

**INTEROFFICE MEMORANDUM**  
**August 19, 2019**

**TO:** Art Valla

**VIA:** Nicholas Maiden  
Sanjeev Kamboj  
Daphne Chong

**FROM:** Ted Hull

**SUBJECT:** Results of Health Risk Assessment (HRA) for Valero Refinery (Benicia, CA) P# 12626,  
**RE:** NOV A58465, S-1004 Reformer Hydrogen Venting

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**SUMMARY:** Per your request, a health risk assessment (HRA) was completed in support of the above referenced Enforcement Action. The HRA estimates the potential health risks associated with uncontrolled discharges of contaminated hydrogen from the Catalytic Reforming operation S-1004. The contaminated hydrogen has been shown to contain Benzene, Ethylbenzene, Toluene, and Xylene (BETX) and may have been discharged into the atmosphere for several years. The HRA results for the provided release estimates are as follows:

- **Cancer Risk (Resident):** 3.3 in a million
- **Chronic HI (Off-site Worker):** 0.04
- **Acute HI :** 10.3

Cancer and Acute HI risks would exceed the Significant Source Thresholds in Regulation 11-18-221; and would not meet the requirements for permitting under Regulations 2-5-301 and 302. Benzene is the overwhelming risk driver in all evaluated categories.

**TAC EMISSIONS:** The toxic air contaminant (TAC) emissions values used in the HRA those from your August 2, 2019 memo. These daily emissions were broken down into the following categories for the purposes of the HRA:

1. **Cancer Risk / Chronic HI:** Annual Average (lb/yr) values of provided BETX emissions.
2. **Acute HI:** Highest single hour of released BETX (max daily values divided by 24).

<b>Scenario:</b>	<b>Benzene</b>	<b>Ethylbenzene</b>	<b>Toluene</b>	<b>Xylene</b>
Annual Average (lb/year)	9,599.5	2,299.5	19,418.0	7,081.0
Highest 1-Hour (lb/hour)	22.3	8.1	45.5	24.0

**HEALTH RISK ASSESSMENT:** The HARP2 Air Dispersion Modeling and Risk Tool (ADMRT) was used to evaluate cancer risk and chronic HI for Residential and Off-site Worker receptors; and acute HI for the highest 1-hour receptor location. Chronic exposure assumptions are based on average annual emission rates and pollutant concentrations that are annual average values; acute exposure is based on the highest hourly concentration value that occurs in the entire meteorological data set. Dispersion modeling for the ADMRT is based on unit emission rates of 1.0 grams per second for each source and determines 1-hour and annual average unit concentrations in micrograms per cubic meter per gram per second (X/Q).

**MODELING:** The AERMOD air dispersion computer model (Version 18081) was used to estimate the annual average and maximum 1-hour pollutant concentrations from the modeled sources. Model runs were made with 5 consecutive years of Valero Admin meteorological data (2013-2017), processed into AERMET sets by BAAQMD meteorological staff. This is on-site meteorological data. Upper air data coincident with the local met data was taken from the Oakland International Airport station, Cloud Cover data is from Concord-Buchanan Field, and the Climate Station is the Martinez Water Plant. Land use parameters including surface roughness length, albedo, and Bowen ratio were evaluated using the USEPA AERSURFACE tool. The model is referenced in NAD 83 UTM coordinates and uses 10-meter resolution terrain data from Solano County (1/3 arc second NED files). A flagpole height of 1.5 meters was used at each receptor to represent the human breathing zone. Default (rural) dispersion coefficients were used to best represent the land use of the area surrounding the facility. The model includes (1) point source.

**HEALTH RISK:** Health risk estimates were calculated in accordance with the BAAQMD's Air Toxics NSR Program HRA Guidelines, dated December 2016. Estimates of residential risk assume potential exposure to annual average TAC concentrations occur 350 days per year, for 30 years. In addition, residential risk estimates assume a 95<sup>th</sup> percentile breathing rate for age groups younger than two years old, and 80<sup>th</sup> percentile breathing rate for age groups that are older than or equal to two years of age. Risk estimates for offsite workers assume potential exposure occurs 8 hours per day, 250 days per year, for 25 years. For offsite workers, the 95<sup>th</sup> percentile 8-hour breathing rate based on moderate activity was assumed. Residential cancer risk estimates include age sensitivity factors (ASFs) and fraction of time at home (FAH) adjustments. The ASFs are age-specific weighting factors used in calculating cancer risks from exposures of infants, children and adolescents, to reflect their anticipated special sensitivity to carcinogens. A Worker Adjustment Factor (WAF) multiplier is applied to cancer risk estimates in cases where source operation is not continuous to account for higher than estimated coincident exposure to source emissions. A similar exposure adjustment factor (EAF) is used for students while attending school. The estimated health risks for this permit application are presented in the table below.

Receptor	NAD 83 UTM Coordinates (meters)		Cancer Risk (in a million)	Chronic HI	Acute HI
	Easting (x)	Northing (y)			
Resident	574,765	4,213,140	3.3	0.016	NA
Worker (WAF = 1.0)	576,065	4,214,240	0.62	0.036	NA
PMI (Max 1-hour)	574,465	4,213,140	NA	NA	10.3