

Air Quality Technical Report
for the Draft Environmental Impact Statement
for the Mandan, Hidatsa, and Arikara
Nation's Proposed Clean Fuels Refinery
Project

May 2006

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U.S. Environmental Protection Agency (EPA) Region 8

May 2006

Portions of this document were prepared by Greystone Environmental Consultants, Inc. in consultation with Triad Project Corporation and modified by EPA Region 8. The information in this document is intended to supplement information provided in the Draft Environmental Impact Statement (DEIS).

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Chapter 1 — Introduction

On July 22, 2003, the Mandan, Hidatsa, and Arikara (MHA) Nation purchased three tracts of land on the Fort Berthold Indian Reservation (Reservation) in North Dakota. These tracts, which are in the northeast corner of the Reservation and in Ward County (Figure 1, Project Location Map) include:

- the NW $\frac{1}{4}$ of Section 20, Township 152 North, Range 87 West (Tract 1);
- the North $\frac{1}{2}$ of Section 19, Township 152 North, Range 87 West (Tract 2); and
- Outlot 1 in the NE $\frac{1}{4}$ of Section 19, Township 152 North, Range 87 West (Tract 3).

Taken together as a single parcel, these tracts encompass almost 469 acres. Following the purchase, the MHA Nation requested that the Department of Interior, Bureau of Indian Affairs (BIA) accept the tracts into trust status. The Indian Reorganization Act of 1935 (IRA) authorizes the Secretary of the Interior to hold land for Indian Tribes and individual Indians in trust (Resolution 03-020 dated March 17, 2003).

The MHA Nation proposes to construct, operate, and maintain a clean fuels refinery on 190 acres of the 469-acre parcel. The MHA Nation would own the refinery. Additionally, the MHA Nation would grow feed for its herd of buffalo on the other 279 acres. The purpose of this report is to describe and evaluate the effects to air quality associated with the proposed refinery. This evaluation was done using existing monitoring data available for the Reservation and surrounding areas, projections of criteria, and hazardous air pollutants (HAPs) from the proposed refinery and air quality modeling. The report also identifies the federal air regulatory requirements for air emissions from the proposed refinery.

The air quality modeling conducted was built on modeling conducted by EPA for Prevention of Significant Deterioration (PSD) purposes in North Dakota. It included analyses that compared concentrations of criteria air pollutants to the National Ambient Air Quality Standards (NAAQS), the Class I and Class II increments and air quality related values.



Chapter 2 — Applicable Requirements

This chapter describes the federal air regulatory requirements that would apply to the MHA Nation's proposed refinery. The primary sources of air pollutants would be various heaters and boilers that serve the proposed refinery's processes and general facility heating requirements. A soybean/oilseed oil extrusion process and a bio-diesel production process are also included as sources of emissions.

The synthetic crude feedstock would be delivered to the proposed refinery by pipeline. Several storage tanks would store various refinery products. The refinery products would be exported from the refinery site by trucks and railcars.

Annual Emission Summary

Table 1 summarizes the estimated annual emissions for the MHA Nation's proposed clean fuels refinery. The criteria pollutants include oxides of nitrogen (NO_x), carbon monoxide (CO), non-methane-ethane volatile organic compounds (VOCs), sulfur dioxide (SO₂), and particulate matter with a nominal aerodynamic diameter less than 10 micrometers (PM₁₀) and less than 2.5 micrometers (PM_{2.5}). The HAPS include benzene, formaldehyde, hexane, toluene, etc. From the emissions data presented in Table 1, the proposed Clean Fuels Refinery would be classified as a new minor stationary source.

Table 1 Estimated Annual Emissions for the Proposed MHA Nation's Proposed Clean Fuels Refinery

Pollutant	Annual Project Emission Rate (ton/yr)
NO _x	35.7
CO	78.3
SO ₂	51.2
VOC	38.9
PM ₁₀ /PM _{2.5}	16.8
Benzene	0.0704
Cyclohexane	0.0493
Ethyl benzene	0.0004
Formaldehyde	0.0883
Hexane (-n)	0.0057
PAH	0.0005
Toluene	0.0063
Xylene (Total)	0.0020

Ambient Air Quality Standards

The EPA has established NAAQS for ozone, NO₂, CO, SO₂, PM₁₀, PM_{2.5} and airborne lead that have been developed to protect public health and welfare with an adequate margin of safety. The NAAQS are presented in Table 2 as well as the State of North Dakota’s ambient air quality standards. These are the regulatory limits that concentrations of pollutants must not exceed during the specific averaging period for an area to be considered in attainment for air quality.

Table 2 Summary of Regulatory Ambient Air Quality Concentrations (µg/m³)¹

Pollutant	Averaging Period	NAAQS ²	North Dakota AAQS
NO ₂	Annual	100	100
CO	1-Hour	40,000	40,000
	8-Hour	10,000	10,000
PM _{2.5}	24-Hour	65	
	Annual	15	
PM ₁₀	24-Hour	150	150
	Annual	50	50
SO ₂	3-Hour	1,300	1,300
	24-Hour	365	365
	Annual	80	80
Ozone	1-Hour	235	
	8-Hour	157	
Pb	Calendar Quarter	1.5	1.5
H ₂ S	1-Hour		280
	24-Hour		140

Notes:

1. µg/m³ = micrograms per cubic meter
2. National Ambient Air Quality Standards (40 CFR 50)

Prevention of Significant Deterioration (PSD) Increment Standards

Federal PSD requirements provide three area classifications that establish the amount of allowable air quality deterioration in areas where the air quality meets the NAAQS. Deterioration is determined by the increase of a pollutants ambient concentration above a baseline concentration. This allowable increase is referred to as an “increment.” In practice, only two classifications are currently used throughout the U.S. – Class I areas and Class II areas. Class I areas are undeveloped public areas that include many of the National Parks and Wilderness Areas. Class II areas are all other areas that are not Class I.

As shown in Table 3, PSD regulations have established much lower increments for Class I areas than for Class II areas.

Table 3 Summary of PSD Increment Standards ($\mu\text{g}/\text{m}^3$)

Pollutant	Averaging Period	PSD Increments	
		Class I	Class II
NO ₂	Annual	2.5	25
PM ₁₀	24-Hour	8	30
	Annual	4	17
SO ₂	3-Hour	25	512
	24-Hour	5	91
	Annual	2	20

The general vicinity surrounding the project site is classified as Class II. Regional Class I areas include Lostwood Wilderness (58 kilometers north of the project site) and Theodore Roosevelt National Park (112 kilometers southwest of the project site).

Standards of Performance for New Stationary Sources

The MHA Refinery would be required to comply with the following Standards of Performance for New Stationary Sources:

- 40 CFR 60 Subpart J (Standards of Performance for Petroleum Refineries)
- 40 CFR 60 Subpart Kb (Standards of Performance for Storage Vessels for Petroleum Liquids for which Construction, Reconstruction, or Modification Commenced after July 23, 1984)
- 40 CFR 60 Subpart GGG (Standards of Performance for Equipment Leaks of VOC in Petroleum Refineries)
- 40 CFR 60 Subpart Dc (Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units)
- 40 CFR 60 Support QQQ (Standards of Performance for VOC Emissions from Petroleum Refinery Wastewater Systems)

Additional details on New Source Performance Standards (NSPS) applicability for each source at the refinery are included in Appendix A, NSPS Applicability by Source.

National Emission Standards for Hazardous Air Pollutants Requirements

Hazardous air pollutants are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. EPA is working with state, local, and tribal governments to reduce HAPs releases of 189 pollutants to the environment. Examples of HAPs include benzene, which is found in gasoline; perchlorethylene, which is emitted from some dry cleaning facilities; and methylene chloride, which is used as a solvent and paint stripper by a number of industries.

Most HAPs originate from human-made sources, including mobile sources (such as cars, trucks, and buses) and stationary sources (such as factories, refineries, and power plants), as well as indoor sources (building materials and activities such as cleaning). EPA classifies the types of stationary sources that emit HAPs into two groups:

- “Major” sources are defined as sources that emit 10 tons per year of any of the listed HAPs, or 25 tons per year of a mixture of air toxics. These sources may release air toxics from equipment leaks, when material are transferred from one location to another, or during discharge through emission stacks or vents.
- “Area” sources consist of smaller-size facilities that release lesser quantities of toxic pollutants into the air. Area sources are redefined as sources that emit less than 10 tons per year of a single air toxic, or less than 25 tons per year of a combination of air toxics. Though emissions from individual area sources are often relatively small, collectively their emissions can be of concern, particularly where large numbers of sources are located in heavily populated areas.

Air Quality Designation

According to federal air quality criteria, the air quality in the general vicinity of the MHA Nation’s proposed clean fuels refinery has a federal designation of attainment or unclassifiable for all criteria air pollutants. Table 4 shows the federal air quality designations for criteria pollutants for the project site.

Table 4 Federal Air Quality Designations

Pollutant	Designation ¹
NO ₂	Unclassifiable/Attainment
CO	Unclassifiable/Attainment
PM _{2.5}	Unclassifiable/Attainment
PM ₁₀	Unclassifiable
SO ₂	Attainment
Ozone	Unclassifiable/Attainment

1. Unclassifiable/Attainment = monitoring of the pollutant is insufficient to classify and the pollutant is assumed to be in attainment of the NAAQS.

Attainment = monitoring and modeling demonstrates the pollutant is in attainment of the NAAQS. Source: 40 CFR 81.335

Existing Ambient Air Quality

PM₁₀ and SO₂ ambient air quality data have been collected at White Shield, North Dakota. This location is 25 miles (40 kilometers) south of the location proposed for the MHA Nation’s clean fuels refinery. Figure 2, Ambient Monitor and Major Source Locations, shows the location of the White Shield monitoring station relative to the proposed refinery as well as other major sources in North Dakota.

Because White Shield is closer to most of the existing major sources than the proposed refinery would be, these data can be assumed as a conservative representation of the existing air quality at the project site. Tables 5 and Table 6 summarize the data collected at this monitoring site.

Table 5 Summary of White Shield SO₂ Monitoring Data

SO ₂ Ambient Concentrations (µg/m ³) ¹			
Year	3-Hour Maximum	24-Hour Maximum	Annual Average
2003	53.2	21.3	3.7
2002	53.2	16.0	3.5
2001	87.9	29.3	4.0
2000	61.2	31.9	4.3
1999	106.5	26.6	4.3
1998	90.5	29.3	4.8
Maximum	106.5	31.9	4.8

Note: 1. µg/m³ = micrograms per cubic meter

Table 6 Summary of White Shield PM₁₀ Monitoring Data

PM ₁₀ Ambient Concentrations (µg/m ³) ¹		
Year	24-Hour Maximum	Annual Average
2003	33.2	7.7
2002	26.6	9.2
2001	37.2	11.2
2000	23.3	7.7
1999	18.7	6.9
1998	45.0	11.6
Maximum	45.0	11.6

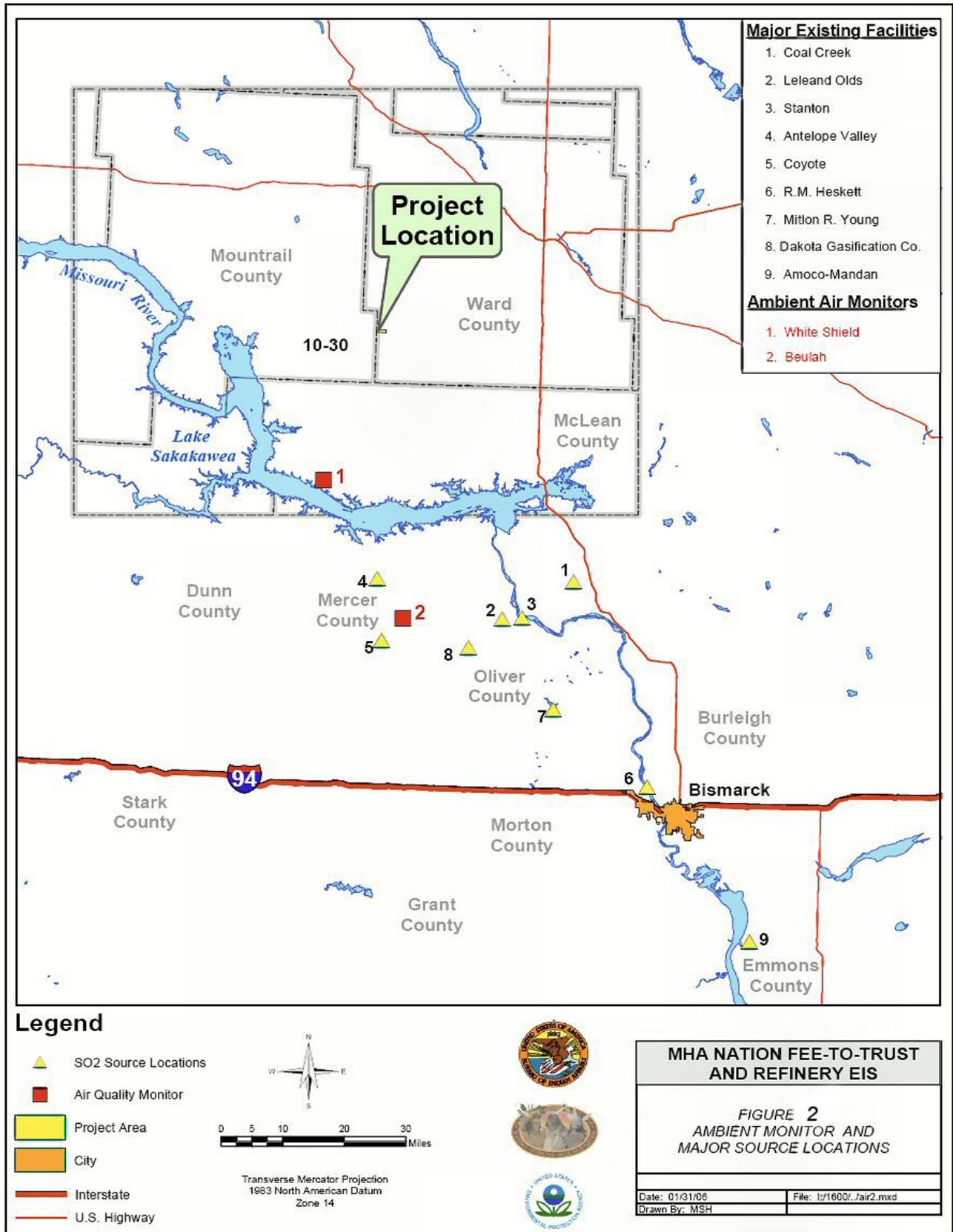
Note: 1. µg/m³ = micrograms per cubic meter

The nearest NO₂ monitoring site is in Beulah, North Dakota, which is 47 miles (76 kilometers) south of the project site. Table 7 summarizes the NO₂ ambient concentration data collected at this location.

Table 7 Summary of Beulah NO₂ Monitoring Data

NO ₂ Ambient Concentrations	
Year	Annual Average (µg/m ³) ¹
2003	5.7
2002	6.5
2001	6.9
2000	7.1
1999	6.9
Maximum	7.1

Note: 1. µg/m³ = micrograms per cubic meter



Class I Area Air Quality Related Values

Class I area air quality related values (AQRVs) include visual range and sulfur (S) and nitrogen (N) deposition. Table 8 presents recent measurements of standard visual range (SVR) and N and S deposition at Theodore Roosevelt National Park and Lostwood Wilderness.

SVR is defined as the greatest distance at which a standard observer can discern a large black object against the horizon sky under uniform lighting conditions. This value is calculated (rather than measured), using Interagency Monitoring of Protected Visual Environments (IMPROVE) methodology. This calculation uses measured ambient air concentrations of aerosols that include sulfate, nitrate, organic carbon, elemental carbon, and soil material.

Wet deposition is measured as concentrations of sulfate ion (SO₄) and nitrate ion (NO₃) in precipitation. The wet deposition values shown in Table 8 are also presented as elemental nitrogen and sulfur, using the ratios of molecular weights, since deposition impacts are referenced in terms of elemental nitrogen and sulfur.

Table 8 Measurements of Standard Visual Range

Year	Class I Area	Standard Visual Range (SVR) (km) ³			Wet Deposition – Annual Total (kg/ha) ⁴			
		Best 20% SVR	Mid 20% SVR	Worst 20% SVR	Nitrogen		Sulfur	
					NO ₃	As N	SO ₄	As S
2001	TRNP ¹	182.2	112.1	65.3	3.43	0.77	2.51	0.84
2002	TRNP	181.5	123.6	72.6	4.17	0.94	2.77	0.92
2003	TRNP	187.4	114.8	64.8	4.42	1.00	3.15	1.05
2004	TRNP	188.4	125.8	71.3	2.07	0.47	1.67	0.56
2001	LW ²	173.5	98.5	51.6	NA ⁵	NA	NA	NA
2002	LW	181.5	109.3	60.5	NA	NA	NA	NA
2003	LW	179.3	103.0	61.6	NA	NA	NA	NA
2004	LW	179.0	114.5	55.6	NA	NA	NA	NA

1 Teddy Roosevelt National Park

2 Lostwood Wilderness

3 Source: Interagency Monitoring of Protected Visual Environments (IMPROVE) Aerosol data, Visibility Information Exchange Web System (VIEWS) (<http://vista.cira.colostate.edu/views/>)

4 Source: National Atmospheric Deposition Program (NADP) (<http://nadp.sws.uiuc.edu/>)

5 NA – Data not available

Chapter 3 — Project Description and Equipment Specifications

The proposed refinery would consist of primary (separation) and secondary (upgrading) process units to produce finished products for consumer use. These products would include:

- Propane and butane
- Reformulated gasoline
- Jet fuel
- Summer diesel
- Winter diesel
- Bio-diesel
- Liquid sulfur
- Residual oil

The processes used to generate and treat these products at the refinery would include:

- Atmospheric distillation
- Saturate gas recovery
- Naphtha reformulating
- Steam methane reformulating (hydrogen plant)
- Sulfur recovery
- Distillate desulfurizing
- Hydrocracking
- Butane feed treatment
- Deisobutanizing
- Butane isomerization
- Isobutane dehydrogenation
- Iso-octane
- Oilseed extrusion (potential future)
- Bio-diesel reactor (potential future)
- Flaring

Boilers and heaters, fired by natural gas and refinery gas, would generate the energy required to drive these processes. These combustion sources would be the primary emission sources at the refinery.

Other emission sources would include tail gas exhaust from the sulfur/amine process that would be vented to a flare. Fugitive VOC emissions from the plant, storage tanks, and product loadout would be controlled and vented back to the processes or to the flare.

Process Description

The proposed facility would be a 10,000-barrel per stream day (BPSD) complex grassroots clean fuels petroleum refinery, feeding synthetic crude piped in from northern Alberta. In addition, the refinery would receive 3,000 BPSD of field butanes and 6 million standard cubic feet (MMSCFD) of natural gas. Figure 3, MHA Nation Clean Fuels Refinery Flow Diagram, presents a simplified process flow diagram for the refinery.

The purpose of petroleum refining is to separate crude oil into desired individual components for sale, such as gasoline and diesel fuels. Crude oil is composed of a mixture of many different types of chemical compounds, which are accompanied by smaller amounts of impurities. The majority of the chemical compounds are hydrocarbons. The refinery process breaks this mixture of hydrocarbon compounds into other more useable mixtures of compounds.

The composition of hydrocarbons and impurities of crude oil can vary substantially because of its origin (e.g., different natural crudes and synthetic crudes). The equipment and operations of a given refinery are designed and operated in a fashion to process the specific crude oils and produce specific products. Therefore, no two refineries are typically the same because of the composition of the crude oil and the desired final products.

The MHA Nation's proposed refinery is designed to use synthetic crude oil as its basic feedstock to produce clean and efficient fuels. State-of-the-art technologies have been used to produce clean fuels that meet today's clean fuel requirements and needs.

The proposed refinery would be composed of 14 plants that are summarized in Table 9. Emission sources would consist of a variety of boilers and heaters. These sources would provide energy for the processes and would combust both natural gas and refinery gas. The bio-diesel process would include extracting oil from soy beans and soy meal and producing bio-diesel fuel from the raw soy oil.

Utilities would consist of the following sources:

- Flare System
- Emergency Generator
- Fire Pump Engine

The refinery would maintain sufficient storage tanks and support facilities to handle the production, handling, blending, and distribution of the products produced by the refinery. An inventory of the storage tanks is shown in Table 10. The specific data concerning the storage tanks is found in Appendix B, Raw Data.

Rail loading would be provided for light diesel, heavy diesel, regular gasoline, and premium gasoline. These loading facilities would use vapor recovery systems to control emissions during loading.

Truck loading facilities with vapor recovery systems would be available for loading and shipping light diesel, heavy diesel, regular gasoline, premium gasoline, and propane. Field butanes would be delivered to the refinery butane storage vessels via transport trucks.

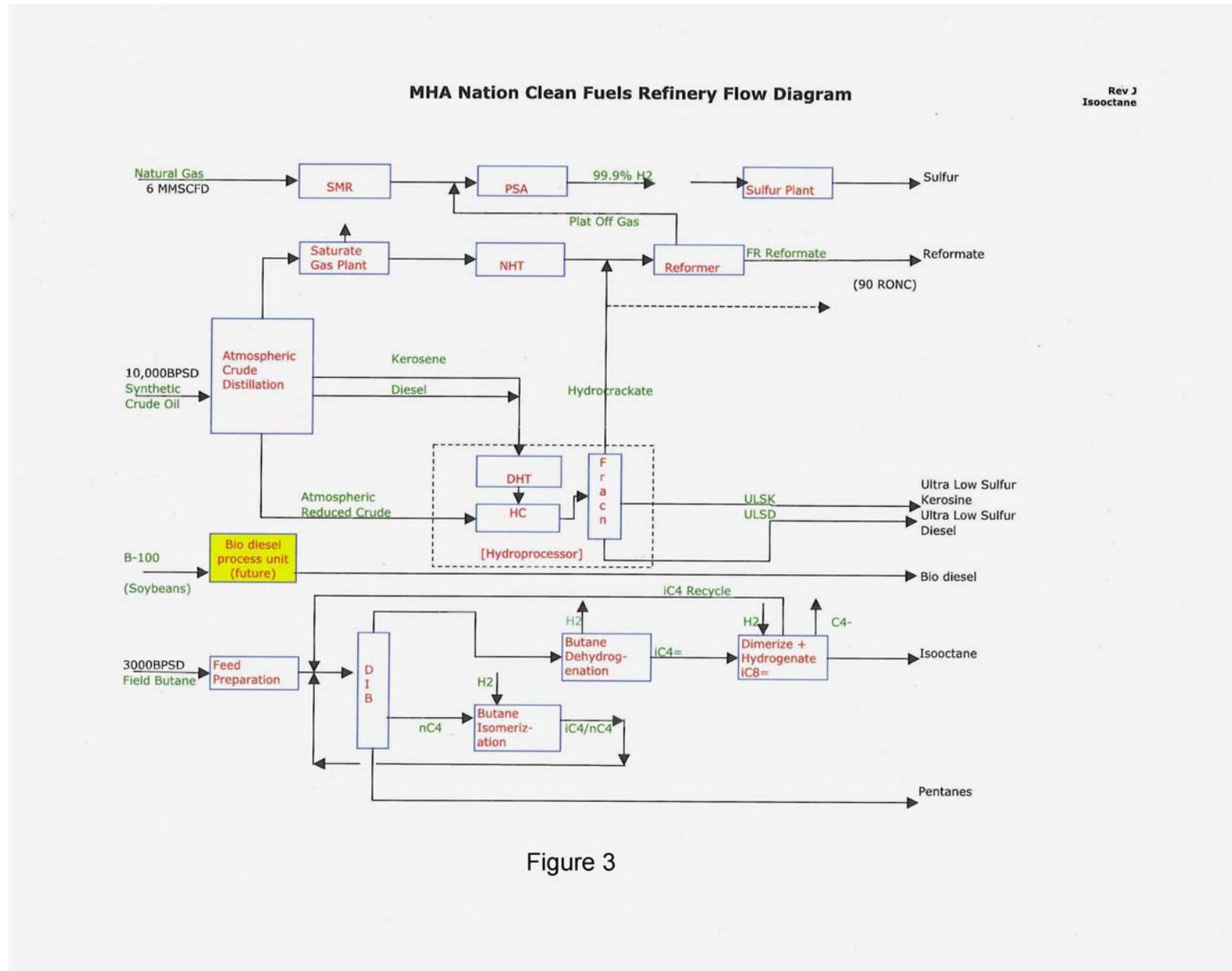


Figure 3

Table 9 Summary of Plants That Would Comprise the Refinery

Unit	Description
Crude Processing	Takes the crude oil and separates it into component parts by a heating process called distillation.
Naphtha Hydrotreater	Removes sulfur from naphtha feedstock and reforms the desulfurized naphtha with hydrogen to produce a high-octane gasoline blending component.
Reformer	Reformate stream is collected and sent to storage as a gasoline blending component.
Hydroprocessor	Cracks hydrocarbons into smaller, lighter ones under high temperatures, high pressures, and a hydrogen atmosphere. Produces light and heavy ultra-low sulfur diesel fuels.
Treating	Removes sulfur compounds from various water and gas streams and converts the removed material into elemental sulfur.
Butane Isomerization	Processes normal butane into isobutane. The isobutane is isolated in the DIB overhead and fed to the Olefin Unit.
Olefin	Converts isobutane to isobutylene as part of the process to produce iso-octane.
Iso-octane	The process dimerizes isobutylene (from the Olefin Unit) into iso-octene. Then the iso-octene is saturated with hydrogen in a separate reactor to produce iso-octane, a very clean high octane gasoline blending component.
Hydrogen	Produces the hydrogen needed for other refinery units.
Utilities	Composed of the fuel gas, flare, instrument and utility air, fire water, boiler feed water, and nitrogen systems.
Water Treatment	Process raw water from wells to treated water and treats wastewater.
Storage, Blending, and Shipping	Includes tanks for storing products, pumps for blending products, and facilities for loading railcars and trucks.
Bio-diesel	Processes oil from soybeans into bio-diesel (methyl esters).
General Refinery	Consists of off-sites, office/warehouse, and general offices.

Source: Triad Project Corporation 2003b, Woolley 2004a, Woolley 2006

Table 10 Summary of Tanks to be Constructed on the Refinery Site

Content of Tank	Volume (bbls)	Size of Tank		Type of Tank
		Diameter (feet)	Height (feet)	
Crude Oil	40,000	85	48	Floating roof
Crude Oil	40,000	85	48	Floating roof
Mid Distillate	50,000	86	48	Floating roof
Mid Distillate	50,000	86	48	Floating roof
Mid Distillate	50,000	86	48	Floating roof
Mid Distillate	50,000	86	48	Floating roof
Raw Light HC	5,000	30	40	Floating roof
Light Slop HC	5,000	30	40	Floating roof
Hydrocrackate	5,000	30	40	Floating roof
Naphtha	5,000	30	40	Floating roof
Ethanol	5,000	30	40	Floating roof
Alkylate	10,000	45	40	Floating roof
Reformate	10,000	45	40	Floating roof
Bio-diesel	10,000	45	40	Floating roof
Atm Red Crude	8,000	42	40	Fixed Roof
Raw Heavy HC	5,000	30	40	Fixed Roof
Raw Heavy Diesel	8,000	42	40	Fixed Roof
Raw Light Diesel	8,000	42	40	Fixed Roof
Heavy Slop HC	5,000	30	40	Fixed Roof
Regular Gasoline	25,000	67	40	Floating roof
Regular Gasoline	25,000	67	40	Floating roof
Premium Gasoline	25,000	67	40	Floating roof
Off Road Gasoline	3,000	30	32	Floating roof
Propane	2,000	11	126	Pressure vessel
Propane	2,000	11	126	Pressure vessel
Propane	2,000	11	126	Pressure vessel
Propane	2,000	11	126	Pressure vessel
n Butane	2,000	14	85	Pressure vessel
Field Butanes	2,000	14	85	Pressure vessel
Field Butanes	2,000	14	85	Pressure vessel
Field Butanes	2,000	14	85	Pressure vessel
Total	461,000			

Source: Woolley 2003, Woolley 2006

Process Emission Sources

Table 11 lists the combustion process equipment for the MHA Nation’s proposed refinery. Additional data on these sources can be found in Appendix A, NSPS Applicability by Source. Table 12 presents the estimated composition of the tail gas stack exhaust. Figure 4, Site Layout, shows the layout of sources at the MHA Nation’s proposed clean fuels refinery.

Table 11 MHA Nation’s Proposed Refinery Process Equipment

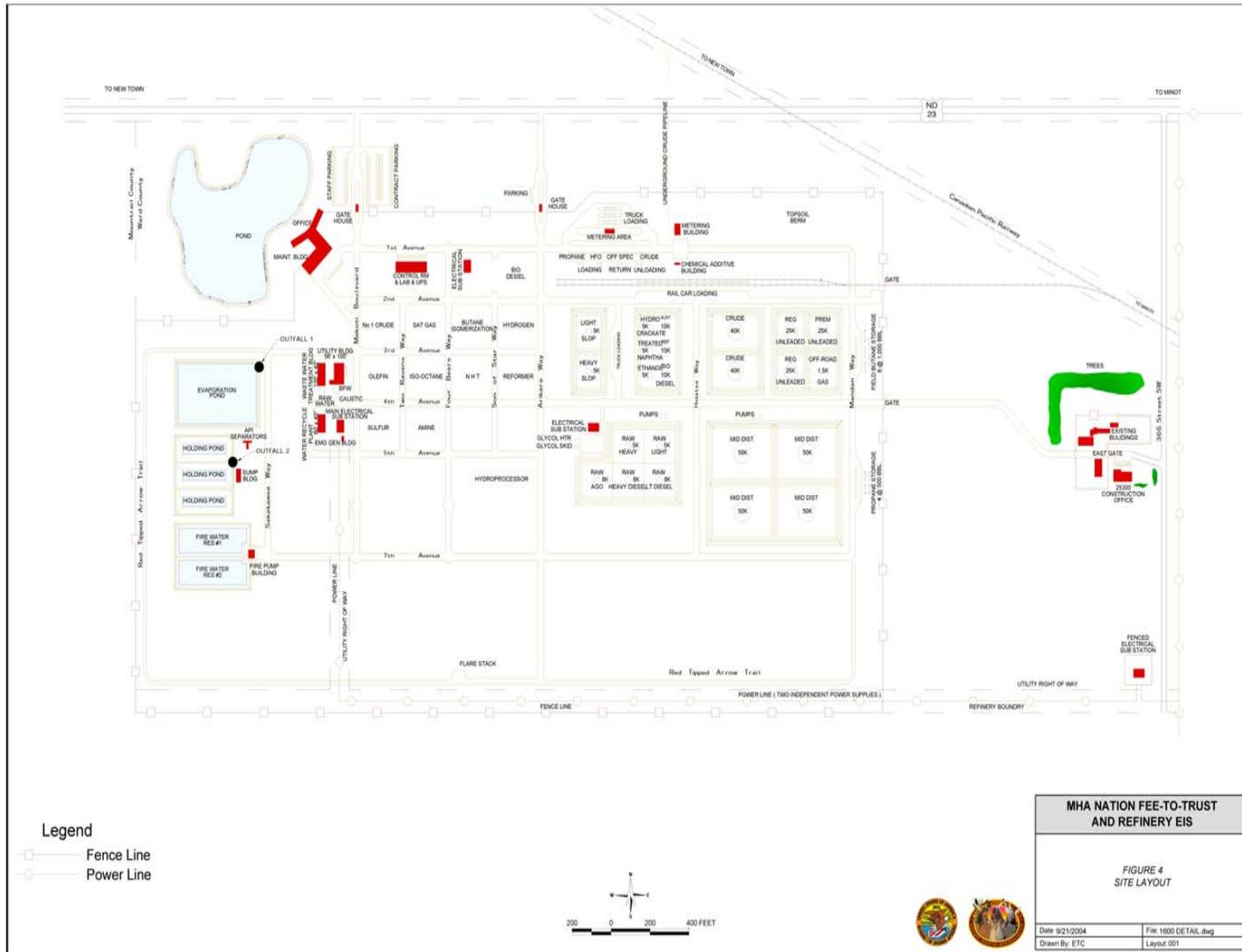
Equipment Name	Nominal Capacity	Units ¹
Crude Heater	35,000,000	BTU/hr
Reformer Heater 1	3,000,000	BTU/hr
Reformer Heater 2	3,000,000	BTU/hr
Reformer Heater 3	8,000,000	BTU/hr
Reformer Heater 4	6,000,000	BTU/hr
Reformer Heater 5	1,500,000	BTU/hr
Hydrocracker 1	6,000,000	BTU/hr
Hydrocracker 2	7,000,000	BTU/hr
Hydrocracker 3	10,000,000	BTU/hr
Hydrocracker 4	7,000,000	BTU/hr
Olefin	30,000,000	BTU/hr
Hydrogen	50,000,000	BTU/hr
Boiler 1	20,000,000	BTU/hr
Boiler 2	20,000,000	BTU/hr
Boiler 3	20,000,000	BTU/hr
Flare	10,000,000	BTU/hr
Tail Gas	20,000	scf/hr

Notes:

1. BTU = British Thermal Unit, scf/hr = standard cubic feet per hour

Table 12 Projected Tail Gas Exhaust Composition at the MHA Nation’s Proposed Clean Fuels Refinery

Tail Gas Exhaust Component	Flow Rate (lb moles/hr)
Ar	0.4
CO	.17
CO ₂	9.87
H ₂	.17
H ₂ O	11.08
N ₂	31.87
O ₂	1.59
SO ₂	0.11
Total	55.27



Process Fuel Data

The primary fuel for the refinery processes would be pipeline-quality natural gas. The composition of the natural gas is presented on Table 13.

Table 13 Typical Natural Gas Components

Component	Value	Units
Hexane	0.04	mole percent
Propane	0.32	mole percent
i-Butane	0.04	mole percent
n-Butane	0.05	mole percent
i-Pentane	0.02	mole percent
n-Pentane	0.01	mole percent
Carbon dioxide	1.25	mole percent
Ethane	1.76	mole percent
Nitrogen	0.43	mole percent
Methane	96.08	mole percent
Total Sulfur	10	ppmv ¹
LHV	915	BTU/scf ²
Molecular Weight	16.86	

Note:

1. ppmv = parts per million by volume

2. BTU/scf = British thermal units/standard cubic foot

Source: Triad Project Corporation 2003

Bio-diesel Process

A 7.5-million-gallon/year bio-diesel production facility would generate a blending component for the petroleum-based diesel fuel. The bio-diesel would be generated from soybean oil or other oil-bearing seeds such as canola or rapeseed.

There would be two sources of soybean/oilseed oil; raw oil would be imported to the site, and would also be produced from soybeans or oilseeds that would be delivered to the site. Up to 765,000 pounds of soybeans would be processed each day. If canola or rapeseed oil is used for oil production, the mass process rates would be lower because these seed have much higher oil content than soybeans.

A dry extrusion process would be used to produce oil from the soybeans. This process cooks, conditions, and ruptures the oil cells from low-oil, bearing seeds. This mechanical process would not use external heat sources. The process heat would be generated through friction within the extrusion barrel, and moisture present in the raw seed would be used to create a type of environment that resembles a pressure cooker. A pressure of approximately 40 atmospheres and a temperature of approximately 320⁰F would be generated within the barrel of the extruder. As product exits the barrel end, moisture is released in the form of steam. Steam would be the only emission from this process.

The proposed bio-diesel process would involve mixing soybean or oilseed oil with a 30 percent sodium methoxide in a methanol solution. A reaction with this alkaline catalyst replaces the trihydric alcohol glycerol in the vegetable oil with three equivalents of monohydric alcohol methanol.

Chapter 4 — Project Emissions

Emissions that were estimated for all the combustion sources included NO_x, CO, VOC, PM₁₀, PM_{2.5}, SO₂, and HAPs. Emissions of VOC and HAPs were estimated for the storage tanks and fugitive sources.

All production emission sources at the MHA Nation's proposed refinery were assumed to operate continuously (24 hours per day, 7 days per week, and 52 weeks per year). Therefore, there is no variability among the emission rates for the various averaging periods. For these sources, maximum 1-hour emission rates were used to estimate emissions for all averaging periods.

The emergency generator and fire pump would operate periodically for testing and maintenance. The emergency generator is expected to operate for 1 hour per day and the fire pump would operate for 500 hours per year.

Combustion Sources

Criteria Pollutant Emission Rates

Projections of the rates of emissions for criteria pollutants from the MHA Nation's proposed clean fuels refinery are shown on Table 14.

The normal loading at the flare would be approximately 15 lbs/hr (65.7 tons/yr). A loading rate of 500 lbs/hr (2,190 tons/yr) or 10 million British thermal units per hour (MMBTU/hr) was used to generate conservative emission estimates for NO_x that would account for potential process upsets and other activities that may increase loading rates

Table 14 Maximum Combustion Source Criteria Pollutant Emissions

Source	Concentration of Pollutant (tons/year)				
	NO _x	CO	SO ₂	VOC	PM ₁₀ /PM _{2.5}
Crude Heater	4.15	6.32	2.99	0.92	1.27
Reformer Heater 1	0.36	0.54	0.26	0.08	0.11
Reformer Heater 2	0.36	0.54	0.26	0.08	0.11
Reformer Heater 3	0.95	1.44	0.68	0.21	0.29
Reformer Heater 4	0.71	1.08	0.51	0.16	0.22
Reformer Heater 5	0.18	0.27	0.13	0.04	0.05
Hydrocracker 1	0.71	1.08	0.51	0.16	0.22
Hydrocracker 2	0.83	1.26	0.60	0.18	0.25
Hydrocracker 3	1.19	1.81	0.85	0.26	0.36
Hydrocracker 4	0.83	1.26	0.60	0.18	0.25
Olefin	3.56	5.42	2.56	0.79	1.09
Hydrogen	5.93	9.03	4.27	1.32	1.82

Source	Concentration of Pollutant (tons/year)				
	NO _x	CO	SO ₂	VOC	PM ₁₀ /PM _{2.5}
Boiler 1	2.37	3.61	1.71	0.53	0.73
Boiler 2	2.37	3.61	1.71	0.53	0.73
Boiler 3	2.37	3.61	1.71	0.53	0.73
Flare	2.98	16.21	0.85	6.13	0.00
S Recovery Tail Gas	0.00	20.85	30.84	0.00	0.00
Emergency Generator	4.92	0.36	0.12	0.10	0.04
Fire Pump	0.91	0.04	0.02	0.01	0.01
Total	35.68	78.34	51.18	12.21	8.28

HAP Emission Rates

Emission factors from AP-42 Table 1.4-3 were used to estimate HAP emissions from the boilers and heaters. Projections of the rates of emissions for HAPs from the MHA Nation's proposed clean fuels refinery are shown in Table 15.

Table 15 Maximum Combustion Source HAP Emissions Source

Source	Concentration of Pollutant (tons/year)			
	Benzene	Formaldehyde	Toluene	Xylene
Crude Heater	3.5E-04	1.3E-02	5.7E-04	0.0E+00
Reformer Heater 1	3.0E-05	1.1E-03	4.9E-05	0.0E+00
Reformer Heater 2	8.0E-05	2.9E-03	1.3E-04	0.0E+00
Reformer Heater 3	6.0E-05	2.2E-03	9.8E-05	0.0E+00
Reformer Heater 4	1.5E-05	5.4E-04	2.4E-05	0.0E+00
Reformer Heater 5	6.0E-05	2.2E-03	9.8E-05	0.0E+00
Hydrocracker 1	7.0E-05	2.5E-03	1.1E-04	0.0E+00
Hydrocracker 2	1.0E-04	3.6E-03	1.6E-04	0.0E+00
Hydrocracker 3	7.0E-05	2.5E-03	1.1E-04	0.0E+00
Hydrocracker 4	3.0E-04	1.1E-02	4.9E-04	0.0E+00
Olefin	5.0E-04	1.8E-02	8.1E-04	0.0E+00
Hydrogen	2.0E-04	7.2E-03	3.3E-04	0.0E+00
Boiler 1	2.0E-04	7.2E-03	3.3E-04	0.0E+00
Boiler 2	2.0E-04	7.2E-03	3.3E-04	0.0E+00
Boiler 3	1.0E-04	3.6E-03	1.6E-04	0.0E+00
Flare	0.0E+00	0.0E+00	0.0E+00	0.0E+00
S Recovery Tail Gas	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Emergency Generator	2.2E-03	2.8E-03	9.7E-04	6.8E-04
Fire Pump	4.3E-04	5.5E-04	1.9E-04	1.3E-04
Total	5.0E-03	8.8E-02	5.0E-03	8.1E-04

Bio-diesel Process Emissions

Emissions from the bio-diesel process would be generated from a soybean loadout hopper, transfer of processed meal to storage, and meal loadout to trucks that would transfer the meal off-site. Loadout and transfer areas would be covered and vented. Emissions from these processes would be vented to three stacks: soybean loadout, meal storage, and meal loadout.

Emission factors for these processes were taken from AP-42 (U. S. Environmental Protection Agency 2004) Chapter 9.9.1 Grain Elevators and Processes. Although there are emission factors for similar processes in AP-42 Chapter 9.11.1 Vegetable Oil Processing, the data in this chapter was related to the traditional solvent extraction process, which requires a high degree of soybean and meal conditioning that would not apply to the dry extrusion process.

Table 16 presents the estimated PM₁₀/PM_{2.5} rates for the soybean oil production process. As explained in Chapter 3, production rates for canola or rapeseed oils would be lower. Therefore, emissions from processing these seeds would also be expected to be lower. The bio-diesel process itself would be enclosed, would be heated by existing refinery heat sources, and would not generate air emissions.

Table 16 Soybean Oil Extrusion Emissions

Process	PM₁₀/PM_{2.5} Emission Rate (tons/year)
Truck Unloading	4.12
Meal Handling	2.37
Meal Loadout	2.02
Total	8.51

Storage Tank Emissions

Storage tank emissions were calculated using EPA’s TANKS software. Outputs from TANKS are provided in Appendix C, Calculations. Table 17 presents the estimated VOC and HAP emissions from these sources.

Facility Fugitive Emissions

Fugitive emissions at refineries can include fugitive VOC emissions from processes and material handling, and fugitive dust (PM₁₀ and PM_{2.5}) from vehicle traffic at the refinery site.

Table 17 Maximum Storage Tank Criteria Pollutant and HAP Emissions

Storage Tank	Concentration of Pollutant (tons/year)						
	VOC	Benzene	Cyclo-hexane	E-Benzene	n-Hexane	Toluene	Xylene
Crude Oil	0.676	0.004	0.005	0.002	0.003	0.005	0.006
Crude Oil	0.676	0.004	0.005	0.002	0.003	0.005	0.006
Mid Distillate	0.238	0.005	0.006	0.000	0.006	0.002	0.001
Mid Distillate	0.238	0.005	0.006	0.000	0.006	0.002	0.001
Mid Distillate	0.238	0.005	0.006	0.000	0.006	0.002	0.001
Mid Distillate	0.238	0.005	0.006	0.000	0.006	0.002	0.001
Raw Light HC	0.222	0.000	-	0.000	0.000	0.000	0.000
Light Slop HC	2.707	0.000	-	0.000	0.000	0.000	0.000
Hydrocrackate	5.015	0.003	0.006	0.001	0.011	0.004	0.003
Naphtha	4.633	0.002	0.005	0.000	0.009	0.002	0.001
Ethanol	0.301	-	-	-	-	-	-
Iso-octane	0.660	-	-	-	-	-	-
Reformate	0.612	0.006	0.001	0.002	0.005	0.010	0.007
Bio-diesel	0.110	-	-	-	-	-	-
Regular Gasoline	2.646	0.006	0.001	0.001	0.006	0.008	0.003
Regular Gasoline	2.646	0.006	0.001	0.001	0.006	0.008	0.003
Premium Gasoline	2.695	0.007	0.001	0.001	0.006	0.011	0.006
Off Road Gasoline	2.104	0.007	0.001	0.002	0.005	0.013	0.009
Atm Red Crude	VR ¹	VR	VR	VR	VR	VR	VR
Raw Heavy HC	VR	VR	VR	VR	VR	VR	VR
Raw Heavy Diesel	VR	VR	VR	VR	VR	VR	VR
Raw Light Diesel	VR	VR	VR	VR	VR	VR	VR
Heavy Slop HC	VR	VR	VR	VR	VR	VR	VR
n-Butane	PT ²	PT	PT	PT	PT	PT	PT
Field Butanes	PT	PT	PT	PT	PT	PT	PT
Field Butanes	PT	PT	PT	PT	PT	PT	PT
Field Butanes	PT	PT	PT	PT	PT	PT	PT
Field Butanes	PT	PT	PT	PT	PT	PT	PT
Total	26.7	6.5E-02	5.0E-02	1.2E-02	7.8E-02	7.4E-02	4.8E-02

Notes: 1. VR= Vapor Recovery 2. PT = Pressurized Tank

Fugitive VOC Emissions

Fugitive VOC emissions from loading docks, pumps, seals, valves, etc. would be controlled using a variety of controls. All of the emission controls considered in the emission estimates are inherent to the processes and cannot be removed, shut off, or bypassed. These emissions controls include:

- Flanges would be minimized and seal rings would be applied;
- Double-seal or seal-less pumps would be used;
- Leakless valves would be used;
- Open-ended valves would be blinded or plugged;
- Relief valves would be discharged to flare;
- Compressor seals would be recycled to process, would have enclosed distance pieces, and would have crankcases vented to flare;
- Drains would be hard-piped to Maintenance Drain Out (MDO) system;
- Sample connections would have totally enclosed sample loops;
- Tanks would have floating roofs;
- Fixed-roof tanks would have vapor recovery;
- Loading arms at rail and truck loading would have integral vapor recovery systems; and
- Boilers and heaters would have integral combustion controls

The vapor recovery system is an integral component of the loading arm apparatus. If the loading arms are used, fugitive hydrocarbon emissions are collected and recompressed by the vapor recovery system. The design would incorporate a separate pipe loop to collect vapors from the above locations at each loading spot. These vapors would be compressed, air cooled, and returned to the process for recovery. In addition to being an integral component, these emissions controls are also considered inherent to the process for the following reasons:

- The integral controls would be necessary to minimize VOCs and to meet NSPS requirements (40 CFR Subparts Kb, GGG, QQQ);
- The loading arm/vapor recovery system constitutes an energy conservation measure;
- The integral controls would be necessary to reduce employee exposure to hazardous compounds; and
- The controls would be necessary to limit explosion and fire hazard.

Emissions from the wastewater treatment process would be vented back to the processes or to the flare. The contribution of these emissions to the flaring emissions was accounted for in the report.

Based on the information provided in the EPA document “Protocol for Equipment Leak Emission Estimates” (U. S. Environmental Protection Agency 1995), the control measures listed above should provide 100 percent control of fugitive VOC emissions. Captured emissions would either be vented back to the refinery processes or to the flare.

Fugitive Dust Emissions

The main source of fugitive dust emissions at the refinery would be truck traffic. All traffic at the refinery would be on paved surfaces. This traffic would include delivery of feedstock to the refinery and exporting finished products off-site. The feedstock and products include:

- Butane (feedstock)
- Soy beans or other oilseeds (feedstock)
- Soybean/oilseed meal (product)
- Gasoline (product)
- Diesel (product)
- Sulfur (product)
- Propane (product)

EPA emission factors and default parameters (U. S. Environmental Protection Agency 2004) were used to calculate fugitive PM₁₀ and PM_{2.5} emissions from these sources. Detailed calculations are provided in Appendix C, Calculations.

Chapter 5 — Air Quality Impact Analysis

This section discusses the ambient air quality impact and dispersion modeling analysis. In general, this discussion includes:

- Topographical, climate and meteorological factors,
- ISCST3 modeling analysis setup,
- Emission source characterization,
- Background air quality, and
- Impact analysis results

Air Quality Criteria Standards

Ambient air quality standards are presented in Chapter 2.

Topography, Climate, and Meteorology

This section summarizes topography, climatology, meteorology, and their relationships to the air quality analyses.

Regional Topography

The local terrain is fairly flat, thus simple and intermediate terrain were the primary terrain types in the evaluation for NAAQS impacts. Simple terrain is defined as terrain at or below the stack base. Intermediate terrain is defined as terrain with elevations that are above stack base, but below stack height. No complex terrain (terrain above stack height) was included in the area that was evaluated for NAAQS impacts.

Regional Climate

North Dakota's location at the geographic center of North America results in a typical continental climate. Primarily because of location, the climate of the state is characterized by wide annual and day-to-day fluctuations in temperature; light to moderate precipitation, which tends to be irregular in time and coverage; low relative humidity; plentiful sunshine; and nearly continuous air movement (Jensen 1998).

The Rocky Mountains act as a barrier to the prevailing westerly flow of air in the atmosphere. This mountain barrier modifies the temperature and moisture characteristics of air masses originating over the Pacific Ocean when they flow over the mountains in ways that reinforce the continental characteristics of the climate (Jensen 1998). Conversely, there are no mountainous barriers to air mass originating in the polar areas to the north or the Gulf of Mexico to the south. Therefore, air masses originating in these regions easily overflow North Dakota, sometimes with only minor changes in the basic weather pattern.

North Dakota has varied weather in all seasons based on cold and dry air masses that originate in the polar regions; warm and moist air masses from tropical regions; or mild and dry air from the northern

Pacific (Jensen 1998). The rapid progression of these air masses over North Dakota from the different source regions usually results in frequent and rapid changes of weather patterns.

Precipitation

In Ward and Mountrail Counties, the occurrence of precipitation varies seasonally. Most of the annual precipitation (70 percent) occurs during the May to September growing season (Table 18). The more limited precipitation that occurs during the rest of the year may fall as rain or snow. The 100-year, 24-hour storm event for the portion of North Dakota that encompasses the project site is about 5 inches (Hershfield 1961).

With the arrival of spring, the amount of precipitation begins to increase. Monthly precipitation amounts increase as spring wears on because the storm systems that traveled south of the state in winter tend to follow more northerly tracks during spring and summer. The first substantial rains of spring sometimes occur in late March, but usually occur in early April.

Both counties are usually quite warm in the summer, with frequent spells of hot weather and occasional cool days interspersed. Thunderstorms, which occur on about 34 calendar days per year, become more frequent (VanderBusch 1991). These thunderstorms deliver most of the total annual precipitation. Rainfall typically hits its peak in June (Table 18).

Precipitation decreases rapidly through the fall months and is minimal during the winter. Winter precipitation typically occurs as snowstorms and the occasional blizzard. The first significant snowfall of the season usually occurs during the middle or latter part of November. However, measurable amounts of snow (0.1 inch or more) may fall in September about once every 10 years. In this portion of North Dakota, the average seasonal snowfall is 40 inches (VanderBusch 1991). On average, 43 days of the calendar year have at least 1 inch of snow on the ground.

Table 18 Summary of Monthly Precipitation at the National Weather Service and North Dakota Agricultural Weather Network Meteorological Stations

Period	Precipitation by Station (inches)		
	Plaza	Parshall	Ryder
January	0.47	0.38	0.39
February	0.4	0.33	0.42
March	0.67	0.42	0.56
April	1.37	1.35	1.47
May	2.24	2.3	2.12
June	3.2	3.66	3.61
July	2.58	2.27	2.52
August	1.68	1.89	1.79
September	1.7	1.95	1.65
October	1.28	0.72	0.68
November	0.65	0.42	0.44
December	0.42	0.38	0.38
Annual (total)	16.66	16.06	16.04

Sources: High Plains Regional Climate Center 2004a, High Plains Regional Climate Center 2004b, North Dakota Agricultural Weather Network 2004

Temperature

Temperature data from the weather stations also show a seasonal pattern that is characteristic of a continental climate. Average temperatures peak during July and August (Table 19). In contrast, January is the coldest month. The difference between the average temperatures for January and July is more than 60°F (Table 19). The highest temperature ever recorded at the Parshall station was 107°F on August 7, 1949 and the lowest temperature recorded was -45°F on January 18, 1950.

Table 19 Summary of Monthly Temperatures at the National Weather Service and North Dakota Agricultural Weather Network Meteorological Stations

Month	Temperature by Station ¹ (°F)	
	Plaza	Parshall
January	9	5.3
February	17	12.7
March	28	24.3
April	42	40.8
May	55	53.6
June	64	62.9
July	69	68.6
August	68	67.3
September	57	56.2
October	44	45.3
November	26	27.3
December	14	13.4
Average	41	39.8

Notes: 1. Data from the Ryder Station were insufficient for inclusion in the tabular summary.

Sources: High Plains Regional Climate Center 2004a, High Plains Regional Climate Center 2004b, North Dakota Agricultural Weather Network 2004

Regional Meteorology

The following discussion on regional meteorology is based on the meteorological data that have been proposed for the dispersion modeling analysis.

Meteorological Data

Minot, North Dakota surface data combined with Bismarck, North Dakota mixing height data were used for the NAAQS impact assessments.

Data Selection

The surface data and mixing height data were obtained from the EPA SCRAM website. Four years of surface and mixing height data (1984, 1985, 1987, and 1988) were used for the dispersion modeling. These are the only years of contemporaneous surface and mixing height data for these monitoring sites that have been processed for dispersion modeling by EPA.

Data Processing

Surface and mixing height data were processed by PCRAMMET into an ISCST3 meteorological data set. A stability class for each hour of data was calculated as part of this processing. Table 20 presents the PCRAMMET processor setup.

Table 20 PCRAMMET Parameter Setup

Parameter	Value
Min. Obukhov length (m)	2,000
Anemometer height (m)	10,000
Roughness length (m), measurement site	0.150
Roughness length (m), application site	0.150
Noon time albedo	0.450
Bowen ratio	6.000
Anthropogenic heat flux (W/m ²) ¹	0.000
Fraction net radiation absorbed by ground	0.150

Note: 1. W/m² = flux per square meter

Data Capture

The data are 100 percent complete.

Treatment of Calms

Occurrences of any calms (zero wind speed and direction) in the meteorological data were handled by the calms processing routine of the ISCST3 dispersion model.

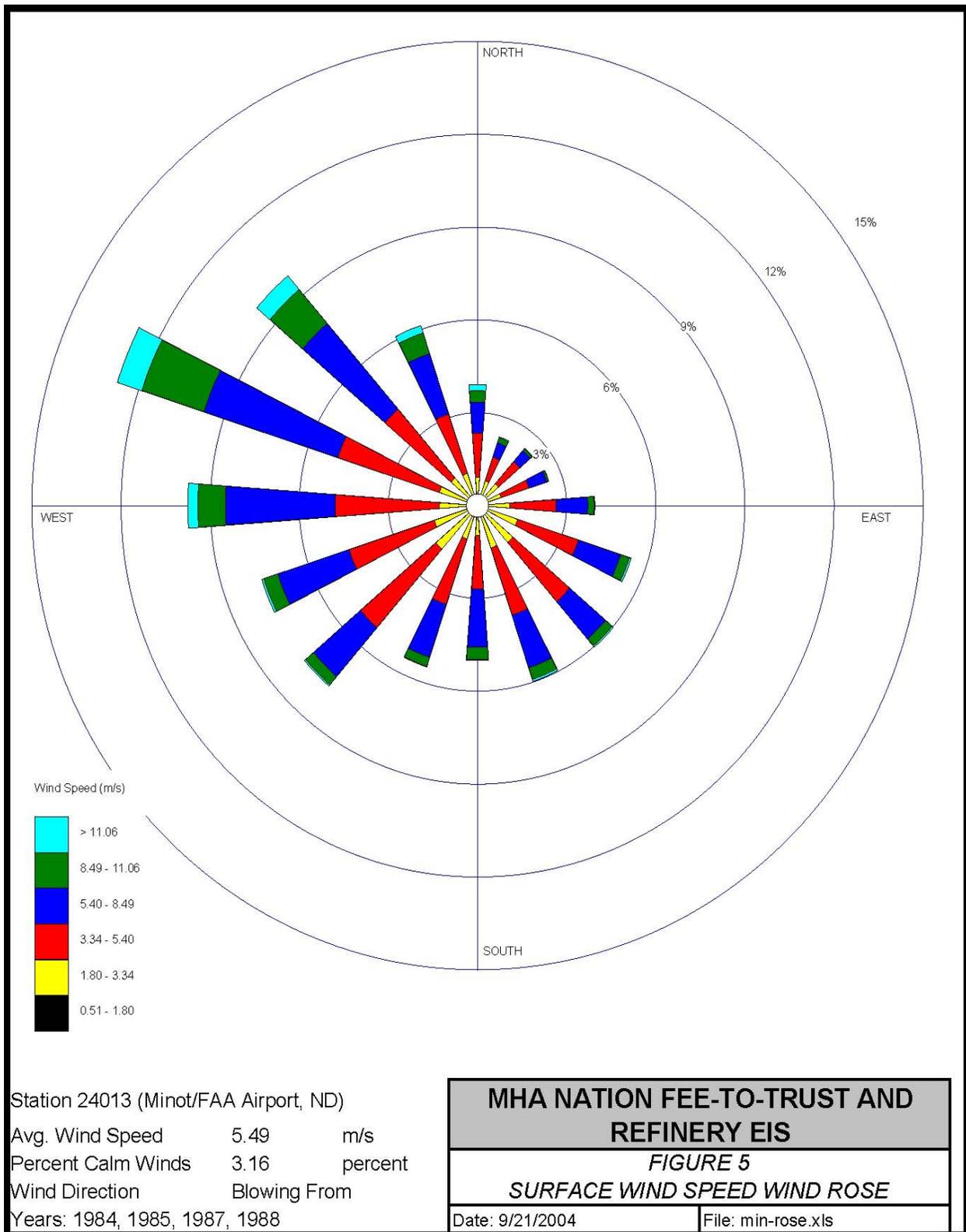
Wind Speed and Wind Direction

Figure 5, Surface Wind Speed Wind Rose, presents a wind rose that was generated from the 4 years of meteorological data described above for the Minot Airport which is about 30 miles from the project site. In this figure, each wind vector is apportioned by wind speed categories. Thus, the prevailing winds are from the west-northwest.

Stability Class

Figure 6, Atmospheric Stability Wind Rose, shows the same wind direction distribution as Figure 5. Instead of apportioning each wind vector by speed categories, Figure 6 apportions the wind vectors by stability class. The stability class “A” represents unstable atmospheres and the stability class “G” represents stable atmospheres.

Table 21 provides another summary for the stability data. This table presents the percent frequency of occurrence of each stability class for each month of the year. These data show that unstable conditions increase during the summer months, but also that neutral to stable atmospheres are more dominant in general.



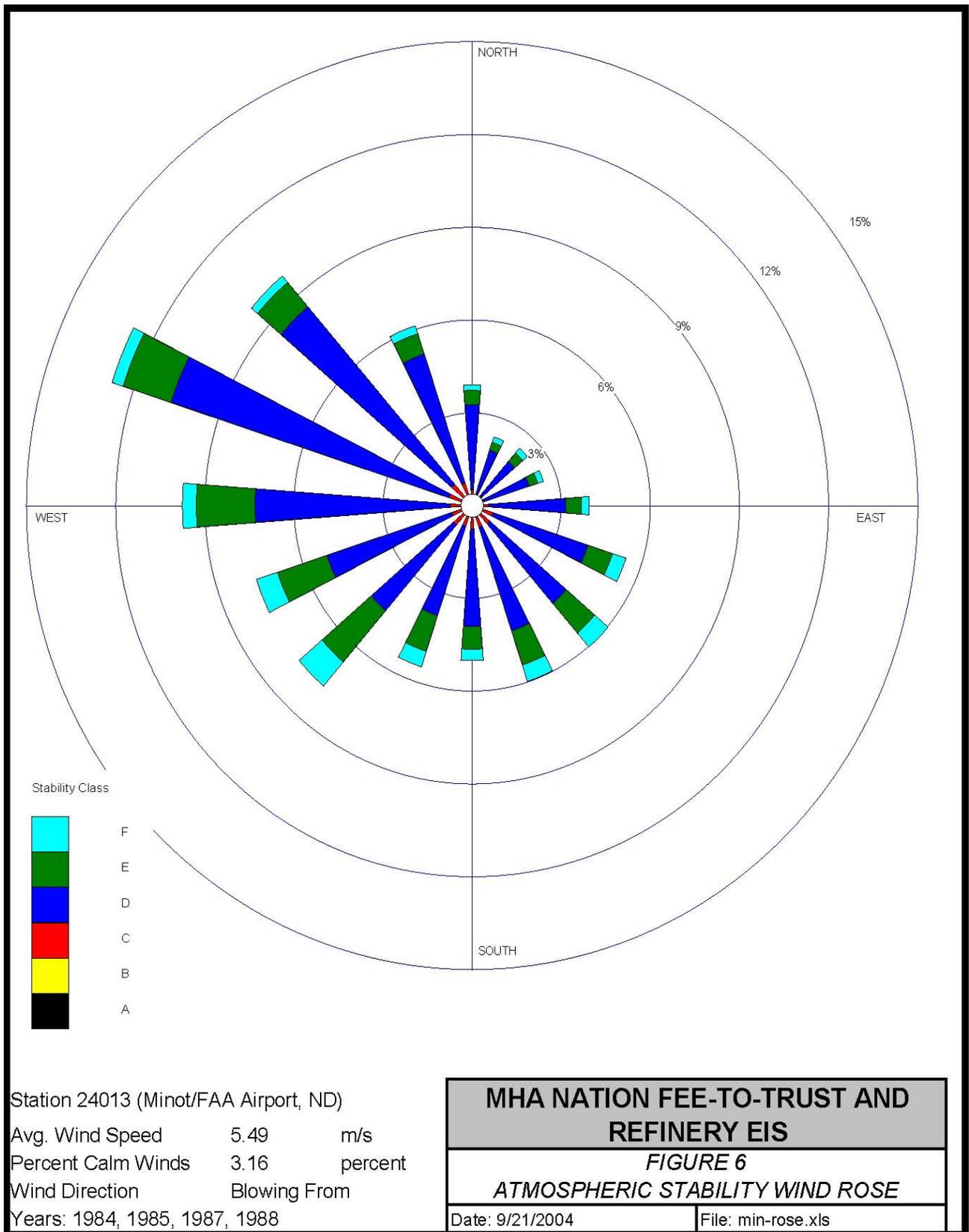


Table 21 Annual Stability Class Percent Frequency Distribution

Stability Class	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A	0.00	0.00	0.00	0.04	0.03	0.07	0.09	0.03	0.01	0.01	0.00	0.00
B	0.01	0.02	0.16	0.30	0.32	0.48	0.56	0.34	0.17	0.05	0.02	0.01
C	0.22	0.41	0.57	0.90	1.03	1.46	1.58	0.95	0.60	0.42	0.44	0.15
D	6.59	5.38	5.91	4.70	5.13	4.32	3.86	4.83	5.30	5.79	5.40	6.30
E	1.20	1.33	1.24	1.42	1.34	1.06	1.40	1.56	1.55	1.64	1.62	1.44
F	0.40	0.52	0.55	0.71	0.54	0.70	0.84	0.70	0.49	0.52	0.62	0.51
G	0.06	0.14	0.05	0.14	0.10	0.11	0.15	0.09	0.10	0.06	0.11	0.06

ISCST3 Modeling Analysis Design

This section summarizes the ISCST3 dispersion modeling setup and analyses.

Refined Model Selection

The ISCST3 model, version 02035, was used for this ambient air quality impact analyses.

Model Input Defaults/Option

The ISCST3 model was run using the standard regulatory configuration. The following regulatory default options were used:

- Final plume rise
- Stack tip downwash
- Buoyancy-induced dispersion
- Calm processing
- Missing data routine not used
- Default wind profile exponents (rural) = 0.07, 0.07, 0.10, 0.15, 0.35, 0.55
- Default vertical temperature gradients = 0.0, 0.0, 0.0, 0.0, 0.02, 0.035
- “Upper Bound” values used for supersquat buildings
- No exponential decay for Rural Mode

Rural/Urban Classification

More than 50 percent of the land use within a 3-kilometer radius of the project site is rural. Therefore, rural dispersion coefficients were used in the modeling analyses.

Receptor Network

Receptors were placed at 25-meter intervals around the facility’s process area and out to the fence line. Outside the fence line, receptors were placed as described below in Table 22. The distances are related to the center of the facility.

Table 22 ISCST3 Modeling Receptor Grid

From	To (km)¹	Distance Receptor Spacing (m)²
Fence Line	2.0	100
2.0 km	5.0	250
5.0 km	10.0	500

Notes:

1. km = kilometers
2. m = meters

Figure 7, Detail of Receptor Locations Around Process Area, is a graphical representation of the receptor locations inside the fence line, and Figure 8, General Receptor Grid, presents the full extent of the receptor grid.

Receptor Elevations

The receptor elevation values were obtained by importing the Universal Transverse Mercator (UTM) easting and northing coordinates of the dispersion modeling grid into Microimages' TNT Mips image processing software. These grid points were overlaid on 30-meter U.S. Geological Survey (USGS) digital elevation models (DEM) to extract the elevation value at each location. Each 30-meter digital elevation model is coincident with (or has the same extent as) the associated 7.5-minute USGS quadrangle.

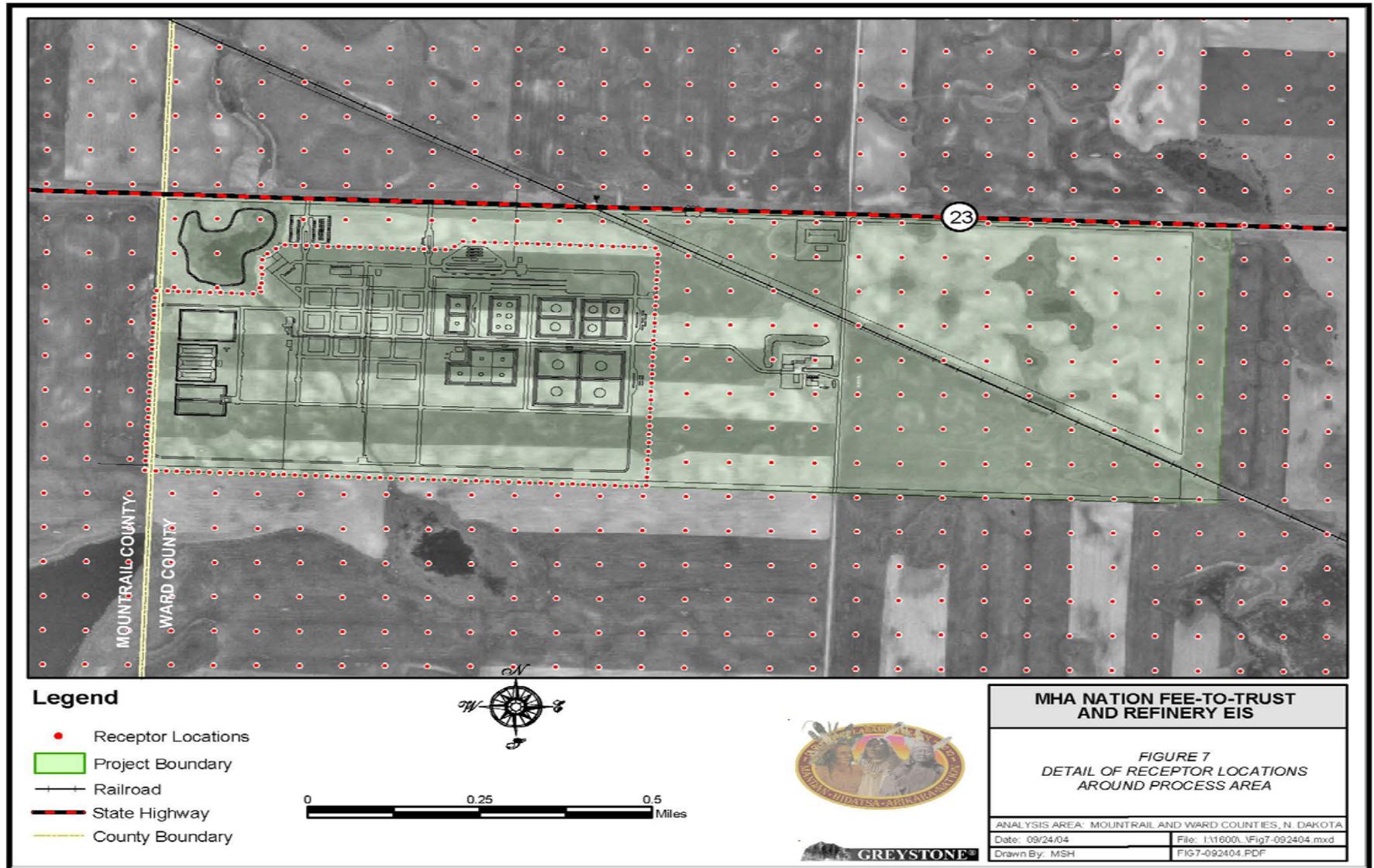
Building Wake Effects

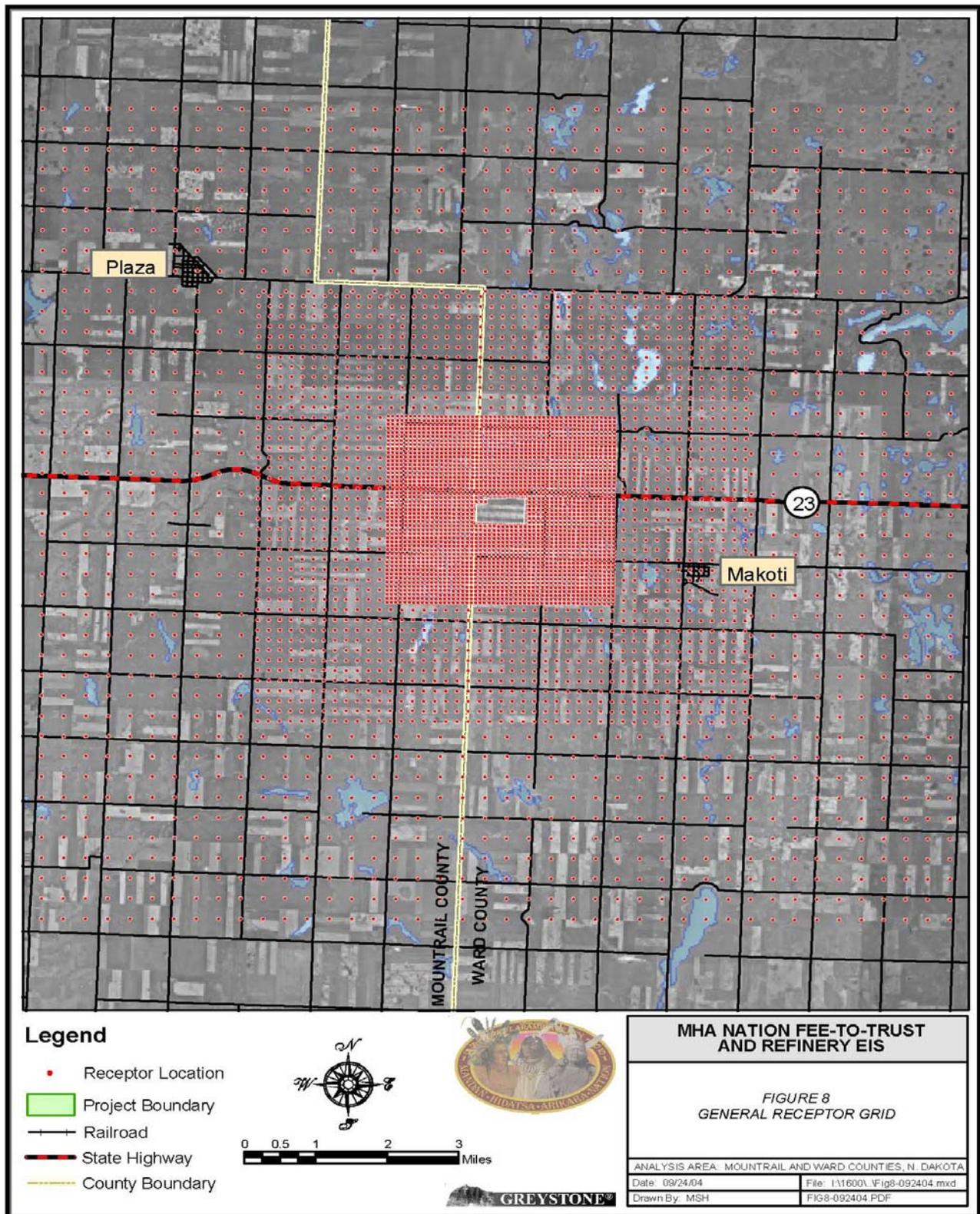
Building wake effects were assessed with the Building Profile Input Program (BPIP, dated 95086). BPIP was also be used to analyze Good Engineering Practice (GEP) stack heights for the point sources. Table 23 presents the dimensions of the buildings to be used in this analysis.

Table 23 Dimensions of Buildings at the MHA Nation's Proposed Clean Fuels Refinery

Building/Structure	Length 1 (m)¹	Length 2 (m)	Height (m)
Office Building	71	55	12.2
Utility Building	28	33	12.2
Control Building	49	15	12.2

Note: 1. m = meter





Source Data MHA Refinery Modeled Emission Rates

The general refinery processes operate continuously, therefore the modeled emission rates are the same for all averaging periods. Table 24 presents the emission rates used for these sources.

Table 24 Modeled MHA Refinery Criteria Air Pollutant Emissions

MHA Refinery Source	Pollutant Emission Rates (gm/s)			
	NO _x	CO	SO ₂	PM ₁₀ / PM _{2.5}
Crude Heater	0.1195	0.1819	0.0860	0.0367
Reformer Heater 1	0.0102	0.0156	0.0074	0.0031
Reformer Heater 2	0.0102	0.0156	0.0074	0.0031
Reformer Heater 3	0.0273	0.0416	0.0197	0.0084
Reformer Heater 4	0.0205	0.0312	0.0147	0.0063
Reformer Heater 5	0.0051	0.0078	0.0037	0.0016
Hydrocracker 1	0.0205	0.0312	0.0147	0.0063
Hydrocracker 2	0.0239	0.0364	0.0172	0.0073
Hydrocracker 3	0.0342	0.0520	0.0246	0.0105
Hydrocracker 4	0.0239	0.0364	0.0172	0.0073
Olefin	0.1025	0.1559	0.0737	0.0314
Hydrogen	0.1708	0.2599	0.1229	0.0524
Boiler 1	0.0683	0.1039	0.0491	0.0209
Boiler 2	0.0683	0.1039	0.0491	0.0209
Boiler 3	0.0683	0.1039	0.0491	0.0209
Flare	0.0858	0.4666	0.0246	0.0000
S Recovery Tail Gas	0.0000	0.6003	0.8878	0.0000
Soybean Loadout	0.0000	0.0000	0.0000	0.1186
Meal Handling	0.0000	0.0000	0.0000	0.0683
Meal Loadout	0.0000	0.0000	0.0000	0.0583

The standby generator and emergency fire pump engine are projected to operate 1 hour per day and 500 hours per year, respectively. This operating schedule would primarily involve testing and performing maintenance on these engines. Table 25 and Table 26 present the modeled emission rates for these sources. Table 27 presents the emission rates for hazardous air pollutants used in the dispersion modeling analysis.

Table 25 Modeled Standby Generator Emissions

Time Frame	NO_x	CO	SO₂	PM₁₀
1-Hour	-	0.1821	-	-
3-Hour	-	-	0.0207	-
8-Hour	-	0.0607	-	-
Daily	-	-	0.0026	0.0009
Annual	0.1417	-	0.0035	0.0012

Table 26 Modeled Fire Pump Engine Emissions

Time Frame	NO_x	CO	SO₂	PM₁₀
1-Hour	-	0.0201	-	-
3-Hour	-	-	0.0040	-
8-Hour	-	0.0067	-	-
Daily	-	-	0.0005	0.0002
Annual	0.0262	-	0.0007	0.0003

Table 27 Modeled Hazardous Air Pollutant Emissions

Modeled HAP Emissions (gm/sec)								
Source	Benzene	Cyclohexane	E-benzene	Formaldehyde	n-Hexane	PAH	Toluene	Xylene
Crude Heater	1.03E-05	0.0E+00	0.0E+00	3.6E-04	0.0E+00	5.8E-09	1.6E-05	0.0E+00
Reformer Heater 1	8.7E-07	0.0E+00	0.0E+00	3.1E-05	0.0E+00	5.0E-10	1.4E-06	0.0E+00
Reformer Heater 2	8.7E-07	0.0E+00	0.0E+00	3.1E-05	0.0E+00	5.0E-10	1.4E-06	0.0E+00
Reformer Heater 3	2.3E-06	0.0E+00	0.0E+00	8.3E-05	0.0E+00	1.3E-09	3.7E-06	0.0E+00
Reformer Heater 4	1.7E-06	0.0E+00	0.0E+00	6.2E-05	0.0E+00	9.9E-10	2.8E-06	0.0E+00
Reformer Heater 5	4.3E-07	0.0E+00	0.0E+00	1.6E-05	0.0E+00	2.5E-10	7.0E-07	0.0E+00
Hydrocracker 1	1.7E-06	0.0E+00	0.0E+00	6.2E-05	0.0E+00	9.9E-10	2.8E-06	0.0E+00
Hydrocracker 2	2.0E-06	0.0E+00	0.0E+00	7.2E-05	0.0E+00	1.2E-09	3.3E-06	0.0E+00
Hydrocracker 3	2.9E-06	0.0E+00	0.0E+00	1.0E-04	0.0E+00	1.7E-09	4.7E-06	0.0E+00
Hydrocracker 4	2.0E-06	0.0E+00	0.0E+00	7.2E-05	0.0E+00	1.2E-09	3.3E-06	0.0E+00
Olefin	8.7E-06	0.0E+00	0.0E+00	3.1E-04	0.0E+00	5.0E-09	1.4E-05	0.0E+00
Hydrogen	1.4E-05	0.0E+00	0.0E+00	5.2E-04	0.0E+00	8.3E-09	2.3E-05	0.0E+00
Boiler 1	5.8E-06	0.0E+00	0.0E+00	2.1E-04	0.0E+00	3.3E-09	9.4E-06	0.0E+00
Boiler 2	5.8E-06	0.0E+00	0.0E+00	2.1E-04	0.0E+00	3.3E-09	9.4E-06	0.0E+00
Boiler 3	5.8E-06	0.0E+00	0.0E+00	2.1E-04	0.0E+00	3.3E-09	9.4E-06	0.0E+00
Flare	2.9E-06	0.0E+00	0.0E+00	1.0E-04	0.0E+00	1.7E-09	4.7E-06	0.0E+00
Tail Gas Flare	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Floating Roof Tanks	4.3E-08	3.3E-08	2.6E-10	0.0E+00	3.8E-09	0.0E+00	1.6E-09	7.9E-10
Emergency Gen – 1 Hr	1.1E-03	0.0E+00	0.0E+00	1.4E-03	0.0E+00	2.0E-04	4.9E-04	3.4E-04
Emergency Gen – 24 Hr	4.7E-05	0.0E+00	0.0E+00	5.9E-05	0.0E+00	8.4E-04	4.9E-04	3.4E-04
Emergency Gen – Ann	6.4E-05	0.0E+00	0.0E+00	8.1E-05	0.0E+00	1.1E-05	2.8E-05	1.9E-05
Fire Pump – 1 Hr	2.2E-04	0.0E+00	0.0E+00	2.8E-04	0.0E+00	3.9E-05	9.5E-05	6.6E-05
Fire Pump – 24 Hr	9.1E-06	0.0E+00	0.0E+00	1.1E-05	0.0E+00	1.6E-06	4.0E-06	2.8E-06
Fire Pump – Ann	1.2E-05	0.0E+00	0.0E+00	1.6E-05	0.0E+00	2.2E-06	5.4E-06	3.8E-06

MHA Refinery Modeled Stack Parameters

Table 28 presents the physical parameters for the sources' exhausts that were used in the dispersion modeling analysis.

Table 28 Modeled MHA Refinery Exhaust Data

MHA Refinery Source	Height (meters)	Temp (K)	Velocity (m/s) ¹	Diameter (meters)
Crude Heater	30.48	483.0	0.75	3.048
Reformer Heater 1	30.48	483.0	0.72	0.914
Reformer Heater 2	30.48	483.0	0.72	0.914
Reformer Heater 3	30.48	483.0	1.92	0.914
Reformer Heater 4	30.48	483.0	1.44	0.914
Reformer Heater 5	30.48	483.0	0.36	0.914
Hydrocracker 1	30.48	483.0	1.44	0.914
Hydrocracker 2	30.48	483.0	1.68	0.914
Hydrocracker 3	30.48	483.0	2.40	0.914
Hydrocracker 4	30.48	483.0	1.68	0.914
Olefin	30.48	483.0	7.19	0.914
Hydrogen	30.48	483.0	11.98	0.914
Boiler 1	30.48	483.0	4.79	0.914
Boiler 2	30.48	483.0	4.79	0.914
Boiler 3	30.48	483.0	4.79	0.914
Flare	54.86	1273.0	40.30	0.835
S Recovery Tail Gas	36.58	310.8	0.03	3.048
Emergency Generator	6.10	796.9	50.29	0.30
Fire Pump	6.10	730.2	9.74	0.30
Soybean Unloading	11.6	294.1	6.47	0.30
Meal Handling	11.6	294.1	6.47	0.30
Meal Loadout	11.6	294.1	6.47	0.30

Notes: 1. m/s = meters per second

Background Concentrations

As recommended by the North Dakota Division of Air Quality (NDDAQ), Table 29 presents the background concentrations used in the NAAQS analysis.

Table 29 Default Ambient Background Concentration

Pollutant	Averaging Period	Concentration ($\mu\text{g}/\text{m}^3$)
NO ₂	Annual	5
CO	1-Hour	1,140
	8-Hour	1,140
PM ₁₀	24-Hour	30
	Annual	15
SO ₂	3-Hour	11
	24-Hour	9
	Annual	3

Modeling Results

This section presents the results of the following from the dispersion modeling analysis:

- NAAQS impacts
- HAP impacts
- Near-field acid deposition
- Increment consumption
- Class I area air quality related values impacts

Effects to air quality were evaluated using existing monitoring data available for the Reservation and surrounding areas, projections of criteria and hazardous air pollutant emissions from the refinery, and air quality modeling. The air quality modeling overlaid projected emissions on existing conditions and quantitatively estimated the potential near-field and far-field effects. Near-field effects are those that occur within a 10 km radius of the project, and far-field effects are those that occur at Class I areas. The modeling was built on recent modeling done by EPA for Prevention of Significant Deterioration purposes in North Dakota. It included analyses that compared concentrations of criteria air pollutants with the NAAQS, the Class I or Class II increments, and air quality related values. The modeling also included an analysis that compared concentrations of hazardous air pollutants (HAPs) with reference concentrations.

The results of these modeling analyses demonstrated that air emissions from the MHA Nation's Refinery would have negligible impacts on the quality of the air in and near the project area.

Class II Area Air Quality Analysis Results

Criteria Air Pollutants

Modeled impacts from the MHA Refinery sources, along with criteria pollutant background concentration data, were used to assess NAAQS impacts. As shown in Table 30, none of the pollutants would exceed the NAAQS or the PSD Class II increment.

Maximum project impacts occurred near the project fence line. There are no other nearby increment consuming sources that would contribute significantly to the project's maximum increment consumption represented by these values.

Table 30 Modeled Maximum Ambient Air Impacts

Pollutant	Period	NAAQS ($\mu\text{g}/\text{m}^3$) ¹	Back-ground ($\mu\text{g}/\text{m}^3$)	Modeled Impact ($\mu\text{g}/\text{m}^3$) ³	PSD Class II Increment	Relative to PSD Class II Increment (percent)	Modeled Impact with Background ($\mu\text{g}/\text{m}^3$)	Relative to NAAQS (percent)
NO ₂	Annual	100	5	0.79	25	3	5.79	6
CO	1-Hour	40,000	1,140	67.7	-	-	1207.72	3
	8-Hour	10,000	1,140	30.3	-	-	1170.34	12
PM _{2.5}	24-Hour	65	32.8 ²	26.31	-	-	59.11	91
	Annual	15	3.36 ²	2.94	-	-	6.30	42
PM ₁₀	24-Hour	150	30	26.31	30	88	56.31	38
	Annual	50	15	2.94	17	17	17.94	36
SO ₂	3-Hour	1,300	11	45.50	512	9	56.50	4
	24-Hour	365	9	17.49	91	19	26.49	7
	Annual	80	3	1.34	20	7	4.34	5

Note:

1. $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter
2. 2005 annual and maximum 24-hour concentrations EPA monitor 38-013-0004 (8315 Highway, 8 Kenmare)
3. For 1-, 8-, and 24-hour standards the modeled impacts are 1st highest short term values.

Hazardous Air Pollutants

Hazardous emission modeling was conducted to determine human health impacts and was conducted for the following parameters:

- Benzene
- Cyclohexane
- Ethylbenzene
- Formaldehyde
- Hexane (-n)
- Polycyclic Aromatic Hydrocarbons
- Toluene
- Xylene

These are common parameters that are typically found in air emissions from petroleum refineries. Table 31 presents the results of the HAP ambient impact modeling and current health-based inhalation risk estimates. Modeling was conducted to assess noncarcinogenic health effects of substances (chronic reference concentration [RfC]) and cancer unit risk. The first three columns of this table show the estimated impacts from dispersion modeling. The fourth and sixth columns present the Federal Risk estimates that are used to determine the significance of the impacts. The fifth column presents the Unit Risk value. This value shows the estimated probability of cancer risk, from inhalation, for an ambient

concentration of 1.0 microgram per cubic meter ($\mu\text{g}/\text{m}^3$) of the corresponding HAP. The value in the sixth column is a conversion of the Unit Risk value that represents the ambient concentration that would result in an estimated probability of cancer incidence, from inhalation, of 1 in 1,000,000.

Because the hazardous emissions are correlated to chronic health effects (i.e., long-term exposure), only the estimated annual concentrations need to be assessed. Both the RfC and Unit Risk are related to lifetime exposure to a hazardous emission; therefore, assessing a one-year average concentration against these criteria is a conservative estimate of exposure over a lifetime. As Table 31 shows the estimated ambient impacts are below the federal risk based concentrations.

Table 31 Hazardous Air Pollutant Ambient Impact Analysis Results

HAP	Estimated Ambient Concentrations ($\mu\text{g}/\text{m}^3$)			RfC ¹ (non-cancer risk) ($\mu\text{g}/\text{m}^3$)	Unit Risk ² (excess cancer risk per 1.0 $\mu\text{g}/\text{m}^3$) ($\mu\text{g}/\text{m}^3$) ⁻¹	1:1E+6 Risk Conc. ³ (cancer risk) ($\mu\text{g}/\text{m}^3$)	Risk Estimate Source ⁵
	1-Hour	24-Hour	Annual	($\mu\text{g}/\text{m}^3$)	($\mu\text{g}/\text{m}^3$) ⁻¹	($\mu\text{g}/\text{m}^3$)	
Benzene	4.04E-01	8.77E-02	1.32E-02	30	2.20E-06	4.55E-01	1
Cyclohexane	3.05E-01	6.63E-02	9.91E-03	6000	-	-	1
Ethylbenzene	2.38E-03	5.20E-04	8.00E-05	1000	-	-	1
Formaldehyde	4.36E-01	1.34E-02	1.81E-03	-	1.30E-05	7.69E-02	1
Hexane (-n)	3.50E-02	7.60E-03	1.14E-03	700	-	-	1
PAH ⁴	6.22E-02	4.80E-04	5.00E-05	-	1.10E-03	9.09E-04	2
Toluene	1.52E-01	3.37E-03	6.00E-04	5000	-	-	1
Xylene	1.06E-01	1.59E-03	2.70E-04	100	-	-	1

Notes:

1. Chronic Reference Concentration (RfC): An estimate of a continuous inhalation exposure for a chronic duration (up to a lifetime) to the human population (including susceptible subgroups) that is likely to be without an appreciable risk of adverse health effects over a lifetime.
2. Unit Risk: The upper-bound excess lifetime cancer risk estimated to result from continuous exposure to an agent at a concentration of 1 $\mu\text{g}/\text{m}^3$.
3. Unit risk value converted to a concentration that may cause 1 incident per 1,000,000 people exposed.
4. Polycyclic Aromatic Hydrocarbons
5. Sources: U.S. Environmental Protection Agency 2005, California Environmental Protection Agency 2005

Chronic Reference Concentration

In general, the RfC is an estimate of a continuous inhalation exposure for a chronic duration (up to a lifetime) to the human population (including susceptible subgroups) that is likely to be without an appreciable risk of adverse health effects. The inhalation RfC considers toxic effects for both the respiratory system and peripheral to the respiratory system. The RfC values are chemical-specific, with a lower RfC value implying a greater toxicity of the substance. As an example, benzene with an RfC concentration of 30 $\mu\text{g}/\text{m}^3$ would have a higher toxicity than cyclohexane with an RfC value of 6,000 $\mu\text{g}/\text{m}^3$.

The RfC concentration values for specific chemical parameters established by EPA and OEHHA/ARB (Table 31) are compared directly to the estimated annual concentrations resulting from the proposed

refinery's hazardous emission modeling. The predicted annual ambient concentrations in $\mu\text{g}/\text{m}^3$ are significantly (3 to 8 orders of magnitude) lower than the RfC values for the listed parameters.

Unit Risk

Unit risk is defined as the lifetime cancer risk estimated to result from continuous exposure to an agent at a concentration of $1 \mu\text{g}/\text{m}^3$. The Unit risk is converted to a comparable concentration that may result in 1 incident of cancer for every 1,000,000 people exposed. The calculation is as follows:

$$(1/\text{Unit Risk } (\mu\text{g}/\text{m}^3)^{-1})/1,000,000 = 1:1,000,000 \text{ Risk Concentration } (\mu\text{g}/\text{m}^3)$$

Comparing the estimated annual concentrations to the 1:1,000,000 risk concentrations shows that the estimated annual concentrations are below the 1:1,000,000 risk concentrations for cancer (Table 31). A 1:1,000,000 risk concentration means that there is one chance in 1,000,000 of an additional person developing cancer due to exposure to the parameter(s) being assessed.

Acid Deposition

Near-field acid deposition was estimated using the wet deposition function of ISCST3. A gas-scavenging coefficient of 0.0001 hours per second-millimeter was used for emissions of SO_2 and NO_x . Precipitation data for Bismarck were used because precipitation data were not represented in the Minot surface meteorological data.

The results (Table 32) are below the natural background total nitrogen (N) and sulfur (S) deposition level for western Class I areas, which is 0.25 kilogram per hectare-year (kg/ha-yr) for each element (National Park Service and U. S. Fish and Wildlife Service 2005).

Table 32 Modeled Near-field Wet Deposition

Year	Total Nitrogen and Sulfur Deposition (kg/ha-yr)	
	N	S
1984	0.08	0.11
1985	0.06	0.08
1987	0.08	0.14
1988	0.04	0.06

Class I Area Air Quality Analysis Results

Impacts to Class I areas were assessed at two areas: Theodore Roosevelt National Park (TRNP) and Lostwood Wilderness (LW). The following tables indicate the Class I area where the maximum impact was predicted to occur.

Class I SO_2 increment consumption was evaluated using the same methods as were used in the EPA Region 8, North Dakota increment modeling analysis (Draft U.S. Environmental Protection Agency, 2003). This modeling included the same sources and receptors as the draft EPA 2003 analysis with the addition of the proposed refinery and showed that the refinery would have a negligible impact on the Class I SO_2 increment for TRNP. Table 33 summarizes this analysis.

Table 33 CALPUFF Class I SO₂ Increment Analysis

Averaging Period/Year	Class I Area	Project Impact	PSD Class I Increment (µg/m ³)
		(µg/m ³)	
3-Hour			25
1990	TRNP	0.0060	
1991	TRNP	0.0030	
1992	TRNP	0.0000	
1993	TRNP	0.0020	
1994	TRNP	0.0000	
24-Hour			5
1990	TRNP	0.0030	
1991	TRNP	0.0040	
1992	TRNP	0.0050	
1993	TRNP	0.0010	
1994	TRNP	0.0000	
Annual			2
1990	TRNP	0.0005	
1991	TRNP	0.0024	
1992	TRNP	0.0005	
1993	TRNP	0.0005	
1994	TRNP	0.0015	

Table 34 presents the maximum estimated increment consumption from the project's emissions at the two Class I areas. These results show that the project would consume a negligible amount of the NO₂ and PM₁₀ Class I increment.

Table 34 Project Increment Consumption at Class I Areas

Year	Maximum Modeled Impacts (µg/m ³)						
	Class I Area	NO ₂ Annual		PM ₁₀ 24-Hour		PM ₁₀ Annual	
		Project Impact	Percent of Increment	Project Impact	Percent of Increment	Project Impact	Percent of Increment
1990	LW	0.0029	0.12%	0.0082	0.21%	0.0005	0.01%
1991	LW	0.0036	0.14%	0.0171	0.43%	0.0007	0.01%
1992	LW	0.0034	0.13%	0.0189	0.47%	0.0006	0.01%
1993	LW	0.0035	0.14%	0.0174	0.43%	0.0007	0.01%
1994	LW	0.0024	0.10%	0.0122	0.31%	0.0004	0.00%

Table 35 presents the estimated project impacts to air quality related values for the two nearby Class I areas. Both areas were assessed for each model year, and this table shows the Class I area where the maximum impact occurred.

The estimated maximum deposition values resulting from the project emissions are well below natural background levels shown on Table 35.

The estimated maximum visual range extinctions resulting from the project emissions are below the five percent threshold that is the general level of concern for Federal Land Managers (FLAG 2000).

Table 35 Class I Area AQRV Analyses

Year Modeled	Estimated Maximum Total Wet Deposition				Estimated Maximum Visual Range Extinction	
	Nitrogen kg/ha-yr	Class I Area	Sulfur kg/ha-yr	Class I Area	Percent	Class I Area
1990	0.010	TRNP	0.013	LW	1.59	LW
1991	0.011	TRNP	0.012	TRNP	3.68	LW
1992	0.010	TRNP	0.014	TRNP	4.14	LW
1993	0.011	TRNP	0.011	TRNP	3.89	LW
1994	0.013	LW	0.018	LW	2.38	LW
Maximum	0.013	LW	0.018	LW	4.14	LW

Summary of Air Quality Impacts

This air quality technical report shows the results of an air quality impact assessment conducted by air dispersion modeling. The assessment involved near-field and far-field analyses. According to the modeled results, potential impacts of the criteria pollutants fell below all NAAQS. The maximum modeled impacts did not exceed the PSD increments (i.e., for NO₂, SO₂, and PM₁₀). Deposition of sulfur and nitrogen fell below levels of acceptable change established by Federal Land Manager (FLM) agencies. The modeled direct impact of the project on visibility in nearby Class I areas was also less than thresholds established by the FLMs.

Chapter 6—References

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Appendix A NSPS Applicability by Source

Source	Capacity Units	Emission Controls	Bypass?	NSPS
Crude Heater	35,000,000 BTU/hr	Low NOx burners	No	Subpart J (60.104 - 60.108)
Reformer Heater 1	3,000,000 BTU/hr	Low NOx burners	No	Subpart J (60.104 - 60.108)
Reformer Heater 2	3,000,000 BTU/hr	Low NOx burners	No	Subpart J (60.104 - 60.108)
Reformer Heater'3	8,000,000 BTU/hr	Low NOx burners	No	Subpart J (60.104 - 60.108)
Reformer Heater 4	6,000,000 BTU/hr	Low NOx burners	No	Subpart J (60.104 - 60.108)
Reformer Heater 5	1,500,000 BTU/hr	Low NOx burners	No	Subpart J (60.104 - 60.108)
Hydrocracker 1	6,000,000 BTU/hr	Low NOx burners	No	Subpart J (60.104 - 60.108)
Hydrocracker 3	10,000,000 BTU/hr	Low NOx burners	No	Subpart J (60.104 - 60.108)
Hydrocracker 4	7,000,000 BTU/hr	Low NOx burners	No	Subpart J (60.104 - 60.108)
Olefin	30,000,000 BTU/hr	Low NOx burners	No	Subpart J (60.104 - 60.108)
Hydrogen	50,000,000 BTU/hr	Low NOx burners	No	Subpart J (60.104 - 60.108)
Boiler 1	20,000,000 BTU/hr	Low NOx burners	No	Subpart Dc, Subpart J (60.104 - 60.108)
Boiler 2	20,000,000 BTU/hr	Low NOx burners	No	Subpart Dc, Subpart J (60.104 - 60.108)
Boiler 3	20,000,000 BTU/hr	Low NOx burners	No	Subpart Dc, Subpart J (60.104 - 60.108)
Flare	10,000,000 BTU/hr	Smokeless	No	NA
S Recovery Tail Gas	3 ton/day			Not applicable to Subpart J (<20 long-tons per day)
Standby Generator				
Fire Water Pump				
Crude Oil Tank	2,037,515 gal	Fixed roof	No	Subpart Kb
Mid Distillate Tank	2,085,738 gal	Fixed roof	No	Subpart Kb
Mid Distillate Tank	2,085,738 gal	Fixed roof	No	Subpart Kb
Mid Distillate Tank	2,085,738 gal	Fixed roof	No	Subpart Kb

Source	Capacity Units	Emission Controls	Bypass?	NSPS
Mid Distillate Tank	2,085,738 gal	Fixed roof	No	Subpart Kb
Raw Light HC Tank	211,507 gal	Fixed roof	No	Subpart Kb
Light Slop HC Tank	211,507 gal	Fixed roof	No	Subpart Kb
Hydrocrackate Tank	211,507 gal	Fixed roof	No	Subpart Kb
Naphtha Tank	211,507 gal	Fixed roof	No	Subpart Kb
Ethanol Tank	211,507 gal	Fixed roof	No	Subpart Kb
Alkylate (IsoOctane) Tank	475,890 gal	Fixed roof	No	Subpart Kb
Reformate Tank	475,890 gal	Fixed roof	No	Subpart Kb
Bio-diesel Tank	475,890 gal	Fixed roof	No	Subpart Kb
Regular Gasoline Tank	1,054,949 gal	Fixed roof	No	Subpart Kb
Regular Gasoline Tank	1,054,949 gal	Fixed roof	No	Subpart Kb
Premium Gasoline Tank	1,054,949 gal	Fixed roof	No	Subpart Kb
Off Road Gasoline Tank	169,205 gal	Fixed roof	No	Subpart Kb
Atm Red Crude	414,553 gal	Vapor recovery	No	Subpart Kb
Raw Heavy HC	211,507 gal	Vapor recovery	No	Subpart Kb
Raw Hvy Diesel	414,553 gal	Vapor recovery	No	Subpart Kb
Raw Light Diesel	414,553 gal	Vapor recovery	No	Subpart Kb
Heavy Slop HC	211,507 gal	Vapor recovery	No	Subpart Kb
Propane	50,762 gal	Pressure vessel	No	NA
Propane	50,762 gal	Pressure vessel	No	NA
Propane	50,762 gal	Pressure vessel	No	NA
Propane	50,762 gal	Pressure vessel	No	NA
n Butane	97,881 gal	Pressure vessel	No	NA
Field Butanes	97,881 gal	Pressure vessel	No	NA
Field Butanes	97,881 gal	Pressure vessel	No	NA
Field Butanes	97,881 gal	Pressure vessel	No	NA
Field Butanes	97,881 gal	Pressure vessel	No	NA
Receiving (soy beans)	10.63 ton/hr			NA
Cracking/dehulling	10.63 ton/hr			NA
Hull grinding	10.63 ton/hr			NA
Bean conditioning	10.63 ton/hr			NA
Flaking rolls	10.63 ton/hr			NA
Meal dryer	10.63 ton/hr			NA
Meal cooler	10.63 ton/hr			NA
Meal loadout	10.63 ton/hr			NA
White flake cooler	10.63			NA

Source	Capacity Units	Emission Controls	Bypass?	NSPS
Meal grinder/sizing	10.63 ton/hr			NA
Valves – Gas	7150 count	Use leakless valve	No	Subpart GGG
Valves – Lt Liquid	4735 count	Use leakless valve	No	Subpart GGG
Valves – Hvy Liquid	2870 count	Use leakless valve	No	Subpart GGG
Pump seals – Lt Liquid	215 count	Use double seal	No	Subpart GGG
Pump Seals – Hvy Liquid	84 count	Use double seal	No	Subpart GGG
Flanges – Gas	12225 count	Minimize flanges	No	Subpart GGG
Flanges - Lt Liquid	8410 count	Minimize flanges	No	Subpart GGG
Flanges – Hvy Liquid	5370 count	Minimize flanges	No	Subpart GGG
Open ended valves	3835 count	Blind or plug open	No	Subpart GGG
Relief Valves	388 count	Discharge to flare	No	Subpart GGG
Compressed Seals	47 count	Recycle to process	No	Subpart GGG
Drains	1210 count	Hard pipe to MDO	No	Subpart GGG
Sample connections	264 count	Totally enclosed	No	Subpart GGG
Wastewater System				Subpart QQQ
Rail and truck loadout		Vapor recovery	No	Not a “bulk gasoline terminal” as define in Subpart XX

Appendix B Raw Data

MHA Clean Fuels Furnaces Summary of Revisions

Furnace	Duty	Net Heat Const (LHV) (BTU/h)	Service	Revised Duties	Reference
Remarks	100%	35,000,000	Crude Heater	35	Forced Draft
Reformer Heater 1	100%	3,000,000	NHT Feed	3 RGW email Dec 18/03	Natural draft
Reformer Heater 2	100%	3,000,000	NHT Stripper Reboiler	3	"
Reformer Heater 3	100%	8,000,000	Reformer Charge	8	"
Reformer Heater 4	100%	6,000,000	No. 2 Reformer	6	"
Reformer Heater 5	100%	1,500,000	No. 3 Reformer	1.5	"
Hydrocracker 1	100%	6,000,000	DHT Feed	6	"
Hydrocracker 2	100%	7,000,000	DHT Stripper	7	"
Hydrocracker 3	100%	10,000,000	Fractionator Feed	10	Forced Draft
Hydrocracker 4	100%	7,000,000	Recycle Gas	7	"
Olefin	100%	30,000,000	Olefin	30	"
Hydrogen	100%	50,000,000	Hydrogen Feed	50 RGW email Oct 16/03	Forced Draft
Boiler 1	100%	20,000,000	Boiler 1	20	Forced Draft
Boiler 2	100%	20,000,000	Boiler 2	20	"
Boiler 3	100%	20,000,000	Boiler 3	20	"
Flare	100%		Flare	See Ref 5	See Flare data attached
			Hot Oil Furnace*		Natural Draft
			*(for stripping in lieu of steam)		
				Burner Controls sent separately	
			Total Duty	231.5	

Floating Roof Data

Product	Annual Throughput (bbl)	Roof Type Pontoon or Double Deck	Roof Fitting Category Typical or Detail	Tank Construction Welded or Rivited	Primary Seal Mechanical Shoe or Liquid-mounted or Vapor-mounted
Crude oil	3,470,000	DD	API 650 H.4.4	W	H.4.4.5 (a) – Note 1
Mid Distillate	1,900,000	DD	API 650 H.4.4	W	H.4.4.5 (a) – Note 1
Raw Light HC	100,000	DD	API 650 H.4.4	W	H.4.4.5 (a) – Note 1
Light Slop HC	100,000	DD	API 650 H.4.4	W	H.4.4.5 (a) – Note 1
Hydrocrackate	680,000	DD	API 650 H.4.4	W	H.4.4.5 (a) – Note 1
Naphtha	100,000	DD	API 650 H.4.4	W	H.4.4.5 (a) – Note 1
Ethanol	115,000	DD	API 650 H.4.4	W	H.4.4.5 (a) – Note 1
Alkylate (IsoOctane)	760,000	DD	API 650 H.4.4	W	H.4.4.5 (a) – Note 1
Reformate	855,000	DD	API 650 H.4.4	W	H.4.4.5 (a) – Note 1
Bio -diesel	105,000	DD	API 650 H.4.4	W	H.4.4.5 (a) – Note 1
Regular Gasoline	585,000	DD	API 650 H.4.4	W	H.4.4.5 (a) – Note 1
Premium Gasoline	1,000,000	DD	API 650 H.4.4	W	H.4.4.5 (a) – Note 1
Off-Road Gasoline	750,000	DD	API 650 H.4.4	W	H.4.4.5 (a) – Note 1

Notes:

API 650 – Appendix H.4.4.5 (a) is liquid-mounted rim seal, both primary and secondary.

Floating Roof Data

Product	Liquid Density @60 deg F (lb/gal)	Ncentations (ppm)				Concentration Ba- sis Mass or Molar or Volume
		Benzene	Toluene	Ethylbenzene	Xylene	
Crude oil	7.4	5000	5000	5000	5000	ppmw
Mid Distillate	7.0	5000	5000	5000	5000	ppmw
Raw Light HC	6.7	5000	5000	5000	5000	ppmw
Light Slop HC	6.5	5000	5000	5000	5000	ppmw
Hydrocrackate	6.5	5000	5000	5000	5000	ppmw
Naphtha	6	5000	5000	5000	5000	ppmw
Ethanol	6.61	0	0	0	0	ppmw
Alkylate (IsoOctane)	6.5	0	0	0	0	ppmw
Reformate	6.5	5	5	5	5	LV%
Bio-diesel	7.4	0	0	0	0	ppmw
Regular Gasoline	6.5	1	1	1	1	LV%
Premium Gasoline	6.5	1	1	1	1	LV%
Off-Road Gasoline	6.5	1	1	1	1	LV%

Floating Roof Data

Product	Secondary Seal None or Rim- mounted or Shoe-mounted or Weather Shield	Vapor Pressure @ 45 deg F (psia)	Reid Vapor Pressure	Liquid Molecular Weight	Vapor Molecular Weight
Crude oil	H.4.4.5 (a)	15.5		225	200
Mid Distillate	H.4.4.5 (a)	14.9		200	180
Raw Light HC	H.4.4.5 (a)	15.2		185	165
Light Slop HC	H.4.4.5 (a)	21.5		140	120
Hydrocrackate	H.4.4.5 (a)	26.5		105	85
Naphtha	H.4.4.5 (a)	26.5		100	80
Ethanol	H.4.4.5 (a)	17		46	46
Alkylate (IsoOctane)	H.4.4.5 (a)	16.7		111	100
Reformate	H.4.4.5 (a)	16.7		110	90
Bio-diesel	H.4.4.5 (a)	14.9		200	180
Regular Gasoline	H.4.4.5 (a)	21.7	7	105	85
Premium Gasoline	H.4.4.5 (a)	21.7	7	105	85
Off-Road Gasoline	H.4.4.5 (a)	21.7	7	105	85

Notes:

1. API 650 - Appendix

Fixed Roof Tank Data

Product	Annual Throughput (bbl)	Is Tank Heated? (Y/N)	Vapor Pressure @45 deg F (psia)	Athr Vent Settings Vacuum Setting (psig)	Pressure Setting (psig)
Atm Red Crude	1,175,000	N	14.9	Note 2	Note 1
Raw Heavy HC	100,000	N	14.9		
Raw Hvy Diesel	150,000	N	15.0		
Raw Light Diesel	150,000	N	15.5		
Heavy Slop HC	100,000	N	14.9		

Notes:

1. Connected to Vapor Recovery System
2. Set for tank protection

Fixed Roof Tank Data

Product	Liquid Molecular Weight	Vapor Molecular Weight	Toluene	Ethylbenzene	Xylene	Concentration Basis Mass/Molar/Volume
Atm Red Crude	250	230	5000	5000	5000	ppmv
Raw Heavy HC	250	230	5000	5000	5000	ppmv
Raw Hvy Diesel	220	200	5000	5000	5000	ppmv
Raw Light Diesel	200	180	5000	5000	5000	ppmv
Heavy Slop HC	220	200	5000	5000	5000	ppmv

Notes:

1. Connected to Vapor Recovery System
2. Set for tank protection

Pressure Vessel Data

Product	Annual Throughput (bbl)	Is Tank Heated? (Y/N)	Vapor Pressure ather Vent Setting		
			@45 deg F (psia)	Vacuum Setting (psig)	Pressure Setting (psig)
Propane	70,000	N	223		275
n Butane	50,000	N	75		100
Field Butanes	1,050,000	N	90		150

Pressure Vessel

Product	Liquid Molecular Weight	Vapor Molecular Weight	Toluene	Ethylbenzene	Xylene	Concentration Basis Mass/Molar/Volume
Propane	44.1	44.1	0	0	0	ppmv
n Butane	58	58	0	0	0	ppmv
Field Butanes	58	58	0	0	0	ppmv

From: Dave Cameron
Sent: Tuesday, November 25, 2003 8:34 AM To: Gordon Frisbie
Cc: Jerry Koblitz Subject: FW: Tail Gas

Gordon:

Some more information for air.

-----original Message-----

From: Robert Woolley [<mailto:rgw@triadengineers.com>] Sent: Tuesday, 25 November, 2003 8:15 AM
To: Dave Cameron
Cc: Horace Pipe; Myrle Astrope Subject: Tail Gas

Dave,

Thee sulfur plant will require a separate incinerated stack adjacent to the Sulfur plant. The case presented for you is 98.6% recovery, 3 stage Claus, as a worst case. The following composition in moles/hour for the stack effluent is:

Ar	0.4
CO	.17
CO ₂	9.87
H ₂	017
H ₂ O	11.08
N ₂	31.87
O ₂	1.59
SO ₂	0.11
Total	55.27 lb moles/hr

The stack height should be 120 feet and the diameter to suit your required exit velocity.

Regards, Bob

Date: August 24, 2004

Customer: Triad Project Co.

PERFORMANCE DATA (CONTINUED)

Continuous Transesterification

Capacity: 3.0 million gallons per year of bio-diesel based on operating 300 days per year and 24 hours per day

Product Yields:

Biodiesel (to ASTM D 6751-02) 98% minimum conversion of available triglycerides*
 Glycerine (80% concentration) Approximately 0.125 lb crude glycerine per lb of biodiesel product
 Fatty Acid (Crude) Approximately 0.0051b per lb of biodiesel product

Available triglyceride defined as: total feed wt - wt of (moisture + volatiles + unsaponifiables + FFA + soap)

Approximate Feedstock Consumption:	lb/hour	lb/year
Vegetable Oil	3050	21,960,000
Methanol (includes MeOH in sodium methoxide)	336	2,425,000
Sodium Methoxide, pure basis (0.5 % addition)	15.2	109,400
Sulfuric Acid	16.0	267,000
Sodium Hydroxide (50%)	4.2	30,240

Estimated Utility Consumption:	units/hour	units/year
Steam - 150 psig (lb)	910	6,534,000
Cooling Water- recirculated (gal)	14,300	103,000,000
Electricity (kw)	32	230,400
Softened Water (gal)	300	2,160,000
Nitrogen (std cu ft)	TBD	TBD

Waste Streams:	units/hour	units/year
Waste Water Discharge (gal)	75	540,000
Methanol Vapor Discharge (lb)	<1.0 if scrubbing option is included	

FINISHED PRODUCT SPECIFICATIONS

Truck Traffic at the Refinery Site

Makoti, N.D.

FEEDSTOCK (inbound)

Synthetic crude oil via pipeline (6" & 8") Natural gas via pipeline (8")

BUTANE (inbound feedstock)

Butane 3,000BPSD 75% by rail = 2,250BPSD x 42 gals = 94,500 GPSD 25% by truck = 750BPSD x 42 gals = 31,500 GPSD Butane Truck hauls approx. 10,000 gals/ load = 3.15/day x 7 = 22 loads /week. (Butane weighs approx 4.81 lbs/gal @ 60°F)

SOY BEANS (inbound feedstock)

Soy beans 8,500 bushels/day (inbound) by Truck 8,500bu x 60 lbs = 510,000 lbs/day Soy bean Truck/trailer hauls approx. 30 tons/load = 8.5/day x 7 = 60 loads/week (Soy beans weigh approx. 60 lbs/bu)

SOY BEAN MEAL(outbound product)

Soy bean meal weighs approx. 47.5 lbs/inbound bushel 8,500bu x 47.5 = 403,750lbs/day Soy bean Truck/Trailer hauls approx. 30 tons/load = 6.7/day x 7 = 47 loads/week outbound. The Soy oil is blended on site approx. 300BPSD

GASOLINE (outbound product)

Gasoline 6,800 BPSD by truck = 6,800BPSD x 42 gals = 285,600 GPSD Gasoline Truck /Trailer hauls approx. 12,500 gals/ load = 23/day x 7 = 161 loads/week (Gasoline weighs approx. 6.21 lbs/gal @ 60°F) Round trip avg. 400 miles. G.V.W. 105,500 Truck net weight 27,500

DIESEL (outbound product)

Diesel 5,755 BPSD by truck = 5,755BPSD x 42 gals = 241,710 GPSD Diesel Truck/Trailer hauls approx. 11,000 gals/load = 22/day x 7 = 154 loads/week (Diesel weighs approx. 7.03 lbs/gal @ 60°F) Round trip avg. 400 miles. G.V.W. 105,500 Truck net weight 27,500

SULFUR (outbound)

Sulfur 3T/day by truck = 21 tons/week = 1 truck load/week Avg. round trip 400 miles. G.V.W. 80,000 Truck net weight 27,000

PROPANE (outbound product)

Propane by Truck = 200BPSD x 42 gals = 8,400 GPSD Propane Truck hauls approx. 10,000 gals/load = .84/day x 7 = 6 loads/week

07/14/04

TRUCK WEIGHTS (AVERAGE) ROUND TRIP CALCULATIONS

BUTANE (INBOUND FEEDSTOCK)

22 loads/wk = 1,058,200lbs/wk (load) + net weight of Truck (29,500) x 2 (roundtrip) = 59,000lbs x 22 = 1,298,000 lbs/wk

		1,058,200lbs
		1,298,000lbs
	Grand Total	2,356,200 lbs/wk
G.V.W. of truck 80,000lbs		= 1,178.1 tons/wk

Roundtrip mileage

Grasslands Plant to Makoti 260 miles x 22 = 5720 miles/wk

SOY OIL. (INBOUND FEEDSTOCK) - SOY BEANS & SOY BEAN MEAL

PLAN "A" Soy oil

The intent is to purchase "Soy Oil" (B100) from other Soy Bean refiners located in North Dakota and the surrounding states. Initially we would be hauling approximately 300 BBLS of Soy Oil/day = 12,000 gal/day = 90,120 lbs/day possibly from *Enderlin N.D. +Volga S.D. or #Mankato M.N. This will be transported by tank truck or rail car depending on the freight rates The existing market conditions do not warrant construction of a crushing plant and refinery at this time. We will just build a "blending plant" for the foreseeable future.

This transportation will be all on paved roads or railway.

G.V.W. of Tank Truck 80,000lbs

*Enderlin to Makoti 580 miles round trip.

+Volga South Dakota 1000 miles round trip (Likely by Rail Car)

#Mankato Minnesota 1220 miles round trip (Likely by Rail Car)

In this scenario we will not be processing any Soy Bean Meal at Makoti.

If the market conditions alter significantly where there is no longer an adequate supply of Soy Oil, we need the ability to proceed with the crushing plant and refinery to process the raw Soy Beans into Soy Oil (B100) Feedstock for the blending plant.

PLAN "B" Soy Beans (Inbound Feedstock)

If the market conditions dictate there will be truck and rail traffic with a small amount of traffic on unpaved (gravel) roads and considerable mileage on paved roads as the majority of Soy Bean crops are grown in the eastern portion of N.D. S.D. and Minnesota.

We would expect to purchase approximately 10% of the Soy Beans locally with most of this being travel on gravel roads probably within a 20 mile radius of Makoti. This will amount to approximately 1 truckload per day 850 bushels @ 601bs/bu = 51,000lbs.

Truck net weight 27,000lbs G.V.W. 80,000 lbs

The balance 7,650bu would transport by Truck or Rail having a radius of 250 miles primarily all paved road. This will be 9 truckloads probably an average of 10 miles per truckload (round trip) on gravel.

SOY BEAN MEAL (OUTBOUND)

The Soy Bean Meal will be shipped by rail.

Appendix C Calculations

TAT Refinery Calculation Constants