SCREENING-LEVEL HAZARD CHARACTERIZATION

Reclaimed Substances: Naphthenic Acids Category

SPONSORED CHEMICALS

Naphthenic Acids, Sodium Salts	**CASRN 61790-13-4**
Crude Naphthenic Acids (Petroleum)	**CASRN 64754-89-8**
Naphthenic Acids	**CASRN 1338-24-5**

The High Production Volume (HPV) Challenge Program[1] was conceived as a voluntary initiative aimed at developing and making publicly available screening-level health and environmental effects information on chemicals manufactured in or imported into the United States in quantities greater than one million pounds per year. In the Challenge Program, producers and importers of HPV chemicals voluntarily sponsored chemicals; sponsorship entailed the identification and initial assessment of the adequacy of existing toxicity data/information, conducting new testing if adequate data did not exist, and making both new and existing data and information available to the public. Each complete data submission contains data on 18 internationally agreed to "SIDS" (Screening Information Data Set[2]) endpoints that are screening-level indicators of potential hazards (toxicity) for humans or the environment.

The Environmental Protection Agency's Office of Pollution Prevention and Toxics (OPPT) is evaluating the data submitted in the HPV Challenge Program on approximately 1400 sponsored chemicals by developing hazard characterizations (HCs). These HCs consist of an evaluation of the quality and completeness of the data set provided in the Challenge Program submissions. They are not intended to be definitive statements regarding the possibility of unreasonable risk of injury to health or the environment.

The evaluation is performed according to established EPA guidance[2,3] and is based primarily on hazard data provided by sponsors; however, in preparing the hazard characterization, EPA considered its own comments and public comments on the original submission as well as the sponsor's responses to comments and revisions made to the submission. In order to determine whether any new hazard information was developed since the time of the HPV submission, a search of the following databases was made from one year prior to the date of the HPV Challenge submission to the present: (ChemID to locate available data sources including Medline/PubMed, Toxline, HSDB, IRIS, NTP, ATSDR, IARC, EXTOXNET, EPA SRS, etc.), STN/CAS online databases (Registry file for locators, ChemAbs for toxicology data, RTECS, Merck, etc.) and Science Direct and ECHA[4]. OPPT's focus on these specific sources is based on their being of high quality, highly relevant to hazard characterization, and publicly available.

[1] U.S. EPA. High Production Volume (HPV) Challenge Program; http://www.epa.gov/chemrtk/index.htm.
[2] U.S. EPA. HPV Challenge Program – Information Sources; http://www.epa.gov/chemrtk/pubs/general/guidocs.htm.
[3] U.S. EPA. Risk Assessment Guidelines; http://cfpub.epa.gov/ncea/raf/rafguid.cfm.
[4] European Chemicals Agency, http://echa.europa.eu.

OPPT does not develop HCs for those HPV chemicals which have already been assessed internationally through the HPV program of the Organization for Economic Cooperation and Development (OECD) and for which Screening Initial Data Set (SIDS) Initial Assessment Reports (SIAR) and SIDS Initial Assessment Profiles (SIAP) are available. These documents are presented in an international forum that involves review and endorsement by governmental authorities around the world. OPPT is an active participant in these meetings and accepts these documents as reliable screening-level hazard assessments.

These hazard characterizations are technical documents intended to inform subsequent decisions and actions by OPPT. Accordingly, the documents are not written with the goal of informing the general public. However, they do provide a vehicle for public access to a concise assessment of the raw technical data on HPV chemicals and provide information previously not readily available to the public.

Chemical Abstract Service Registry Number (CASRN)	**Sponsored Chemicals** **CASRN 61790-13-4** **CASRN 64754-89-8** **CASRN 1338-24-5**
Chemical Abstract Index Name	**Sponsored Chemicals** **Naphthenic acids, sodium salts** **Naphthenic acids (petroleum), crude** **Naphthenic acids**
Structural Formula	**See Appendix**

Summary

Naphthenic acids occur naturally in crude oil. They are oily liquids; however, the mixtures of their sodium salts may be solids. These substances tend to have low to negligible vapor pressure and low to moderate water solubility. They are expected to have low to moderate mobility in soil. Volatilization from water is low based on estimated Henry's Law constants for representative structures and the fact that these substances are expected to exist in the environment as anions that do not volatilize. The rate of hydrolysis is negligible for the components of these complex mixtures. The rate of atmospheric photooxidation is considered moderate; however, most of the components of these mixtures are not expected to exist in the vapor phase in the ambient atmosphere. The components of the naphthenic acids category are expected to have low (P1) to moderate (P2) persistence and low (B1) bioaccumulation potential under environmental conditions (pH 5–9).

The acute oral and dermal toxicity of CASRN 1338-24-5 is low in rats and rabbits, respectively. No adequate data are available to assess the repeated-dose, reproductive and developmental toxicity of the category members. CASRN 61790-13-4 is not mutagenic in bacterial *in vitro* and did not induce chromosomal aberrations in *in vitro* test. CASRN 61790-13-4 induced sister chromatid exchanges (SCE) without metabolic activation *in vitro*. CASRN 1338-24-5 is irritating to the rabbit eye and mice skin.

Repeated-dose, reproductive and developmental toxicity were identified as data gaps under the HPV Challenge Program.

No adequate data are available for acute toxicity to fish and aquatic invertebrates and toxicity to aquatic plants and chronic toxicity to fish and aquatic invertebrates.

Acute and chronic toxicity to fish and aquatic invertebrates and toxicity to aquatic plants were identified as data gaps under the HPV Challenge Program.

The sponsor, The American Petroleum Institute Petroleum HPV Testing Group, submitted a Test Plan and Robust Summaries to EPA for the Reclaimed Substances: Streams Containing Naphthenic Acids on December 15, 2003. EPA posted the submission on the ChemRTK HPV Challenge website on January 20, 2004 (http://www.epa.gov/chemrtk/pubs/summaries/resbscat/c14906tc.htm). EPA comments on the original submission were posted to the website on September 7, 2004. Public comments were also received and posted to the website. The sponsor submitted responses to EPA comments on March 16, 2005, which were posted to the ChemRTK website on May 10, 2005.

In its test plan submission, the Sponsor chose to address four separate categories in a single submission of reclaimed substances, which included naphthenic acids, acids/caustics, phenolics and disulfides categories. The focus of this submission was subsequently narrowed to include only the naphthenic acids as noted in the sponsor's response to EPA comments in March 2005.

Category Justification

The naphthenic acids are a complex mixture of naturally occurring cycloaliphatic carboxylic acids recovered from petroleum distillates. Of the three sponsored chemicals in the naphthenic acids category, "naphthenic acids" (CASRN 1338-24-5) is the only material sold commercially; the other two are intermediates in the production of naphthenic acids. The grouping of the category members is based on their naphthenic acids content, as either the free acid or sodium salt. Since all of the category members contain naphthenic acids, and two of the streams are intermediate in production of the third, information on the health and environmental effects of naphthenic acids (CASRN 1338-24-5) can be extrapolated to the two intermediate streams, sodium naphthenates and crude naphthenic acids.

For health effects endpoints, the sponsor focused on the free acid form of naphthenic acids for fulfilling the testing needs of the category. EPA considers this focus to be reasonable under conditions where the spent streams are diluted and/or neutralized, whereby the toxicological data for the acids are expected to be representative of the salts in the diluted naphthenate stream. Thus, although differences would exist, there are some expected similarities in the toxicological properties of these substances that can justify their grouping under a single category.

For environmental effects endpoints, the category is reasonable given the closely related chemical content of the three category members, and that data generated for the free acids can also apply to the sodium salts.

Overall, since the naphthenic acid streams in this category share a common process pathway and it is anticipated that the data provided for end-product naphthenic acids will be representative of the other members for health and environmental toxicity, EPA supports the grouping of the members into one category.

1. Chemical Identity

1.1 Identification and Purity

Naphthenic acids are extracted from kerosene and diesel streams in the refinery to improve the burning qualities and storage properties of the finished products. Naphthenic acids, sodium salts (CASRN 61790-13-4) may be liquid or solid. Naphthenic acids (petroleum), crude (CASRN 64754-89-8) is a complex combination of compounds, predominantly naturally occurring organic acids, obtained from petroleum fractions by saponification and acidification. It consists predominantly of compounds that contain carboxylic acid functional groups and five to six-member naphthenic rings in their molecular structures. Phenolic compounds and acidic sulfur compounds may also be present. Naphthenic acids (CASRN 1338-24-5) are classified as monobasic carboxylic acids of the general formula RCOOH, where R represents the naphthene moiety consisting of cyclopentane and cyclohexane derivatives. Naphthenic acids are composed predominantly of alkyl-substituted cycloaliphatic carboxylic acids, with smaller amounts of acyclic aliphatic acids. The cycloaliphatic acids include single and fused multiple cyclopentane and cyclohexane rings. The carboxyl group is usually attached to a side chain rather than directly to the ring. Aromatic, olefinic, hydroxy and dibasic acids are present as minor components. Naphthenic acids recovered from refinery streams occur naturally in the crude oil and are not formed during the refining process. Heavy crudes have the highest acid content, and paraffinic crudes usually have low acid content. Naphthenic acids are obtained by caustic extraction of petroleum distillates, primarily kerosene and diesel fractions.

1.2 Physical-Chemical Properties

The physical-chemical properties of the naphthenic acids category are provided in Table 1. Representative structures for individual components of the aromatic extracts are provided in the Appendix.

Naphthenic acids are naturally occurring acidic substances found in crude oil. These substances are oily liquids; however, the commercial mixtures of the sodium salts of naphthenic acids may be solids. These substances tend to have low to negligible vapor pressure and low to moderate water solubility.

Table 1. Physical-Chemical Properties of Reclaimed Substances: Naphthenic Acids Category[1]			
Property	**SPONSORED CHEMICAL Naphthenic acids, sodium salts**	**SPONSORED CHEMICAL Naphthenic acids (petroleum), crude**	**SPONSORED CHEMICAL Naphthenic acids**
CASRN	61790-13-4	64754-89-8	1338-24-5
Molecular Weight[2,3]	240–330 (average molecular weight naphthenic acids crude); 210–250 (average molecular weight naphthenic acids refined); 180–250 (average molecular weight naphthenic acids highly refined)		
Physical State	Oily liquid; however, the salts may be solid		
Melting Point	-35–0°C (measured); -35–2°C (measured); 30°C (measured)		
Boiling Point	250–350°C (measured); 140–200°C (measured); 200–370°C (measured)		
Vapor Pressure	1.1×10^{-7} to 7.1×10^{-6} mm Hg at 25°C (estimated)[4,5,6]		
Dissociation Constant (pK_a)	Approximately 5 (measured)		
Henry's Law Constant	4.2×10^{-8} to 2.9×10^{-5} atm-m^3/mol (estimated)[4,5,6]		
Water Solubility	0.00028–2.1 mg/L at 25°C (estimated)[4,5,6]		
Log K_{ow}	5.4–9.2 (estimated)[4,5,6]		

[1]American Petroleum Institute Petroleum HPV Testing Group. 2003. Test Plan and Robust Summary for Reclaimed Substances: Naphthenic Acids.
Available online at http://www.epa.gov/chemrtk/pubs/summaries/resbscat/c14906tc.htm as of April 12, 2011.
[2]Brient JA; Wessner PJ; Doyle MN. 1995. Naphthenic Acids. Kirk-Othmer Encyclopedia of Chemical Technology. Volume 16, 4th ed. John Wiley and Sons: New York, NY.
[3]Average molecular weight range reported for 3 grades of commercial naphthenic acids.
[4]U.S. EPA. 2011. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of April 7, 2011.
[5]Values reported for 1- to 4-ring structures as depicted in the appendix with molecular weight range 254–325.
[6]The largest percentage of naphthenic acids in crude oil tends to be 2- or 3-ringed members.
See: Hsu CS; Dechert GJ; Robbins WK; et al. 2000. Naphthenic Acids in Crude Oil Characterized by Mass Spectroscopy. Energy & Fuels 14:217–223.

2. General Information on Exposure

2.1 Production Volume and Use Pattern

The Reclaimed Substances: Naphthenic Acids category chemicals had an aggregated production and/or import volume in the United States between 11 million pounds and 60.5 million pounds during calendar year 2005.

- CASRN 61790-13-4: 1 million to <10 million pounds;
- CASRN 64754-89-8: < 500,000 pounds;
- CASRN 1338-24-5: 10 million to <50 million pounds

CASRN 6179-13-4: Non-confidential information in the IUR indicated that the industrial processing and uses for the chemical include petroleum refineries as "others." No commercial and consumer uses were reported for this chemical.

CASRN 64754-89-8: No industrial processing and uses, and commercial and consumer uses were reported for this chemical.

CASRN 1338-24-5: Non-confidential information in the IUR indicated that the industrial processing and uses for the chemical include all other chemical product and preparation manufacturing, and pesticide and other agricultural chemical manufacturing as "other"; other petroleum and coal products manufacturing, and all other chemical product and preparation manufacturing as lubricants; other petroleum and coal products manufacturing, and petrochemical manufacturing as process regulator, used in vulcanization or polymerization processes; petroleum refineries as corrosion inhibitors and anti-scaling agents; tire manufacturing as adhesives and binding agents. No commercial and consumer uses were reported for this chemical.

2.2 Environmental Exposure and Fate

The components of this category are not subject to hydrolysis because they lack functional groups that hydrolyze. The rate of atmospheric photooxidation is considered moderate; however, most of the components of these mixtures are not expected to exist in the vapor phase in the ambient atmosphere. Naphthenic acids are expected to have low to moderate mobility in soil. Mobility is likely to increase with increasing pH owing to a higher percentage of these substances existing in the environment as anions, which tend to have greater mobility in soils. The components of this category are not readily biodegradable. The data suggest that most of the category members are expected to have low persistence (P1), with the exception of those that are highly branched, which are expected to have moderate persistence (P2). From measured bioconcentration factors (BCF), naphthenic acids are expected to have low bioaccumulation potential under environmental conditions (pH 5–9).

The environmental fate properties are provided in Table 2.

Table 2. Physical-Chemical Properties of Reclaimed Substances: Naphthenic Acids Category[1]

Property	SPONSORED CHEMICAL Naphthenic acids, sodium salts	SPONSORED CHEMICAL Naphthenic acids (petroleum), crude	SPONSORED CHEMICAL Naphthenic acids
CASRN	61790-13-4	64754-89-8	1338-24-5
Photodegradation Half-life	3.0–6.8 hours (estimated)[2,3]		
Hydrolysis Half-life	Stable		
Biodegradation	33–58% after 28 days (not readily biodegradable)[4,5];		
Bioaccumulation Factor	BCF = 1.6–13 (measured in carp over 6 weeks for monocyclic compound with molecular weight 257)[4,5]; BCF = 7.8–27 (measured in carp over 6 weeks for bicyclic compound with molecular weight 283)[4,5]; BCF = <9.2 (measured in carp over 6 weeks for tricyclic compound with molecular weight 281)[4,5]; BCF = 2 (measured for rainbow trout exposed to naphthenic acids at 3 mg/L for 4 days followed by 5 days depuration)[6]; BAF = 2.1×10^4 to 4.7×10^6 (estimated)[2,3,7]		
Log K_{oc}	3.6–4.9 (estimated)[2,3]		
Fugacity (Level III Model)[2,3] Air (%) Water (%) Soil (%) Sediment (%)	 0.3–0.7 13.0–27.7 59.0–77.8 2.2–26.1		
Persistence[8]	P1 (low) to P2 (moderate)		
Bioaccumulation[8]	B1 (low)		

[1] American Petroleum Institute Petroleum HPV Testing Group. 2003. Test Plan and Robust Summary for Reclaimed Substances: Naphthenic Acids. Available online at http://www.epa.gov/chemrtk/pubs/summaries/resbscat/c14906tc.htm as of April 12, 2011.
[2] U.S. EPA. 2011. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of April 7, 2011.
[3] Values reported for 1- to 4-ring structures as depicted in the appendix with molecular weight range 254–325.
[4] National Institute of Technology and Evaluation. 2002. Biodegradation and bioaccumulation of the existing chemical substances under the Chemical Substances Control Law. Available online at http://www.safe.nite.go.jp/english/kizon/KIZON_start_hazkizon.html as of April 12, 2011.
[5] Data for Naphthenic acids, sodium salts (CASRN 61790-13-4).
[6] Young RF., Wismer WV., Fedorak PM. 2008. Estimating Naphthenic Acids Concentrations in Laboratory-exposed Fish and Fish From the Wild. Chemosphere 73: 498 – 505.
[7] Estimated BAF values calculated using log K_{ow} values for the fully protonated species; however, these substances are expected to exist as anions under environmental pH and are outside the domain of the estimation.
[8] Federal Register. 1999. Category for Persistent, Bioaccumulative, and Toxic New Chemical Substances. *Federal Register* 64, Number 213 (November 4, 1999) pp. 60194–60204.

Conclusion: Naphthenic acids occur naturally in crude oil. They are oily liquids; however, the mixtures of their sodium salts may be solids. These substances tend to have low to negligible

vapor pressure and low to moderate water solubility. They are expected to have low to moderate mobility in soil. Volatilization from water is low based on estimated Henry's Law constants for representative structures and the fact that these substances are expected to exist in the environment as anions that do not volatilize. The rate of hydrolysis is negligible for the components of these complex mixtures. The rate of atmospheric photooxidation is considered moderate; however, most of the components of these mixtures are not expected to exist in the vapor phase in the ambient atmosphere. The components of the naphthenic acids category are expected to have low (P1) to moderate (P2) persistence and low (B1) bioaccumulation potential under environmental conditions (pH 5–9).

3. Human Health Hazard

A summary of the human health toxicity data submitted for SIDS endpoints is provided in Table 3. The table indicates where test data are read across (RA) to the sponsored chemicals of the naphthenic acids category.

Acute Oral Toxicity

Naphthenic acids (CASRN 1338-24-5)
(1) Wistar rats (10/sex/dose) were administered naphthenic acids in aqueous solutions via oral gavage. Females were given a single dose at 0, 3, 30 or 300 mg/kg and males were given a single dose at 300 mg/kg and observed for 14 days. No mortalities were reported.
LD_{50} > 300 mg/kg

Naphthenic acids (7-93% fraction from crude kerosene acids) (CASRN 1338-24-5)
(2) Male rats (strain and number not specified) were administered 0.25 mL of napthenic acids 7-93% fraction from kerosene acids via oral gavage and observed for 30 days. The number of mortalities was not specified (Rockhold, 1955).
LD_{50} = 640 mg/kg

Naphthenic acids (65-90% fraction from mixed crude acids, acid number 205) (CASRN 1338-24-5)
(3) Male rats (strain and number not specified) were administered 0.25 mL of napthenic acids 65-90% fraction from mixed crude acids, acid number 205 via oral gavage and observed for 30 days. The number of mortalities was not specified (Rockhold, 1955).
LD_{50} = 750 mg/kg

Naphthenic acids (CASRN 1338-24-5) MRD 79-10 (Raw naphthenic acid from kerosene)
(4) Male Wistar rats (5/dose) were administered a single undiluted dose of naphthenic acids via gavage at 1000, 1470, 2150, 3160, 4640, 6810 or 10,000 mg/kg and observed at 1, 2, 4 and 6 hours and then once daily for 14 days. Mortalities were observed at the four highest dose levels but the number of deaths was not specified at all the doses.
$LD_{50} \geq$ 3160 mg/kg

Acute Dermal Toxicity

Naphthenic acids (CASRN 1338-24-5) MRD79-10 (Raw naphthenic acid from kerosene)
(1) New Zealand White rabbits (2/sex) were administered undiluted naphthenic acids via the dermal route at 3160 mg/kg to clipped abraded skin under occluded conditions for 24 hours and observed for 14 days. No mortalities were observed.
LD_{50} > 3160 mg/kg

(2) New Zealand White rabbits (3/sex) were administered naphthenic acids via the dermal route at 20,000 mg/kg to clipped abraded skin under occluded conditions for 24 hours and observed at 0-2, 4-6 hours and 14 days. No mortalities were observed (TSCATS OTS0570531).
LD_{50} > 20,000 mg/kg

Repeated-Dose Toxicity
Currently there are no adequate data to address this endpoint.

Reproductive Toxicity
Currently there are no adequate data to address this endpoint

Developmental Toxicity
Currently there are no adequate data to address this endpoint

Genetic Toxicity – Gene Mutations

In vitro

Naphthenic acids, sodium salt (CASRN 61790-13-4)

In a gene mutations assay conducted by the National Toxicology Program (NTP), *Salmonella typhimurium* strains were exposed to naphthenic acids, sodium salt in ethanol at concentrations of 3.3 – 333 µg/plate (TA97 and TA100) or 3.3 – 1000 µg/plate (TA98 and TA1535) without metabolic activation and 3.3 – 1000 µg/plate (TA100) or 3.3 – 3333 µg/plate (TA97,TA98 and TA1535) with activation. Positive controls produced an appropriate response. Cytotoxicity was observed at concentrations ≥ 1000 and 100 µg/plate with and without metabolic activation, respectively.
Naphthenic acids, sodium salt was not mutagenic in this assay.

Genetic Toxicity – Chromosomal Aberrations

In vitro

Naphthenic acids, sodium salt (CASRN 61790-13-4)
In a Chromosomal Aberrations conducted by NTP, Chinese hamster ovary cells were exposed to naphthenic acids, sodium salt in water at concentrations of 0 (control), 25, 54 or 116 µg/mL without metabolic activation and 0, 54, 116 and 250 µg/mL and with activation (induced Rat Liver S9). Positive controls responded appropriately. Cytotoxic concentrations were not specified. No increase in cells with aberrations were noted in this assay. http://ntp-apps.niehs.nih.gov/ntp_tox/index.cfm?fuseaction=invitro.choosestudytype&cas_no=61790-13-4&endpointlist=CAB%2CSCE
Naphthenic acids, sodium salt did not induce chromosomal aberrations in this assay.

Genetic Toxicity –Other

In vitro

Naphthenic acids, sodium salt (CASRN 61790-13-4)
In a cytogenetics assay (Sister Chromatid Exchanges, SCEs) conducted by NTP, Chinese hamster ovary cells were exposed to naphthenic acids, sodium salt in water at concentrations of 0 (control), 17, 50 or 167 µg/mL with and without metabolic activation (trail #1); and at concentrations of 0 (control), 100, 150 and 200 µg/plate without metabolic activation (trial #2). Positive controls responded appropriately. Cytotoxic concentrations were not specified. There was an increase in SCEs without metabolic activation. http://ntp-apps.niehs.nih.gov/ntp_tox/index.cfm?fuseaction=invitro.choosestudytype&cas_no=61790-13-4&endpointlist=CAB%2CSCE
Naphthenic acids, sodium salt induced sister chromatid exchange in this assay in the absence of metabolic activation.

Additional Information

Eye Irritation

Naphthenic acids (CASRN 1338-24-5) MRD-79-10 (Raw naphthenic acid derived from kerosene)
New Zealand White rabbits (3/sex) were administered 0.1mL of undiluted naphthenic acids into the conjunctival sac of one eye and observed after 1 and 4 hours and 1, 2, 3, 4 and 7 days. The untreated eye served as the control. Corneal irritation was noted in one animal on days 1 and 2 and irritation of the iris was observed in one animal at hours 1 and 4. All animals exhibited positive conjunctival scores at some point during the first 3 days of observation. All animals fully recovered by day 4.
Naphthenic acids are irritating to the rabbit eye in this study.

Skin Irritation

Naphthenic acids (CASRN 1338-24-5) MRD79-10 (Raw naphthenic acid from kerosene)
(1) New Zealand White rabbits (2/sex) were administered undiluted naphthenic acids via the dermal route at 3160 mg/kg to clipped abraded skin under occluded conditions for 24 hours and observed for 14 days. Animals showed mild to severe irritation on day 1 to 14 of the study.
Naphthenic acids are irritating to the rabbit skin in this study.

Naphthenic Acids (CASRN 1338-24-5) SAP Oil
(2) In a 2-year dermal carcinogenicity study, female STCF mice (50) were exposed to SAP oil additive twice per week on shorn dorsal skin at 0.05 mL for two years. Moderate to severe skin Irritancy was seen in all animals. All mice showing severe skin irritation were killed for humane reasons *(TSCATS OTS-0512234).*
Naphthenic acids (SAP Oil) are dermal irritants to the skin of mice after repeated exposure.

Conclusion:
The acute oral and dermal toxicity of CASRN 1338-24-5 is low in rats and rabbits, respectively. No adequate data are available to assess the repeated-dose, reproductive and developmental toxicity of the category members. CASRN 61790-13-4 is not mutagenic in bacterial *in vitro* and did not induce chromosomal aberrations in *in vitro* test. CASRN 61790-13-4 induced sister chromatid exchanges (SCE) without metabolic activation *in vitro*. CASRN 1338-24-5 is severly irritating to the rabbit eye and mice skin.

Table 3. Summary Table of the Screening Information Data Sets Submitted under the U.S. HPV Challenge Program – Human Health Data			
Endpoints	**SPONSORED CHEMICAL Sodium Naphthenate (CASRN 61790-13-4)**	**SPONSORED CHEMICAL Crude Naphthenic Acid (CASRN 64754-89-8)**	**SPONSORED CHEMICAL Naphthenic Acid (CASRN 1338-24-5)**
Acute Oral Toxicity LD_{50} (mg/kg)	No Data 640 RA	No Data 640 RA	**640**
Acute Dermal Toxicity LD_{50} (mg/kg)	No Data 3160 RA	No Data 3160 RA	**3160**
Repeated-Dose Toxicity (mg/kg/day)	No adequate Data	No adequate Data	No adequate Data
Reproductive Toxicity	No adequate Data	No Adequate Data	No Adequate Data
Developmental Toxicity	No adequate Data	No Adequate Data	No Adequate Data
Genetic Toxicity – Gene Mutation ***In vitro***	**Negative**	No Data Negative RA	No Data Negative RA
Genetic Toxicity – Chromosomal Aberrations ***In vitro***	**Negative**	No Data Negative	No Data Negative
Genetic Toxicity – Other ***In vitro*** SCE	**Positive**	Positive RA	Positive RA
Additional Information **Eye Irritation** **Skin Irritation**	No Data Irritating Irritating	No Data Irritating Irritating	**Irritating** **Irritating**

4. Hazard to the Environment

A summary of aquatic toxicity data submitted for SIDS endpoints is provided below.

Acute Toxicity to Fish

No adequate data were available for this endpoint. The purity of the test substance in tests provided by the sponsor was not reported and the pH of the test substance was not adjusted in the acute fish toxicity tests; therefore, these data were not adequate for the evaluation of the toxicity of the reclaimed substances: naphthenic acids category.

Acute Toxicity to Aquatic Invertebrates

No adequate data were available for this endpoint.

Toxicity to Aquatic Plants

No data were available for this endpoint.

Chronic Toxicity to Fish and Aquatic Invertebrates

No data were available for this endpoint.

Conclusions: No adequate data are available for acute toxicity to fish and aquatic invertebrates and toxicity to aquatic plants and chronic toxicity to fish and aquatic invertebrates.

5. References

1. Rockhold, William T. 1955. The toxicity of naphthenic acids and their metal salts. Archs Ind Hlth 12, 477-482.

2. Rogers VV; Wickstrom M; Liber K; MacKinnon MD. 2001. Acute and sub-chronic mammalian toxicity of naphthenic acids from oil sands tailings.

APPENDIX

Naphthenic acids are described as a complex combination of compounds, predominantly naturally occurring organic acids, obtained from petroleum fractions by saponification and acidification. They consist predominantly of compounds which contain carboxylic acid functional groups and five- to six-member naphthenic rings in their molecular structures. Phenolic compounds and acidic sulfur compounds may also be present.

Table A-1. Process Streams, CASRN, and Description of the Reclaimed Substances: Naphthenic Acids Category

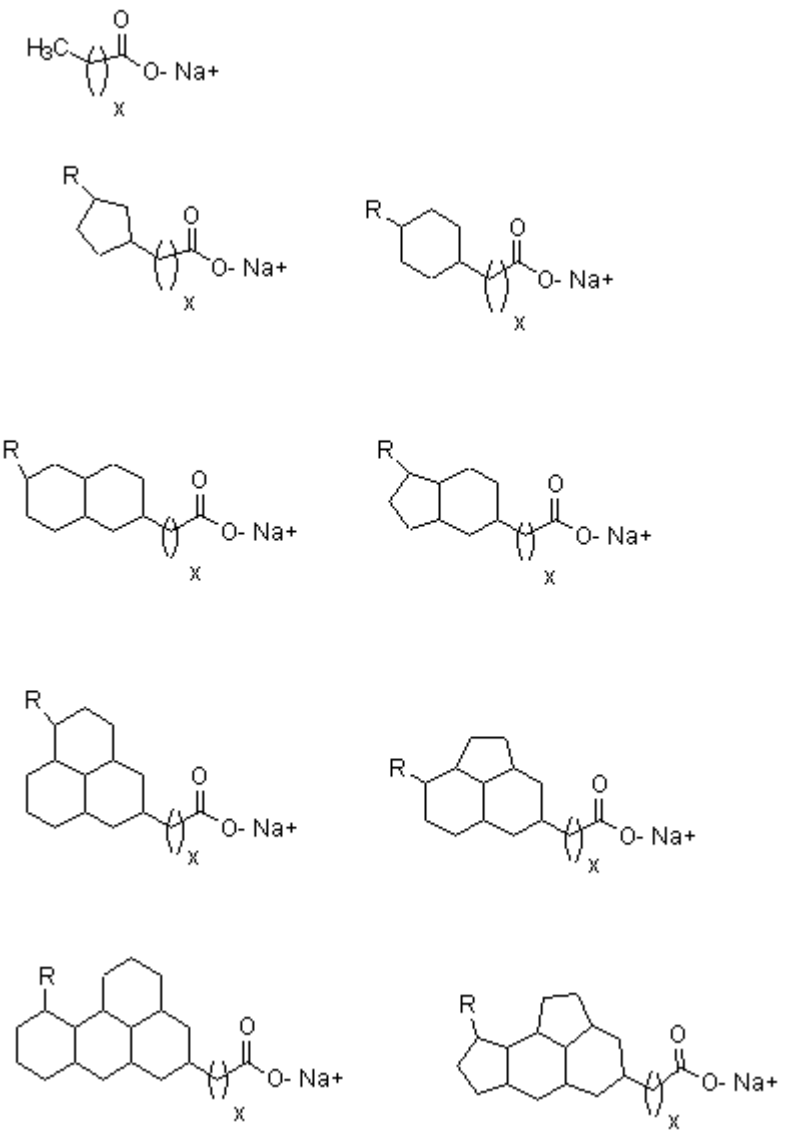
Name	CASRN	Representative Structures[1,2,3,4]
Naphthenic acids, sodium salts	61790-13-4	

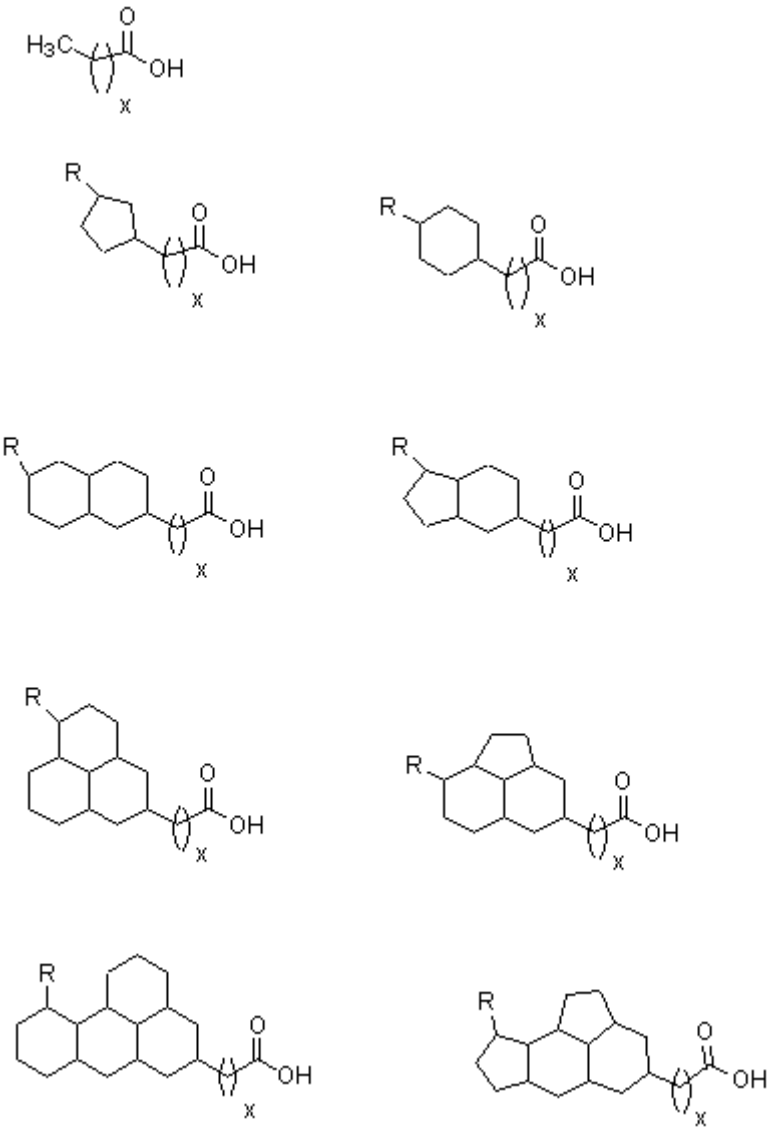
Table A-1. Process Streams, CASRN, and Description of the Reclaimed Substances: Naphthenic Acids Category		
Name	**CASRN**	**Representative Structures[1,2,3,4]**
Naphthenic acids (petroleum), crude	64754-89-8	

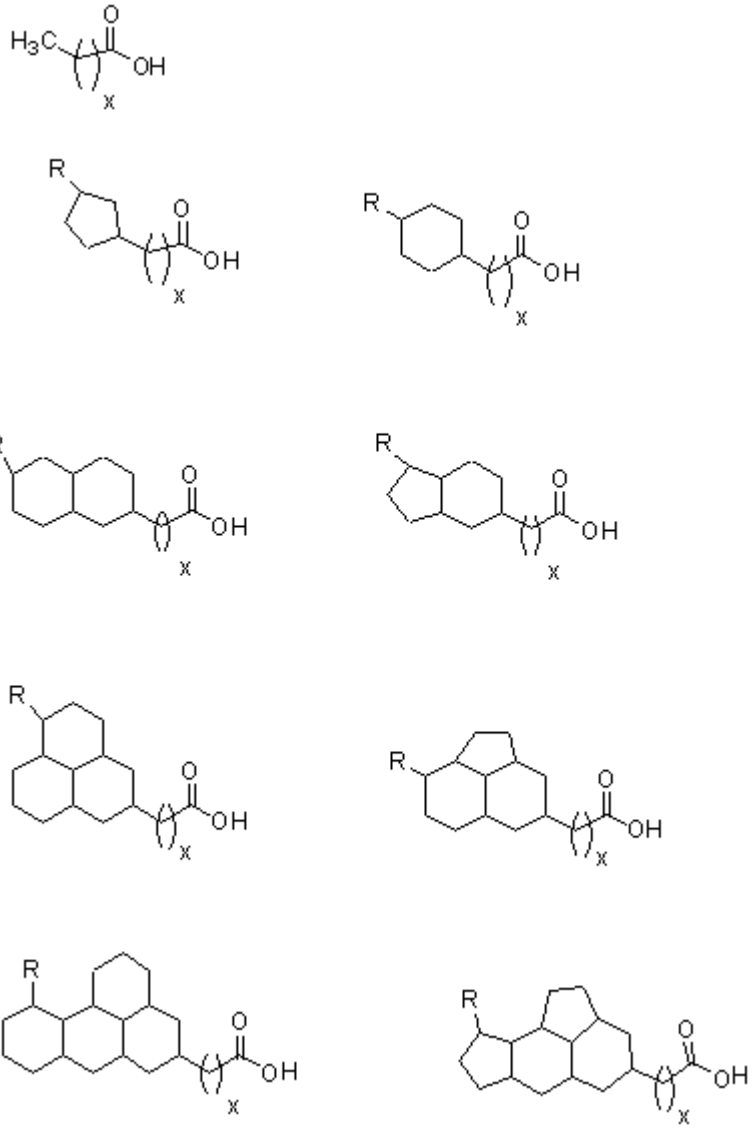
Table A-1. Process Streams, CASRN, and Description of the Reclaimed Substances: Naphthenic Acids Category		
Name	**CASRN**	**Representative Structures[1,2,3,4]**
Naphthenic acids	1338-24-5	

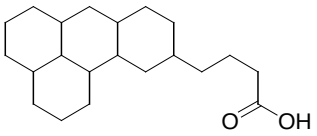
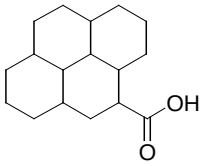
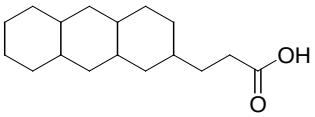
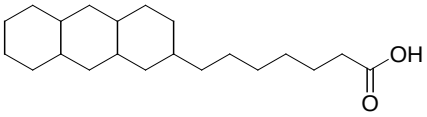
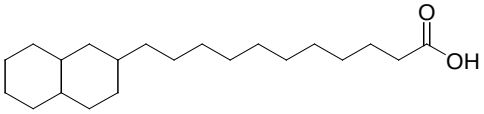
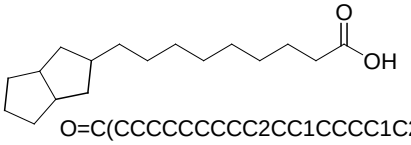
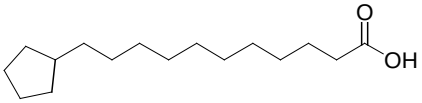
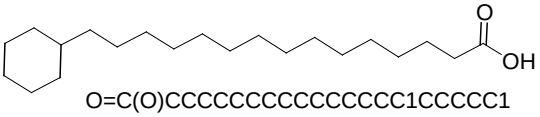
Table A-1. Process Streams, CASRN, and Description of the Reclaimed Substances: Naphthenic Acids Category		
Name	**CASRN**	**Representative Structures[1,2,3,4]**
1- to 4-ringed structures used in the estimations[5]		
		 O=C(O)CCCC2CC1C4C3C(CCCC3CCC4)CC1CC2  O=C(O)C2CC1CCCC4C1C3C2CCCC3CC4  O=C(O)CCC3CC2CC1CCCCC1CC2CC3  O=C(O)CCCCCCC3CC2CC1CCCCC1CC2CC3  O=C(O)CCCCCCCCCCC2CCC1CCCCC1C2  O=C(CCCCCCCCC2CC1CCCC1C2)O  O=C(O)CCCCCCCCCCC1CCCC1  O=C(O)CCCCCCCCCCCCCCC1CCCCC1

Table A-1. Process Streams, CASRN, and Description of the Reclaimed Substances: Naphthenic Acids Category		
Name	**CASRN**	**Representative Structures[1,2,3,4]**

[1]Structures obtained from: Rogers VV; Liber K; MacKinnon MD. 2002. Isolation and Characterization of Naphthenic Acids from Athabasca Oil Sands Tailings Pond Water. Chemosphere 48:519–-527.
[2]Examples of naphthenic structures where R is a hydrogen or an alkyl group and x is a variable describing the carboxyl side chain.
[3]The fractional distribution of naphthenic acids from Athabasca oil sands tailings pond water was roughly 19.9% noncyclic; 22.6% 1-ringed; 19.8% 2-ringed; 19.7% 3-ringed; 18% 4-ringed.
[4]The ring type and carbon number distributions of naphthenic acids from an acidic Californian crude oil suggested that the presence of 5- or 6-ringed structures is very low. The percentage distribution of naphthenic acids was approximately 6% noncyclic; 32% 1-ringed; 38% 2-ringed; 15% 3-ringed; 5% 4-ringed; 3% 5-ringed; 1% 6-ringed. See: Hsu CS; Dechert GJ; Robbins WK; et al. 2000. Naphthenic Acids in Crude Oil Characterized by Mass Spectroscopy. Energy & Fuels 14:217–223.
[5]These appear to be the representative structures used in the Test Plan and Robust Summary. It is likely that there is branching among naturally-occurring naphthenic acids, which is not shown in these structures.