Santa Barbara County
Air Pollution Control District

Our Vision Clean Air

Health Risk Assessment Report

Facility: Santa Maria Refining Company
Inventory Year: 2002

1.0 SUMMARY

In May 2012, the Santa Barbara County Air Pollution Control District (District) completed an air toxics Health Risk Assessment (HRA) for the Santa Maria Refining Company (SMRC), using the Hotspots Analysis and Reporting Program (HARP) software, Version 1.4e (Build 23.10.01). In March 2014, the District revised the HRA for SMRC using HARP Version 1.4.f (Build 23.11.01) based on comments received from SMRC. The cancer risk and chronic and acute non-cancer hazard index risk values were revised and compared to *significance thresholds* for cancer and chronic and acute non-cancer risks adopted by the District's Board of Directors. The calculated risk values and applicable thresholds are as follows (with significant risks shown in **bold**):

	SMRC Max Risks	Significance Threshold
Cancer risk:	**16.6 /million**	≥10/million
Chronic non-cancer risk:	0.269	≥ 1
Acute non-cancer risk:	**5.247**	≥ 1

Based on these results, the operations at the Santa Maria Refining Company present a significant risk to the surrounding community. For that reason, a revised Risk Reduction Audit and Plan is required. In addition, public notification is required.

2.0 BACKGROUND

2.1 Facility Operations

Crude feedstock is transported by truck and pumped directly into one of four crude storage tanks. Vapor collected by the vapor recovery system from the fixed roof tanks is routed to either of the two crude heaters for incineration. The external floating roof tank is equipped with primary and secondary seals and therefore is not vented to the vapor recovery system. Crude from the storage tanks is pumped through heat exchangers before entering the pre-flash tower. Naphtha from the flash tower overhead is routed to the atmospheric crude fractionator tower. Pre-flash bottoms are pumped to two fired heaters operating in parallel.

After heating, the pre-flash tower bottoms go to the atmospheric crude fractionator tower for fractionation into naphtha, kerosene distillate, and gas oil. The kerosene distillate and gas oil is sent to storage following stripping in a dual chamber tower.

The atmospheric crude tower bottoms are pumped through a vacuum heater prior to vacuum distillation. Gas oils are sent through heat exchangers and water coolers to storage. Asphalt is sent through heat exchangers to storage.

Asphalt from the vacuum unit can be: (1) sold as paving asphalt, (2) mixed with gas oil to produce slow cure cutback asphalt or (3) combined with water and emulsifying agents to produce emulsified asphalt. Asphalt storage tanks are kept warm by tank steam coils or circulating the asphalt through gas-fired heaters. Steam for the refinery is supplied by steam boilers.

Heated liquid paving asphalt is stored in the asphalt tank farm. Asphalt storage tank temperatures are maintained by steam coils located near the tank bottoms or by circulating through gas fired heaters. The asphalt is loaded into tank cars or trucks via loading racks equipped with a vapor recovery system to catch asphaltic vapors. Asphalt is also stored for longer periods of time (i.e., winter months) in in a 220,000 bbl gunite-lined open sump and a 100,000 bbl cone-roofed steel storage tank. Asphalt is retrieved from the sump and the tank by steam heated suction heaters at the pump suction inlet. The heated asphalt is pumped directly into tanks at the asphalt tank farm where it is sold. From the storage tanks, the asphalt is either transferred from the property by truck or rail tank car.

All distillate products are loaded through the distillate loading rack located near the east boundary fence. A concrete lined sump is located near the rack to contain any spills. The concrete loading pads are piped into this pit. A sump pump automatically empties the pit to the API separator. Gas oil with an API gravity between 20.0-25.0 is also used as a cutter stock for Slow-Curing asphalt road oils.

Naphtha may be "switch loaded" into trucks that previously carried gasoline. Displaced vapors from the truck being loaded are collected for vapor recovery. The vapors from the knockout vessel are compressed and then cooled by the air cooler, causing liquid hydrocarbons to condense from the vapor. The condensed liquids are sent to tank T-10008. Vapors from the compressor discharge knockout drum pass through a demister pad and are combusted in two process heaters.

The SMRC refining process requires that additives be blended in the crude to achieve certain asphalt specifications. These additives include plasticizers, such as heavy vacuum gas oil (HVGO) which are injected into the crude to facilitate blending. HVGO is typically purchased and is stored in tank T-10009.

The refinery operations at the Santa Maria Refinery result in residual tailgas vapors from various processes that are incinerated in the crude oil heaters. These sources include the naptha accumulator and the naptha loading rack. The high concentration H_2S vapors from the naphtha loading rack and naptha accumulator are directed to a dry bed adsorbent system, utilizing SulfaTreat.

2.2 SMRC in the AB 2588 Air Toxics "Hot Spots" Program

The Air Toxics "Hot Spots" Information and Assessment Act requires businesses and industries throughout the state to: 1) quantify and report their emissions of listed air toxics; 2) assess the possible health risks from their emissions; 3) notify members of the public who are exposed to significant risks attributable to their emissions; and, 4) take steps to reduce this risk.

The HRA described in this report was conducted as part of the AB 2588 Air Toxics "Hot Spots" Program. Based on its permitted potential to emit, SMRC has been part of "Hot Spots" since the program began. SMRC submitted its first Air Toxics Emission Inventory Plan in 1989. The "Hot Spots" Program initially required biennial updates. In the 1990's the legislation changed to require quadrennial updates to Air Toxics Emission

Inventory Plans and Reports. The HRA discussed in this report was conducted as part of the quadrennial reporting cycle, for inventory year 2002, under the "Hot Spots" Program.

2.3 Health Risk

As used in this report, the term "health risk" addresses the likelihood that exposure to a given toxic air contaminant under a given set of conditions will result in an adverse health effect. Health risk is affected by several factors, such as: the amount, toxicity, and concentration of the contaminant; the meteorological conditions; the distance from emission sources to people; the distance between emission sources; the age, health, and lifestyle of the people living or working at a location; and, the duration of exposure to the toxic air contaminant.

Health effects are divided into cancer and non-cancer risks. "Cancer risk" refers to the increased chance of contracting cancer as a result of an exposure, and is expressed as a probability: chances-in-a-million. The values expressed for cancer risk do not predict actual cases of cancer that will result from exposure to toxic air contaminants. Rather, they state a possible risk of contracting cancer over and above the background level.

For non-cancer health effects, risk is characterized by a "hazard index" (HI), which is obtained by dividing the predicted concentration of a toxic air contaminant (TAC) by a reference exposure level (REL) for that pollutant that has been determined by health professionals, the Office of Environmental Health Hazard Assessment (OEHHA) and the California Air Resources Board (ARB). RELs are used as indicators of the potential adverse effects of chemicals. A REL is the concentration at or below which no adverse health effects are anticipated for specific exposure duration. Thus, the HI is a measure of the exposure relative to a level of safety and is appropriately protective of public health. Each TAC emitted by the facility has a different emission rate and a different REL. A HI for each TAC is calculated separately at each modeled receptor location. A composite HI at each receptor is then calculated as the sum of HIs for each individual TAC. The maximum HI reported here for each scenario is the maximum composite HI among all receptors.

2.4 Historical Health Risk Assessments

The previous HRA results for SMRC are shown below.

	1998 Max Risk	1994 Max Risk	1991 Max Risk	Significance Threshold
Cancer risk:	**20.49** /mil	3/mil	**16/mil**	≥10/million
Chronic non-cancer risk:	0.04	0.002	0.5	≥ 1
Acute non-cancer risk:	**18.22**	0.6	**12.4**	≥ 1

The 1998 cancer risk was primarily due to benzene. The acute non-cancer risk in 1998 was driven by hydrogen sulfide.

2.5 Revisions to the Health Risk Assessment for Reporting Year 2002

The District provided the draft HRA files and report to SMRC in February 2013 and requested comments on the HRA by mid-May 2013. SMRC did not provide comments on the HRA during the specified review period. The District submitted the draft HRA to OEHHA for review in June 2013. OEHHA submitted comments in July 2013. OEHHA's comments and the District's response to comments is included in the Attachment section of this report. In February 2014, the District prepared the draft notification letter and package to mail out to all

residents and businesses within the significant risk isopleths. The District provided SMRC a draft notification package and allowed SMRC to submit comments on the notification package. SMRC responded with comments on the HRA, noting errors in some data that would affect the health risk results. For that reason, the District delayed the notification, corrected the errors, and reran the HRA. The results of the revised HRA for 2002 are shown in this report. The revisions to the HRA are listed below.

1. Corrected units for all building heights. Building heights were originally input into HARP in units of feet instead of meters. This change affected point sources with building downwash affects.

2. Corrected source parameters for the fugitive components. The initial lateral dimension (Sigma Yint) and the initial vertical dimension (Sigma Zint) were interchanged. Sigma Yint was input as 3.05 ft instead of 152.56 ft. while Sigma Zint was input as 152.56 ft instead of 3.05 ft.

3. Changed datum from NAD 83 to NAD 27. SMRC now believes that the datum for all UTM coordinates is in NAD 27. It was previously thought that the UTM coordinates were submitted in NAD 83. SMRC's new consultants, Ashworth Leininger Group (ALG), reviewed that data and overlayed the facility coordinates on a basemap of NAD 27 and NAD 83. ALG determined that the facility coordinates matched more closely with NAD 27 datum. For this reason, the District revised the HRA by changing the coordinates to NAD 27.

4. Per OEHHA's comments on the draft HRA, the most current *heath.mdb* file available was used. There were no updates to the RELs or Unit Risk Factors for the risk driving pollutants (e.g., diesel particulate matter and sodium hydroxide).

2.6 Results of 2002 Health Risk Assessment

Diesel particulate matter (DPM) from the Fire Water Pump's internal combustion engine is the primary contributor (risk driver) to this facility's significant cancer risk status. At the point of maximum impact (PMI) for cancer risk, Boundary Receptor 1735 (Run 1), 83 percent (13.8/mil risk) of the total risk is from DPM. Further discussion of risk driver devices and pollutants is found in Section 10.0.

Sodium hydroxide from a cleaning product is the risk driver for the acute non-cancer risk. It contributes nearly all the acute non-cancer risk (99 percent) at the acute PMI.

2.7 Differences between the 2002 HRA and the 1998 HRA

The emissions calculation methodology changed substantially between the 1998 ATEIP and the 2002 ATEIP. The 1998 HRA was based on emission calculation methodology that originated from previous ATEIPs, dating back to the first ATEIP from 1989. Upon review of this early emissions calculation methodology, it was found that newer methods are now available that are more representative of actual operations. In 2006, SMRC source tested many tanks and other hydrocarbon sources to determine the toxics profile in the oil, gas, and asphalt vapor streams. Although some problems were encountered during testing that rendered parts of the test invalid, there were many data points that were collected and determined to be valid.

The high acute risk from hydrogen sulfide in 1998 was attributed to process water tanks, slop tanks and the API separator. The annual emissions from the process water tanks and slop tanks between the 1998 HRA and the 2002 HRA are very similar. However, the maximum hourly emissions are significantly less in the 2002 HRA. This is because it was assumed in the 2002 HRA that the process water tanks and slop tanks are continuous types of operations, while the maximum hourly emissions in the 1998 HRA were not based on

continuous operations. The assumption that these processes are continuous is an appropriate assumption that is generally used for these types of tanks.

There were also changes to the risk assessment methodology. The largest change included using a different model, HARP, instead of the older ACE2588 program. HARP includes OEHHA's risk assessment methodologies that were last updated in August 2003. In addition to the model change, many RELs or Unit Risk Factors changed. Finally, diesel exhaust is now treated as an individual pollutant (Diesel PM) for the purpose of risk assessments. In the prior HRAs, the pollutants in the diesel exhaust were speciated.

2.8 Health Risk Assessment for Reporting Year 2002

The HRA for inventory year 2002 was conducted as part of the quadrennial reporting cycle under the AB 2588 Air Toxics "Hot Spots" Program. SMRC submitted an Air Toxics Emission Inventory Plan (ATEIP) that discussed the methodologies used for quantifying emissions. Upon District approval of the ATEIP, SMRC calculated the emissions and submitted that information in an Air Toxics Emissions Inventory Report (ATEIR). The ATEIR was reviewed and modified by the District. The modifications are included in Excel files located in the *SMRC2002HRA.zip* file referenced in the Attachment section of this report. The files include the following:

- *2002 Asphalt Tank TOC Emis Calcs_Revised by APCD.xlsx*
- *2002 Fugitive TOC Component Emis_Revised by APCD.xlsx*
- *2002 Loading Rack TOC Emis Calcs_Revised by APCD.xlsx*
- *2002 Nonasphalt Tank TOC Emis Calcs_Revised by APCD.xls*
- *Attachment 1 - 2002 ATEIR Ems Calc Tables_Revised by APCD.xls*

After modifying the ATEIR, the District completed the HRA in May 2012 and revised the HRA in March 2014. The results of the revised HRA are summarized in Section 1.0 and discussed in further detail in Section 2.6 and Section 10.

3.0 FACILITY INFORMATION

EQUIPMENT OWNER/OPERATOR:	Santa Maria Refining Company
SOURCE IDENTIFICATION NUMBER:	4640
EQUIPMENT LOCATION:	1660 Sinton Road, Santa Maria
FACILITY UTM COORDINATES:	SMRC provided the UTM coordinates of the facility's property boundaries, buildings and structures, and emission release points. UTM Zone 10 Easting: 727540 m Northing: 3867865 m Datum: NAD 27
EQUIPMENT DESCRIPTION:	The HRA included emissions from 57 stacks or emission release points. This includes emissions from internal

combustion engines, heaters, boilers, loading racks, tanks, sumps, chemical usage and fugitive components.

4.0 STACKS AND MODELING PARAMETERS

The stack locations and modeling parameters used in the HRA are found in Table 4.1 of the Attachment section of this report. Additional information on the modeling parameters and devices is found in the ATEIP and ATEIR.

5.0 Emissions

The emissions estimate techniques were presented in the ATEIP for inventory year 2002. Emissions were quantified in the 2002 ATEIR and modified by the District. A summary of the toxic emissions from SMRC for reporting year 2002 are presented in Table 5.1 in the Attachment section of this report.

6.0 BUILDING INFORMATION

UTM coordinates for buildings and structures (e.g., tanks) were submitted by SMRC in the 2002 ATEIP/R. Building downwash applies for these structures and all were included in the HRA.

7.0 MET DATA & DEM FILES

Meteorological data used in the dispersion analysis was acquired at the Battles Gas Plant, which is representative of the area surrounding the Santa Maria Refining Company. The data file is found under *BAT89.ASC* located in the *SMRC2002HRA.zip* file referenced in the Attachment section of this report. The Digital Elevation Model (DEM) files used were *guadalupe.dem* and *santa_maria.dem*. These files are also found in the *SMRC2002HRA.zip*file.

8.0 MODEL INFORMATION

The revised dispersion modeling and risk assessment were conducted using the California Air Resources Board Hotspots Analysis and Reporting Program, Version 1.4f (Build 23.11.01). The Control options that were used for the dispersion model are found in Table 8.1 of this report. Current risk assessment health values were obtained using the most recent *heath.mdb* file available (updated by the ARB on February 20, 2014).

Due to the large number of grid receptors and sources, it was necessary to run the air dispersion model three times to determine the refined acute values. In the first run, a grid range of 500 m × 500 m with a grid increment spacing of 25 m was established. This first run was used for the cancer risk, chronic non-cancer risk, and the simple acute non-cancer risk. The second run was used to determine the refined acute non-cancer risk. For the second run, receptors were placed 175 meters East of the center of SMRC to 400 m West and 350 m North to 250 m South of the facility's center. A grid increment spacing of 25 m was established for the second run. A third run was done to determine the significant acute non-cancer footprint. The acute non-cancer risk extends offsite approximately one mile. For the third run, grid range of 2500 m x 2500 m with a grid increment spacing of 50 m was established. All receptors were set a flagpole height of 1.5 meters. Grid and receptor data may be found in *SMRC2002.SRC* and *SMRC2002.ISC* files located in *SMRC2002HRA.zip.* For the refined acute non-cancer risk, the grid and receptor data are found in *SMRC2002_ACUTE.SRC,*

SMRC2002_ACUTE.ISC, SMRC2002_LGGRID.SRC, and *SMRC2002_LGGRID.ISC* files located in *SMRC2002HRA.zip.*

The cancer analysis method chosen in HARP was the Derived (Adjusted) Method for a 70 year lifetime exposure duration (adult resident). The chronic non-cancer analysis method chosen in HARP was the Derived (OEHHA) Method for a resident. Multipathway cancer and chronic analyses were performed with the following exposure pathways: inhalation, soil, dermal and mother's milk.

A deposition rate must be used when determining potential non-inhalation health impacts. A deposition rate of 0.02 m/s was used. Section 8.2.5 A, *Deposition Rate*, of OEHHA's *Air Toxics Hot Spots Program Risk Assessment Guidelines* allows the use of 0.2 m/s default deposition velocity for controlled or uncontrolled sources that emit only particulate matter that is less than 2.5 microns. According to the California Air Resources Board's (ARB) PM profile 120 for *Gaseous Material Combustion*, the particle size is less than 2.5 microns. The PM size of diesel combustion is not considered for the deposition velocity as diesel PM is not a multipathway pollutant.

Table 8.1 – Control Options for Dispersion Model

Control Option	Assumption
Use Regulatory Default?	No
Rural or Urban	Rural
Gradual Plume Rise?	Yes
Stack Tip Downwash?	Yes
Buoyancy Induced Dispersion?	No
Calms Processing?	No
Missing Data Processing?	No
Include Building Downwash?	Yes
Lowbound Option?	No
Terrain Model	Both

9.0 RESULTS

Risk assessment results at the point of maximum impact receptor locations for cancer and for chronic and acute non-cancer health effects are shown in Table 9.1. The *italicized* values indicate the maximum offsite risk for each risk category. Bolded numbers represent a significant offsite risk.

Table 9.1 – Risk at Point of Maximum Impact Receptors

Receptor	Location	Cancer Risk (per million)	Chronic HI	Acute HI (Screening)	Acute HI (Refined)	UTME (m)	UTMN (m)
1735 (Run 1)	Boundary (West)	***16.6***	0.0824	**5.43**	**4.594**	727354	3867838
669 (Run 1)	Grid (Northwest)	9.10	*0.269*	**4.14**	**3.89**	727350	3867950
150 (Acute)	Grid (Northwest)	6.23	0.102	**5.377**	***5.247***	727275	3868050

Risk contours representing the cancer risk isopleth and acute non-cancer risk isopleth were plotted on an aerial photograph of the facility and adjacent land and are attached to this report. The chronic non-cancer risk was

not plotted as both the onsite and offsite risk is below one. All resultant HRA risk data by receptor are found in the *SMRC2002HRA.zip*file referenced in the Attachment section of this report.

The screening acute risk is a timesaving approximation that is conservative in nature. It is calculated by assuming that the contribution of risk from each source is at its maximum at the same instant in time. The maximum hourly risk from each source is summed to give the screening value, as if they had all occurred at the same time. In reality, the time that the risk from each source is at a maximum will differ depending on location and meteorology. The highest screening acute risk values were further refined (using the *Refined Max Hourly Acute HHI* feature in HARP) to determine the PMI. In the case for SMRC, the refined acute risk PMI was only slightly less than the screening acute risk. This was due to there being one primary risk driver, sodium hydroxide in Cleaner 103F.

The acute non-cancer risk footprint shown in the Attachment section of this report is based on the simple acute risk. The significant acute non-cancer risk extends approximately one mile from the property boundary. It was expected that at that far of a distance from the facility, all acute non-cancer risk contributors except for the Process Chemical Usage, are negligible. Therefore, at the acute non-cancer risk isopleth of 1, the screening simple acute risk would be approximately equal to refined acute risk. This was confirmed by viewing the simple acute risk contour of 1 for all sources and the simple acute risk contour of 1 for only Process Chemical Usage. Additional details are found in *Comparison of Simple Acute Risk to Refined Acute Risk for Isopleth.docx* located in *SMRC2002HRA.zip* file referenced in the Attachment section of this report.

10.0 RISK DRIVER DEVICES AND POLLUTANTS FOR CANCER RISK

The primary cancer risk driver pollutant is diesel particulate matter for the 2002 risk assessment. Diesel particulate matter is emitted from two diesel-fired internal combustion engines; a fire water pump and an emergency generator. However, the significant cancer risk is due to the fire water pump.

10.1 RISK DRIVER DEVICES AND POLLUTANTS FOR ACUTE NON-CANCER RISK

The risk driver for the acute non-cancer risk is sodium hydroxide from the Process Chemical Usage area. Cleaner 103F contains 5 weight percent sodium hydroxide. This product is used to clean the process unit concrete pad. The operator brushes it on the concrete and then rinses it off with a water hose. SMRC estimated that a maximum of one half gallon is used within one hour. If a non-toxic product replaced the Cleaner 103F, this facility would no longer create a significant acute non-cancer risk.

The acute non-cancer health endpoints are the eyes, respiratory system and skin.

10.2 RISK DRIVER DEVICES AND POLLUTANTS FOR CHRONIC NON-CANCER RISK

The risk driver for the chronic non-cancer risk is hydrogen sulfide from fugitive components. The health endpoint is the respiratory system. However, there is no significant chronic non-cancer risk offsite.

11.0 RISK REDUCTION

SMRC submitted a Risk Reduction Audit and Plan (RRAP) on November 26, 2002, a revised RRAP on May 9, 2005, and a second revised RRAP on March 15, 2006. The District remanded all submittals of the RRAP as the

plans did not include measurable and enforceable risk reduction strategies that would reduce the risk below the District's thresholds.

The District and SMRC agreed that the ATEIP and ATEIR should be updated to include the latest emission calculation methodologies to determine if a significant risk still exists. The 2002 ATEIP/R and HRA show that the significant risk identified in the 1998 HRA is no longer significant. The cancer risk in 1998 was significant due to benzene and the acute non-cancer risk was significant due to hydrogen sulfide. However, there is a newly identified significant cancer risk from diesel PM. In addition, there is a newly identified significant acute non-cancer risk from sodium hydroxide.

The 2002 HRA shows that SMRC creates a significant risk to the surrounding community. For that reason, a new Risk Reduction Audit and Plan are required.

12.0 PUBLIC NOTIFICATION

SMRC creates a significant risk to the surrounding community. The owners of the residences and businesses within the significant risk footprints will be notified by mail of the modeled risk that is projected on their property. In addition, the information will be posted on the District website at: http://www.sbcapcd.org/airtoxics/GrekaSRS/SMR/greka_smr.htm

13.0 CONCLUSION

Per District guidelines, if a facility's toxic emissions result in a cancer risk equal to or greater than 10 in a million, it is considered a *significant risk* facility. For non-cancer risk, if a facility's toxic emissions result in a Hazard Index equal to or greater than 1.0, it is considered a *significant risk* facility. The risk assessment results show that the Santa Maria Refining Company presents a significant risk to the surrounding community. Therefore, based on the results of this HRA, a RRAP is required and the public will be notified of the significant risk.

14.0 REFERENCES

- Risk notification levels were adopted by the Santa Barbara County Air Pollution Control District Board of Directors on June 1993. The risk notification levels were set at 10 per million for cancer risk and a Hazard Index of 1.0 for non-cancer risk.
- Risk reduction thresholds were adopted by the Santa Barbara County Air Pollution Control District Board of Directors on September 17, 1998. These risk reduction thresholds were set at the same level as public notification thresholds, i.e., 10 per million for cancer risk and a Hazard Index of 1.0 for non-cancer risk.
- *AB2588 Air Toxics Emission Inventory Plan Update Santa Maria Refining Company Emissions Reporting Year 2002* (July 1, 2005; Revised December 1, 2006, December 6, 2007, October 30, 2009 and June, 1 2010)
- *AB2588 Air Toxic Emission Inventory Report Update Santa Maria Refining Company Emissions Reporting Year 2002* (June, 1 2010; Modified by the District)

15.0 ATTACHMENTS

- Significant Cancer Risk Location for 2002 – 16.6 in a million

- Significant Acute Non-Cancer Risk Footprint for 2002 – Hazard Index of 1.0
- Table 4.1 – UTM Coordinates and Modeling Parameters for Emission Release Points
- Table 5.1 – Facility Emissions Summary for 2002
- Comments from the Office of Environmental Health Hazard Assessment
- Response to Comments from the Office of Environmental Health Hazard Assessment
- Source parameter data and HRA input and output files and revisions to the 2002 ATEIR made by the District may be found in the following location: \\NT40\Toxics\Sources\SMRC\2002 HRA Report\SMRC2002HRA.zip

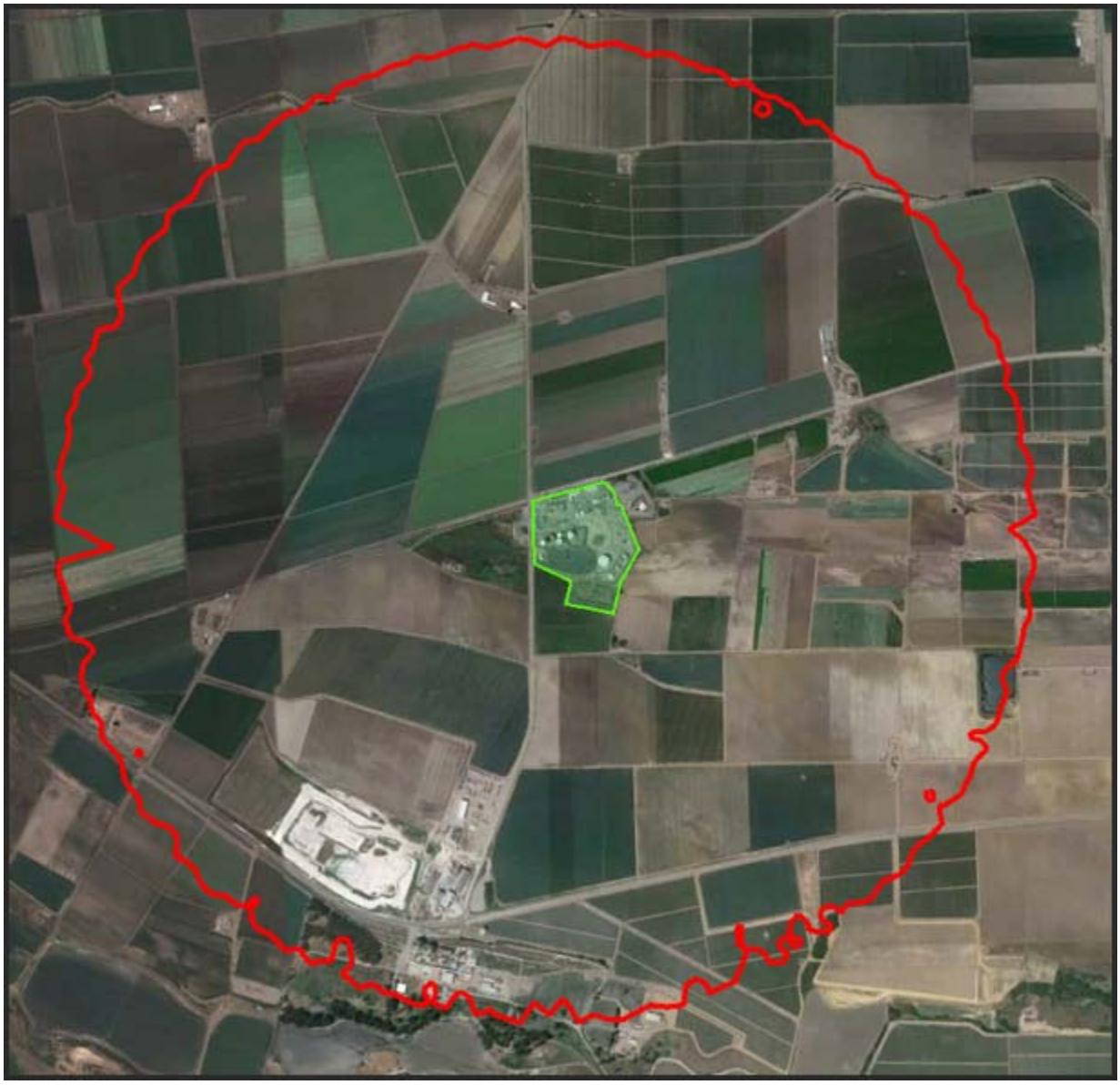
\\sbcapcd.org\toxics\SourceFiles\SSID04640SMRC\2002 HRA Report\Final Revised SMRC 2002 HRA Report.doc

SANTA MARIA REFINING COMPANY

SIGNIFICANT CANCER RISK FOOTPRINT IN RED FOR 2002 – CANCER RISK ≥ 10 IN A MILLION
MAXIMUM OFFSITE CANCER RISK = 16.6 IN A MILLION

(PROPERTY BOUNDARY IN GREEN)

SANTA MARIA REFINING COMPANY



SIGNIFICANT ACUTE RISK FOOTPRINT IN RED FOR 2002 – ACUTE HAZARD INDEX ≥ 1.0
MAXIMUM OFFSITE ACUTE NON-CANCER RISK FOR 2002 = 5.247

(PROPERTY BOUNDARY IN GREEN)

Table 4.1 – UTM Coordinates and Modeling Parameters for Emission Release Points

HARP Stack ID	Stack Name	Release Type	UTM East (m)	UTM North (m)	Release Height (ft)	Temp (F)	Velocity (fpm)	Stack Diam (ft)	Sigma Yint Vol Width (ft)	Sigma Zint Vol Height (ft)	Xint Area X-width (ft)	Yint Area Y-width (ft)	Angle (deg)
2236	Crude Oil Tank T-40001	Point	727450	3867880	48	160	0.01	0.01	Not applicable to point sources				
2237	Crude Oil Tank T-27001	Point	727390	3867860	40	160	0.01	0.01					
2238	Crude Oil Tank T-40002	Point	727420	3867880	48	160	0.01	0.01					
2239	Naphtha Tank T-10008	Point	727613.6	3867735	24.5	68	0.01	0.01					
2240	Gas-Oil Tank T-10009	Point	727446.3	3867879	34	68	0.01	0.01					
2241	Gas-Oil Tank T-25001	Point	727670	3867810	30.5	68	0.01	0.01					
2242	Gas-Oil Tank T-10007	Point	727635.9	3867767	33.3	68	0.01	0.01					
2243	Process Water Tank T-2003	Point	727533.9	3867923	24	68	0.01	0.01					
2244	Gas-Oil Storage Tank T-510	Point	727461.2	3867976	16	68	0.01	0.01					
2245	Cutback Asphalt Tank T-511	Point	727467.2	3867975	16	300	0.01	0.01					
2246	Cutback Asphalt Tank T-512	Point	727467.2	3867981	16	300	0.01	0.01					
2247	Cutback Asphalt Tank T-2001	Point	727431.3	3868014	16	300	0.01	0.01					
2248	Cutback Asphalt Tank T-1509	Point	727420.3	3867988	15.8	300	0.01	0.01					
2249	Lube/Asphalt Tank T-1507	Point	727420.3	3868000	24	400	0.01	0.01					
2250	Lube/Asphalt Tank T-1508	Point	727428.1	3867998	24	400	0.01	0.01					
2251	Asphalt Tank T-2002	Point	727453.1	3868019	25.4	400	0.01	0.01					
2252	Asphalt Tank T-2501	Point	727440.6	3868000	16	400	0.01	0.01					
2253	Asphalt Tank T-2502	Point	727440.6	3867984	16	400	0.01	0.01					
2254	Asphalt Tank T-2503	Point	727451.6	3867998	16	400	0.01	0.01					
2255	Asphalt Tank T-3001	Point	727421.9	3868011	24	400	0.01	0.01					
2256	Asphalt Tank T-5001	Point	727467.2	3868022	24	400	0.01	0.01					
2257	Asphalt Tank T-5003	Point	727464.1	3868000	24	400	0.01	0.01					
2258	Asphalt Tank T-5004	Point	727442.2	3868016	24	400	0.01	0.01					
2259	Asphalt Tank T-10004	Point	727513.8	3867956	40	400	0.01	0.01					
2260	Asphalt Tank T-10005	Point	727528.1	3867961	40	400	0.01	0.01					
2261	Asphalt Tank T-10006	Point	727546.9	3867964	40	400	0.01	0.01					
2262	Emulsion Tank T-1003	Point	727589.8	3868000	16	180	0.01	0.01					
2263	Emulsion Tank T-1004	Point	727596.9	3868003	16	180	0.01	0.01					
2262	Emulsion Tank T-1005	Point	727614.1	3868007	16	180	0.01	0.01					

Table 4.1 – UTM Coordinates and Modeling Parameters for Emission Release Points, Continued

									Sigma Yint	Sigma Zint	Xint	Yint	
HARP Stack ID	**Stack Name**	**Release Type**	**UTM East (m)**	**UTM North (m)**	**Release Height (ft)**	**Temp (F)**	**Velocity (fpm)**	**Stack Diam (ft)**	**Vol Width (ft)**	**Vol Height (ft)**	**Area X-width (ft)**	**Area Y-width (ft)**	**Angle (deg)**
2265	Emulsion Tank T-1601	Point	727620	3868009	17.8	180	0.01	0.01					
2266	Wax Emulsion Tank T-471	Point	727593.8	3867975	29.2	180	0.01	0.01					
2267	Asphalt Emulsion Tank T-472	Point	727603.1	3867976	29.7	180	0.01	0.01					
2268	Asphalt Tank T-100001	Point	727600.9	3867794	40	400	0.01	0.01					
2269	Tank 1501 - Process water	Point	727454	3867944	16.2	68	0.01	0.01					
2270	Tank 253 - Slop Oil	Point	727455	3867928	16	68	0.01	0.01					
2271	Tank 254 - Slop Oil	Point	727450	3867928	16	68	0.01	0.01					
2272	Crude Heater #1, 12.8 MMBtu/hr	Point	727383.6	3867912	40	746	905	3.61					
2273	Crude Heater #2, 18.0 MMBtu/hr	Point	727391.9	3867912	43	674	945	2.62					
2274	Crude Heater #3, 11.0 MMBtu/hr	Point	727378.8	3867914	67.9	674	689	2.95					
2275	Asphalt Heater #1, 4.5 MMBtu/hr	Point	727404	3867981	37.1	651	610	1.97					
2276	Asphalt Heater #2, 4.5 MMBtu/hr	Point	727404	3867985	37.1	651	610	1.97					
2277	Asphalt Heater #3, 3.5 MMBtu/hr	Point	727402.4	3867994	33.1	651	472	1.97					
2278	Asphalt Heater #4, 9.0 MMBtu/hr	Point	727497.2	3867999	54.1	651	590	2.95					
2279	Boiler #1 - 24.0 MMBtu/hr	Point	727366.1	3867921	73.1	550	984	3.61					
2280	Boiler #2 - 25.0 MMBtu/hr	Point	727366.9	3867915	47.9	581	1043	3.61					
2281	Boiler #3 - 4.0 MMBtu/hr	Point	727362.7	3867908	43	581	374	2.3					
2282	DICE 266-hp – firewater	Point	727379.3	3867821	20	531	7,310	0.33					
2283	DICE 92-hp – standby compressor	Point	727390.6	3867903	10	531	6,473	0.21					
2284	Naphtha/Distillate Loading Racks, LR-8 & LR-9	Area	727658.1	3867852	19.70	Not applicable to area sources					47.9	47.9	0
2285	Cutback Emulsion Loading Rack, LR-5	Area	727465.4	3867975	19.70						40.3	40.3	0
2286	Asphalt Emulsion Loading Racks, LR-6, LR-7	Area	727591.6	3867985	19.70						43.0	43.0	0
2287	Asphalt Loading Racks, LR-1, LR-2	Area	727407.7	3867962	19.70						47.9	47.9	0
2288	Cutback/Asphalt Loading Rack, LR-3	Area	727453.9	3867968	19.70						25.3	25.3	0
2289	Asphalt Loading Rack, LR-4	Area	727488.5	3867986	19.70						49.2	49.2	0
2290	API Separator	Area	727458.7	3867931	9.84						47.6	47.6	0
2291	Process Chemical Usage	Area	727350.0	3867890	19.70						209.6	209.6	0
2292	Fugitive Pipe Components: Gas, Oil, Asphalt, Emulsion	Volume	727453.7	3867900	6.56	Not applicable to volume sources			152.56	3.05	Not applicable to volume sources		

Table 5.1 – Facility Emissions Summary for 2002 [1]

Pollutant Name	Emissions (lb/year)
Acetaldehyde	1.724
Acrolein	8.411E-02
Arsenic	8.411E-02
Barium	1.850
Benz[a]anthracene	0.198
Benzene	161.676
Beryllium	5.046E-03
Cadmium	0.463
Carbon disulfide	1.645
Chromium	0.589
Chrysene	0.744
Cobalt	3.533E-02
Copper	0.357
Diesel PM	18.251
Ethyl benzene	597.615
Ethyl chloride {Chloroethane}	0.411
Ethylene glycol monobutyl ether	21.768
Formaldehyde	80.396
Hexane	1911.218
Hydrogen sulfide	1354.538
Isopropyl alcohol	827.280
Manganese	0.160
Mercury	0.109
Methyl bromide {Bromomethane}	0.504
Methyl ethyl ketone	4.011
Methylene chloride {Dichloromethane}	2.777E-02
Naphthalene	34.233
Nickel	0.883
PAHs, total	4.668E-02
p-Dichlorobenzene	2.380
Propylene	132.473
Selenium	1.009E-02
Sodium Hydroxide	27.210
Styrene	0.555
Toluene	476.495
Vanadium	0.967
Xylenes (mixed)	1212.195
Zinc	12.196

[1] The facility emissions summary does not include criteria pollutants or pollutants that do not have OEHHA/ARB approved risk assessment health values (i.e., pollutants that have no contribution to risk).

Office of Environmental Health Hazard Assessment

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Matthew Rodriquez
Secretary for
Environmental Protection

Edmund G. Brown Jr.
Governor

July 30, 2013

Ms. Kaitlin McNally, Engineering Supervisor
Engineering Division
Santa Barbara County Air Pollution Control District
260 North San Antonio Road, Suite A
Santa Barbara, California 93110

Subject: Review of risk assessment for Santa Maria Refinery

Dear Ms. McNally:

The May 2012 Air Toxics Hot Spots Program health risk assessment for airborne emissions from **Santa Maria Refinery Company** has been reviewed by staff of the Office of Environmental Health Hazard Assessment (OEHHA), as required by Health and Safety Code Section 44361. The facility processes crude oil feedstock into asphalt and other products. The report uses ISCST3 and HARP version 1.4e computer programs and models at 1752 receptors (in Run 1) the risks due to 38 Hot Spots chemicals emitted from in 57 point, area, and volume sources. The facility based the report on estimated air emissions in reporting year 2002 which included 162 lbs. of benzene, 18 lbs. of diesel engine exhaust particulate matter, 1911 lbs. of hexane, 1355 lbs. of hydrogen sulfide, and 27 lbs. of sodium hydroxide (Table 5.1).

The risk assessment reports that the total cancer risk at the off-site PMI (Point of Maximum Impact, located 100 feet west of the facility) is 1.05×10^{-5} (receptor #832). Diesel engine exhaust particulate matter is the principal toxic air contaminant driving the risk.

The highest chronic hazard index (HI) is predicted to be 0.165 for the respiratory system.

The highest acute hazard index (HI) is predicted to be 5.236 due to emissions of sodium hydroxide. Sodium hydroxide affects the respiratory system, the eyes, and the skin.

OEHHA is continuing to update its risk assessment guidelines as mandated by the Children's Environmental Health Protection Act of 1999. In 2008 the Scientific Review

Panel on Toxic Air Contaminants approved OEHHA's Technical Support Document for the Derivation of Noncancer Reference Exposure Levels and the Director of OEHHA adopted new acute, 8-hour, and chronic RELs for acetaldehyde, acrolein, arsenic, formaldehyde, manganese, and mercury. Recently OEHHA updated the REL values for nickel and butadiene. The most current health values for noncancer effects of nickel were not used in this report and should be used in any updates of the risk assessment.

Our analysis of the risks depends on the accuracy of the emissions estimates and the appropriateness of the air dispersion modeling. The intent of this letter is to confirm or reevaluate the results of the risk assessment; it should not be construed to imply that OEHHA agrees with any editorial comments or statements contained in the text of the risk assessment that do not impact the results. We hope that our comments are useful to the District and will help in any risk management decisions. If you would like to discuss the review, please call Air Toxics staff at (510) 622-3150.

Sincerely,

James F. Collins

James F. Collins, Ph.D.
Staff Toxicologist
Air Toxicology and
Epidemiology Branch

The District will use the most current RELs during any updates of the HRA for SMRC.

From: Dan Godden [mailto:dgodden@algcorp.com]
Sent: Wednesday, February 26, 2014 2:26 PM
To: Kaitlin E. McNally; Bart Leininger
Cc: Susan Whalen; Lisa Kiehl
Subject: RE: AB2588 - Refinery

Kaitlin,

The "less significant" error referenced in Bart's email yesterday was also related to the coordinates. When I previously superimposed the source, structure, and boundary data on NAD27-based aerial imagery, there was much better agreement than with the NAD83-based aerial imagery; this prompted yesterday's comment. Even with the Datum change, however, there was still an offset, but it was ~20 meters as opposed to ~200 meters for the difference between NAD27 and NAD83. From what you said on the phone a couple weeks ago, making an adjustment for a ~20 m offset is not unusual, so it was not noted.

After taking another look at the model input file today, we discovered an additional ISC3 input error that escaped prior notice and needs to be corrected. Specifically, it appears that the initial horizontal and vertical dimensions for the volume source representing piping components ("Stack" ID 43, modeled source S032) have been reversed in the model input file. See the As modeled and Corrected input lines for ISC3 below.

As modeled: SRCPARAM S032 1.000 1.982 0.930 **46.512**
Corrected: SRCPARAM S032 1.000 1.982 **46.512** 0.930

Let me know if you have any questions about either of these issues.
Regards,
--
Dan Godden | Senior Atmospheric Scientist
dgodden@algcorp.com | www.algcorp.com

From: Kaitlin E. McNally [mailto:McNallyK@sbcapcd.org]
Sent: Wednesday, February 26, 2014 9:27 AM
To: Bart Leininger
Cc: Susan Whalen; Lisa Kiehl; Dan Godden
Subject: RE: AB2588 - Refinery

Bart,

Thank you for informing us of these errors! We are in agreement with your findings and we will not mail the public notice until we have corrected them. You indicated in your e-mail that you found additional, less significant errors with the HRA as well. Please provide me with a list of all errors that you found by the end of the week (COB Friday, 2/28/14). We will make the necessary corrections to the HRA and associated documents and provide the updated public notice documents to you before the public notice is mailed. Thank you!

Sincerely,

Kaitlin

Kaitlin McNally, Air Quality Engineering Supervisor
Engineering Division
Santa Barbara County Air Pollution Control District
Phone: (805) 961-8855
Fax: (805) 961-8801
McNallyK@sbcapcd.org

From: Bart Leininger [mailto:bleininger@algcorp.com]
Sent: Tuesday, February 25, 2014 12:08 PM
To: Kaitlin E. McNally
Cc: Susan Whalen; Lisa Kiehl; Dan Godden
Subject: RE: AB2588 - Refinery
Importance: High

Kaitlin:

I write to request a delay, on behalf of Greka, in sending out the AB-2588 notification for the Santa Maria Refining Co. We had an opportunity to review the HRA that the District prepared, and found a few significant errors that affect the results, and potentially the notification being prepared by the District. The most significant errors we found were:

- The heights of structures entered into the HARP model were in the wrong units. The District entered the values, which were in feet, as meters into the HARP model. No conversion was made before the entries were made. Thus, all structures modeled in HARP were approximately three time too high.

- The UTM coordinates were reported as being based on the NAD83 projection. However, they appear to have been determined from a base map in the NAD27 projection. Since elevations are determined based on these coordinates, this could affect the elevations of all sources, structures, and receptors.

Let me know if you would like to discuss these findings in greater detail with you and your modeling staff.

Separately, we are working on the risk mitigation plans and will forward those to you under separate cover.

Let us know if you request to delay the notification is approved.

Thank you .

Bart

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Bart Leininger, P.E. | Principal
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and delete the message.

From: Kaitlin E. McNally [mailto:McNallyK@sbcapcd.org]
Sent: Thursday, February 20, 2014 8:38 AM
To: Susan Whalen
Cc: Bart Leininger
Subject: RE: AB2588 - Refinery
Importance: High

Susan,

Thank you for the submittal. Please see attached for the draft notification package. We will be sending this package out next week so please let me know if you have any questions by COB Tuesday, February 25, 2014. Thank you!

Sincerely,

Kaitlin

Kaitlin McNally, Air Quality Engineering Supervisor
Engineering Division
Santa Barbara County Air Pollution Control District
Phone: (805) 961-8855
Fax: (805) 961-8801
McNallyK@sbcapcd.org

From: Susan Whalen [mailto:smw@greka.com]
Sent: Thursday, January 30, 2014 4:23 PM
To: Kaitlin E. McNally
Cc: Bart Leininger
Subject: AB2588 - Refinery

Ms. McNally, reference is made to the attached letter and enclosure.

Regards.

Susan M. Whalen
SVP & General Counsel
Direct Ph: (805) 357-2945