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July 9, 2012

Mr. James S.H. Sher, P.E.
Texas Commission on Environmental Quality
Mail Code MC-177
P.O. Box 13087
Austin, TX 78711-3087

Re: Texas Custodial Trust
Former ASARCO Smelter Site, El Paso, Texas

Subject: Response to EPA Comments on Category 1 Landfill, Cell 4,
Former ASARCO Smelter Site, Design Remediation

Dear Mr. Sher:

On behalf of the Texas Custodial Trust (TCT), Malcolm Pirnie, Inc. (MP) submits this package in response to the United States Environmental Protection Agency (USEPA) comments dated February 21, 2012. As requested in your email dated March 22, 2012, we have responded to comments on the lining system. We will address comments on the cover system at a later date. We have had two internationally-recognized members of our team, Dr. Scott Potter, PhD., P.E. and Dr. Rudy Bonaparte, PhD., P.E. review and sign-off on this submittal. Their resumes are included for your review.

The content of this submittal is the following:

- Response to Technical Review Comments from USEPA, Region 6, February/March 2012
- Attachment A – Updated Drawings – Design Drawings – Category 1 Landfill – Cell 4
- Attachment B – Evaluation of Potential Leakage through Category 1 Landfill, Cell 4 Lining System
- Attachment C – Resumes of Dr. Scott Potter, PhD., P.E. and Dr. Rudy Bonaparte, PhD., P.E.

We hope this submittal is responsive to your request. Please call me at 602-659-3253 if you have any questions or need additional information.

Very truly yours,

MALCOLM PIRNIE, INC.

Scott M. Brown, P.E.
Vice President

cc: Roberto Puga (Project Navigator)
Dr. Beth Gross, PhD., P.E. (Geosyntec)
Dr. Rudy Bonaparte, PhD., P.E. (Geosyntec)
Dr. Scott Potter, PhD., P.E.
Seth Matters
Alicia Fogg
Gaston Leone

Attachments:
Response to Technical Review Comments
Attachment A – Updated Drawings – Design Drawings – Category 1 Landfill – Cell 4
Attachment B – Evaluation of Potential Leakage through Category 1 Landfill, Cell 4 Lining System
Attachment C – Resumes of Dr. Scott Potter, PhD., P.E. and Dr. Rudy Bonaparte, PhD., P.E.

FORMER ASARCO EL PASO SMELTER SITE
CATEGORY 1 LANDFILL - CELL 4
RESPONSES TO TECHNICAL REVIEW COMMENTS FROM US EPA, REGION 6
February/March 2012

Comment:

1. Drainage – Hydraulics - Landfill Slope Toe Perimeter Channels (1/3) Sheet 5 of 15

(A) Please provide the equation(s) and sizing calculations used for the Landfill Toe Perimeter Channel that will collect storm water run-off from the Landfill.

(B) Provide Calculations of the velocities in each branch of the perimeter channel.

(C) Provide Calculations of the Landfill storm-water flow velocity and the discharge rate (Q, cfs) of storm water flowing down the chute Channel. Provide the hydraulic grade line of the 100 year frequency return storm.

(D) Size and provide in the landfill cover drainage drawing(s) in part (E) below, the Energy dissipation structure needed in the apron at the end of the chute. Show calculations and equations used.

(E) In Fig H/15 please provide properly sized permanent energy dissipaters where the flow precedes the hydraulic jump at the chute channel apron, at the toe of the slope.

(F) Provide the storm water sheet flow runoff flow rate (Q) on the slope above the terrace channel that captures it. Show the calculations of the sizing of the terrace channel based on that, Q.

(G) Show calculations of the Chute Channel design and the discharge flow rate in the chute channel. Draw and label the hydraulic grade line in the chute profile.

(H) Calculate the sum Landfill of the storm water discharge flow (Q) into the Landfill perimeter channel, at the toe of the landfill; and ($\sum Q_i$) that then discharges into the Arroyo.

(I) Provide the hydraulic freeboard in the Arroyo and hydraulic grade line for the 100 year return rainfall event.

(J) What is the design storm event for which the Arroyo channel and the Landfill Perimeter drainage channels are sized, respectively?

Response:

(Comments A through J):
TCEQ has asked that the grading of the final cover system be revised to a 3:1 slope with two interceptor terraces/ditches to decrease drainage path lengths. A design package for this modification will be submitted under separate cover. The design package will include the following:

- *A calculation package presenting the hydrology and hydraulic evaluations for the final cover system*
- *A revised soil loss calculation package*
- *A calculation package demonstrating the performance of the proposed evapotranspirative cover*
- *Revised Design Drawings Nos. 9 to 13 and, possibly, 14 and 15 depending on the design modifications made to the surface-water management system for Cell 4*

Comment

2. Liner Design

(a) Liner Integrity & Performance

1. Provide the geosynthetic liner performance capacity against low pH leachate fluids leak discharge that may seep through the geomembrane HDPE induced construction failure defects.

Response

(a) Liner Integrity & Performance

1. As described in the Final Remedial Action Work Plan (Malcolm-Pirnie, Inc., 2011), the wastes proposed for disposal in Cell 4 consist primarily of soils or solids from the smelter process. Most of these materials are inert; however, up to 10 percent of the wastes may be wood, a degradable material. The chemicals of concern identified in the Remedial Investigations conducted at the site consist of metals (arsenic, cadmium, chromium, copper, iron, lead, selenium, and zinc). If precipitation contacts the wastes in Cell 4 during operations, leachate can be generated. Based on the characteristics of the proposed waste, the generated leachate is expected to contain dissolved metals, but is not expected to have a very low pH. Shallow groundwater at the site serves as an analog for leachate chemistry. Based on the site groundwater data, (e.g., Site Groundwater Data, TCEQ, accessed May 2012. Groundwater Data, on Document Download Page for ASARCO, El Paso, Texas. http://www.tceq.texas.gov/remediation/sites/asarco/downloads) groundwater pH is in the range of 4 to 9, with values closer to neutral being more common. GCLs can accommodate a wide pH range without adverse effect. Jo et al. (2001) evaluated the effect of leachate pH on the hydraulic conductivity of nonprehydrated GCLs. They found no significant change in the hydraulic conductivity of GCLs permeated with leachate (HCl or NaOH solutions) having a pH in the range of 3 to 12. Since a very low (<3) or very high (>12) pH of leachate is not anticipated at Cell 4, it is concluded that the pH of leachate will have minimal or negligible effect on the hydraulic conductivity of the GCL.

Comment

2. Provide the CEC of bentonite and the Sub Grade geo-media and from the Langmuir or Freundlich isotherms, calculate the Retardation factor (R) for; Copper, Arsenic, Chromium, Copper and Zinc chemicals of concern that would be present as dissolved constituents in the leachate; and; calculate what concentrations, of each the four Chemicals, would reach impact the shallow ground water table.

Response

2. Based on the results of the subsurface flow hydraulic analysis presented in the response to Comment 4, leachate from the landfill is not expected to reach the shallow groundwater during the operational life and 50-year post-closure period. Retardation of dissolved metals in the leachate was conservatively neglected in the analysis. To be responsive to EPA's request, the cation exchange capacity (CEC) of bentonite is generally in the range from 60 to 90 milliequivalents/100g (Rollins, 1969; Egloffstein, 2001).

Comment

(b) Landfill Cover slope has been designed on a 3H:1V slope. Given the design of the landfill cover and proposed landfill height, this slope appears to be steeper than the normal landfill cover slopes design of 4H:1V. Please consider reducing the slope.

Response

(b) Please see the Response to Comment 1.

Comment

(c) The landfill bottom and sidewall liner design, consisting of the geosynthetic layer and a geomembrane HDPE liner, is a weak design for preventing dissolved hazardous waste solutes in the leachate that may leak across a defective HDPE geomembrane. The leachate migration across the geosynthetic layer would be quicker and might quickly reach the groundwater table. Please provide justification for this alternate liner design.

Response

(c) The proposed liner for Cell 4 is a composite consisting of, from top to bottom, a textured 60-mil thick high density polyethylene (HDPE) geomembrane, GCL, and 6-in. thick prepared subgrade layer. This composite liner provides a highly effective barrier design. Geomembranes are essentially impervious to advective flow of leachate when they are intact. Construction quality assurance procedures will be implemented throughout liner construction to minimize the potential for geomembrane defects. If there is a defect in the geomembrane and the defect is subjected to a sustained leachate head, the leachate would cause the GCL to hydrate at the location of the defect, causing the GCL to swell and "plug" the defect, thereby reducing leakage into the GCL. The very good performance of geomembrane/GCL composite liners in operating landfills was clearly demonstrated in the published EPA report "Assessment and Recommendations for Improving the Performance of Waste Containment Systems", EPA/600/R-02/099, December 2002.

In the arid climate of the site, little or no leachate production is expected from rainfall onto liner areas that have been covered with some waste. If leachate is generated, it will flow to the leachate collection sump and be removed. Most of the time there will be no minimum sustained hydraulic head of leachate in most parts of the cell during the short time (i.e., several years) while the cell is operational. After cell closure hydraulic heads are expected to be negligible. A conservative subsurface flow hydraulic analysis is presented in the response to Comment 4 (see below). The results show that even assuming that sustained leachate generation occurs in the landfill (unlikely due to dry climate), this "hypothetical sustained leachate source" is not predicted to reach groundwater during the operational life and a 50-year post-closure period of the landfill.

It is noted that although the geomembrane/GCL composite liner proposed for Cell 4 may be considered an alternative liner in comparison to the standard geomembrane/compacted clay composite liner used for Resource Conservation and Recovery Act (RCRA) Subtitle C landfills are some Subtitle D landfills, it is the same as the composite liner used for the other Category 1 landfill cells (i.e., Cells 1 to 3) at the site.

Additional Comment

d. Provide design drawing(s) for the landfill cover to show that the Landfill Cover will be constructed with a Composite liner the same as that to be constructed on the landfill bottom and side slopes. It must include the 60 mil geomembrane HDPE plastic liner.

Response

(d) Please see the Response to Comment 1.

Comment

3. Leachate Collection & Disposal

(a) Provide the leachate pipe support structure to be constructed on the ground where the Leachate collection pipe will exit the landfill side slope and terminate in the air. Also show the details of how it will be equipped to couple to the collection vehicle, or any piping manifold to allow it to discharge the leachate to the treatment facility/system.

Response

(a) *A revised Design Drawing No. 8 showing a concrete headwall support structure for the leachate collection pipe, a flange at the end of the pipe and a discharge line with a quick connect fitting extending through the flange is provided as Attachment A.*

Comment

(b) Provide diameters of perforation openings in the leachate collection pipes and provide methods for clogging control. Please provide a statement describing the method that will be used to clean the pipes when they clog from leachate drainage fluids and solids/bacterial colonies, as is expected they will.

Response

(b) The leachate collection pipe in Cell 4 consists of an 18-in. diameter HDPE SDR 32.5 riser pipe that is solid on the landfill side slope and perforated in the sump on the landfill floor (Section D on Drawings 7 of 15). A detail of the 3/8-in. diameter pipe perforations is provided as Detail 9 on Design Drawing No. 8 of 15. These drawings are provided in Attachment A. The pipe will be monitored and cleaned (e.g., by swabbing or jetting) if clogging is observed.

Comment

(c) Provide Soil Loss Rate Analysis from the Landfill side slopes final cover and compute soil loss rate using approved methods such as RUSLE/MUSLE etc. Show how soil loss will be controlled and minimized.

Response

(c) Please see the Response to Comment 1.

Additional Comment

d. Provide the RUSLE Equation as used in calculating the Soil Loss (A) and specify each parameter numerical values used in the RUSLE Equation below, or whichever revised version is used by the Consultant:

A = R*K*L*S*C*P
A = Tons/acre. Year) of Soil lost from each area (a_i) of the slope under analysis.

Response

(d) Please see the Response to Comment 1.

Comment

4. Ground Water Protection

1. Provide subsurface flow hydraulic analysis in the Vadose Zone below the Sub grade and above the groundwater table.

Response

1. A vadose zone flow and transport model was developed to assess the migration of landfill leachate through potential defects in the liner system under the conservative assumption that there is a sustained head of leachate acting above a defect in the geomembrane component of the composite liner. Due to the arid climate of the project site, a sustained leachate head is not predicted. The results of this modeling effort indicate that any potential leachate migrating through the vadose zone will not reach the water table (see Attachment B).

Additional Comment

Will this analysis include the potential impacts from the permeable barriers? It should.

Response

The modeling results indicate that no impact to groundwater will occur, thus the permeable reactive barriers (PRBs) do not need to be considered as part of this analysis. However, an additional level of protectiveness is provided by PRB-2 since it is downgradient of the landfill sump.

Comment

2. Using the appropriate flow transport equations show the rate of movement of any leachate leaking out of the landfill liner and how long it might take to reach the ground water table immediately below the geosynthetic bentonite clay liner layer and to the point of exposure located hydraulically down gradient of the landfill cell.

Response

2. As described in the previous response, the modeling presented in Attachment B indicates that even under very conservative analysis assumptions, groundwater will not be impacted by potential leachate migrating through the landfill liner.

Additional Comments by EPA for TCEQ to Consider

1. POST CLOSURE CARE OF THE LANDFILL(s) for perpetuity?
   Please state how the Trustee plans to conduct and transfer responsibility for Post Closure care of this Landfill for perpetuity?

2. Please discuss what will happen to the Landfill structure if and when the site experiences a rainfall storm event of a frequency greater that the 100 year occurrence frequency 24-hr event. Who will perform and what actions will be taken to repair the landfill, address any washout areas/damages to the landfill, collect

environmental samples for laboratory analysis and potentially perform any remedial actions resulting from pollution entering the IBWC and/or Rio Grande River?

3. Storm water sampling locations need to be established to document that the storm water runoff from the cover is not contaminated and entering the IBWC and/or Rio Grande River.

Response

These comments are included for completeness and will be addressed with the cover design update submittal addressed in our response to original Comment 1.

References:

Bonaparte, R., Koerner, R.M., and Daniel, D.E. (2002). "*Assessment and Recommendations for Improving the Performance of Waste Containment Systems*," research report published by the U.S. Environmental Protection Agency, National Risk Management Research Laboratory, EPA/600/R-02/099, December.

Egloffstein, T.A. (2001). "Technical Note – Natural Bentonites-Influence of the Ion Exchange and Partial Desiccation on Permeability and Self-Healing Capacity of Bentonites Used in GCLs, "Geotextiles and Geomembranes, Vol 19, pp. 427-444.

Jo, Y.H., Katsumi, T., Benson, C.H., and Edil, T.B. (2001). "Hydraulic Conductivity and Swelling of Nonprehydrated GCLs Permeated with Single-Species Salt Solutions," *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 127, No. 7, pp. 557-567.

Malcolm-Pirnie, Inc. (2011). "Final Remedial Design Work Plan, Former ASARCO Smelter, El Paso, Texas," April.

Rollins, M.B. (1969). "Sealing Properties of Bentonite," *Clays and Clay Minerals*, Vol. 16, pp. 415-423.