AP - 001

STAGE 1 & 2 REPORTS

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December 20, 1996

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Environmental Bureau
Oil Conservation Division

Mr. William Olsen
New Mexico Oil Conservation Division
2040 S. Pacheco
Santa Fe, NM 87505

RE: FINAL SITE INVESTIGATION REPORT FOR THE BRICKLAND REFINERY SITE

Dear Bill:

Submitted herein are two copies of the Final Site Investigation Report for the Brickland Refinery Site, Sunland Park, New Mexico. The final report incorporates Rexene's response to New Mexico Oil Conservation Division (NMOCD) comments in your letter dated August 21, 1996.

NMOCD Comment No. 1. Section 3.2.1, Page 10

This section references Appendix E as containing the soil metals study conducted by the El Paso City-County Health Department and the Texas Air Control Board. However, Appendix E actually contains the International Boundary Water Commission Report.

Response to NMOCD Comment No. 1

The correct report, which presents studies conducted by the El Paso City-County Health Department and the Texas Air Control Board, has been inserted into Appendix E. The incorrect report has been removed.

NMOCD Comment No. 2. Section 3.2.2, Area B, Page 12

The elevated concentration of silver and mercury in Area B soil samples needs to be included in the discussion.

Response to NMOCD Comment No. 2

The following text has been inserted at the end of the first partial sentence on page 13: "Mercury was 0.41 mg/kg in B-HA-4. B-HA-1, -2, and -4 contained 1.4, 1.8, and 4.9 mg/kg silver, respectively; B-HA-3 contained 177.0 mg/kg silver."

NMOCD Comment No. 3. Section 3.2.2, Area C, Page 13

The elevated concentrations of cadmium and silver in Area C soil samples needs to be included in the discussion.

Response to NMOCD Comment No. 3

The following text has been inserted at the end of the last paragraph of the Area C discussion on page 13: "Silver occurs in C-TP-8 at 2.9 mg/kg. Cadmium was identified at concentrations 16.5 and 19.0 mg/kg in C-TP-5 and C-TP-7, respectively. All other test pits contained cadmium near or below background levels."

NMOCD Comment No. 4. Section 3.2.2, Area D, Page 14

The elevated concentration of lead in Area D soil samples needs to be included in the discussion.

Response to NMOCD Comment No. 4

The following text has been inserted as a new paragraph preceding the last paragraph of the Area D discussion on pages 14 and 15: "Lead was identified in GCL trench TR-02 at a concentration of 55 mg/kg and in boring B-04 at concentrations of 46.0 and 9.0 mg/kg at depths of 2 to 4 and 6 to 8 feet, respectively. Eder soil sampling detected lead in borings B-1 through B-16 at concentrations ranging from 5.9 to 1,500 mg/kg."

NMOCD Comment No. 5. Section 3.2.2, Area E, Page 15

a. The elevated concentration of mercury in Area E soil samples needs to be included in the discussion.

b. The bottom paragraph on the page has a soil concentration of 139 mg/kg lead listed for boring E-TP-26. This appears to be a typographical error. Table 8c lists the concentration as 139,000 mg/kg.

c. What is the significance of comparing the soil lead concentration in boring E-TP-29 with that from trench TR-01? These sample locations are approximately 250 feet apart and therefore would not confirm that TR-01 samples represent accurate sample concentrations at E-TP-29's location.

Response to NMOCD Comment No. 5

a. The following text has been inserted as a new paragraph after the last paragraph of the Area E discussion on page 15: "Soil sampling by Eder detected mercury at concentrations of 0.15, 0.16, and 0.76 mg/kg in test pits E-TP-25, -26 and -27, respectively. Soil sampled from GCL trench TR-01 contained 0.14 mg/kg at a depth of 0 to 2 feet, while the 2 to 4 foot sample was below the detection limit."

b. "139 mg/kg" has been changed to "139,000 mg/kg"

c. The last sentence of the last paragraph of the Area E discussion on page 15 has been revised to: "Lead concentrations from samples obtained by GCL from TR-01 at zero to two feet (53.0 mg/kg)

and two to four feet (9-10 mg/kg) were low and are comparable to Eder results obtained from E-TP-29 (88.4 mg/kg), located in the southeast corner of Area E (Figure 11a)."

NMOCD Comment No. 6. Section 3.2.2, Area F, Page 16

The elevated concentrations of mercury, chromium, cadmium, and silver in Area F soil samples need to be included in the discussion.

Response to NMOCD Comment No. 6

The following text was proposed and rejected for insertion as a new paragraph following the last paragraph of the Area F discussion on page 16: "Limited sampling for other metals also detected concentrations of mercury, cadmium, chromium, and silver between background concentration and approximately one order of magnitude above background concentrations." Based on Bill Olsen's additional comments this paragraph will now read: "Mercury was identified in Eder test pits ranging in concentration from 0.03 to 2.8 mg/kg while samples from GCL trenches were non-detect. Eder surface samples for mercury ranged from 0.1 to 10 mg/kg. Chromium was identified in Eder test pits ranging in concentration from 4.7 to 47.2 mg/kg and one GCL trench, TR-3, contained 8 mg/kg. Eder surface samples ranged in concentration from 8 to 28 mg/kg chromium. Cadmium was identified in Eder test pits ranging in concentration from 0.85 to 25.4 mg/kg and one TCLP sample from GCL boring B-06 was 0.12 mg/L. Silver was found in Eder test pits in concentrations ranging from 0.45 to 8.1 mg/kg while samples from GCL borings and trenches were non-detect."

NMOCD Comment No. 7. Section 3.2.2, Area G, Page 17

The elevated concentrations of mercury, chromium, cadmium, and silver in Area F soil samples need to be included in the discussion.

Response to NMOCD Comment No. 7

The following text has been inserted as a new paragraph following the last paragraph of the Area G discussion on page 17: "Other limited sampling detected concentrations of mercury, chromium, cadmium and silver. Eder sampling detected a mercury concentration of 0.06 mg/kg in test pit G-TP-77 and concentrations of 0.03, 0.15, and 0.09 in surface samples G-SS-7, -8, and -9, respectively. GCL borings contained no detectable mercury but trench TR-04 contained 0.14 and 0.19 mg/kg at depths of 0 to 2 and 2 to 4 feet, respectively. Eder test pit and surface samples contained chromium at concentrations ranging from 7.0 to 97.0 mg/kg. All GCL boring and trench samples were within background levels or nondetect for chromium and silver. One Eder sample from test pit G-TP-77 contained 2.5 mg/kg silver. Two samples collected from Eder test pits G-TP-66 and G-TP-75 contained cadmium above background levels, at 36.7 and 24.1 mg/kg, respectively. Cadmium was also found in GCL trench TR-4 at a concentration of 0.6 mg/kg."

NMOCD Comment No. 8. Section 3.2.3, Pages 18-22 and Figure 11b

There appears to be some typographical errors on Figure 11b. Some of the comparative sampling results are reversed in the figure. Some Eder sample results are depicted as GCL sample results and some GCL samples results are depicted as Eder sample results. This figure needs to be corrected.

Response to NMOCD Comment No. 8

The reversed sampling results have been corrected. Figure 11b now presents correct results for GCL and Eder samples as explained in the legend

NMOCD Comment No. 9. Section 3.2.3, Page 18

a. The analytical data sheets and associated quality assurance/quality control data for the April 1996 soil sampling is not included in the report. Since the information has not been previously supplied to the OCD, this data needs to be included in the report.

b. The text states that the soil sampling comparative studies include a discussion of Area D and boring B-1. While Figure 11b shows comparative sample results for boring B-1, there is not discussion of the results in the text.

Response to NMOCD Comment No. 9

a. The following sentence has been inserted before the last sentence of the second paragraph: "Laboratory reports and quality assurance/quality control reports are included as an attachment to this report."

b. The following text has been added at the end of the Area B and before the Area E discussions:

"Area D

- Location: B-1
- Type of sample: shallow subsurface soil
- Sample depth: approximately 24 inches
- Sample method: hand auger
- Soil description: black to gray soil with hydrocarbon odor

Eder detected 44.4 and 169.0 mg/kg cadmium and arsenic while GCL samples were nondetect and 11.0 mg/kg, respectively.

Eder detected 951.0 mg/kg copper and 887.0 mg/kg zinc; GCL did not analyze for these metals.

Eder detected 1,500 mg/kg lead while the GCL sample contained 154 mg/kg."

NMOCD Comment No. 10. Section 3.2.3, Page 20 and Figure 11b

a. The data for the E-SS-4 samples could not be found in the Eder data tables nor elsewhere in the report.

b. There appears to be a typographical error in the sample location on Figure 11b. Sample location F-SS-4 should be E-SS-4.

Response to NMOCD Comment No. 10

a. The missing data has been added to Table 8c.

b. The sample location indicator F-SS-4 on Figure 11b has been changed to E-SS-4.

NMOCD Comment No. 11. Section 3.2.3, Page 21 and Figure 11b

The data for the F-SS-6 samples could not be found in the Eder data tables nor elsewhere in the report. In addition, the E-SS-5 sample location on Figure 11b shows a sample result that is not included as data elsewhere in the report.

Response to NMOCD Comment No. 11

The missing data has been added to Table 9c.

NMOCD Comment No. 12. Section 3.3.2, Page 24

a. This section needs to contain the quarterly total benzene, toluene, ethylbenzene, and xylene (BTEX) maps showing their distribution in groundwater. These maps were to be submitted in quarterly reports as required in OCD's April 14, 1995 approval of the monitoring program. Since the OCD has no record of receiving these maps in the quarterly reports, they will need to be included in this report.

b. The text references GCL surface water and river sediment samples, but it was not clear where these samples were taken. The sample locations should be depicted on the site maps.

c. The analytical data sheets and associated quality assurance/quality control data for the surface water and river sediment sampling is not included in the report. Since the information has not been previously supplied to the OCD, this data needs to be included in the report.

Response to NMOCD Comment No. 12

a. Maps showing benzene in groundwater were submitted for the four most recent quarterly sampling events. Similar maps showing toluene, ethylbenzene and xylenes <u>were not</u> created because there

were no exceedances of WQCC standards for these compounds in any monitor wells in the quarterly sampling events. Table 13 presents quarterly BTEX analytical results.

b. The location of the surface water and river sediment samples has been added to Figure 4.

c. The analytical data sheets and associated quality assurance/quality control data for the surface water and river sediment samples have been added to the report as an attachment. The actual reports are separately attached from the document because the volume precludes inclusion.

NMOCD Comment No. 13. Section 3.3.3, Page 25

a. This section needs to contain the quarterly total polycyclic aromatic hydrocarbon (PAH) maps showing their distribution in groundwater. These maps were to be submitted in quarterly reports as required in OCD's April 14, 1995 approval of the monitoring program. Since the OCD has no record of receiving these maps in the quarterly reports, they will need to be included in this report.

b. The first sentence of the PAH section references Appendix F. This appears to be a typographical error. It should reference Appendix G.

c. PAHs have been detected in prior off-site sampling, therefore the text should not categorically state that off-site migration of these constituents has not occurred. In addition, the OCD's June 21, 1996 sampling of surface water adjacent to MW-6 (sample results and sample location map enclosed) shows low-level PAHs appear to be entering the river at this location.

d. There is no reference to surface water quality sampling for PAHs that was required in OCD's April 14, 1995 approval of the monitoring program. Since the OCD has no record of receiving this information, the analytical data sheets and associated quality assurance/quality control data for these samples needs to be included in the report.

Response to NMOCD Comment No. 13

a. Quarterly PAH maps that correspond to the existing quarterly benzene maps have been added to the report as Figures 15b, 15c, and 15d. Figure 15 has been renumbered to Figure 15a.

b. The reference to Appendix F has been changed to Appendix G.

c. The fifth sentence of the second paragraph of Section 3.3.3 on page 25 has been deleted: "Therefore, off-site migration of these heavier molecular weight compounds does not appear to have occurred."

d. PAHs were not included as analytes for the surface water sampling, but will be included in future sampling on an annual basis.

NMOCD Comment No. 14. Section 3.3.3, Page 27

The sample results show metals concentrations in groundwater have been detected in excess of New Mexico Water Quality Control Commission (WQCC) standards in petroleum-contaminated monitoring wells both on site and off site. At times when WQCC standards have not been exceeded, metals are fairly regularly found in the petroleum-contaminated wells at elevated levels. In addition, GCL's TCLP soil sampling demonstrated that leachable amounts of lead were present in soils in one area, well in excess of state standards and at a level that would classify them as a hazardous waste. Therefore, the summary needs to discuss these trends and should not categorically state that metals do not pose a threat to groundwater and are tightly bound within site soils.

Response to NMOCD Comment No. 14

The last sentence on page 26 and the first sentence on page 27 have been deleted and the following text inserted in place: "Elevated concentrations of selected metals occur in all monitor wells at various times. Of those elevated metals, cadmium and selenium do not appear to correlate with petroleum hydrocarbons in groundwater. One elevated mercury occurrence in MW-14 in December 1994 may or may not be anomalous. Elevated concentrations of barium, iron, manganese, and arsenic may correlate with monitor wells that contain petroleum hydrocarbons. However, there are also elevated background concentrations of those two metals in the soil which may also account for their common occurrence at the site."

NMOCD Comment No. 15. Section 3.4.6, Pages 27-31 and Appendix K

The text in this section accurately reflects that the slug test early time data represents the hydraulic conductivity (K) of the gravel pack and not the aquifer formation materials. However, approximately half of the slug tests in Appendix K still use early time data to calculate the K of the formation. These slug tests need to be recalculated for the correct aquifer K using the late time data.

Response to NMOCD Comment No. 15

Page 28, second paragraph under 3.4.3: Please note MW-10 should be included in the first sentence, which states what wells were tested (a total of 10). Also, a typographic error in the second sentence states that MW-9D was tested, when in fact MW-10 was tested. MW-10 is completed in very fine sand and clay. The reference to "MW-9D" has been changed to "MW-10".

Page 29, section 3.4.5: The procedures described are for falling head tests. Note that GCL also performed rising head tests, as discussed in subsequent sections of the report.

Page 30, third full paragraph. The second sentence states "For the former materials..." when it should state "For the latter materials...". The text has been changed accordingly.

Regarding use of early- or late-time data for determination of conductivity:

The rationale for using early- or late-time data is stated in the third and fourth paragraphs on page 30; however, because of the typographic error described above ("former" instead of "latter") some confusion

may have been created. To restate the point in question, it is common for wells completed across the water table in fine-grained, low-permeability materials to show two distinct responses during slug tests: an early-time steep curve, and a later-time shallow curve. The early-time steep curve is due to water draining from the sand-pack, which has a higher permeability than the surrounding formation. The later-time curve is due to the actual formation response. This phenomenon was called the "double straight line effect" by Bouwer in his 1989 paper titled "The Bouwer and Rice Slug Test -- An Update" (Groundwater, Vol. 27, No. 3, pages 306 and 307).

Examining the plots in Appendix K ("Slug Test Results") of GCL's May 15, 1996 report, the curves selected for determination of conductivity (K) are unique in wells MW-6S, MW-6D, MW-3S, MW-3D, MW-9S (rising head), and MW-10. These wells are generally completed in sandy and gravely materials, which explains why no "double straight line effect" is observed.

The following text has been inserted between the fourth and fifth paragraphs on page 30: "The curves selected for wells MW-1, MW-3D, MW-3S, MW-6D, MW-6S, MW-9S, and MW-10 are for early-time data, and are steep curves which give relatively high values of conductivity. The use of early-time data is appropriate because wells MW-6D and MW-9S are completed in relatively coarse material; however, well MW-1 was completed in relatively fine material, so a better choice would have been late-time data. However, use of early-time data for well MW-1 is a conservative choice, since it results in higher values of K and since using higher K values in the model overestimates groundwater flux into the Rio Grande, and hence overestimates contaminant input.

The curves selected for wells MW-5, MW-8, and MW-11 are for late-time data, and are shallow curves which give relatively low values of conductivity (0.14, 0.12, and 0.5 feet per day, which are the lowest values reported). These wells are also completed in some of the finest formations encountered (silty clay to very fine sand, silty clay, and silty clay, respectively). Note, these wells are completed across the water table in fine-grained formations. The response of the slug tests in these wells represents the "double straight line effect" of Bouwer, so the later-time data in these wells (which yields lower K values) is the correct choice.

In summary, the early versus late curves selected for all wells were appropriate based on the grain sizes and relative slug test response, with the exception of MW-1 for which late-time data may have been more appropriate. However, the result of using the later-time curve for MW-1 would be to decrease the value of K used in the model, which would not be a conservative option since it would result in less loading of chemicals into the Rio Grande.

NMOCD Comment No. 16. Section 3.5, Pages 31-37 and Appendix K

The transport modeling calculations will need to be redone after the proper K values have been recalculated as discussed in comment 15 above. ✓

Response to NMOCD Comment No. 16

Based on the response to NMOCD Comment No. 15, the model does not need to be rerun.

NMOCD Comment No. 17. Section 3.6, Page 37

The text references Figure 18. However, no Figure 18 could be found in the report.

Response to NMOCD Comment No. 17

The last sentence of the third paragraph of Section 3.6 on page 37 has been deleted and the reference to Figure 18 eliminated.

NMOCD Comment No. 18. Table 8a, Figure 4, and Figure 10

The benzene soil sample results for E-TP-4-2, E-TP-5-2, E-TP-6-2, and E-TP-8-2 are not plotted on Figure 10 nor could their sample locations be found on the Figure 4 site map.

Response to NMOCD Comment No. 18

The results for the sample locations cited in NMOCD Comment No. 18 are not shown on Figures 4 and 10 because they are resamples that correspond to existing test pits as follows:

E-TP-4-2 corresponds to E-TP-12
E-TP-5-2 corresponds to E-TP-17
E-TP-6-2 corresponds to E-TP-20
E-TP-8-2 corresponds to E-TP-32

An insert has been added to Figures 4 and 10 that explains the duplicate sampling locations.

NMOCD Comment No. 19. Table 9a, Figure 4, and Figure 10

The benzene soil sample results for F-TP-9-2, T-TP-10-2, and F-TP-91 are not plotted on Figure 10 nor could their sample locations be found on the Figure 4 site map.

Response to NMOCD Comment No. 19

The results for the sample locations cited in NMOCD Comment No. 19 are not shown on Figures 4 and 10 because they are resamples that correspond to existing test pits as follows:

F-TP-9-2 corresponds to F-TP-34
F-TP-10-2 corresponds to F-TP-61

An insert has been added to Figures 4 and 10 that explains the duplicate sampling locations. F-TP-91 is shown on Figures on 4 and 10 and is located along the southwestern property boundary.

NMOCD Comment No. 20. Table 10a, Figure 4, and Figure 10

The benzene soil sample results for G-TP-11-2, G-TP-12-2, G-TP-13-2, G-TP-14-2, G-TP-15-2, and G-TP-16-2 are not plotted on Figure 10 nor could their sample locations be found on the Figure 4 site map.

Response to NMOCD Comment No. 20

The results for the sample locations cited in NMOCD Comment No. 18 are not shown on Figures 4 and 10 because they are resamples that correspond to existing test pits as follows:

G-TP-11-2 corresponds to G-TP-68
G-TP-12-2 corresponds to G-TP-73
G-TP-13-2 corresponds to G-TP-76
G-TP-14-2 corresponds to G-TP-80
G-TP-15-2 corresponds to G-TP-82
G-TP-16-2 corresponds to G-TP-77

An insert has been added to Figures 4 and 10 that explains the duplicate sampling locations.

NMOCD Comment No. 21. Table 13

In order to make comparisons with WQCC standards, this table needs to contain a breakdown of the individual BTEX components for each sampling event.

Response to NMOCD Comment No. 21

Table 13 presents individual BTEX and TPH analytical results compared to WQCC standards for each sampling event.

NMOCD Comment No. 22. Figure 12

The PAH data from Eder reports needs to be included in this figure.

Response to NMOCD Comment No. 22

The Eder PAH data has been included in Figure 12.

NMOCD Comment No. 23. Figure 14a, Figure 14b, Figure 14c, and Figure 14d

When compared with the free-phase hydrocarbon map (Figure 13), the contour lines drawn for these figures are misleading. The benzene maps show known free-phase product areas as having non-detectable concentrations of benzene. These maps need to be re-evaluated.

Response to NMOCD Comment No. 23

Figures 14a through 14d have been revised to assume that benzene is present in groundwater where floating product occurs.

NMOCD Comment No. 24. Appendix B

As stated in the OCD's February 13, 1996 correspondence, the monitor well logs need to include monitor well construction details, or the construction details need to be included as an attachment.

Response to NMOCD Comment No. 24

Well completion details have been incorporated into Appendix B and C include specifications for both Eder and GCL monitor wells.

Executive Summary

The following text was added to the third paragraph on page 1, "Metals are found locally and lead is the primary metal of concern. One soil sample contained lead in leachable concentrations, however, no lead has ever been detected in any of the on- or off-site monitoring wells."

Conclusions

The conclusions to the report have been modified to reflect other changes made in the report. Those changes follow.

Page 39, Third Bullet

- Soil samples collected at the site were analyzed for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Measured concentrations of arsenic, barium, chromium, and lead are above background ranges. However, TCLP testing and groundwater monitoring data demonstrate these elements have limited leaching potential and are highly unlikely to migrate to groundwater.

The last sentence of this bullet now reads, "However, TCLP testing and groundwater monitoring data demonstrate only one TCLP analysis resulted in an exceedance and the remainder of these elements have limited leaching potential."

Page 40, First Bullet Under Groundwater

- Hydrocarbons have been observed off site only in MW-6S. However, the absence of hydrocarbon constituents in all other off-site wells and river samples, with the exception of a single sample of total xylenes at the detection limit, indicate on-site hydrocarbon compound migration is attenuated on site by the interbedded silty/clayey sediments, the relatively flat, shallow water table, and/or

natural biodegradation/dispersion. The minor amount of hydrocarbon migration that occurs is attenuated by biodegradation and dispersion.

This bullet now reads:

- Hydrocarbons exceeding WQCC standards have been observed off site only in MW-6S. However, the absence of hydrocarbon constituents in all other off-site wells, with the exception of sporadic occurrences of BTEX below WQCC standards and a single sample of total xylenes at the detection limit in a river sample, indicate on-site hydrocarbon compound migration is attenuated on site by the interbedded silty/clayey sediments, the relatively flat, shallow water table, and/or natural biodegradation/dispersion. The minor amount of hydrocarbon migration that occurs is attenuated by biodegradation and dispersion.

Page 40, Third Bullet Under Groundwater

- Free-phase hydrocarbon has been observed in monitoring well MW-10 and several well points in the immediate vicinity. The recent investigation determined that this free-phase hydrocarbon occurs locally in discontinuous pockets associated with thin, discontinuous, sand lenses. No free-phase hydrocarbons have been observed in off-site wells.

The text ",MW-11," was added to the first sentence.

Page 41, First Bullet on Page

- PAHs and phenols have been detected in the shallow aquifer at the site. None have been detected in off-site monitoring wells since the quarterly sampling program was initiated in December 1993.

This bullet now reads:

- PAHs and phenols have been detected in the shallow aquifer at the site. None have been detected above regulatory standards in off-site monitoring wells since the quarterly sampling program was initiated in December 1993 and only one sample detected PAHs below regulatory standards.

Additional bullets were added at the end of Section 4.0, these are:

- Lead has not been detected in any on- or off-site monitor wells.

- Other metals have been detected sporadically in monitor wells. Arsenic, barium, iron, and manganese may correlate to metals found in site soils.

When these changes are approved and finalized, I will publish the final report and submit it to the NMOCD.

Sincerely,
Geoscience Consultants, Ltd. (GCL)

Michael W. Selke, RG
Senior Program Manager

JMC:MWS/3031/RESPONSE2.LTR

cc: Todd Carver, Rexene
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