3.1. Summary of Proposed Controls

Since the proposed Davis Refinery is a new refinery, it has allowed Meridian to aggressively pursue emissions controls throughout the plant emissions sources. To assure the level of control required can be achieved, in order to qualify as a Synthetic Minor Source, proposed controls have been "stacked". For this reason, in several instances the facility is redefining what can be achieved as BACT and as a result, there is minimal literature available to confirm some values. In these instances we have relied on mass balance calculations, good engineering practice and speciation analysis of the airstream. Table 5 below presents an overall summary of proposed emission controls across the proposed Davis Refinery.

Table 5. Davis Refinery Summary of Proposed Emissions Controls

Source/Unit	Target Pollutant	Pollution Control Technologies Used	Assumed % Control
Leaks (Fugitive Emissions)	VOC	LDAR (Leak, Detection and Repair) program with 500 ppmv leak definition, and including differential light absorption and ranging (DIAL) or optical gas imaging (OGI) technology	97% valves, 93% pumps, 97% flanges, 97% sample points, (30% heavies). Program baseline/ screen value of 500 ppm
Tanks	VOC	Double Seal and Wipers on IFR Tanks (NESHAP std). Vapor Recovery to product recycle on select fixed roof tanks	95%
Stationary Combustion Sources (Heater and Boilers)	CO NOx VOC/HAPs PM SO2	CO – Best Comb. Practices w/ Ultra Low NOx Burners NOx – SCR's w/ Ultra Low NOx Burners VOC / HAPs – Best Comb. Practices with Ultra Low NOx Burners PM – Venturi Scrubbers on larger heaters	CO–NA vendor guarantee NOx–79% (vendor guar.) VOCs / HAPs – 75% PM - 70% (EPA Fact Sht)
FCC Regeneration Vent	CO NOx SO2	CO– Best Comb. Practices / complete carbon burn regenerator design NOx – COP-NP Combustion Promotor OR Tri-Mer SO2 – Wet Scrubber OR Dri-Sorb Catalyst	CO – 100% NOx – 98% SO_2 – 99%
Catalytic Reforming Unit	HAPs	NA – minor emissions levels	NA
Sulfur Recovery Plants	SO_2	Lo-CAT with tail gas treatment (thermal oxidizer) Other pollutants are considered minor	SO_2 - 99.9%
Blowdown System	CO NOx SO_2	Vapor recovery to product capture and emergency flaring only for upsets	99.8%
Flares	CO NOx VOC HAPs	Lower heating value of feed gases, requirements specified by EPA and NDDoH regulations. Flares will only be used during upset conditions	98% +
Wastewater Treatment System	VOC/HAPs	Covered API/CPI oil/water separators and induced/dissolved air flotation units. Equalization tanks instead of open ponds. Vapor Recovery System	VOC – 95% HAPs – 55%
Cooling Towers	PM VOC	PM10 – drift eliminators VOC – periodic monitoring of flows for VOC's hydrocarbons	Controls are inherent in design for cooling tower for PM10 and are part water level monitoring for VOCs

Source/Unit	Target Pollutant	Pollution Control Technologies Used	Assumed % Control
Product Loading	VOC	Vapor recovery to product recycle with upsets to emergency flares	98%
Fugitive (on-site vehicular) emissions	PM	Paving of areas of routine vehicle traffic. Maintain vehicle speeds to < 15 mph	$PM_{2.5}$ - 0.00054 lb/vmt PM_{10} - 0.0022 lb/vmt Silt load = 2.15E-02
Spent Catalyst	PM	De-minimus	NA – de-minimus

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**Exhibit D: Emissions Dispersion Modeling and Air Quality Impact Analysis
(submitted under separate cover)**

NHOE-16-001-16-419

Summary Report of Air Dispersion Modeling Results

In Support Of An Application For
Air Contaminant Discharge Permit
Meridian Energy Group, Inc.
Davis Refinery
Billings County, North Dakota

October 2016

zia engineering & environmental consultants, llc
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SUMMARY REPORT OF AIR DISPERSION MODELING RESULTS

IN SUPPORT OF AN APPLICATION FOR
AIR CONTAMINANT DISCHARGE PERMIT
MERIDIAN ENERGY GROUP, INC.
DAVIS REFINERY
BILLINGS COUNTY, NORTH DAKOTA

Zia Project # NHOE-16-001
Document # NHOE-16-001-16-419
Submission Date: 14 October 2016

Submitted To: **North Dakota Department of Health**
Air Quality Division

On behalf of: **Vepica USA, Inc.**
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Katy, TX 77449

Submitted by:

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1.0 INTRODUCTION

1.1 PROPOSED PROJECT

Meridian Energy Group, Inc. (Meridian) has applied for a Permit to Construct (PTC) for the proposed Davis Refinery (the “Project”) from the North Dakota Department of Health (NDDoH) Division of Air Quality. The Davis Refinery will be an approximately 55,000 barrels per standard day (“bpsd”) high-conversion crude refinery that will produce a full slate of refined products and specialty chemicals. Meridian has initiated engineering plans and the Refinery design is based upon the availability of process equipment that will shorten the schedule and reduce costs while ensuring environmental compliance.

The project location is a 620-acre site in Billings County, North Dakota (see Figure 1 - the “Site”) where Meridian has entered into an option-purchase agreement with the owner. On July 5th, 2016 the Billings County Board of Commissioners unanimously approved a rezoning permit to industrial use that will allow the construction of the Davis Refinery on this property. Figure 1 provides a map of the proposed project site and immediate area.

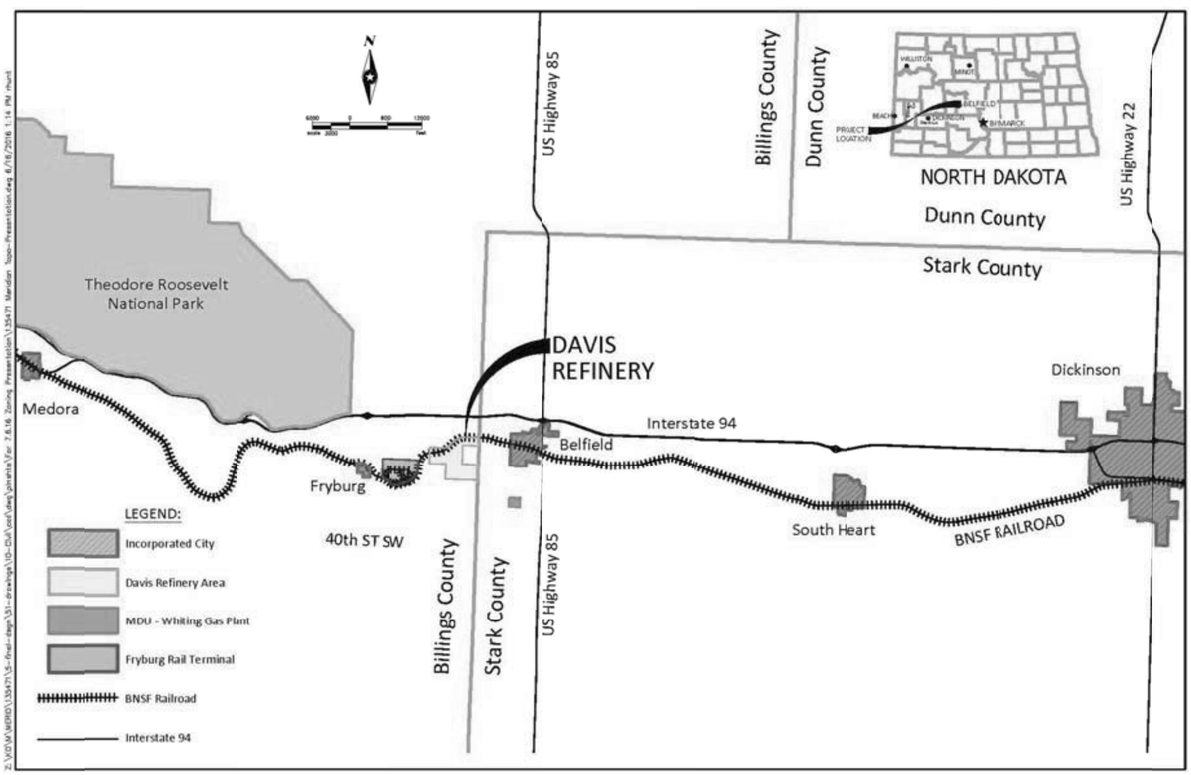

Figure 1: Proposed Site Location Davis Refinery Project, Billings County, ND

Terrain generally rises to the north and west and falls away to the south and east from the site, with the highest locations in proximity to the site being approximately 8-12 miles away and within the boundaries of the nearby Theodore Roosevelt National Park (TRNP) to the west. A review of the land use in the immediate area (3 kilometers) indicates that the subject site is in a rural, farmland area.

1.2 GENERAL REGULATORY OVERVIEW

As noted, Meridian has submitted a PTC for this project to the NDDoH in October 2016. As part of the process of obtaining a PTC and based on review of NDDoH guidance and criteria, the NDDoH is requiring air impacts modeling of the facility's potential impacts to surrounding lands. This is due to the proximity to the TRNP and the high level of public interest in the project. This "Summary Report of Model Results" describes the refined analysis that Zia Engineering and Environmental (Zia), on behalf of Meridian and their primary consultant Vepica USA, Inc. (Vepica), has performed.

The proposed subject site is located in an air attainment area for all criteria pollutants. The project triggers the new source review requirements of the NDDoH under "Designated Air Contaminant Sources Permit to Construct" rules (Chapter 33-15-14) as well as related NDDoH permitting and modeling guidance.

Included in this report is discussion of the analysis and modeling approach as well as summary discussion of results. Specifically, this document summarizes the modeling evaluation of the facility's short range (20 kilometer) air quality impacts in Class II areas as well as the preliminary analysis of impacts to the nearby Class I area (Theodore Roosevelt National Park – South Unit).

As stated in the New Source Review Workshop Manual (Draft 1990): "Class I areas are areas of special national or regional natural, scenic, recreational, or historic value for which the PSD regulations provide special protection." "One way in which air quality degradation is limited in all Class I areas is by stringent limits defined by the Class I increments for sulfur dioxides, particulate matter and nitrogen dioxide. In addition, the Federal Land Manager (FLM) of each Class I area is charged with the affirmative responsibility to protect that area's unique attributes, expressed generically as air quality related values (AQRV's)".

The proposed project location is approximately 2.5 miles southeast of the South Unit of Theodore Roosevelt National Park, a designated Class I area. Due to the close proximity of the project to the Class I area, air dispersion modeling of potential impacts to the Class I area is required by NDDoH in accordance the "Site Specific Modeling Guidance" issued for the project and dated June 20, 2016.

This model analysis has been prepared based on the NDDoH's requirements defined in the "Criteria Pollutant Modeling Requirements for a Permit to Construct" memo dated October 6, 2014 as well as the project specific NDDoH "Site Specific Modeling Guidance" issued for the project and dated June 20, 2016. Also included with the Summary Report submittal are electronic copies of all input and output files of the model analysis as well as related electronic copies of spreadsheets used to support the analysis. File name references and file titles are included as Attachment A of this document. This report includes analysis and discussion both of criteria pollutant impacts under New Source Review Standards (NSR) as well as analysis of air toxics impacts required under the NDDoH Air Toxics Policy and specifically under Section 33-15-02-04, subsection 3 of the North Dakota Air Pollution Control Rules.

2.0 CRITERIA POLLUTANTS ANALYSIS REQUIREMENTS

The NDDoH Division of Air Quality (DAQ) has primary jurisdiction for permitting and operating issues involving air quality at the subject site. As such, the Project is required to comply with the applicable sections of the NDDoH “Criteria Pollutant Modeling Requirements for a Permit to Construct” memo dated October 6, 2014 as well as the project specific NDDoH “Site Specific Modeling Guidance” issued for the project and dated June 20, 2016, as applicable. In addition, Zia prepared and submitted a “Modeling Protocol” document dated August 2016 that summarized proposed approach and methods for the modeling analysis.

The Project is a 55,000 bpd oil refinery facility. However, as shown in Table 2 and based on the proposed level of controls, the facility qualifies as a synthetic minor source. More detailed discussions of emissions estimates and facility and emissions controls is included in the PTC document and related supporting submittals. As a synthetic minor source, it does not meet PSD major source triggers for any of the criteria pollutants. However, based on its location near a Class I area, as well as the general level of public interest, the NDDoH is requiring at least screen modeling analysis for both Class I and Class II National Ambient Air Quality Standards (NAAQS) Significant Impact Levels (SILs). Shown in Table 1 is a summary of the NAAQS SILs that the facility is required to meet for preliminary screening analysis.

Initially, Class I and Class II Significant Impact Level (SIL) modeling is conducted. If the initial screen modeling passes Class I and Class II SILs, further dispersion modeling is not required. If the initial screen modeling exceeds Class I or Class II SILs, then refined dispersion modeling must be conducted for PSD increment consumption and Federal and State Ambient Air Quality Standards (AAQS).

Table 1 – Summary of NAAQS Significant Impact Levels ($\mu g/m^3$) For Preliminary Screening Analysis
Davis Refinery Project, Billings County, ND

	1-hour		3-hour		8-hour		24-hour		Annual	
Pollutant	**Class I**	**Class II**	**Class I**	**Class II**	**Class I**	**Class II**	**Class I**	**Class II**	**Class I**	**Class II**
SO_2	--	7.8	1.0	25	--	--	0.2	5	0.1	1
NO_2	--	7.5	--	--	--	--	--	--	0.1	1
PM_{10}	--	--	--	--	--	--	0.2	5	0.1	1
$PM_{2.5}$	--	--	--	--	--	--	0.07	1.2	0.06	0.3
CO		2,000	--	--	--	500	--	--	--	--

Table 2a – Preliminary Summary of Potential to Emit – Primary Operating Scenario
Davis Refinery Project, Billings County, ND

Unit	Criteria Pollutants										HAPs
	CO	Pb	PM<10	Filterable PM <10	PM <2.5	Filterable PM <2.5	Condensable PM	NOx	SO_2	VOC	Total HAP
Leaks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	21.061	2.389
Tanks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9.174	4.479
Stationary Combustion Sources	91.418	0.002	8.003	2.001	8.003	2.001	6.002	46.404	1.921	17.605	1.620
Fluid Catalytic Cracking Unit	0.000	0.000	1.003	0.663	0.913	0.573	0.340	3.726	6.649	5.772	0.866
Catalytic Reforming Unit	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.043	0.793
Sulfur Recovery Plant	2.149	0.000	0.000	0.000	0.000	0.000	0.000	0.471	0.197	1.502	0.000
Vacuum Systems	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Blowdown System	0.828	0.000	0.005	0.005	0.005	0.005	0.000	3.658	5.198	0.154	0.000
Flares	0.736	0.000	0.067	0.017	0.067	0.017	0.050	0.438	0.005	0.048	0.000
Wastewater	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.520	0.524
Cooling Towers	0.000	0.000	1.863	0.000	0.000	0.000	0.000	0.000	0.000	0.355	0.000
Rail Product Loading	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.809	0.000
Truck Product Loading	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.734	0.000
Fugitive Dust	0.000	0.000	1.326	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Total Short Ton per Year	**95.131**	**0.002**	**12.266**	**2.686**	**8.988**	**2.596**	**6.392**	**54.697**	**13.969**	**69.776**	**10.670**

Table 2b – Preliminary Summary of Potential to Emit – Alternative Operating Scenario
Davis Refinery Project, Billings County, ND

Unit	Criteria Pollutants										HAPs
	CO	Pb	PM<10	Filterable PM <10	PM <2.5	Filterable PM <2.5	Condensable PM	NOx	SO_2	VOC	Total HAP
Leaks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7.237	0.366
Tanks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6.320	2.240
Stationary Combustion Sources	33.818	0.001	4.831	1.208	4.831	1.208	3.623	36.234	0.710	6.513	0.599
Fluid Catalytic Cracking Unit	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Catalytic Reforming Unit	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.029	0.546
Sulfur Recovery Plant	2.149	0.000	0.000	0.000	0.000	0.000	0.000	0.471	0.197	0.637	0.000
Vacuum Systems	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Blowdown System	0.414	0.000	0.003	0.003	0.003	0.003	0.000	1.829	2.599	0.077	0.000
Flares	0.213	0.000	0.030	0.008	0.030	0.008	0.023	0.228	0.004	0.041	0.000
Wastewater	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.234	0.261
Cooling Towers	0.000	0.000	0.932	0.000	0.000	0.000	0.000	0.000	0.000	0.177	0.000
Rail Product Loading	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.172	0.000
Truck Product Loading	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.279	0.000
Fugitive Dust	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Short Ton per Year	**36.594**	**0.001**	**5.797**	**1.218**	**4.864**	**1.218**	**3.646**	**38.762**	**3.511**	**27.716**	**4.011**

3.0 CRITERIA POLLUTANT MODEL APPROACH

3.1 INTRODUCTION

Zia conducted the air quality modeling using applicable sections of the NDDoH "Criteria Pollutant Modeling Requirements for a Permit to Construct" memo dated October 6, 2014 as well as the project specific NDDoH "Site Specific Modeling Guidance" issued for the project and dated June 20, 2016, as applicable. In addition, Zia had previously prepared and submitted a "Modeling Protocol" document dated August 2016 that summarized proposed approach and methods for the modeling analysis. Discussion of Zia's approach is included in subsequent sections of this document and compliance with guidance criteria is structured per the NDDoH, "Air Quality Dispersion Modeling Analysis Guide" (June 21, 2013). A copy of this document is included in Attachment B.

Model analysis results are detailed in Section 3.3 of this report. These results show that preliminary screen modeling shows impacts below the identified Class I and Class II SILs. Thus, analysis approach and results are structured to support discussion of the comparison to the SILs since no further criteria pollutant modeling analysis is otherwise required.

3.2 SCREENING ANALYSIS

Based on the level of modeling required by the NDDoH as well as the anticipated heightened level of interest related to the project and it's potential impacts, screening analysis using either AERSCREEN or SCREEN3 was not conducted for this project.

3.3 REFINED ANALYSES (SIL AND CUMULATIVE)

3.3.1 Model Selection

The air dispersion model used for the screen analysis was AERMOD with the BREEZE Software graphic user interface to load the data into the applicable EPA modules. The module versions used are as follows:

- AERMOD 15181 (Recommended)
- AERMET 15181
- AERMAP 11103
- AERSURFACE 13016
- BPIPPRM 040421

The proposed refinery site will be located 2.2 miles west of Belfield, ND. The geometric mean of the battery limits for the facility is:

UTM Coordinates, WGS84 datum
13T (Northern Hemisphere)
633538.294 m E
5193515.636 m N

The proposed site was surveyed and the resulting plot plan was referenced to UTM coordinates using AUTOCAD. The model used the georeferenced plot plan to determine the coordinate of the individual sources, stacks, and points of interest.

3.3.2 Emissions Inventory

Point Source Characteristics

Included in Attachment C are the Source Characteristics with the applicable physical characteristics of the point sources modeled in this analysis.

The model used National Elevation Data (NED) data downloaded from the USGS Nation Map website to determine the elevation of the sources and receptors. The USGS returned a .TIFF file bound by the following coordinates:

- North 46.628 N -103.25 E
- South 46.628 N -103.30 E
- West 46.876 N -103.61 E
- East 46.8346 N -103.609 E

The elevation data extends 110 km by 93 km in the easterly and northern directions, respectively. The proposed NDDR site and the Theodore Roosevelt National Park (TRNP) are within the boundaries of the downloaded elevation data. The extent of the region allows the variable receptor grid to extend 25 kilometers from fence line of the site in the direction of each compass point. The data were processed with AERMAP to extract the elevation of all sources and the park receptors, as well as their hill height scale.

Source Variable Stack Characteristics

There are two operating scenarios included in the analysis for this project. The Primary Operating Scenario includes full build-out of the project at a total maximum production capacity of 55,000 bpd with all anticipated emissions units and controls included. The Alternative Operating Scenario is described as Phase I build-out of the project, which is anticipated for the first 2-3 years of operation. The Phase I operation is proposed to be approximately 27,500 BPD. Besides overall production capacity, the primary difference between the Primary Operating Scenario and the Alternative Scenario includes several units, which will not be installed until Phase II and the delay of some proposed add-on pollution controls for NOx or PM in heaters and boilers until Phase II.

Both operating scenarios were separately modeled for this analysis and results of each analysis were compared to applicable SILs. Discussion of results is included in Section 3.5.

Stack Exit Velocity Adjustments

All the stacks in the NDDR proposed site are vertical. Thus, the adjustments for horizontal or capped stacks prescribed in the AERMOD Implementation Guide (08/03/2015) were not necessary.

Flare Point Source Characteristics

The flare characteristics were calculated using the November 10, 2010 NDDoH "Model Inputs for Flare" guideline. The results of the calculations are:

Table 3 – Calculation of Virtual Stack Model Characteristics
Davis Refinery Project, Billings County, ND#

ID	FLARE	X	Y	Elevation	Flare LHV		Net Heat Release	Stack Height	Flame Length	Virtual Stack Height	Virtual Stack Diameter
				(m)	MMBTU/h	Qt(Cal/s)	Q (cal/s)	hs (m)	hf (m)	hse (m)	Ds (m)
FL1701	#1 HC Emergency Flare	63350	5193594	810.8	0.156	10920.0	4914.0	45	0.39	45.4	0.05
FL1702	#2 HC Emergency Flare	633492	5193666	809.0	0.156	10920.0	4914.0	45	0.39	45.4	0.05
FL1703	#3 Acid Flare	633495	5193666	808.9	0.104	7280.0	3276.0	45	0.32	45.3	0.04
FL1704	#4 Enclosed HC Operating Flare	633601	5193607	808.9	0.624	43680.0	19656.0	15	0.75	15.8	0.10

Source: Flare Dimension Calculations.xlsx

The virtual stack characteristics were then entered into the model, along with the recommendation of a stack velocity of 40 m/s, and a stack temperature of 1000 K.

Table 4 – Virtual Stack Modeled Characteristics
Davis Refinery Project, Billings County, ND

ID	FLARE	X	Y	Elevation	Stack Model Characteristics			
				(m)	Height (m)	Diameter (m)	Velocity (m/s)	Temperature (k)
FL1701	#1 HC Emergency Flare	63350	5193594	810.8	45.4	0.05	40	1000
FL1702	#2 HC Emergency Flare	633492	5193666	809.0	45.4	0.05	40	1000
FL1703	#3 Acid Flare	633495	5193666	808.9	45.3	0.04	40	1000
FL1704	#4 Enclosed HC Operating Flare	633601	5193607	808.9	15.8	0.10	40	1000

Source: Flare Dimension Calculations.xlsx

Area Sources

No area volume sources were modeled.

Volume Sources

No volume sources were modeled.

Building Downwash

AERMOD and BPIPPRM were used together to determine the Good Engineering Practice Stack Heights (GEP Stack) and the building downwash. BPIP calculated the building height, length, and effective building width for 36 wind directions and provided the X and Y offsets for the adjustment routines. The model also included the storage tanks for the refinery as buildings.

This enabled the model to consider the possible contribution of the storage tanks to building downwash. The model files for the BPIP analysis are as follows:

- *BPIPIN.txt*
- *BPIPOUT.txt*
- *BPIPSUMMARY.txt*

Electronic copies of these files are provided with this report.

<u>Off Site Sources</u>
The *ND Air Dispersion Modeling Guide* does not require the consideration of off-site sources when modeling for Significant Impact Levels (SIL) or Air Toxics.

3.3.3 Meteorological Data

<u>Selection of Meteorological Observations</u>
AERMET version 15181 was used to process five consecutive years of meteorological data for the period of 01/01/2009 to 12/31/2013 from the following stations:

24012 KDIK DICKINSON THEODORE ROOSEVELT R UNITED STATES NORTH DAKOTA
+46.799 -102.797 +786.4
24011 KBIS BISMARCK UNITED STATES NORTH DAKOTA
+46.774 -100.75 +506

<u>Application of AERSURFACE to Process Land Surface Characteristics</u>
The *AERSURFACE Input Recommendations* (09/16/2010) provided by the NDDoH were used in conjunction with AERSURFACE 13016 to generate the SURFACE and PROFILE files. The month to season assignment used was the Southwest North Dakota distribution.

The applicable and resulting files of the *AERSURFACE* program are listed below. Electronic copies of these files are provided with this report.

- *AERMET0913SFC.SFC*
- *AERMET0913PFL.PFL*
- *AERMET0913MRG.MRG*

3.3.4 Receptor Locations

<u>Primary Receptor Network</u>
The refinery site will be fenced at the approximate property boundary to limit public access. As such, for modeling purposes it was modeled as a closed polygon. Per direction from NDDoH guidance, fence line receptors were set apart at 25 meter intervals. The datum for the receptor intervals was placed on the geometric mean of the site. Additional grid receptors were then spaced out per the distances below up to a maximum distance of approximately 23.85 km from the property boundaries (see Table 5).

Table 5 – Non-Uniform Cartesian Grid, Distance and Interval Distribution
Davis Refinery Project, Billings County, ND

Sector	Distance (m)	Interval (m)
1	0-1500m	100
2	1500-10000	250
3	10000-18500	500
4	18500-23850	1000

Additional Receptors Requested

The NDDoH requested that additional receptors be placed in the model for the following locations:

Table 6 – Requested Additional Receptors
Davis Refinery Project, Billings County, ND

Receptor Name	X	Y	Elevation (m)
Painted Canyon Visitor Center	623269.0	5194740.0	847.91
Buckhill Trail Parking Area	622580.0	5198267.0	851.56
TRNP Amphitheater	610813.0	5196768.0	763.33
TRNP Visitor Center	612373.0	5196908.0	691.23

Source: Additional Receptors.xlsx

While individual receptors for these points were established in the model, the highest modeled impacts within the Class I area was not identified in any instance as being close to these receptors and all levels at these receptor points were identified as being significantly below the applicable Class I SIL levels. Impact levels at these specific receptors are identified in the model output files.

Nearby Sources

Per NDDoH guidelines, no nearby sources were included in the preliminary modeling for comparison to SILs. Thus, no receptors associated with nearby sources are included.

Application of AERMAP

The model used National Elevation Data (NED) data downloaded from the USGS Nation Map website to determine the elevation of the sources and receptors. The USGS returned a .TIFF file bound by the following coordinates:

- North 46.628 N -103.25 E
- South 46.628 N -103.30 E
- West 46.876 N -103.61 E
- East 46.8346 N -103.609 E

The elevation data extends 110 km by 93 km in the easterly and northern directions, respectively. The proposed NDDR site and the Theodore Roosevelt National Park (TRNP) are within the boundaries of the downloaded elevation data. The extent of the region allows the variable receptor grid to extend 25 kilometers from fence line of the site in the direction of each compass point. The data were processed with AERMAP verseion 11103 to extract the elevation of all sources and the park receptors, as well as their hill height scale.

3.3.5 Background Concentrations

Per NDDoH modeling guidelines, the background concentration of SO_2, NO_2, PM_{10}, $PM_{2.5}$, and CO were not applicable to the Significant Impact Level (SIL) analysis for the proposed facility.

3.4 AERMOD EXECUTION

A model analysis was run for each of the criteria pollutants that have a corresponding SIL value for both Class I and Class II areas. This was done for both the primary (full production operating scenario as well as the alternative (Phase I = 27,500 bpd) scenario. The following options and assumptions were used in execution of the AERMOD model:

- Pollutant concentrations were calculated to match the frequencies of the SIL values listed in Table 1.
- Based on development on the adjacent properties and the planned use of the Project site area, the model was run using a rural option.
- Five year of representative hourly meteorological data was used (2009 – 2013). Per the Dispersion Modeling Guidelines, the MAKEMET interface was utilized in AERMET for processing of meteorological data.
- it was assumed that 80% of NO_x is converted to NO_2
- Emissions rates were assumed constant.
- Emissions for all stack locations will be modeled as point sources.
- Flare sources were modeled using AERMET flare source option in order to model as point sources.
- Building wake downwash was analyzed, as applicable, based on facility site designs using the BPIPPRM to automate the processing of terrain and building information.
- AERMOD was run using site specific terrain using AERMAP to process DEM data using obtained Geo-TIF data.

3.5 INTERPRETATION OF AERMOD MODEL OUTPUT

To identify the potential near source impacts of the project, the U.S. EPA's AERMOD dispersion model was used for modeling of project only preliminary estimates of pollutant emission rates and stack exit conditions. These results were compared to NAAQS SILs shown in Table 1. Determination of compliance with the SILs within the established receptor grid was conducted for all criteria pollutants. Since the NAAQS SILs are met for both Class I and Class II areas, then no further dispersion modeling shouldl be required. A summary of the highest modeled result for each of the SIL values is shown in Table 7a and 7b for both the primary and alternative operating scenarios, respectively. Identification of the location of each of the highest values for the Class I and Class II SIL comparisons is shown in Tables 8 and 9.

Table 7a – Summary of Modeled Highest Values Compared to NDDoH SILs – Primary Operating Scenario
Davis Refinery Project, Billings County, ND

1-Hour			3-Hour				8-Hour				24-Hour				
	Results		Limits		Results		Limits		Results		Limits		Results		Limit
ss II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I
8	-	2.17	1.0	25	0.635	1.06	-	-	-	-	0.2	5	0.142	0.469	0.1
5	-	7.1	-	-	-	-	-	-	-	-	-	-	-	-	0.1
	-		-	-	-	-	-	-	-	-	0.2	5	0.025	0.638	0.2
	-	-	-	-	-	-	-	-	-		0.07	1.2	0.047	0.168	0.06
00	-	2.17	-	-	-	-	-	500	-	0.65	-	-	-	-	-

Table 7b – Summary of Modeled Highest Values Compared to NDDoH SILs – Alternative Operating Scenario
Davis Refinery Project, Billings County, ND

1-Hour			3-Hour				8-Hour				24-Hour				
	Results		Limits		Results		Limits		Results		Limits		Results		Limit
ss II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I
8	-	0.102	1.0	25	0.026	0.068	-	-	-	-	0.2	5	0.008	0.036	0.1
5	-	3.72	-	-	-	-	-	-	-	-	-	-	-	-	0.1
	-		-	-	-	-	-	-	-	-	0.2	5	0.063	0.331	0.2
	-	-	-	-	-	-	-	-	-		0.07	1.2	0.025	0.140	0.06
00	-	4.88	-	-	-	-	-	500	-	2.33	-	-	-	-	-

Table 8a – Class I Areas PSD Increments and Significant Impact Levels
Primary Operating Scenario
Davis Refinery Project, Billings County, ND

Pollutant / Averaging Time	Significant Impact Level ($\mu g/m^3$)	Modeled Result ($\mu g/m^3$)	Receptor Location / Coordinate	
			X	Y
PM_{10}; Annual	0.2	6.27E-03	627610.4	5195675.9
PM_{10}; 24 hour	0.2	2.53E-02	622580	5198267
$PM_{2.5}$; Annual	0.06	2.49E-03	627610.4	5195675.9
$PM_{2.5}$; 24 hour	0.07	4.69E-02	627610.4	5195675.9
SO_2; Annual	0.1	4.92E-03	627610.4	5195675.9
SO_2; 24 hour	0.2	1.42E-01	620933.44	5195745.45
SO_2; 3 hour	1.0	6.35E-01	627610.4	5195675.9
NO_2; Annual	0.1	2.54E-02	627860.4	5195425.9

Table 8b – Class I Areas PSD Increments and Significant Impact Levels
Alternative Operating Scenario
Davis Refinery Project, Billings County, ND

Pollutant / Averaging Time	Significant Impact Level ($\mu g/m^3$)	Modeled Result ($\mu g/m^3$)	Receptor Location / Coordinate	
			X	Y
PM10; Annual	0.2	2.21E-03	627610.4	5195675.9
PM10; 24 hour	0.2	6.32E-02	620933.44	5195745.45
PM2.5; Annual	0.06	1.51E-03	627610.4	5195675.9
PM2.5; 24 hour	0.07	2.46E-02	628110.4	5197675.9
SO2; Annual	0.1	4.53E-02	627610.4	5195675.9
SO2; 24 hour	0.2	8.14E-03	620933.4	5195745.5
SO2; 3 hour	1.0	2.64E-02	620933.4	5195745.5
NO2; Annual	0.1	1.50E-02	627610.4	5195675.9

Table 9a – Class II Areas PSD Increments and Significant Impact Levels
Primary Operating Scenario
Davis Refinery Project, Billings County, ND

Pollutant / Averaging Time	Significant Impact Level (μg/m^3)	Modeled Result (μg/m^3)	Receptor Location / Coordinate	
			X	Y
PM_{10}; Annual	1.0	6.35E-02	634060.375	5193076
PM_{10}; 24 hour	5.0	6.38E-01	633311.375	5192899
$PM_{2.5}$; Annual	0.3	1.74E-02	634460.4	5192876.0
$PM_{2.5}$; 24 hour	1.2	1.68E-01	634460.4	5192876.0
SO_2; Annual	1.0	2.75E-02	634560.4	5192876.0
SO_2; 24 hour	5.0	0.47	634460.4	5192876.0
SO_2; 3 hour	25	1.06	627610.4	5193426.0
SO_2; 1 hour	7.8	2.17	630960	5195676
NO_2; Annual	1.0	2.87E-01	634060.375	5193076
NO_2; 1 hour	7.5	7.10	630360.375	5192176
CO; 8 hour	500	0.65	634360.375	5193476
CO: 1 hour	2000	2.17	630960.375	5195676

Table 9b – Class II Areas PSD Increments and Significant Impact Levels
Alternative Operating Scenario
Davis Refinery Project, Billings County, ND

Pollutant / Averaging Time	Significant Impact Level (μg/m^3)	Modeled Result (μg/m^3)	Receptor Location / Coordinate	
			X	Y
PM10; Annual	1.0	2.21E-02	634060.375	5192876
PM10; 24 hour	5.0	3.31E-01	634060.375	5192876
$PM_{2.5}$; Annual	0.3	1.28E-02	634060.4	5192976.0
$PM_{2.5}$; 24 hour	1.2	1.39E-01	634060.4	5192876.0
SO_2; Annual	1.0	2.52E-03	634060.4	5192976.0
SO_2; 24 hour	5.0	3.55E-02	634060.4	5192876.0
SO_2; 3 hour	25	6.82E-02	633372.1	5193743.0
SO_2; 1 hour	7.8	1.02E-01	635260.4	5192976
NO_2; Annual	1.0	1.27E-01	634060.4	5192976
NO_2; 1 hour	7.5	3.72	627610.4	5193426
CO; 8 hour	500	2.33	633354.7	5193725.0
CO: 1 hour	2000	4.88	635260.4	5192976.0

4.0 AIR TOXICS ANALYSIS

4.1 DAVIS REFINERY TIER 3 ANALYSIS

To determine compliance with the applicable Guideline Concentration (GC) (8-hour GC, 1-hour GC, or carcinogenic risk criteria) of the policy of the Control of Hazardous Air Pollutant Emissions in North Dakota (NDDH policy), the maximum off-property, ground-level ambient concentration of each Hazardous Air Pollutant (HAP) emitted from an affected HAP source was calculated using the Tier 3 approach as outlined by the NDDoH Air Toxics Policy. The candidate model used for the Tier 3 procedure was BREEZE AERMOD. AERMOD was utilized to model the highest 1-hour and 8-hour HAP concentration beyond project boundaries. These values were then used for further analysis using the Tier 3 approach per the Air Toxics Policy.

For HAPs with known or possible carcinogenic health effects (i.e., those HAPs for which a unit risk factor has been developed in Appendix B of the NDDH policy), the maximum individual carcinogenic risk (MICR) associated with emissions from the source was calculated as outlined in the Determination of Compliance section of the NDDH policy. Similarly, the non-carcinogenic health effects of HAPs emitted from a source was evaluated by determining the hazard index for the HAPs for which an 8-hour GC or 1-hour GC has been established in Appendix A of the NDDH policy.

The following calculations have been performed:

1. Estimating the maximum 1-hour and 8-hour concentrations using the following formula:
   - Maximum 1-hour concentration: Total modeled 1-hour concentration (mg/m3) × weight percentage of each HAP.
   - Maximum 8-hour concentration: Total modeled 8-hour concentration (mg/m3) × weight percentage of each HAP.
2. Conducting the MICR analysis using the following equation:
   - MICR = 1-hour concentration (μg/m3) × Unit Risk Factor (m3/μg)
3. Determining the hazard index for HAPs for which a Guideline Concentration has been established in Appendix A of the NDDH policy. For the HAPs which have both 1-hour and 8-hour GCs, the higher of the two ratios (MC/GC) was utilized in the following equation:
   - Hazard Index = MC1/GC1 + MC2/GC2 + … + MCn/GCn
   - Where MC1, MC, …, MCn are the modeled concentrations for HAPs 1, 2, …, n and GC1, GC2, …, GCn are Guideline Concentration for HAPs 1, 2, …, n.

4.2 AIR TOXICS ANALYSIS RESULTS

The MICR of all HAPs emitted by point sources at the proposed new refinery, in aggregate, is 4.57×10^{-6}, which is less than the NDDH Policy threshold of 1.00×10^{-5}.

The Hazard Index for the proposed new refinery, in aggregate, is 7.95×10^{-2}, which is less than the maximum hazard index of 1.00 for a new source.

The MICR and the hazard index are below the respective thresholds for each chemical category; therefore, the proposed Davis Refinery is in compliance with the NDDH air toxics policy. Emission calculations and the details of the air toxics analysis can be found in Attachment D.

ATTACHMENT A

Electronic Files Lists and Titles

ATTACHMENT A
ELECTRONIC FILES LIST FOR MODELING AND ANALYSIS
DAVIS REFINERY PROJECT, BILLINGS COUNTY, ND

AERMET PROCESSED FILES

- AERMET0913MRG.MRG
- AERMET0913PFL.PFL
- AERMET0913SFC.SFC
- NDDR2009-2013.atz

Bismarck Upper Air Data

- BIS24011-072016.144.txt
- BIS24011-072016.DAT
- BIS24011-072016.txt
- BIS24011FSL.txt

BPIP

- BPIPIN.txt
- BPIPOUT.txt
- BPIPSUMMARY.txt

Dickinson Upper Air Data

- 2013data
- 2013data,inp
- 2013data.inp,txt
- Description.txt
- Invntory.txt
- Station.txt

ELEVATION DATA

- 10012016.bhm
- 10012016.jpg
- NED07192016
- NED072061367.zip

ATTACHMENT A
ELECTRONIC FILES LIST FOR MODELING AND ANALYSIS
DAVIS REFINERY PROJECT, BILLINGS COUNTY, ND

Output Files

Phase I Files

- SOX PHASE I ANNUAL.txt
- SOX PHASE I 24-H.txt
- SOX PHASE I 3-H.txt
- SOX PHASE I 1-H.txt
- PM 25 PHASE I ANNUAL.txt
- PM 25 PHASE I 24-H.txt
- PM 10 PHASE I ANNUAL.txt
- PM 10 PHASE I 24-H.txt
- NO2 PHASE I ANNUAL.txt
- NO2 PHASE I 1-H.txt
- CO PHASE I 8-HL.txt
- CO PHASE I 1-HL.txt

Phase II Files

- SOX PII 3-H.txt
- SOX PII 1-H.txt
- SOX PII 24-H.txt
- SOX PII ANNUAL.txt
- NO2 PII ANNUAL.txt
- NO2 PII 1-H.txt
- PM 10 PII ANNUAL.txt
- PM 10 PII 24-H.txt
- PM 2.5 PII AANUAL.txt
- PM 2.5 PII 24-H.txt
- CO PII 1-H.txt
- CO PII 8H.txt

ATTACHMENT A
ELECTRONIC FILES LIST FOR MODELING AND ANALYSIS
DAVIS REFINERY PROJECT, BILLINGS COUNTY, ND

Phase I In/Out Model Files

CO Phase I
- COPHASE110082016.ami
- COPHASE110082016.amz

NO2 Phase I
- NO2PHASE110082016.ami
- NO2PHASE110082016.amz

PM 2.5 Phase I
- PM25PHASE110082016.ami
- PM25PHASE110082016.amz

PM 10 Phase I
- PM10 PI 10132016.ami
- PM10 PI 10132016.amz

SO2 Phase I
- SOXPHASE110082016.ami
- SOXPHASE110082016.amz

Phase II In/Out Model Files

CO Phase II
- CO Phase II.ami
- CO Phase II.amz

NO2 Phase II
- NO2 Phase II.ami
- NO2 Phase II.amz

PM 2.5 Phase II
- PM25 Phase II.ami
- PM25 Phase II.amz

PM 10 Phase II
- PM10 Phase II.ami
- PM10 Phase II.amz

SO2 Phase II
- SO2 Phase II.ami
- SO2 Phase II.amz

Air Toxics Analysis
- Tier 3 Analysis.xlsx
- Air Toxics Analysis.xlsx

ATTACHMENT B

Air Quality Dispersion Analysis Guide

North Dakota Department of Health, Division of Air Quality
Air Quality Dispersion Modeling Analysis Guide

June 21, 2013

The following Air Quality Modeling Analysis Guide is provided by the North Dakota Department of Health (Department) to aid air permit applicants in the process of developing an air dispersion modeling protocol and in conducting an air dispersion modeling analysis. This general Guide outlines common topics that should be addressed in a dispersion modeling analysis and report for projects located in North Dakota. As each project is unique, the Guide should not be considered "all inclusive" and some important items for a given project may not be reflected in the itemized list below. The Department should be consulted at an early stage in the project to assure that essential items are addressed in any final modeling analysis.

The Department strongly encourages the development of a pre-application dispersion modeling protocol in consultation with the Department in order to expedite the ultimate project review process. This Guide will aid in the development of that protocol.

A list of applicable State issued modeling guidance documents covering specific issues is included at the end of this Guide. Note that these documents include criteria to determine whether modeling will be required for a permit-related project. Also included is guidance related to air toxics analyses. Please contact the Department with any project-specific questions or concerns by calling 701.328.5188.

To the extent applicable, the information in this Guide is consistent with the EPA Guideline on Air Quality Models[1]. The Department Guide is intended to clarify EPA Guidance for applicability to North Dakota regulatory projects, and to supplement EPA guidance on issues where guidance is not specifically provided. This Guide assumes basic familiarity with regulatory air quality modeling applications on the part of the reader.

It is expected that the information contained in this Guide will be updated frequently, so the Department's Web site[2] should be actively monitored for the most recent version. At this time, the Guide applies primarily to local scale modeling analyses for NAAQS, PSD Class II increments, and air toxics thresholds. Future updates to this Guide or supplemental documents will include modeling guidance for Class I PSD increments and air quality related values (AQRVs). If you anticipate that your project will need to address one of these two conditions or any other item not specifically covered by the Guide at this time, please consult with the Department directly for further information and guidance.

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[1] CFR, 2005. EPA Guideline on Air Quality Models. 40 CFR (Code of Federal Regulations) Part 51, Appendix W.

[2] http://www.ndhealth.gov/AQ/DispersionModeling.htm

I. Modeling for NAAQS, NDAAQS, PSD Class II increments, Air Toxics thresholds

A. Screening Analyses (optional for isolated single source)

1. Model selection:

- ☐ AERSCREEN – applicable if significant terrain height variations involved. Because of the relative complexity (for a screening tool) involved in executing and reviewing AERCREEN analyses, the NDDH discourages the use and submittal of AERSCREEN screening techniques for projects in North Dakota. Direct application of refined modeling using AERMOD is recommended if significant terrain height variations are associated with an isolated single source.
- ☐ SCREEN3 – applicable only in relatively level terrain.

2. Model input/execution:

- ☐ AERSCREEN – Refer to AERSCREEN User's Guide for information on input data and execution for AERMOD. As noted above, the NDDH discourages the use of AERSCREEN for projects in North Dakota.
- ☐ SCREEN3 - Command line program which prompts user for all necessary input data (EPA version).

B. Refined Analyses (SIL and cumulative)

1. Model selection:

- ☐ AERMOD (provide version number)

2. Emission inventory:

- ☐ Subject source
  - ☐ Point source fixed stack characteristics for each emission unit:
    - Location (e.g., UTM coordinates)
    - Stack height
    - Stack base elevation (above MSL)

- Stack exit diameter
- Stack orientation (e.g., vertical up, vertical down, horizontal, rain caps, etc.)

☐ Point source variable stack characteristics for each emission unit. Ensure that worst case emission scenarios are accounted for (i.e., consider multiple operating loads, start-up, shut-down) For combustion turbines, where emissions are particularly sensitive to ambient temperature, emission scenarios should also account for a range of ambient temperatures.

- Emission rate for each applicable pollutant species
- Stack exit velocity
- Stack exit temperature

☐ Appropriate adjustment of stack exit velocity based on stack orientation (See AERMOD Implementation Guide[3])

☐ Appropriate determination of point source stack characteristics for flares (See Flare Guidance). Stack characteristics which are adjusted for flares include stack height, stack diameter, exit velocity, and exit temperature.

☐ Area source characteristics for each emission unit (if any):

- Emission rate for each applicable pollutant species
- Boundary of area
- Effective height of area emissions

☐ Volume source characteristics for each emission unit (if any):

- Emission rate for each applicable pollutant species
- Effective dimensions
- Height of center of volume source
- The NDDH does not require inclusion of paved road fugitive emissions in modeling analyses.

☐ Building downwash characteristics for each affected (less than GEP height) point-source stack, developed using the EPA BPIPPRM program (include a plant layout drawing):

- Building height for 36 wind directions
- Effective building width for 36 wind directions
- Building length for 36 wind directions
- X offset for 36 wind directions (XBADJ)
- Y offset for 36 wind directions (YBADJ)

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[3] EPA, 2009. AERMOD Implementation Guide: March 19, 2009. Accessed at: http://www.epa.gov/scram001/7thconf/aermod/aermod_implmtn_guide_19March2009.pdf. June 20, 2013

☐ Off-site (nearby) sources (not applicable for SILs or Air Toxics analyses). For PSD projects, the impact of emissions from all sources located within 50 km of the subject source should generally be included in the modeling analysis. For non-PSD projects, the impact of emissions from all sources located within 20 km of the subject source should generally be included in the modeling analysis. Impact from sources not explicitly modeled will be accounted for with the background concentration(s).

- ☐ Point source stack characteristics for each nearby-source unit:
  - Emission rate for each applicable pollutant species. Emission rate should reflect maximum allowable (permitted). For PSD increment analyses, or if maximum allowable not available for AAQS analyses, actual emission rate may be used.
  - Location (e.g., UTM coordinates)
  - Stack height
  - Stack base elevation (above MSL)
  - Stack exit diameter
  - Stack exit velocity
  - Stack exit temperature
  - Stack orientation (e.g., vertical up, vertical down, horizontal, rain caps, etc.)
- ☐ Appropriate adjustment of stack exit velocity based on stack orientation (See See AERMOD Implementation Guide[4])
- ☐ Appropriate determination of point source stack characteristics for flares (See Flare Guidance). Stack characteristics which are adjusted for flares include stack height, stack diameter, exit velocity, and exit temperature.
- ☐ The NDDH should be consulted regarding the need for including building downwash effects for nearby sources.

NOTE: Stack characteristics for nearby sources can typically be obtained from the Department. Please contact the Department for more information.

3. Meteorological data:

☐ Selection of meteorological observations:

- ☐ Five consecutive years of recent representative National Weather Service (NWS) hourly surface observations (identify station).

[4] EPA, 2009. AERMOD Implementation Guide: March 19, 2009. Accessed at: http://www.epa.gov/scram001/7thconf/aermod/aermod_implmtn_guide_19March2009.pdf. June 20, 2013

- ☐ Five concurrent years of NWS twice-daily upper-air observations (identify station).
- ☐ Surface observations from non-NWS sites may be considered as an option (e.g., on-site, Department monitoring sites), but the Department should be contacted regarding the availability and acceptability of such data, as well as pairing such data with NWS upper-air observations.

☐ Application of AERSURFACE (specify version number) to process land surface characteristics for use with AERMET. (See Department guidance for AERSURFACE input settings.)

☐ Application of AERMET (specify version number) to process surface observations, upper-air observations, and AERSURFACE output in order to create the SURFACE and PROFILE files required by AERMOD.

NOTE: AERMET-compatible surface and upper-air five-year meteorological data sets for a number of NWS stations located in and near North Dakota are available via the Department's FTP site[5].

4. Receptor locations:

☐ Specify primary receptor network (a case-by-case determination will likely be required, but the following is a typical configuration for medium-buoyancy sources):

- ☐ Receptors spaced at 25 m along the limited access (fenced) boundary (ambient air boundary). If access is not limited, receptor coverage must include entire property area.
- ☐ Nested Cartesian receptor grids outside of the fenced boundary. Resolution of nested receptor grids should proceed in a geometric pattern, e.g., 50 m for the inner grid, 100 m for the next grid, 250 m for the next grid, and 500 m for the outside grid. The maximum extent of the outside grid will depend on the buoyancy (plume height) of the source. Generally, a grid extending out to 10 km from the source will be adequate for a medium-buoyancy source.

☐ In addition to the primary network, additional receptors may be needed to address isolated terrain features, impact from low-level sources located near the facility fence line, and to refine predictions when the maximum modeled impact occurs at a receptor located in a relatively coarse portion of the primary receptor network.

☐ If the analysis includes nearby sources, the Department may request that additional receptors are placed to account for the maximum combined impact of the subject source and the nearby source.

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[5] ftp://ftp.state.nd.us/AirQuality/AERMOD/

☐ Obtain digital elevation data (e.g., NED) for the modeling domain.

☐ Application of AERMAP (specify version number) to receptor locations and digital elevation data in order to determine receptor elevation and hill-height scale needed for AERMOD.

☐ Provide map showing receptor locations and elevation with respect to source location(s).

5. Background concentrations (account for contribution of natural and non-modeled anthropogenic sources, not applicable for SILs or Air Toxics analyses):

☐ Fixed background concentrations for SO_2, NO_2, PM_{10}, $PM_{2.5}$, and CO (all averaging times) are provided in Table 1. These fixed background levels reflect default values which are representative for the entire State of North Dakota. The Department should be contacted regarding representativeness and current status of these values for a particular modeling project.

☐ Variable (hourly) background concentration files for SO_2 and NO_2 are available for several locations on the Department's FTP site[6]. These hourly background files cover a five-year period and are concurrent with the meteorological data sets also provided on the FTP site.

☐ Hourly ozone background concentration files are also provided on the Department's FTP site for several locations. These ozone data sets are provided to implement the Ozone Limiting Method (OLM) for NO_2 Tier 3 analysis.

NOTE: The use of hourly background concentration data for SO_2 and NO_2, if representative data are available for the project location, will produce the least conservative results when added to model output (i.e., less conservative than use of fixed background concentrations).

Table 1
Fixed Background Concentrations for North Dakota
($\mu g/m^3$)

Pollutant	**Averaging Period**				
	1-hour	**3-hour**	**8-hour**	**24-hour**	**Annual**
SO_2	13	11	---	9	3
NO_2	35	---	---	---	5
PM_{10}	---	---	---	30	15
$PM_{2.5}$	---	---	---	13.7	4.75
CO	1149	---	1149	---	---

[6] ftp://ftp.state.nd.us/AirQuality/AERMOD/

6. AERMOD execution:

- ☐ Execute AERMOD for emission inventory, meteorological data, receptor locations, and with background concentrations, as outlined above:
  - ☐ Use regulatory default option.
  - ☐ Specify rural source (urban may be appropriate in rare cases).
  - ☐ Use appropriate options for processing form of new 1-hour NAAQS for SO_2 and NO_2, and 24-hour NAAQS for PM_{10} and $PM_{2.5}$.
  - ☐ Use proper settings to implement Tier 3 NO_2 analysis (if applicable):
    - The Department prefers the OLM option to PVMRM.
    - With OLM, use setting "OLMGROUP ALL".
    - Use hourly ozone background data file (above).
    - Contact vendor and Department for appropriate in-stack ratios of NO_2 to NO_X. Use of a default value of 0.5 is acceptable without justification.
    - Note that EPA approval is needed regarding protocol for Tier 3 NO_2 analysis.
  - ☐ Add background concentrations to model results (not applicable for SILs or Air Toxics analyses, and generally not applicable for PSD increment analyses).

7. Interpretation of model output:

- ☐ Comparison of results with acceptable air quality thresholds:
  - ☐ Significant impact levels (see Table 2)
  - ☐ NAAQS/NDAAQS (see Table 3)
  - ☐ PSD Class II increments (see Table 4)
  - ☐ Air Toxics thresholds (MICR and Hazard Index, see State Air Toxics Policy)
- ☐ Provide receptor location of maximum impact for each species and averaging times. Location of maximum impact should be subsequent to processing the form of the NAAQS (e.g., 5-year average of annual 99th percentile of daily maximum 1-hour average concentration for SO_2).

8. Submittal of modeling report:

- ☐ A modeling report, including a detailed description of all input data, model execution, and results, should be prepared and provided with the permit application.
- ☐ All computer modeling files should be submitted along with the modeling report.
- ☐ An electronic copy of the modeling report should be submitted along with at least three hard copies. Electronic submittal should included both PDF and MS Word (or other native) versions.

Table 2
Class II Area Significant Impact Levels
($\mu g/m^3$)

Pollutant	**Averaging Period**				
	1-hour	**3-hour**	**8-hour**	**24-hour**	**Annual**
SO_2	7.8	25	---	5	1
NO_2	7.5	---	---	---	1
PM_{10}	---	---	---	5	1
$PM_{2.5}$	---	---	---	1.2	0.3
CO	2000	---	500	---	---

Table 3
North Dakota and National Ambient Air Quality Standards (AAQS)
Criteria Pollutants (µg/m³)

Pollutant	Averaging Period	N.D. AAQS	National AAQS
Sulfur Dioxide (SO_2)	1-hour	196[2]	196[2]
	3-hour	1309[1]	1309[1]
	24-hour	---	365[1]
	Annual	---	80
Nitrogen Dioxide (NO_2)	1-hour	188[3]	188[3]
	Annual	100	100
Inhalable Particulate (PM_{10})	24-hour	150[1]	150[1]
Particulate ($PM_{2.5}$)	24-hour	35[4]	35[4]
	Annual	15[5]	12[5]
Carbon Monoxide (CO)	1-hour	40,000[1]	40,000[1]
	8-hour	10,000[1]	10,000[1]
Lead (Pb)	Quarterly	1.5	1.5

[1] One exceedance per year is permitted.
[2] Based on 3-year average of annual 99th percentile (4th highest) of daily maximum 1-hour average concentration.
[3] Based on 3-year average of annual 98th percentile (8th highest) of daily maximum 1-hour average concentration.
[4] Based on 3-year average of annual 98th percentile 24-hour concentration.
[5] Based on 3-year average of annual average concentrations.

Table 4
North Dakota / National Prevention of Significant Deterioration (PSD) Increments
Criteria Pollutants (µg/m³)

Pollutant	Averaging Period	Class I	Class II	Class III
Sulfur Dioxide (SO_2)	3-hour	25[1]	512[1]	700[1]
	24-hour	5[1]	91[1]	182[1]
	Annual	2	20	40
Nitrogen Dioxide (NO_2)	Annual	2.5	25	50
Particulate (PM_{10})	24-hour	8[1]	30[1]	60[1]
	Annual	4	17	34
Particulate ($PM_{2.5}$)	24-hour	2[1]	9[1]	18[1]
	Annual	1	4	8

[1] One exceedance per year is permitted.

II. Guidance Documents

The North Department has developed the following guidance and policy documents to assist permit applicants in the process of drafting complete permit applications.

The first three documents referenced below can be accessed via the links posted under the document title. The remainder of the documents can be found on the Department's FTP site under "Guidance and Policy Documents".

To request access to the FTP site, or for more information on Dispersion Modeling, please direct questions or comments to the North Dakota Department of Health at 701.328.5188.

Intradepartmental Memorandum - Criteria Pollutant Modeling Requirements for a Permit to Construct: September 12, 2006
http://www.ndhealth.gov/AQ/AirPermitting_files/Modeling%20Memo.pdf

> The Department has developed a set of guidelines to determine what modeling requirements apply to a facility as part of the application for a Permit to Construct (PTC). This document outlines the requirements for projects subject to the Prevention of Significant Deterioration of Air Quality (PSD) rules and for projects not subject to PSD; and also includes additional information applicable to all projects (both PSD and non-PSD).

Policy for the Control of Hazardous Air Pollutant Emissions in North Dakota (Air Toxics Policy): August 25, 2010
http://www.ndhealth.gov/AQ/Toxics/North%20Dakota%20Air%20Toxics%20Policy.pdf

> This document establishes the policy for the evaluation of sources emitting Hazardous Air Pollutants (HAPs) into the ambient air. It includes a description of the three-tiered approach to calculating the maximum off-property ground-level ambient concentration of each HAP.

Dispersion Modeling Requirements, Compressor Engines and Glycol Dehydration Units
May 16, 2011
http://www.ndhealth.gov/AQ/AirPermitting_files/Compressor%20Engine%20&%20Dehydrator%20Policy.pdf

This document clarifies when dispersion modeling is required to be submitted for facilities which include compressor engine(s) and/or glycol dehydration unit(s) as the primary source(s) of emissions. Both criteria pollutants and hazardous air pollutants (air toxics) are addressed.

Model Input Parameters for Flares
November 10, 2010
Flare Plume Rise.pdf

This document outlines the Department recommended approach for developing the model input parameters of stack temperature, diameter, exit velocity, and stack height to allow a given refined air quality model (e.g. AERMOD, ISC-PRIME) to accurately calculate a buoyancy representative of the conditions above the flare.

Recommended AERSURFACE Inputs (North Dakota)
September 16, 2010
AERSURFACE Inputs.pdf

This document provides Department recommended inputs for AERSURFACE, a surface land cover characteristics preprocessor for AERMOD, appropriate for modeling in North Dakota.

User's Instructions for HRLYNAAQS.
September 24, 2010
HRLYNAAQS User's Guide.pdf

The software program HRLYNAAQS is provided by the Department (on request) to assist permit applicants and consultants in the demonstration of modeled compliance with the new 1-hour National Ambient Air Quality Standards (NAAQS) for NO_2 and SO_2. HRLYNAAQS provides the annual 98th (NO_2) or 99th (SO_2) percentile of maximum daily 1-hour concentrations averaged across five years, for each receptor location. Along with the total concentration, HRLYNAAQS also provides individual contributions for up to five source groups.

AERMET Surface Meteorology Stations (2004-2008)
AERMET Upper-Air Meteorology Stations (2004-2008)
Met Stations 2004-2008 WBAN.pdf

This document provides the locations of surface and upper-air meteorology stations in North Dakota for which meteorological data suitable for use with AERMET is provided by the Department (available on request).

Hourly Ozone Sites (2004-2008)
Ozone Sites 2004-2008.pdf

This document provides the locations within North Dakota of hourly ozone ambient monitoring sites as well as information on the formatting of the hourly ozone source data files (available on request).

ATTACHMENT C

Emissions Sources Characteristics

ID	DESCRIPTION	X	Y	Elevation (m)	Stack Height (m)	Stack temperature (K)	Stack Velocity (m/s)	Stack Diameter (m)
101H0101	Atmospheric Distillation Unit Heater	633487.731	5193293.244	808.38	38.89	692.98	6.13	1.92
102H0201	Atmospheric Distillation A Heater	633559.049	5193295.392	806.57	38.89	693.15	6.13	1.92
103H0301	Vacuum Distillation Unit Heater 1	633656.032	5193379.472	804.96	38.1	588.71	5.15	1.98
103H0302	Vacuum Distillation Unit Heater 2	633656.452	5193373.402	804.93	25.91	588.71	6.34	1.55
112H1201	FCCU Raw Charge Heater	633689.597	5193286.628	805	21.95	691.48	3.02	1.68
112V1201	FCCU Vent Stack	633689.662	5193326.618	804.59	36.58	522.04	19.7	1.22
117H1701	Isomerization Heater 1 Reactor Charge	633715.339	5193381.258	803.89	10.97	713.04	0.76	0.82
117H1702	Isomerization Heater 2	633715.777	5193375.233	803.93	14.02	692.98	0.58	1.4
105H0501	Heavy Naphtha 1 Charge Heater	633435.314	5193367.913	811.04	27.74	692.98	4.94	0.91
105H0502	Heavy Naphtha 2 Strip Reboiler	633444.492	5193368.211	810.98	27.74	692.98	5.82	0.91
106H0601	Catalytic Reformer 2 Heater	633428.819	5193260.307	809.28	12.8	692.15	2.95	1.22
107H0701	Catalytic Reformer 1 Heater	633362.297	5193241.365	811.68	36.58	692.98	8.29	1.83
111H1101	Light Naphthat HDT Charge Heater	633524.931	5193369.69	808.91	51.82	695.98	3.69	1.07
118H1801	Alkylation Unit Heater	633768.252	5193378.01	803	28.96	691.76	6.83	1.22
110H1001	Diesel Hydrotreater Treater Heater	633435.753	5193425.2	813.02	51.82	693.15	6.31	1.07
122H2201	SRU Thermal Oxidizer	633353.807	5193364.491	811.73	18.29	485.65	15.24	0.52
114H1401	FCC Naphtha Hydrotreater Heater	633606.041	5193371.555	805.99	27.74	691.09	6.25	0.91
202B0201	Boiler #1	633461.315	5193193.92	810.06	45	418.71	28.62	0.91
202B0202	Boiler #2	633473.501	5193194.281	809.82	45	418.71	28.62	0.91
202B0203	Boiler #3	633485.688	5193194.643	809.6	45	418.71	28.62	0.91
125H2501	Kerosene Hydrotreater Heater	633523.246	5193427.747	809.63	29.26	679.98	6.68	0.76
CT1501	Cooling Tower 1501	633503.235	5193157.875	810.4	21.34	302.59	1.52	10.97
CT1502	Cooling Tower 1502	633507.481	5193158.001	810.35	21.34	302.59	1.52	10.97
CT1503	Cooling Tower 1503	633511.728	5193158.127	810.3	21.34	302.59	1.52	10.97
FL1701	#1 HC Emergency Flare Conversion to Point Source	633506.045	5193593.555	810.79	47.06	1000	40	0.4
FL1702	#2 HC Emergency Flare Conversion to Point Source	633492.242	5193666.168	808.99	47.06	1000	40	0.4
FL1703	#3 Acid Flare Conversion to Point Source	633495.291	5193666.263	808.93	47.03	1000	40	0.11
FL1704	#4 Enclosed HC Operating Flare Conversion to Point Source	633600.65	5193607.193	808.9	17.86	1000	40	0.79
FLPILOT1	#1 HC Emergency Flare (3 Pilots)	633495.291	5193666.263	808.93	45.72	810	4.75	0.4
FLPILOT2	#2 HC Emergency Flare (3 Pilots)	633600.65	5193607.193	808.9	45.72	810	4.75	0.4
FLPILOT3	#3 Acid Flare (2 Pilots)	633492.242	5193666.168	808.99	45.72	811	4.75	0.11
FLPILOT4	#4 Enclosed HC Operating Flare (12 Pilots)	633506.045	5193593.555	810.79	15.24	811	4.75	0.79

ATTACHMENT D

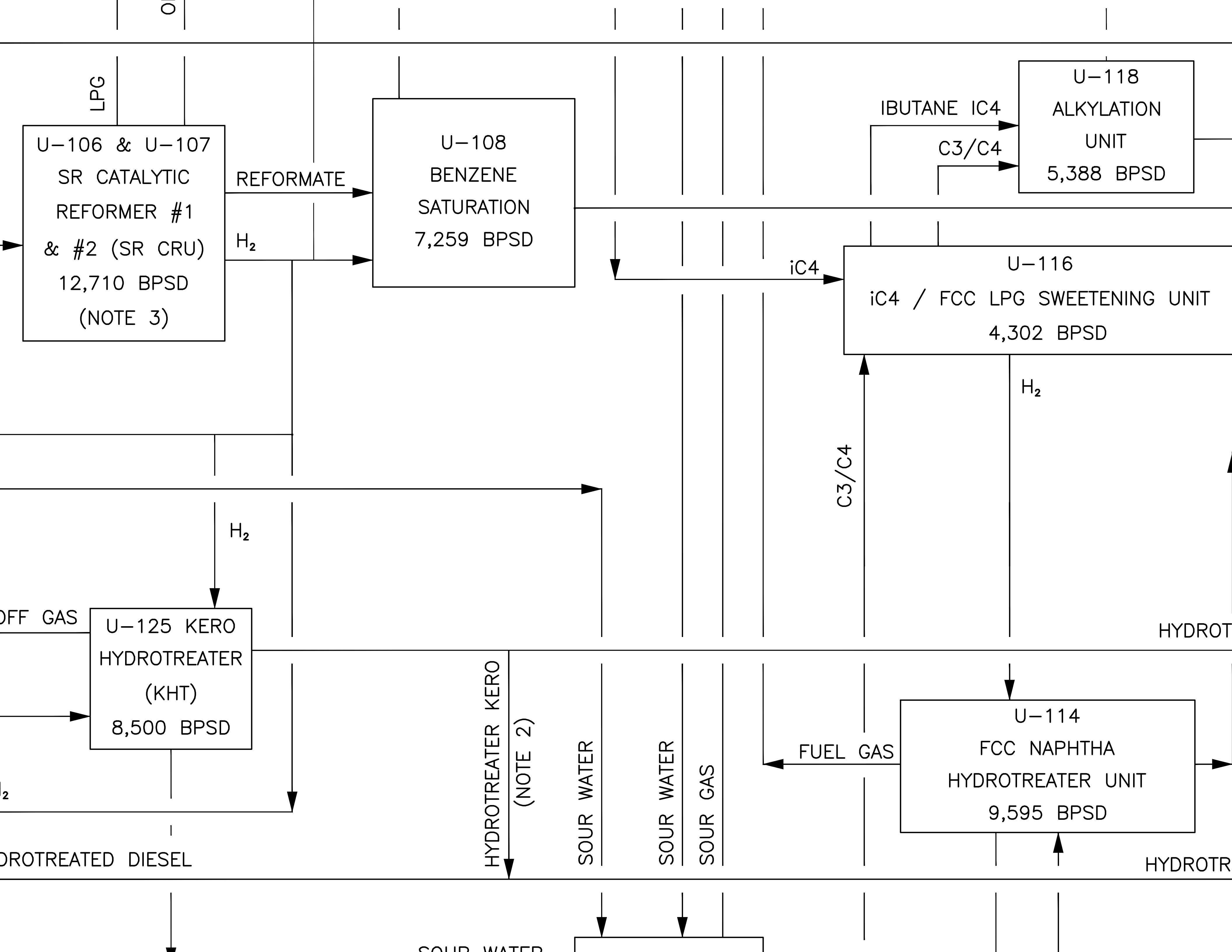
Air Toxics Analysis Spreadsheets

…s	Crude Distillation	Alkylation	Catalytic reforming	Hydrocracking	Hydrotreating/ hydrorefining	Catalytic cracking	Hydrogen plant	Product blending	Sulfur plant	Vacuum distillation	Isomerization	**Tanks**	Crude Oil	Gasoline and Other Light Distillates	Diesel Fuel and Other Middle Distillates	IFR	Cone not connected to VRU	Cone connected to VRU	**Stationary Combustion Sources**	Boilers (Qty: 3)	Heaters (Qty: 16)	Emergency Generator Set
…00	6.74E-01	7.17E-01	6.88E-01		2.06E-01	8.13E-01		0.00E+00		2.06E-02	6.84E-02	4.48E+00	4.50E-01	3.82E+00	2.14E-01				1.74E+00	3.87E-01	1.33E+00	1.37E-02
…01	3.98E-02	0.00E+00	7.32E-02		1.15E-02	1.05E-01		0.00E+00		1.19E-03	0.00E+00											
…03	6.32E-04	5.46E-03	1.12E-04		0.00E+00	6.61E-04		0.00E+00		0.00E+00	0.00E+00											
…01	3.16E-03	6.20E-01	3.10E-03		0.00E+00	1.65E-02		0.00E+00		1.79E-04	1.53E-04											
												9.13E-03	0.00E+00	8.43E-03	7.03E-04				2.10E-05	4.73E-06	1.63E-05	
																			1.58E-06	3.55E-07	1.22E-06	
																			1.40E-05	3.15E-06	1.09E-05	
																			4.60E-05	4.73E-07	1.63E-06	4.07E-05
																			9.23E-05	1.28E-06	4.42E-06	8.03E-05
																			1.08E-02	2.37E-03	8.15E-03	2.19E-04
																			1.50E-02	3.35E-03	1.15E-02	6.85E-05
												6.26E-04	0.00E+00	5.78E-04	4.82E-05							1.07E-05
																			4.56E-04	1.02E-04	3.53E-04	
																			1.75E-04	3.94E-05	1.36E-04	
…01	5.69E-02	7.44E-04	7.82E-02		1.06E-02	5.51E-02				1.79E-04	7.67E-03	2.20E-01	4.02E-02	1.69E-01	1.08E-02				9.12E-03	4.14E-04	1.43E-03	6.75E-03
																			1.93E-05	4.34E-06	1.49E-05	
																			5.24E-05	1.12E-05	3.87E-05	2.23E-06
																			3.41E-05	5.32E-06	1.83E-05	9.65E-06
																			6.35E-06	2.56E-07	8.83E-07	4.83E-06
																			1.69E-05	3.35E-06	1.15E-05	1.90E-06
																			1.14E-04	2.56E-05	8.83E-05	
…02	3.79E-03	0.00E+00	0.00E+00		6.31E-03	2.37E-02				5.36E-03	0.00E+00	1.21E-03	8.03E-04	4.10E-04	0.00E+00				0.00E+00			
																			0.00E+00			
																			9.64E-04	2.17E-04	7.47E-04	
																			2.45E-04	5.52E-05	1.90E-04	
																			1.23E-03	2.76E-04	9.51E-04	
												5.48E-04	0.00E+00	5.06E-04	4.22E-05				1.58E-05	3.15E-07	1.09E-06	1.33E-05
																			7.19E-05	1.62E-05	5.57E-05	
												3.38E-02	2.41E-03	3.13E-02	3.81E-05							
…02	7.59E-03	0.00E+00	5.21E-03		2.01E-03	5.51E-03				0.00E+00	0.00E+00	4.02E-02	2.01E-03	3.61E-02	2.01E-03							
																			4.30E-06	2.37E-07	8.15E-07	3.01E-06
																			1.05E-03	2.37E-04	8.15E-04	
…01	3.98E-02	0.00E+00	4.84E-02		1.06E-02	6.06E-02				1.19E-03	0.00E+00	8.47E-02	6.42E-03	7.47E-02	3.61E-03				1.40E-02	3.15E-03	1.09E-02	
																			4.03E-05	5.72E-07	1.97E-06	3.50E-05
												9.40E-04	0.00E+00	8.67E-04	7.23E-05				1.22E-04	5.32E-07	1.83E-06	1.11E-04
																			6.56E-02	1.46E-02	5.03E-02	6.86E-04
…01	2.72E-01	3.97E-02	3.48E-02		5.45E-02	5.51E-02				5.96E-04	4.91E-02	1.45E+00	3.37E-01	1.01E+00	9.64E-02				1.58E+00	3.55E-01	1.22E+00	
																			6.61E-05	1.40E-05	4.82E-05	3.60E-06
																			3.24E-04	7.29E-05	2.51E-04	
																			2.19E-04	4.93E-05	1.70E-04	
												9.92E-03	0.00E+00	9.15E-03	7.63E-04							
												8.35E-01	0.00E+00	7.71E-01	6.42E-02							
												7.47E-01	0.00E+00	7.47E-01	0.00E+00							
…02	1.58E-02	0.00E+00	1.08E-02		7.17E-03	3.96E-02				7.15E-03	0.00E+00	2.15E-02	2.41E-03	1.83E-02	8.03E-04				1.75E-03	1.18E-04	4.08E-04	1.13E-03
																			1.84E-03	4.14E-04	1.43E-03	
												3.91E-03	0.00E+00	3.61E-03	3.01E-04				3.98E-04	3.35E-06	1.15E-05	3.55E-04
												5.92E-03	3.61E-03	2.17E-03	1.35E-04				3.51E-03	7.88E-04	2.72E-03	
												1.02E-03	0.00E+00	9.40E-04	7.83E-05				3.91E-05	9.66E-07	3.33E-06	3.23E-05
																			7.71E-04	1.73E-04	5.98E-04	
												1.59E-01	0.00E+00	1.59E-01	0.00E+00							
…01	1.08E-01	4.96E-02	2.16E-01		4.88E-02	1.82E-01				2.38E-03	9.20E-03	4.84E-01	3.01E-02	4.34E-01	2.01E-02				5.53E-03	6.50E-04	2.24E-03	2.44E-03

tic ing	Catalytic Reformer #2	Catalytic Reformer #1	**Sulfur Recovery Plant**	SRU + Tail Gas System	**Vacuum Systems**	Vacuum Distillation	**Blowdown System**	Blowdown	**Flares**	General	Flare operation	**Wastewater**	Wastewater System	**Cooling Towers**	Cooling Towers	**Rail Product Loading**	Crude oil	Gasoline +butane	Jet Kerosene	Diesel	Fuel Oil	**Truck Product Loading**	Crude oil	Gasoline +butane	Jet Kerosene
01	2.47E-01	5.46E-01							2.38E+00	2.38E+00		5.24E-01	5.24E-01												
									3.85E-01	3.85E-01		4.38E-05	4.38E-05												
												1.06E-01	1.06E-01												
07	7.21E-08	1.59E-07																							
09	2.38E-09	5.27E-09																							
09	1.66E-09	3.68E-09																							
08	5.05E-09	1.12E-08																							
04	2.22E-04	4.91E-04							4.95E-01	4.95E-01		2.44E-02	2.44E-02												
10	4.99E-11	1.10E-10																							
10	8.32E-11	1.84E-10																							
10	1.61E-10	3.56E-10																							
10	2.22E-10	4.91E-10																							
10	4.16E-11	9.20E-11																							
												1.03E-04	1.03E-04												
02	1.28E-02	2.82E-02																							
10	1.61E-10	3.56E-10																							
												0.00E+00	0.00E+00												
												8.65E-03	8.65E-03												
10	4.32E-11	9.57E-11																							
									1.10E-02	1.10E-02		1.89E-02	1.89E-02												
08	5.54E-09	1.23E-08																							
08	1.11E-08	2.45E-08																							
									5.50E-02	5.50E-02															
									5.50E-01	5.50E-01		1.88E-01	1.88E-01												
01	2.33E-01	5.15E-01																							
10	9.42E-11	2.08E-10																							
									1.65E-01	1.65E-01		5.14E-03	5.14E-03												
06	1.94E-06	4.29E-06										2.77E-03	2.77E-03												
07	3.38E-08	7.48E-08																							
												0.00E+00	0.00E+00												
09	8.32E-10	1.84E-09																							
												3.62E-02	3.62E-02												
03	3.88E-04	1.18E-03							3.85E-01	3.85E-01		6.11E-02	6.11E-02												
03	3.88E-04	8.58E-04							3.30E-01	3.30E-01		7.36E-02	7.36E-02												

t % APs)	1-Hr Guideline Concentration (mg/m3)	8-Hr Guideline Concentration (mg/m3)	APP B Unit Risk Factor (m3/µg)	Model Results based on % HAP 1-hr max (mg/m3)	Model Results based on % HAP 8-hr max (mg/m3)	Maxium Individual Carcinogenic Risk (MICR)	Hazard Index Value 1-hr	Hazard Index Value 8-hr	Highest Haz Index	1-Hr Guideline Concentration Compliance	8-Hr Guideline Concentration Compliance
0E+00											
4E-02		2.46E+00		2.51E-05	9.19E-05	0.00E+00		3.74E-05	3.74E-05		YES
9E-02		8.80E-02	3.00E-05	4.27E-05	1.56E-04	1.28E-06		1.78E-03	1.78E-03		YES
3E-02		2.80E+01		8.16E-05	2.99E-04	0.00E+00		1.07E-05	1.07E-05		YES
8E-04		5.82E-02		1.01E-06	3.68E-06	0.00E+00		6.33E-05	6.33E-05		YES
2E-07				1.72E-10	6.30E-10	0.00E+00			0.00E+00		
9E-07			7.10E-02	1.53E-09	5.60E-09	1.09E-07			0.00E+00		
2E-06				6.00E-09	2.20E-08	0.00E+00			0.00E+00		
3E-05				4.49E-08	1.64E-07	0.00E+00			0.00E+00		
6E-03	9.01E-01		2.20E-06	6.97E-06	2.55E-05	1.53E-08	7.74E-06		7.74E-06	YES	
7E-04	3.56E+01	2.37E+01		7.14E-07	2.61E-06	0.00E+00	2.00E-08	1.10E-07	1.10E-07	YES	YES
6E-03	4.59E-03			1.93E-06	7.05E-06	0.00E+00	4.20E-04		4.20E-04	YES	
2E-05				9.82E-08	3.59E-07	0.00E+00			0.00E+00		
8E-05		1.00E-02		5.16E-08	1.89E-07	0.00E+00		1.89E-05	1.89E-05		YES
7E-05		2.00E-04	4.30E-03	1.94E-08	7.11E-08	8.35E-08		3.55E-04	3.55E-04		YES
5E-02	1.60E-01	3.02E-02	7.80E-06	1.09E-04	4.00E-04	8.53E-07	6.84E-04	1.33E-02	1.33E-02	YES	YES
8E-06			1.10E-04	2.27E-09	8.32E-09	2.50E-10			0.00E+00		
0E-06			1.10E-03	8.88E-09	3.25E-08	9.77E-09			0.00E+00		
3E-06			1.10E-04	4.79E-09	1.75E-08	5.26E-10			0.00E+00		
3E-08				1.47E-10	5.39E-10	0.00E+00			0.00E+00		
6E-06				2.08E-09	7.60E-09	0.00E+00			0.00E+00		
3E-06			1.10E-04	2.65E-09	9.70E-09	2.92E-10			0.00E+00		
8E-06		1.00E-06	2.40E-03	1.25E-08	4.58E-08	3.00E-08		4.58E-02	4.58E-02		YES
8E-03		2.50E-02		4.41E-06	1.61E-05	0.00E+00		6.46E-04	6.46E-04		YES
8E-04				6.25E-07	2.29E-06	0.00E+00			0.00E+00		
0E-05		2.00E-04	1.80E-03	1.06E-07	3.86E-07	1.90E-07		1.93E-03	1.93E-03		YES
8E-04		6.20E-02		1.65E-07	6.04E-07	0.00E+00		9.74E-06	9.74E-06		YES
2E-03	5.80E-02	2.90E-02		4.47E-06	1.63E-05	0.00E+00	7.70E-05	5.64E-04	5.64E-04	YES	YES
5E-05		1.00E-03	1.20E-02	2.68E-08	9.79E-08	3.21E-07		9.79E-05	9.79E-05		YES
3E-05		1.00E-02		1.41E-07	5.17E-07	0.00E+00		5.17E-05	5.17E-05		YES
8E-05			1.10E-05	6.25E-08	2.29E-07	6.87E-10			0.00E+00		
4E-06		4.00E-04		9.40E-09	3.44E-08	0.00E+00		8.60E-05	8.60E-05		YES
1E-03		4.00E-01		3.68E-06	1.35E-05	0.00E+00		3.37E-05	3.37E-05		YES
3E-03		4.92E+00		7.54E-06	2.76E-05	0.00E+00		5.61E-06	5.61E-06		YES
2E-06			1.20E-03	1.72E-09	6.29E-09	2.06E-09			0.00E+00		
0E-05	6.01E+00	3.01E+00	1.10E-05	1.15E-07	4.20E-07	1.26E-09	1.91E-08	1.40E-07	1.40E-07	YES	YES
7E-02	1.09E+01	8.68E+00	2.50E-06	3.16E-05	1.16E-04	7.90E-08	2.91E-06	1.33E-05	1.33E-05	YES	YES
7E-05				3.16E-08	1.16E-07	0.00E+00			0.00E+00		
7E-05	6.22E-02	3.11E-02		1.26E-07	4.63E-07	0.00E+00	2.03E-06	1.49E-05	1.49E-05	YES	YES
2E-02	7.37E-03		1.30E-05	8.45E-05	3.09E-04	1.10E-06	1.15E-02		1.15E-02	YES	
3E-10			1.30E+00	2.50E-13	9.14E-13	3.25E-10			0.00E+00		
4E-10				2.81E-13	1.03E-12	0.00E+00			0.00E+00		
4E-01	7.05E+01	3.52E+01		4.65E-04	1.70E-03	0.00E+00	6.60E-06	4.83E-05	4.83E-05	YES	YES
7E-02	5.97E-02			9.14E-05	3.34E-04	0.00E+00	1.53E-03		1.53E-03	YES	
3E-04		1.04E-01		8.76E-07	3.21E-06	0.00E+00		3.08E-05	3.08E-05		YES
9E-06			1.10E-04	8.55E-09	3.13E-08	9.40E-10			0.00E+00		
7E-05		4.00E-03		3.93E-08	1.44E-07	0.00E+00		3.59E-05	3.59E-05		YES
0E-05		5.00E-04		2.44E-08	8.94E-08	0.00E+00		1.79E-04	1.79E-04		YES
7E-04	6.55E+00	5.24E+00		1.08E-06	3.96E-06	0.00E+00	1.65E-07	7.55E-07	7.55E-07	YES	YES
5E-02	6.15E+00	1.64E+00		9.11E-05	3.33E-04	0.00E+00	1.48E-05	2.03E-04	2.03E-04	YES	YES
3E-02		3.61E+00	2.60E-07	1.00E-04	3.66E-04	2.60E-08		1.01E-04	1.01E-04		YES
8E-03		3.47E+00	4.70E-07	1.96E-06	7.18E-06	9.23E-10		2.07E-06	2.07E-06		YES
0E-03	1.57E+00	1.05E+00	3.40E-05	1.19E-05	4.37E-05	4.06E-07	7.59E-06	4.17E-05	4.17E-05	YES	YES
1E-04		3.00E-02	2.40E-04	2.31E-07	8.44E-07	5.54E-08		2.81E-05	2.81E-05		YES
3E-11				1.43E-13	5.23E-13	0.00E+00			0.00E+00		
4E-04				5.42E-07	1.98E-06	0.00E+00			0.00E+00		
3E-03		3.85E-01		3.57E-06	1.31E-05	0.00E+00		3.39E-05	3.39E-05		YES
0E-05				1.16E-07	4.25E-07	0.00E+00			0.00E+00		
5E-05		4.00E-03		8.48E-08	3.11E-07	0.00E+00		7.76E-05	7.76E-05		YES
9E-02	3.41E+00	1.70E+00		2.13E-05	7.79E-05	0.00E+00	6.24E-06	4.57E-05	4.57E-05	YES	YES
1E-01		1.51E+00		1.70E-04	6.23E-04	0.00E+00		4.13E-04	4.13E-04		YES
7E-04	1.12E+02			7.14E-07	2.61E-06	0.00E+00	6.35E-09		6.35E-09	YES	

Exhibit E: Process Block Diagrams


LPG
U-106 & U-107
SR CATALYTIC
REFORMER #1
& #2 (SR CRU)
12,710 BPSD
(NOTE 3)
REFORMATE
H_2
U-108
BENZENE
SATURATION
7,259 BPSD
IBUTANE IC4
C3/C4
U-118
ALKYLATION
UNIT
5,388 BPSD
iC4
U-116
iC4 / FCC LPG SWEETENING UNIT
4,302 BPSD
H_2
C3/C4
H_2
OFF GAS
U-125 KERO
HYDROTREATER
(KHT)
8,500 BPSD
HYDROTREATER KERO
(NOTE 2)
SOUR WATER
SOUR WATER
SOUR GAS
FUEL GAS
U-114
FCC NAPHTHA
HYDROTREATER UNIT
9,595 BPSD

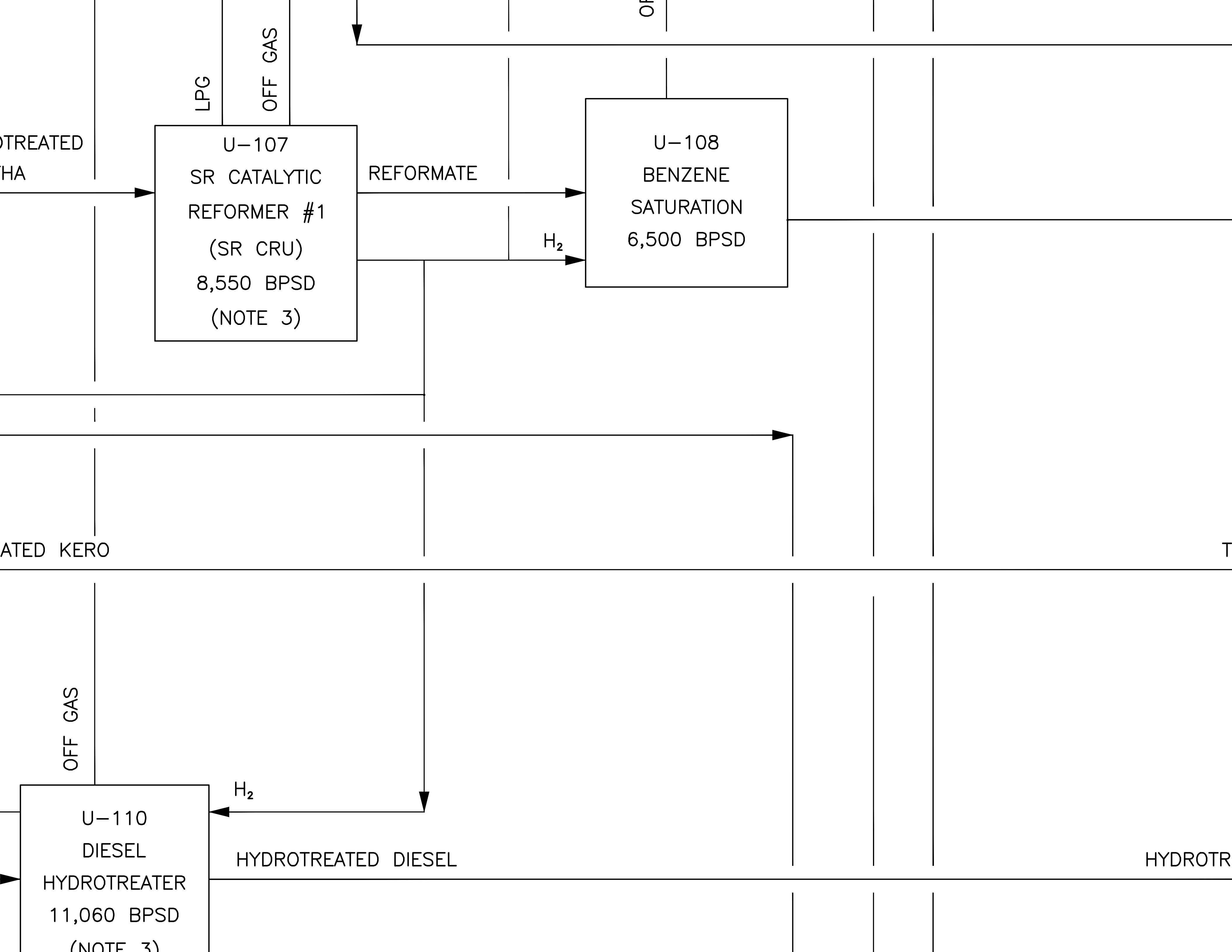
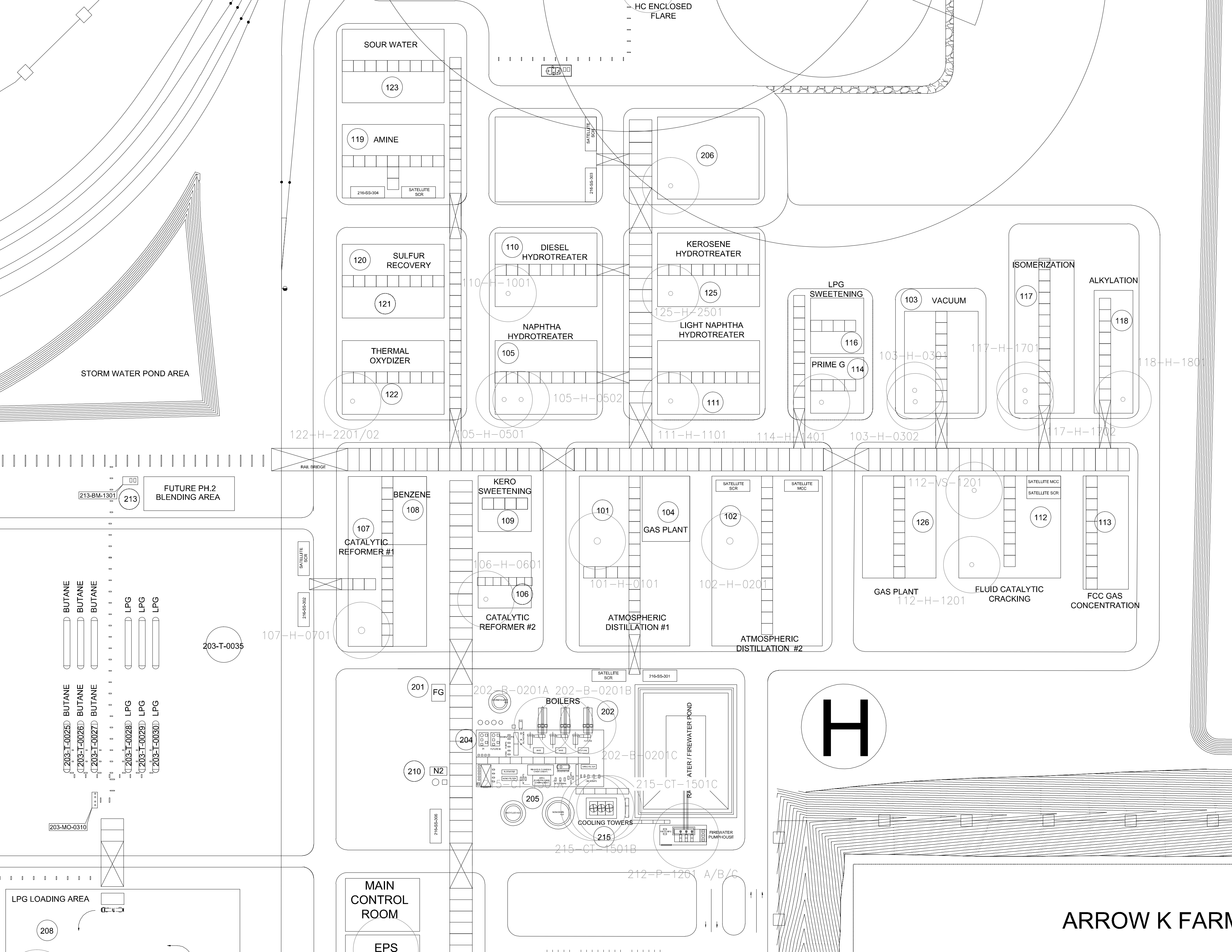

LPG
OFF GAS
OTREATED
THA
U–107
SR CATALYTIC
REFORMER #1
(SR CRU)
8,550 BPSD
(NOTE 3)
REFORMATE
H2
U–108
BENZENE
SATURATION
6,500 BPSD
ATED KERO
OFF GAS
H2
U–110
DIESEL
HYDROTREATER
11,060 BPSD
HYDROTREATED DIESEL
HYDROTR

Exhibit F: Site Plan


HC ENCLOSED FLARE
SOUR WATER
123
119 AMINE
216-SS-304
SATELLITE SCR
216-SS-303
206
120 SULFUR RECOVERY
121
110 DIESEL HYDROTREATER
110-H-1001
KEROSENE HYDROTREATER
125
125-H-2501
LPG SWEETENING
103 VACUUM
ISOMERIZATION
117
ALKYLATION
118
NAPHTHA HYDROTREATER
105
LIGHT NAPHTHA HYDROTREATER
116
PRIME G
114
103-H-0301
117-H-1701
118-H-1801
THERMAL OXYDIZER
122
105-H-0502
111
STORM WATER POND AREA
122-H-2201/02
105-H-0501
111-H-1101
114-H-1401
103-H-0302
117-H-1702
RAIL BRIDGE
FUTURE PH.2 BLENDING AREA
213-BM-1301
213
BENZENE
108
KERO SWEETENING
109
107
CATALYTIC REFORMER #1
101
104
GAS PLANT
102
SATELLITE SCR
SATELLITE MCC
112-VS-1201
126
112
SATELLITE MCC
SATELLITE SCR
113
106-H-0601
106
CATALYTIC REFORMER #2
101-H-0101
102-H-0201
ATMOSPHERIC DISTILLATION #1
ATMOSPHERIC DISTILLATION #2
GAS PLANT
112-H-1201
FLUID CATALYTIC CRACKING
FCC GAS CONCENTRATION
216-SS-302
107-H-0701
203-T-0035
BUTANE
BUTANE
BUTANE
LPG
LPG
LPG
203-T-0025 BUTANE
203-T-0026 BUTANE
203-T-0027 BUTANE
203-T-0028 LPG
203-T-0029 LPG
203-T-0030 LPG
201
FG
202-B-0201A
202-B-0201B
BOILERS
202
216-SS-301
H
204
202-B-0201C
ATER / FIREWATER POND
210
N2
215-CT-1501C
205
COOLING TOWERS
215
FIREWATER PUMPHOUSE
215-CT-1501B
216-SS-306
203-MO-0310
212-P-1201 A/B/C
LPG LOADING AREA
208
MAIN CONTROL ROOM
EPS
ARROW K FARM