SGW-62461
Revision 0

200 WEST PUMP AND TREAT HISTORICAL MODELING SUMMARY

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

P.O. Box 1600
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

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APPROVED
By Mary P. Curry at 2:36 pm, Nov 15, 2018

Release Approval Date

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Contents

1 Purpose **1**

2 Introduction **1**

3 Model History **1**

4 2013 Sampling Events **3**

5 Conclusions **4**

6 References **5**

Appendices

A Air Emissions Modeling (382519-CALC-053, Rev. 0) ..... **A-i**

B Air Emissions Modeling (382519-CALC-053, Rev. 1) ..... **B-i**

C Air Emissions Modeling (382519-CALC-053, Rev. 1, Signed on March 17, 2014) ..... **C-i**

D 200 West Pump and Treat Facility Stack Emissions (SGRP-WSA-2014-15046) ..... **D-i**

Figure

Figure 1. Reported Hexavalent Chromium Values with Incorrect Values (Top) and Corrected Values (Bottom) due to Incorrect Assumption of Reported Sample Values 4

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Terms

200 West P&T	200 West Pump and Treat Facility
ARAR	applicable or relevant and appropriate requirement
ASIL	acceptable source impact level
CCl4	carbon tetrachloride
ECO	environmental compliance officer
EPA	U.S. Environmental Protection Agency
MDL	method detection limit
MSA	Mission Support Alliance
OU	Operable Unit
SGRP	Soil and Groundwater Remediation Project
SQER	small quantity emissions rate
TAP	toxic air pollutant
TOG	treated off gas
VPGAC	vapor-phase granular activated carbon

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1 Purpose

This summary is intended to provide information regarding the errors discovered in previous air modeling performed at the 200 West Pump and Treat Facility (200 West P&T) treated off gas (TOG) stack. A new air model was created with the corrected data to show continued compliance with the U.S. Environmental Protection Agency (EPA) and *Washington Administrative Code* regulations designated as applicable or relative and appropriate (ARAR) requirements.

2 Introduction

The 200 West P&T is located on the U.S. Department of Energy's Hanford Site, and is used to remove contaminants of concern from groundwater in the 200-ZP-1 Operable Unit (OU), 200-UP-1 OU, 200-DV-1 OU perched water, 200-BP-5 OU, and leachate from the Environmental Restoration Disposal Facility. The treatment processes include ion exchange, fluidized bed reactors, membrane bioreactors, and air strippers. Treated water is injected back into the aquifer for recharge and to provide flow-path control (containment) for some of the groundwater plumes. Vapor emissions from the treatment systems are collected and treated by vapor-phase granular activated carbon (VPGAC) before being discharged through the TOG stack (also known as the VPGAC Exhaust).

Substantive portions of the WAC 173-400, "General Regulations for Air Pollution Sources," and WAC 173-460, "Controls for New Sources of Toxic Air Pollutants," have been determined to be ARARs for the 200 West P&T. These requirements can be found in the 200 West P&T Operations and Maintenance Plan (Appendix A in DOE/RL-2009-124, *200 West Pump and Treat Operations and Maintenance Plan*). For the 200 West P&T Air Monitoring Plan (Appendix C in DOE/RL-2009-124), an evaluation was done to determine compliance with WAC 173-460 ARARs. This included an initial review (new source review) of the toxic air pollutants (TAPs) expected to be released as emissions from the 200 West P&T, compared to their respective *de minimis* limits found in WAC 173-460-150, "Table of ASIL, SQER and de Minimis Emission Values," and after the application of any best available control technology for toxics. Any emissions greater than *de minimis* must be evaluated in accordance with WAC 173-460-080, "First Tier Review."

Emissions for each toxic compound were previously calculated to determine if exceedance of *de minimis* values would occur during the 200 West P&T processes. If any toxic compound was found to exceed the *de minimis* value, an analysis of the acceptable source impact level (ASIL) must be performed in accordance with WAC 173-460-080. This analysis can be performed either through comparison for the TAP's small quantity emissions rate (SQER) or through air modeling. Soil and Groundwater Remediation Project (SGRP) initially performed a comparison analysis for each TAP above *de minimis* to their respective SQER found in WAC 173-460-150. If both the *de minimis* and the SQER levels are exceeded, then an air dispersion model is developed and the output value is compared to the TAP's ASIL, also found in WAC 173-460-150. Typically, air dispersion models are first analyzed using dispersion screening models. If ASIL values are exceeded after analysis in the dispersion screening model, a more refined model must be used to demonstrate compliance.

3 Model History

During the initial planning stages of the 200 West P&T, an air dispersion model was created to provide bounding conditions for operations. This early model made assumptions based on the old soil vapor extraction system used for carbon tetrachloride (CCl4) treatment in the 200-ZP-1 OU. The earliest iterations of the calculated model can be found in 382519-CALC-053, *Air Emissions Modeling*, Rev. 0

(Appendix A), which was released in late 2009. The 382519-CALC-053, Rev. 1 (Appendix B) was published in early 2010, as the model was updated to include changes to the anticipated design of the plant. These early versions of the model used the EPA approved TSCREEN and SCREEN3 modeling software.

In 2013, sample data was collected from the TOG stack by a subcontractor to CH2M HILL Plateau Remediation Company (Subcontract #50032) during the months of February, June, August, and November. The sample data showed that the concentrations of carbon tetrachloride, chloroform, benzene, and hexavalent chromium in the TOG stack effluent exceeded the values used in the original pre-operations emissions estimate. The calculation of air quality needed to be updated to verify continued compliance with the *Washington Administrative Code* substantive requirements. A new air model using the 2013 data was requested by SGRP.

Between the 2010 model version and the 2013 model version, the EPA had changed the acceptable model software to be used in air emissions compliance from TSCREEN and SCREEN3 to AERSCREEN and AERMOD. The new modeling software, AERSCREEN and AERMOD, is still the accepted air modeling software approved by EPA. According to EPA guidelines and *Washington Administrative Code* substantive requirements, the more conservative AERSCREEN can be used first to compare constituent levels to the ASIL values. If the AERSCREEN results show the constituent levels to be under the ASIL values, then no additional modeling is required. AERMOD is a more refined air model that uses hourly meteorological data as well as terrain data to refine the air dispersion model. If the constituent levels exceed the ASIL values using AERSCREEN, then the more detailed model AERMOD version may be used. The 2013 sample data were used in the early 2014 model, still Revision 1,, signed on March 17, 2014. In the March 17, 2014 release of the model, 382519-CALC-053, Rev, 1 (Appendix C), only AERSCREEN was needed, as all the constituents that were above the SQER values (carbon tetrachloride, chloroform, benzene, and hexavalent chromium) were demonstrated to be below the ASIL values when processed through AERSCREEN.

Another version of the air model was requested later in 2014 (ECF-200W-17-0206, *200 W Area Pump & Treat Air Emissions Modeling CY2014*), after a breakthrough event of CCl4 from the TOG stack. The Air Monitoring Plan (Appendix C in the plan; DOE/RL-2009-124) states if emissions are detected at levels higher than previously considered, air modeling will be performed. Detection may be from values reported during required stack sample collection, or presumption based on an inability to maintain the best available control technology for toxics. The breakthrough event occurred from approximately May 2014 through August 2014, with additional sampling performed in September 2014 to confirm the August 2014 high CCl4 concentrations (SGRP-WSA-2014-15046, *200 West Pump and Treat Facility Stack Emissions* [Appendix D]). The previous model completed in early 2014 used AERSCREEN. Due to the increased concentrations of carbon tetrachloride and chloroform detected in the air samples, the AERMOD model software was used to refine the air dispersion model. However, two of the constituents (hexavalent chrome and benzene) were not considered in this iteration of the model, as they were previously shown to be below the ASIL values when analyzed with the more conservative AERSCREEN software and were not seen in greater concentrations during the breakthrough event. This version of the model has been in use and has not been updated since it was received from the CH2M HILL corporate office in February 2015.

In 2018, the environmental compliance officer (ECO) for SGRP was contacted by an air modeler working for another Hanford Site contractor, Mission Support Alliance (MSA), to provide stack data from the 200 West P&T. The SGRP ECO provided the MSA air modeler a version of the air model results produced by the CH2M HILL corporate office believed to be the most current version (Appendix C). An air dispersion modeler for MSA contacted the ECO with concerns regarding the reported levels of

hexavalent chromium in the model summary, specifically that the data reported in Table 2 of the report was in mathematical error. Upon review of the model summary report that was submitted to MSA, the ECO found that the version that was submitted was an older version that had used the AERSCREEN model and not AERMOD. Per the EPA guidelines for using AERMOD, if AERSCREEN (which is simpler but more conservative) results show compliance with the ASIL values, then AERMOD does not need to be run. If values are found to exceed the ASIL, then AERMOD can be used as a refined model assessment of the data.

4 2013 Sampling Events

In 2013, SGRP worked with an offsite subcontractor (Subcontract #50032) to perform stack sampling for hexavalent chromium and volatile organic compounds at the 200 West P&T TOG stack. Sampling was performed four times, once per quarter, during the calendar year 2013. The majority of the samples that were collected by the subcontractor were sent to the laboratory at the Waste Sampling and Characterization Facility. However, during the second sampling event, several of the samples were instead sent to an offsite laboratory. The Waste Sampling and Characterization Facility was unable to receive any new samples in June 2013 due to ventilation issues, so the samples were sent to the 222-S Facility and an offsite laboratory.

The 222-S Facility and the offsite laboratory reported the method detection limit (MDL) differently, causing an error on the part of the subcontractor. The 222-S Facility reported the hexavalent chromium data in units of µg/mL, while the offsite laboratory reported their data in mg/L. This led to an initial reporting error from the subcontractor in their summary report of the June 2013 samples. The subcontractor assumed that the laboratory report from the offsite laboratory had made a typographical error in their detection limit, reporting the MDL in mg/L instead of µg/L. The error translated into the calculated value for the hexavalent emissions from the stack, which was initially reported at <2.1E-07 lb/hr. The error was discovered by SGRP in 2013 during a review of the report, and the subcontractor was notified and corrected the value to <2.1E-04 lb/hr for their calculation (Figure 1). The corrected value was not communicated to all appropriate SGRP staff, and the initial incorrect value, <2.1E-07 lb/hr, was eventually passed along to the contractor working on an AERMOD air model of the 200 West P&T emissions.

It is important to note that the values for hexavalent chromium reported from the laboratory were less than the MDL, but the MDL value was used for the compliance calculations. Unfortunately, the MDL values were high enough to require SGRP to include hexavalent chromium in the first 2014 air dispersion model (Appendix C) that was being generated. The SQER threshold to require air modeling for hexavalent chromium is 1.28E-03 lb/yr. An emissions rate of 2.1E-07 lb/hr is equal to 1.84E-03 lb/yr, which is just slightly above the SQER threshold. The corrected value of 2.1E-04 lb/hr is equal to 1.84 lb/yr, which is still above the SQER, requiring a modeling effort. The corrected value, and emissions rate, were analyzed in an updated model, ECF-200W-18-0060, *Hexavalent Chromium Air Emissions Modeling 200 West Area Pump & Treat CY14*, and determined to also be under the ASIL for hexavalent chromium.

PARAMETER	2-MS-Cr6-1	2-MS-Cr6-2	2-MS-Cr6-3	AVERAGE	2-MS-Cr6-EB
Date	6/20/13	6/21/13	6/21/13		6/21/13
Time	1113-1312	0732-0918	1015-1200		1215-1250
Stack Gas Parameters					
Moisture Content (%)	1.61	1.96	1.78	1.8	--
Volumetric Flow Rate (dscfm)	35,302	34,301	33,886	34,496	--
Hexavalent Chromium (EPA Method 0061 w/ Method 7196)					
Cr6 in impinger solution (µg/L)	0.00968	0.00800	0.00800	**0.0086**	0.0080
Cr6 (µg /m^3)	0.00176	0.00150	0.00154	**0.0016**	--
Cr6 (lb/hr)	2.33E-07	1.92E-07	1.95E-07	**2.1E-07**	--
Total Chromium (EPA Method 0061 w/ Method 200.8)					
Total Chromium in impinger solution (µg/L)	Not reported	Not reported	Not reported	**Not reported**	Not reported
Total Chromium in rinse solution (µg/L)	1.82	0.354	0.200	**0.79**	2.07
Total Chromium (µg/m^3)	0.0414	0.0290	0.0169	**0.029**	--
Total Chromium (lb/hr)	5.47E-06	3.72E-06	2.14E-06	**3.8E-06**	--

PARAMETER	2-MS-Cr6-1	2-MS-Cr6-2	2-MS-Cr6-3	AVERAGE	Equipment Blank 2-MS-Cr6-EB
Date	6/20/13	6/21/13	6/21/13		6/21/13
Time	1113-1312	0732-0918	1015-1200		1215-1250
Stack Gas Parameters					
Moisture Content (%)	1.61	1.96	1.78	1.8	--
Volumetric Flow Rate (dscfm)	35,302	34,301	33,886	34,496	--
Hexavalent Chromium (EPA Method 0061 w/ Method 7196)					
Cr^{+6} in impinger solution (µg/L)	9.68	8.00	8.00	**8.6**	8.0
Cr^{+6} emission concentration (µg /m^3)	1.76	1.50	1.54	**1.6**	--
Cr^{+6} emission rate (lb/hr)	2.33E-04	1.92E-04	1.95E-04	**2.1E-04**	--

Figure 1. Reported Hexavalent Chromium Values with Incorrect Values (Top) and Corrected Values (Bottom) due to Incorrect Assumption of Reported Sample Values

5 Conclusions

Using the updated data, and following EPA guidance and *Washington Administrative Code* ARAR requirements, the 200 West P&T air dispersion model was updated using the corrected emission rate for hexavalent chromium of 2.1E-04 lb/hr. The model report (ECF-200W-18-0060) shows that the 200 West P&T remains below the ASIL value for hexavalent chromium emissions, with a modeled ASIL value of 1.05E-06 µg/m^3. The ASIL found in WAC 173-460-150 is 6.67E-06 µg/m^3. Additional analysis has been performed by the 200W P&T engineering group to determine hexavalent chromium processing through the plant, which is documented in SGW-62363, *Hexavalent Chromium Treatment at the 200 West Pump and Treat*. The report concluded that hexavalent chromium is not expected to be present in the offgas, and if it were present, would be absorbed by the granular activated carbon units upstream of the TOG stack.

6 References

DOE/RL-2009-124, 2016, *200 West Pump and Treat Operations and Maintenance Plan*, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0077130H.

ECF-200W-17-0206, 2017, *200 W Area Pump & Treat Air Emissions Modeling CY2014*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0067648H.

ECF-200W-18-0060, 2018, *Hexavalent Chromium Air Emissions Modeling 200 West Area Pump & Treat CY14*, pending, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0064433H.

SGW-62363, 2018, *Hexavalent Chromium Treatment at the 200 West Pump and Treat*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0064570H.

WAC 173-400, "General Regulations for Air Pollution Sources," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-400.

WAC 173-460, "Controls for New Sources of Toxic Air Pollutants," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-460.

460-080, "First Tier Review."

460-150, "Table of ASIL, SQER and de Minimis Emission Values."

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Appendix A

Air Emissions Modeling
(382519-CALC-053, Rev. 0)

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Calculation

Project 200 West Area Pump and Treat

Client PRC Project No. 382519

Calculation Title: Air Emissions Modeling			
Calculation Identifier: 382519-CALC-053			
Role	**Printed Name**	**Signature**	**Date**
Originator	Rebecca King/SEA	Rebecca King	11/25/2009
Checker	John Frohning/SAC		11/24/2009
Independent reviewer	Mark Bennett/SDO	Mark J. Bennett	11/292009
Approval	Mike Keating		
Comments:			
Information Requiring Confirmation:			

Revision History

Revision Number	Description	Effective Date
0	Original Issue of document.	12/23/2009

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1. **Subject and Objective**

   Determine if emissions from air stripper stack meet regulatory requirements.

2. **Methodology**

   Use TSCREEN model, version 95250, to calculate maximum ambient concentrations of toxic air pollutants.

3. **Design Input**

   The TSCREEN model input values are shown in Table 1.

TABLE 1

TSCREEN INPUT VALUES PER STACK

Parameter	Value
Unit Emission Rate	1 gram per second
Stack Height	6.096 meters
Stack Flow Rate	7,442 scfm
Stack Exhaust Velocity	7.56 meters/second
Stack Diameter	0.769 meters
Stack Exit Temperature	80 °Fahrenheit
Building Height	9.144 meters
Minimum Horizontal Building Dimension	30.48 meters
Maximum Horizontal Building Dimension	96.39 meters

4. **Assumptions**

   The emission rates for toxic air pollutants are presented in Table 1. Details regarding the emission rates are provided in the Supplemental Mass Balance, document number 382519-CALC-050_Rev0.

TABLE 2

TOXIC AIR POLLUTANT EMISSION RATES

Pollutant	Hourly Emission Rate (lb/day)
Carbon Tetrachloride	7.90E-02
Trichloroethylene	1.47E-04
1,1,1-TCA	1.08E-03

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TABLE 2

TOXIC AIR POLLUTANT EMISSION RATES

Pollutant	Hourly Emission Rate (lb/day)
1,2-DCA	6.93E-04
Benzene	3.92E-03
Acetone	1.81E-04
Chloroform	6.00E-01
DBCM	5.69E-04
Methylene Chloride	1.11E-01
DCEs	6.36E-04
Vinyl Chloride	1.86E-02

Ground-level ambient air concentrations were calculated at a distance of 5.6 kilometers from the source. This distance was provided by Hanford, based on the distance from the source location to the nearest location of public access, State Route 240.

Plant emissions are from 2 identical stacks and miscellaneous fugitive sources. The model was run assuming each stack exhaust has half the total project flow and half the total project emissions. The results from each stack were added together for the resultant downwind ground-level concentration for each pollutant. Fugitive emissions were modeled as coming out of the stack to represent a worst-case condition because fugitive emissions of the magnitude modeled for this project would not likely reach the fenceline.

The TSCREEN model was run with a 1 g/s emission rate. Model results should be considered to be in units of $\mu g/m^3$ (micrograms per cubic meter) per 1 g/s of emissions. The model output was scaled by the emission rate for each pollutant to determine the pollutant-specific concentration.

The stack height is assumed to be 20 feet. The exhaust temperature of 80 degrees F and total exhaust flow rate of 7,442 scfm were provided in the Supplemental Mass Balance. The velocity was calculated based on a 30 inch by 24 inch duct size, temperature, and flow of 7,442 scfm per stack. This flow rate is consistent with nominal flow conditions, which is appropriate for this analysis because all modeled pollutants are analyzed as an annual average concentration.

Building downwash effects were considered. The adjacent buildings are assumed to be the Rad Building and the Bioprocess Building. The Rad Building is assumed to be 100 feet by 60 feet with a height of 30 feet and the Bioprocess Building is assumed to be 300 feet by 100 feet with a height of 30 feet.

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5. References

Modeling was performed according to the procedures in 40 CFR 51 Appendix W (Guideline on Air Quality Models). The Washington State air toxics rule (Chapter 173-460 WAC) requires that new stationary sources that have the potential to emit toxic air pollutants (TAPs) demonstrate that the TAP emissions would be sufficiently low to protect human health and safety from potential carcinogenic and/or other toxic effects.

6. Results

Compliance with the state air toxic rule was demonstrated according to procedures in Chapter 173-460 WAC. First the potential emissions are compared to the small quantity emission rate (SQER) for each toxic air pollutant. If the emissions are lower than the SQER, no further air quality impact analysis would be required under the regulation.

If the emissions are above the SQER, an ambient air quality modeling analysis would be required. Concentrations from the ambient air quality analysis are compared to the acceptable source impact level (ASIL) to demonstrate compliance with the Washington State air toxics rule. The comparison of emission rates to the SQERs is presented in Table 3.

TABLE 3

COMPARISON OF EMISSIONS TO SQER

Pollutant	Daily Emission Rate (lb/day)	Averaging Period	SQER (lb/averaging period)	Emission Rate (lb/averaging period)	Modeling Required?
Carbon Tetrachloride	7.90E-02	year	4.57	2.88E+01	YES
Trichloroethylene	1.47E-04	year	95.9	5.37E-02	no
1,1,1-TCA	1.08E-03	24-hour	131	1.08E-03	no
1,2-DCA	6.93E-04	year	7.39	2.53E-01	no
Benzene	3.92E-03	year	6.62	1.43E+00	no
Acetone	1.81E-04	N/A	N/A	N/A	no
Chloroform	6.00E-01	year	8.35	2.19E+02	YES
DBCM	5.69E-04	year	7.1	2.08E-01	no
Methylene Chloride	1.11E-01	year	192	4.05E+01	no
DCEs	6.36E-04	24-hour	26.3	6.36E-04	no
Vinyl Chloride	1.86E-02	year	2.46	6.79E+00	YES

N/A: this pollutant is not listed as a toxic air pollutant in WAC 173-460

The model results for both stacks are shown in Table 4. The model output would be the maximum 1-hour concentration at the ambient boundary (State Route 240) in $\mu g/m^3$ per

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1 g/s of emissions. This result is conservatively based on 2 identical stacks, each with half the nominal system flow and half the project emissions. The value in Table 4 is then scaled based on each total pollutant emission rate.

TABLE 4

MODEL RESULTS

1-hour average concentration per 1 g/s of emissions	50.43	$\mu g/m^3$

Recommended EPA persistence factors from EPA's Screening Procedure Manual[1] were applied to the maximum 1-hour concentration at the ambient boundary to estimate the concentrations for the desired averaging period results. The persistence factor is 0.08 for an annual averaging period. The concentrations for each toxic air pollutant were calculated based on multiplying the model result by the corresponding emission rate and persistence factor for each pollutant. This result for each stack was then multiplied by two to determine the maximum concentration from both stacks.

Table 5 presents the model results compared to the applicable standards. Model results demonstrate no toxic air pollutants would exceed their applicable ASIL and the project would comply with Chapter 173-460 WAC. The results in Table 5 represent the total concentration from both stacks.

TABLE 5

COMPARISON OF CONCENTRATIONS TO ASIL

Pollutant	Maximum Ambient Concentration ($\mu g/m^3$)	ASIL($\mu g/m^3$)
Carbon Tetrachloride	0.0017	0.0238
Chloroform	0.0127	0.0435
Vinyl Chloride	0.0004	0.0128

7. Calculations

The TSCREEN model is based on the calculations described in the EPA technical document Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised. EPA-450/R-92-019. The screening procedure utilizes the Briggs plume rise formula and the Gaussian dispersion equation to estimate the maximum 1-hour ground-level concentration for the source in question.

[1] EPA 1992. *Screening Procedures for Estimating the Air Quality Impact from Stationary Sources.* Research Triangle Park, NC. EPA-454/R-92-019.

The basic equation for determining ground-level concentrations under the plume centerline is:

$$x = Q/(2\pi u_s \sigma_y \sigma_z)\left\{\begin{array}{l} \exp\left[-1/2((z_r - h_e)/\sigma_z)^2\right] \\ +\exp\left[-1/2((z_r + h_e)/\sigma_z)^2\right] \\ +\sum_{N=1}^{k}\left[\begin{array}{l} \exp\left[-1/2((z_r - h_e - 2Nz_i)/\sigma_z)^2\right] \\ +\exp\left[-1/2((z_r + h_e - 2Nz_i)/\sigma_z)^2\right] \\ +\exp\left[-1/2((z_r - h_e + 2Nz_i)/\sigma_z)^2\right] \\ +\exp\left[-1/2((z_r + h_e + 2Nz_i)/\sigma_z)^2\right] \end{array}\right] \end{array}\right\}$$

Where

x = concentration (g/m^3)

Q = emission rate (g/s)

π = 3.14159

u_s = stack height wind speed (m/s)

σ_y = lateral dispersion parameter (m)

σ_z = vertical dispersion parameter (m)

z_r = receptor height above ground (m)

h_e = plume centerline height (m)

z_i = mixing height (m)

k = summation limit for multiple reflections of plume off of the ground and elevated inversion, usually ≤ 4

8. List of Attachments

Attachment A – TSCREEN Output File

9. Computer Program Information (if a computer calculation):

TSCREEN model version 95250. Software Validation number 382519-SVAL-003, Revision 0.

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ATTACHMENT A
TSCREEN DATA OUTPUT (1 Page)

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```
11/25/09

07:12:58
  ***  SCREEN3 MODEL RUN  ***
  *** VERSION DATED 95250 ***

 Hanford 200 West 11/25/09

 SIMPLE TERRAIN INPUTS:
    SOURCE TYPE            =        POINT
    EMISSION RATE (G/S)    =      1.00000
    STACK HEIGHT (M)       =       6.0960
    STK INSIDE DIAM (M)    =        .7690
    STK EXIT VELOCITY (M/S)=       7.5600
    STK GAS EXIT TEMP (K)  =     299.8200
    AMBIENT AIR TEMP (K)   =     293.0000
    RECEPTOR HEIGHT (M)    =        .0000
    URBAN/RURAL OPTION     =        RURAL
    BUILDING HEIGHT (M)    =       9.1440
    MIN HORIZ BLDG DIM (M) =      30.4800
    MAX HORIZ BLDG DIM (M) =      96.3900


      ***************************************
      *** SUMMARY OF SCREEN MODEL RESULTS ***
      ***************************************

  CALCULATION      MAX CONC   DIST TO  TERRAIN
   PROCEDURE      (UG/M**3)   MAX (M)   HT (M)
 --------------  -----------  -------  -------
 SIMPLE TERRAIN    50.43        5600.       0.

 BLDG. CAVITY-1    364.1          46.      --  (DIST = CAVITY LENGTH)
 BLDG. CAVITY-2    1093.          29.      --  (DIST = CAVITY LENGTH)


 ***************************************************
 ** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
 ***************************************************


 BUOY. FLUX =     .249 M**4/S**3;  MOM. FLUX =    8.257 M**4/S**2.

 *** FULL METEOROLOGY ***

 **********************************
 *** SCREEN AUTOMATED DISTANCES ***
 **********************************

 *** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING
DISTANCES ***
```

```
   DIST     CONC            U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
    (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   Y (M)   Z (M)
DWASH
 -------  ----------  ----  -----  -----  ------  ------  ------  ------
-----
   5600.   50.43        6     1.0    1.0 10000.0   14.60  161.28   36.06
SS
   6000.   46.14        6     1.0    1.0 10000.0   14.60  171.58   37.23
SS
   6500.   41.61        6     1.0    1.0 10000.0   14.60  184.34   38.64
SS
   7000.   37.79        6     1.0    1.0 10000.0   14.60  196.99   40.00
SS
   7500.   34.66        6     1.0    1.0 10000.0   14.60  209.54   41.16
SS
   8000.   31.95        6     1.0    1.0 10000.0   14.60  221.98   42.28
SS
   8500.   29.60        6     1.0    1.0 10000.0   14.60  234.34   43.36
SS
   9000.   27.54        6     1.0    1.0 10000.0   14.60  246.61   44.40
SS
   9500.   25.72        6     1.0    1.0 10000.0   14.60  258.79   45.41
SS
  10000.   24.11        6     1.0    1.0 10000.0   14.60  270.90   46.38
SS
  15000.   14.41        6     1.0    1.0 10000.0   14.60  388.43   54.88
SS
  20000.   10.23        6     1.0    1.0 10000.0   14.60  500.95   60.29
SS
  25000.   7.848        6     1.0    1.0 10000.0   14.60  609.75   64.86
SS
  30000.   6.318        6     1.0    1.0 10000.0   14.60  715.59   68.84
SS
  40000.   4.555        6     1.0    1.0 10000.0   14.60  920.22   74.49
SS
  50000.   3.536        6     1.0    1.0 10000.0   14.60 1117.42   79.19
SS

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND  5600. M:
   5600.   50.43        6     1.0    1.0 10000.0   14.60  161.28   36.06
SS

  DIST    = DISTANCE FROM THE SOURCE
  CONC    = MAXIMUM GROUND LEVEL CONCENTRATION
  STAB    = ATMOSPHERIC STABILITY CLASS (1=A, 2=B, 3=C, 4=D, 5=E, 6=F)
  U10M    = WIND SPEED AT THE 10-M LEVEL
  USTK    = WIND SPEED AT STACK HEIGHT
  MIX HT  = MIXING HEIGHT
  PLUME HT= PLUME CENTERLINE HEIGHT
  SIGMA Y = LATERAL DISPERSION PARAMETER
  SIGMA Z = VERTICAL DISPERSION PARAMETER
  DWASH   = BUILDING DOWNWASH:
            DWASH=   MEANS NO CALC MADE (CONC = 0.0)
            DWASH=NO MEANS NO BUILDING DOWNWASH USED
```

```
            DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
            DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
            DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

  *** CAVITY CALCULATION - 1 ***       *** CAVITY CALCULATION - 2 ***
   CONC (UG/M**3)      =    364.1        CONC (UG/M**3)      =    1093.
   CRIT WS @10M (M/S) =     4.15        CRIT WS @10M (M/S) =     4.38
   CRIT WS @ HS (M/S) =     4.15        CRIT WS @ HS (M/S) =     4.38
   DILUTION WS (M/S)  =     2.08        DILUTION WS (M/S)  =     2.19
   CAVITY HT (M)      =     9.34        CAVITY HT (M)      =     9.14
   CAVITY LENGTH (M)  =    46.40        CAVITY LENGTH (M)  =    29.09
   ALONGWIND DIM (M)  =    30.48        ALONGWIND DIM (M)  =    96.39

**********************************
*** END OF SCREEN MODEL OUTPUT ***
**********************************
```

Appendix B

Air Emissions Modeling
(382519-CALC-053, Rev. 1)

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CH2MHILL

Calculation

EFFECTIVE DATE: 02/11/2010
382519-CALC-053
REVISION: 1

Project 200 West Area Pump and Treat

Client PRC Project No. 382519

Calculation Title: Air Emissions Modeling

Calculation Identifier: 382519-CALC-053

Role	Printed Name	Signature	Date
Originator	Rebecca King/SEA	Rebecca King	2/11/2010
Checker	John Frohning/PDX		2/11/2010
Independent reviewer	Mark Bennett/SDO	Mark J. Bennett	2/10/2010
Approval	Mike Keating	Michael Keating Digitally signed by Michael Keating DN: cn=Michael Keating, o=NBG, ou=CH2M HILL, email=mkeating@ch2m.com, c=US Date: 2010.02.11 15:15:08 -07'00'	

Comments:

Information Requiring Confirmation:

Revision History

Revision Number	Description	Effective Date
A	Original Issue of document.	11/17/2009
1	Revised air modeling based on updated emissions in mass balance Calc-050-Rev1	2/~~08~~/2010 10 JMK

1. Subject and Objective

Determine if emissions from air stripper stack meet regulatory requirements.

2. Methodology

Use TSCREEN model, version 95250, to calculate maximum ambient concentrations of toxic air pollutants.

3. Design Input

The TSCREEN model input values are shown in Table 1.

TABLE 1

TSCREEN INPUT VALUES

Parameter	Value
Carbon Tetrachloride Emission Rate	4.36E-04 gram per second
Chloroform Emission Rate	3.27E-03 gram per second
Stack Height	7.62 meters
Stack Flow Rate	40,000 acfm
Stack Exhaust Velocity	14.9 meters per second
Stack Diameter	1.27 meters
Stack Exit Temperature	80 °Fahrenheit
Building Height	9.144 meters
Minimum Horizontal Building Dimension	30.48 meters
Maximum Horizontal Building Dimension	96.39 meters

4. Assumptions

The emission rates for toxic air pollutants are presented in Table 1. Details regarding the emission rates are provided in the Supplemental Mass Balance, document number 382519-CALC-050_Rev1.

TABLE 2

TOXIC AIR POLLUTANT EMISSION RATES

Toxic Air Pollutant	Emission Rate (lb/day)[1]
Carbon Tetrachloride	8.31E-02
Trichloroethylene	1.56E-04
1,1,1-TCA	1.12E-03

TABLE 2

TOXIC AIR POLLUTANT EMISSION RATES

Toxic Air Pollutant	Emission Rate (lb/day)[1]
1,2-DCA	7.11E-04
Benzene	4.06E-03
Acetone	2.21E-04
Chloroform	6.23E-01
DBCM	5.84E-04
Methylene Chloride	1.15E-01
1,1-Dichloroethylene	6.71E-04
Vinyl Chloride	1.96E-02
Beryllium	3.02E-08
Lead	6.78E-08
Vanadium	4.07E-07

1. lb/day: Pounds per day

Ground-level ambient air concentrations were calculated at a distance of 5.6 kilometers from the source. This distance was provided by Hanford, based on the distance from the source location to the nearest location of public access, State Route 240.

Plant emissions are from a single stack and miscellaneous fugitive sources. Fugitive emissions were modeled as coming from the stack to represent a worst-case condition. This would be considered a conservative approach because the small quantity of fugitive emissions for this project would not likely reach the fenceline.

The stack height of 25 feet and exit diameter of 50 inches were provided by the design team. The exhaust temperature of 80 degrees F and total exhaust flow rate of 40,000 acfm were provided in the Supplemental Mass Balance. The velocity was calculated based on the stack diameter and flow rate.

Building downwash effects were considered. The adjacent buildings are assumed to be the Rad Building and the Bioprocess Building. The Rad Building is assumed to be 100 feet by 60 feet with a height of 30 feet and the Bioprocess Building is assumed to be 300 feet by 100 feet with a height of 30 feet.

5. References

Modeling was performed according to the procedures in 40 CFR 51 Appendix W (Guideline on Air Quality Models). The Washington State air toxics rule (Chapter 173-460 WAC) requires that new stationary sources that have the potential to emit toxic air

pollutants (TAPs) demonstrate that the TAP emissions would be sufficiently low to protect human health and safety from potential carcinogenic and/or other toxic effects.

6. Results

Compliance with the state air toxic rule was demonstrated according to procedures in Chapter 173-460 WAC. First the potential emissions are compared to the small quantity emission rate (SQER) for each toxic air pollutant and applicable averaging period. If the potential emissions are lower than the SQER, no further air quality impact analysis would be required under the regulation.

If the potential emissions are above the SQER, an ambient air quality modeling analysis would be required. Concentrations from the ambient air quality analysis are compared to the acceptable source impact level (ASIL) to demonstrate compliance with the Washington State air toxics rule. The comparison of emission rates to the SQERs is presented in Table 3.

TABLE 3

COMPARISON OF EMISSIONS TO SQER

Pollutant	Daily Emission Rate (lb/day)	Averaging Period	SQER (lb/averaging period)	Emission Rate (lb/averaging period)	Modeling Required?
Carbon Tetrachloride	8.31E-02	year	4.57	3.03E+01	**YES**
Trichloroethylene	1.56E-04	year	95.9	5.71E-02	no
1,1,1-TCA	1.12E-03	24-hour	131	1.12E-03	no
1,2-DCA	7.11E-04	year	7.39	2.60E-01	no
Benzene	4.06E-03	year	6.62	1.48E+00	no
Acetone	2.21E-04	N/A	N/A	N/A	no
Chloroform	6.23E-01	year	8.35	2.28E+02	**YES**
DBCM	5.84E-04	year	7.1	2.13E-01	no
Methylene Chloride	1.15E-01	year	192	4.19E+01	no
1,1-Dichloroethylene	6.71E-04	24-hour	26.3	6.71E-04	no
Vinyl Chloride	1.96E-02	year	2.46	7.16E+00	**YES**
Beryllium	3.02E-08	year	2.46	1.10E-05	no
Lead	6.78E-08	year	2.46	2.48E-05	no
Vanadium	4.07E-07	24-hour	2.46	1.49E-04	no

N/A: this pollutant is not listed as a toxic air pollutant in WAC 173-460

The analysis of potential TAP emissions with the applicable SQER demonstrates that an ambient air quality analysis would be required for Carbon Tetrachloride,

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Chloroform, and Vinyl Chloride. All other potential TAP emissions are below the applicable SQER.

The model results for the TAPs which exceed the SQER are summarized in Table 4. The model output from TSCREEN is the maximum 1-hour concentration at the ambient boundary (State Route 240) in micrograms per cubic meter (μg/m³). Recommended EPA persistence factors from EPA's Screening Procedure Manual[1] were applied to the maximum 1-hour concentration at the ambient boundary to estimate the concentrations for the desired averaging period results. The persistence factor is 0.08 for an annual averaging period, which applies to the TAPs modeled.

Table 4 presents the TSCREEN model results compared to the applicable thresholds. Model results demonstrate Carbon Tetrachloride, Chloroform, and Vinyl Chloride concentrations would not exceed their applicable ASIL and the project would comply with Chapter 173-460 WAC.

TABLE 4

COMPARISON OF CONCENTRATIONS TO ASIL

Pollutant	Maximum 1-Hour Concentration (μg/m³)	Annual Average Concentration (μg/m³)	Annual ASIL(μg/m³)
Carbon Tetrachloride	0.0149	0.0012	0.0238
Chloroform	0.1120	0.0090	0.0435
Vinyl Chloride	0.0035	0.0003	0.0128

7. Calculations

The TSCREEN model is based on the calculations described in the EPA technical document Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised. EPA-450/R-92-019. The screening procedure utilizes the Briggs plume rise formula and the Gaussian dispersion equation to estimate the maximum 1-hour ground-level concentration for the source in question.

The basic equation for determining ground-level concentrations under the plume centerline is:

[1] EPA 1992. *Screening Procedures for Estimating the Air Quality Impact from Stationary Sources.* Research Triangle Park, NC. EPA-454/R-92-019.

$$x = Q/(2\pi u_s \sigma_y \sigma_z)\left\{\begin{array}{l} \exp\left[-1/2((z_r - h_e)/\sigma_z)^2\right] \\ +\exp\left[-1/2((z_r + h_e)/\sigma_z)^2\right] \\ +\sum_{N=1}^{k}\left[\begin{array}{l} \exp\left[-1/2((z_r - h_e - 2Nz_i)/\sigma_z)^2\right] \\ +\exp\left[-1/2((z_r + h_e - 2Nz_i)/\sigma_z)^2\right] \\ +\exp\left[-1/2((z_r - h_e + 2Nz_i)/\sigma_z)^2\right] \\ +\exp\left[-1/2((z_r + h_e + 2Nz_i)/\sigma_z)^2\right] \end{array}\right] \end{array}\right\}$$

Where

x = concentration (g/m^3)
Q = emission rate (g/s)
π = 3.14159
u_s = stack height wind speed (m/s)
σ_y = lateral dispersion parameter (m)
σ_z = vertical dispersion parameter (m)
z_r = receptor height above ground (m)
h_e = plume centerline height (m)
z_i = mixing height (m)
k = summation limit for multiple reflections of plume off of the ground and elevated inversion, usually ≤ 4

8. List of Attachments

Attachment A - TSCREEN Output File

9. Computer Program Information (if a computer calculation):

TSCREEN model version 95250. Software Validation number 382519-SVAL-003, Revision 0.

ATTACHMENT A

TSCREEN DATA OUTPUT (1 Page)

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VC.RPT

02/11/10
10:14:48

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 95250 ***

Hanford 200 West 02/11/10 Vinyl Chloride

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =      .103000E-03
   STACK HEIGHT (M)       =       7.6200
   STK INSIDE DIAM (M)    =       1.2700
   STK EXIT VELOCITY (M/S)=      14.9000
   STK GAS EXIT TEMP (K)  =     299.8200
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =        .0000
   URBAN/RURAL OPTION     =        RURAL
   BUILDING HEIGHT (M)    =       9.1440
   MIN HORIZ BLDG DIM (M) =      30.4800
   MAX HORIZ BLDG DIM (M) =      96.3900

      ***************************************
      *** SUMMARY OF SCREEN MODEL RESULTS ***
      ***************************************

 CALCULATION       MAX CONC   DIST TO  TERRAIN
  PROCEDURE       (UG/M**3)   MAX (M)   HT (M)
--------------   -----------  -------  -------
SIMPLE TERRAIN     .3526E-02    5600.       0.

BLDG. CAVITY-1     .1193E-01      46.      --  (DIST = CAVITY LENGTH)
BLDG. CAVITY-2     .3628E-01      29.      --  (DIST = CAVITY LENGTH)

***************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
***************************************************


BUOY. FLUX =    1.340 M**4/S**3;  MOM. FLUX =   87.484 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

  DIST     CONC              U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
   (M)   (UG/M**3)   STAB   (M/S)  (M/S)   (M)    HT (M)   Y (M)   Z (M)  DWASH
-------  ----------  ----  -----  -----  ------  ------  ------  ------  -----
  5600.   .3526E-02    6     1.0    1.0 10000.0   34.81  161.47   36.89    NO
  6000.   .3301E-02    6     1.0    1.0 10000.0   34.81  171.75   38.04    NO
  6500.   .3052E-02    6     1.0    1.0 10000.0   34.81  184.51   39.42    NO
  7000.   .2833E-02    6     1.0    1.0 10000.0   34.81  197.15   40.75    NO
  7500.   .2643E-02    6     1.0    1.0 10000.0   34.81  209.68   41.89    NO
  8000.   .2474E-02    6     1.0    1.0 10000.0   34.81  222.12   42.99    NO
  8500.   .2323E-02    6     1.0    1.0 10000.0   34.81  234.47   44.05    NO
  9000.   .2188E-02    6     1.0    1.0 10000.0   34.81  246.73   45.07    NO
  9500.   .2066E-02    6     1.0    1.0 10000.0   34.81  258.91   46.07    NO
```

Page 1

```
                                        VC.RPT
  10000.   .1956E-02    6     1.0    1.0 10000.0   34.81  271.01   47.03    NO
  15000.   .1250E-02    6     1.0    1.0 10000.0   34.81  388.51   55.43    NO
  20000.   .9137E-03    6     1.0    1.0 10000.0   34.81  501.01   60.79    NO
  25000.   .7141E-03    6     1.0    1.0 10000.0   34.81  609.80   65.32    NO
  30000.   .5829E-03    6     1.0    1.0 10000.0   34.81  715.63   69.27    NO
  40000.   .4270E-03    6     1.0    1.0 10000.0   34.81  920.26   74.89    NO
  50000.   .3351E-03    6     1.0    1.0 10000.0   34.81 1117.45   79.57    NO

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND  5600. M:
   5600.   .3526E-02    6     1.0    1.0 10000.0   34.81  161.47   36.89    NO

  DIST     = DISTANCE FROM THE SOURCE
  CONC     = MAXIMUM GROUND LEVEL CONCENTRATION
  STAB     = ATMOSPHERIC STABILITY CLASS (1=A, 2=B, 3=C, 4=D, 5=E, 6=F)
  U10M     = WIND SPEED AT THE 10-M LEVEL
  USTK     = WIND SPEED AT STACK HEIGHT
  MIX HT   = MIXING HEIGHT
  PLUME HT= PLUME CENTERLINE HEIGHT
  SIGMA Y = LATERAL DISPERSION PARAMETER
  SIGMA Z = VERTICAL DISPERSION PARAMETER
  DWASH    = BUILDING DOWNWASH:
             DWASH=   MEANS NO CALC MADE (CONC = 0.0)
             DWASH=NO MEANS NO BUILDING DOWNWASH USED
             DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
             DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
             DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

  *** CAVITY CALCULATION - 1 ***        *** CAVITY CALCULATION - 2 ***
   CONC (UG/M**3)      =    .1193E-01    CONC (UG/M**3)      =    .3628E-01
   CRIT WS @10M (M/S) =    13.06         CRIT WS @10M (M/S) =    13.58
   CRIT WS @ HS (M/S) =    13.06         CRIT WS @ HS (M/S) =    13.58
   DILUTION WS (M/S)  =     6.53         DILUTION WS (M/S)  =     6.79
   CAVITY HT (M)      =     9.34         CAVITY HT (M)      =     9.14
   CAVITY LENGTH (M)  =    46.40         CAVITY LENGTH (M)  =    29.09
   ALONGWIND DIM (M)  =    30.48         ALONGWIND DIM (M)  =    96.39

***********************************
*** END OF SCREEN MODEL OUTPUT ***
***********************************
```

CHLOROFO.RPT

02/08/10
16:22:28

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 95250 ***

Hanford 200 West 02/08/10 Chloroform

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =      .327000E-02
   STACK HEIGHT (M)       =       7.6200
   STK INSIDE DIAM (M)    =       1.2700
   STK EXIT VELOCITY (M/S)=      14.9000
   STK GAS EXIT TEMP (K)  =     299.8200
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =        .0000
   URBAN/RURAL OPTION     =        RURAL
   BUILDING HEIGHT (M)    =       9.1440
   MIN HORIZ BLDG DIM (M) =      30.4800
   MAX HORIZ BLDG DIM (M) =      96.3900

      ***************************************
      *** SUMMARY OF SCREEN MODEL RESULTS ***
      ***************************************

 CALCULATION      MAX CONC   DIST TO  TERRAIN
  PROCEDURE      (UG/M**3)   MAX (M)   HT (M)
--------------  -----------  -------  -------
SIMPLE TERRAIN    .1120        5600.       0.

BLDG. CAVITY-1    .3788          46.      --  (DIST = CAVITY LENGTH)
BLDG. CAVITY-2   1.152           29.      --  (DIST = CAVITY LENGTH)

***************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
***************************************************


BUOY. FLUX =    1.340 M**4/S**3;  MOM. FLUX =   87.484 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

  DIST     CONC             U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
   (M)   (UG/M**3)   STAB   (M/S)  (M/S)   (M)    HT (M)   Y (M)   Z (M)  DWASH
-------  ----------  ----  -----  -----  ------  ------  ------  ------  -----
  5600.   .1120        6     1.0    1.0 10000.0   34.81  161.47   36.89    NO
  6000.   .1048        6     1.0    1.0 10000.0   34.81  171.75   38.04    NO
  6500.   .9690E-01    6     1.0    1.0 10000.0   34.81  184.51   39.42    NO
  7000.   .8995E-01    6     1.0    1.0 10000.0   34.81  197.15   40.75    NO
  7500.   .8390E-01    6     1.0    1.0 10000.0   34.81  209.68   41.89    NO
  8000.   .7853E-01    6     1.0    1.0 10000.0   34.81  222.12   42.99    NO
  8500.   .7375E-01    6     1.0    1.0 10000.0   34.81  234.47   44.05    NO
  9000.   .6946E-01    6     1.0    1.0 10000.0   34.81  246.73   45.07    NO
  9500.   .6559E-01    6     1.0    1.0 10000.0   34.81  258.91   46.07    NO
```

Page 1

```
                                        CHLOROFO.RPT
 10000.    .6209E-01    6     1.0     1.0 10000.0   34.81  271.01   47.03    NO
 15000.    .3968E-01    6     1.0     1.0 10000.0   34.81  388.51   55.43    NO
 20000.    .2901E-01    6     1.0     1.0 10000.0   34.81  501.01   60.79    NO
 25000.    .2267E-01    6     1.0     1.0 10000.0   34.81  609.80   65.32    NO
 30000.    .1851E-01    6     1.0     1.0 10000.0   34.81  715.63   69.27    NO
 40000.    .1356E-01    6     1.0     1.0 10000.0   34.81  920.26   74.89    NO
 50000.    .1064E-01    6     1.0     1.0 10000.0   34.81 1117.45   79.57    NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND  5600. M:
  5600.    .1120        6     1.0     1.0 10000.0   34.81  161.47   36.89    NO

 DIST     = DISTANCE FROM THE SOURCE
 CONC     = MAXIMUM GROUND LEVEL CONCENTRATION
 STAB     = ATMOSPHERIC STABILITY CLASS (1=A, 2=B, 3=C, 4=D, 5=E, 6=F)
 U10M     = WIND SPEED AT THE 10-M LEVEL
 USTK     = WIND SPEED AT STACK HEIGHT
 MIX HT   = MIXING HEIGHT
 PLUME HT= PLUME CENTERLINE HEIGHT
 SIGMA Y = LATERAL DISPERSION PARAMETER
 SIGMA Z = VERTICAL DISPERSION PARAMETER
 DWASH    = BUILDING DOWNWASH:
            DWASH=   MEANS NO CALC MADE (CONC = 0.0)
            DWASH=NO MEANS NO BUILDING DOWNWASH USED
            DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
            DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
            DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

 *** CAVITY CALCULATION - 1 ***        *** CAVITY CALCULATION - 2 ***
  CONC (UG/M**3)      =    .3788         CONC (UG/M**3)      =    1.152
  CRIT WS @10M (M/S) =    13.06         CRIT WS @10M (M/S) =    13.58
  CRIT WS @ HS (M/S) =    13.06         CRIT WS @ HS (M/S) =    13.58
  DILUTION WS (M/S)  =     6.53         DILUTION WS (M/S)  =     6.79
  CAVITY HT (M)      =     9.34         CAVITY HT (M)      =     9.14
  CAVITY LENGTH (M)  =    46.40         CAVITY LENGTH (M)  =    29.09
  ALONGWIND DIM (M)  =    30.48         ALONGWIND DIM (M)  =    96.39

***********************************
*** END OF SCREEN MODEL OUTPUT ***
***********************************
```

CTET.RPT

02/08/10
10:50:52

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 95250 ***

Hanford 200 West 02/08/10 CCL4

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =      .436000E-03
   STACK HEIGHT (M)       =       7.6200
   STK INSIDE DIAM (M)    =       1.2700
   STK EXIT VELOCITY (M/S)=      14.9000
   STK GAS EXIT TEMP (K)  =     299.8200
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =        .0000
   URBAN/RURAL OPTION     =        RURAL
   BUILDING HEIGHT (M)    =       9.1440
   MIN HORIZ BLDG DIM (M) =      30.4800
   MAX HORIZ BLDG DIM (M) =      96.3900

      ***************************************
      *** SUMMARY OF SCREEN MODEL RESULTS ***
      ***************************************

 CALCULATION      MAX CONC   DIST TO  TERRAIN
  PROCEDURE      (UG/M**3)   MAX (M)   HT (M)
--------------  -----------  -------  -------
SIMPLE TERRAIN    .1493E-01    5600.       0.

BLDG. CAVITY-1    .5050E-01      46.      --  (DIST = CAVITY LENGTH)
BLDG. CAVITY-2    .1536          29.      --  (DIST = CAVITY LENGTH)

***************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
***************************************************


BUOY. FLUX =    1.340 M**4/S**3;  MOM. FLUX =   87.484 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

  DIST     CONC            U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
   (M)   (UG/M**3)   STAB  (M/S)  (M/S)   (M)    HT (M)   Y (M)   Z (M)  DWASH
-------  ----------  ----  -----  -----  ------  ------  ------  ------  -----
  5600.   .1493E-01    6     1.0    1.0 10000.0   34.81  161.47   36.89    NO
  6000.   .1397E-01    6     1.0    1.0 10000.0   34.81  171.75   38.04    NO
  6500.   .1292E-01    6     1.0    1.0 10000.0   34.81  184.51   39.42    NO
  7000.   .1199E-01    6     1.0    1.0 10000.0   34.81  197.15   40.75    NO
  7500.   .1119E-01    6     1.0    1.0 10000.0   34.81  209.68   41.89    NO
  8000.   .1047E-01    6     1.0    1.0 10000.0   34.81  222.12   42.99    NO
  8500.   .9833E-02    6     1.0    1.0 10000.0   34.81  234.47   44.05    NO
  9000.   .9261E-02    6     1.0    1.0 10000.0   34.81  246.73   45.07    NO
  9500.   .8746E-02    6     1.0    1.0 10000.0   34.81  258.91   46.07    NO
```

```
                                        CTET.RPT
  10000.    .8279E-02    6     1.0     1.0 10000.0   34.81  271.01   47.03    NO
  15000.    .5291E-02    6     1.0     1.0 10000.0   34.81  388.51   55.43    NO
  20000.    .3867E-02    6     1.0     1.0 10000.0   34.81  501.01   60.79    NO
  25000.    .3023E-02    6     1.0     1.0 10000.0   34.81  609.80   65.32    NO
  30000.    .2467E-02    6     1.0     1.0 10000.0   34.81  715.63   69.27    NO
  40000.    .1807E-02    6     1.0     1.0 10000.0   34.81  920.26   74.89    NO
  50000.    .1418E-02    6     1.0     1.0 10000.0   34.81 1117.45   79.57    NO

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND  5600. M:
   5600.    .1493E-01    6     1.0     1.0 10000.0   34.81  161.47   36.89    NO

  DIST     = DISTANCE FROM THE SOURCE
  CONC     = MAXIMUM GROUND LEVEL CONCENTRATION
  STAB     = ATMOSPHERIC STABILITY CLASS (1=A, 2=B, 3=C, 4=D, 5=E, 6=F)
  U10M     = WIND SPEED AT THE 10-M LEVEL
  USTK     = WIND SPEED AT STACK HEIGHT
  MIX HT   = MIXING HEIGHT
  PLUME HT= PLUME CENTERLINE HEIGHT
  SIGMA Y = LATERAL DISPERSION PARAMETER
  SIGMA Z = VERTICAL DISPERSION PARAMETER
  DWASH    = BUILDING DOWNWASH:
             DWASH=   MEANS NO CALC MADE (CONC = 0.0)
             DWASH=NO MEANS NO BUILDING DOWNWASH USED
             DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
             DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
             DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

  *** CAVITY CALCULATION - 1 ***        *** CAVITY CALCULATION - 2 ***
   CONC (UG/M**3)      =    .5050E-01    CONC (UG/M**3)      =    .1536
   CRIT WS @10M (M/S) =    13.06         CRIT WS @10M (M/S) =    13.58
   CRIT WS @ HS (M/S) =    13.06         CRIT WS @ HS (M/S) =    13.58
   DILUTION WS (M/S)  =     6.53         DILUTION WS (M/S)  =     6.79
   CAVITY HT (M)      =     9.34         CAVITY HT (M)      =     9.14
   CAVITY LENGTH (M)  =    46.40         CAVITY LENGTH (M)  =    29.09
   ALONGWIND DIM (M)  =    30.48         ALONGWIND DIM (M)  =    96.39

***********************************
*** END OF SCREEN MODEL OUTPUT ***
***********************************
```

Hanford ZP-1 Emissions
Comparison of TAP Emissions to SQER in WAC 173-460

Toxic Air Pollutant	CAS #	Averaging Period	ASIL (ug/m3)	SQER (lb/averaging period)	De Minimus (lb/averaging period)	Emission Rate (lb/day)	Emission Rate (lb/averaging period)	Exceed SQER?	Modeling Required?
Carbon Tetrachloride	56-23-5	year	0.0238	4.57	0.228	8.31E-02	3.03E+01	**YES**	**YES**
Trichloroethylene	79-01-6	year	0.5	95.9	4.8	1.56E-04	5.71E-02	no	
1,1,1-TCA	71-55-6	24-hour	1000	131	6.57	1.12E-03	1.12E-03	no	
1,2-DCA	107-06-2	year	0.0385	7.39	0.369	7.11E-04	2.60E-01	no	
Benzene	71-43-2	year	0.0345	6.62	0.331	4.06E-03	1.48E+00	no	
Acetone		na	na	na		2.21E-04	na		
Chloroform	67-66-3	year	0.0435	8.35	0.417	6.23E-01	2.28E+02	**YES**	**YES**
DBCM	124-48-1	year	0.037	7.1	0.355	5.84E-04	2.13E-01	no	
Methylene Chloride	75-09-2	year	1	192	9.59	4.60E-03	1.68E+00	no	
1,1-Dichloroethylene	75-35-4	24-hour	200	26.3	1.31	6.71E-04	6.71E-04	no	
Vinyl Chloride	75-01-4	year	0.0128	2.46	0.123	7.80E-04	2.85E-01	no	
Beryllium		year	0.000417	0.08	0.004	3.02E-08	1.10E-05	no	
Lead		year	0.0833	16	10	6.78E-08	2.48E-05	no	
Vanadium		24-hour	0.2	0.0263	0.00131	4.07E-07	1.49E-04	no	

Pollutant	Stack Emissions lb/day	Fugitive Emissions lb/day	Total Emissions lb/day
Tc-99 (Activity)	0.00	1.4306E-09	1.43E-09
I-129 (Activity)	0.00	9.5321E-13	9.53E-13
Tritium (Activity)	0.00	3.1887E-08	3.07E-06
Uranium	0.00	2.5638E-08	2.56E-08
Carbon Tet	0.06	0.02110978	8.31E-02
Trichloroethylene	0.0001	3.9955E-05	1.56E-04
Nitrate (as NO3)	0.00	6.7162E-05	6.72E-05
Cr (T)	0.00	1.296E-06	1.30E-06
Cr (VI)	0.00	1.4125E-07	1.41E-07
COIs			
1,1,1-TCA	0.001	0.00028607	1.12E-03
1,2-DCA	0.001	0.00019327	7.11E-04
Benzene	0.003	0.0010453	4.06E-03

Acetone	0.000	0.00011276	2.21E-04
Chloroform	0.46	0.16181813	6.23E-01
DBCM	0.000	0.0001614	5.84E-04
Methylene Chloride	0.003	0.00119432	4.60E-03
DCEs	0.000	0.00017149	6.71E-04
Vinyl Chloride	0.001	0.00019815	7.80E-04
Beryllium	0.00	3.0177E-08	3.02E-08
Lead	0.00	6.782E-08	6.78E-08
Vanadium	0.00	4.0714E-07	4.07E-07
NDMA	0.00	2.6291E-12	2.63E-12
NDBA	0.00	1.7393E-11	1.74E-11
Americium-241 (Activit	0.00	2.7359E-12	2.74E-12
Carbon-14 (Activity)	0.00	7.657E-11	7.66E-11
Cesium-137 (Activity)	0.00	2.2725E-11	2.27E-11
Cobalt-60 (Activity)	0.00	2.9027E-10	2.90E-10
Neptunium-237 (Activit	0.00	3.0498E-13	3.05E-13
Nickel-63 (Activity)	0.00	7.9198E-10	7.92E-10
Protactinium-231 (Acti	0.00	3.423E-10	3.42E-10
Selenium-79 (Activity)	0.00	1.0848E-09	1.08E-09
Strontium-90 (Activity)	0.00	2.0045E-11	2.00E-11
Plutonium (Activity)	0.00	2.678E-12	2.68E-12
Extra Rad 2 (Activity)	0.00	1.0901E-09	1.09E-09
Common Salts			
Ca	0.00	0.00053721	5.37E-04
Mg	0.00	0.00016507	1.65E-04
Na	0.00	0.00015635	1.56E-04
HCO3	0.00	0.00056407	5.64E-04
CO3	0.00	0	0.00E+00
H2CO3	0.00	0.00030773	3.08E-04
SO4	0.00	0.00058399	5.84E-04
Cl	0.00	0.00015843	1.58E-04
P	0.00	6.3371E-06	6.34E-06
Fe	0.00	2.0314E-07	2.03E-07
Mn	0.00	3.1919E-07	3.19E-07
TSS	0.00	0.00480422	4.80E-03
TOC	0.00	0.00342368	3.42E-03
Ammonia (as NH3)	0.00	9.9473E-08	9.95E-08
Alkalinity (as CaCO3)	0.00	0.00083322	8.33E-04

Hanford ZP-1 Emissions
Comparison of TAP Emissions to SQER in WAC 173-460

Toxic Air Pollutant	CAS #	Averaging Period	ASIL (ug/m3)	SQER (lb/averaging period)	De Minimus (lb/averaging period)	Emission Rate (lb/day)	Emission Rate (lb/averaging period)	Exceed SQER?	Modeling Required?
Carbon Tetrachloride	56-23-5	year	0.0238	4.57	0.228	8.31E-02	3.03E+01	**YES**	**YES**
Trichloroethylene	79-01-6	year	0.5	95.9	4.8	1.56E-04	5.71E-02	no	
1,1,1-TCA	71-55-6	24-hour	1000	131	6.57	1.12E-03	1.12E-03	no	
1,2-DCA	107-06-2	year	0.0385	7.39	0.369	7.11E-04	2.60E-01	no	
Benzene	71-43-2	year	0.0345	6.62	0.331	4.06E-03	1.48E+00	no	
Acetone		na	na	na		2.21E-04	na		
Chloroform	67-66-3	year	0.0435	8.35	0.417	6.23E-01	2.28E+02	**YES**	**YES**
DBCM	124-48-1	year	0.037	7.1	0.355	5.84E-04	2.13E-01	no	
Methylene Chloride	75-09-2	year	1	192	9.59	4.60E-03	1.68E+00	no	
1,1-Dichloroethylene	75-35-4	24-hour	200	26.3	1.31	6.71E-04	6.71E-04	no	
Vinyl Chloride	75-01-4	year	0.0128	2.46	0.123	7.80E-04	2.85E-01	no	
Beryllium		year	0.000417	0.08	0.004	3.02E-08	1.10E-05	no	
Lead		year	0.0833	16	10	6.78E-08	2.48E-05	no	
Vanadium		24-hour	0.2	0.0263	0.00131	4.07E-07	1.49E-04	no	

Pollutant	Stack Emissions lb/day	Fugitive Emissions lb/day	Total Emissions lb/day
Tc-99 (Activity)	0.00	1.4306E-09	1.43E-09
I-129 (Activity)	0.00	9.5321E-13	9.53E-13
Tritium (Activity)	0.00	3.1887E-08	3.07E-06
Uranium	0.00	2.5638E-08	2.56E-08
Carbon Tet	0.06	0.02110978	8.31E-02
Trichloroethylene	0.0001	3.9955E-05	1.56E-04
Nitrate (as NO3)	0.00	6.7162E-05	6.72E-05
Cr (T)	0.00	1.296E-06	1.30E-06
Cr (VI)	0.00	1.4125E-07	1.41E-07
COIs			
1,1,1-TCA	0.001	0.00028607	1.12E-03
1,2-DCA	0.001	0.00019327	7.11E-04
Benzene	0.003	0.0010453	4.06E-03

Acetone	0.000	0.00011276	2.21E-04
Chloroform	0.46	0.16181813	6.23E-01
DBCM	0.000	0.0001614	5.84E-04
Methylene Chloride	0.003	0.00119432	4.60E-03
DCEs	0.000	0.00017149	6.71E-04
Vinyl Chloride	0.001	0.00019815	7.80E-04
Beryllium	0.00	3.0177E-08	3.02E-08
Lead	0.00	6.782E-08	6.78E-08
Vanadium	0.00	4.0714E-07	4.07E-07
NDMA	0.00	2.6291E-12	2.63E-12
NDBA	0.00	1.7393E-11	1.74E-11
Americium-241 (Activit	0.00	2.7359E-12	2.74E-12
Carbon-14 (Activity)	0.00	7.657E-11	7.66E-11
Cesium-137 (Activity)	0.00	2.2725E-11	2.27E-11
Cobalt-60 (Activity)	0.00	2.9027E-10	2.90E-10
Neptunium-237 (Activit	0.00	3.0498E-13	3.05E-13
Nickel-63 (Activity)	0.00	7.9198E-10	7.92E-10
Protactinium-231 (Acti	0.00	3.423E-10	3.42E-10
Selenium-79 (Activity)	0.00	1.0848E-09	1.08E-09
Strontium-90 (Activity)	0.00	2.0045E-11	2.00E-11
Plutonium (Activity)	0.00	2.678E-12	2.68E-12
Extra Rad 2 (Activity)	0.00	1.0901E-09	1.09E-09
Common Salts			
Ca	0.00	0.00053721	5.37E-04
Mg	0.00	0.00016507	1.65E-04
Na	0.00	0.00015635	1.56E-04
HCO3	0.00	0.00056407	5.64E-04
CO3	0.00	0	0.00E+00
H2CO3	0.00	0.00030773	3.08E-04
SO4	0.00	0.00058399	5.84E-04
Cl	0.00	0.00015843	1.58E-04
P	0.00	6.3371E-06	6.34E-06
Fe	0.00	2.0314E-07	2.03E-07
Mn	0.00	3.1919E-07	3.19E-07
TSS	0.00	0.00480422	4.80E-03
TOC	0.00	0.00342368	3.42E-03
Ammonia (as NH3)	0.00	9.9473E-08	9.95E-08
Alkalinity (as CaCO3)	0.00	0.00083322	8.33E-04

Hanford ZP-1 TSCREEN Results
2/11/2008

Input Values	Provided Values		Modeled Values	
Stack Height	25	feet	7.62	meters
Stack Diameter	50	inches	1.27	meters
Temperature	80	F	299.8167	K
Flow Rate	40000	acfm	40000	acfm
Area	13.63538	ft^2	1.266769	m2
velocity	2933.544	fpm	14.90	m/s
Distance to receptor	5.6	km	5600	m
Carbon tetrachloride emission rate	8.31E-02	lb/day	4.36E-04	g/s
Chloroform emission rate	6.23E-01	lb/day	3.27E-03	g/s
Vinyl Chloride emission rate	1.96E-02	lb/day	1.03E-04	g/s

Model Results			
Carbon Tetrachloride 1-hour maximum concentration	1.49E-02	ug/m3	
Chloroform 1-hour maximum concentration	0.1120	ug/m3	
Vinyl Chloride 1-hour maximum concentration	0.0035	ug/m3	
Carbon Tetrachloride annual average concentration	0.0012	µg/m3	using EPA persistence factor of 0.08 for annual average
Chloroform annual average concentration	0.0090	µg/m3	
Vinyl Chloride annual average concentration	0.0003	µg/m3	
Carbon Tetrachloride ASIL	0.0238	ug/m3	
Chloroform ASIL	0.0435	ug/m3	
Vinyl Chloride ASIL	0.0128	ug/m3	

Hanford ZP-1 TSCREEN Results
2/8/2010

Input Values	Provided Values	Modeled Values
Stack Height	25 feet	7.62 meters
Stack Diameter	50 inches	1.27 meters
Temperature	80 F	299.8167 K
Flow Rate	40000 acfm	40000 acfm
Area	13.63538 ft^2	1.266769 m2
velocity	2933.544 fpm	14.90 m/s
Distance to receptor	5.6 km	5600 m
Carbon tetrachloride emission rate	8.31E-02 lb/day	4.36E-04 g/s
Chloroform emission rate	6.23E-01 lb/day	3.27E-03 g/s

Model Results		
Carbon Tetrachloride 1-hour maximum concentration	1.49E-02 ug/m3	
Chloroform 1-hour maximum concentration	0.1120 ug/m3	
Carbon Tetrachloride annual average concentration	0.0012 µg/m3	using EPA persistence factor of 0.08 for annual average
Chloroform annual average concentration	0.0090 µg/m3	
Carbon Tetrachloride ASIL	0.0238 ug/m3	
Chloroform ASIL	0.0435 ug/m3	

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Appendix C

Air Emissions Modeling
(382519-CALC-053, Rev. 1,
Signed on March 17, 2014)

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CH2MHILL

Calculation

Project 200 West Area Pump and Treat

Client PRC Project No. 489740

Calculation Title: Air Emissions Modeling

Calculation Identifier: 382519-CALC-053

Role	Printed Name	Signature	Date
Originator	Michelle Neumann/SEA		3/17/14
Checker	John Frohning/SEA		
Independent reviewer	Jay Willenberg/SEA	J M Willenberg	3/17/14
Approval			

Comments:

Information Requiring Confirmation:

Revision History

Revision Number	Description	Effective Date
A	Original Issue of document.	

1. Subject and Objective

Determine if emissions from T.O.G. stack meet compliance requirements as mentioned in the DOE/RL-2009-124 Appendix C Air Monitoring Plan. Under the C4 Monitoring section it states:

"Quarterly sampling will occur for annual determination of compliance with SQERs and ASILs. Grab samples will be collected in each stack. Additional modeling to confirm compliance with ASILs would be completed only if needed and if emissions are higher than previously calculated/modeled."

2. Methodology

Use AERSCREEN model, version 11126, to calculate maximum ambient concentrations of toxic air pollutants. AERSCREEN is the US Environmental Protection Agency's (EPAs) latest generation screening model for calculating conservative downwind concentrations from a source of air emissions. The AERSCREEN model utilizes the following additional modules:

- AERMOD
- MAKEMET
- BPIPRM
- AERSURFACE (optional)
- AERMAP (optional)

3. Design Input

The AERSCREEN model input values are shown in Table 1.

TABLE 1

AERSCREEN INPUT VALUES

Parameter	Value
Benzene Emission Rate	4.32E-04 gram per second
Carbon Tetrachloride Emission Rate	5.03E-03 gram per second
Hexavalent Chromium	2.65E-07 gram per second
Stack Height	18.54 meters
Stack Flow Rate	40,000 acfm
Stack Exhaust Velocity	17.56 meters per second
Stack Diameter	1.17 meters
Stack Exit Temperature	80 °Fahrenheit

TABLE 1

AERSCREEN INPUT VALUES

Parameter	Value
Building Height	21.87 meters
Minimum Horizontal Building Dimension	3.05 meters
Maximum Horizontal Building Dimension	3.05 meters

Source: Email sent on February 12, 2014 from Richard W Oldham to John Frohning

4. Assumptions

The emission rates for toxic air pollutants (TAPs) based on quarterly sampling events are presented in Table 1.

TABLE 2

TOXIC AIR POLLUTANT EMISSION RATES

Toxic Air Pollutant	February 2013 (lb/hr)	June 2013 (lb/hr)	August 2013 (lb/hr)[1]	November 2013 (lb/hr)	Average (lb/hr)
Carbon Tetrachloride	1.7E-02	9.9E-02	<2.5E-03	2.9E-02	3.66E-02
Benzene	<9.5E-05	<1.2E-03	<1.2E-03	3.3E-03	3.3E-03
Chloroform	<2.5E-04	<3.2E-03	<3.3E-03	<2.9E-04	2.8E-03
Chromium(VI)	1.7E-02	9.9E-02	<2.5E-03	2.9E-02	2.1E-07

NOTES:

1. Used ½ of the August detection limit for CCl4 in the average emission calculation
lb/hr: Pounds per hour

Ground-level ambient air concentrations were calculated at a distance of 5.6 kilometers from the source. This distance was based on previous analysis as mentioned in the 382519-CALC-053-Rev1.doc document, and represents the distance from the source location to the nearest location of public access, State Route 240.

Plant emissions are from a single stack. Emissions were based on source testing of the unit after being operational.

The stack height of 18.54 meters, exit diameter of 1.17 meters, exhaust temperature of 80 degrees F, and total exhaust flow rate of 40,000 acfm were provided by the design team. The velocity was calculated based on the stack-tip diameter and flow rate.

Building downwash effects were considered. The adjacent structures are assumed to be an air stripper and the Bioprocess Building. The air stripper is assumed to be 3.05 meters by 3.05 meters with a height of 21.87 meters and the Bioprocess Building is assumed to be 106.86 meters by 30.48 meters with a height of 6.2 meters. Because the distance to the

stack was less compared to the Bio Building, the air stripper was included in the analysis.

5. References

Modeling was performed according to the procedures in 40 CFR 51 Appendix W (Guideline on Air Quality Models). Based on the *Guideline on Air Quality Models*, AERSCREEN replaced SCREEN3 as the recommended screening tool. According to the *AERSCREEN Released as the EPA Recommended Screening Model* Memorandum by EPA (EPA, 2011), AERSCREEN incorporates several improvements in comparison to SCREEN3 which includes generating application specific worst-case meteorology based on the AERMET boundary layer scaling algorithm and PRIME building downwash algorithms. Using AERSCREEN as a screening model also follows Ecology's *Guidance Document on First, Second, and Third Tier Review of Toxic Air Pollution Sources.*

6. Results

Compliance with the Air Monitoring Plan was demonstrated. First the potential emissions are compared to the small quantity emission rate (SQER) for each toxic air pollutant and applicable averaging period. If the potential emissions are lower than the SQER, no further air quality impact analysis would be required under the regulation.

If the emissions are above the SQER, an ambient air quality modeling analysis is required. As shown in Table 3 four TAPs have emission rates exceeding the respective SQERs; they are carbon tetrachloride, benzene, chloroform, and hexavalent chromium.

TABLE 3

COMPARISON OF EMISSIONS TO SQER

Pollutant	Average Emission Rate (lb/hr)	Averaging Period	SQER (lb/year)	Emission Rate (lb/year)	Modeling Required?
Carbon Tetrachloride	3.66E-02	year	4.57	320	**YES**
Benzene	3.3E-03	year	6.62	28.9	**YES**
Chloroform	2.8E-03	year	8.35	24.6	**YES**
Hexavalent Chromium	2.1E-07	year	0.00128	0.00184	**YES**

However, chloroform was not modeled because the current model run (DOE/RL-2009-124, Appendix C) provides a conservative emission rate upper bound which is greater than the measured rates. All other potential TAP emissions are below the applicable SQER.

The model results for the TAPs which exceed the SQER are summarized in Table 4. The model output from AERSCREEN is the maximum 1-hour concentration at the ambient boundary (State Route 240) in micrograms per cubic meter ($\mu g/m^3$). AERSCREEN

automatically includes scaling ratios to provide annual averaging period impacts. (A fixed ratio scaling factor of 0.10 is used in AERSCREEN for annual averaging period)

Table 4 presents the AERSCREEN model results compared to the applicable thresholds. Model results demonstrate Carbon Tetrachloride, Benzene, and Hexavalent Chromium concentrations would not exceed their applicable ASIL and the project would comply with the Air Monitoring Plan.

TABLE 4

COMPARISON OF CONCENTRATIONS TO ASIL

Pollutant	Maximum 1-Hour Concentration (µg/m³)	Annual Average Concentration (µg/m³)	Annual ASIL(µg/m³)
Carbon Tetrachloride	0.1558	0.01558	0.0238
Benzene	0.01336	0.001336	0.0345
Hexavalent Chromium	8.19E-06	8.19E-07	6.67E-06

Utilizing the above modeled results, emissions were back calculated to determine emissions corresponding to 95 percent of the ASIL. Table 5 presents the emissions resulting in 95 percentile of the ASIL impacts. That is, if emissions are less than the values presented below in Table 5, resultant impacts would be below the ASIL.

TABLE 5

EMISSIONS FOR 95% OF ASIL IMPACTS

Pollutant	Emission Rate (lb/yr)	Emission Rate (g/s)	95% of Annual ASIL(µg/m³)	Annual ASIL(µg/m³)
Carbon Tetrachloride	508	7.30E-03	0.0226	0.0238
Benzene	736	1.06E-02	0.0328	0.0345
Hexavalent Chromium	1.42E-01	2.05E-06	6.34E-06	6.67E-06

7. Calculations

The AERSCREEN model follows the dispersion calculations in AERMOD. As mentioned in the *AERMOD: Description of Model Formulation* (EPA, 2004), AERMOD utilizes the Gaussian dispersion equation for estimating horizontal and vertical distribution for stable boundary layer condition and horizontal distribution for the convective boundary layer condition. A bi-Gaussian with probability density function dispersion is used for the vertical distribution for convective boundary layer condition. Plume rise follows the Weil formula for stable boundary layer condition and Briggs formula for the convective boundary layer condition.

The basic equation (equation 67 in the Formulation Document) for concentrations in the stable boundary layer condition is:

$$C_s\{x_r, y_r, z\} = \frac{Q}{\sqrt{2\pi}\tilde{u}\sigma_{zs}} \cdot F_y \cdot \sum_{m=-\infty}^{\infty}\left[\exp\left(-\frac{\left(z - h_{es} - 2mz_{ieff}\right)^2}{2\sigma_{zs}^2}\right) + \exp\left(-\frac{\left(z + h_{es} + 2mz_{ieff}\right)^2}{2\sigma_{zs}^2}\right)\right]$$

Where:

C_s: total concentration (SBL) (g/m³)
Q: source emission rate (g/s)
$\tilde{u}$: wind speed at stack top (m/s)
σ_{zs}: total vertical dispersion (m)
F_y: total horizontal distribution function with meander (1/m)
z: height of receptor in horizontal plume state/ terrain-following state (m)
h_{es}: plume height (m)
$2m$: two meters
z_{ieff}: height of reflecting surface (m)

The basic equation for concentration in the convective boundary layer is composed of the sum of three components, concentration contribution from the direct source, concentration contribution from the penetrated source, and concentration contribution from the indirect source. The equation is as follows (equations 59, 65, and 66 in the Formulation Document):

$$\begin{aligned} C_c\{x_r, y_r, z\} = &\left(\frac{Qf_p}{\sqrt{2\pi}\tilde{u}} \cdot F_y \cdot \sum_{j=1}^{2}\sum_{m=0}^{\infty}\frac{\lambda_j}{\sigma_{zj}}\left[\exp\left(-\frac{\left(z - \Psi_{dj} - 2mz_i\right)^2}{2\sigma_{zj}^2}\right) + \exp\left(-\frac{\left(z + \Psi_{dj} + 2mz_i\right)^2}{2\sigma_{zj}^2}\right)\right]\right) \\ &+ \left(\frac{Qf_p}{\sqrt{2\pi}\tilde{u}} \cdot F_y \cdot \sum_{j=1}^{2}\sum_{m=1}^{\infty}\frac{\lambda_j}{\sigma_{zj}}\left[\exp\left(-\frac{\left(z + \Psi_{rj} - 2mz_i\right)^2}{2\sigma_{zj}^2}\right) + \exp\left(-\frac{\left(z - \Psi_{rj} + 2mz_i\right)^2}{2\sigma_{zj}^2}\right)\right]\right) \\ &+ \left(\frac{Q(1 - f_p)}{\sqrt{2\pi}\tilde{u}\sigma_{zp}} \cdot F_y \cdot \sum_{m=-\infty}^{\infty}\left[\exp\left(-\frac{\left(z - h_{ep} + 2mz_{ieff}\right)^2}{2\sigma_{zp}^2}\right) + \exp\left(-\frac{\left(z + h_{ep} + 2mz_{ieff}\right)^2}{2\sigma_{zp}^2}\right)\right]\right) \end{aligned}$$

Where

C_c: total concentration (CBL) (g/m³)
Q: source emission rate (g/s)
f_p: fraction of plume mass
$\tilde{u}$: wind speed at stack top (m/s)
F_y: total horizontal distribution function with meander (1/m)
λ_j: weighting coefficient for the updraft and downdraft distributions
z: height of receptor in horizontal plume state/ terrain-following state (m)
Ψ_{dj}: total height of the direct source plume (m)
$2m$: two meters
z_i: mixing height (m)
σ_{zj}: total vertical dispersion for the updrafts and downdrafts for both direct and indirect sources (m)
Ψ_{rj}: total height of the indirect source plume (m)
h_{ep}: penetrated source plume height above stack base (m)
σ_{zp}: total dispersion of for the penetrated source (m)
z_{ieff}: height of the upper reflecting surface in a stable layer (m)

8. List of Attachments

Attachment A – AERSCREEN Output Files

9. Computer Program Information (if a computer calculation):

AERSCREEN model version 11126, AERMOD version 12345, BPIPPRIM version 04274, MAKEMET version 09183, and AERSURFACE version 13016.

10. References:

EPA, 2004: AERMOD: Description of Model Formulation. EPA-454/R-03-004. Office of Air Quality Planning and Standards Emissions Monitoring and Analysis Division, Research Triangle Park, North Carolina 27711.

EPA, 2011: AERSCREEN Released as the EPA Recommended Screening Model. Tyler Fox Memorandum dated April 11, 2011. U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711.

ATTACHMENT A
AERSCREEN DATA OUTPUT

AERSCREEN 11126 / AERMOD 1234

03/11/14
16:39:06

TITLE: Hanford 2WPT CY13 1g/s

********** STACK PARAMETERS **********

SOURCE EMISSION RATE:	1.0000	g/s	7.937	lb/hr
STACK HEIGHT:	18.54	meters	60.83	feet
STACK INNER DIAMETER:	1.170	meters	46.06	inches
PLUME EXIT TEMPERATURE:	299.8	K	80.0	Deg F
PLUME EXIT VELOCITY:	17.559	m/s	57.61	ft/s
STACK AIR FLOW RATE:	40000	ACFM		
RURAL OR URBAN:	RURAL			
INITIAL PROBE DISTANCE =	5600.	meters	18373.	feet

********** BUILDING DOWNWASH PARAMETERS **********

BUILDING HEIGHT:	21.9	meters	71.8	feet
MAX BUILDING DIMENSION:	3.0	meters	10.0	feet
MIN BUILDING DIMENSION:	3.0	meters	10.0	feet
BUILDING ORIENTATION TO NORTH:	0.	degrees		
STACK DIRECTION FROM CENTER:	0.	degrees		
STACK DISTANCE FROM CENTER:	45.8	meters	150.1	feet

********** FLOW SECTOR ANALYSIS **********

25 meter receptor spacing: 5600. meters - 5600. meters

FLOW SECTOR	BUILD WIDTH	BUILD LENGTH	XBADJ	YBADJ	MAX 1-HR CONC	DIST (m)	TEMPORAL PERIOD
10	0.00	0.00	0.00	0.00	29.47	5600.0	JAN
20	0.00	0.00	0.00	0.00	29.47	5600.0	JAN
30	0.00	0.00	0.00	0.00	26.14	5600.0	JAN
40	0.00	0.00	0.00	0.00	26.14	5600.0	JAN
50	0.00	0.00	0.00	0.00	26.14	5600.0	JAN
60*	0.00	0.00	0.00	0.00	30.95	5600.0	JAN
70	0.00	0.00	0.00	0.00	30.95	5600.0	JAN
80	0.00	0.00	0.00	0.00	30.95	5600.0	JAN
90	0.00	0.00	0.00	0.00	29.91	5600.0	JAN
100	0.00	0.00	0.00	0.00	29.91	5600.0	JAN
110	0.00	0.00	0.00	0.00	29.91	5600.0	JAN
120	0.00	0.00	0.00	0.00	28.80	5600.0	JAN
130	0.00	0.00	0.00	0.00	28.80	5600.0	JAN
140	0.00	0.00	0.00	0.00	28.80	5600.0	JAN
150	0.00	0.00	0.00	0.00	25.91	5600.0	JAN
160	0.00	0.00	0.00	0.00	25.91	5600.0	JAN
170	0.00	0.00	0.00	0.00	25.91	5600.0	JAN
180	0.00	0.00	0.00	0.00	25.91	5600.0	JAN
190	0.00	0.00	0.00	0.00	28.34	5600.0	JAN
200	0.00	0.00	0.00	0.00	28.34	5600.0	JAN
210	0.00	0.00	0.00	0.00	29.44	5600.0	JAN
220	0.00	0.00	0.00	0.00	29.44	5600.0	JAN
230	0.00	0.00	0.00	0.00	29.44	5600.0	JAN
240	0.00	0.00	0.00	0.00	29.93	5600.0	JAN
250	0.00	0.00	0.00	0.00	29.93	5600.0	JAN
260	0.00	0.00	0.00	0.00	29.93	5600.0	JAN
270	0.00	0.00	0.00	0.00	28.17	5600.0	JAN
280	0.00	0.00	0.00	0.00	28.17	5600.0	JAN
290	0.00	0.00	0.00	0.00	28.17	5600.0	JAN
300	0.00	0.00	0.00	0.00	25.67	5600.0	JAN
310	0.00	0.00	0.00	0.00	25.67	5600.0	JAN
320	0.00	0.00	0.00	0.00	25.67	5600.0	JAN

```
         330     0.00      0.00      0.00      0.00    25.92      5600.0    JAN
         340     0.00      0.00      0.00      0.00    25.92      5600.0    JAN
         350     0.00      0.00      0.00      0.00    25.92      5600.0    JAN
         360     0.00      0.00      0.00      0.00    29.47      5600.0    JAN
* = worst case flow sector


---------------------------------------------------------------------------
**********************  MAKEMET METEOROLOGY PARAMETERS  *********************
---------------------------------------------------------------------------

MIN/MAX TEMPERATURE:    243.1 / 318.1 (K)

MINIMUM WIND SPEED:       0.5 m/s

ANEMOMETER HEIGHT:     10.000 meters

SURFACE CHARACTERISTICS INPUT: surf_site_ave.out

DOMINANT SECTOR:           9 (240 270)

DOMINANT MONTH:           January

ALBEDO:                  0.24
BOWEN RATIO:             4.24
ROUGHNESS LENGTH:       0.177 (meters)

       METEOROLOGY CONDITIONS USED TO PREDICT OVERALL MAXIMUM IMPACT
       -------------------------------------------------------------

 YR MO DY JDY HR
 -- -- -- --- --
 10 03 02   2 01

    HO     U*     W*  DT/DZ ZICNV ZIMCH  M-O LEN    Z0  BOWEN ALBEDO  REF WS
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 -1.61  0.050 -9.000  0.020 -999.   25.      7.4 0.177   4.24   0.24    1.00

    HT  REF TA     HT
- - - - - - - - - - -
  10.0   318.1    2.0

ESTIMATED FINAL PLUME HEIGHT (non-downwash):     55.6 meters

       METEOROLOGY CONDITIONS USED TO PREDICT AMBIENT BOUNDARY IMPACT
       --------------------------------------------------------------

 YR MO DY JDY HR
 -- -- -- --- --
 10 03 02   2 01

    HO     U*     W*  DT/DZ ZICNV ZIMCH  M-O LEN    Z0  BOWEN ALBEDO  REF WS
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 -1.61  0.050 -9.000  0.020 -999.   25.      7.4 0.177   4.24   0.24    1.00

    HT  REF TA     HT
- - - - - - - - - - -
  10.0   318.1    2.0

ESTIMATED FINAL PLUME HEIGHT (non-downwash):     55.6 meters


---------------------------------------------------------------------------
************************* AERSCREEN AUTOMATED DISTANCES ********************
                 OVERALL MAXIMUM CONCENTRATIONS BY DISTANCE
---------------------------------------------------------------------------


                    MAXIMUM                              MAXIMUM
          DIST     1-HR CONC                  DIST     1-HR CONC
           (m)      (ug/m3)                    (m)      (ug/m3)
        --------------------                --------------------
        5600.00     30.95
```

```
---------------------------------------------------------------------------
**********************  AERSCREEN MAXIMUM IMPACT SUMMARY  **********************
---------------------------------------------------------------------------
```

CALCULATION PROCEDURE	MAXIMUM 1-HOUR CONC (ug/m3)	SCALED 3-HOUR CONC (ug/m3)	SCALED 8-HOUR CONC (ug/m3)	SCALED 24-HOUR CONC (ug/m3)	SCALED ANNUAL CONC (ug/m3)
FLAT TERRAIN	30.95	30.95	27.86	18.57	3.095
DISTANCE FROM SOURCE	5600.00 meters directed toward 60 degrees				
IMPACT AT THE AMBIENT BOUNDARY	30.95	30.95	27.86	18.57	3.095
DISTANCE FROM SOURCE	5600.00 meters directed toward 60 degrees				

NUCLEAR BUSINESS GROUP CONTROLLED DOCUMENT
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Appendix D

200 West Pump and Treat Facility Stack Emissions (SGRP-WSA-2014-15046)

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CHPRC WORK SITE ASSESSMENT REPORT

1. WSA NO.:	2. Project/Function:	3. Date(s):
SGRP-WSA-2014-15046	Soil & Groundwater Remediation Project	09/16/14

4. Assessment Title and Purpose/Scope:

200 West Pump and Treat Facility Stack Emissions.

This assessment satisfies CHPRC Environmental Management System objective 14-EMS-SGWR-OB1-T1 to reduce air emissions at the 200 West Pump and Treat Facility. The EMS target is to update the air emissions baseline from CY13 with CY14 analytical results and evaluate data to identify if additional modeling is warranted and whether opportunities exist to reduce air-toxic emissions.

5. Location:

200 West Area

6. Assessment Personnel:

Rick Oldham

7. Personnel Contacted: (titles may be used rather than specific names to identify people contacted and interviewed during the review)

Bill Barrett, Greg Berquist, Steve Burk, Mark Carlson, Bob Evans, Bob Cathel, Mark Burns of CHPRC and John Frohning of CH2MHill Bellevue.

8. Applicable Requirements/Criteria:

200 West Area Pump-and-Treat Facility Remedial Design/Remedial Action Work Plan (DOE/RL-2008-78) and Operations and Maintenance Plan (DOE/RL-2009-124), Appendix C, Air Monitoring Plan.

9. Documents Reviewed:

WSCF Laboratory report dated 03/26/2014 for samples collected 02/25/14.
Test America Laboratory report dated 06/10/2014 for samples collected 05/13/14.
Test America Laboratory report dated 08/27/2014 for samples collected 08/14/14.
Test America Laboratory report dated 09/08/2014 for samples collected 09/04/14.

10. Description of Assessment Methods: (e.g., what methods were used in the assessment)

The Air Monitoring Plan and Remedial Design/Remedial Action Work Plan for the 200 West Pump & Treat Facility (2WPT) were reviewed. Laboratory analytical results were reviewed. Cognizant personnel from 200 West Pump and Treat Operations/Engineering and S&GRP Sampling organizations were interviewed.

11. Assessment Summary Containing Information That Address the LOIs, Assessment Conclusion, and Findings and Opportunities for Improvement Identified:

Since 2WPT operations are less than Hazard Category III, Safety Management Program lines of inquiry, pursuant to HNF-22632, *Process Description for Safety Management Program Implementation Verification*, were not used. General lines of inquiry were developed from the Remedial Design/Remedial Action Work Plan and from the 200 West Area Pump-and-Treat Facility Operations and Maintenance Plan (DOE/RL-2009-124), Appendix C, Air Monitoring Plan as follows:

- Were grab samples collected quarterly at the treated off gas stack?

CHPRC WORK SITE ASSESSMENT REPORT

1. WSA NO.:	2. Project/Function:	3. Date(s):
SGRP-WSA-2014-15046	Soil & Groundwater Remediation Project	09/16/14

- Was an acceptable source impact analysis completed pursuant to WAC 173-460, "Controls for New Sources of Toxic Air Pollutants".

- Is additional dispersion modeling needed to confirm compliance with *acceptable source impact levels* (ASILs) if emissions are higher than previously detected?

- What actions have been taken, or are being taken, to reduce air-toxic emissions at the 200 West Pump and Treat Facility?

ISMS/EMS Guiding Principles, Core Functions and Core Elements evaluated during this assessment are:

- Guiding Principle 1, Line management responsibility for Safety and Environmental Requirements, Core Function 6, Establish ESH&Q Policy, Core Element 1, Establish Environmental Policy.
- Guiding Principal 9, Conformance Audits, Corrective Actions, and Continuous Improvement, Core Function 5, Provide Feedback and Continuous Improvement, and Core Element 4, Checking and Corrective Action.

Results from the lines of inquiry are as follows:

Were grab samples collected quarterly at the treated off gas stack?

Grab sampling was completed at the treated off gas (TOG) stack on 02/25/14, 05/13/14, 08/14/14 and 09/04/14. The 09/04/14 sample event was a sample obtained to confirm high carbon tetrachloride (CCl_4) concentrations reported from the 08/14/14 sample event. Collection of the CY14 fourth quarter sample is in planning.

Was an acceptable source impact analysis completed pursuant to WAC 173-460, "Controls for New Sources of Toxic Air Pollutants".

The acceptable source impact analysis is documented in DOE/RL-2009-124, Appendix C, Air Monitoring Plan. It does not need to be redone unless it is demonstrated that stack emissions have been reduced to below small quantity emission rates. No such data exists, at this point, to suggest that emissions have been reduced. The principal air-toxic pollutant is CCl_4.

Is additional dispersion modeling needed to confirm compliance with ASILs if emissions are higher than previously detected?

Dispersion modeling is required to be completed when a WAC 173-460 toxic air pollutant exceeds the small quantity emission rate (SQER) after treatment (as measured at the emission point). Dispersion modeling was completed based on calculated potential emissions prior to commencement of operations. The results were documented in DOE/RL-2009-124, Appendix C, Air Monitoring Plan. Additional modeling was completed to confirm compliance with acceptable source impact levels based on samples obtained in CY13 (CH2MHill calculation 382519-CALC-53, 03/17/14). Based on sample results obtained in the third quarter CY14, dispersion modeling for emission of CCl_4 needs to be updated again. The 02/25/14 result was 31 ppbv, the 05/13/14 average result was 38 ppbv, and the 08/14/14 average result was 690 ppbv.

CHPRC WORK SITE ASSESSMENT REPORT

1. WSA NO.:	2. Project/Function:	3. Date(s):
SGRP-WSA-2014-15046	Soil & Groundwater Remediation Project	09/16/14

The high result from the 08/14/14 sample event was confirmed in the 09/04/14 sample event, the average result for which was 890 ppbv. At some point between the 05/13/14 sample event and the 08/14/14 sample event, saturation of the granular activated carbon (GAC) occurred such that efficient removal of carbon tetrachloride was lost.

Historical process sampling of the vessel off gas system (VOG) has shown that the VOG GAC are being challenged by higher concentrations of CCl4 than the GAC for the air stripper off gas. Accordingly, the VOG GAC was changed out in July 2013. Due to lesser CCl4 challenge on the air stripper GAC, such was not changed out until June 2014. It is suspected that the high CCl4 concentrations detected in the August and September 2014 sample events were caused by breakthrough in the VOG GAC.

Additional dispersion modeling is needed to confirm compliance with ASILs. Previous dispersion modeling used the EPA dispersion model *AERSCREEN*. *AERSCREEN* assumes that the nearest site boundary is the location of the nearest downwind site boundary regardless of the actual prevailing wind direction. It is recommended that dispersion modeling be updated using the EPA dispersion model *AERMOD*. *AERMOD* uses local meteorological data to determine the nearest downwind site boundary for dispersion modeling.

What actions have been taken, or are being taken, to reduce air-toxic emissions at the 200 West Pump and Treat Facility?

There are two sets of GAC treatment in lead and lag vessels for both VOG and air stripper off gas. Since the air stripper GAC is relatively fresh, the two lag GAC vessels were removed and placed in the lag position for VOG treatment. The change out work was completed 09/15/14. TOG sampling is scheduled for 09/17/14. The sample event is expected to confirm reduction of CCl4 emissions to historical lower range.

Condensation is a factor in GAC CCl4 removal efficiency. When water coats the GAC, surficial contact between CCl4 vapors and GAC is greatly diminished. To mitigate generation of condensation, during colder and moist months, heat tracing has been applied at off gas drain locations to prevent freeze up and allow condensation to drain from off gas duct work prior to off gas treatment in the GAC.

Temperature fluctuation in the GAC vessels during colder months can also cause condensation. To mitigate this, insulation blankets are being installed on the GAC vessels.

Since the TOG is exhausted by constant rate exhaust fans, off gas within the GAC treatment system is balanced with large dampers located at the east and west ends of the VOG and air stripper off gas systems. This configuration allows blending of outside air into the GAC treatment system. As such, ambient temperature and moisture enter the GAC system, potentially impacting CCl4 removal efficiencies, especially during colder months. Current plans are to replace the existing fan motors with variable frequency drives. Once installed, this will greatly reduce reliance on the dampers for achieving balance within the TOG system.

The change out frequency for the VOG GAC is being increased to once every six months.

CHPRC WORK SITE ASSESSMENT REPORT

1. WSA NO.:	2. Project/Function:	3. Date(s):
SGRP-WSA-2014-15046	Soil & Groundwater Remediation Project	09/16/14

Planning is underway to monitor individual GAC vessel performance with respect to CCl4 removal efficiency. This is planned to be accomplished by monthly sampling of off gas upstream and downstream of each individual GAC vessel.

12. WSA Performed By:

Name	Signature	Date
Rick Oldham	R O Oldham	9.16.14

13. Approved Responsible Manager:

Name	Signature	Date
Bob Cathel	Bob Cathel	9/16/14

14. Attachments: [X] Yes [] No (It is not necessary to attach copies of records, documents, procedures, etc. which are retrievable from IDMS or other records storage locations, which are referenced in block 9)

If Yes, List:

Condition Reports CR-2014-1937, CR-2014-1938, CR-2014-1940, CR-2014-1941, CR-2014-1942 and CR-2014-1943.

15. Distribution:

Initiator:	R. W. Oldham	NSR&ER (^PAAADocs):	
Responsible Manager:	R. L. Cathel	Others (list):	S. P. Burke
Affected Management, as applicable:	B. F. Barrett		G. G. Bergquist
Project Assessment Coordinator (Electronic):	B. L. Bates		J. R. Seaver/S. G. Austin

CHPRC CONDITION REPORT FORM

Status: Assignment CR NUMBER: CR-2014-1937

Issue Identification and Processing

Initiator:	Initiating Document:	Date Identified:
Oldham, Rick W	SGRP-WSA-2014-15046	9/16/2014

Title of Issue:
Higher than expected emissions of CCl4 at the 2WPT

Description of Issue:
Following change out of the GAC i1n the vessel off gas lag position with new GAC from the air stripper off gas system, resample treated off gas for the 2WPT TOG stack.

Requirements Not Met: (Orders, Requirements, Procedures)	Responsible Project/Program:
N/A	SOIL & GROUNDWATER REMEDIATION
Date Submitted: 9/16/2014	**Other Related Documents:**

Immediate Action(s) Taken:
New GAC in the lag position for the air stripper off gas system was removed and placed in the lag position for the vessel off gas system.

Recommended Corrective Actions:
Complete sampling.

Initiator Comments:
Chris Sutton (Bob Evans) in the S&GRP Sample Management organization.

Associated Files
WSA-SGRP-2014-15046CY142WPTTOGStackEmissions.pdf

Issue Significance, Analysis, Extent of Condition, Action Assignment, and Closure

Significance Level:	Date Submitted to Responsible Manager:	Date CAP was approved by Responsible Manager/Delegate:
Track Until Fixed	9/16/2014 - Sutton, Chris	

☐ ORPS ☐ Compliance Determination ☐ NTS ☐ No Action Taken

Significant Level Justification:
This condition is screened as a Track Until Fixed (TUF).

The screening level as a TUF is assigned to this CR for the purpose of tracking actions to closure for addressing the subject condition.

PLH

Assigned To:	Date Assigned:

Extent of Conditions:

Causal Analysis Method Used:	Analysis Completion Date:

Analysis Results:

Trend Codes:
FAC0403 - 200 W P&T
OP08 - Chapter 8, Control of Equipment and System Status
AC02 - Sampling and Analysis
ZIS01 - Self-identified (COAR Use Only)

Cause Codes:

PAAA/851 Citations:

ISMS:

CHPRC CONDITION REPORT FORM

Status: Assignment CR NUMBER: CR-2014-1938

Issue Identification and Processing

Initiator:	Initiating Document:	Date Identified:
Oldham, Rick W	SGRP-WSA-2014-15046	9/16/2014

Title of Issue:
Temperature fluctuation in the 2WPT GAC vessels.

Description of Issue:
Temperature fluctuation in the GAC vessels during colder months can cause condensation. When water coats the GAC, surficial contact between CCl4 vapors and GAC is greatly diminished.

Requirements Not Met: (Orders, Requirements, Procedures)	Responsible Project/Program:
N/A	SOIL & GROUNDWATER REMEDIATION
Date Submitted:	**Other Related Documents:**
9/16/2014	

Immediate Action(s) Taken:
To mitigate this, insulation blankets are being installed on the GAC vessels. One insulation blanket has been installed on a GAC vessel.

Recommended Corrective Actions:
The remaining seven GAC vessels need to have GAC insulation installed.

Initiator Comments:
Barrett/Burke/Bergquist

Associated Files
WSA-SGRP-2014-15046CY142WPTTOGStackEmissions.pdf

Issue Significance, Analysis, Extent of Condition, Action Assignment, and Closure

Significance Level:	Date Submitted to Responsible Manager:	Date CAP was approved by Responsible Manager/Delegate:
OFI	9/16/2014 - Burke, Steven P	

☐ ORPS ☐ Compliance Determination ☐ NTS ☐ No Action Taken

Significant Level Justification:
This issue is screened as an Opportunity for Improvement (OFI).

As an OFI, the issue needs to be reviewed to determine if actions need to be developed for addressing the subject condition. If actions are developed this CR will track those actions to closure. If closing the CR utilizing the "No Action" button, PROVIDE the rationale in the no action justification box.

PLH

Assigned To:	Date Assigned:

Extent of Conditions:

Causal Analysis Method Used:	Analysis Completion Date:

Analysis Results:

Trend Codes:
FAC0403 - 200 W P&T
OP08 - Chapter 8, Control of Equipment and System Status
MN16 - Seasonal Facility Preservation Requirements
ZIS01 - Self-identified (COAR Use Only)

Cause Codes:

PAAA/851 Citations:

ISMS:

CHPRC CONDITION REPORT FORM

Status: Screening CR NUMBER: CR-2014-1940

Issue Identification and Processing

Initiator:	Initiating Document:	Date Identified:
Oldham, Rick W	SGRP-WSA-2014-15046	9/16/2014

Title of Issue:
Ambient moisture in 2WPT TOG system.

Description of Issue:
Since the TOG is exhausted by constant rate exhaust fans, off gas within the GAC treatment system is balanced with large dampers located at the east and west ends of the VOG and air stripper off gas systems. This configuration allows blending of outside air into the GAC treatment system. As such, ambient temperature and moisture enters the GAC system, potentially impacting CCl4 removal efficiencies, especially during colder months.

Requirements Not Met: (Orders, Requirements, Procedures)	Responsible Project/Program:
N/A	SOIL & GROUNDWATER REMEDIATION
Date Submitted:	**Other Related Documents:**
9/16/2014	

Immediate Action(s) Taken:
Current plans are to replace the existing fan motors with variable frequency drives. Once installed, this will greatly reduce reliance on the dampers for achieving balance within the TOG system.

Recommended Corrective Actions:
Complete procurement and installation of 2WPT TOG variable frequency drives for exhaust fan motors.

Initiator Comments:
Barrett/Burke/Bergquist

Associated Files
WSA-SGRP-2014-15046CY142WPTTOGStackEmissions.pdf

Issue Significance, Analysis, Extent of Condition, Action Assignment, and Closure

Significance Level:	Date Submitted to Responsible Manager:	Date CAP was approved by Responsible Manager/Delegate:
	-	

☐ ORPS ☐ Compliance Determination ☐ NTS ☐ No Action Taken

Significant Level Justification:

Assigned To:	Date Assigned:
Extent of Conditions:	
Causal Analysis Method Used:	**Analysis Completion Date:**

Analysis Results:

Trend Codes:

Cause Codes:

PAAA/851 Citations:

ISMS:

CHPRC CONDITION REPORT FORM

Status: Screening CR NUMBER: CR-2014-1941

Issue Identification and Processing

Initiator:	Initiating Document:	Date Identified:
Oldham, Rick W	SGRP-WSA-2014-15046	9/16/2014

Title of Issue:
Increased CCl4 emissions at the 2WPT TOG stack.

Description of Issue:
Historical process sampling of the vessel off gas system (VOG) has shown that the VOG GAC are being challenged by higher concentrations of CCl4 than the GAC for the air stripper off gas. Accordingly, the VOG GAC was changed out in July 2013. Due to lesser CCl4 challenge on the air stripper GAC, such was not changed out until June 2014. It is suspected that the high CCl4 concentrations detected in the August and September 2014 TOG stack sample events were caused by breakthrough in the VOG GAC.

Requirements Not Met: (Orders, Requirements, Procedures)	Responsible Project/Program:
N/A	SOIL & GROUNDWATER REMEDIATION
Date Submitted: 9/16/2014	**Other Related Documents:**

Immediate Action(s) Taken:
The relatively new GAC vessels in the lag position for the 2WPT air stripper off gas system were removed from that position and placed into the lag position for the VOG GAC treatment system. This should immediately reduce CCl4 emissions from the 2WPT TOG stack.

Recommended Corrective Actions:
The change out frequency for the VOG GAC is being increased, for instance, to once every six months.

Initiator Comments:
Barrett/Burke/Bergquist

Associated Files
WSA-SGRP-2014-15046CY142WPTTOGStackEmissions.pdf

Issue Significance, Analysis, Extent of Condition, Action Assignment, and Closure

Significance Level:	Date Submitted to Responsible Manager:	Date CAP was approved by Responsible Manager/Delegate:
	-	

☐ ORPS ☐ Compliance Determination ☐ NTS ☐ No Action Taken

Significant Level Justification:

Assigned To:	Date Assigned:

Extent of Conditions:

Causal Analysis Method Used:	Analysis Completion Date:

Analysis Results:

Trend Codes:

Cause Codes:

PAAA/851 Citations:

ISMS:

CHPRC CONDITION REPORT FORM

Status: Screening CR NUMBER: CR-2014-1942

Issue Identification and Processing		
Initiator: Oldham, Rick W	**Initiating Document:** SGRP-WSA-2014-15046	**Date Identified:** 9/16/2014
Title of Issue: Better monitoring is needed for 2WPT GAC removal of CCl4 vapors.		
Description of Issue: Increase in CCl4 emissions from the 2WPT TOG stack.		
Requirements Not Met: (Orders, Requirements, Procedures) N/A	**Responsible Project/Program:** SOIL & GROUNDWATER REMEDIATION	
Date Submitted: 9/16/2014	**Other Related Documents:**	
Immediate Action(s) Taken: Planning is underway to monitor individual GAC performance with respect to CCl4 removal efficiency. This is planned to be accomplished by monthly sampling of off gas upstream and downstream of each individual GAC vessel.		
Recommended Corrective Actions: Initiate monthly sampling upstream and down stream from each individual GAC vessel at the 2WPT. Track analytical results to ensure the GAC saturation does not occur.		
Initiator Comments: Barrett/Bergquist/Riddelle/Carlson		
Associated Files WSA-SGRP-2014-15046CY142WPTTOGStackEmissions.pdf		

Issue Significance, Analysis, Extent of Condition, Action Assignment, and Closure		
Significance Level:	**Date Submitted to Responsible Manager:** -	**Date CAP was approved by Responsible Manager/Delegate:**
☐ ORPS ☐ Compliance Determination ☐ NTS ☐ No Action Taken		
Significant Level Justification:		
Assigned To:	**Date Assigned:**	
Extent of Conditions:		
Causal Analysis Method Used:	**Analysis Completion Date:**	
Analysis Results:		
Trend Codes:		
Cause Codes:		
PAAA/851 Citations:		
ISMS:		

CHPRC CONDITION REPORT FORM

Status: Screening CR NUMBER: CR-2014-1943

Issue Identification and Processing

Initiator:	Initiating Document:	Date Identified:
Oldham, Rick W	SGRP-WSA-2014-15046	9/16/2014

Title of Issue:
Higher than expected emissions of CCl4 at the 2WPT

Description of Issue:
Additional dispersion modeling is needed to confirm compliance with Acceptible Source Impact Levels. Previous dispersion modeling used the EPA dispersion model AERSCREEN. AERSCREEN assumes that the nearest site boundary is the location of the nearest downwind site boundary regardless of the actual prevailing wind direction. It is recommended that dispersion modeling be updated using the EPA dispersion model AERMOD. AERMOD uses local meteorological data for dispersion modeling.

Requirements Not Met: (Orders, Requirements, Procedures)	Responsible Project/Program:
N/A	SOIL & GROUNDWATER REMEDIATION
Date Submitted:	**Other Related Documents:**
9/16/2014	

Immediate Action(s) Taken:
Coordinated with CH2MHill subject matter expert for dispersion modeling update.

Recommended Corrective Actions:
Using CH2MHill corporate resources, update dispersion modeling for CCl4 emissions from the 2WPT TOG stack.

Initiator Comments:
Bean/Cathel/Oldham

Associated Files
WSA-SGRP-2014-15046CY142WPTTOGStackEmissions.pdf

Issue Significance, Analysis, Extent of Condition, Action Assignment, and Closure

Significance Level:	Date Submitted to Responsible Manager:	Date CAP was approved by Responsible Manager/Delegate:
	-	

☐ ORPS ☐ Compliance Determination ☐ NTS ☐ No Action Taken

Significant Level Justification:

Assigned To:	Date Assigned:

Extent of Conditions:

Causal Analysis Method Used:	Analysis Completion Date:

Analysis Results:

Trend Codes:

Cause Codes:

PAAA/851 Citations:

ISMS: