Georgia Department of Natural Resources

Environmental Protection Division-Land Protection Branch
2 Martin Luther King Jr., Dr., Suite 1054 East, Atlanta, Georgia 30334
(404) 657-8600; Fax (404) 657-0807
Richard E. Dunn, Director

June 30, 2016

VIA U.S. MAIL AND E-MAIL

Trust for Benefit of Brenda Heisey and
Rheem Manufacturing
c/o Ms. Hollister Hill
Troutman Sanders, LLP
600 Peachtree Street, NE, Suite 5200
Atlanta, Georgia 30305

Re: Voluntary Remediation Program
Semi-Annual Progress Reports October 2014, April 2015, and October 2015
VRP Compliance Status Report May 2016
139 Brampton Road (former Rheem Manufacturing), HSI Site No. 10208
Savannah, Chatham County, Georgia
Tax Parcel ID#1-0720-01-002

Dear Ms. Hill:

The Georgia Environmental Protection Division (EPD) has reviewed the 6th, 7th, and 8th Semi-Annual Progress Reports, and the Voluntary Remediation Program (VRP) Compliance Status Report (CSR) that that were submitted pursuant to the Georgia Voluntary Remediation Program Act. These reports are dated October 2014, April 2015, October 2015, and May 2016, respectively.

EPD's review of the October 2014 Semi-Annual report finds the soil remediation plan adequate to bring the site into compliance with the approved Type 4 risk reduction standard (RRS) for lead. In addition, our review of the April 2015 Semi-Annual report finds that the soil excavations performed in December 2014 have met the goals outlined in the proposed remediation plan. The confirmation sampling data presented in the April 2015 Semi-Annual report are adequate to demonstrate compliance to the Type 4 RRS for lead in soil. However, EPD does have the following comments that must be addressed in order to approve the CSR.

Groundwater Fate and Transport Modeling

1) **Additional Information Needed:** Additional information regarding the modeling documentation provided in the VRP CSR is necessary for EPD's review. Please provide the following:

   a) An updated table(s) with all model input values listed as well as their source/justification:

      i) For model calibration and validation.

      ii) For the predictive model runs, Table D-1 of the VRP CSR did not include the source of the source decay constant (k_s).

   b) Additional clarification regarding sources of input values is necessary as follows:

      i) If field data was acquired for a specific parameter, the range (high and low) of values obtained should also be included on the table with a reference to the submittal where said information was provided.

      ii) If a literature value was used, a Bibliographic Reference to the original literature source should be provided both in the table and in the associated narrative. In addition, if a literature input value is dependent upon field observations or analyses, please provide the range for those values and a reference to their sources.

   The table below is an example of what should be provided for review:

Parameter	Input Value Used with Units[1]	Source of Value[2]	Range of Observed or Published Values[2]	Bibliographic Reference[2]
Hydraulic Conductivity (K)	5.6E-04 (cm/sec)	Average of Slug Test Results	3.5E-04 to 4.1E-03 (cm/sec)	VIRP for Site (Date)
Hydraulic Gradient (*i*)	0.005 (ft/ft)	Average derived from historical potentiometric surface maps for Site	0.001 to 0.006 (ft/ft)	Calculations in Appendix IV, VIRP (July 19, 2011)
Effective Porosity (n_e)	0.2 (dimensionless)	Literature based on field observed soil type (Sandy Clay) and literature lookup table	0.279-0.511 (dimensionless)	Boring logs in Appendix V VIRP (July 19, 2011) and Rawls, *et.al.*, 1983

c) Paper copies of the model runs are needed and should be appropriately labeled (by hand if necessary) according to model simulation run and include the comparison sampling date. Specifically, the following should be provided:

i) Input sheets for the following model runs:

(1) Calibration Simulation: Please provide the final input sheets representative of the 1987 sampling date (see Comment 2).

(2) Validation Comparison Simulation (See Comment 2): Only the comparison data concentrations and dates in Field #6, and possibly the simulation time, should change from the calibration simulation.

(3) Maximum Plume Extent Predictive Simulation (See Comment 3): Field comparison data has no relevance to this modeling run and should be removed.

(4) Type 5 RRS Groundwater Cleanup Standards (See Comment 4a): Field comparison data should not appear on this input sheet as it has no relevance to this modeling run.

ii) Output sheets for the same simulation runs:

(1) Calibration and validation run output sheets should be representative of the sampling date for the groundwater analytical data set used to calibrate and validate the modeling effort. Comparison data, along with notations for the locations of said data, should be included.

(2) For the maximum plume extent predictive run, please provide three output sheets as follows:

(a) One sheet representing the date the plume is predicted to reach its maximum extent.

(b) Two sheets representing the simulation dates immediately before and after the predicted date when the maximum extent of the plume is reached. These three output sheets should be temporally spaced as closely together as the model allows.

(3) Output sheets for a minimum of two additional monitoring events that represent the predicted concentrations for those sampling dates (see Comment 2b). Please include comparison data, along with notations for the locations of said data.

d) A contaminant plume map from which source dimensions used directly by the model were

[1] Value on model input sheet copies in the subject submittal.

[2] Example only, fictitious values or random references provided.

determined or estimated. Specifically, the map should include:

i) Posted groundwater analytical results with acquisition dates and concentration units.

ii) Isoconcentration contours (isocons).

iii) Lines or other notations representing the total source width or width of source concentration zones (as appropriate), and plume length input into the model.

e) Contaminant plume maps representing the groundwater contaminant plume configurations on the sampling dates for the groundwater samples used for comparison for the calibration and validation model runs. More than one isocon representing the delineated extent of the plume will be necessary.

f) A table summarizing predicted contaminant concentrations vs. field-measured concentrations along the plume centerline. Analytical results from each data point used to calibrate and validate the model should be included and should be updated using newly acquired analytical data for comparison. Please see the example table below, which does not include all POD wells:

Monitoring Location	Sampling Date	Contaminant Concentrations (mg/L)								Comments/ Conclusions
		PCE		TCE		DCE		Vinyl Chloride		
		Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	
W-4 (Source Well)	1987	TBD	1.800	TBD	0.040	TBD	0.160	TBD	<0.002	Calibration Run
	1997	TBD	0.150	TBD	0.038	TBD	0.057	TBD	<0.002	Validation Run
	Cleanup Standard	TBD		TBD		TBD		TBD		Compare field data to cleanup standards
EW-2 (Downgradient Well	2012	TBD	0.076	TBD	0.051	TBD	0.024	TBD	<0.002	Are the model predictions accurate?
	2015	TBD	0.031	TBD	0.021	TBD	0.017	TBD	<0.002	
	Additional Data Set	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	
	Cleanup Standard	TBD		TBD		TBD		TBD		Compare field data to cleanup standards
	2015	Not Sampled								TBD
	2016	TBD	0.001	TBD	0.011	TBD	0.018	TBD	<0.002	Are the model predictions accurate?
	Additional Data Set	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	
	Cleanup Standard	TBD		TBD		TBD		TBD		Compare field data to cleanup standards

TBD = to be determined

g) A minimum of one cross-section depicting the source thickness used in the model: The modeler should indicate how this value was determined since it represents the thickness of the impacted portion of the aquifer at the source and not necessarily the entire thickness of the aquifer. Please use isocons on the cross-section(s) to represent the vertical thickness of the source.

2) **Model Calibration and Validation:** The model must be both calibrated and validated for EPD to be able to concur with any conclusions based on it. EPD does not concur that the model has been properly calibrated and/or validated. Input parameters have been modified multiple times since the first iteration was submitted to EPD. If a model is properly calibrated, the only parameters that should be modified for predicting contaminant plume behavior are: 1) simulation time, 2) modeled area width, and 3) field data for comparison. As long as other parameters are being modified, EPD assumes that the calibration process is ongoing.

   a) EPD recommends that the initial recalibration and validation of the model be conducted using the groundwater analytical results obtained from monitoring wells W-4 (source well) and W-5 (downgradient well) in 1987 and 1997, respectively, using a site-specific source decay (k_s) value (see Part c.vi of this Comment). The modeler may wish to use a source tetrachloroethene (PCE) concentration greater than 1,800 ug/L since that was the concentration detected in W-4 several years after the release is likely to have occurred.

   b) After the model has been recalibrated and validated as requested above, validate the calibration simulation using the 2012 and 2015/2016 groundwater analytical results for monitoring wells EW-2, W-5, and EW-7. Print the input/output sheets showing the predicted and actual comparison concentration data for the date(s) represented by the applicable comparison data acquisition date and submit them to EPD in the modeling report. If the 1987, 1997, 2012, and 2015/2016 comparison data reasonably matches the predicted concentrations (using the same aquifer and contaminant input values); then additional groundwater monitoring beyond the site's removal from the HSI may not be required.

   c) EPD will defer a complete evaluation of the input parameters used in the current modeling effort until the revised input parameter summary table, referenced in Comment 1a has been provided. However, EPD noted the following regarding specific input parameters on Table D-1 and/or model input sheets provided in the CSR that could affect the calibration and validation of the model:

      i) Hydraulic Gradient (*i*): According to Table D-1, measured groundwater elevations measured during a single monitoring event were used to determine this input parameter value. Please justify using the *i* value for a single monitoring event rather than an average of historical *i* values, which is EPD's preferred starting point when calibrating a model since it should be representative of site conditions that will have impacted plume conditions over time.

      ii) Effective Porosity (n_e) and Bulk Density (ρ_b): A bibliographic reference should be provided on Table D-1 for the publication from which the final n_e value was acquired.

      iii) Dispersivities (α_x, α_y, and α_z): Very conservative values were shown on the modeling input sheets provided, assuming the plume length used to determine them is correct. These parameters can be manipulated during model calibration using the methods referenced in the BioChlor User's Manual based on plume length determined using the isoconcentration map requested in Comment 1e, if necessary. Please manipulate these parameters before you manipulate K_s, *i*, or n_e, excessively.

      iv) Fraction of Organic Carbon (f_{oc}): If field measured data is not available and you choose not to acquire it, the modeler may manipulate this parameter using a default value of 0.001 (dimensionless) as recommended in the BioChlor User's Manual. This parameter may be manipulated as long as the recommended default value is not exceeded without corresponding field acquired data to justify it. However, EPD does not recommend that extremely low values be used before attempting to manipulate other less certain parameters such as the contaminant dispersivity values, half-life, source concentrations, etc.

      v) Organic Carbon Partition Coefficient (K_{oc}): The organic carbon partition coefficient (K_{oc}) values used are not consistent with the values posted on the EPA Regional Screening Level (RSL) Tables, which EPD prefers and were discussed during the last meeting between the site

consultant and EPD. K_{oc} values currently posted on the RSL tables are more recent values compared to those listed in the model user's manual. Note: the K_{oc} value for "DCE" should be the value posted on the RSL tables for "cis-1,2-DCE."

vi) Source Decay Constant (k_s): A low default value of 0.01 (1/yr) value was used in the current modeling effort. Calculation of this parameter value may be useful in calibration of the model in the future as some source removal/remediation has been conducted. Please estimate a site-specific value for this parameter by plotting historical dissolved PCE concentrations in the assumed source well over time using a semi-logarithmic scale for PCE concentrations similar to Figure 1 in the BioChlor User's Manual Addendum (March 2002) and attempt to use said value in future model calibration efforts. Said graph should be provided as justification for the value used, even if the calculated value was manipulated during model calibration or a default value is used. Copies of the referenced graph and the equation used for determining the slope should be submitted if used in estimating a site-specific k_s value.

vii) Source and Plume Dimensions (width, length, thickness): Please see Comment 1 d and 1e.

viii) Field Data for Comparison: This data should only appear on the paper copies of the input/output sheets for the appropriate simulation time that corresponds with the date of acquisition of the field comparison data (e.g., calibration, validation, and prediction runs using data already acquired). Please note the following:

(1) Paper copies of input/output sheets for simulation runs used to predict future plume behavior should not include comparison data.

(2) Analytical data for the assumed source well (W-4) used in the model should be included as a comparison data point at zero feet distance from the source for the initial calibration/validation simulation runs for 1987 and 1997.

(3) Each of the existing monitoring well locations for which groundwater analytical results are used for comparison to model predicted results is considered by EPD to be a Point of Determination (POD) well for validation purposes and for determining groundwater concentrations that would trigger revaluation of the model.

3) **Modeled Maximum Projected Extent of the Contaminant Plume:** The simulation time for the properly calibrated and validated model referenced in Comment 2 should be extended until the contaminants begin to retreat or reach asymptotic levels. Please provide output sheets representing:

a) The predicted year(s) that the contaminant plume(s) ceases to migrate downgradient, and

b) The plume conditions on the animation dates immediately before and after the output sheet referenced in Part a of this comment showing the plume migrating forward before and retreating or stabilized afterward.

Risk Reduction Standards

4) Determination of soil and groundwater RRS for PCE and regulated degradation products:

a) Type 5 RRS for groundwater: Using the calibrated/validated model run referenced in Comment 2 above, contaminant source concentrations should be manipulated to determine the maximum concentrations for each of the contaminants at the source area (W-4) and centerline downgradient POD well(s) (EW-2, W-5, and EW-7), that will not result in an unacceptable impact at the point-of-exposure. The predicted values at each well location will be the Type 5 RRS for groundwater at the applicable wells. If historical groundwater analytical results have not exceeded the predicted values, EPD may not require additional groundwater monitoring beyond removal of the site from the HSI.

b) Volatile organic compounds (VOCs) in soil: EPD does not agree with considering leaching an incomplete pathway for VOCs based solely on the presence of building cover. If VOC impacted soil in the vicinity of GP-05 is to remain, it must be demonstrated by leaching tests or modeling

that groundwater will not be impacted above acceptable levels. Additionally, reliance on engineering controls (e.g., building slab as a cap) to meet cleanup standards will be considered use of Type 5 RRS.

5) Area averaging for lead on adjacent properties:

   a) Soil data used to conduct averaging for lead on adjacent properties should be evaluated using EPA ProUCL software. The results of this evaluation should be presented and include the selected 95% upper confidence limit (UCL) of the mean for each exposure domain.

   b) There must be sufficient soil data to conduct averaging for appropriate exposure domains. Note that vertically, the soil exposure domain for routine surficial contact with soil is the ground surface to a depth of two feet. Laterally, the extent of the exposure domains should be justified based on current and potential future receptor use. In particular, for the Norfolk Southern property, more soil samples are needed and the exposure domain may need to be divided into smaller units. Soil samples should be collected in a random manner that does not bias the results.

6) Table comparing maximum soil concentrations to RRS: A table should be provided that identifies the maximum concentrations of all regulated substances in soil that remain in place, the boring location / sample depth, and the applicable RRS.

General Comments

7) EPD requests that your responses to the Groundwater Fate and Transport Modeling comments above be submitted in a stand-alone document or appendix that includes all supporting data.

8) The certification of compliance with RRS references selected regulated substances (i.e., lead and VOCs). The certification of compliance must apply to all regulated substances evaluated by the CSR.

9) Vapor intrusion evaluation comments:

   a) Due to the magnitude of sub-slab VOC concentrations and the site-specific use of the Johnson and Ettinger Model, indoor air sampling is needed on the subject property to validate the model predictions.

   b) For the McDonald Ventures property, groundwater VOC concentrations were used to screen the vapor intrusion pathway, with the depth to groundwater identified as 1.54 feet. Both the 2015 EPA *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* and the superseded 2002 EPA *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* identify shallow groundwater (i.e., less than 5 feet) as a precluding factor for screening based on groundwater data. Therefore, soil gas data should be collected and used for further evaluation of the pathway for this property.

These comments should be addressed in a CSR Addendum, which may be submitted in lieu of the next progress report. The next progress report is due by October 4, 2016. Please direct questions regarding this matter to Bill Williams of the Response and Remediation Program at 404-657-7126.

Sincerely,

David Hayes
Unit Coordinator
Response and Remediation Program

c: Charles T. Ferry, AMEC Foster Wheeler (via email)
Dwight Feemster, Duffy & Feemster, LLC (via email)

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