Voluntary Use and Exposure Information Profile
N-ethyl perfluorooctanesulfonamide

I. CHEMICAL IDENTIFICATION

Chemical Name: N-ethyl perfluorooctanesulfonamide (EtFOSA)
CAS Number: 4151-50-2

II. COMPANY IDENTIFICATION

Company Name: 3M

Site Location: 10746 Innovation Road
Cottage Grove, MN 55016

1400 State Docks Road
Decatur, AL 35601

Technical Contact: W.A. Weppner
Phone: 651/733-6374
Address: 3M Center, Building 236-1B-10
St. Paul, MN 55144

III. ON-SITE ACTIVITIES

CAS #	Mfg. (1997)	Imported
4151-50-2*	< 100,000 lbs.	0

Estimate the amount of subject chemical distributed off-site:

59% **of manufacture/import**

*Submitted in 1998 TSCA IUR. Significant production occurs that is non-isolated and non-reportable under TSCA.

If you have already provided the above information to EPA and it is still representative please reference that submission here:

Narrative Description and Process Flow Schematic:

3M Company utilizes a process known as Simons Electro-Chemical Fluorination (ECF) to synthesize organofluorine molecules. In this process, organic feedstocks are dispersed in liquid, anhydrous hydrogen fluoride, and an electric current is passed through the solution, causing the hydrogen atoms on the molecule to be replaced with fluorine. The predominant components of the products created by this process have the same carbon skeletal arrangement as the feedstock used, but with all of the hydrogen atoms replaced by fluorine. However, fragmentation and rearrangement of the carbon skeleton can also occur and significant amounts of cleaved, branched and cyclic structures may be formed. The degree of fluorination of the organic feedstock is also dependent upon the specific carbon chain length of the feedstock and parameters of the ECF process such as electrical current and the length of time the process is run. It is possible to synthesize fully fluorinated or perfluoroorganic molecules where all of the hydrogen atoms of the hydrocarbon feedstock have been replaced by fluorine atoms. Using these perfluoroorganic molecules as basic building blocks, unique chemistries can be created by further reactions with functionalized hydrocarbon molecules.

3M has produced sulfonyl based fluorochemicals commercially for over 40 years using the ECF process. A basic building block of such products and the highest production volume fluorochemical 3M manufactures is perfluorooctanesulfonyl fluoride (POSF). The starting feedstock for this reaction is 1-octanesulfonyl fluoride.
(Reaction 1)

Reaction 1

$$C_8H_{17}S0_2F + 17\ HF \xrightarrow[\text{ECF}]{\text{Energy}} C_8F_{17}S0_2F + 17\ H_2$$

1-Octanesulfonyl fluoride Perfluorooctanesulfonyl fluoride

The electrochemical fluorination process yields about 35%-40% straight chain (normal) POSF, and a mixture of biproducts and waste of unknown and variable composition comprised of the following:

1) higher and lower straight-chain homologs, i.e., $n\text{-}CnF_2n_{+1}SO_2F$, e.g., $C_6F_{13}SO_2F$, $C_7F_{15}SO_2F$, $C_9F_{19}SO_2F$ which comprise about 7% of the process output

2) branched-chain, perfluoroalkylsulfonyl fluorides with various chain lengths, about 18-20% of the output

3) straight-chain, branched, and cyclic (non-functional) perfluoroalkanes and ethers, which comprise about 20-25% of the output

4) "tars" (high molecular weight fluorochemical byproducts) and other byproducts, including molecular hydrogen, which comprise about 10-15% of the output.

Because of slight differences in process conditions, raw materials, and equipment, the mixture produced by the electrochemical fluorination process varies somewhat from lot-to-lot and from plant-to-plant. The product that results from electrochemical fluorination is thus not a pure chemical but rather a mix of isomers and homologues. The commercialized POSF derived products are a mixture of approximately 70% linear POSF derivatives and 30% branched POSF derived impurities.

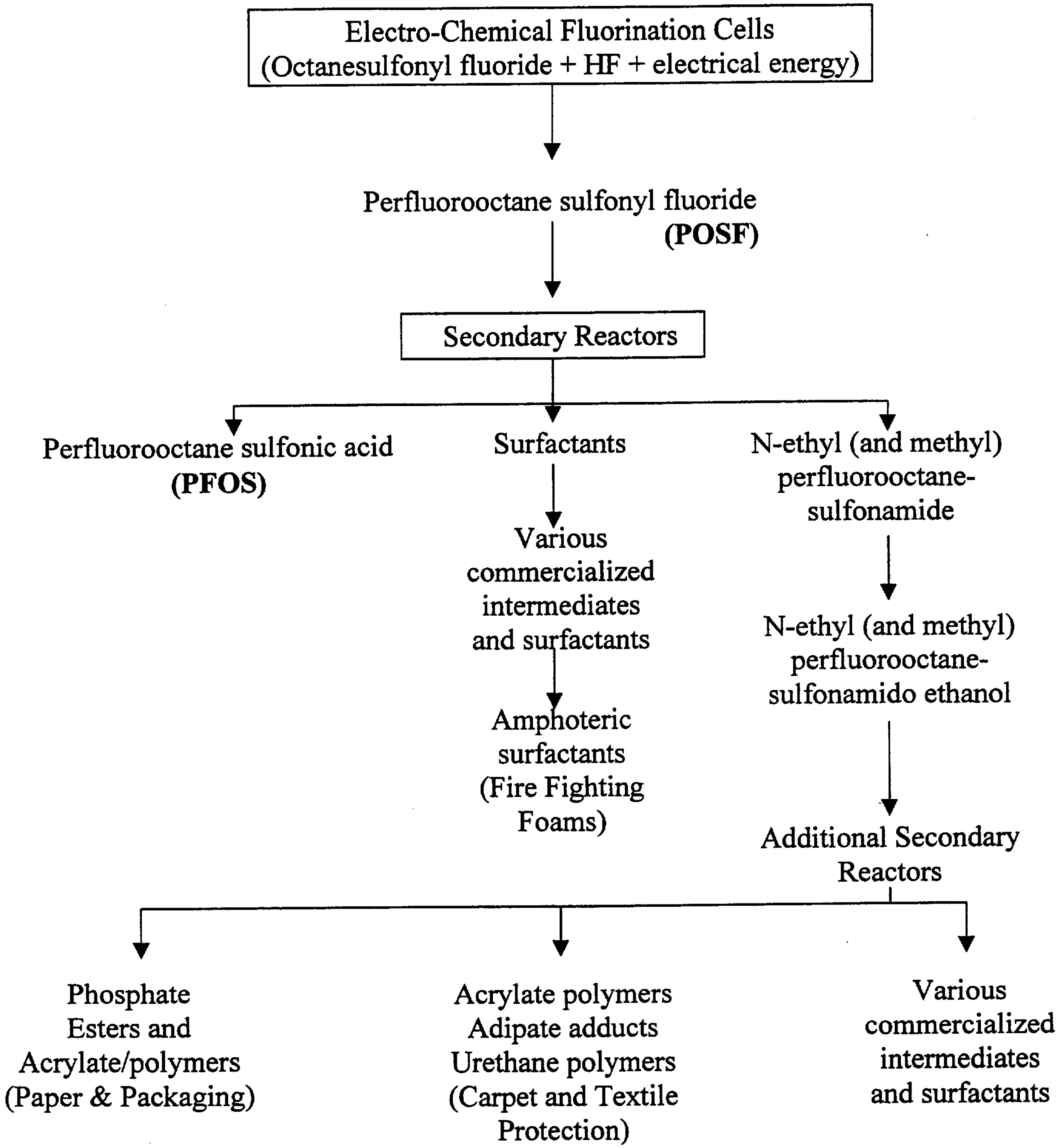
During production, byproducts and waste products are formed. The volatile waste products, such as perfluoromethane, have been vented to the atmosphere in the past, but plans are being implemented to capture and destroy these releases by thermal oxidation over the next few years. The tars have been landfilled in a hazardous waste landfill in the past, but are all currently being incinerated at an in-house or external hazardous waste incinerator. The byproducts, many of which are incompletely fluorinated with hydrogen atoms still present, can be recycled back into the ECF process or are partially degraded in stabilization processes and discharged to controlled, in-house, wastewater treatment systems. The treatment sludge associated with the ECF process has been either landfilled or land-incorporated in the past, but all of this treatment sludge is being landfilled off-site since early 1998.

POSF is itself a commercially viable product, but is primarily an important intermediate in the synthesis of substances used in many other 3M fluorochemical products. The majority is used to produce functionally derivatized fluorochemicals and high molecular weight polymeric products.

Unique chemistries can be created by derivatizing POSF through the sulfonyl fluoride moiety of the molecule using conventional hydrocarbon reactions. POSF is reacted with methyl or ethyl amine to produce either N-methyl or N-ethylperfluorooctanesulfonamide (MeFOSA or EtFOSA). Some of the MeFOSA and EtFOSA is isolated to be used as intermediates to be reacted to form other materials. The majority of the MeFOSA and EtFOSA is not isolated and subsequently reacted with ethylene carbonate to form either N-methyl or N-ethylperfluorooctane sulfonamido ethanol. These are the principal building blocks of the 3M product lines.

The following block flow diagram describes the process discussed above.

BLOCK FLOW DIAGRAM



IV. SITE RELEASE AND TRANSFER INFORMATION FOR TRI CHEMICALS

Not applicable.

V. SITE RELEASE AND TRANSFER INFORMATION FOR NON-TRI CHEMICALS

While analytical methods have improved over time, large variability still exists for certain matrices and compounds, so data available for this report is mostly of a qualitative nature. Although limited monitoring data exists, most emission and waste estimates are based upon process models and engineering calculations. Engineering calculations, however, have limitations with respect to fluorochemicals because fluorochemical losses were not always included in the analysis of each intermediate step.

The accuracy of the emissions data submitted varies due to several factors. Batch process systems are difficult to measure due to quickly changing process conditions, venting pressures and difficulty in isolating processes to take measurements. Additionally, the unique characteristics of these compounds cause them to behave differently from conventional compounds, and physical chemical data properties are not available for all intermediate reaction steps in the past.

A. ON-SITE AIR RELEASES

ALL PLANTS - Fugitive emissions may occur from vacuum charging from drums, sampling from reactors, drumming of product/intermediate, flaking monomer, drying operations. Materials may be handled in a molten or solid state; vapors are produced from molten material. Industrial hygiene monitoring has been conducted for some compounds. Some minor amounts of these compounds have been detected as fugitive emissions during industrial hygiene exposure testing.

<u>Decatur, AL</u>

Wastewater fugitive emission data was based upon wastewater testing.

Emission estimates are based upon existing process models and engineering calculations from the facility. Fugitive emissions may have occurred during some handling steps but have not been quantified.

	Estimated Total Annual Releases (lbs.)	**Estimated % Accuracy of Estimate** (optional)	**# days/years release occurs**
Fugitive – (non-point)	< 40 in 1997 < 40 in 1999		250

Stack (point)

	Estimated Total Annual Releases (lbs.) (1997)	**Estimated % Accuracy of Estimate** (optional)	**# days/years release occurs**
	< 1		250

Cottage Grove

Emission estimates are based upon existing process models and engineering calculations from the facility. Fugitive emissions may have occurred during some handling steps but have not been quantified.

	Estimated Total Annual Releases (lbs.) (1997)	**Estimated % Accuracy of Estimate** (optional)	**# days/years release occurs**
Fugitive (non-point)	No data available.		<10
Stack (point)	No data available.		<10

Comments:

B. WATER RELEASES FROM SITE

Decatur, AL

The data presented is part of wastewater testing conducted in 1998, since the individual compounds of interest were not analyzed in the 1997 wastewater material balance due to method availability and initial project focus. The 1998 data has not been adjusted for production levels in 1997, since most production remained at similar levels.

It is not possible to distinguish the amount of chemicals generated from specific reaction steps in production of various compounds, or whether their presence may be the result of hydrolysis of more complex molecules.

	Estimated Total Annual Releases (lbs.) (1997)	Estimated % Accuracy of Estimate (optional)
Water releases:	140	

Number of days/year release occurs: 250

Receiving Water Name: Baker's Creek at the junction with the Tennessee River

NPDES Number: ALD004023164

Comments:

Cottage Grove, MN

Engineering calculations were used to estimate the amount of material discharged to wastewater. The amount of material discharged to the river was determined through use of existing removal efficiency testing results from another facility.

	Estimated Total Annual Releases (lbs.) (1997)	Estimated % Accuracy of Estimate (optional)
Water releases:	0	

Number of days/year release occurs:

Receiving Water Name:

NPDES Number:

Comments:

C. ON-SITE LAND RELEASES

Decatur, AL

The land treatment of Decatur sludge was discontinued in early 1998. Sludge is now transported to an offsite landfill, after passing through a thickener and a sludge press. An impoundment was used in 1997 as part of the wastewater treatment operation but is now only used for back-up operation. Levels of the compound in the sludge were determined from wastewater data.

	Estimated Total Annual Releases (lbs.) (1997)	**Estimated % Accuracy of Estimate (optional)**
Landfill	0	
Land Treatment/Land Amendment	0	
Surface Impoundments	No data available/No longer used	
Underground Injection	0	
Other (specify):		

Comments:

Cottage Grove, MN

Sludge from the Cottage Grove facility is sent to an off-site industrial landfill

	Estimated Total Annual Releases (lbs.) (1997)	**Estimated % Accuracy of Estimate (optional)**
Landfill	0	
Land Treatment/Land Amendment	0	
Surface Impoundments	0	
Underground Injection	0	
Other (specify):		

Comments:

C. OFF-SITE TRANSFERS

Decatur, AL

Process wastewaters are managed in an on-site wastewater treatment facility and are not sent to the POTW.

D1. Transfer to Publicly Owned Treatment Works (POTW)

Number of days/year the release occurs:

Annual Transfer (lb): 0

Estimated % Accuracy of Transfer Estimate (optional) (%):

POTW Name:
Street Address:
City: **Country:**
State: **Zip Code:**
NPDES Number:

Comments:

Cottage Grove, MN

Process wastewaters are managed in an on-site wastewater treatment facility and are not sent to the POTW.

D1. Transfer to Publicly Owned Treatment Works (POTW)

Number of days/year the release occurs:

Annual Transfer (lb): 0

Estimated % Accuracy of Transfer Estimate (optional) (%):

POTW Name:
Street Address:
City: **Country:**
State: **Zip Code:**
NPDES Number:

Comments:

D2. TRANSFERS TO OTHER OFF-SITE LOCATIONS

General Waste Information: There is limited information by CAS number for compound specific reporting and off-site releases cannot be readily verified. Rather wastes are classified by halogen content, regulatory waste codes, physical properties and non-specific fluorochemical categories. Where wastes are tracked by CAS number, the amounts have been included.

Decatur, AL

A review of plant records regarding waste disposal locations for Decatur fluoride-containing wastes indicates that 70% is disposed through incineration at various off-site locations and approximately 30% is landfilled at a hazardous waste landfill. Incineration is now the predominant disposal method for these materials.

	Estimated Total Annual Releases (lbs.)	**Estimated % Accuracy of Estimate** (optional)
Incineration:	No specific CAS number data available.	
Wastewater Treatment (Excluding POTW)	0	
Underground Injection	0	
Hazardous Waste (RCRA Subtitle C) landfill	No specific CAS number data available.	
Other Landfill	No specific CAS number data available.	
Recycle or Recovery	0	
Unknown or Other		

Comments:

Cottage Grove, MN

Cottage Grove facility utilizes incineration for all their drummed wastes.

Sludge from the Cottage Grove facility is sent to an industrial landfill.

	Estimated Total Annual Releases (lbs.)	Estimated % Accuracy of Estimate (optional)
Incineration:	No specific CAS number data available.	
Wastewater Treatment (Excluding POTW)	0	
Underground Injection	0	
Hazardous Waste (RCRA Subtitle C) landfill	0	
Other Landfill	0	
Recycle or Recovery	0	
Unknown or Other	0	

Comments:

VI. ON-SITE WORKPLACE EXPOSURE

3M Company, Specialty Materials Manufacturing Division, Cottage Grove, MN

This information will assist EPA in characterizing the number of workers potentially exposed and the magnitude, frequency, and duration of potential exposure. When providing monitoring data, ensure that data is linked with worker activities described in question 2.

1. **Estimate the number of workers potentially exposed routinely to the subject chemical for each of the exposure duration times. If a worker is involved in more than one activity, enter only his/her most typical activity in the table. Don't count a worker more than once. The total number in the table should equal the total number of workers potentially exposed.**

	Days/Year			
Hours/Day	<10	10-100	100-250	>250
<.25	6			
.25-1	2			
1-8	4			
>8				

2. **Describe the routine worker activities to which the workers in question 1 are exposed: sampling, removal of filter cake, and drumming of liquids, manufacture an article, etc. For these activities, describe the physical state of the subject chemical (liquid, gas, particulate, or aerosol, etc.) and, if in a mixture, the chemical's concentration:**

   Vacuum charging from drums, sampling from reactor, drumming of product/intermediate, maintenance (changing flange, hose, pipe, valve, filter, pump or sight glass); materials may be handled in a molten or solid state or dissolved in organic solvents; vapors are produced from molten material; approximate concentration ranges from <1% to 80%.

3. **Provide industrial hygiene monitoring data, if available, with a brief description of the sampling method and exposure scenario monitored, e.g., describe the specific worker activities performed by the individuals monitored. For privacy considerations, please do not include any personal identifiers such as a worker's name or social security number with any data submitted to EPA.**

   There is no chemical-specific personal industrial hygiene monitoring data or area/source monitoring data for this specific material at this facility. For most areas of the facility, recent qualitative assessment of potential exposure to this material under 3M's ongoing industrial hygiene program indicates a low exposure potential to this material.

   Each 3M plant that produces sulfonated fluorochemicals has an industrial hygienist on staff and is supported by a corporate industrial hygiene group. 3M's industrial hygiene program focuses on task-based exposure assessment and control. Exposures are identified and assessed qualitatively and/or quantitatively. Qualitative assessments are performed by an industrial hygienist. Quantitative assessments include task-based personal sampling for certain, specific fluorochemicals and/or source or area sampling. The results of the assessments support decisions on exposure control. Engineering controls are preferred, but personal protective equipment may be used on an interim basis or when effective engineering control is not feasible.

4. **Briefly describe the engineering controls used to minimize exposure to this chemical:**

   Materials are transferred using closed piping (where possible) from reactor vessels to other containers. Vacuum charging of materials from drums is a standard practice. Positionable local exhaust ventilation hoods are situated at significant point sources such as at drum bungs when drumming. General room air provides for dilution of airborne materials.

5. **Briefly list the personal protective equipment your workers regularly wear to prevent exposure of this chemical:**

   Process operating standards list the respirator (e.g., supplied air, organic vapor cartridge with particulate prefilter, or particulate filtering), glove by elastomer (e.g., neoprene or nitrile), chemical protective clothing (e.g., 2-piece PVC rainsuit), eye protection (e.g., chemical splash goggles with or without full faceshield depending on type of respirator used) to be used by the employee when the task involves exposure to a particular fluorochemical material.

   Comments: (This section is available to clarify the responses given. Attach additional pages if desired.)

3M Company, Specialty Materials Manufacturing Division, Decatur, AL

This information will assist EPA in characterizing the number of workers potentially exposed and the magnitude, frequency, and duration of potential exposure. When providing monitoring data, ensure that data is linked with worker activities described in question 2.

1. **Estimate the number of workers potentially exposed routinely to the subject chemical for each of the exposure duration times. If a worker is involved in more than one activity, enter only his/her most typical activity in the table. Don't count a worker more than once. The total number in the table should equal the total number of workers potentially exposed.**

	Days/Year			
Hours/Day	<10	10-100	100-250	>250
<0.25				
0.25-1	4	4	24	
1-8		24		
>8				

2. **Describe the routine worker activities to which the workers in question 1 are exposed: sampling, removal of filter cake, and drumming of liquids, manufacture an article, etc. For these activities, describe the physical state of the subject chemical (liquid, gas, particulate, or aerosol, etc.) and, if in a mixture, the chemical's concentration:**

   Vacuum charging from drums, sampling from reactor, drumming of product/intermediate, maintenance (changing flange, hose, pipe, valve, filter, pump or sight glass); materials may be handled in a molten or solid state; vapors are produced from molten material; material concentration ranges from <1% to 80%.

   Wastewater treatment operations: collecting and analyzing QC samples, operating filter press, monitoring process, and maintenance activities; materials typically present in waste stream at less than 1%.

3. **Provide industrial hygiene monitoring data, if available, with a brief description of the sampling method and exposure scenario monitored, e.g., describe the specific worker activities performed by the individuals monitored. For privacy considerations, please do not include any personal identifiers such as a worker's name or social security number with any data submitted to EPA.**

Personal sampling for these materials is currently (late 1999 to present) done using OSHA Versatile Sampler tubes with XAD-4 resin and mixed cellulose ester or glass fiber prefilter. Sample analysis is by LC-MS. Previous sampling had employed silica gel acid mist tubes with GC-ECD analysis. See attached table for air sample results.

There has been area/source air monitoring data and/or surface wipe sampling data collected for this material at the plant. Area/source sample results and/or surface wipe sample results are used to identify areas with employee exposure potential as part of exposure assessment under 3M's industrial hygiene program and are not measurements of actual employee exposures. Hence, they are not included with this submission. Prior to 1999, these samples were considered to be semi-validated.

Surfaces in production and administration areas were sampled in 1998. A glass fiber filter wetted with methyl alcohol was wiped inside a 10 cm x 10 cm square with analysis by LC-MS. Results indicated the presence of these materials on floors and equipment surfaces in production areas. This resulted in improvements to Hazard Communication practices, personal hygiene emphasis, personal protective equipment emphasis, and several engineering and administrative changes.

The sample results of any air monitoring are compared to 3M's voluntary exposure guideline (EG) of 0.1 mg/m3 (milligrams of fluorochemical per cubic meter of air) for various fluorochemical compounds, including compounds covered in this submittal. The EG is an 8-hour time-weighted average (TWA) personal breathing zone exposure chosen to minimize potential for uptake.

Each 3M plant that produces sulfonated fluorochemicals has an industrial hygienist on staff and is supported by a corporate industrial hygiene group. 3M's industrial hygiene program focuses on task-based exposure assessment and control. Exposures are identified and assessed qualitatively and/or quantitatively. Qualitative assessments are performed by an industrial hygienist. Quantitative assessments include task-based personal sampling for certain, specific fluorochemicals and/or source or area sampling. The results of the assessments support decisions on exposure control. Engineering controls are preferred, but personal protective equipment may be used on an interim basis or when effective engineering control is not feasible.

Air Sampling Data for 4151-50-2

Job Classification	Sample number	Concentration (mg/m3)	Minimum (mg/m3)	Maximum(mg/m3)	Geometric Mean	Geometric Standard Deviation
		Totals →	<0.005	0.1	0.01	2.3
Chemical Operator Building 3	94-031*	0.015				
	94-032*	<0.01				
	94-034*	<0.005				
	94-037*	0.004				
	94-038*	0.007				
	94-039*	0.013				
	94-041*	0.008				
	94-046*	0.007				
	94-050*	0.005				
Team Leader Building 3	94-036*	0.014				
	94-047*	<0.02				
	94-051*	<0.005				
	94-054*	0.012				
	94-055*	0.1				

* The value for this sample is one of several fluorochemical analytes collected on the sample.

Samples are all personal breathing zone samples taken over the duration of a specific task.

4. **Briefly describe the engineering controls used to minimize exposure to this chemical:**

Materials are transferred using closed piping (where possible) from reactor vessels to other containers. Vacuum charging of materials from drums is a standard practice. Local exhaust ventilation hoods are situated at significant point sources such as at drum bungs when drumming. General room air provides for dilution of airborne materials. Operator control rooms are segregated from process areas and provided separate room air ventilation.

5. **Briefly list the personal protective equipment your workers regularly wear to prevent exposure of this chemical:**

Specific personal protective equipment is indicated on written operating procedures used by process operators.

Respiratory protection: Tasks with significant exposure potential (charging, drumming, some maintenance tasks) are performed using positive pressure, pressure demand full face supplied air respirators. Tasks with moderate exposure potential (short term sampling from taps or drums, and some maintenance tasks) are performed using full face air-purifying respirators with organic vapor cartridges and P100 prefilters.

Hand protection: All tasks identified as having potential for hand contact require neoprene (Scorpio) or nitrile industrial gloves.

Body protection: Exposure significant tasks use one or two-piece PVC suits. Aprons may be worn for some low exposure potential tasks such as sampling.

Foot protection: Tasks identified as posing a significant foot exposure potential require chemical resistant boots.

Comments: (This section is available to clarify the responses given. Attach additional pages if desired.)

Current exposures are expected to be less than those measured in the recent past. Significant sources have been identified and eliminated. In 1998 an extensive area air sampling of the production areas was performed. Areas with higher levels of airborne materials were investigated further to identify sources. These sources, which include the flaking equipment, are in the process of being eliminated or reduced through replacement with better ventilated equipment. In addition, the ventilation system in the primary production building (3) is being upgraded.

The fluorochemical hazard communication program was improved upon in 1998. This has resulted in improved exposure avoidance behaviors among production employees and better use of personal protective equipment.

Additional hand wash facilities have been installed in primary process buildings. Food consumption and other hand-to-mouth activities are prohibited. There is no smoking in process buildings. Process employees are instructed to remove and leave their work boots and work coveralls at the plant. Work coveralls are professionally laundered.
Non-production equipment surfaces such as floors, doorknobs and stair rails are cleaned frequently.

VII. CHEMICAL END USES

A. END USE AS AN INTERMEDIATE CONSUMED TO MAKE OTHER CHEMICALS

A1. On-Site Use as a Intermediate:

Fluorinated alkyl sulfonamides are used as an intermediate in the production of fluorinated alkyl alkoxylates, and as an intermediate used to make foam tape additives.

	Product chemical class or product chemical (Include CAS number if appropriate)	% of total volume of subject chemical manufactured or imported
1.	Fluorinated CAS #68958-61-2 alkyl alkoxylate	75-80

As reported in Part III, p.2

A2. Off-Site Use as an Intermediate

	Product chemical class or product chemical (Include CAS number if appropriate)	% of total volume of subject chemical manufactured or imported
1.	Not Applicable	Not Applicable

As reported in Part III, p.2

B. END USES OTHER THAN AS A CONSUMED INTERMEDIATE

Use Number 1 of 6

Description of Chemical End Use: Chemical formulators use this chemical as a registered active ingredient for insect control. It is blended with bait that is attractive to insects and placed in bait stations. Either commercial facilities or consumers can use these bait stations.

Percent of total manufactured or imported volume going to this use: 19 ± 1

If used in a mixture check appropriate box to indicate weight fraction. Average values are acceptable:

X <1% (0.5-1.0%)
___ 1-30%
___ 30-60%
___ 60-90%
___ >90%

Check all physical forms of the chemical during this use:

___ Aerosol
___ Dry Powder
___ Pellets or large crystals
___ Water or solvent – wet solid
___ Gas or vapor
___ Liquid solution
X Other (Explain) **Waxy Solid**

Use Number 2 of 6

Description of Chemical End Use: Chemical formulators add this chemical as a surfactant to improve the wetting of protective coatings.

Percent of total manufactured or imported volume going to this use: 2 ± 0.5

If used in a mixture check appropriate box to indicate weight fraction. Average values are acceptable:

X <1% (20 ppm)
___ 1-30%
___ 30-60%
___ 60-90%
___ >90%

Check all physical forms of the chemical during this use:

___ Aerosol
___ Dry Powder
___ Pellets or large crystals
___ Water or solvent – wet solid
___ Gas or vapor
X Liquid solution
___ Other (Explain)

Use Number 3 of 6

Description of Chemical End Use: Oil well service formulators and oil companies use this chemical as a surfactant in a well stimulation formula that is injected into an oil well to enhance the recovery of oil and gas.

Percent of total manufactured or imported volume going to this use: < 1

If used in a mixture check appropriate box to indicate weight fraction. Average values are acceptable:

_X_ <1% (500 ppm)
___ 1-30%
___ 30-60%
___ 60-90%
___ >90%

Check all physical forms of the chemical during this use:

___ Aerosol
___ Dry Powder
___ Pellets or large crystals
___ Water or solvent – wet solid
___ Gas or vapor
_X_ Liquid solution
___ Other (Explain)

Use Number 4 of 6

Description of Chemical End Use: Mining operations utilizing the solution mining process use this chemical as a surfactant to increase wetting of other chemicals that leach the metals from the ore.

Percent of total manufactured or imported volume going to this use: < 1

If used in a mixture check appropriate box to indicate weight fraction. Average values are acceptable:

_X_ <1% (100 ppm)
___ 1-30%
___ 30-60%
___ 60-90%
___ >90%

Check all physical forms of the chemical during this use:

___ Aerosol
___ Dry Powder
___ Pellets or large crystals
___ Water or solvent – wet solid
___ Gas or vapor
_X_ Liquid solution
___ Other (Explain)

Use Number 5 of 6

Description of Chemical End Use: Powder additive formulators use this chemical as a wetting agent for thickeners (Carbopol).

Percent of total manufactured or imported volume going to this use: < 1

If used in a mixture check appropriate box to indicate weight fraction. Average values are acceptable:

_X_ <1%
___ 1-30%
___ 30-60%
___ 60-90%
___ >90%

Check all physical forms of the chemical during this use:

___ Aerosol
___ Dry Powder
___ Pellets or large crystals
___ Water or solvent – wet solid
___ Gas or vapor
_X_ Liquid solution
___ Other (Explain)

Use Number 6 of 6

Description of Chemical End Use: A formulator of powder additives adds this chemical to aid the gelling of medical waste solutions.

Percent of total manufactured or imported volume going to this use: < 1

If used in a mixture check appropriate box to indicate weight fraction. Average values are acceptable:

_X_ <1%
___ 1-30%
___ 30-60%
___ 60-90%
___ >90%

Check all physical forms of the chemical during this use:

___ Aerosol
___ Dry Powder
___ Pellets or large crystals
___ Water or solvent – wet solid
___ Gas or vapor
_X_ Liquid solution
___ Other (Explain)