegradation and are not expected to be persistent in the environment.

HAZARD CLASSIFICATION SUMMARY

GROUP I HUMAN HEALTH EFFECTS (GROUP I HUMAN)

Carcinogenicity (C): L

Ammonium Laureth Sulfate was assigned a hazard classification level of Low for carcinogenicity based on negative results reported for quality oral and dermal studies. This conclusion is supported by studies showing that AES are non-genotoxic and are metabolized to physiologically occurring metabolites. The studies used to develop this hazard score used high quality analogs. Therefore, the hazard score is reported with high confidence.

Data
- Lists
  - *Authoritative: None*
  - *Screening: None*
- Measured Data

ECHA 2023
Alcohols, C12-14 (linear, even-numbered), ethoxylated, sulfates, ammonium salts, < 2.5 mol EO

- Several studies investigating the genetic toxicity of different AES in vitro and in vivo have shown that AES are not genotoxic. Moreover, the repeated dose toxicity tests revealed no substance-related adverse effects indicative for carcinogenicity such as preneoplastic lesions (e.g., hyperplasia or metaplasia). Furthermore, AES are metabolized to physiologically occurring metabolites, which chemically behave like in the same way as their natural counterparts. The systemic toxicity of the compounds in this category is predicted to be very low, based on the known properties of the predictable metabolites. Based on this weight of evidence approach members of the AES category does not cause carcinogenicity.

CIR 1983

- The tumorigenicity of Sodium Laureth Sulfate was tested in groups of 30 female Swiss mice. Approximately 0.1 ml of a 5% aqueous solution was ap- plied twice weekly to the skin of the interscapular area for 105 weeks. The total quantity of Sodium Laureth Sulfate applied to each mouse was about 1 g. Controls had only the solvent applied. No skin tumors appeared, and mortality did not differ substantially in the two groups.

HERA 2003

- In a 2-year study, rats (20/sex/group) were administered with the AES C12AE3S in the drinking water at a concentration of 0.1%. At termination, survival, growth, food consumption, body weights, clinical laboratory findings, hematology and urinalyses were all comparable in control and treated animals. The only unusual findings were slight, but consistently higher water consumption by all rats receiving the test compound in their drinking water and a significant difference in the empty cecum to body weight ratio of females. Absolute organ weights were all comparable to controls and no consistent gross or histopathology was found. Generally, pathological findings for controls and treated rats after two years on test were varied and consisted predominantly of incidental findings attributable to advanced age. Various types of benign and malignant tumors were found in both groups. The frequency of tumors in the treated group was not significantly different from that of control animals [Arthur D. Little, 1991].
- No indications of an increased incidence in tumors were noted in a 2-year chronic feeding study in rats in which C12 AE3S was given at 0, 0.1 or 0.5% in the diet for 2 years. An occasional tumor (type and incidence unspecified) was found in various groups. The tumors were characterized as “typical” of those commonly found in aged rats and did not appear to be associated with the ingestion of AES [Tusing et al., 1962 quoted in Arthur D. Little, 1991].

- Estimated Data: None

Mutagenicity/Genotoxicity (M): L

Ammonium Laureth Sulfate was assigned a hazard classification level of Low for mutagenicity based on both *in vitro* and *in vivo* studies reporting negative results using high quality analogs. In addition, structure activity analysis did not reveal any functional groups in the chemical structure of AES that were associated with mutagenic or genotoxic properties.

In all available in vitro and in vivo genotoxicity assays, there is no indication of genetic toxicity of AES. Only 2 studies, an Ames test and a mouse lymphoma assay were conducted according to OECD guideline methodologies and GLP regulations. However, all the other available in vitro and in vivo studies appear to be well documented and conducted. Some of these studies were published in peer-reviewed journals. The studies used to develop this hazard score used high quality analogs. Therefore, the hazard score is reported with high confidence.

Data

- Lists
  - *Authoritative: None*
  - *Screening: None*
- Measured Data

ECHA 2023

Alcohols, C12-14 (linear, even-numbered), ethoxylated, sulfates, ammonium salts, < 2.5 mol EO

- Mutagenicity in bacteria was assessed in a key study performed similar to OECD Guideline 471. Tester strain TA 102 or E.coli were not used during the conduct of the study (Schöberl, 1994). In the study with AES (C12-14; EO2)Na (CAS 68891-38-3, analytical purity 71.5%) Salmonella typhimurium strains TA 1535, TA 1537, TA 98, TA 1538, and TA 100 were treated using the plate incorporation method with and without the addition of a rat liver S9-mix. The dose range for the plate incorporation test was 11, 56, 280, 1400 and 7000 µg/plate. Results achieved with vehicle (distilled water) and positive controls were valid. Cytotoxicity was seen in presence and absence of metabolic activation while no genotoxicity was observed under both circumstances for AES (C12-14; 1-2.5 EO) Na (CAS 68891-38-3).
- The mutagenicity of AES (C12-14) Na (CAS 68891-38-3, analytical purity 27.6%, no data on grade of ethoxylation) in a mammalian cell line was investigated according to OECD guideline 476 using the mouse lymphoma L5178Y cells with and without metabolic activation (Falezza, 1995). The test concentrations were 2.44, 4.88, 9.76, 19.5, 39.1 and 58.6 µg/mL without metabolic activation as well as 2.44, 4.88, 9.76, 19.5, 39.1, 78.1 and 117 µg/mL with metabolic activation. Results achieved with the negative (distilled water) and positive controls were valid. Cytotoxicity was seen in presence and absence of metabolic activation while no genotoxicity was observed under both circumstances for Na AES (C12-14, 1-2.5 EO) (CAS 68891-38-3).
- The in vivo clastogenic potential of AES (C12-14) Na (CAS 68891-38-3, analytical purity 27-29%, no data on grade of ethoxylation) was assessed in a mammalian bone marrow chromosomal aberration test with CD-1 mouse according to OECD Guideline 475 (Ciliutti, 1995). The test substance was administered via gavage at doses of 1000 and 2000 mg/kg bw to five animals per sex per dose. Distilled water was used as vehicle. The post exposure period were 10, 24 and 48 h for the test group including the vehicle control and 26 h for the positive control group. Results achieved with the negative (distilled water) and positive controls were valid. No signs of toxicity and no increased number of chromosome aberration were seen at 1000 and 2000 mg/kg bw. Thus, the test substance did not show clastogenicity at 1000 and 2000 mg/kg bw based on the test material and 270 to 290 and 540 to 580 mg/kg bw based on the active ingredient.

HERA 2003

- Representing the whole range of studies, a recent OECD method 471 and GLP compliant study [Hüls AG, 1996] should be mentioned at this place: In this study, Salmonella typhimurium strains TA98, TA100, TA1535 and TA 1537 were treated with the triisopranolammonium salt of C12-14AE2S in the Ames test plate incorporation assay as well as the preincubation method. Dose levels covering the range of 1 to 5000 µg/plate, in triplicate both with and without the addition of a metabolizing system (Aroclor 1254 induced rat liver S9 mix) were employed. All 4 bacterial strains exhibited mutagenic responses to the appropriate positive control substances. Solvent controls were also tested with each strain and the mean number of spontaneous revertants were in an acceptable range. Mutagenic activity of the test compound to any of the tester strains was not observed with and without metabolic activation. It was therefore concluded that under the chosen test conditions, the triisopranolammonium salt of C12-14AE2S is not a bacterial mutagen.
- The majority of the studies evaluated the mutagenicity of AES in Salmonella typhimurium strains TA98, TA100, TA1535, TA 1537 and TA 1538. One study [Shell Research, 1980b], however, evaluated the mutagenicity of NaC12-15E3S in presence and absence of a metabolic activation system in the Escherichia coli strains WP2 and WP2uvrA, in addition to the Salmonella typhimurium strains. Also, in these E. coli strains, the tested AES compounds were not mutagenic under the test conditions.
- The mutagenic activity of NaC12-15AE3S was further evaluated in a Saccharomyces gene conversion assay [Shell Research, 1980b]. In this study, it was concluded that the addition of NaC12-15AE3S to liquid suspension cultures of Saccharomyces cerevisiae JD1 with or without metabolic activation did not induce a consistent increase in mitotic gene conversion at either gene locus in two replicate experiments.
- AES was examined for mutagenic activity by assaying for the induction of trifluoro thymidine resistant mutants in L5178Y TK+/- mouse lymphoma cells after in vitro treatment in the absence and presence of S9 metabolic activation [Research Toxicology Centre S.p.A., 1995]. Under the reported experimental conditions, it was concluded that in the presence and absence of metabolic activation, the test material NaC12-14AE2S did not induce gene mutations in L5178Y TK+/- mouse lymphoma cells. This study was conducted in compliance with OECD method 476 and GLP regulations.
- The ability of NaC12-15E3S to induce chromatid and chromosome aberrations was studied in rat liver cells [Shell Research, 1980b]. In slide cultures of rat liver cells exposed to culture medium containing NaC12-15E3S at concentrations of 25, 50 and 100 µg/ml the frequency of chromatid and chromosome aberrations did not differ significantly from that of the control's cultures.
- No morphological cell transformations were observed in Syrian golden hamster embryo cells exposed in culture to concentrations up to 50 mg/ml C12-13E2.5S [Inoue et al., 1980].
- In an in vitro transformation study with NaC12-15E3S [Shell Research Ltd., 1983], the transforming activities of NaC12-15E3S and 1,4-dioxane were determined using cultured C3H 10T1/2 mouse embryo fibroblasts as the target cell population. Monolayer cell cultures were incubated for 24 hours in growth medium containing NaC12-15E3S or 1.4-dioxane. Transformation frequencies were assessed by counting the number of actively dividing, darkly stained cell foci per dish, 3 or 4 weeks after test compound treatment. In conclusion, there was no evidence to suggest that either NaC12-15E3S or

1,4-dioxane increased the frequency of 10T1/2 mouse embryo fibroblasts under the experimental conditions described.

- NaC12-15E3S has been evaluated in an alkaline elution assay [Shell Research Ltd., 1982b]. In this screen which aims to measure DNA single-strand breaks induced in DNA by reaction with electrophiles, NaC12-15E3S did not cause measurable DNA-strand damage when administered to Wistar rats as a single oral dose of 2.5 ml/kg (equals about half of the LD50 of NaC12-15E3S) for an exposure period of 6 hours. Based on this result it was concluded that neither NaC12-15E3S nor its in situ generated metabolites have any effect upon the integrity of rat liver DNA in vivo under the conditions of the test.
- In a series of studies with a 55% AES:45% LAS mixture, no significant differences from control values were noted in a dominant lethal study or in vivo or in vitro cytogenicity studies [Arthur D. Little, 1991]. In the dominant lethal assay, male mice were orally administered either 100, 150, or 200 mg/kg subacutely or 500, 750, or 1000 mg/kg acutely of the surfactant mixture. No significant differences from water-dosed controls were observed in the mutagenic index. Similarly, no significant differences in chromosomal anomalies were found in bone marrow cells of male rats given 40, 500, or 1000 mg/kg of the surfactant mixture orally, then killed 18, 24 or 48 hours post-dosing. Likewise, human leukocytes incubated for 18, 24, or 48 hours with 4, 40 or 200 µg/l of the surfactant mixture exhibited no increased incidence of chromosomal anomalies above the water control group.
- Another published in vivo study indicated that AES is not clastogenic. Hope [Hope, 1977] reported that the incorporation of C12-15AES into the diet of rats at a maximum tolerated dose (1.13% active ingredient) for 90 days had no effect on the chromosome of rat bone marrow cells.
- A structure activity analysis did not reveal any functional groups in the chemical structure of AES that were associated with mutagenic or genotoxic properties.

- Estimated Data: None

Reproductive Toxicity (R): L

Ammonium Laureth Sulfate was assigned a hazard classification level of Low for reproductive toxicity based on numerous guideline studies reporting no adverse reproductive effects. While one study reported reduced straight-line velocity of the sperm, the changes were either not statistically significant or within the range of the historical control data. The hazard conclusion is based on study data using high quality analogs. Therefore, the hazard score is reported with high confidence.

Data

- Lists
  - *Authoritative: None*
  - *Screening: None*
- Measured Data

ECHA 2023
Alcohols, C12-14 (linear, even-numbered), ethoxylated, sulfates, ammonium salts, < 2.5 mol EO

- The purpose of the key study conducted by Pittermann (1994b) was to assess the effects of orally administered AES (C12-14) Na (CAS 68891-38-3) on embryonic and fetal development in pregnant CD rats. The study followed OECD Guideline 414 and complied with the OECD principles of GLP. In this study, AES (C12-14) Na (CAS 68891-38-3) was administered orally by gavage at dose levels of 0, 100, 300, and 1000 mg/kg bw/day once daily on Day 6-15 of gestation. In summary, the results of the study showed that repeated oral administration of AES (C12-14; 2EO) Na (CAS 68891-38-3) to pregnant rats did not cause symptoms of cumulative toxicity up to a dose level of 1000 mg/kg bw/day. There were no treatment-related fetal abnormalities at necropsy and no treatment-related effects in the reproduction data.
- Pregnant albino rabbits, artificially inseminated, were administered AES (C10-16; 3 EO) Na (CAS 68585-34-2) by gavage at levels of 50, 100, or 300 mg/kg bw/day on Days 2-16 of gestation (Klusman, 1972). No maternal deaths were attributable to the test substance and there were no significant differences in the number of corpora lutea, resorptions, implantations, or live fetuses. The number of dead fetuses, 19 in the high level treatment group (300 mg/kg bw/day) and 17 in the control group, were higher than the remaining groups. All but four of these deaths occurred in just three litters. This lack of dose response indicated that something other than the test substance caused the deaths of these fetuses. The NOAEL for the test substance was 300 mg/kg bw/day on the basis that the test substance did not produce any significant increases in the number of abnormal fetuses at any dose level. There were no significant test substance-related differences in the numbers of corpora lutea, implantation, resorptions, or dead fetuses. Under the conditions of this study, the test substance, at the levels tested, was neither embryotoxic nor teratogenic.

HERA 2003

- As part of a chronic feeding study, 10 rats/sex/group fed diets containing 0.1% of C12AES were mated after 14 weeks on the test [Arthur D. Little, 1991]. The F1 generation was maintained on the parental diet and mated at 100 days of age. The F2 generation was fed the same diet for 5 weeks, and then killed. No adverse effects on fertility, lactation, litter size or survival and growth of the offspring were seen. Hematological, biochemical, and histopathological findings were comparable to controls. From this study it can be concluded that the NOEL for reproductive toxicity is estimated to be greater than 50 mg/kg bw/day. This estimation was based on the assumption of a mean adult rat body weight of 0.4kg and a water consumption of 30 ml/day [US Environmental Protection Agency, 1978].
- No adverse parental toxicity or significant differences in either litter parameters or viability of offspring were noted in two generations of rats fed diets containing either 0.1% C12AES [Tusing et al., 1962] or 1% (reported to equal an exposure of 800 mg/kg/day) of a detergent formulation containing 55%TE3S and 45% LAS [Nolen, et al., 1975].
- In available subchronic [Henkel KGaA, 1994a, Shell Research Ltd., 1982a, Walker, 1967] and chronic toxicity studies [Arthur D. Little, 1991, Hüls AG, 1997b] on various AES (NaC12- 14AE2S, CaC123-15AE3S, C12AE3S), the primary sex organs of the males and females did not show evidence for treatment-related adverse effects as indicated by organ weight differences, gross examination, and microscopic histology examination at the highest tested exposure levels of 250 mg/kg bw/day.
- Further information can be deduced from a two-generation reproduction study with

NaC12- 14AE2S [Henkel 1999]. This GLP-study followed the OECD guideline method 416. Four groups of thirty male and thirty female Sprague Dawley rats (strain Crl:CD(SD)BR) (F0 generation) were dosed via the drinking water. Concentrations used were 0 (control), 0.03, 0.1 and 0.3 %, which corresponded to daily doses of ca. 0, 30, 100 and 300 mg/kg/day. There were some changes indicative of parental toxicity in the group treated with 0.3 % of the test substance, which were characterized by reduced straight line velocity of the sperm. The observed reduced triglyceride levels (female) and increased percentage neutrophil counts (males) were slight and within the range of the historical control data. There were some changes seen in reduced straight line velocity of the sperm, reduced triglyceride levels (female) and increased percentage neutrophil counts (males) in the group treated at 0.1 %. All the changes were either not statistically significant or within the range of the historical control data. In summary, there was no effect of treatment at any dose level on reproduction of the parents or offspring (NOAEL > 3 %; > 300 mg/kg/day) Based on this study an overall NOAEL for systemic effects of 0.1 % (86.6 mg/kg bw) for the F0 generation and a NOAEL of 0.1 % (149.5 mg/kg bw) for the F1 generation can be deduced.

- Estimated Data: None

Developmental Toxicity incl. Developmental Neurotoxicity (D): L

Ammonium Laureth Sulfate was assigned a hazard classification level of Low for developmental toxicity based on numerous oral exposure studies reporting no adverse developmental effects. Although the majority of these studies did not fulfill all requirements of existing guideline protocols and were not conducted according to GLP standards, the studies appeared to be well conducted and documented. The hazard score is based on studies using high quality analogs. Therefore, the hazard score is reported with high confidence.

Data

- Lists
  - *Authoritative: None*
  - *Screening: None*
- Measured Data

ECHA 2023

Alcohols, C12-14 (linear, even-numbered), ethoxylated, sulfates, ammonium salts, < 2.5 mol EO

- AES (C12-15; 3 EO) Na (CAS 125301-92-0) was administered orally via the diet to pregnant Colworth-Wistar rats at dose levels of 0.375, 0.5, 1.0, 1.5% (corresponding to 0, 350, 450, 950 and 1500 mg/kg bw/day) once daily on Day 0-20 of gestation (Ashmole and Denning, 1989). In summary, maternal toxicity was revealed solely as a reduction in body weight gain at the 1.5 and 1% treatment levels; this was associated with reduced food intake. The increase in sternebrae variations in the 1.5% treatment group was probably related to maternal toxicity. This group also showed an increase in the number of fetuses with unossified phalanges. No other dose related defects were seen, and it is considered that there is no indication of a teratogenic effect attributable to treatment with AES (C12-15, 3EO) Na (CAS 125301-92-0). Treatment throughout pregnancy at the

highest dose level (1500 mg/kg bw/day) did not induce any teratogenic effects.

- Pregnant albino rabbits, artificially inseminated, were administered AES (C10-16; 3 EO) Na (CAS 68585-34-2) by gavage at levels of 50, 100, or 300 mg/kg bw/day on Days 2-16 of gestation (Klusman, 1972). No maternal deaths were attributable to the test substance and there were no significant differences in the number of corpora lutea, resorptions, implantations, or live fetuses. The number of dead fetuses, 19 in the high level treatment group (300 mg/kg bw/day) and 17 in the control group, were higher than the remaining groups. All but four of these deaths occurred in just three litters. This lack of dose response indicated that something other than the test substance caused the deaths of these fetuses. In addition, no statistical differences were seen in the fetal weights of survivors or with regard to the number of fetuses with skeletal defects. The examination of fetuses from this study for soft-tissue abnormalities revealed only one instance of significant difference occurring in one litter of the low-level treatment group. The lack of a dose response relationship between the levels of the test substance and the incidences of stressed bladder (five) indicates an isolated incidence of spontaneous malformations which have been seen in previous teratology studies. The NOAEL for the test substance was 300 mg/kg bw/day on the basis that the test substance did not produce any significant increases in the number of abnormal fetuses at any dose level. There were no significant test substance-related differences in the numbers of corpora lutea, implantation, resorptions, or dead fetuses. Under the conditions of this study, the test substance, at the levels tested, was neither embryotoxic nor teratogenic.

<u>HERA 2003</u>

- NaC12-14AE2S was tested in a segment II embryotoxicity study [Henkel KGaA, 1994b]. The purpose of the study was to assess the effects of orally administered NaC12-14AE2S on embryonic and fetal development in pregnant CD-rats. The study followed the guidelines of OECD method 414 “Teratogenicity” and complied with the OECD principles of GLP. In this study, NaC12-14AE2S was administered orally by gavage at dose levels of 0, 100, 300, and 1000 mg/kg body weight once daily from day 6 to day 15 of gestation. Each group consisted of at least 24 female rats. A standard dose volume of 10 ml/kg body weight was used, and the control animals were dosed with the vehicle alone over the period described. Clinical condition and reaction to treatment were recorded at least once daily. Body weights were reported for days 0, 6, 16 and 20 of gestation. All surviving females were sacrificed on day 20 of gestation and the fetuses were removed by caesarean section. At necropsy the females were examined macroscopically, and live fetuses were weighed, sexed, and examined for visceral and skeletal abnormalities. In summary, the results of the study showed that repeated oral administration (day 6 – day 15 post coitum) of NaC12-14AE2S to pregnant rats did not cause symptoms of cumulative toxicity up to a dose level of 1000 mg/kg/day. No compound related symptoms were observed, and no treatment-related abnormalities were found at necropsy of the females. All females had viable fetuses. Pre-implantation loss, postimplementation loss, mean number of resorptions, embryonic deaths, total fetuses, mean fetal placental and uterus weights were not affected by the treatment. Fetal sex ratio was comparable in all groups. There were no treatment-related fetal abnormalities at necropsy and no treatment-related effects in the reproduction data. In conclusion, in the described embryotoxicity study, NaC12-14AE2S was not cumulatively toxic to pregnant rats and did not reveal any teratogenic potential at the tested dose levels. Thus, based on the available information, the NOAEL for teratogenicity and

developmental toxicity are assessed to be greater than 1000 mg/kg bw/day.

- NaC12-15AE3S was administered orally by gavage to pregnant Colworth-Wistar rats at dose levels of 0, 375 and 750 mg/kg/day once daily from day 6 to 15 of gestation [Unilever, 1980c]. Two different samples of the test material were tested. Fifteen (15) animals were used per dose group, 10 for dissection and 5 for natural parturition. Throughout the study, the females were monitored for signs of toxicity. Upon necropsy, fetal toxicity was determined by evaluating pre-implantation and post-implantation fetal loss and fetal weight. Fetuses were evaluated for externally visible malformations, as well as malformations of the internal organs and skeleton. In the post-partum phase pup mortalities, body weights and litter size as well as incidence of external and gross visceral and skeletal defects were monitored until weaning day 21. The resulting data were compared to the control group. In summary, NaC12-15AE3S induced maternal toxicity, indicated by body weight changes and other clinical and behavioral observations, when administered by gavage to pregnant rats at doses of 750 mg/kg. The authors were unable to detect any specific abnormality which would indicate a developmental toxicity or teratogenic response related to the treatment. This study was not conducted according to any recognized guideline. However, the study was conducted according to GLP, is well-documented and judged to be scientifically acceptable. Based on the available information the NOAEL for maternal toxicity was estimated to be 375 mg/kg bw/day and the NOAEL for teratogenic effects or developmental toxicity is greater than 750 mg/kg bw/day.
- NH4C13-15AE3S was administered orally by gavage to pregnant Colworth-Wistar rats at dose levels of 0, 63, 125, 250 and 500 mg/kg/day once daily from day 6 to 15 of gestation [Unilever, 1986a]. Fifteen (15) animals were used per dose group, 10 for dissection and 5 for natural parturition. No detailed information was available on the study design. Some slight maternal toxicity indicated by body weight changes and other clinical observations (e.g., diarrhea, respiratory wheeziness) was seen in rats with exposure to 250 and 500 mg/kg bw/day, but given the limited information available, there is some uncertainty regarding the severity of these effects. No evidence of developmental toxicity or a teratogenic response to the treatment were reported at any dose level. This study was not conducted according to GLP or according to any recognized guideline. Given the lack of information and the uncertainty mentioned before, a NOAEL could not be reliably determined.
- NaC12-14AE3S was administered orally by gavage to pregnant Colworth-Wistar rats at dose levels of 0, 93, 187, 375 and 750 mg/kg/day once daily from day 6 to 15 of gestation [Unilever, 1986b]. Fifteen (15) animals were used per dose group, 10 for dissection and 5 for natural parturition. Maternal and fetus effects were evaluated as described previously (i.e., study with NaC12-15AE3S). The treatment of pregnant rats with NaC12-14AE3S during days 6-15 of gestation did induce some maternal toxicity at the dose level of 750 mg/kg bw/day. No evidence of treatment-related teratogenic effects or developmental toxicity was reported. This study was not conducted according to GLP or according to any recognized guideline. However, the study appeared well-conducted, was well-documented and judged to be scientifically acceptable. Based on the available information the NOAEL for maternal toxicity was determined to be 375 mg/kg bw/day and the NOAEL for teratogenic or developmental effects is estimated to be greater than 750 mg/kg bw/day.
- NaC16-18AE4S was administered orally by gavage to pregnant Colworth-Wistar rats at dose levels of 0, 63, 125, 250 and 500 mg/kg/day once daily from day 6 to 15 of

gestation [Unilever, 1986c]. Twenty (20) animals were used per dose group, 15 for dissection and 5 for natural parturition. Forty (40) animals were used for the negative control. Maternal, fetus and post-partum effects were evaluated as described previously (i.e., study with NaC12- 15AE3S). In summary, there was no evidence of teratogenic potential or developmental toxicity. This study was not conducted according to any recognized guideline. The study was conducted according to GLP, is well-documented and judged to be scientifically acceptable. Based on the available information, the NOAEL for both maternal toxicity, teratogenic and developmental effects appeared to be greater than 500 mg/kg bw/day.

- In a last study of this series, NaC12-15E3S was administered orally by gavage to pregnant Colworth-Wistar rats at dose levels of 0, 125, 250, 500 and 1000 mg/kg/day once daily from day 6 to 15 of gestation [Unilever, 1979f]. Fifteen (15) animals were used per dose group, 10 for dissection and 5 for natural parturition. Maternal, fetus and post-partum effects were evaluated as described previously. The authors of the study concluded that a degree of maternal toxicity indicated by a significant reduction in body weight gain of NaC12-15E3S was observed at the highest dose level of 1000 mg/kg. However, no evidence of treatment related developmental toxicity or teratogenic effects was detected. This study was not conducted in compliance with GLP or according to any recognized guideline. The study appeared well-conducted, was well-documented and judged to be scientifically acceptable.
- Pregnant rats were administered 50, 100, and 500 mg/kg/day of C12-13AES by oral gavage on days 6-15 of gestation. Effects observed were a decrease in maternal body weight gain and food consumption [Arthur D. Little, 1991]. There were no treatment-related maternal effects noted at necropsy or following a uterine examination on day 13 of gestation. The incidence of fetal malformations in AES-treated groups was not different from the control group.

- Estimated Data: None

Endocrine Activity (E): DG

Ammonium Laureth Sulfate was assigned a hazard classification level of Data Gap for endocrine activity based on based on lack of adequate studies. No data was located for the compound of interest or any of the analog compounds.

Data

- Lists
  - *Authoritative: None*
  - *Screening: None*
- Measured Data: None

- Estimated Data: None

GROUP II AND II* HUMAN HEALTH EFFECTS (GROUP II AND II* HUMAN)

Note: Group II and Group II endpoints are distinguished in the v1.4 Benchmark system (the asterisk indicates repeated exposure). For Systemic Toxicity and Neurotoxicity, Group II and II* are considered sub-endpoints. See GreenScreen Guidance v1.4, Annex 2 for more details.*

Acute Mammalian Toxicity (AT): L

Ammonium Laureth Sulfate was assigned a hazard classification level of Low for acute mammalian toxicity based on oral and dermal study data which report LD50 values >2000 mg/kg bw. While screening lists indicate that the compound is classified as a GHS category 4 acute toxicant, this is not supported by study data. This hazard conclusion is based on numerous studies using high quality analogs and is therefore reported with high confidence.

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Data

- Lists
  - *Authoritative: None*
  - *Screening:*
    - *GHS – Australia H302 - Harmful if swallowed [Acute toxicity (oral) - Category 4]*
    - *GHS - New Zealand Acute dermal toxicity category 4*
    - *GHS - New Zealand Acute oral toxicity category 4*
    - *DK-EPA - Danish Advisory List Acute Tox. 4 - Harmful if swallowed (modeled)*
- Measured Data

ECHA 2023

Alcohols, C12-14 (linear, even-numbered), ethoxylated, sulfates, ammonium salts, < 2.5 mol EO

- In an OECD Guideline 401 (Acute Oral Toxicity) study there were no deaths among animals dosed at 4000 and 5000 mg/kg bw. The reported LD50 is 4,100 mg/kg bw
- The available data on acute oral toxicity in the Alkyl Ether Sulfates (AES) category reveal an oral LD50 value > 2000 mg/kg bw. Based on the category approach, an oral LD50 value > 2000 mg/kg bw is predicted for the target substance. As explained in the category justification, the differences in molecular structure and composition between the target substance and the members of the AES category are unlikely to lead to differences in the toxicological properties with respect to acute oral toxicity.
- In an OECD Guideline 402 (Acute Dermal Toxicity) study there were no deaths among animals dosed at 2000 mg/kg bw. The reported LD50 is >2000 mg/kg bw
- The available data on acute dermal toxicity in the Alkyl Ether Sulfates (AES) category reveal a dermal LD50 value > 2000 mg/kg bw. Based on the category approach, a dermal LD50 value > 2000 mg/kg bw is predicted for the target substance. As explained in the category justification, the differences in molecular structure and composition between the target substance and the members of the AES category are unlikely to lead

to differences in the toxicological properties with respect to acute dermal toxicity.

HERA 2003

- The acute oral toxicity of alcohol ethoxysulphates (AES) was evaluated with rats in several acute oral toxicity studies [Hüls AG, 1997a; Hüls AG, 1986a; Shell Research Ltd. 1975a; Shell Research Ltd., 1978a; Shell Research Ltd., 1978b; Brown, V. et al., 1968; Shell Research Ltd., 1975b; Shell Research Ltd., 1978c; Shell Research Ltd., 1975c; Shell Research Ltd., 1972; Brown, V. et al., 1970; Shell Chemical Co., 1967; Arthur D. Little, 1991]. The test materials were typically AES solutions containing 25 – 70% active material. The dilutions were administered at doses ranging from 2.5 – 10 ml/kg bodyweight. Most of the studies predate Good Laboratory Practice (GLP) regulations and in only one of these [Vermeire et al., 1993], the study design included at least 5 animals of each sex per dose group, thus meeting the critical aspect of current testing standards as defined in OECD methodologies. In these studies, the LD50 was estimated to be > 1.3 g active material per kg bodyweight.
- A recent study [Hüls AG, 1997a] which was rated as reliable without restrictions according to the Klimisch criteria [Klimisch et al. (1997)], followed the guidelines of OECD method 401 and was compliant with GLP, a group of ten rats, five of each sex, was given a single oral dose of the triisopranolammonium salt of C12-14AE2S (90% active material) at a dose level of 2000 mg/kg bodyweight. The undiluted liquid was administered by gavage with an application volume of 2 ml/kg bodyweight. The rats were observed daily for any mortalities and clinical symptoms following treatment. Individual body weights were recorded on days 0 (prior to dosing), 7 and 14. At the end of the 14-day observation period, the animals were sacrificed and macroscopically examined. There were no deaths following a single oral application of the tested AES. In conclusion, the acute lethal oral dose to male and female rats of the tested AES was found to be > 2 g/kg.
- In a further study, rated as reliable with restrictions according to the Klimisch criteria, was also conducted according to the guidelines of OECD method 401, but not following GLP standards, a 70% solution of NaC12-14AE2S was administered by oral gavage at a dose level of 2.5 g/kg. No mortalities occurred under the dosing conditions.
- The acute dermal toxicity of AES has been evaluated in several rat studies [Hüls AG, 1997b;Shell Research Ltd. 1975a; Shell Research Ltd., 1978a; Shell Research Ltd., 1978b; Shell Research Ltd., 1975b; Shell Research Ltd., 1978c; Shell Research Ltd., 1975c; Shell Research Ltd., 1972; Shell Chemical Co., 1967; Arthur D. Little, 1991] and in one rabbit study [Shell Chemical Co., 1967]. Most of the studies did not follow OECD guidelines (e.g., use of small group sizes) and did not comply with GLP regulations. However, despite some protocol deficiencies, the studies were reported in sufficient detail to allow a reasonable assessment of the potential dermal toxicity of AES in laboratory animals. The investigations included mortality and clinical observations. No mortality was observed in the rat studies at the dose level tested and subsequently LD50 values were expressed to be above the highest investigated dose levels, i.e., >0.65 g/kg [Shell Research Ltd., 1978a], >1.12 g/kg [Shell Research Ltd., 1978b], >2.4 g/kg [Shell Research Ltd. 1975a], >1.25 g/kg [Shell Research Ltd., 1972], >1.08 g/kg [Shell Research Ltd., 1975b], >0.54 g/kg [Shell Research Ltd., 1978c], >1.8 g/kg [Shell Research Ltd., 1975c] and 4.6 g/kg [Shell Chemical Co., 1967]. Arthur D. Little, 1991 reported dermal LD50 values for AES on both intact and abraded rabbit skin ranging from 4 – 12 g/kg bodyweight.

- An acute dermal toxicity study (limit test) following OECD method 402 and complying with GLP guidelines was performed to assess the acute dermal toxicity of triisopranolammonium salt of C12-14AE2S (90% active material) in the rat. A group of ten rats, five of each sex, was given a single dermal application of the test substance at a dose level of 2 g/kg bodyweight. There were no deaths and no signs of systemic reaction to the treatment. The acute lethal dermal dose to male and female rats of NH4C12-14AE2S was determined to be > 2 g/kg bodyweight

- Estimated Data: None

Systemic Toxicity/Organ Effects incl. Immunotoxicity (ST-single): L

Ammonium Laureth Sulfate was assigned a hazard classification level of Low for single dose systemic toxicity/organ effects. The hazard score is based on no indication of specific target organ toxicity reported following oral or dermal exposures. While some test-material related effects were observed in a few animals following both oral and dermal exposures these effects were not of toxicological significance and were only observed to occur at very high concentrations. Furthermore, these effects only occurred during and shortly after dosing and were resolved during the post exposure observation period. The low hazard conclusion is based on study data using high quality analogs. Therefore, the hazard score is reported with high confidence.

Data

- Lists
    - *Authoritative: None*
    - *Screening: None*
- Measured Data

ECHA 2023

Alcohols, C12-14 (linear, even-numbered), ethoxylated, sulfates, ammonium salts, < 2.5 mol EO

- Tested AES substances induced no or only mild clinical symptoms (e.g., increased/decreased activity, piloerection/hunched posture, diarrhea, salivation, central nervous system depression) and had no effect on body weights or gross pathology. These clinical symptoms observed in some studies were transient in nature and resolved within a maximum of 3 days post-administration. More severe clinical symptoms were noted in one study (conducted with alcohols, C12-14, ethoxylated, sulfates, sodium salts, CAS No. 68891-38-3, EC No. 500-234-8), which included abnormal gait, decreased respiratory rate, ptosis, and pallor of extremities additionally to the symptoms mentioned above, at a dose of ≥ 3200 mg/kg bw (corresponding to ≥ 2240 mg a.i./kg bw). This dose, however, well exceeds the limit dose of 2000 mg/kg bw recommended for acute oral toxicity studies In the same study, one female at the 4000 mg/kg bw (equivalent to 2800 mg a.i./kg bw) dose also presented with low body weight gain between Days 8 -15, and the dose of 4100 mg/kg bw (corresponding to 2870 mg a.i./kg bw) was lethal in male and female rats. In another study (study no. 69-7701 conducted with alcohols, C9-11, branched and linear, ethoxylated, sulfates, sodium salts, CAS No. 160901-28-0, EC No. 500-465-4) one incidence of mortality without previously evident clinical symptoms occurred at the dose of 5100 mg/kg bw

(corresponding to 1530 mg a.i./kg bw), 9 Days after dosing. The reason for the deviation of the two studies from the non-toxicity observed in the other studies remains unclear. However, both studies are not the main contributors to the overall hazard conclusion.

- In an OECD Guideline 402 (Acute Dermal Toxicity) study animals dosed at 2000 mg/kg bw showed no clinical signs of toxicity

HERA 2003

- A recent study [Hüls AG, 1997a] which was rated as reliable without restrictions according to the Klimisch criteria [Klimisch et al. (1997)], followed the guidelines of OECD method 401 and was compliant with GLP, a group of ten rats, five of each sex, was given a single oral dose of the triisopranolammonium salt of C12-14AE2S (90% active material) at a dose level of 2000 mg/kg bodyweight. The undiluted liquid was administered by gavage with an application volume of 2 ml/kg bodyweight. The rats were observed daily for any mortalities and clinical symptoms following treatment. Individual body weights were recorded on days 0 (prior to dosing), 7 and 14. At the end of the 14-day observation period, the animals were sacrificed and macroscopically examined. The animals showed mild clinical symptoms such as increased activity and piloerection as a reaction to the treatment for approximately four hours after dosing. The macroscopic examination on day 14 showed no significant lesions.
- In a further study, rated as reliable with restrictions according to the Klimisch criteria, was also conducted according to the guidelines of OECD method 401, but not following GLP standards, a 70% solution of NaC12-14AE2S was administered by oral gavage at a dose level of 2.5 g/kg. The rats achieved acceptable bodyweight gains throughout the study and showed mild clinical signs (unkempt fur, abdominal position, diarrhea) as a reaction to the treatment for approximately 2 hours after dosing. The macroscopic examination on day 14 showed no significant lesions.
- The acute dermal toxicity of AES has been evaluated in several rat studies [Hüls AG, 1997b;Shell Research Ltd. 1975a; Shell Research Ltd., 1978a; Shell Research Ltd., 1978b; Shell Research Ltd., 1975b; Shell Research Ltd., 1978c; Shell Research Ltd., 1975c; Shell Research Ltd., 1972; Shell Chemical Co., 1967; Arthur D. Little, 1991] and in one rabbit study [Shell Chemical Co., 1967]. Most of the studies did not follow OECD guidelines (e.g., use of small group sizes) and did not comply with GLP regulations. However, despite some protocol deficiencies, the studies were reported in sufficient detail to allow a reasonable assessment of the potential dermal toxicity of AES in laboratory animals. At highest dosage levels, various degrees of skin irritation (moderate to severe erythema and oedema) were reported, and signs of intoxication included sporadic signs of hemorrhage around the eyes and nose, piloerection, and diarrhea.
- An acute dermal toxicity study (limit test) following OECD method 402 and complying with GLP guidelines was performed to assess the acute dermal toxicity of triisopranolammonium salt of C12-14AE2S (90% active material) in the rat. A group of ten rats, five of each sex, was given a single dermal application of the test substance at a dose level of 2 g/kg bodyweight. There were no deaths and no signs of systemic reaction to the treatment. Following removal of the dressing, moderate to severe dermal irritations indicated by inflammation of the epidermis and eschar formation were observed at the treatment site. The effects cleared over time. Some minor residual skin lesions were observed in 1 animal at the end of the 14-day observation period. No abnormalities were recorded at the macroscopic examination on day 14. The acute lethal dermal dose to male and female rats of NH4C12-14AE2S was determined to be >

2 g/kg bodyweight

- Estimated Data: None

Systemic Toxicity/Organ Effects incl. Immunotoxicity (ST-repeat) (Group II*): L

Ammonium Laureth Sulfate was assigned a hazard classification level of Low for repeated dose systemic toxicity/organ effects based on numerous oral repeat dose studies reporting NOAELs > 100 mg/kg-bw using high quality analogs and a dermal study reporting no systemic effects at the highest dose tested (195 mg/kg-bw). In most studies no LOAEL could be determined as no effects were observed at the highest dose tested. One oral study reports a NOAEL of 100 mg/kg (within the moderate GreenScreen classification level); however, the LOAEL from this study was established at 1100 mg/kg bw/d. Likewise, the available dermal study reported a NOEL of 195 mg/kg, which is within the moderate GreenScreen classification level; however, this concentration was the highest dose tested with no reported systemic effects. The low hazard conclusion is based on study data using high quality analogs. Therefore, the hazard score is reported with high confidence.

Data

- Lists
  - *Authoritative: None*
  - *Screening: None*
- Measured Data

ECHA 2023

Alcohols, C12-14 (linear, even-numbered), ethoxylated, sulfates, ammonium salts, < 2.5 mol EO

- In a subchronic oral gavage study according to OECD Guideline 408, AES (C12-14) Na (CAS 68891-38-3, no data on grade of ethoxylation) was tested for systemic toxicity at doses of 0, 25, 75, 225 mg/kg bw/day on Wistar rats (Pittermann, 1994a). No clinical signs of toxicity, no mortalities, and no effects on any other investigated parameter (body weight, body weight gain, food consumption, water consumption, ophthalmoscopic examinations, hematology, clinical chemistry, organ weights, gross pathology, and histopathology) were seen at the highest dose level. Apart from the missing systemic toxicity, local treatment-related concentration-dependent irritation to different degrees in the forestomach was seen in all test groups. Thus, a NOEL value was not determined. Since there is no human equivalent to the rat forestomach, these effects are not considered to be relevant to human health assessment. Thus, a no adverse effect level (NOAEL) of greater than 225 mg/kg could be established.
- In a subchronic feeding study four groups of 20 rats per sex were fed 0, 0.05, 0.5 and 5.0% (w/w) of the AES (C10-16; 3 EO) Na (CAS 68585-34-2) over a period of 91 days (Ashby, 1977). The test material contained 30% active ingredient, converting the doses to 0, 10, 100 and 1100 mg/kg bw/day active substance. There were no observable differences in the appearance, mood, locomotion, and fecal consistency of treated and control animals and no animals died during the treatment period. No statistically significant changes in food consumption occurred during the study. The body weight gains of both sexes in the 5.0% group were reduced from the commencement of

treatment, so that their body weights were significantly different from the controls when analyzed at Week 2, at termination their body weights were 84% (males) and 85% (females) of those of the respective controls. The body weight gains of both sexes in the 0.5% group were lower from Week 5 (males) or 6 (females), although this reduction was statistically significant in the males only. The food conversion ratio of males in the 5.0% group was consistently reduced, indicating inferior food utilization; however, it is not specified if this finding was statistically significant. Females in the 5.0% group displayed erythrocytic characteristics slightly lower than in the controls, with statistically significant effects on packed cell volume and erythrocyte count. Serum glutamate pyruvate transaminase and alkaline phosphatase levels were significantly elevated in both sexes in the 5.0% group. The liver weights of both sexes in the 5.0% group were significantly elevated. The heart weights of both sexes in the 5.0% group were significantly reduced when analyzed in absolute terms and relative to brain weight. No treatment-related changes were seen in the macroscopic appearance of the tissues examined at necropsy. No histopathological changes or variations that were considered treatment-related were observed in any of the tissues and organs examined. Several effects were seen in the lungs, liver, and kidneys; however, they were not statistically significant and were considered not to be of toxicological significance. There were no treatment-related effects on the organ weights (both absolute and relative), or macroscopic or microscopic pathology of the gonadal tissues examined. Since the decrease in the erythrocyte count was not dose-dependent, it was concluded that the test substance at dietary levels up to 0.05% test material (corresponding to 100 mg/kg bw/day) elicited no adverse effects.

- A subchronic study was designed to evaluate the toxicological effects of AES (C10-16; 3 EO) Na (CAS 68585-34-2) in albino rats (20/sex/group) when administered in the diet for thirteen weeks at levels of 0.0, 0.1, 0.5, and 1.0% active ingredient (corresponding to 0, 60, 300 and 600 mg/kg bw/day) (Picrillo, 1977). Interim sacrifices were performed on five rats/sex/group at four weeks and ten rats/sex/group at thirteen weeks. Five rats/sex/group were maintained on study for one additional week and sacrificed at Week 14. The criteria evaluated for compound effects were clinical signs, mortality, body weight and food consumption, ophthalmoscopic findings, clinical chemistry and hematology, organ weights, and gross and microscopic pathology. No distinct effect attributed to the administration of the test substance were noted in comparisons of the clinical signs, mortality rates, ophthalmoscopic findings or hematology and blood chemistry values of the test groups to the controls. In addition, no compound related gross or histomorphology organ or tissue alterations were noted in any of the treated animals. When compared to the data of the control group, slightly lower body weight gains were noted in the mid- and high-dose male groups. These differences were not statistically significant. The absolute and relative liver weights of all treated groups of both sexes were slightly, to moderately higher than respective control data at Weeks 4, 13 and 14. These differences were generally (but not always distinctly) dose-related and statistically significant at some of the intervals. The heart weights and ratios of all of the male treated groups were slightly (not statistically significantly) lower than those of the controls at Weeks 4, 13 and 14. However, neither gross pathology, nor microscopic examination of liver and heart sections confirmed the presence of any treatment-related hepatic or cardiac alterations. Gonadal tissues were examined for both gross pathology and histopathology and no treatment-related effects were detected. No outstanding treatment related toxic effects were noted when the test substance was administrated up to 600 mg/kg bw/day in the diet to albino rats. Although there were statistically

significant differences in absolute and relative liver and heart weights noted in test substance-treated groups compared to control animals, and these differences were generally dose-related, no histopathological correlation was found to confirm the presence of any treatment-related alterations. As such the NOEL was determined to be 600 mg/kg bw/day.

- Synthetic AES (C12-15; 3 EO) Na and natural AES (C12; 3 EO) Na (sodium lauryl(3EO)ethoxysulphate) were tested in a 90-day rat diet study at dose levels of 0, 40, 200, 1000 and 5000 ppm active material, corresponding to 0, 2, 10, 50 and 250 mg/kg bw/day (Walker, 1967). Health, behavior, body weight, food intake, hematological and urinary parameters remained within normal limits at all doses. In both studies organ weight and blood chemistry effects observed were unaccompanied by any pathological changes. Based on the available information and taking into account that the study was conducted prior to the development of GLP and OECD guidelines, a NOAEL could be established at the dose level of greater than 250 mg/kg bw/day.
- Further information on sub chronic toxicity can be deduced from a two-generation reproduction study with AES (C12-14, no data on grade of ethoxylation) Na (CAS 68891-38-3) (Biggs, 1999). Sprague Dawley rats were dosed via the drinking water at the concentrations 0, 0.03, 0.1 and 0.3%, which corresponded to daily doses of ca. 0, 30, 100 and 300 mg/kg bw. There were some changes indicative of parental toxicity in the group treated with 0.3% of the test substance. Slight but significantly reduced straight line velocity (VSL) of the sperm was without any significant effects on averaged path velocity (VAP) or total motility. Moreover, in the available sub chronic and chronic toxicity studies on various AES the primary sex organs of the males and females did not show evidence for treatment-related adverse effects. The observed reduced triglyceride levels (female) and increased percentage neutrophil counts (males) were slight and within the range of the historical control data. The male F0 generation showed a small but significant reduction in body weight-liver weight ratios, but the corresponding brain related liver weights and the absolute liver weights developed not in a dose dependent way. For the F1 generation where similar results were reported, no dose-response relationship was detected either. No influence on liver weight development was seen in the F2 generation. None of the groups revealed any histopathological or clinical-chemical findings, which could be attributed to hepatotoxicity. This led to the conclusion that this untypical liver weight reduction was of no toxicological relevance, additionally underlined by the absence of such effects in the studies for sub chronic toxicity mentioned above. There was evidence of toxicity on pup development at this dose level that was characterized by an increase in the time taken for sexual development of the male (not significant) and female (significant) offspring. This was investigated in more detail in the developmental toxicity studies up to 1500 mg/kg bw and no effects were noted there. Considering all these facts the sub chronic NOAEL for systemic toxicity can be set to greater than 300 mg/kg bw.
- No unusual findings regarding systemic toxicity were noted in a 2-year chronic feeding study in rats in which AES (C12; 3EO) (lauryl(3EO)ethoxysulphate) was given at 0, 0.1 or 0.5% (corresponding to 0, 50, 250 mg/kg bw/day) in the diet (Little, 1991). The results of this study suggest that the NOEL for AES (C12; 3EO) in this 2-year chronic feeding study in rats was greater than 250 mg/kg bw. In another 2-year study (Little, 1991), rats were administered AES (C12; 3 EO) (lauryl(3EO)ethoxysulphate) in the drinking water at a concentration of 0.1% (equals a dose of 75 mg/kg bw/day). The only unusual finding was slight, but consistently higher water consumption by all rats receiving the test

compound in their drinking water and a significant difference in the empty caecum to body weight ratio of females. Absolute organ weights were all comparable to controls and no consistent gross or histopathology was found. A NOEL greater than 75 mg/kg bw can be estimated on the basis of the available information.

- A dermal exposure study was conducted to determine the histopathological effects on the skin at treatment sites after repeated dermal exposure to AES (C10-16; 3 EO) Na (CAS 68585-34-2) over 91 days with a 28 day interim sacrifice. 25 ICR-Swiss CD-1 mice per sex and group were assigned to each of the following treatment groups. The dose volume for each group was 0.1 mL with the control group being sterile water, a 2.38 mg/day test group, and a 6.91 mg/day test group. An area of 2 x 3 cm of the dorsal area of all animals was clipped and treated with the appropriate dose five times per week. All animals were observed daily for signs of general health, mortality, and gross skin irritation effects. Gross signs of toxicity and body weights were recorded on a weekly basis throughout the study. After 28 days (21 dermal applications) ten animals per sex from each group were sacrificed and necropsied. The remaining animals continued on the treatment regimen until the termination of the study. At study termination (90-92 days from initiation of the study), five females from each group were sent to the sponsor for in-vitro skin penetration studies. The remainder of the animals were sacrificed and necropsied. No mortalities were attributed to treatment and there were no significant differences in body weights in any animals throughout the study. Gross necropsies at interim or terminal sacrifice did not reveal any compound related lesions with the exception of skin effects at the site of treatment. At the 28 day interim evaluation, repeated dermal applications in both test groups did not result in any gross skin effects with exception of two animals per group, which exhibited scaling and erythema or scales in the dorsal area which were not deemed to be of significance. Histopathological examinations of the skin exhibited comparable skin effects as controls. Furthermore, animals treated with 2.38 mg/day of the test substance did not exhibit any gross or microscopic compound related irritative effects after 91 days of treatment. However, mice treated with 6.91 mg/day of the test substance showed minimal or slight acanthosis in 12 of the 25 mice. Gonadal tissues were examined for both gross pathology and histopathology and no treatment-related effects were detected. The test substance did not produce dermal irritation after 91 days of treatment at a dose of 2.38 mg/day. When calculating the concentrations based on mg/cm2 the NOAEL for local effects was 0.4 mg/cm^2. Increasing the dose to 6.91 mg/day (corresponds to 1.15 mg/cm^2) over 91 days did induce some irritation effects. No systemic effects were identified at either dose level. Thus, the systemic NOEL was the highest dose of 195 mg/kg bw/d.

Dietary NOAELs and LOAELs (a.i.) for repeated oral toxicity studies of AES

Substance	**Duration (weeks)**	**NOAEL/NOEL (mg/kg bw/day)**	**LOAEL (mg/kg bw/day)**	**Reference**
AES(C12-14)Na	13	225	> 225	Pittermann (1994a)
AES(C12-15;3EO)Na AES(C12;3EO)Na	13	250	> 250	Walker (1967)
AES(C10-16;3EO)Na	13	100	1100	Ashby (1977)

AES(C10-16;3EO)Na	13	600	> 600	Piccirillo (1977)
AES(C12-14)Na	13	300	> 300	Biggs (1999)
AES(C12;3EO)	104	250	> 250	Little (1991)

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- NaC12-15E3S was fed to rats at dietary concentrations of active ingredient of 0, 40, 200, 500, 1000 and 5000ppm in a 90-day oral feeding study [Shell Research Ltd., 1982a]. During the study, observations were made on the general health and behavior, body weight and food intake of each rat. At necropsy, major organs were weighed and specified tissues examined histologically. Terminal blood samples were taken for hematological and clinical chemical examinations. All animals survived until their scheduled necropsy date. The general health and behavior of control and treated rats were similar throughout the study. No significant change was found in female body weights. Male body weights were significantly higher than controls at 500ppm from week 10 onwards and at 200ppm at weeks 11 and 13. At higher concentrations, there was no difference in body weights from the control values. Male and female liver weights significantly increased at 5000ppm. Absolute testes weights were increased at 5000ppm. However, no differences were observed when adjusted for terminal body weight. These increases were not accompanied by histological, clinical chemical or hematological changes and were therefore considered to be adaptive in nature and not a toxic effect of the compound. A NOEL or NOAEL was not indicated by the authors but based on the available information and taking a conservative approach, the NOAEL is considered to be 1000ppm. It was not indicated in the report whether the study followed the principles of the OECD method 407 and was GLP compliant.

- Estimated Data: None

Neurotoxicity (N-single): *M*

Ammonium Laureth Sulfate was assigned a hazard classification level of Moderate for single dose neurotoxicity based effects such as increased/decreased activity, piloerection/hunched posture, diarrhea, salivation, and central nervous system depression reported following oral exposures. These clinical symptoms observed in some studies were transient in nature and resolved within a maximum of 3 days post-administration. Based on the reported reversible nature of these effects, a GHS Category 3 for single exposure is assigned to the compound. The reported effects were made using cage-side observations and it is unclear if these effects are based on specific neurotoxicity of the tested compound or are secondary effects associated with general toxicity. Therefore, the hazard score is reported with low confidence.

Data

- Lists
  - *Authoritative: None*
  - *Screening: None*
- Measured Data

ECHA 2023

Alcohols, C12-14 (linear, even-numbered), ethoxylated, sulfates, ammonium salts, < 2.5 mol EO

- Tested AES substances induced no or only mild clinical symptoms (e.g., increased/decreased activity, piloerection/hunched posture, diarrhea, salivation, central nervous system depression) and had no effect on body weights or gross pathology. These clinical symptoms observed in some studies were transient in nature and resolved within a maximum of 3 days post-administration. More severe clinical symptoms were noted in one study (conducted with alcohols, C12-14, ethoxylated, sulfates, sodium salts, CAS No. 68891-38-3, EC No. 500-234-8), which included abnormal gait, decreased respiratory rate, ptosis, and pallor of extremities additionally to the symptoms mentioned above, at a dose of ≥ 3200 mg/kg bw (corresponding to ≥ 2240 mg a.i./kg bw). This dose, however, well exceeds the limit dose of 2000 mg/kg bw recommended for acute oral toxicity studies.
- In an OECD Guideline 402 (Acute Dermal Toxicity) study animals dosed at 2000 mg/kg bw showed no clinical signs of toxicity

HERA 2003

- A recent study [Hüls AG, 1997a] which was rated as reliable without restrictions according to the Klimisch criteria [Klimisch et al. (1997)], followed the guidelines of OECD method 401 and was compliant with GLP, a group of ten rats, five of each sex, was given a single oral dose of the triisopranolammonium salt of C12-14AE2S (90% active material) at a dose level of 2000 mg/kg bodyweight. The undiluted liquid was administered by gavage with an application volume of 2 ml/kg bodyweight. The rats were observed daily for any mortalities and clinical symptoms following treatment. Individual body weights were recorded on days 0 (prior to dosing), 7 and 14. At the end of the 14-day observation period, the animals were sacrificed and macroscopically examined. The animals showed mild clinical symptoms such as increased activity and piloerection as a reaction to the treatment for approximately four hours after dosing. The macroscopic examination on day 14 showed no significant lesions.
- In a further study, rated as reliable with restrictions according to the Klimisch criteria, was also conducted according to the guidelines of OECD method 401, but not following GLP standards, a 70% solution of NaC12-14AE2S was administered by oral gavage at a dose level of 2.5 g/kg. The rats achieved acceptable bodyweight gains throughout the study and showed mild clinical signs (unkempt fur, abdominal position, diarrhea) as a reaction to the treatment for approximately 2 hours after dosing. The macroscopic examination on day 14 showed no significant lesions.
- The acute dermal toxicity of AES has been evaluated in several rat studies [Hüls AG, 1997b;Shell Research Ltd. 1975a; Shell Research Ltd., 1978a; Shell Research Ltd., 1978b; Shell Research Ltd., 1975b; Shell Research Ltd., 1978c; Shell Research Ltd., 1975c; Shell Research Ltd., 1972; Shell Chemical Co., 1967; Arthur D. Little, 1991] and in one rabbit study [Shell Chemical Co., 1967]. Most of the studies did not follow OECD guidelines (e.g., use of small group sizes) and did not comply with GLP regulations. However, despite some protocol deficiencies, the studies were reported in sufficient detail to allow a reasonable assessment of the potential dermal toxicity of AES in laboratory animals. At highest dosage levels, various degrees of skin irritation (moderate to severe erythema and oedema) were reported, and signs of intoxication included sporadic signs of hemorrhage around the eyes and nose, piloerection, and diarrhea.

- An acute dermal toxicity study (limit test) following OECD method 402 and complying with GLP guidelines was performed to assess the acute dermal toxicity of triisopranolammonium salt of C12-14AE2S (90% active material) in the rat. A group of ten rats, five of each sex, was given a single dermal application of the test substance at a dose level of 2 g/kg bodyweight. There were no deaths and no signs of systemic reaction to the treatment.

- Estimated Data: None

Neurotoxicity (N-repeated) (Group II*): *L*

Ammonium Laureth Sulfate was assigned a hazard classification level of Low for repeated dose neurotoxicity based on available oral repeated dose toxicity studies which report no adverse effects, behavioral or clinical abnormalities observed. This hazard score is based on cage side observation and does not include specific neurobehavioral examinations. Therefore, the hazard score is reported with low confidence.

Data

- Lists
  - *Authoritative: None*
  - *Screening: None*
- Measured Data

HERA 2003

- Synthetic NaC12-15AE3S and natural NaC12AE3S were tested in a 90-day rat diet study at dose levels of 0, 40 200, 1000 and 5000ppm active material [Walker, 1967]. Health, behavior, body weight, food intake, hematological and urinary parameters remained within normal limits at all doses. Similarly, to the study by Butterworth [Shell Research Ltd., 1982a], a NOEL or NOAEL was not established by the authors but based on the available information and taking a conservative approach, the NOAEL could be established at the dose level of 1000ppm. The study was conducted prior to the development of GLP and OECD guidelines. However, the principles and the procedures were similar in various respects to the OECD test guidelines.
- NaC12-15E3S was fed to rats at dietary concentrations of active ingredient of 0, 40, 200, 500, 1000 and 5000ppm in a 90-day oral feeding study [Shell Research Ltd., 1982a]. During the study, observations were made on the general health and behavior, body weight and food intake of each rat. At necropsy, major organs were weighed and specified tissues examined histologically. Terminal blood samples were taken for hematological and clinical chemical examinations. All animals survived until their scheduled necropsy date. The general health and behavior of control and treated rats were similar throughout the study. A NOEL or NOAEL was not indicated by the authors, but based on the available information and taking a conservative approach, the NOAEL is considered to be 1000ppm. It was not indicated in the report whether the study followed the principles of the OECD method 407 and was GLP compliant.
- NaC12-14AE2S was tested for systemic toxicity at repeated doses by oral gavage of 0 (group 1), 25 (group 2), 75 (group 3), and 225 (group 4) mg/kg bodyweight [Henkel KGaA, 1994a]. The compound was administered by gavage over a period of 90 days. Ten (10) male and female rats were used for each dose. Five (5) male and female

animals of groups 1, 3, and 4 were observed to determine the reversibility of possible compound-related alterations for 28-days after treatment. Four (4) animals died during the treatment period. The mortality of the animals was, however, considered to be incidental. Three (3) animals died due to experimental procedures such as anesthesia for blood sampling and the fourth animal was sacrificed due to a traumatic fracture of the mandibula. No systemic treatment-related effects were observed in any test group. Looking at systemic toxicity, behavioral and clinical abnormalities and other general or specific toxic effects, a no adverse effect level (NOAEL) of 225 mg/kg could be established. The study followed the OECD guideline method 408. GLP compliance was not indicated in the study report.

- Estimated Data: None

Skin Sensitization (SnS) (Group II*): L

Ammonium Laureth Sulfate was assigned a hazard classification level of Low for skin sensitization based on most available guinea pig studies in which AES was tested for skin sensitization properties demonstrating the absence of skin sensitizing potential. A few studies indicated a weak sensitization potential of AES, but it should be taken into consideration that observed reactions may have been confounded with irritation reactions. It must be noted that most of the available studies were not conducted according to the OECD guideline protocols, nor according GLP standards. Nevertheless, based on the limited information available, these studies appear to have been scientifically well conducted and the results should be included in the overall evaluation. Taking a weight of evidence approach and considering quality criteria (i.e., compliance with OECD methods, GLP) in evaluating reliability of individual studies, AES are not considered to be skin sensitizers. The hazard conclusion is based on study data using high quality analogs. Therefore, the hazard score is reported with high confidence.

Data
- Lists
    - *Authoritative: None*
    - *Screening: None*
- Measured Data

ECHA 2023
Alcohols, C12-14 (linear, even-numbered), ethoxylated, sulfates, ammonium salts, < 2.5 mol EO
- A study was performed with alcohols, C8-10, ethoxylated, sulfates, sodium salts (CAS No. 1471312-55-6, EC No. 939-523-2) according to the guinea pig maximization test protocol described in OECD guideline 406 and under GLP conditions (Z&S, 2013). Ten female guinea pigs were included in the test group. The pure test substance (98.7%) was suspended in physiological saline for the intradermal induction, and in Vaseline for the topical induction and challenge phases, respectively. On Day 0 the intradermal induction was performed with 2.5% test substance. The topical induction started on Day 6 with a 1.5% suspension, lasting for 48 h under occlusive conditions. On Day 20 the animals of the test and negative control groups were challenged with 0.5% test substance for 24 h under occlusive conditions. Skin reactions were scored 24 and 48 h

after patch removal. The concentrations used in the main study were selected based on the results of a range-finding test with 10 animals. In the positive control group, 5 female guinea pigs were treated according to the same protocol as the test group with mercaptobenzothiazole. The intradermal and topical induction concentrations were 2% and 25%, respectively, while the challenge was performed with a 15% suspension in Vaseline. Following the intradermal induction, skin irritation was noted at the test sites of all animals. The topical induction did not cause skin irritation in any negative control or test group animals. Following the challenge, no skin irritation was observed in the negative control and test group animals. No adverse systemic effects of the treatment or significant body weight changes were noted in any animals. The 5 animals in the negative control group did not show any skin reactions following the challenge, while 5/5 animals in the positive control group showed a positive indication of skin sensitization, indicating the controls were valid. The test substance showed no sensitizing potential under the study conditions.

- The study with alcohols C12-14 (even numbered), ethoxylated (< 2.5 EO), sulphated, triisopropanolamine salts (CAS No. 174450-50-1, EC No. 605-725-1) was performed according to the Buehler protocol described in OECD guideline 406 and under GLP conditions. Twenty female guinea pigs were included in the test group and ten in the negative control group. The pure test substance (83.8%) was suspended in deionized water for the topical induction and challenge phases. On Day 0 the first topical induction was performed with 50% test substance, lasting for 6 h under occlusive conditions. The second and third topical induction was performed on Day 7 and 14, respectively, with a 50% concentration. On Day 28 the animals of the test and negative control groups were challenged with 25% test substance for 6 h under occlusive conditions. Skin reactions were scored 24 and 48 h after patch removal. The concentrations used in the main study were selected based on the results of a range-finding test with 6 animals. The dermal treatment during the first induction phase led to scarcely detectable skin irritation in 2/20 animals, 24 h after patch removal. After the second induction phase, 14/20 animals exhibited slight to well-defined erythema in combination with slight oedema 24 h after patch removal. Before the treatment in the third induction phase, these 14 animals, after shearing, still exhibited scaling in the administration area. The test substance was administered to intact skin. 24 h after the second induction phase, the administration area exhibited scarcely detectable erythema and oedema in 4/20 animals, well-defined erythema, and oedema in 5/20 animals and moderate erythema and oedema in 2/20 animals, in 1 animal combined with necrotic spots on the skin. The control animals treated with the vehicle did not show irritation on the treated skin at any reading time point during the three induction phases. The challenge treatment did not cause any cutaneous reactions in the negative control and test group animals in the form of erythema or oedema 24 and 48 h after patch removal. No adverse systemic effects of the treatment or significant body weight changes were noted in any animals. A reliability check was performed regularly with 2-mercaptobenzothiazole. The test substance showed no sensitizing potential under the conditions of the study.
- Two Human Repeated Insult Patch Tests (study No. 30449 and 07-009A) were performed with alcohols C10-16, ethoxylated (1-2,5 EO) sulphated, sodium salts (CAS No. 68585-34-2, EC No. 500-223-8). Some skin irritation was noted during the induction phases in a majority of the volunteers. Both studies concluded that the test substance showed no skin sensitizing potential in the human volunteers.
- The WoE analysis based on the in vivo studies and HIRPTs indicates that AES

substances in general do not show a skin sensitizing potential. The conclusion is fully supported by the OECD QSAR Toolbox profiling results. This applies to all AES substances in the category, whether they belong to the 'linear', 'unsaturated' or 'mixed branched & linear' subgroups and regardless of their counter ion. The outcome of this WoE evaluation is used for the hazard assessment and to conclude on classification and labelling of all AES substances in the category.

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- NaC12-14AE2S (28% active material) was evaluated in the Magnusson-Kligman guinea pig maximization test [Hüls AG, 1989] according to OECD method 406. In the induction phase, the treatment group was injected on day zero 3 pairs of 0.1ml volume (injection 1: a 1:1 mixture Freunds' complete adjuvant (FCA) and water; injection 2: 0.1% test substance in water; injection 3: 0.1% test substance in a 1:1 mixture FCA) in the shoulder region of female guinea pigs. A week later, a patch containing 30% solution of the test substance was placed over the injection area for 48 hours in the treatment group. The control groups were treated in the same manner, but without the test substance (i.e., 3 injections on day 0 and patch application on day 7). Two weeks after the induction phase, the flanks of the treated and the control animals were cleared of hair and an occlusive 'challenge' patch containing 10% of the test substance (or water in case of the control group) was applied to one flank of the animals for 24 hours. Approximately 48 and 72 hours from the start of the challenge application, the skin reaction was observed and recorded according to the Magnusson-Kligman grading scale. Under the test conditions, NaC12-14AE2S did not cause skin sensitization in guinea pigs.
- Further AES materials such as NaC12-14AE2S (27% active material) and a mixture of sodium laureth sulphate, sodium laureth-8 sulphate and sodium oleth sulphate (5-10EO, 29% active matter) were evaluated according to the same protocol and were found to not cause skin sensitization in guinea pigs [Henkel KGaA, 1977a, Henkel KGaA, 1977b]. However, one batch of NaC12-15E3S caused a weak skin sensitization response [Henkel KGaA, 1985]. In this study, 20 animals were induced intradermally with a 0.25% aqueous solution of the test item and complete Freund' adjuvant. One week after, an occluded patch containing 50% solution of the test substance was placed over the injection area for 48 hours. After a 14 day rest period, the test animals were challenged with an occluded patch containing a 20% solution of the test substance. 24 and 48 hours after removal of the challenge patch, dermal reactions (score 1) were seen in seven animals. A rechallenge was performed seven days later by applying a 10% aqueous solution of the test substance on the flanks opposite to the treatment area. Two out of twenty animals displayed weak skin effects (score 1).
- In 1966, skin sensitization associated with exposure to ethoxysulphates was reported in Norway. Walker et al., 1973 conducted a series of investigations to determine the source of this response and identified a contaminant in one particular AES batch shown to be the responsible sensitizing agent. Connor et al., 1975 identified the contaminant in AES to be 1- dodecene-1,3-sultone, 1-tetradecene-1,3 sultone, 2-chloro-1,3 dodecene sultone and 2-chloro1,3-tetradecene sultone. Connor et al. demonstrated that these sultones could be formed only under very specific, extreme AES manufacturing conditions. It became evident that the unsaturated and the chloro-sultones which are considered to be potent skin sensitizers were the result of conditions not normally present and readily avoidable in AES manufacture. The formation of sultones in the AES

production is to date not an issue anymore. Presently, residual levels of unsaturated and chloro-sultones and their precursors are monitored in AES batches on a routine basis.

- Estimated Data: None

Respiratory Sensitization (SnR) (Group II*): DG

Ammonium Laureth Sulfate was assigned a hazard classification level of Data Gap for respiratory sensitization based on the absence of study data for the compound of interest or for analog compounds. However, inhalation is not viewed as a significant route of exposure due to its very low vapor pressure.

Data
- Lists
  - *Authoritative: None*
  - *Screening: None*
- Measured Data: None
- Estimated Data: None

Skin Irritation/Corrosivity (IrS): H

Ammonium Laureth Sulfate was assigned a hazard classification level of High for skin irritation/corrosivity based on studies for analog compounds that report an erythema/eschar mean score of 2.33 and an oedema mean score of 2.78 following dermal exposures. Most studies report that the skin irritation effects were reversible within 21 days post exposure and therefore are assigned a GHS category 2 for skin irritation. The irritation potential of the analog compounds is concentration dependent. Materials with concentrations higher than 70% are moderately to severely irritating to rabbit skin. At concentrations between 10 and 30%, the AES solutions exhibit mild to moderate irritancy under the conditions of an occluded patch test. AES concentrations below 1% are virtually non-irritating under the conditions of the acute skin irritation testing protocol. The hazard conclusion is based on reliable data using high quality analogs. Therefore, the hazard score is reported with high confidence.

Data
- Lists
  - *Authoritative:*
  - *Screening:*
    - *GHS – Australia H315 - Causes skin irritation [Skin corrosion/irritation - Category 2]*
    - *GHS - New Zealand Skin irritation category 2*
- Measured Data

ECHA 2023
- The concentration of AES substances in the test materials used in the skin irritation / corrosion studies varies from 1% to approx. 100%. Tested AES substances induced

mostly moderate to severe erythema and oedema at concentrations above 25%. Irritation symptoms started to occur immediately after removal of the test substance and were usually reversible within the 21-day observation period of the respective studies. However, since in some studies observations were made for a period less than the maximum of 21 days, skin effects were still observed at the termination of most of these studies. AES concentrations ≤ 10% did not cause irritation (studies 4299 and 4306 with alcohols C10-16, ethoxylated (1-2,5 EO) sulphated, sodium salts, CAS No. 68585-34-2, EC No. 500-223-8). The only exception to this finding was one of the in vivo studies with alcohols, C12-14, ethoxylated, sulfates, sodium salts (CAS No. 68891-38-3, EC No. 500-234-8, study No. 3108) in which the substance was tested at a concentration of 28% and induced only very weak erythema which was fully reversible within the 8-day observation period. No oedema was observed in this study. The reason for this deviation from the general observation is unknown. In some studies, the exposure period was 24 h and/or an occlusive cover was used. Only one of the available studies revealed a corrosive potential (study no. R9400325 performed with alcohols, C12-14, ethoxylated, sulfates, sodium salts. All other available studies indicate a potential to induce irritation. The reason for the corrosion found in study R9400325 is unknown. However, since it is the only study in the database of the category, it is considered not to contradict the overall conclusion of skin irritation for AES substances. The main findings of the in vivo studies are supported by the available in vitro assays performed with alcohols, C8-10, ethoxylated, sulfates, sodium salts (CAS No. 1471312-55-6, EC No. 939-523-2). The combined results of the in vitro studies provide evidence for an irritating (but not corrosive) potential.

<u>HERA 2003</u>

- The triisopranolammonium salt of C12-14AE2S (90% active material) was tested in an EC standard (4h) skin irritation study on rabbits [Hüls AG, 1997b]. The study followed OECD method 404 and followed GLP regulations. In this study, the undiluted liquid test substance was applied in a single dose for 4 hours to the shorn intact skin of three animals. The administration of the test substance led to well-defined erythema 24 hours after application and was associated with distinct oedema in two animals and severe oedema in the 3rd animal. Forty-eight (48) hours after application, these signs of irritation were still well-defined and without change in 2 out of 3 animals. The 3rd animal presented with moderately severe erythema, associated with severe oedema, dry skin and scaling, 48 hours after application. Seventy-two (72) hours after application, 2 animals exhibited localized skin irritation in the form of well-defined or moderately severe erythema and oedema, and 1 rabbit had slight subcutaneous hemorrhages. On the 14th day after administration of the test substance, the skin of all the animals was free from signs of irritation. For all 3 animals, an erythema/eschar mean score of 2.33 and an oedema mean score of 2.78 was determined. This score indicates moderate skin irritation properties of the undiluted test substance.
- In two further studies [NOTOX, 1994, Hüls AG, 1986b], NaC12-14AE2 (70% active material) was tested in the EC standard irritation test. Both studies were conducted in compliance with OECD method 404, but only 1 complied with GLP regulations [NOTOX, 1994]. As in the case of the study discussed before, exposure to the test substance for 4 hours resulted in moderate to severe erythema and oedema. After 72 hours, reduced flexibility, fissuring of the skin and severe erythema and oedema were apparent. One study [Hüls AG, 1986b] terminated the observations at the 14th observation day and

clinical signs of irritation were still apparent at this time. In the other study [NOTOX, 1994], animals were observed for 21 days, and irritation had completely resolved within 21 days after exposure, but patches of bold skin persisted at termination.

- Further studies were conducted to investigate the skin irritation of effects of various dilutions of AES at different exposure durations and conditions. These studies were investigative in nature, and neither was in compliance with OECD guidelines, nor with GLP regulations. However, these studies provide useful information on AES exposure conditions that are of particular relevance in consumer product applications. In 4hr or 24hr skin irritation studies on rabbits, a 0.1% AES solution did not show any signs of irritation, a 1% AES solution showed slight irritation, and solutions containing AES of 10 – 30% were mildly to moderately irritating under the patch conditions of the animal test.

- Estimated Data: None

Eye Irritation/Corrosivity (IrE): *vH*

Ammonium Laureth Sulfate was assigned a hazard classification level of Very High for eye irritation/corrosivity based on study data using an analog compound which reported moderate corneal opacity and circumcorneal injection in the iris that persisted throughout the 21-day observation period. Mixed results are reported for analog compounds regarding the reversibility of eye irritation. In addition, studies using analog substances suggest that AES in the C12-16 range produced more severe effects than AES with longer or shorter chains, that a threshold exists for irritation, and ocular irritation potential is influenced by alkyl chain length. While the hazard conclusion is based on study data using high quality analogs, the uncertainty associated with irritation potential and alkyl chain lengths results in the hazard score being reported with low confidence.

Data

- Lists
  - *Authoritative: None*
  - *Screening:*
    - *GHS – Australia H319 - Causes serious eye irritation [Serious eye damage/eye irritation - Category 2A]*
    - *GHS - New Zealand Eye irritation category 2*
- Measured Data

ECHA 2023

- The concentration of AES substances in the tested materials ranges from 1% in the studies with alcohols C10-16, ethoxylated (1-2,5 EO) sulphated, sodium salts (CAS No. 68585-34-2, EC No. 500-223-8) and alcohols, C12-14, ethoxylated, sulfates, sodium salts (CAS No. 68891-38-3, EC No. 500-234-8) to 83% applied in the study with alcohols C12-14 (even numbered), ethoxylated (< 2.5 EO), sulphated, triisopropanolamine salts (CAS No. 174450-50-1, EC No. 605-725-1). Most of the studies were performed with AES concentrations between 25% and 70%. Concentrations at or above 10% generally induce moderate to severe irritant responses in conjunctiva, iris and cornea and cause chemosis. Some studies were terminated

while effects were still observed in one or several animals. Since the observation periods applied in the different studies were not always as defined in the current OECD guideline 405, a concluding evaluation with respect to the reversibility of effects could not always be made and a case-by-case evaluation was made to reach a hazard conclusion. The exceptions to the general finding of irritating / damaging properties at concentrations > 10% are the studies with alcohols C10-16, ethoxylated (1-2,5 EO) sulphated, sodium salts (CAS No. 68585-34-2, EC No. 500-223-8). These studies resulted in 'not irritating' at concentrations of 27% and 70%, respectively. The reason for the deviation of the general irritating / damaging properties is not known. However, the studies contribute only to a minor extent to the hazard assessment of the whole AES category.

- In the following studies severe eye damage was observed: (10% concentration) and (60% concentration) with alcohols C10-16, ethoxylated (1-2,5 EO) sulphated, sodium salts (CAS No. 68585-34-2, EC No. 500-223-8), as well as with alcohols, C12-14, ethoxylated, sulfates, sodium salts (CAS No. 68891-38-3, EC No. 500-234-8) at concentrations of 25%, 28%, and 70%, respectively. There is no clear trend in the available data between the concentration of a substance and the severity of eye effects (measured as chemosis, and reaction in conjunctivae, cornea, and iris) and it is therefore not possible to predict when eye irritation turns into serious eye damage. Therefore, all AES substances at concentrations ≥ 10% are considered to induce serious eye damage. The with alcohols C10-16, ethoxylated (1-2,5 EO) sulphated, sodium salts (CAS No. 68585-34-2, EC No. 500-223-8) and with alcohols, C12-14, ethoxylated, sulfates, sodium salts (CAS No. 68891-38-3, EC No. 500-234-8) clearly demonstrate that highly diluted AES substances are not irritating anymore. Based on the fact that most of the available studies revealed an eye irritating rather than an eye damaging potential, and that the lowest concentration inducing eye damage is 25%, it is considered justifiable to define a cut-off concentration for eye damage of 10%. Therefore, a cut-off value for the induction of severe eye damage is set at a concentration of ≥ 10% for all AES substances in the category. The cut-off value for inducing irritation is set at a concentration of ≥ 5%.

<u>HERA 2003</u>

- Most of the studies with undiluted or concentrated AES solutions (e.g., 32.6% C9-11AE2.5S, 70% C12-13AE2S, 28% C12-13AE2S) resulted in extensive corneal damage, inflammation of the iris and maximal conjunctival irritation with no significant improvement seen over a 7-day recovery period after product administration [Shell Research Ltd. 1975a, Shell Research Ltd., 1975b, Brown et al., 1970]. In the same studies, which were neither conducted according to OECD guidelines (e.g., protocol deviations such as application volume and observation period), nor followed the principles of GLP, the authors also investigated the same materials at concentrations of 10%, 1% and 0.1%. Generally, solutions containing 10% AES were observed to cause moderately irritating effects while 1% and 0.1% dilutions were virtually non-irritating.
- The triisopranolammonium salt of C12-14AE2S (90% active material) was tested in an acute eye irritation study ("Draize test") according to OECD method 405 and following the principles of GLP. In this study, 0.1ml of the liquid test substance was administered into the conjunctival sac of one eye of each of the 3 rabbits. After an exposure time of 24 hours, the eyes were flushed with warm physiological saline. Twenty-four hours after exposure, the animals were observed to have reactions of the conjunctivae in the form

of diffuse crimson red discoloration (individual blood vessels not easily discernible), together with distinct swelling and partial eversion of the eyelids. The cornea was slightly opaque over the entire surface, and the iris of one animal showed severe hyperemia. Up to 72 hours after administration, these signs of irritation were largely unchanged and after 6 days, all signs of irritation began to diminish. After day 17, 2 animals were free from signs of irritation of the eye and mucosa. The 3rd animal was cleared after 24 days.

- In another study, 28% active C12-14AE2S was also tested in the Draize test, following the guidelines specified in the OECD method 405. GLP compliance was not mentioned. Again, in this study the tested AES material caused corneal opacity, iritis, and conjunctivitis in all test animals. While the conjunctivitis appeared to improve in all 3 test animals approximately 8- 10 days after exposure to the test material, corneal opacity and the circumcorneal injection in the iris were still present in 2 animals after 21 days.
- Further investigative studies were conducted to determine the effect of rinsing and AES alkyl chain length on the eye irritation potential in rabbits [Procter & Gamble, 1996b]. It was found that rinsing after instillation greatly reduced the severity of eye effects and that AES in the C12-16 range produced more severe effects than AES with longer or shorter chains. This was primarily manifested by longer clearing times (> 7 days versus 1-7 days).

- Estimated Data: None

ECOTOXICITY (ECOTOX)

Acute Aquatic Toxicity (AA): H

Ammonium Laureth Sulfate was assigned a hazard classification level of High for acute aquatic toxicity based on LC50 values of 1<10 mg/L reported for fish and aquatic invertebrates. The hazard conclusion is based on study data using high quality analogs. Therefore, the hazard score is reported with high confidence.

Data

- Lists
  - *Authoritative: None*
  - *Screening:*
    - *DK-EPA - Danish Advisory List Aquatic Acute1 - Very toxic to aquatic life (modeled)*
    - *DK-EPA - Danish Advisory List Aquatic Chronic1 - Very toxic to aquatic life with long lasting effects (modeled)*
    - *GHS - New Zealand Hazardous to the aquatic environment - acute category 1*
- Measured Data

ECHA 2023

- According to OECD guideline 203 in compliance with GLP requirements. Under flow-through conditions zebra fish (Danio rerio) were exposed to AES (C12-14, 1-2.5EO) Na (CAS 68891-38-3). After 96 h a LC50 of 7.1 mg a.i./L (nominal) was determined (Sasol,

1995).
- In a GLP-study zebra fish (Danio rerio) were exposed to AES (C12-14, 1-2.5EO) MIPA (CAS 1187742 -72 -8) according to OECD guideline 203 (Sasol, 1999). The resulting LC50 (96 h) was 7.7 mg a.i./L (nominal).
- The acute toxicity of Alcohols, C12-14 (linear, even-numbered), ethoxylated, sulfates, ammonium salts, < 2.5 mol EO to aquatic invertebrates was investigated in a study following OECD GD 202. The test organism Daphnia magna was exposed to nominal test concentrations of 1, 1.8, 3.2, 5.6 and 10 mg a.i./L in a semi-static test approach. The test concentrations were analytically monitored by LC-MS/MS. Eight constituents of the UVCB substance were targeted in the analysis. The determined EC50 (48 h) was 3.61 mg a.i./L, based calculated exposure concentrations.
- For AES (C12-14, 1-2.5EO) MIPA (CAS 1187742 -72 -8) a GLP-study was performed according to OECD guideline 201. Based on growth rate an EC50 (72 h) of 14 mg a.i./L (nominal) for Scenedesmus subspicatus was observed (nominal).
- For AES (C12-14, 1-2.5EO) Na (CAS 68891-38-3) a GLP-study was performed according to OECD guideline 201. Based on growth rate an EC50 (72 h) of 27.7 mg a.i./L (measured) for Scenedesmus subspicatus was determined.

- Estimated Data: None

Chronic Aquatic Toxicity (CA): H

Ammonium Laureth Sulfate was assigned a hazard classification level of High for chronic aquatic toxicity based on NOEC values of 0.1<1.0 mg/L reported for three trophic levels (fish, aquatic invertebrates, and algae). The hazard conclusion is based on study data using high quality analogs. Therefore, the hazard score is reported with high confidence.

Data
- Lists
  - *Authoritative: None*
  - *Screening: None*
- Measured Data

ECHA 2023
- To determine the toxic effect of the AES (C12 -14, 2EO) Na a study similar to OECD guideline 215 was performed (TEGEWA, 1995). In this test juvenile individuals of rainbow trout (Oncorhynchus mykiss) were exposed to different concentrations of AES (C12 -14, 2EO) Na under flow-through conditions. Mortality and growth were determined over 28 days. Related to mortality and sublethal effects a NOEC of 0.14 mg/L (measured) was determined.
- This result is supported by a non-GLP study carried out similar to OECD guideline 210, eggs of fathead minnow (Pimephales promelas) were exposed to the pure AES homologue (C14, 2EO) Na (P&G, 2004). Under flow-through conditions a NOEC (28 d) of 0.18 mg a.i./L (measured) was determined. The NOEC based on mortality.
- Effects of AES (C12 -14, 2.5EO) sodium salt mixture were examined in a non-GLP study according to OECD guideline 211 (P&G, 1977). Under flow-through conditions a NOEC (21 d) of 0.27 mg a.i./L (measured) for Daphnia magna was observed. The NOEC value

was based on reproduction.
- Following the procedures of the EPA-guideline 600/489/00 (which is equivalent or similar to OECD 211), individuals of Ceriodaphnia dubia were exposed under flow-through conditions in separate test systems to pure AES homologue Na salts with different chain-lengths (C12 and C14) and EO concentrations (EO1 and EO2). Based on reproduction the resulting 7-day-NOECs ranged from 0.31 mg a.i./L (measured) for C14, 2EO to 6.25 mg a.i./L (measured) for C12, 2EO.
- For AES (C12-14, 1-2.5EO) MIPA (CAS 1187742 -72 -8) a GLP-study was performed according to OECD guideline 201. Based on growth rate an EC50 (72 h) of 14 mg a.i./L (nominal) for Scenedesmus subspicatus was observed (nominal). The corresponding NOEC (72 h) was 2 mg a.i./L (nominal) (Sasol, 1999).
- For AES (C12-14, 1-2.5EO) Na (CAS 68891-38-3) a GLP-study was performed according to OECD guideline 201. Based on growth rate an EC50 (72 h) of 27.7 mg a.i./L (measured) for Scenedesmus subspicatus was determined. The corresponding NOEC (72 h) was 0.95 mg a.i./L (measured) (Sasol, 1993).

- Estimated Data: None

ENVIRONMENTAL FATE (FATE)

Persistence (P): L

Ammonium Laureth Sulfate was assigned a hazard classification level of Low for persistence based on meeting the criteria of readily biodegradable in OECD 301B and EU-guideline (C.4-A) studies. The hazard score is based on study data using quality analogs. Therefore, the hazard score is reported with high confidence.

Data
- Lists
  - *Authoritative: None*
  - *Screening: None*
- Measured Data

ECHA 2023
Alcohols, C12-14 (linear, even-numbered), ethoxylated, sulfates, ammonium salts, < 2.5 mol EO
- The first GLP-study was performed according to OECD guideline 301B and non-adapted domestic sludge was used (Sasol, 2004). After 28 days a biodegradation rate between 78 - 100% (CO2 evolution) was reported for the MIPA salt. The report concluded that the degradation rate meets the classification of readily biodegradable
- The second GLP-study was performed with non-adapted domestic sludge according to EU-guidelines (C.4-A) (Sasol, 1993). This test shows a biodegradation rate of 100% (DOC removal) after 28 days for the Na salt. The report concluded that the degradation rate meets the classification of readily biodegradable.

Alcohols, C-12-14, ethoxylated, sulfates, sodium salts (68891-38-3)
- In a screening study investigating the ready biodegradability of Alcohols, C16-18 and C18-unsatd., ethoxylated, sulfates, sodium salts a degradation rate of 69 % after 28

days was determined. The study was conducted according to OECD 301B using activated sludge from a municipal wastewater treatment plant as inoculum. The degradation rate was determined by measuring the CO2 evolution of the activated sludge organisms during the 28-day incubation period. The report concluded that the degradation rate meets the classification of readily biodegradable.

HERA 2004

- Several reviews highlight that AES are readily biodegradable, with alkyl-chain length having little effect
- The ultimate biodegradability of alcohol ethoxylates is well established (Swisher 1987, Holt et al. 1992) and glycol ether sulphates have also been shown to be fully degradable by mixed cultures forming inorganic sulphate and carbon dioxide (Griffith et al 1986, White and Russell 1988). The conclusion that AES degradation will not produce any recalcitrant metabolite is in line with the experimental findings on AES in the "Test for detecting recalcitrant metabolites" (Gerike and Jasiak 1986). In addition, Yoshimura et al (1982) reported test data showing that the (fish) toxicity of AES decreases in the course of AES degradation.
- Based on the chemical structure of AES and the proven easy anaerobic biodegradability of the structurally related alcohol ethoxylates and alkyl sulphates, good anaerobic biodegradability of AES is likely (Steber and Berger, 1995). This is supported by the result from testing C12-14EO2S in a stringent anaerobic biodegradability screening test (ECETOC test) which showed a gas (CO2 + methane) production of 75 % within the 41-day incubation period (Steber 1991). In addition, Nuck & Federle (1996) tested AES in a lab digester that simulated the situation in practice except that the system was static while real digesters are mainly run semi-continuously. Within the 17-day incubation period 88% ultimate biodegradation (based on 14C-gas formation) was found for C14[14C]EO3S.

- Estimated Data: None

Bioaccumulation (B): vL

Ammonium Laureth Sulfate was assigned a hazard classification level of Very Low for bioaccumulation based on measured Log Kow values of <4 reported for high quality analogs. The chemical group of alkyl ether sulfates are expected to be rapidly biotransformed and eliminated. The hazard score is based measured values and is supported by professional judgement. Therefore, the hazard score is reported with high confidence.

Data

- Lists
  - *Authoritative: None*
  - *Screening: None*
- Measured Data

ECHA 2023

Alcohols, C12-14 (linear, even-numbered), ethoxylated, sulfates, ammonium salts, < 2.5 mol EO

- The partition coefficient of < -1.22 at 20 °C was determined using calculation method according to OECD 107 (EU A.8). The method is based on measured solubility values in water and in n-octanol.
- Alkyl ether sulfates have a limited potential to bioaccumulate. The substances are expected to be rapidly biotransformed and eliminated.
- Alkyl ether sulfates have a limited potential to bioaccumulate. Available studies on the uptake and elimination of surfactants suggest a rapid uptake, but also fast biotransformation and elimination of the substances. The proposed mechanism for the elimination is the enzymatic breakdown to polar metabolites and alkyl chains by ω- and ß-oxidations subsequently or in parallel.

Alcohols, C-12-14, ethoxylated, sulfates, sodium salts (68891-38-3)

- The partition coefficient of -0.2 at 20 °C was determined using calculation method according to OECD 107 (EU A.8). The method is based on measured solubility values in water and in n-octanol.

- Estimated Data: None

PHYSICAL HAZARDS (PHYSICAL)

Reactivity (Rx): *L*

Ammonium Laureth Sulfate was assigned a hazard classification level of Low for reactivity based on the absence of chemical groups that are associated with explosivity or oxidizing properties. The hazard score is based on the chemical structure and professional judgement and therefore is reported with low confidence.

Data

- Lists
  - *Authoritative: None*
  - *Screening: None*
- Measured Data

ECHA 2023

Alcohols, C12-14 (linear, even-numbered), ethoxylated, sulfates, ammonium salts, < 2.5 mol EO

- There are no chemical groups associated with explosive properties present in the molecule. The available data on explosive properties of the test substance do not meet the criteria for classification according to Regulation (EC) 1272/2008 or Directive 67/548/EEC and are therefore conclusive but not sufficient for classification: based on chemical structure the substance is not explosive.
- On the basis of the chemical structure the substance is incapable of reacting exothermically with combustible materials. The available data on oxidizing properties of the test substance do not meet the criteria for classification according to Regulation (EC) 1272/2008 or Directive 67/548/EEC and are therefore conclusive but not sufficient for classification: based on the chemical structure the substance is not oxidizing.

Alcohols, C-12-14, ethoxylated, sulfates, sodium salts (68891-38-3)

- There are no chemical groups associated with explosive properties present in the molecule. The available data on explosive properties of the test substance do not meet the criteria for classification according to Regulation (EC) 1272/2008 or Directive 67/548/EEC and are therefore conclusive but not sufficient for classification: based on chemical structure the substance is not explosive.
- On the basis of the chemical structure the substance is incapable of reacting exothermically with combustible materials. The available data on oxidizing properties of the test substance do not meet the criteria for classification according to Regulation (EC) 1272/2008 or Directive 67/548/EEC and are therefore conclusive but not sufficient for classification: based on the chemical structure the substance is not oxidizing.

- Estimated Data: None

Flammability (F): L

Ammonium Laureth Sulfate was assigned a hazard classification level of Low for flammability based on the suitable analogs being known to be inflammable. This classification is based on the available study data of the suitable analogs and the chemical structure of the compound of interest and is therefore reported with high confidence.

Data
- Lists
  - *Authoritative: None*
  - *Screening: None*
- Measured Data

ECHA 2023
Alcohols, C12-14 (linear, even-numbered), ethoxylated, sulfates, ammonium salts, < 2.5 mol EO
- The substance is non-flammable based on the flash point determined in the test according to EU A.9 (closed cup; 189.5 °C at normal pressure).
- Based on the flash point the substance is nonflammable.
- Based on the chemical structure and experience in handling and use, pyrophoricity and flammability on contact with water are not expected.

Alcohols, C-12-14, ethoxylated, sulfates, sodium salts (68891-38-3)
- Alcohols, C16-18 and C18-unsatd., ethoxylated, sulfates, sodium salts is non-flammable based on the test according to EU A.10 (preliminary test; very slow propagation of combustion). Specifically, the substance ignites by a hot flame from a gas burner, but the flame stops burning after less than 10 mm and 30 seconds of propagation. Therefore, the combustion is beyond the specified time frame for flammability of 4 minutes for 200 mm
- Based on experience in handling and use and the chemical structure, pyrophoricity and flammability on contact with water are not to be expected.

- Estimated Data: None

REFERENCES

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CIR 1983. Final Report on the Safety Assessment of Sodium Laureth Sulfate and Ammonium Laureth Sulfate. Available at https://journals.sagepub.com/doi/epdf/10.3109/10915818309140713

APPENDIX A: HAZARD CLASSIFICATION 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

APPENDIX B – OPTIONAL HAZARD SUMMARY TABLE

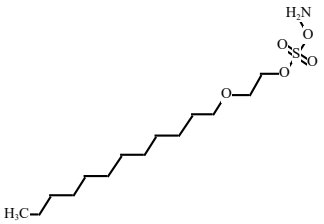
Exposure Route	GreenScreen Hazard Ratings: [*Chemical Name*]																	
	Group I Human					Group II and II* Human								Ecotox		Fate		Physical	
	C	M	R	D	E	AT	ST		N		SnS*	SnR*	IrS	IrE	AA	CA	P	B	Rx	F
							single	repeated*	single	repeated*										
oral																				
dermal																				
inhalation																				

APPENDIX C – MODELING RESULTS

Attach:

- **EPISuite Results for Ammonium Laureth Sulfate (32612-48-9)**

EPI Suite Results For CAS



```
SMILES : CCCCCCCCCCCCOCCOS(=O)(=O)ON
CHEM   : Ammonium Laureth Sulfate
MOL FOR: C14 H31 N1 O5 S1
MOL WT : 325.47
------------------------------ EPI SUMMARY (v4.11) --------------------------
Physical Property Inputs:
Log Kow (octanol-water):   ------
Boiling Point (deg C)  :   ------
Melting Point (deg C)  :   ------
Vapor Pressure (mm Hg) :   ------
Water Solubility (mg/L):   ------
Henry LC (atm-m3/mole) :   ------

Log Octanol-Water Partition Coef (SRC):
Log Kow (KOWWIN v1.68 estimate) =  4.58

Boiling Pt, Melting Pt, Vapor Pressure Estimations (MPBPVP v1.43):
Boiling Pt (deg C):  413.93  (Adapted Stein & Brown method)
Melting Pt (deg C):  157.29  (Mean or Weighted MP)
VP(mm Hg,25 deg C):  1.68E-007  (Modified Grain method)
VP (Pa, 25 deg C) :  2.25E-005  (Modified Grain method)
Subcooled liquid VP: 3.8E-006 mm Hg (25 deg C, Mod-Grain method)
: 0.000507 Pa (25 deg C, Mod-Grain method)
```

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Water Solubility Estimate from Log Kow (WSKOW v1.42):
Water Solubility at 25 deg C (mg/L):  1.061
log Kow used: 4.58 (estimated)
no-melting pt equation used

Water Sol Estimate from Fragments:
Wat Sol (v1.01 est) =  2.2725 mg/L

ECOSAR Class Program (ECOSAR v1.11):
Class(es) found:
Aliphatic Amines

Henrys Law Constant (25 deg C) [HENRYWIN v3.20]:
Bond Method :   2.34E-009  atm-m3/mole  (2.38E-004 Pa-m3/mole)
Group Method:   Incomplete
For Henry LC Comparison Purposes:
User-Entered Henry LC:  not entered
Henrys LC [via VP/WSol estimate using User-Entered or Estimated values]:
HLC:  6.781E-008 atm-m3/mole  (6.871E-003 Pa-m3/mole)
VP:   1.68E-007 mm Hg (source: MPBPVP)
WS:   1.06 mg/L (source: WSKOWWIN)

Log Octanol-Air Partition Coefficient (25 deg C) [KOAWIN v1.10]:
Log Kow used:  4.58  (KowWin est)
Log Kaw used:  -7.019  (HenryWin est)
Log Koa (KOAWIN v1.10 estimate):  11.599
Log Koa (experimental database):  None

Probability of Rapid Biodegradation (BIOWIN v4.10):
Biowin1 (Linear Model)         :   0.3537
Biowin2 (Non-Linear Model)     :   0.0392
Expert Survey Biodegradation Results:
Biowin3 (Ultimate Survey Model):   2.7696  (weeks       )
Biowin4 (Primary Survey Model) :   3.6375  (days-weeks  )
MITI Biodegradation Probability:
Biowin5 (MITI Linear Model)    :   0.3882
Biowin6 (MITI Non-Linear Model):   0.2019
Anaerobic Biodegradation Probability:
Biowin7 (Anaerobic Linear Model):  0.5194
Ready Biodegradability Prediction:   NO

Hydrocarbon Biodegradation (BioHCwin v1.01):
Structure incompatible with current estimation method!

Sorption to aerosols (25 Dec C)[AEROWIN v1.00]:
Vapor pressure (liquid/subcooled):  0.000507 Pa (3.8E-006 mm Hg)
Log Koa (Koawin est  ): 11.599
Kp (particle/gas partition coef. (m3/ug)):
Mackay model           :  0.00592
Octanol/air (Koa) model:  0.0975
Fraction sorbed to airborne particulates (phi):
Junge-Pankow model     :  0.176
Mackay model           :  0.321
Octanol/air (Koa) model:  0.886

Atmospheric Oxidation (25 deg C) [AopWin v1.92]:
```

```
Hydroxyl Radicals Reaction:
OVERALL OH Rate Constant =  52.4611 E-12 cm3/molecule-sec
Half-Life =     0.204 Days (12-hr day; 1.5E6 OH/cm3)
Half-Life =     2.447 Hrs
Ozone Reaction:
No Ozone Reaction Estimation
Fraction sorbed to airborne particulates (phi):
0.249 (Junge-Pankow, Mackay avg)
0.886 (Koa method)
Note: the sorbed fraction may be resistant to atmospheric oxidation

Soil Adsorption Coefficient (KOCWIN v2.00):
Koc    :  5087  L/kg (MCI method)
Log Koc:  3.706       (MCI method)
Koc    :  3383  L/kg (Kow method)
Log Koc:  3.529       (Kow method)

Aqueous Base/Acid-Catalyzed Hydrolysis (25 deg C) [HYDROWIN v2.00]:
Rate constants can NOT be estimated for this structure!

Bioaccumulation Estimates (BCFBAF v3.01):
Log BCF from regression-based method = 1.316 (BCF = 20.72 L/kg wet-wt)
Log Biotransformation Half-life (HL) = -0.3928 days (HL = 0.4047 days)
Log BCF Arnot-Gobas method (upper trophic) = 2.216 (BCF = 164.5)
Log BAF Arnot-Gobas method (upper trophic) = 2.216 (BAF = 164.5)
log Kow used: 4.58 (estimated)

Volatilization from Water:
Henry LC:  2.34E-009 atm-m3/mole  (estimated by Bond SAR Method)
Half-Life from Model River: 4.514E+005  hours   (1.881E+004 days)
Half-Life from Model Lake : 4.924E+006  hours   (2.052E+005 days)

Removal In Wastewater Treatment:
Total removal:              60.17  percent
Total biodegradation:        0.55  percent
Total sludge adsorption:    59.61  percent
Total to Air:                0.00  percent
(using 10000 hr Bio P,A,S)

Level III Fugacity Model:
Mass Amount    Half-Life    Emissions
(percent)        (hr)       (kg/hr)
Air       0.0449          4.89         1000
Water     16.3            360          1000
Soil      81.1            720          1000
Sediment  2.55            3.24e+003    0
Persistence Time: 751 hr
```

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- **ECOSAR Results for Ammonium Laureth Sulfate (32612-48-9)]**

ECOSAR Version 1.11 Results Page

SMILES : CCCCCCCCCCCCOCCOS(=O)(=O)ON
CHEM :
CAS Num:
ChemID1:
MOL FOR: C14 H31 N1 O5 S1
MOL WT : 325.47
Log Kow: 4.583 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: (deg C, PhysProp DB exp value for Wat Sol estimate)
Wat Sol: 1.061 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: (PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 4.583 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 1.061 (mg/L, EPISuite WSKowwin v1.43 Estimate)

ECOSAR v1.11 Class-specific Estimations

Aliphatic Amines

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Aliphatic Amines	: Fish	96-hr	LC50	1.257 *
Aliphatic Amines	: Daphnid	48-hr	LC50	0.202
Aliphatic Amines	: Green Algae	96-hr	EC50	0.092
Aliphatic Amines	: Fish		ChV	0.029
Aliphatic Amines	: Daphnid		ChV	0.022
Aliphatic Amines	: Green Algae		ChV	0.038
Neutral Organic SAR (Baseline Toxicity)	: Fish	96-hr	LC50	1.281 *
	: Daphnid	48-hr	LC50	0.923
	: Green Algae	96-hr	EC50	1.844 *

: Fish ChV 0.166
: Daphnid ChV 0.175
: Green Algae ChV 0.821

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Aliphatic Amines:

Maximum LogKow: 6.0 (Fish, Mysid LC50)
Maximum LogKow: 5.0 (Daphnid LC50)
Maximum LogKow: 7.0 (Green Algae EC50)
Maximum LogKow: 8.0 (Fish, Daphnid ChV)
Maximum LogKow: 7.0 (Green Algae ChV)

Baseline Toxicity SAR Limitations:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)

- **Other**