Chevron

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Site Assessment & Remediation Group
Phone (510) 842-9500

August 7, 1995

Ms. Jennifer Eberle
Alameda County Health Care Services
Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Re: Former Chevron Service Station #9-4587
609 Oak Street, Oakland, CA

Dear Ms. Eberle:

Enclosed is a letter dated July 28, 1995, signed by Terra Vac and Chevron providing further clarification of expected outcomes of the forthcoming remediation at the above referenced site. We are in concurrence with your May 31, 1995, approval letter with the clarifications included herein.

We look forward to working with your office on this project. If you have any questions or comments, please feel free to contact me at (510) 842-8134.

Sincerely,
CHEVRON U.S.A. PRODUCTS COMPANY

Mark A. Miller
Site Assessment and Remediation Engineer

Enclosure

cc: Ms. B.C. Owen

Mr. Dewey Bargiacchi
The Paris Company
8520 Pardee
Oakland, CA 94621

Mr. James Kimberlin
1100 Howe Avenue #415
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51 Eureka Street
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TERRA VAC
14798 WICKS BOULEVARD
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■ TEL (510) 351-8900
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July 28, 1995

Jennifer Eberle
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway
Alameda, CA 94502-6577

Re: Former Chevron Station 9-4587
609 Oak Street, Oakland, CA

Dear Ms. Eberle:

We have received and reviewed your letter of June 1, 1995, approving the "Addendum Remediation Work Plan" submitted by Terra Vac on April 26, 1995. We are in concurrence with your clarifications and conditions on cleanup goals and remediation deadlines with the following exceptions:

1) DVE will be replaced by air sparging when the vapor removal approaches asymptotic or removal rates are less than 50 pounds per day and when vapor monitoring indicates a decrease in lighter hydrocarbon constituents and an increase in heavier hydrocarbon constituents over time.

2) Terra Vac and Chevron request that the interim borings be accepted as confirmatory borings if the results are consistent with soil closure goals (100 ppm TPH and 1 ppm benzene). All interim boring locations will be approved by your office before installation.

3) Cessation of air sparging will occur when it is no longer technologically or economically feasible as determined by field testing. The effectiveness of air sparging will be periodically monitored by Oxygen Uptake Recovery (OUR) testing and quarterly groundwater monitoring. When sparging is no longer effective, a risk assessment will be performed to determine if the hydrocarbons remaining in the groundwater present a human health risk. This risk assessment will utilize the American Petroleum Institute Decision Support System (APIDSS) Exposure/Risk Assessment model and the ASTM Emergency Standard, Risk-Based Corrective Action (RBCA) document to determine if the exposure pathway from contaminated groundwater through the vadose zone and into an enclosed space would present a health risk. An example of this informal risk assessment, which was submitted to Mr. Ravi Arulanantham of your office, is included for your review. In conjunction with the submittal of this risk assessment, a

Management Plan will be included. The Management Plan will request a "no further active remediation" status for the site and will discuss the monitoring schedule to be implemented.

Terra Vac and Chevron request written approval of these conditions before remediation begins. Please feel free to contact either Timothy Warner at (510) 351-8900 or Mark Miller at (510) 842-8134 if you have any questions or need any further clarifications.

Sincerely,
Terra Vac Corp.

Timothy Warner
Project Manager

Chevron U.S.A. Products Company

Mark Miller
Site Assessment & Remediation Engineer

cc: 30-0219.17

MEMORANDUM

July 18, 1995
Richmond, California

Risk Assessment - Soil Exposure
Former Gulf Service Station #897
895 West Tennyson Road
Hayward, California

Mr. Mark Miller:
San Ramon, California

Chevron has been working with the City of Hayward Fire Department, San Francisco RWQCB and Alameda County Health Care Services to address soil and groundwater contamination at the above referenced site in an effort to get a "no further active remediation" approval to enable site development. Part of this effort has been the implementation of remedial activities for both the soil and groundwater. Because these remedial activities had reached the "point of diminishing returns", Chevron has undertaken the following exposure assessment to determine the potential health effects of the remaining soil contamination.

The American Petroleum Institute Decision Support System (APIDSS) Exposure/Risk Assessment model was used to generate risk values for both residential and construction worker inhalation and dermal exposure to the subsurface remediated soils that are currently present at the former Gulf service station #897 site. The exposure pathway from contaminated groundwater through the vadose zone and into an enclosed space (Volatilization Factor wesp equation) was modeled using the guidance of the American Society for Testing and Materials (ASTM) Emergency Standard (ES) 38-94, Risk-Based Corrective Action (RBCA) document. Where site specific data was not available, conservative assumptions were made to provide a conservative approximation of the actual risk present at the site.

The results of APIDSS modeling (attached) indicate that the benzene inhalation exposure risk for the residents would be 6e-8 (6 in one hundred million) and for construction workers it would be 2e-9 (2 in one billion). The results for benzene dermal exposure risk for the residents would be 2e-10 (2 in ten billion) and for construction workers it would be 7e-13 (7 in ten trillion). Results of the RBCA modeling for volatilization of vapors from the groundwater to an enclosed space (VFwesp) indicate that the exposure risk to the 62 ppb of benzene in well C-6 would be 8e-7 (8 in 10,000,000).

The following discussion includes background information of the site, a description of the APIDSS and VFwesp models, the selection of exposure scenarios, model input parameters and the APIDSS and VFwesp model results.

Background

The site is underlain by clays from 0-8 feet, sands-silty sands from 8-20 feet and clays from 20-25 feet (total depth explored). Site Assessment activities occurred during 1990 (SB's 1 through 9 and wells C-1 through C-5), 1991 (wells C-6 through C-9) and 1992 (24 SB's). Groundwater has been monitored since 10/90 (current depth to water is 5-8') and the current hydrocarbon plume has been defined and extends offsite to the south of the property. Remedial activities have included Groundwater Extraction (GWE) from 9/12/92 to 12/2/92 and Dual Vapor Extraction (DVE) from 5/16/94 to 7/25/94 and 2/9/95 to 3/29/95. Approximately 1630 pounds of TPH have been removed via DVE and approximately 690,000 gallons of impacted groundwater were removed via GWE.

APIDSS Model - Description

The APIDSS model was developed by API's Soils and Groundwater Task Force to aid in the management of subsurface contaminants by providing a scientific basis to evaluate the potential health threats due to exposure to petroleum related contaminants. The American Society for Testing and Materials (ASTM) has included APIDSS as a component in their Risk Based Corrective Action (RBCA) model for evaluating appropriate corrective actions at petroleum contaminated sites.

The APIDSS model consists of 4 modules that are inter-related and are briefly explained below:

1) Module 1 is the Development of a Risk Scenario module. In this module the modeler is allowed to choose any of six exposure pathways, up to 5 chemicals of concern (BTEX predominantly), and the Fate and Transport models to be run (Groundwater, Soil and Air models).

2) Module 2 is the Fate and Transport module. Here the modeler inputs the site specific physical and chemical parameters into the chosen groundwater model (AT123D), soil model (SESOIL or Jury), and/or air model (Jury, SESOIL, Thibodeaux-Hwang, Farmers). This module will calculate the theoretical receptor point contaminant concentrations in any of these three media (water, soil and air). The receptor point concentration is that concentration that a person (receptor) would be exposed to due to the presence of contaminants in any of the three media. The location of the receptor point can be chosen as either onsite or offsite residents or workers.

3) Module 3 is the Chemical Intake and Risk Calculation module. The calculated contaminant concentrations from the Fate and Transport module for a receptor point are used to calculate a risk value associated with an exposure to the chosen contaminants. The modeler is able to input the individual receptor characteristics into the model (body weight/life-span, routes of entry and dose-response data). Based on the receptor point concentration and characteristics, a risk value is generated from look-up tables imbedded in the program. Carcinogenic risk values (Benzene exposure) and Hazard Indices (TEX exposure) are generated in this module.

4) Module 4 is the Risk Presentation module. The output from module 3 (carcinogenic risk, hazard indices) is presented in table or chart format for each of the chemicals of concern and exposure pathways for presentation purposes.

Also included in the APIDSS model is the Data Requirements module in which the entire input data set is captured (all module input parameters). This data can be presented for both model results verification and for Regulatory inspection/acceptance of input parameters.

Volatilization Factor for groundwater to enclosed spaces (VFwesp)

Using the equations presented in ASTM document ES 38-94 (Table x2.4 attached), the VFwesp value is calculated by solving equation 1) on the next page. The VFwesp value is then combined with actual site groundwater concentration values (62 ppb from C-6) to calculate a vapor concentration (C building) in the enclosed space (equation 2). The Chemical Intake value is generated for specific receptor characteristics (equation 3) and a Risk value is calculated by multiplying the Cancer Slope Factor for benzene (0.029 mg/Kg-day) times the calculated Chemical Intake value (equation 4).

1) Volatilization Factor wesp - (VFwesp) - groundwater to enclosed space vapors:

A) See attached ES 38-94 Table x2.4; note that VFwesp calculation requires the solving of equations for effective diffusion between groundwater and soil and for effective diffusion between soil and foundation crack.

2) Vapor concentration in a building - C (building) = VFwesp * C (groundwater)

3) Intake Value - Intake = $\frac{\text{C (building) * Respiration rate * Days exposed * Years exposed}}{\text{Receptor Weight * Days/years * Lifetime (years)}}$

4) Risk Value - Risk = Intake * Cancer Slope Factor for Benzene (0.029 mg/Kg-day)

(0.1) CA

Exposure Scenarios

Future site development plans for this site may include a paved church parking lot and a potential church health care facility. Based on this proposed development, several hypothetical future exposure scenarios were evaluated in the risk assessment, including: 1) on-site construction worker exposure to soil contamination through inhalation of vapors and dermal exposure; and 2) hypothetical future on-site adult resident exposure to soil contamination through inhalation of vapors and dermal exposure; and 3) Residential exposure from volatilization of groundwater contamination migrating through the vadose zone and into enclosed spaces (residence) above the contamination plume. Construction worker and resident ingestion of, inhalation of, and dermal exposure to impacted groundwater was not considered because EBMUD supplies the drinking water to the residents. Also, the probable development options would preclude exposure to the groundwater for construction purposes.

Benzene, toluene, ethylbenzene and xylene (BTEX) were the contaminants modeled using the APIDSS model and benzene was modeled by the ASTM RBCA volatilization model as they are the regulated primary chemicals of concern in gasoline contaminated soils and groundwater. These contaminants also represent the greatest health threat to humans. Total petroleum hydrocarbons (TPH) were not modeled as it is not a specific compound and does not have compound specific chemical, physical and exposure/risk parameters.

APIDSS Input Parameters

The attached Data Requirements section for the resident (G-897A) and construction worker (G-897CW) scenarios lists the input parameters used for both of these models. SESOIL was the Fate and Transport model used to determine dermal exposure and these results were used to determine volatile emissions for inhalation exposure. Where site-specific data was available it was used as input values and conservative estimates were used where such data was not available. The modeled site soil contamination was characterized by 2 soil layers consisting of a 2.5 meter clay overlying a 0.25 meter sand at the groundwater interface for the site. The impacted area of the site was estimated to be the areal reach of the vapor extraction system, about 125' by 80'. Interim borings VE-1 and VE-2 were located within the contaminated area and were drilled and sampled to determine the remaining soil contamination prior to completion of soil remediation by HVE. The soil analytical results from boring VE-1 at 10' depth were used as the mass input values for the BTEX constituents in both soil layers at the site. Because additional soil remediation was conducted following the collection of these soil samples, true soil concentrations would probably be lower, making this a conservative assumption in the model. Note that biodegradation was not applied to any soil or groundwater calculation for the models at this site.

VFwesp Input Parameters

Site-specific values for porosity, thickness of capillary and vadose zones and benzene physical parameters were combined with estimated parameters (attached table X2.5) to solve equations 1 through 4 in the above section on VFwesp.

APIDSS and VFwesp Results

The APIDSS generated tables for Carcinogenic Risk and Hazard Indices for the resident and construction worker (attached) indicate the resident would have an exposure risk to benzene of 6e-8 for inhalation of soil emissions and a 2e-10 risk due to dermal contact with the soils. The construction worker would have a 2e-9 risk due to inhalation of soil emissions and a 7e-13 risk due to dermal contact with soil. The risk due to volatilization of a groundwater contaminant (benzene) migrating into enclosed spaces (residence) for 30 years using the groundwater concentration in well C-6 is approximately 8e-7. The generally accepted risk levels for these exposure scenarios are between 1e-4 to 1e-6 (1 in 10,000 to 1 in a million). Because these modeled results are approximately 1 to 6 orders of magnitude less than the 1e-6 value, it is reasonable to say that the site soils and groundwater do not represent a human health threat to offsite residents.

Summary

Modeling of site-specific parameters for exposure scenarios related to soil and groundwater contamination (dermal contact, inhalation, vapor emissions to enclosed spaces) indicates that the site remediation activities undertaken at this site have lowered the contaminant concentrations to levels that do not represent a threat to human health at this site. It is therefore recommended that Chevron apply for a "no further active remediation" designation for the soils at this site to enable site development to proceed.

Please contact me at 510-242-7086 with questions or comments regarding this memorandum.

Curtis A. Peck

Curtis A. Peck, R. G.
Lead Hydrogeologist

Attachments:
1) ASTM RBCA ES 38-94 Table x2.4
2) ASTM RBCA ES 38-94 Table x2.5
3) Solutions for Equations
4) Risk Output for Resident and Construction Worker
5) APIDSS Output 9-0897CW; Construction Worker scenario
6) APIDSS Output G-897A; Resident scenario

Table X2.4. Volatilization factors (VF_i), leaching factor (LF_{sw}), and effective diffusion coefficients (D_i^{eff}).

VF_i	Cross-Media Route	Equation
VF_{wesp}	groundwater -> enclosed-space vapors	$$VF_{wesp}\left[\frac{(mg/m^3\text{-air})}{(mg/L\text{-}H_2O)}\right] = \frac{H\left[\frac{D_{ws}^{eff}/L_{GW}}{ER\,L_B}\right]}{1+\left[\frac{D_{ws}^{eff}/L_{GW}}{ER\,L_B}\right]+\left[\frac{D_{ws}^{eff}/L_{GW}}{(D_{crack}^{eff}/L_{crack})\,h}\right]} \times 10^3 \frac{L}{m^3}$$ (based on Johnson and Ettinger, 1991).
VF_{wamb}	groundwater -> ambient (outdoor) vapors	$$VF_{amb}\left[\frac{(mg/m^3\text{-air})}{(mg/L\text{-}H_2O)}\right] = \frac{H}{1+\left[\frac{U_{air}\,d_{air}\,L_{GW}}{W\,D_{ws}^{eff}}\right]} \times 10^3 \frac{L}{m^3}$$ (based on USEPA "Superfund Exposure Assessment Manual". 1988)
VF_{ss}	Surficial Soils -> Ambient Air (vapors)	$$VF_{ss}\left[\frac{(mg/m^3\text{-air})}{(mg/kg\text{-soil})}\right] = \frac{2\,W\,r_s}{U_{air}\,d_{air}}\sqrt{\frac{D_s^{eff}\,H}{p\,[q_{ws}+k_s\,r_s+H\,q_{as}]\,t}} \times 10^3 \frac{cm^3\text{-}kg}{m^3\text{-}g}$$ (based on Jury et al.. 1983) or $$VF_{ss}\left[\frac{(mg/m^3\text{-air})}{(mg/kg\text{-soil})}\right] = \frac{W\,r_s\,d}{U_{air}\,d_{air}\,t} \times 10^3 \frac{cm^3\text{-}kg}{m^3\text{-}g}$$; whichever is less (based on mass balance)
VF_p	Surficial Soils -> Ambient Air (particulates)	$$VF_p\left[\frac{(mg/m^3\text{-air})}{(mg/kg\text{-soil})}\right] = \frac{P_e\,W}{U_{air}\,d_{air}} \times 10^3 \frac{cm^3\text{-}kg}{m^3\text{-}g}$$ (based on Cowherd et al. 1985)
VF_{samb}	Subsurface Soils -> Ambient Air	$$VF_{samb}\left[\frac{(mg/m^3\text{-air})}{(mg/kg\text{-soil})}\right] = \frac{H\,r_s}{[q_{ws}+k_s\,r_s+H\,q_{as}]\left(1+\frac{U_{air}\,d_{air}\,LS}{D_s^{eff}\,W}\right)} \times 10^3 \frac{cm^3\text{-}kg}{m^3\text{-}g}$$ (based on Johnson et al. 1990)

Table X2.4. Volatilization factors (VF_i), leaching factor (LF_{sw}), and effective diffusion coefficients (D_i^{eff}) (cont.).

Symbol	Definition	Equation
VF_{sesp}	subsurface soil -> enclosed-space vapors	$VF_{sesp}\left[\frac{(mg/m^3\text{-air})}{(mg/kg\text{-soil})}\right] = \frac{\frac{H\,r_s}{[q_{ws} + k_s r_s + H\,q_{as}]}\left[\frac{D_s^{eff}/L_S}{ER\,L_B}\right]}{1 + \left[\frac{D_s^{eff}/L_S}{ER\,L_B}\right] + \left[\frac{D_S^{eff}/L_s}{(D_{crack}^{eff}/L_{crack})\,h}\right]} \times 10^3\,\frac{cm^3\text{-kg}}{m^3\text{-g}}$ (based on Johnson and Ettinger, 1991).
LF_{sw}	Subsurface Soils -> groundwater	$LF_{sw}\left[\frac{(mg/l\text{-}H_2O)}{(mg/kg\text{-soil})}\right] = \frac{r_s}{[q_{ws} + k_s r_s + H\,q_{as}]\left(1 + \frac{U_{gw}\,d_{gw}}{I\,W}\right)} \times 10^0\,\frac{cm^3\text{-kg}}{L\text{-g}}$ (based on USEPA "Superfund Exposure Assessment Manual". 1988)
D_s^{eff}	effective diffusion coefficient in soil based on vapor-phase concentration	$D_s^{eff}\left[\frac{cm^2}{s}\right] = D^{air}\frac{q_{as}^{3.33}}{q_T^2} + D^{wat}\frac{1}{H}\frac{q_{ws}^{3.33}}{q_T^2}$ (based on Johnson and Ettinger, 1991)
D_{crack}^{eff}	effective diffusion coefficient through foundation cracks	$D_{crack}^{eff}\left[\frac{cm^2}{s}\right] = D^{air}\frac{q_{acrack}^{3.33}}{q_T^2} + D^{wat}\frac{1}{H}\frac{q_{wcrack}^{3.33}}{q_T^2}$ (based on Johnson and Ettinger, 1991)
D_{cap}^{eff}	effective diffusion coefficient through capillary fringe	$D_{cap}^{eff}\left[\frac{cm^2}{s}\right] = D^{air}\frac{q_{acap}^{3.33}}{q_T^2} + D^{wat}\frac{1}{H}\frac{q_{wcap}^{3.33}}{q_T^2}$ (based on Johnson and Ettinger, 1991)
D_{ws}^{eff}	effective diffusion coefficient between groundwater and soil surface	$D_{ws}^{eff}\left[\frac{cm^2}{s}\right] = (h_{cap} + h_v)\left[\frac{h_{cap}}{D_{cap}^{eff}} + \frac{h_v}{D_s^{eff}}\right]^{-1}$ (based on Johnson and Ettinger, 1991)
C_s^{sat}	soil concentration at which dissolved pore-water and vapor phases become saturated	$C_s^{sat}\left[\frac{mg}{kg\text{-soil}}\right] = \frac{S}{r_s} \times [H\,q_{as} + q_{ws} + k_s r_s] \times 10^0\,\frac{L\text{-g}}{cm^3\text{-kg}}$ (based on Johnson et al. 1990)

X2.6. Soil, building, surface, and subsurface parameters used in generating example Tier 1 RBSLs (see §X2.10 for justification of parameter selection).

Parameters	Definitions (Units)	Residential	Comm/Ind
d	lower depth of surficial soil zone (cm)	100 cm	100 cm
D^{air}	diffusion coefficient in air (cm^2/s)	Chem. specific	Chem. specific
D^{wat}	diffusion coefficient in water (cm^2/s)	Chem. specific	Chem. specific
ER	enclosed-space air exchange rate (1/s)	0.00014 s^{-1}	0.00023 s^{-1}
f_{oc}	fraction of organic carbon in soil (g-C/g-soil)	0.01	0.01
H	Henry's Law Constant (cm^3-H_2O)/(cm^3-air)	Chem. specific	Chem. specific
h_{cap}	thickness of capillary fringe (cm)	5 cm	5 cm
h_v	thickness of vadose zone (cm)	295 cm	295 cm
I	infiltration rate of water through soil (cm/y)	30 cm/y	30 cm/y
k_{oc}	carbon-water sorption coefficient (cm^3-H_2O/g-C)	Chem. specific	Chem. specific
k_s	soil-water sorption coefficient (cm^3-H_2O/g-soil)	$f_{oc} \times k_{oc}$	$f_{oc} \times k_{oc}$
L_B	enclosed-space volume/infiltration area ratio (cm)	200 cm	300 cm
L_{crack}	enclosed-space foundation or wall thickness (cm)	15 cm	15 cm
L_{GW}	depth to groundwater = $h_{cap} + h_v$ (cm)	300 cm	300 cm
L_S	depth to subsurface soil sources (cm)	100 cm	100 cm
P_e	particulate emission rate (g/cm^2-s)	6.9×10^{-14}	6.9×10^{-14}
S	pure component solubility in water (mg/L-H_2O)	Chem. specific	Chem. specific
U_{air}	wind speed above ground surface in ambient mixing zone (cm/s)	225 cm/s	225 cm/s
U_{gw}	groundwater Darcy velocity (cm/y)	2500 cm/y	2500 cm/y
W	width of source area parallel to wind, or groundwater flow direction (cm)	1500 cm	1500 cm
d_{air}	ambient air mixing zone height (cm)	200 cm	200 cm
d_{gw}	groundwater mixing zone thickness (cm)	200 cm	200 cm
h	areal fraction of cracks in foundations/walls (cm^2-cracks/cm^2-total area)	0.01 cm^2-cracks/cm^2-total area	0.01 cm^2-cracks/cm^2-total area
q_{acap}	volumetric air content in capillary fringe soils (cm^3-air/cm^3-soil)	0.038 cm^3-air/cm^3-soil	0.38 cm^3-air/cm^3-soil
q_{acrack}	volumetric air content in foundation/wall cracks (cm^3-air/cm^3 total volume)	0.26 cm^3-air/cm^3 total volume	0.26 cm^3-air/cm^3 total volume
q_{as}	volumetric air content in vadose zone soils (cm^3-air/cm^3-soil)	0.26 cm^3-air/cm^3-soil	0.26 cm^3-air/cm^3-soil
q_T	total soil porosity (cm^3/cm^3-soil)	0.38 cm^3/cm^3-soil	0.38 cm^3/cm^3-soil
q_{wcap}	volumetric water content in capillary fringe soils (cm^3-H_2O/cm^3-soil)	0.342 cm^3-H_2O/cm^3-soil	0.342 cm^3-H_2O/cm^3-soil
q_{wcrack}	volumetric water content in foundation/wall cracks (cm^3-H_2O/cm^3 total volume)	0.12 cm^3-H_2O/cm^3 total volume	0.12 cm^3-H_2O/cm^3 total volume
q_{ws}	volumetric water content in vadose zone soils (cm^3-H_2O/cm^3-soil)	0.12 cm^3-H_2O/cm^3-soil	0.12 cm^3-H_2O/cm^3-soil
[illegible]	soil bulk density (g-soil/cm^3-soil)	1.7 g/cm^3	1.7 g/cm^3
t	averaging time for vapor flux (s)	7.88×10^8 s	7.88×10^8 s

EQUATIONS

$$1)\ \mathbf{VFwesp} = \frac{(0.22)\ \frac{[(1.7e\text{-}4\ cm2/s)\ /\ (275\ cm)]}{[(1.4e\text{-}4\ s\text{-}1) * (200\ cm)]}}{1 + \frac{[(1.7e\text{-}4\ cm2/s)\ /\ (275\ cm)]}{[(1.4e\text{-}4\ s\text{-}1) * (200\ cm)]} + \frac{[(1.7e\text{-}4\ cm2/s\ /\ (275\ cm)]}{[(6.5e\text{-}3\ cm/s)\ /\ 20\ cm)e0.01]} * 1e3\ L/m*3}$$

$$VFwesp = \frac{(0.22)\ (2.21e\text{-}5)}{1 + [(2.21e\text{-}5) + (6e\text{-}7\ /\ 0.923)]} * 1e3\ L/m*3$$

$$VFwesp = \frac{(4.9e\text{-}6)}{1 + [(2.21e\text{-}5) + (7e\text{-}7)]} * 1e3\ L/m*3$$

VFwesp = (4.9e-6) * 1e3 L/m*3

$$\mathbf{VFwesp = 4.9e\text{-}3\ \frac{mg/m*3\text{-}air}{mg/L\text{-}water}}$$

2) C building = (VFwesp) * (C water) ; where C water = 62 ppb (0.062 mg/L) from well C-6

$$C\ building = 4.9e\text{-}3\ \frac{[mg/m*3\text{-}air]}{[mg/L\text{-}water]} * (0.062\ mg/L)$$

C building = 3.04e-4 mg/m*3-air

$$\mathbf{3)\ Chemical\ Intake} = \frac{(C\ building) * (Respiration\ Rate) * (Days\ Exposed) * (Years\ Exposed)}{(Receptor\ Weight) * (Days/year) * (Expected\ Lifetime)}$$

$$Intake = \frac{(3.04e\text{-}4\ mg/m*3) * (15\ m*3/day) * (350\ days) * (30\ years)}{(70\ Kg) * (365\ days) * (70\ years)}$$

Intake = 2.7e-5 mg/Kg/day

4) Risk = Chemical Intake * Cancer Potency Factor (benzene); where CPF = 0.029 mg/Kg-day

Risk = (2.7e-5 mg/Kg/day) * (0.029 mg/Kg-day)

Risk = 8e-7

Analysis for Gulf # 897

Carcinogenic Risk by Chemical for Each Route of Concern

Chemical	Inhalation of Soil Emissions	Dermal Contact With Soil	Total
Benzene	6.12E-08	1.72E-10	6.14E-08
Ethylbenzene	ND	ND	0.00E+00
Toluene	ND	ND	0.00E+00
Xylene	ND	ND	0.00E+00
Total	6.12E-08	1.72E-10	6.14E-08

Hazard Index by Chemical for Each Route of Concern

Chemical	Inhalation of Soil Emissions	Dermal Contact With Soil	Total
Benzene	ND	ND	0.00E+00
Ethylbenzene	7.31E-06	8.70E-07	8.18E-06
Toluene	1.94E-05	1.08E-07	1.95E-05
Xylene	1.13E-04	8.64E-08	1.13E-04
Total	1.40E-04	1.06E-06	1.41E-04

Deterministic Run
ND = Not Determined because RfD or Slope Factor not entered
NA = Not Applicable
06/30/95 14:58

Analysis for Gulf # 897 - Construction Worker

Carcinogenic Risk by Chemical for Each Route of Concern

Chemical	Inhalation of Soil Emissions	Dermal Contact With Soil	Total
Benzene	1.99E-09	7.37E-13	1.99E-09
Ethylbenzene	ND	ND	0.00E+00
Toluene	ND	ND	0.00E+00
Xylene	ND	ND	0.00E+00
Total	1.99E-09	7.37E-13	1.99E-09

Hazard Index by Chemical for Each Route of Concern

Chemical	Inhalation of Soil Emissions	Dermal Contact With Soil	Total
Benzene	ND	ND	0.00E+00
Ethylbenzene	1.28E-05	2.00E-07	1.30E-05
Toluene	3.72E-05	2.73E-08	3.72E-05
Xylene	2.30E-04	2.31E-08	2.30E-04
Total	2.80E-04	2.50E-07	2.80E-04

Deterministic Run
ND = Not Determined because RfD or Slope Factor not entered
NA = Not Applicable
07/05/95 12:44

The following chemicals were selected:
Benzene
Ethylbenzene
Toluene
Xylene

Data for Fate and Transport Models

Sesoil Model - Deterministic

Model Control Parameters	
Simulation Time (max=100) [years]	25
Number of soil layers	2
Sublayers in layer 1	1
Sublayers in layer 2	1
Volatile emissions:	Yes
Climate Parameters	
Surface Temperature [C]	16
Evapotranspiration [cm/day]	0.001
Precipitation [cm/yr]	60
Storm duration [days]	2
Number of storms [yr^-1]	6
Length of Rainy Season [months]	5
Soil Column Data	
Effective porosity [-]	0.25
Dry Wt. Soil Bulk Density [g/cm^3]	1.8
X-dimension of the source [m]	38
Y-dimension of the source [m]	24
Layer 1	
Thickness of Layer [m]	2.5
Intrinsic Permeability [cm^2]	1e-10
Fraction Organic Carbon [-]	0.05
Benzene Load [kg]	1.2
Ethylbenzene Load [kg]	2.7
Toluene Load [kg]	0.77
Xylene Load [kg]	6.58
Layer 2	
Thickness of Layer [m]	0.25
Intrinsic Permeability [cm^2]	1e-7
Fraction Organic Carbon [-]	0.05
Benzene Load [kg]	0.12
Ethylbenzene Load [kg]	0.27
Toluene Load [kg]	0.08
Xylene Load [kg]	0.66
Sesoil Chemical Specific Parameters	
Benzene	
Solubility [mg/l]	1750
Diffusion Coeff. in Air [cm^2/s]	0.087
Henrys Constant [Atm/m^3/mol]	2.49E-01
Koc [ug/gOC/ug/ml]	83
Degradation Rate Constant in Unsaturated Zc	0.0E+00s]
Vapor Pressure [mmHg]	95.2
Ethylbenzene	
Solubility [mg/l]	152
Diffusion Coeff. in Air [cm^2/s]	0.066
Henrys Constant [Atm/m^3/mol]	2.87E-01
Koc [ug/gOC/ug/ml]	1100
Degradation Rate Constant in Unsaturated Zc	0.00E+00]
Vapor Pressure [mmHg]	7
Toluene	
Solubility [mg/l]	535

Diffusion Coeff. in Air [cm^2/s]	0.078
Henrys Constant [Atm/m^3/mol]	2.84E-01
Koc [ug/gOC/ug/ml]	300
Degradation Rate Constant in Unsaturated Zc	0.00E+00]
Vapor Pressure [mmHg]	28.1
Xylene	
Solubility [mg/l]	198
Diffusion Coeff. in Air [cm^2/s]	0.072
Henrys Constant [Atm/m^3/mol]	3.15E-01
Koc [ug/gOC/ug/ml]	240
Degradation Rate Constant in Unsaturated Zc	0.00E+00]
Vapor Pressure [mmHg]	10

Sesoil Model - Deterministic

Model Control Parameters	
Simulation Time (max=100) [years]	25
Number of soil layers	2
Sublayers in layer 1	1
Sublayers in layer 2	1
Volatile emissions:	Yes
Climate Parameters	
Surface Temperature [C]	16
Evapotranspiration [cm/day]	0.001
Precipitation [cm/yr]	60
Storm duration [days]	2
Number of storms [yr^-1]	6
Length of Rainy Season [months]	5
Soil Column Data	
Effective porosity [-]	0.25
Dry Wt. Soil Bulk Density [g/cm^3]	1.8
X-dimension of the source [m]	38
Y-dimension of the source [m]	24
Layer 1	
Thickness of Layer [m]	2.5
Intrinsic Permeability [cm^2]	1e-10
Fraction Organic Carbon [-]	0.05
Benzene Load [kg]	1.2
Ethylbenzene Load [kg]	2.7
Toluene Load [kg]	0.77
Xylene Load [kg]	6.58
Layer 2	
Thickness of Layer [m]	0.25
Intrinsic Permeability [cm^2]	1e-7
Fraction Organic Carbon [-]	0.05
Benzene Load [kg]	0.12
Ethylbenzene Load [kg]	0.27
Toluene Load [kg]	0.08
Xylene Load [kg]	0.66
Sesoil Chemical Specific Parameters	
Benzene	
Solubility [mg/l]	1750
Diffusion Coeff. in Air [cm^2/s]	0.087
Henrys Constant [Atm/m^3/mol]	2.49E-01
Koc [ug/gOC/ug/ml]	83
Degradation Rate Constant in Unsaturated Zc	0.0E+00s]
Vapor Pressure [mmHg]	95.2
Ethylbenzene	
Solubility [mg/l]	152
Diffusion Coeff. in Air [cm^2/s]	0.066
Henrys Constant [Atm/m^3/mol]	2.87E-01
Koc [ug/gOC/ug/ml]	1100
Degradation Rate Constant in Unsaturated Zc	0.00E+00]

Vapor Pressure [mmHg]	7
Toluene	
Solubility [mg/l]	535
Diffusion Coeff. in Air [cm^2/s]	0.078
Henrys Constant [Atm/m^3/mol]	2.84E-01
Koc [ug/gOC/ug/ml]	300
Degradation Rate Constant in Unsaturated Zc	0.00E+00]
Vapor Pressure [mmHg]	28.1
Xylene	
Solubility [mg/l]	198
Diffusion Coeff. in Air [cm^2/s]	0.072
Henrys Constant [Atm/m^3/mol]	3.15E-01
Koc [ug/gOC/ug/ml]	240
Degradation Rate Constant in Unsaturated Zc	0.00E+00]
Vapor Pressure [mmHg]	10

Box Dispersion Model - Deterministic

Wind Speed [m/s]	2.5
Height of Box [m]	2
Width of Box [m]	2

Data for Risk Assessment

Body Weight and Lifetime - Deterministic

Average Weight (kg)	70
Lifetime (yrs)	75

Inhalation of Soil Emissions

Exposure Frequency [days/yr]	78
Exposure Duration [years]	0.25
Inhalation Rate [m^3/hr]	3.7
Time Outdoors [hours/day]	8

nhalation of Soil Emissions Chemical Specific Parameters

Benzene	
Bioavailability [fraction]	1
Ethylbenzene	
Bioavailability [fraction]	1
Toluene	
Bioavailability [fraction]	1
Xylene	
Bioavailability [fraction]	1

Dermal Contact with Soil

Exposure Frequency [days/yr]	78
Exposure Duration [years]	0.25
Skin Surface Area [cm^2]	3120.
Adherence Factor [mg/cm^2]	1

Dermal Contact Chemical Specific Parameters

Benzene	
Dermal Absorption Factors [fraction]	1
Ethylbenzene	
Dermal Absorption Factors [fraction]	1
Toluene	
Dermal Absorption Factors [fraction]	1
Xylene	
Dermal Absorption Factors [fraction]	1

Dermal Dose

Benzene	
Slope Factor [1/(mg/kg-day)]	0.029
Reference Dose [mg/kg-day]	ND
Ethylbenzene	

Slope Factor [1/(mg/kg-day)]	NA
Reference Dose [mg/kg-day]	0.1
Toluene	
Slope Factor [1/(mg/kg-day)]	NA
Reference Dose [mg/kg-day]	0.2
Xylene	
Slope Factor [1/(mg/kg-day)]	NA
Reference Dose [mg/kg-day]	2
Inhalation Dose	
Benzene	
Slope Factor [1/(mg/kg-day)]	0.029
Reference Dose [mg/kg-day]	ND
Ethylbenzene	
Slope Factor [1/(mg/kg-day)]	NA
Reference Dose [mg/kg-day]	2.86E-1
Toluene	
Slope Factor [1/(mg/kg-day)]	NA
Reference Dose [mg/kg-day]	1.14E-1
Xylene	
Slope Factor [1/(mg/kg-day)]	NA
Reference Dose [mg/kg-day]	0.2

Analysis for Gulf # 897 - Construction Worker
Receptor Point Concentration in Soil

Averaging Time* [Years]	Benzene [mg/kg]	Ethylbenzene [mg/kg]	Toluene [mg/kg]	Xylene [mg/kg]
5	8.00E-04	2.10E-03	5.74E-04	4.86E-03
10	6.90E-04	2.08E-03	5.48E-04	4.56E-03
15	5.97E-04	2.06E-03	5.24E-04	4.29E-03
20	5.21E-04	2.03E-03	5.02E-04	4.04E-03
25	4.57E-04	2.01E-03	4.81E-04	3.81E-03
30	4.57E-04	2.01E-03	4.81E-04	3.81E-03
35	4.57E-04	2.01E-03	4.81E-04	3.81E-03
40	4.57E-04	2.01E-03	4.81E-04	3.81E-03
45	4.57E-04	2.01E-03	4.81E-04	3.81E-03
50	4.57E-04	2.01E-03	4.81E-04	3.81E-03
55	4.57E-04	2.01E-03	4.81E-04	3.81E-03
60	4.57E-04	2.01E-03	4.81E-04	3.81E-03
65	4.57E-04	2.01E-03	4.81E-04	3.81E-03
70	4.57E-04	2.01E-03	4.81E-04	3.81E-03
75	4.57E-04	2.01E-03	4.81E-04	3.81E-03

*The maximum RUNNING average concentration is shown for these averaging times.
For example, the maximum 5-year average concentration may not occur in the first five years.
To find out when the maximum RUNNING concentrations occured, view the charts.
Simulation Time = 25 Years
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Analysis for Gulf # 897 - Construction Worker
Receptor Point Concentration in Air

Averaging Time* [Years]	Benzene [mg/m^3]	Ethylbenzene [mg/m^3]	Toluene [mg/m^3]	Xylene [mg/m^3]
5	2.28E-04	4.04E-05	4.70E-05	5.08E-04
10	1.96E-04	3.99E-05	4.49E-05	4.77E-04
15	1.70E-04	3.95E-05	4.29E-05	4.48E-04
20	1.48E-04	3.90E-05	4.11E-05	4.22E-04
25	1.30E-04	3.86E-05	3.93E-05	3.98E-04
30	1.30E-04	3.86E-05	3.93E-05	3.98E-04
35	1.30E-04	3.86E-05	3.93E-05	3.98E-04
40	1.30E-04	3.86E-05	3.93E-05	3.98E-04
45	1.30E-04	3.86E-05	3.93E-05	3.98E-04
50	1.30E-04	3.86E-05	3.93E-05	3.98E-04
55	1.30E-04	3.86E-05	3.93E-05	3.98E-04
60	1.30E-04	3.86E-05	3.93E-05	3.98E-04
65	1.30E-04	3.86E-05	3.93E-05	3.98E-04
70	1.30E-04	3.86E-05	3.93E-05	3.98E-04
75	1.30E-04	3.86E-05	3.93E-05	3.98E-04

*The maximum RUNNING average concentration is shown for these averaging times.
For example, the maximum 5-year average concentration may not occur in the first five years.
To find out when the maximum RUNNING concentrations occured, view the charts.
Simulation Time = 75 Years
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Analysis for Gulf # 897 - Construction Worker
Volatile Emissions

Averaging Time* [Years]	Benzene [kg/year]	Ethylbenzene [kg/year]	Toluene [kg/year]	Xylene [kg/year]
5	7.18E-02	1.27E-02	1.48E-02	1.60E-01
10	6.19E-02	1.26E-02	1.42E-02	1.51E-01
15	5.36E-02	1.24E-02	1.35E-02	1.41E-01
20	4.67E-02	1.23E-02	1.30E-02	1.33E-01
25	4.10E-02	1.22E-02	1.24E-02	1.26E-01
30	4.10E-02	1.22E-02	1.24E-02	1.26E-01
35	4.10E-02	1.22E-02	1.24E-02	1.26E-01
40	4.10E-02	1.22E-02	1.24E-02	1.26E-01
45	4.10E-02	1.22E-02	1.24E-02	1.26E-01
50	4.10E-02	1.22E-02	1.24E-02	1.26E-01
55	4.10E-02	1.22E-02	1.24E-02	1.26E-01
60	4.10E-02	1.22E-02	1.24E-02	1.26E-01
65	4.10E-02	1.22E-02	1.24E-02	1.26E-01
70	4.10E-02	1.22E-02	1.24E-02	1.26E-01
75	4.10E-02	1.22E-02	1.24E-02	1.26E-01

*The maximum RUNNING average concentration is shown for these averaging times.
For example, the maximum 5-year average concentration may not occur in the first five years.
To find out when the maximum RUNNING concentrations occured, view the charts.
Simulation Time = 25 Years
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Analysis for Gulf # 897 - Construction Worker

Carcinogenic Risk by Chemical for Each Route of Concern

Chemical	Inhalation of Soil Emissions	Dermal Contact With Soil	Total
Benzene	1.99E-09	7.37E-13	1.99E-09
Ethylbenzene	ND	ND	0.00E+00
Toluene	ND	ND	0.00E+00
Xylene	ND	ND	0.00E+00
Total	1.99E-09	7.37E-13	1.99E-09

Hazard Index by Chemical for Each Route of Concern

Chemical	Inhalation of Soil Emissions	Dermal Contact With Soil	Total
Benzene	ND	ND	0.00E+00
Ethylbenzene	1.28E-05	2.00E-07	1.30E-05
Toluene	3.72E-05	2.73E-08	3.72E-05
Xylene	2.30E-04	2.31E-08	2.30E-04
Total	2.80E-04	2.50E-07	2.80E-04

Deterministic Run
ND = Not Determined because RfD or Slope Factor not entered
NA = Not Applicable
07/05/95 12:44

The following chemicals were selected:
Benzene
Ethylbenzene
Toluene
Xylene

Data for Fate and Transport Models

Sesoil Model - Deterministic

Model Control Parameters	
Simulation Time (max=100) [years]	25
Number of soil layers	2
Sublayers in layer 1	1
Sublayers in layer 2	1
Volatile emissions:	Yes
Climate Parameters	
Surface Temperature [C]	16
Evapotranspiration [cm/day]	0.001
Precipitation [cm/yr]	60
Storm duration [days]	2
Number of storms [yr^-1]	6
Length of Rainy Season [months]	5
Soil Column Data	
Effective porosity [-]	0.25
Dry Wt. Soil Bulk Density [g/cm^3]	1.8
X-dimension of the source [m]	38
Y-dimension of the source [m]	25
Layer 1	
Thickness of Layer [m]	2.5
Intrinsic Permeability [cm^2]	1e-10
Fraction Organic Carbon [-]	0.05
Benzene Load [kg]	1.2
Ethylbenzene Load [kg]	2.7
Toluene Load [kg]	0.77
Xylene Load [kg]	6.58
Layer 2	
Thickness of Layer [m]	0.25
Intrinsic Permeability [cm^2]	1e-7
Fraction Organic Carbon [-]	0.05
Benzene Load [kg]	0.12
Ethylbenzene Load [kg]	0.27
Toluene Load [kg]	0.08
Xylene Load [kg]	0.66
Sesoil Chemical Specific Parameters	
Benzene	
Solubility [mg/l]	1750
Diffusion Coeff. in Air [cm^2/s]	0.087
Henrys Constant [Atm/m^3/mol]	2.49E-01
Koc [ug/gOC/ug/ml]	83
Degradation Rate Constant in Unsaturated Zc	0.0E+00s]
Vapor Pressure [mmHg]	95.2
Ethylbenzene	
Solubility [mg/l]	152
Diffusion Coeff. in Air [cm^2/s]	0.066
Henrys Constant [Atm/m^3/mol]	2.87E-01
Koc [ug/gOC/ug/ml]	1100
Degradation Rate Constant in Unsaturated Zc	0.00E+00]
Vapor Pressure [mmHg]	7
Toluene	
Solubility [mg/l]	535

Diffusion Coeff. in Air [cm^2/s]	0.078
Henrys Constant [Atm/m^3/mol]	2.84E-01
Koc [ug/gOC/ug/ml]	300
Degradation Rate Constant in Unsaturated Zc	0.00E+00]
Vapor Pressure [mmHg]	28.1
Xylene	
Solubility [mg/l]	198
Diffusion Coeff. in Air [cm^2/s]	0.072
Henrys Constant [Atm/m^3/mol]	3.15E-01
Koc [ug/gOC/ug/ml]	240
Degradation Rate Constant in Unsaturated Zc	0.00E+00]
Vapor Pressure [mmHg]	10

Sesoil Model - Deterministic

Model Control Parameters

Simulation Time (max=100) [years]	25
Number of soil layers	2
Sublayers in layer 1	1
Sublayers in layer 2	1
Volatile emissions:	Yes

Climate Parameters

Surface Temperature [C]	16
Evapotranspiration [cm/day]	0.001
Precipitation [cm/yr]	60
Storm duration [days]	2
Number of storms [yr^-1]	6
Length of Rainy Season [months]	5

Soil Column Data

Effective porosity [-]	0.25
Dry Wt. Soil Bulk Density [g/cm^3]	1.8
X-dimension of the source [m]	38
Y-dimension of the source [m]	25
Layer 1	
Thickness of Layer [m]	2.5
Intrinsic Permeability [cm^2]	1e-10
Fraction Organic Carbon [-]	0.05
Benzene Load [kg]	1.2
Ethylbenzene Load [kg]	2.7
Toluene Load [kg]	0.77
Xylene Load [kg]	6.58
Layer 2	
Thickness of Layer [m]	0.25
Intrinsic Permeability [cm^2]	1e-7
Fraction Organic Carbon [-]	0.05
Benzene Load [kg]	0.12
Ethylbenzene Load [kg]	0.27
Toluene Load [kg]	0.08
Xylene Load [kg]	0.66

Sesoil Chemical Specific Parameters

Benzene	
Solubility [mg/l]	1750
Diffusion Coeff. in Air [cm^2/s]	0.087
Henrys Constant [Atm/m^3/mol]	2.49E-01
Koc [ug/gOC/ug/ml]	83
Degradation Rate Constant in Unsaturated Zc	0.0E+00s]
Vapor Pressure [mmHg]	95.2
Ethylbenzene	
Solubility [mg/l]	152
Diffusion Coeff. in Air [cm^2/s]	0.066
Henrys Constant [Atm/m^3/mol]	2.87E-01
Koc [ug/gOC/ug/ml]	1100
Degradation Rate Constant in Unsaturated Zc	*0.00E+00]*

Vapor Pressure [mmHg]	7
Toluene	
Solubility [mg/l]	535
Diffusion Coeff. in Air [cm^2/s]	0.078
Henrys Constant [Atm/m^3/mol]	2.84E-01
Koc [ug/gOC/ug/ml]	300
Degradation Rate Constant in Unsaturated Zc	0.00E+00]
Vapor Pressure [mmHg]	28.1
Xylene	
Solubility [mg/l]	198
Diffusion Coeff. in Air [cm^2/s]	0.072
Henrys Constant [Atm/m^3/mol]	3.15E-01
Koc [ug/gOC/ug/ml]	240
Degradation Rate Constant in Unsaturated Zc	0.00E+00]
Vapor Pressure [mmHg]	10

Box Dispersion Model - Deterministic

Wind Speed [m/s]	2.5
Height of Box [m]	2
Width of Box [m]	2

Data for Risk Assessment

Body Weight and Lifetime - Deterministic

Average Weight (kg)	70
Lifetime (yrs)	75

Inhalation of Soil Emissions

Exposure Frequency [days/yr]	365
Exposure Duration [years]	20
Inhalation Rate [m^3/hr]	1.25
Time Outdoors [hours/day]	3

nhalation of Soil Emissions Chemical Specific Parameters

Benzene	
Bioavailability [fraction]	1
Ethylbenzene	
Bioavailability [fraction]	1
oluene	
Bioavailability [fraction]	1
ylene	
Bioavailability [fraction]	1

Dermal Contact with Soil

Exposure Frequency [days/yr]	365
Exposure Duration [years]	20
Skin Surface Area [cm^2]	3120.
dherence Factor [mg/cm^2]	1

ermal Contact Chemical Specific Parameters

enzene	
Dermal Absorption Factors [fraction]	1
thylbenzene	
Dermal Absorption Factors [fraction]	1
oluene	
Dermal Absorption Factors [fraction]	1
ylene	
Dermal Absorption Factors [fraction]	1

ermal Dose

enzene	
Slope Factor [1/(mg/kg-day)]	0.029
Reference Dose [mg/kg-day]	ND
thylbenzene	

Slope Factor [1/(mg/kg-day)]	NA
Reference Dose [mg/kg-day]	0.1
Toluene	
Slope Factor [1/(mg/kg-day)]	NA
Reference Dose [mg/kg-day]	0.2
Xylene	
Slope Factor [1/(mg/kg-day)]	NA
Reference Dose [mg/kg-day]	2
Inhalation Dose	
Benzene	
Slope Factor [1/(mg/kg-day)]	0.029
Reference Dose [mg/kg-day]	ND
Ethylbenzene	
Slope Factor [1/(mg/kg-day)]	NA
Reference Dose [mg/kg-day]	2.86E-1
Toluene	
Slope Factor [1/(mg/kg-day)]	NA
Reference Dose [mg/kg-day]	1.14E-1
Xylene	
Slope Factor [1/(mg/kg-day)]	NA
Reference Dose [mg/kg-day]	0.2

Analysis for Gulf # 897
Receptor Point Concentration In Air

Averaging Time* [Years]	Benzene [mg/m^3]	Ethylbenzene [mg/m^3]	Toluene [mg/m^3]	Xylene [mg/m^3]
5	2.27E-04	4.04E-05	4.73E-05	5.08E-04
10	1.96E-04	3.99E-05	4.52E-05	4.77E-04
15	1.70E-04	3.95E-05	4.32E-05	4.48E-04
20	1.48E-04	3.90E-05	4.14E-05	4.22E-04
25	1.30E-04	3.86E-05	3.96E-05	3.98E-04
30	1.30E-04	3.86E-05	3.96E-05	3.98E-04
35	1.30E-04	3.86E-05	3.96E-05	3.98E-04
40	1.30E-04	3.86E-05	3.96E-05	3.98E-04
45	1.30E-04	3.86E-05	3.96E-05	3.98E-04
50	1.30E-04	3.86E-05	3.96E-05	3.98E-04
55	1.30E-04	3.86E-05	3.96E-05	3.98E-04
60	1.30E-04	3.86E-05	3.96E-05	3.98E-04
65	1.30E-04	3.86E-05	3.96E-05	3.98E-04
70	1.30E-04	3.86E-05	3.96E-05	3.98E-04
75	1.30E-04	3.86E-05	3.96E-05	3.98E-04

*The maximum RUNNING average concentration is shown for these averaging times.
For example, the maximum 5-year average concentration may not occur in the first five years.
To find out when the maximum RUNNING concentrations occured, view the charts.

Simulation Time = 75 Years

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Analysis for Gulf # 897
Receptor Point Concentration in Soil

Averaging Time* [Years]	Benzene [mg/kg]	Ethylbenzene [mg/kg]	Toluene [mg/kg]	Xylene [mg/kg]
5	7.67E-04	2.02E-03	5.55E-04	4.66E-03
10	6.61E-04	2.00E-03	5.30E-04	4.38E-03
15	5.72E-04	1.97E-03	5.07E-04	4.12E-03
20	4.99E-04	1.95E-03	4.85E-04	3.88E-03
25	4.38E-04	1.93E-03	4.65E-04	3.66E-03
30	4.38E-04	1.93E-03	4.65E-04	3.66E-03
35	4.38E-04	1.93E-03	4.65E-04	3.66E-03
40	4.38E-04	1.93E-03	4.65E-04	3.66E-03
45	4.38E-04	1.93E-03	4.65E-04	3.66E-03
50	4.38E-04	1.93E-03	4.65E-04	3.66E-03
55	4.38E-04	1.93E-03	4.65E-04	3.66E-03
60	4.38E-04	1.93E-03	4.65E-04	3.66E-03
65	4.38E-04	1.93E-03	4.65E-04	3.66E-03
70	4.38E-04	1.93E-03	4.65E-04	3.66E-03
75	4.38E-04	1.93E-03	4.65E-04	3.66E-03

*The maximum RUNNING average concentration is shown for these averaging times.
For example, the maximum 5-year average concentration may not occur in the first five years.
To find out when the maximum RUNNING concentrations occured, view the charts.

Simulation Time = 25 Years

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Analysis for Gulf # 897

Carcinogenic Risk by Chemical for Each Route of Concern

Chemical	Inhalation of Soil Emissions	Dermal Contact With Soil	Total
Benzene	6.12E-08	1.72E-10	6.14E-08
Ethylbenzene	ND	ND	0.00E+00
Toluene	ND	ND	0.00E+00
Xylene	ND	ND	0.00E+00
Total	6.12E-08	1.72E-10	6.14E-08

Hazard Index by Chemical for Each Route of Concern

Chemical	Inhalation of Soil Emissions	Dermal Contact With Soil	Total
Benzene	ND	ND	0.00E+00
Ethylbenzene	7.31E-06	8.70E-07	8.18E-06
Toluene	1.94E-05	1.08E-07	1.95E-05
Xylene	1.13E-04	8.64E-08	1.13E-04
Total	1.40E-04	1.06E-06	1.41E-04

Deterministic Run
ND = Not Determined because RfD or Slope Factor not entered
NA = Not Applicable
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