APPENDIX B

Facility Process Information

Process Overview

1) Raw material, such as crude oil, is received at the facility by pipeline, tanker trucks, and rail cars.

2) Crude oil is refined or processed by various common refinery processes (see Diagram 1). For example:

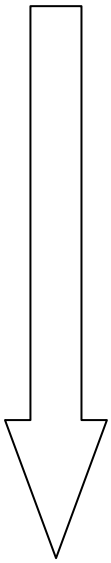
- Distillation – boiling crude oil to separate it into its constituent hydrocarbons (different hydrocarbons will boil at different temperatures depending on the amount of carbon atoms it contains). See diagram below for the different products of distillation.
- Hydrotreating – utilizes catalysts in the presence of substantial amounts of hydrogen under high pressure and temperature to react the feedstocks and impurities with hydrogen.
- Propane deasphalting – extracts asphaltenes and resins from the residuals of the vacuum distillation unit to produce a lubricating oil base.
- Solvent extraction – uses solvents to dissolve and remove aromatics from lube oil feed stocks, improving viscosity, oxidation resistance, color and gum formation.

3) Two types of end products from refinery processes:

- Products that are delivered to customers by truck or rail car
- Wastes that have been generated that need to be treated and/or discharged

Distillation products

Lightest



propane and butane – liquefied petroleum gases

petrochemicals – for plastics, fabrics, and other consumer products

Gasoline
Kerosene
Diesel fuel
} different fuel types

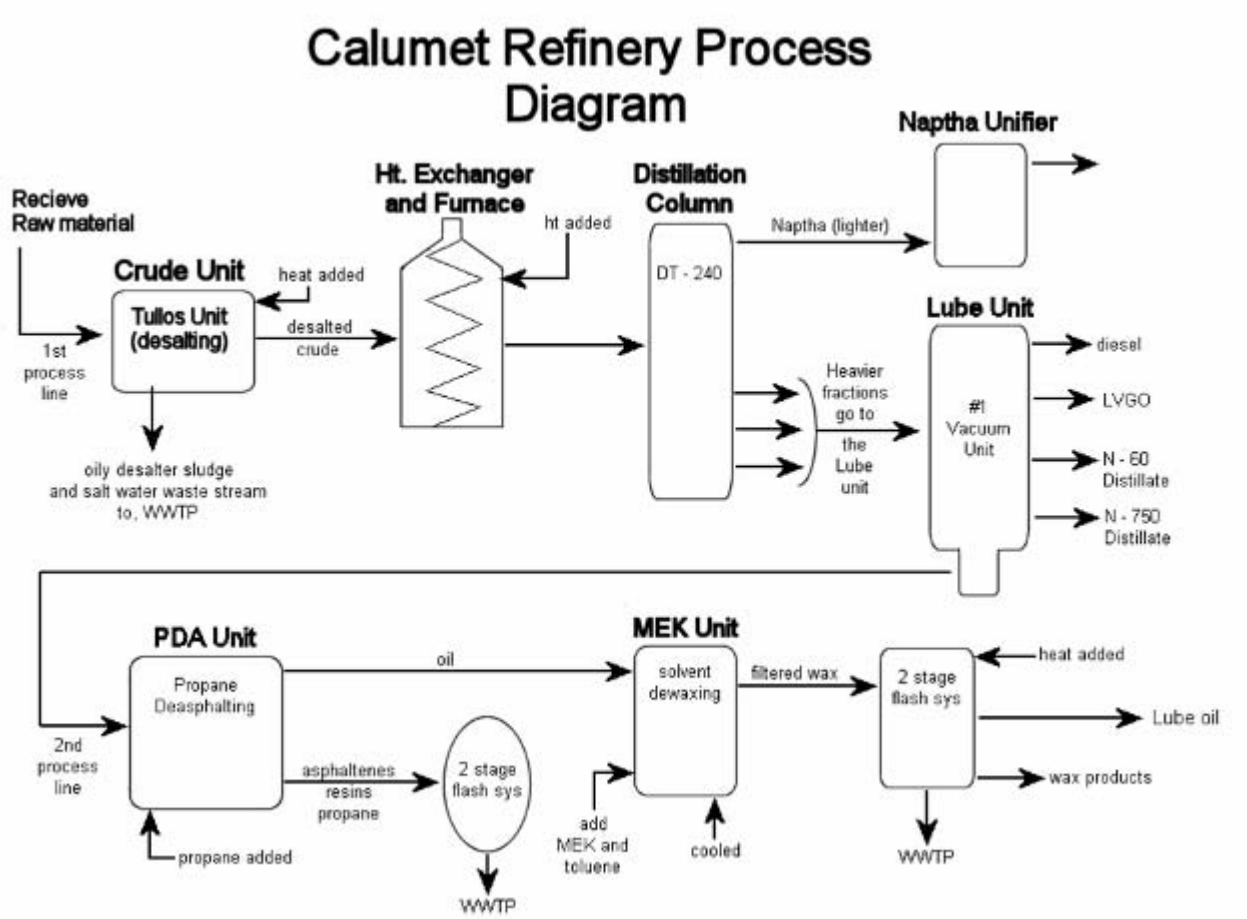
Heating oils

Lubricants
Waxes

Asphalt and other residuals

Heaviest

Diagram 1. Calumet Refinery Processes Flowchart



Source of diagram: TOSC's workshop booklet for the RAN community group, February 22, 2003.

APPENDIX C

Grab Air Sampling Results for VOCs

Table 1. Grab Air Sampling Results (2002) for VOCs in parts per billion (ppb) and Corresponding ATSDR* Comparison Values

Name of VOC	Sample Date						Chronic EMEG[H] (ppb)[I]	Intermediate EMEG (ppb)	Acute EMEG (ppb)
	5/23	6/23	2/12	1/31	3/10	3/09			
1-Butene	0.31	0.63	0.28	0.15	0.09	ND			
1-Hexene	0.64	0.44	0.13	ND	ND	0.65			
1-Pentene	0.91	0.84	0.19	0.1	ND	ND			
1,1,1-Trichloroethane	0.05m	0.05m	0.09	0.07	0.02	0.05		700	2000
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND		400	
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND			
1,1-Dichloroethane	ND	0.15j	ND	ND	ND	ND			
1,1-Dichloroethene	0.04m	0.04m	ND	ND	ND	ND		20	
1,2,3-Trimethylbenzene	0.35	0.79	ND	ND	ND	ND			
1,2,4-Trimethylbenzene §	1.22, 0.03m	1.41, 0.63	0.1, 0.02	0.15, 0.07	0.06, 0.05	0.15, 0.07			
1,2,4-Trichlorobenzene	ND	0.05m	ND	ND	0.02	ND			
1,2-Dibromoethane	ND	ND	ND	ND	ND	ND			
1,2-Dichloroethane	ND	0.03m	ND	ND	ND	ND	600		
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND		7	50
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND			
1,3-Butadiene §	0.13, ND	ND, ND	ND, ND	0.24, ND	ND, ND	ND, ND			
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND			
1,3-Hexachlorobutadiene	ND	0.03m	ND	ND	ND	ND			
1,4-Dichlorobenzene	0.06m	ND	ND	ND	ND	ND	100	200	800
1,3,5-Trimethylbenzene §	0.34, 0.01m	1.88, 0.25j	ND, ND	ND, 0.02	ND, 0.02	ND, 0.02			
2-Butanone	0.23j	1.05	3.66	0.07	0.43	1.89			

Name of VOC	Sample Date						Chronic EMEGH (ppb)I	Intermediate EMEG (ppb)	Acute EMEG (ppb)
	5/23	6/23	2/12	1/31	3/10	3/09			
2-Hexanone	ND	ND	ND	ND	ND	ND			
2-Methylbutane	2.8	27.26	1.19	2.06	0.47	1.63			
2-Methylheptane	0.28	7.74	ND	0.09	ND	0.09			
2-Methylhexane	0.32	6.34	0.22	0.08	0.08	0.38			
2-Methylpentane	0.77	ND	0.49	0.71	0.24	0.72			
2-Nitropropane	ND	ND	ND	ND	ND	ND			
2,2-Dimethylbutane	0.49	3.27	0.13	0.14	ND	ND			
2,2,4-Trimethylpentane	0.38	9.81	0.22	0.28	ND	0.36			
2,3-Dimethylbutane	0.63	12.64	0.2	0.24	ND	0.19			
2,3-Dimethylpentane	0.4	9.85	ND	0.09	ND	0.09			
2,3,4-Trimethylpentane	ND	1.77	ND	0.07	ND	0.11			
2,4-Dimethylpentane	0.3	5.2	ND	0.13	ND	0.18			
3-Methylheptane	0.32	1.42	ND	0.26	ND	0.23			
3-Methylhexane	0.83	7.45	0.13	0.2	0.05	0.43			
3-Methylpentane	0.74	14.67	0.45	0.6	0.09	0.58			
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND			
Acetone	4.7	5.14	1.09	1.07	1.08	1.31	13000	13000	26000
Acetonitrile	0.11j	0.19j	0.09	ND	ND	ND			
Acetylene	1.12	0.48	0.85	2.95	0.76	0.8			
Acrylonitrile	ND	ND	ND	ND	ND	ND			100
Allyl chloride	ND	ND	ND	ND	ND	ND			
Benzene§	0.81, 0.12j	4.99, 5.95	0.63, 0.2	0.6, 0.35	0.26, 0.22	0.67, 0.51		4	50
Benzyl chloride	ND	ND	ND	ND	ND	ND			

Name of VOC	Sample Date						Chronic EMEGH (ppb)I	Intermediate EMEG (ppb)	Acute EMEG (ppb)
	5/23	6/23	2/12	1/31	3/10	3/09			
Bromomethane	0.04m	0.03m	ND	ND	0.05	ND	5	50	50
n-Butane	2.26	18.92	2.16	4.22	0.69	1.69			
Carbon disulfide	0.03m	0.56	0.02	0.05	0.1	0.07	300		
Carbon tetrachloride	0.1j	0.1j	0.11	0.12	0.07	0.1		50	200
Chloroacetonitrile	ND	ND	ND	ND	ND	ND			
Chlorobenzene	ND	ND	ND	0.02	ND	0.02			
Chlorobutane	ND	ND	ND	ND	ND	ND			
Chloromethane	0.67	0.54	0.56	0.56	0.48	0.48	50	200	500
Chloroform	0.02m	0.03	0.02	0.02	0.02	0.02	20	50	100
Chloroethane	ND	ND	ND	ND	ND	ND			
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND			
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND			
cis-2-Butene	0.11	0.17	ND	ND	ND	ND			
cis-2-Pentene	0.26	1.22	ND	ND	ND	0.09			
Cumene	0.28	0.68	ND	ND	ND	ND			
Cyclohexane	0.48	23	0.44	0.57	0.07	0.52			
Cyclopentane	0.21	7.45	0.13	0.19	ND	0.14			
Diethyl ether	ND	ND	ND	ND	ND	ND			
Ethane	6.98	14.86	6.15	17.6	4.03	4.62			
Ethylbenzene§	0.42, 0.02m	0.93, 0.76	0.06, 0.02	0.07, 0.05	0.02, 0.02	0.15, 0.07		1000	
Ethylene	0.73	0.54	1.45	1.71	0.84	0.75			
Ethyl Methacrylate	ND	ND	ND	ND	ND	ND			
Freon 11	0.33j	0.28j	0.31	0.32	0.22	0.27			

Name of VOC	Sample Date						Chronic EMEGH (ppb)I	Intermediate EMEG (ppb)	Acute EMEG (ppb)
	5/23	6/23	2/12	1/31	3/10	3/09			
Freon 12	0.65	0.6	0.67	0.7	0.48	0.53			
Freon 113	0.12j	0.09j	0.11	0.09	0.07	0.1			
Freon 114	0.02m	0.02	0.02	0.02	0.02	0.02			
n-Heptane	0.3	13.36	0.16	0.43	0.12	0.72			
n-Hexane	0.64	17.29	1.16	0.92	0.12	0.92			
Isobutane	1.54	4.46	0.85	1.63	0.31	0.83			
Isoprene	8.78	1.24	ND	ND	ND	ND			
m-Diethylbenzene	0.29	0.27	ND	ND	ND	ND			
m-Ethyltoluene	0.52	2.22	0.05	0.11	ND	0.12			
Methyl Acrylate	ND	ND	ND	ND	ND	ND			
Methylcyclohexane	0.32	47.26	0.34	0.93	0.08	0.08			
Methylcyclopentane	0.39	15.58	0.58	0.54	0.08	0.54			
Methyl Methacrylate	ND	ND	ND	ND	ND	ND			
Methacrylonitrile	ND	ND	ND	ND	ND	ND			
Methyl-t-butyl ether	0.01M	ND	ND	ND	ND	ND	700	700	2000
Methylene chloride	0.17j	0.17j	0.25	0.26	0.24	0.27	300	300	600
m,p-Xylenes§	1.03, 0.05m	2.60, 3.53	0.15, 0.04	0.32, 0.19	0.11, 0.07	0.64, 0.29	100	700	1000
Nitrobenzene	ND	0.05m	ND	ND	ND	ND			
n-Decane	0.59	0.41	ND	0.12	ND	0.14			
n-Nonane	0.33	0.22	ND	0.21	ND	0.24			
n-Undecane	0.59	0.61	ND	0.08	ND	0.09			
o-Ethyltoluene	0.56	1.7	ND	ND	ND	ND			
o-Xylene§	0.57,	3.27,	0.06,	0.11,	0.11,	0.21,	100	700	1000

Name of VOC	Sample Date						Chronic EMEG[H] (ppb)[I]	Intermediate EMEG (ppb)	Acute EMEG (ppb)
	5/23	6/23	2/12	1/31	3/10	3/09			
	0.03m	0.97	0.02	0.07	0.05	0.10			
n-Octane	0.36	6.83	ND	0.28	0.06	0.41			
n-Pentane	1.52	16.51	0.88	1.71	0.31	1.09			
p-Diethylbenzene	ND	0.55	ND	ND	ND	ND			
p-Ethyltoluene	0.39	1.51	ND	ND	ND	ND			
Propane	4.29	14.28	12.21	11.64	1.56	4.89			
n-Propylbenzene	0.3	0.95	ND	ND	ND	ND			
Propylene	0.54	1.92	4.65	0.79	0.28	0.27			
Styrene (Ethenylbenzene) §	0.22, ND	1.07, ND	0.06, ND	ND, ND	ND, ND	ND, ND	60		
Tetrachloroethene	ND	0.01	ND	ND	ND	ND	40		200
Tetrahydrofuran	ND	ND	ND	ND	ND	ND			
Toluene	1.34, 0.11j	30.11, 34.96j	1.13, 0.56	0.82, 0.51	0.35, 0.14	1.35, 0.94	80		1000
trans-1,3-Dichloro-1-propene	ND	ND	ND	ND	ND	ND			
trans-2-Butene	0.14	0.09	ND	0.12	ND	ND			
trans-2-Pentene	0.3	1.4	ND	ND	ND	ND			
Trichloroethene	0.06m	ND	ND	ND	0.02	ND		100	2000
Vinyl chloride	ND	ND	ND	ND	ND	ND		30	500

* ATSDR denotes Agency for Toxic Substances and Disease Registry, US Department of Health and Human Services.

H EMEG denotes Environmental Media Evaluation Guide

I ppb denotes parts per billion

ND Indicates the chemical was not detected.

§ Chemicals were analyzed by two different methods – results are displayed for both.

j Denotes an estimated concentration (laboratory qualifier)

m Denotes an estimated concentration reported below average method detection limit (laboratory qualifier)

Shaded areas indicate a comparison value was not available.

APPENDIX D

Air Modeling Data and Maps

Hydrogen Sulfide and Sulfur Dioxide Air Modeling *

Purpose

This modeling exercise has two parts:
1) Estimate ground level annual average concentrations of sulfur dioxide generated by the sulfur recovery unit incinerator based on an emission rate of 300 tons/year.
2) Estimate worst case ground level concentrations of sulfur dioxide (ranging from 500 to 50000 pounds) and hydrogen sulfide (ranging from 1 to 500 pounds), based on various hypothetical one-time releases from the sulfur recovery unit incinerator.

Meteorological data

Hourly meteorological data from the National Weather Service (NWS) observation station in Shreveport, LA, for the years 1984 to 1988 was used to estimate ambient concentrations of sulfur dioxide. A predefined set of meteorological data was used to simulate worst-case weather conditions to determine maximum ground level concentrations of sulfur dioxide and hydrogen sulfide from hypothetical one-time releases.

Model information and parameters

The model was completed using the Industrial Source Complex Short Term Model (ISCST3), which is the only regulatory model approved to estimate pollutant concentrations from industrial sources. ISCST3 was run for five separate years (1984 to 1988) using hourly meteorological data from the Shreveport, LA weather observation station and upper air data for the same period from Little Rock, AR.

Data for the sulfur recovery unit incinerator (source of the hydrogen sulfide and sulfur dioxide emissions) obtained include the following:

emission rate	8.63 g/s
stack height	53 m
stack gas exit temperature	922^{o}K
stack gas exit velocity	18.1 m/s
stack diameter	0.76 m

Source of data: Louisiana Department of Environmental Quality. Emission Inventory Questionnaire for Air Pollutants. Pennzoil Quaker State Company, Sulfur Recovery Plant Incinerator. Submitted to LDEQ November 9, 1999.

Model results

Figure 1 displays expected ground level concentrations of sulfur dioxide based on an annual average release of 300 tons/year (8.63 g/s). Highest concentrations of nearly 4.0 $\mu g/m^3$ are displayed to the north of the facility with a secondary maximum of over 2.0 $\mu g/m^3$ to the south of the facility. Prevailing wind directions from the south and north as shown in Figure 2 account for the locations of the maximums predicted by the ISCST3 model.

* The information in this appendix was compiled from the air modeling performed by US EPA's Environmental Response Team in a report dated August 8, 2002.

The second part of the modeling exercise was to estimate ground level concentrations based on hypothetical one-time releases of various amounts of hydrogen and sulfur dioxide. A file simulating all meteorological stability combinations was used in this modeling run. The weather data simulates all categories of wind speeds, stability classes, and wind directions (every 5 degrees of the compass). The highest one-hour concentrations for each emission rate for each receptor were chosen from the model output and are depicted in Figures 3 and 4.

Figure 1. Sulfur dioxide – estimated annual average.

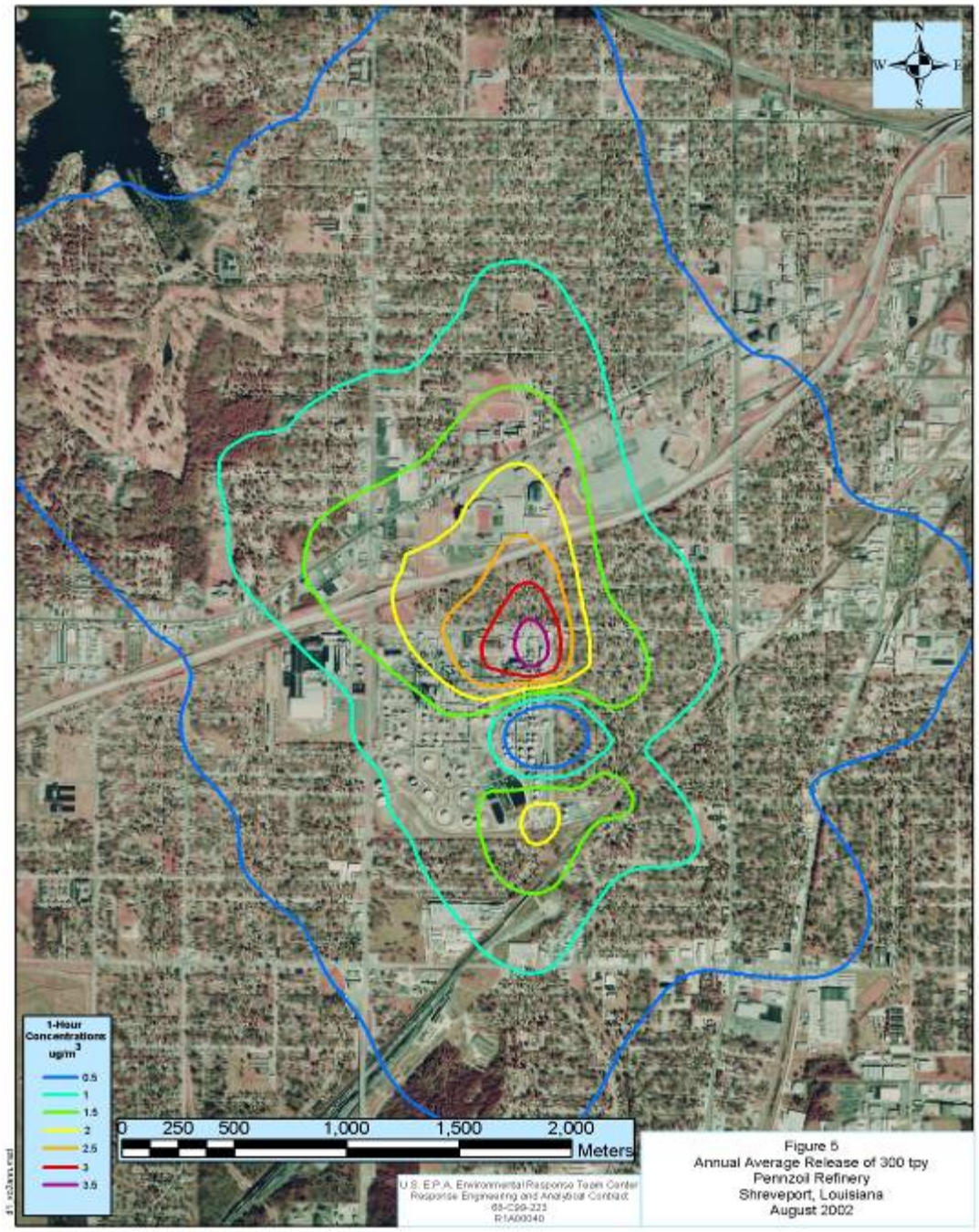


Figure 2. Sulfur dioxide – hypothetical release scenario.

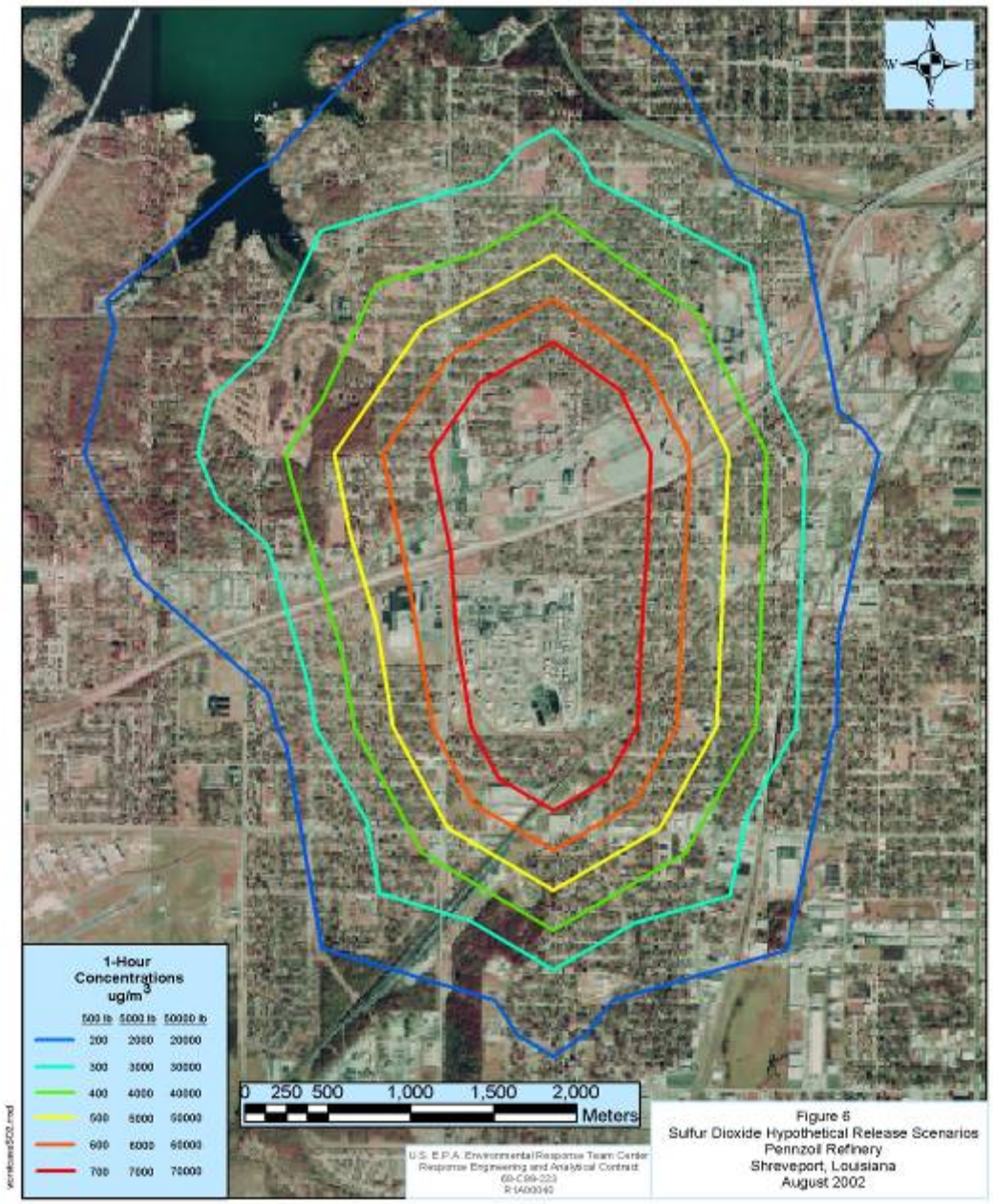


Figure 3. Hydrogen sulfide – hypothetical release scenario.

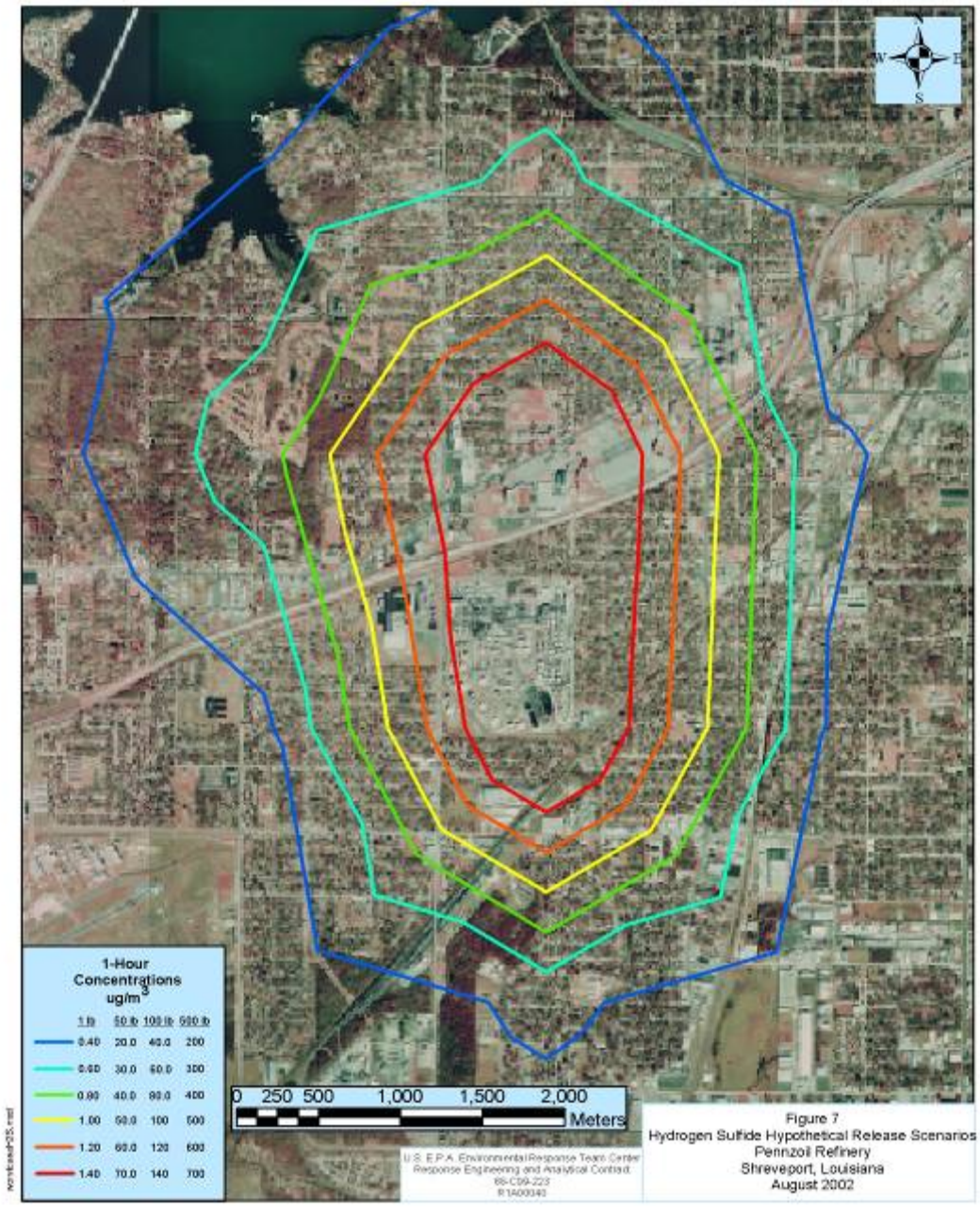
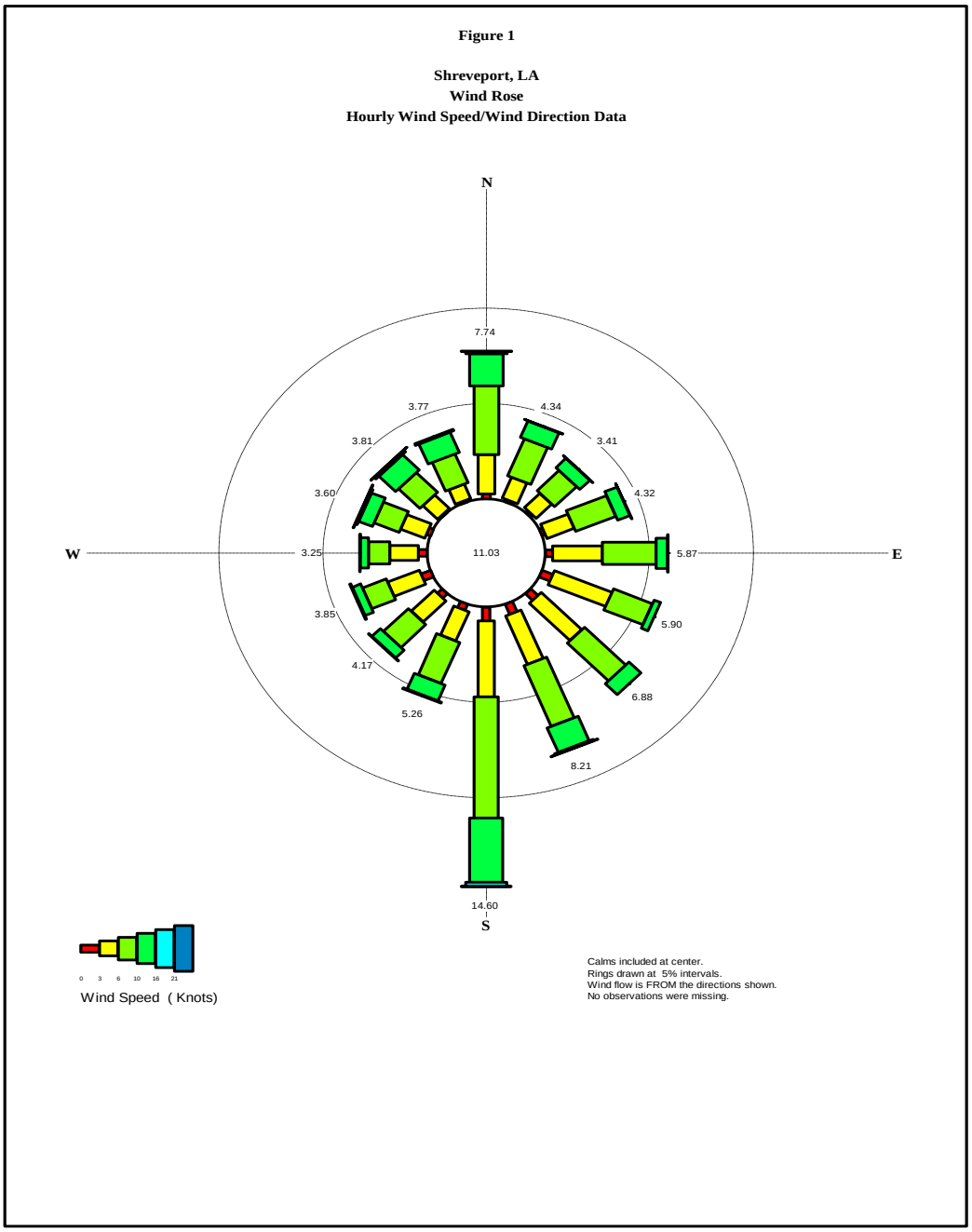


Figure 4. Wind rose.



APPENDIX E

Hydrogen Sulfide and Sulfur Dioxide Health Information

Hydrogen Sulfide

Hydrogen sulfide is a colorless, flammable gas under normal conditions. Hydrogen sulfide gas in water usually does not pose a health risk, but gives the water a nuisance "rotten-egg" smell and taste. People can smell hydrogen sulfide at concentrations as low as 0.5 ppb. It is found naturally as a constituent of crude petroleum, natural gas, volcanic gases, and is often the result of bacterial breakdown of organic matter. Industrial sources of hydrogen sulfide include petroleum refineries and natural gas plants. Hydrogen sulfide is also produced in the human body in the mouth and gastrointestinal tract [1].

Short term exposures to high levels of hydrogen sulfide may cause adverse health effects. For example, bronchial constriction was noted in 2 out of 10 asthmatics exposed to 2,000 ppb hydrogen sulfide for 30 minutes [2]. Other studies have documented respiratory distress in an occupational setting with exposures of greater than 40,000 ppb hydrogen sulfide and changes in oxygen uptake, and shortness of breath in subjects exposed to between 5,000 and 10,000 ppb hydrogen sulfide for short periods of time [3-7]. Much higher levels of hydrogen sulfide, from about 20,000 to 100,000 ppb, may result in eye irritation, sore throat, and memory problems. Breathing these levels on an everyday basis may result in dizziness, fatigue, headache, loss of consciousness and respiratory distress. For example, neurological effects resulting from chronic-duration exposure to hydrogen sulfide in shale industry workers have been reported. Symptoms in workers exposed to daily concentrations of hydrogen sulfide (which often exceeded 20,000 ppb) included fatigue, loss of appetite, headache, irritability, poor memory, and dizziness [8]. Breathing hydrogen sulfide at levels greater than 500,000 ppb can be fatal. In addition, prolonged exposure to high levels of hydrogen sulfide can cause the person being exposed to no longer be able to smell the gas.

The health effects of long-term exposures to low levels (<1 ppm) of hydrogen sulfide are not well known. A recent study examining health effects in a community exposed to low levels of hydrogen sulfide has noted an increase in asthma-related hospital visits among children following days when H_2S levels are above 30 ppb [9]. Several studies of communities exposed to low levels of malodorous sulfur compounds (including hydrogen sulfide, methyl mercaptan and methyl sulfides) indicate an increase in reported nasal symptoms, coughs and breathlessness, or wheezing with increasing air concentrations of these compounds [1]. However, it is not known if these symptoms can be attributed solely to hydrogen sulfide, since other compounds existed as well.

Sulfur Dioxide

Sulfur dioxide is a colorless gas with a strong odor that is irritating to the eyes and nose. SO_2 is a liquid when under pressure, and it dissolves in water very easily. Humans can smell sulfur dioxide at approximately 450 ppb. Sulfur dioxide is formed when fuel containing sulfur (mainly coal and oil) is burned and during metal smelting and other industrial processes. The highest concentrations of SO_2 are recorded in the vicinity of large industrial facilities [10].

The lowest level that resulted in human health effects from sulfur dioxide exposure was in young adult asthmatics who were exposed to 100 to 250 ppb of sulfur dioxide through a mouthpiece for 10 minutes. The people exposed experienced airway resistance or "bronchoconstriction", which made it more difficult to breathe. Decreased lung function in asthmatics exposed by inhalation to 250 ppb sulfur dioxide has also been reported by other investigators. In some studies, about 25% of asthmatics exposed to 250 to 500 ppb of sulfur dioxide experienced airway resistance 100% greater than the response to clean air when they were exposed for 5 minutes [11-13]. Researchers concluded that about 25% of mild asthmatics who were

sensitive to sulfur dioxide could exhibit bronchoconstriction if they were to perform exercise routinely in some highly industrialized areas of the Unites States [10]. Some studies have found that cold air may aggravate an asthmatic response to exposure to sulfur dioxide [11,14-21].Other studies found no association between sulfur dioxide exposure at low levels and asthmatic responses [22,23]. Asthmatic reactions to sulfur dioxide exposure at low levels seems to be varied and differs from person to person.

Studies of children have found an association between sulfur dioxide exposure of varying concentrations and respiratory effects. The study noted a significant correlation between coughing and annual levels of sulfur dioxide measured as low as 5 to 40 ppb [24]. Other studies have reported that children's forced expiratory volume (amount of breath a person breathes out after inhaling) was affected at levels ranging from 24 to 170 ppb [25,26].

In general, scientific studies have demonstrated that difficult breathing, airway resistance, bronchoconstriction, cough, iritation, and wheezing have been observed in asthmatic individuals from exposure to sulfur dioxide levels as low as 100 ppb. The lowest effect level for non-asthmatic individuals is 600 to 800 ppb, which infers that even non-asthmatic individuals can experience discomfort from exposure to low levels of sulfur dioxide [10].

References

1. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Hydrogen Sulfide. Atlanta: US Department of Health and Human Services; 1999.
2. Jappinen P, Vilkka V, Marttila O, Haahtela T.. Exposure to hydrogen sulfide and respiratory function. Br. J. Ind. Med. 1990;47:824–8.
3. Spolyar LW. Three men overcome by hydrogen sulfide in starch plant. Ind Health Monthly. 1951; 11(8): 116-7.
4. Bhambhani Y, Singh M. Physiological effects of hydrogen sulfide inhalation during exercise in healthy men. J Appl Physiol. 1991; 71(5):1872-7.
5. Bhambhani Y, Burnham R, Snydmiller G, et al. Comparative physiological responses of exercising men and women to 5 ppm hydrogen sulfide exposure. Am Ind Hyg Assoc J. 1994;55:1030-5.
6. Bhambhani Y, Burnham R, Snydmiller G, et al. Effects of 10-ppm hydrogen sulfide inhalation on pulmonary function in health men and women. J Occup Environ Med. 1996a; 38:1012-7.
7. Bhambhani Y, Burnham R, Snydmiller G, et al. Effects of 5 ppm hydrogen sulfide inhalation on biochemical properties of skeletal muscle in exercising men and women. Am Ind Hyg Assoc J. 1996b; 57:464-8.
8. Ahlborg G. Hydrogen sulfide poisoning in the shale industry. Arch. Ind. Hyg. Occup. Med. 1951; 3:247-66.
9. D Campagna, S Kathman, R Pierson, et al. Impact of ambient hydrogen sulfide and total reduced sulfur levels on hospital visits for respiratory diseases among children and adults in Dakota City and South Sioux City, Nebraska. American Thoracic Society - ATS 2001, 97th International Conference, San Francisco, California, USA, 2001.
10. Agency for Toxic Substances and Disease Registry. Toxicological profile for sulfur dioxide. Atlanta: U.S. Department of Health and Human Services; 1998.
11. Horstman D, Roger LJ, Kehrl H, et al. Airway sensitivity of asthmatics to sulfur dioxide. Toxicol Ind Health 1986;2:289-98.
12. Bethel RA, Sheppard D, Geffroy B, et al. Effects of 0.25 ppm sulfur dioxide on airway resistance in freely breathy, heavily exercising, asthmatic subjects. Am Rev Respir Dis. 1985;131:659-61.
13. Myers DJ, Bigby BG, Boushey HA. The inhibition of sulfur dioxide-induced bronchoconstriction in asthmatic subjects by cromolyn is dose dependent. Am Rev Respir Dis. 1986a;133:1150-3.
14. Sheppard D, Eschenbacher WL, Boushey HA, et al. Magnitude of the interaction between the bronchomotor effects of sulfur dioxide and those of dry (cold) air. Am Rev Respir Dis. 1984;130:52-5.
15. Bethel RA, Sheppard D, Epstein J, et al. Interaction of sulfur dioxide and dry cold air in causing bronchoconstriction in asthmatic subjects. J Appl Physiol: Respir Environ Exercise Physiol. 1984;57:419-23.

16. Koenig JQ, Morgan MS, Horike M, et al. The effects of sulfur oxides on nasal and lung function in adolescents with extrinsic asthma. J Allergy Clin Immunol. 1985;76:813-8.
17. Balmes JR, Fine JM, Sheppard D. Symptomatic bronchoconstriction after short-term inhalation of sulfur dioxide. Am Rev Respir Dis. 1987;136:1117-21.
18. Linn WS, Avol EL, Shamoo DA, et al. Asthmatic response to 6-hour sulfur dioxide exposures on two successive days. Arch Environ Health. 1984a;39:313-9.
19. Linn WS, Shamoo DA, Venet TG, et al. Comparative effects of sulfur dioxide exposures at 5^0C and 22^0C in exercising asthmatics. Am Rev Respir Dis. 1984b;129: 234-239.
20. Linn WS, Shamoo DA, Venet TG, et al. Combined effects of sulfur dioxide and cold in exercising asthmatics. Arch Environ Health. 1984c; 39:339-46.
21. Roger LG, Kehrl HR, Hazucha M, et al. Bronchoconstriction in asthmatic exposed to sulfur dioxide during repeated exercise. J Appl Physiol. 1985; 59:784-91.
22. Jorres R, Magnussen H. Airway response of asthmatics after a 30 minute exposure at resting ventilation, to 0.25 ppm No_2 or 0.5 ppm sulfur dioxide. Eur Respir J. 1990; 3:132-7.
23. Koenig JQ, Covert DS, Hanley QS, et al. Prior exposure to ozone potentiates subsequent responses to sulfur dioxide in adolescent asthmatic subjects. Am Rev Respir Dis. 1990; 141:377-80.
24. Dodge R, Solomon P, Moyers J, et al. A longitudinal study of children exposed to sulfur oxides. Am J Epidmiol. 1985;121:730-6.
25. Dockery D, Ware JH, Ferris BG, et al. Change in pulmonary function in children associated with air pollution episodes. J Air Pollut Control Assoc. 1982; 32:937-42.
26. Shy CM, HasselbladV, Burton RM, et al. Air pollution effects on ventilatory function of US schoolchildren: Results of studies in Cincinnati, Chattanooga, and New York. Arch Environ Health. 1973; 27:124-8.

APPENDIX F

Public Comments

Responses to Public Comments

The Agency for Toxic Substances and Disease Registry (ATSDR) issued a draft public comment version of the petitioned public health consultation on August 19, 2003, for the Pennzoil Quaker Refinery/Calumet Lubricants site. Between August 19, 2003, and October 6, 2003, the public had the opportunity to provide comments on the draft public health consultation. ATSDR received written comments and questions from the industry and the community. Where possible, these comments and questions are presented unchanged below. However, for the sake of clarity and brevity, some comments or questions were either paraphrased or summarized. The full correspondence is available upon request. Each comment or question is followed by a response from ATSDR.

Comments received from Industry

Page 2, paragraphs 3 and 4 and Appendix B, Process Overview

1. Comment: This section could leave open the impression that Calumet Shreveport Refinery (CSR) refines and produces fuels – no gasoline, kerosene, or jet fuel. CSR does not refine and produce fuels. CSR does provide gasoline and jet fuel storage for third parties in four floating roof tanks and shipped by pipeline. There are no significant emissions from these tanks.

Response: The following statement was added to the text on page 2: "The facility does not refine or produce gasoline, kerosene or jet fuel, but does provide storage for gasoline and jet fuel in large storage tanks onsite."

2. Comment: This section leaves open the impression that Calumet is currently using at least some sour crude as a feedstock. This is not accurate. The facility primarily uses Reduced Crude feedstocks that are relatively low in sulfur and VOC content.

Response: ATSDR believes that it is sufficient to say that Calumet uses a less sour crude feedstock than the previous facility to demonstrate the likelihood of a decrease in sulfur emissions in comparison to that of the previous facility.

3. Comment: The section also leaves a possible impression that significant VOC emissions are likely but just not measured. This is also inaccurate. The loss of VOCs and ancillary chemicals (such as MEK) is tightly controlled not only for environmental concerns but also because such losses would decrease revenue.

Response: Because VOCs are used or produced at the facility, it is important to list what types of VOCs have the potential to be emitted to the air. The facility has reported VOCs, including MEK, to EPA's Toxic Release Inventory (TRI) as releases to air. The listing of these chemicals does not imply the amount of VOCs emitted to the air. No ambient air monitoring has been conducted to determine if VOC emissions are significant from a community health standpoint.

4. Comment: Paragraph 4 could be read to suggest that there are significant sulfur compounds released at the flare. This is not accurate, as the continuous DEQ monitoring has demonstrated. CSR currently has one operating flare that provides a minimum 98% destruction of gases, which is only used in emergency shutdown or process upsets which are very rare.

Response: Comment noted. The following statement was included in paragraph 3: The facility maintains several flares, but only one is currently active. The operating flare is used in emergencies to burn excess product at a 98% efficiency to keep it from being released to the air.

Page 2, paragraph 5

5. Comment: This paragraph lists the health concerns of the community with the primary concern listed as “air quality”. Calumet Lubricants is also concerned about air quality. We live here. Every effort is made daily to protect lives and health of Calumet employees. The management of each facility is dedicated to preventing employee exposures to fires, explosions and chemicals to the maximum degree feasible. This exposure prevention for Calumet employees has a secondary benefit of reducing or eliminating these exposures for the community outside the fence. Calumet does not believe that the community health concerns can reasonably be related to Calumet’s operations.

Response: Comment noted. However, there is a fundamental difference between worker exposures and community exposures. Protecting workers does not necessarily mean that a community is protected to the same degree. A few examples of this are: 1.) workers may wear personal protective equipment to eliminate exposure; 2.) workers are normally healthy adults and not part of susceptible subpopulations such as children and elderly; 3.) worker exposure is typically 40 hours a week, but a community exposure may be 24 hours/day, 7 days/week.

Table 1, page 4

6. Comment: Calumet would like to suggest that this table be expanded to include the identity of the VOCs found, the range and mean of concentration.

Response: The final version of the health consultation now includes a table listing the VOCs analyzed, the results, and the corresponding ATSDR comparison value.

Page 4, paragraph 2

7. Comment: Calumet would like to state for the record that CSR did not have any unusual or accidental releases of any sort on the dates noted in Table 1 nor the day previous.

Response: Comment noted.

Page 4, paragraph 3

8. Comment: For bullet 2: It should be clarified for the record that there are many potential sources for "fuel components" in this area of Shreveport and that CSR, which is not a fuels refinery, is not a probable source.

Response: CSR uses crude oil in its refining process; therefore, CSR is a potential source of fuel components in the air. ATSDR acknowledges that there may also be other sources of fuel components in the area.

9. Comment: For bullet 3: This paragraph could leave the impression that air contaminants found "in the air at the community" likely came from CSR. However, the available data does not lead to that conclusion. In addition, it does not appear that the results of the sampling analyses were compared to contemporaneous samples taken at other locations. This would be necessary to determine if the levels of compounds found were unusual or were at background levels. The unstated levels of chemical found by LDEQ's sampling efforts could be completely normal to the Shreveport or Jewella Road urban area and not related to plant emissions.

Response: ATSDR did not attempt to identify the source of the contaminants that were detected, and acknowledges that the chemicals detected may be typical of urban air. The purpose of the discussion regarding these samples was to explain why these samples were not sufficient for ATSDR to evaluate the community's exposure to VOC emissions.

Page 4, Paragraph 4

10. Comment: This paragraph seems to suggest that air contaminants likely came from CSR. The implication that these compounds can only come from activities (permitted or accidental) at CSR is erroneous. The authors further imply that unusual or excessive emissions tend to occur at CSR. This is a false assumption. Calumet has long standing policies and procedures predating the purchase of CSR that forbid anything but strict compliance with all reporting regulations. Had there been a release of this kind, it would have been reported to LDEQ in a timely manner.

Response: See response to comment #9. ATSDR did not intend to imply that CSR does not report accidental releases. The discussion in this paragraph was included to explain to the reader the limitations of the available VOC data. Accidental releases and excessive emissions are important to consider when evaluating community exposures from an operating facility. Although CSR may be compliant with reporting regulations, that does not prevent these events from occurring.

Table 2

11. Comment: Table 2 should include columns for reporting monthly prevailing wind direction, range of recorded H_2S and SO_2 levels and the 24-hour maximum for SO_2.

Response: According to the wind data on the Shreveport monitor, the wind rose, and the air modeling exercise, prevailing wind direction is north. The monitor is north of Calumet. Monthly prevailing wind direction is not necessary in the table, but a statement was added to the text. Range of values detected for H_2S and SO_2 were from non-detect to the 1-hour maximum shown in the table. This statement was also added to the text. 24-hour maximum SO_2 concentrations are not necessary for our evaluation. If the 1-hour maximum concentration did not exceed the 24-hour standard, then the 24-hour maximum will not exceed the 24-hour standard.

Page 5, paragraph 3

12. Comment: Without indications of prevailing wind direction, readers are lead to conclude that all the H_2S and SO_2 levels recorded by LDEQ originated at CSR. This is obviously not the case as several readings were recorded by LDEQ when the wind was from the North, the Northeast and the West. Calumet has no suggestion on the sources of these readings, but would like for the record to state that other sources are not only possible but likely.

Response: Comment noted. It is possible for other sources of H_2S and SO_2 to be present in the area in small amounts. ATSDR did not attempt to identify other sources of contaminants or background levels. However, ATSDR did confirm the wind direction for peaks of H_2S and SO_2, which suggests these elevated readings come from the direction of Calumet.

Page 7, paragraph 1, sentence 3

13. Comment: This sentence should read, “Since the former facility had released…”. CSR has radically changed the operation of the facility. It is no longer a fuels refinery, it does not operate a “Cat Cracker” and associated fired equipment, it does not operate a naphtha unifier, the “two stage flash system” has been removed and it has dramatically reduced the amount of sulfur handled at the site. Calumet has not had any excess emissions or accidental releases during 2002 and to date in 2003 [editorial note: Date of submission of comments was October 3, 2003].

Response: Comment noted. The sentence was changed to “the former facility”.

Page 7, paragraph 4

14. Comment: CSR operates under the “Prevention of Significant Deterioration” (PSD) permit issued to the former owner. PSD permits are in many ways stricter than Title V permits. The facility is currently in complete compliance with that permit according to the results of recent USEPA and LDEQ inspections. A Title V application has been submitted to LDEQ and has been accepted as “Administratively Complete”. There has been no time line offered by LDEQ on completion of the permit. The significant limitation in the permit on each source is the “pounds per hour” limit. CSR is obligated to report any exceedance of this limit within 24 hours regardless of the RQ of the pollutant. It should be stated for the record that the discharge limits for each pollutant addressed in a PSD or Title V permit are designed to be protective of public health and to prevent deterioration of the environment.

Response: The information that Calumet operates under a PSD permit was added to the text. ATSDR disagrees with the statement that operating air permits are designed to be protective of public health. The Clean Air Act, which mandates Title V operating permits for operating facilities, has set regulations based on best available and maximum achievable control technology. In other words, permit limits are based on what is technologically and economically feasible for a specified process. Residual risk assessments, which would evaluate public health risk after permit limits are applied, are mandated under a second set of regulations in the Clean Air Act, but have not been completed for the majority of processes and facilities.

Page 8, paragraph 3

15. Comment: This sentence should read "The only source of surface water in the community is Brushy Bayou. Brushy Bayou receives water from area stormwater runoff, wash down activities at area small businesses, unconnected sewage lines, and discharge of stormwater and treated wastewater from Calumet."

Response: This sentence was changed to reflect the comment.

16. Comment: By saying that ATSDR has no data on the level of contaminants in the CSR outfalls, ATSDR leaves the impression that there could be significant contaminant levels. There is data, it is publicly available, and it demonstrates that there are no significant contaminants in the CSR outfalls. NPDES permits and the state LPDES permits are very strict. Any pollutant found in the discharge during the extensive water sampling done prior to preparing the application will appear with limits in the final permit. The wastewater discharge (outfall 001) was sampled several times for monitoring of the 129 priority pollutants as required by the Clean Water Act. The GC/MS analyses done by an independent laboratory found none of the priority pollutants at detectable levels of 1-10 ppb (depending on the compound). Furthermore, CSR is required to monitor Chronic and Acute Toxicity once a quarter. These tests measure the effect of undiluted effluent on the growth and reproduction of aquatic creatures. The facility has never failed either of these tests. Calumet will gladly make these records available for ATSDR examination. The NPDES and LPDES permits make no distinction between exceeding a permit limit during routine activities or during accidental releases. The release must not be allowed to leave the property and the contaminant must be removed below permit limits before discharge. Calumet agrees with the authors that children should not be allowed to play in Brushy Bayou. The discharge of untreated sewage, the runoff of pesticides and fertilizers from lawns, and the runoff of fuels from the roads and parking lots would likely make this an unhealthy playground during a storm event.

Response: Comment noted. Information on the requirements that CSR must comply with under NPDES and LPDES, were added to the text. The text was also changed to reflect that ATSDR does not have water sampling data from Brushy Bayou off-site, rather than monitoring data from CSR outfalls. ATSDR understands that CSR has monitoring data on discharges of treated wastewater; however, this monitoring does not reflect what the concentrations would be downstream in Brushy Bayou, and would not include any additional chemicals that might be released into the water from other sources.

Page 9, Environmental concerns

17. Comment: Not enough attention is paid to the role of Interstate 20 on the Air Quality of the community. Vehicular traffic on the interstate contributes more SO_2 and other pollutants to the community than any industrial facility.

Response: ATSDR states in the document that urban areas have air quality problems due to motor vehicle traffic. A line was added to the text to identify Interstate 20 as a major highway in the area.

18. Comment: As the flare at CSR is an emergency flare, it is rarely used or needed. The residents may confuse the pilot light (which is relatively substantial to maintain a lit condition) with actual flaring.

Response: Comment noted.

19. Comment: Calumet believes that the complaints of a rotten egg smell and gasoline smell are historical rather than current except to the extent that there are other sources of the same odor. It should be mentioned that untreated sewage is another extant ambient source of H_2S. There are several sewage lift stations in the area of study; each could contribute to the odor problem experienced. Calumet does not believe that it would be the source of either rotten egg or gasoline odors.

Response: Comment noted. This evaluation focuses on the Calumet and former Pennzoil facility. ATSDR has no way to prove where the odors come from. However, hydrogen sulfide and gasoline compounds are plausible chemicals to be emitted from the facility. Therefore, ATSDR included these complaints as valid community concerns for this section of the document.

20. Comment: This paragraph appears to assume that Calumet is a likely significant source of emissions that could create “acid rain”. This is an unwarranted assumption, as the DEQ monitoring data would tend to suggest. If residents are affected by “acid rain”, a more likely source would be SOx and NOx emissions from traffic on I-20.

Response: Motor vehicle traffic was added to the list of sources that may contribute to acid rain in the area.

21. Comment: Again, Calumet agrees with the authors that children should not be allowed to play in Brushy Bayou. Although the water discharged from CSR meets or exceeds state and federal guidelines (and on most days is safe to drink), the presence of untreated sewage, the runoff of pesticides and fertilizers from lawns, and the runoff of fuels and trace metals from the roads and parking lots would make this an unhealthy playground.

Response: Comment noted.

22. Comment: The reference to “fires and explosions occurring at the facility” must be a historical rather than current reference, although the impression is left that these fires and explosions are currently occurring. There have been no fires or explosions since Calumet purchased CSR. Furthermore, Calumet, the Shreveport police and fire departments, and the LDEQ are in routine, frequent consultation on the prevention and response to emergencies of all types.

Response: Fires and explosions at the facility are a current community concern, whether there has been a recent incident or not. Accidents happen at all industrial facilities and are a concern to those who live nearby and might be affected. ATSDR understands that there has been a recent explosion in March of this year, heightening the community concern about explosions.

23. Comment: Calumet is aware of an incident relating to a record flood in the early 1990s, which happened well before Calumet’s ownership of the facility. There have not been any flooding events of the type complained of during Calumet’s ownership of CSR.

Response: Comment noted.

Page 11, Health concerns

24. Comment: Calumet does not believe that its operations should engender health concerns in the surrounding community, and the available data bears out this belief. Calumet appreciates the courage of ATSDR to report its findings despite pressure by the current litigants for support of their pending lawsuits.

Response: ATSDR treated this site the same as all the sites petitioned by concerned citizens; e.g., evaluate available data, draw conclusions about potential public health hazards, and make recommendations to other agencies to protect public health.

Comments from residents

General comments

25. Comment (paraphrased and summarized): We’re thankful for the participation and hard work from the agency, and we knew that limited data would create a vague conclusion. If the records or monitors could be studied for the November 7, 2001 incident, then a conclusion could have been made.

Response: ATSDR regrets that there are no data to study the November 2001 incident and how it may have affected nearby residents.

26. Comment: We need some thorough studies from the different medical agencies to determine the number of illnesses.

Response: Comment noted. LDHH has studied cancer incidence in the three zip codes surrounding the facility. LDHH is also evaluating the feasibility of studying asthma rates in the area.

27. Comment: The two studies that have been done are pertaining to the refinery emissions of hydrogen sulfide and sulfur dioxide. In December 2002, EPA fined Pennzoil Quaker for violation of the Clean Air Act pertaining to these two gases. The chemicals that can cause major illnesses haven't been monitored for, at least not to public knowledge. There is no way it can be stated that our community is safe.

Response: Comment noted. VOCs have not been monitored in a similar way to hydrogen sulfide and sulfur dioxide. This is why ATSDR recommended monitoring for VOCs for this site.

28. Comment: Another issue is assuming each individual's health reaction to be the same for different chemicals – this could never be conclusive. The majority of major illnesses have derived from the former Pennzoil-Quaker State. We know that Calumet is not operating the entire plant, but they are using some of the same products and by-products. Even though they changed from sour crude to sweet crude oil, they are still dealing with the same chemicals, except the sulfur odor isn't as strong as it would be in sour crude oil. We would like to see monitors for VOCs, some surface water and soil sampling, and studies concerning the different illnesses in the community.

Response: Comment noted. ATSDR appreciates that fact that the community agrees with the agency's recommendations.

29. Comment: The health consultation did not include enough information about VOCs such as benzene, toluene, ethylbenzene, and xylene, and how they could affect long term health problems (e.g., asthma, diabetes and kidney problems.

Response: ATSDR does not have enough environmental data to evaluate whether the community near the facility is being exposed to VOCs at a level to warrant health concern. However, ATSDR did recommend monitoring for VOCs in the community. LDHH will evaluate any additional data that becomes available (see the *Public Health Action Plan*).

30. Comment: I've lived near the refinery for many years and the plant has had many incidents – once the plant almost blew up and the streets were so crowded it was hard for the emergency vehicles to get through to the plant, which was Atlas Processing at the time. The odor has been terrible at times and much greasy oil is on everything including screen doors, windows, tv, and mirrors.

Response: ASTDR regrets it has no data to evaluate past exposures or incidents.

31. Comment: I have family members that have died of cancer and many more people around here who have died of cancer.

Response: LDHH has evaluated cancer incidence data in the area. Please see the section on *Health Outcome Data*.

32. Comment: Air pollution, including hazardous air pollutants that are known carcinogens, are a special health concern to our community living next door to Calumet Lubricant Company. Our residents have suffered for years from an epidemic of cancers, birth defects, miscarriages, respiratory illness, immune system, reproductive system and learning disabilities. LDEQ should monitor for VOCs and other chemicals used for refining not found in crude oil such as methyl ethyl ketone. The community should be made aware of the results. Has a release of benzene or any VOCs occurred above the reportable quantity? The community should be provided with testing to determine if they have been affected short-term or long-term to hazardous air pollutants that are known carcinogens. All recommendations the ATSDR has provided should be done.

Response: Comment noted. ATSDR is not aware of any releases of VOCs above the reportable quantity since Calumet has taken ownership of the facility.

33. Comment: The city and government officials should get more involved and find out if Calumet has its own permit.

Response: Please see Comment and Response #14.

34. Comment: The agency did a tremendous survey on the health issues. They formed their conclusion pertaining to the limited data and we appreciate their strive and effort.

Response: Comment noted.

35. Comment: The Mooretown community is very concerned and wants answers about the known cancer causing agents. The community should have the option of moving out of the area. Thanks to ATSDR for coming to check on this facility.

Response: Comment noted.

36. Comment: Any plant that uses so many different chemicals will cause harm to your health. We have been breathing this air for a long time, under many different plant ownerships. I have health problems and a family member had cancer.

Response: Comment noted.