

APPENDIX A
AGENCY COMMENTS



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

October 30, 2006

Mr. George Landreth
Shell Oil Company, OSP 1770B
P.O. Box 2463
Houston, TX 77252-2463

Re: Remedial Investigation Report, Administrative Order on Consent, Docket No. 92-13, Del Amo Superfund Site

Dear George:

EPA has reviewed the document entitled "*Draft Final Remedial Investigation Report, Soil and NAPL Operable Unit, Del Amo Superfund Site, Los Angeles, California*," dated July 28, 2006. This document constitutes the draft final Remedial Investigation report, required pursuant to the Administrative Order on Consent, Addendum to Attachment B – Schedule of Deliverables. Attached are EPA's technical comments on this report. EPA's legal review is still ongoing. DTSC has no comments on this report. I wanted to provide the technical comments to you at this time, so that you can start work on those revisions. The technical comments are not expected to change as a result of the legal review. The Respondents can now start revising the report, addressing the technical comments, but do not have to resubmit those revised portions until any final EPA legal comments are submitted. Pursuant to the AOC's Addendum to Attachment B – Schedule of Deliverables, the report revisions will be due two months after receipt of EPA's final legal review comments.

EPA conducted two data quality assessment activities in order to evaluate the quality and usability of the environmental data presented in this RI report. The first activity was conducting split sampling of the Respondents' 2001 Addendum Investigation sampling, and the second activity was reviewing the data quality assessment presented in Appendix E of this RI report. These activities and their results are described below.

EPA's Quality Assurance ("QA") Office reviewed the *Data Quality Assessment Report* ("DQA Report"), presented as Appendix A of the draft RI Report dated 4/7/04 and Appendix E of the draft final RI Report. The DQA Report stated that data collected from RI and non-RI data collection efforts was utilized only if such data met project analytical data quality objectives. The report also described the cursory and detailed data review procedures that were used in evaluating project data quality. The purpose of EPA's review was to verify that the detailed data review component was conducted in

accordance with EPA's *National Functional Guidelines for Data Review*. To do so, EPA's review consisted of the following objectives:

- a. ensure that an adequate level of data validation was performed;
- b. ensure that an adequate level of data validation documentation was provided to EPA;
- c. spot check selected data packages and data validation reports for level of detail and level of data review conducted;
- d. review selected data package raw data for calibration problems;
- e. review selected data package raw data for LCS and/or surrogate recovery problems.

EPA reviewed the following data packages and associated data validation reports:

- a) BC Analytical Laboratory #G93-02-229
 - i) Method 8080 Pesticides/PCBs
 - ii) Method 6010 Metals
 - iii) Method 8270 SVOCs
- b) Air Toxics LTD #9410293, Method TO-14
- c) Severen Trent Laboratories (STL) #E3F250349
 - i) Methods 8260B VOCs
 - ii) Method 8270 PAHs
 - iii) Method 6010 Metals

The results of EPA's review are as follows.

(1.) The Data Validation Methods section of the DQA report (Section A.3 of the 2004 draft RI Report) stated that cursory data validation was conducted on all laboratory data, and that more than 20% of the laboratory data underwent full data validation. Therefore, EPA obtained a few randomly selected data validation reports from URS and checked them for calibrations, internal standards, and instrument tuning, to verify that the data validation reports did indeed review project data at this level of detail. The results of EPA's review confirmed that these QC parameters were reviewed by Dames and Moore (now URS) and the results were within the method acceptance windows. EPA's review also confirmed that the data validation reports contained an adequate level of documentation.

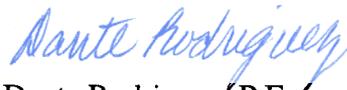
(2.) The data validation reports and data packages were reviewed to verify that LCS recoveries, surrogate recoveries, and MS/MSD recoveries were acceptable (Section A.4.1.3 "Accuracy," of the 2004 draft RI Report). EPA's review confirmed that percent recoveries of all these QC parameters were checked by Dames & Moore (URS) and were within the method acceptance windows.

In conclusion, EPA agrees with the DQA Report in that project data has met quality assurance criteria set forth in the *Quality Assurance Project Plan* and there does not appear to be any data usability issues or concerns.

EPA also conducted split sampling of the Respondents' 2003 Addendum Investigation sampling activities, and compared the results. EPA's evaluation of the split sampling results concluded that there appeared to be general agreement between EPA and the Respondents' sample results. There were only a handful of samples with some level of disagreement. EPA followed up by reviewing the complete data package for the Respondents' sample that showed the greatest disagreement with EPA's split sample result, looking for low bias. Upon completing this review, EPA found that the laboratory information showed an acceptable level of performance, and that the data at large met the general acceptance criteria.

Please let me know if you have any questions or would like to discuss any of the attached comments. Thank you.

Sincerely,



Dante Rodriguez, P.E.
Del Amo Project Manager
U.S. EPA Region 9

cc: John Dudley, URS
Larry Bone, Dow
Safouh Sayed, DTSC

COMMENTS
on
Draft Final Remedial Investigation Report
Soil and NAPL Operable Unit
Del Amo Superfund Site
Los Angeles, California

July 28, 2006

Main Report

1. Section 1.2.3, 5th paragraph, 1st sentence: Insert reference as follows, “*Aerial photographs from 1927 through 1941 (see Figure 9) show . . .*”
2. Section 1.2.5, 3rd paragraph, last sentence: The reference to *Table 1* is incorrect - it should be *Table 2*. Correct this.
3. Section 1.2.5, last paragraph, last sentence: The reference to *Section 3* is incorrect – it should be *Section 2*. Correct this.
4. Section 1.2.6, 2nd paragraph, 1st sentence: The reference to *Table 2* is incorrect – it should be *Table 3*. Correct this.
5. Section 2.1.1, 3rd paragraph, 1st sentence: Edit as follows, “*The rubber plant was comprised of three inter-related plancors . . .*”
6. Section 2.2, 3rd paragraph, 3rd sentence: Edit as follows, “. . . directed by the ROD, *soil* vapor extraction, . . .,” so as not to confuse soil vapor extraction with cap vapor extraction.
7. Section 2.3.2.7, 1st paragraph: Edit the second and third sentences as follows, in order to be more complete in your description of the information shown on the map, “*Benzene, ethylbenzene, styrene, toluene, polyethylbenzenes, propylbenzene, butylbenzene, and resin fraction were stored in large vertical tanks along the western border of the plant. Fuel oil was stored in a very large tank at the southern end of the area and in a large tank at the northern end of the area.*”
8. Section 2.3.3.1, 2nd paragraph, 1st sentence: The vent, relief, and flare system mentioned in the sentence is not labeled on the map. If we know its location, label it on the map; if its location is unknown, say so in the text.

Also, edit the sentence as follows, “. . . caustic, *acetone/acetone*nitrile, and slop oil.”
9. Section 2.3.4.7, last paragraph: Also mention in the paragraph that there are isoprene storage tanks near the northwest corner of the laboratory building.
10. Section 2.3.4.8, last paragraph, last sentence: Footnote #6 was formatted incorrectly, as it runs between this page and the next. Correct this formatting error.
11. Section 2.3.6, 4th paragraph: In the first bullet item, the first sentence misspelled *Channel*; fix this misspelling.

In the fifth bullet item, first sentence, the acronym *COD* needs to be defined and added to the acronym list.

12. Section 4.1, 4th paragraph, 2nd sentence: The sentence is confusing as written; rearrange as follows to clarify, “*Data for soil ingestion, dermal contact, and particulate inhalation pathways were collected, through surface and shallow soil sampling and shallow soil gas sampling, in areas where historical information indicated a potential for chemical releases.*”
13. Section 4.2, 1st paragraph, 2nd sentence: Edit as follows, “*A separate RI/FS and FS reports (D&M, 1996b), as well as a ROD documenting USEPA-selected remedial technique for the Waste Pits Area (USEPA, 1997) have been previously completed.*” The Waste Pits OU did not have separate RI and FS documents, they were combined into one document known as the “FFS.”
14. Section 4.2, 2nd paragraph, 1st sentence: Capitalize *Unit* in the sentence.
15. Section 4.3, 2nd paragraph, 3rd sentence: The sentence refers to *USEPA-approved documents*. Strike the term *USEPA-approved documents*, as I cannot confirm whether all the documents were specifically approved by EPA.
16. Section 4.3.7, 1st sentence: The sentence states that significant undeveloped and unpaved areas were present in the northwest corner of the copolymer plancor (and in the southern margins of the styrene and butadiene plancors), but the figure referenced (Figure 23) does not have the northwest corner marked in orange. Edit Figure 23 to indicate in orange outlines the northwest corner (previously) undeveloped area. (This is also noted in my comments regarding the figures).
17. Section 4.2.8, 2nd paragraph, 2nd sentence: Add comma as follows, to improve the grammar and clarify the meaning, “. . . *excluding the Waste Pit Area, between 1992 and 1995.*”
18. Section 4.3.13, 1st paragraph, 2nd sentence: Strike “*and distribution*” from the sentence. The NAPL screening investigation did not seek to characterize the horizontal and vertical distribution of NAPL in the three select areas.
19. Section 5.1, 1st paragraph, last sentence: Edit as follows, “. . . *that were applied only to shallow soil gas data-only.*”
20. Section 5.1, 2nd paragraph: Edit the first sentence as follows, “*The “threshold levels” screening criteria indicated the compound concentrations at which a potential for unacceptable exposure may have existed within . . .*”

The third sentence incorrectly references Section 8, whereas it should be Section 9. Correct this.
21. Section 5.1, 3rd paragraph: Edit the first sentence as follows, “*VOCs were also considered to be . . .*”

Edit the second sentence as follows, “*Exceedance of ~~the~~ this screening criterion . . .*”
22. Section 5.1, 4th paragraph, 3rd sentence: Strike the phrase “*that were approved by USEPA.*” My files indicate that this work plan (D&M, 1994b) was never actually

approved by EPA. My files show that there were meetings and discussions, but the Phase II work plan was never actually agreed to.

23. Section 5.2, 2nd paragraph, 2nd sentence: The sentence is somewhat unclear as written, and can be improved with the following edits, “*Industrial rather than residential PRGs were used as the screening criteria for PAHs, as agreed to by USEPA, due to the ~~common~~ ubiquitous background presence of these combustion products in shallow soil, especially near likely associated with the nearby freeways.*”
24. Section 6.1.1, 2nd paragraph, 1st sentence: The sentence is somewhat unclear as written, and can be improved with the following edits, “*1,3-Butadiene is also known to have been associated with the former rubber plant, but soil gas investigations did not normally include 1,3-butadiene it as a target analyte since this compound is a gas at standard conditions and would have rapidly volatilized to the atmosphere upon release.*”
25. Section 6.1.3, 3rd paragraph, 2nd sentence: The reference to Figure 26 is incorrect - it should be Figure 27. Correct this.
26. Section 6.2, 2nd paragraph, last sentence: The sentence states that neither ethylbenzene nor toluene exceeded 310 ppmv in any samples. Is there a significance to 310? If not, the sentence sounds strange, and should be edited to just say the values ranged up to 310 ppmv.
27. Section 7.1, 1st paragraph, 2nd sentence: The sentence states that the surface soil investigation focused on three large areas of exposed soil, but Figure 18, the referenced figure, only shows one large area of exposed soil. Change the reference to Figure 23, which seems to be the better reference for this sentence.
28. Section 7.1.2, 1st sentence: Edit the sentence as follows (consistent with wording used in Section 7.1.4), “*Surface soil sampling locations analyzed for SVOCs/PAHs are presented in Figure 30, with concentration data provided for locations with screening criteria exceedances.*”
29. Section 7.1.3, 1st sentence: Edit the sentence as follows (consistent with wording used in Section 7.1.4), “*Pesticide/PCB sampling locations in surface soil are presented in Figure 31, with concentration data provided for locations with screening criteria exceedances.*”
30. Section 7.2.2, 2nd paragraph, 8th bullet point: Correct typographical error “*They* ~~The.~~”
31. Section 7.3.2, last sentence: Correct the reference “*Section 7.2.2.*”
32. Section 8.0, 1st paragraph, 2nd sentence: The sentence references Section 5 as the place where screening criteria exceedances for each analyte class are summarized, but the better reference would be “*Sections 6-10.*” Section 5 only tells what the screening levels were, not what the results were.
33. Section 8.0, 2nd paragraph, last sentence: The sentence references Table 17 for results for each location, but it only provides the statistical summary. Table 16 would be the better reference. Correct this.

34. Section 8.1.1, 4th paragraph, 6th sentence: Correct the typographical errors as follows, “However, ~~however~~ the elevated lead concentrations in the vicinity of ~~as a~~ former machine shop suggests a potential associations.”

35. Section 8.1.2, 5th paragraph: The contents of the paragraph are repeated in the numbered list. Edit as follows to make the paragraph (and associated numbered list) more concise,

~~“There is no documentation indicating the use of TCE or similar chlorinated solvents at the plant site. It is unclear whether the elevated concentrations of TCE are associated with the pits and trenches feature since the maximum detected TCE concentration occurs outside of the pits and trenches footprint. Additionally, there are known, offsite TCE source areas immediately west and southwest of the pits and trenches features that are unrelated to the former rubber plant. Data supporting the presence of these offsite source areas was provided to USEPA via email in a November 20, 2003 memorandum (URS, 2003b). The elevated concentrations of TCE are not believed~~ *interpreted* ~~to be associated with the plant site or pits and trenches feature~~ *adjacent offsite TCE source areas* for the following reasons:

(1) *There is no documentation indicating the use of TCE or similar chlorinated solvents at the plant site.*

(2) *The maximum detected TCE concentration occurs outside of the pits and trenches footprint; and*

(3) *There are known, offsite TCE source areas immediately west and southwest of the pits and trenches feature that are unrelated to the former rubber plant. Data supporting the presence of offsite source areas was provided to USEPA via email in a November 20, 2003 memorandum (URS, 2003b).”*

36. Section 8.1.2, 6th paragraph, last sentence: Consistent with the edits in the above comment, edit this sentence as follows, “While *interpreted as being* attributable to offsite sources, . . .”

37. Section 8.1.3, 2nd sentence: Make the following grammatical edit to improve the sentence’s clarity, “. . . *sampling location where the exceedance was detected*, based on laboratory data for surrounding sampling locations.”

38. Section 8.2.4, 2nd paragraph, 2nd sentence: Put a period after “Figure 47,” as that is the intended end of the sentence.

39. Section 8.2.4, 3rd paragraph: The first sentence is missing a comma after “extensive grading.” Correct this.

In the last sentence, the reference (regarding elevated arsenic and DDT) would be more complete if it referred to both Sections 7.1.3 and 7.1.4. Make this change. Section 7.1.3 discussed DDT, and 7.1.4 discusses arsenic.

40. Section 8.3.1, 4th paragraph, 2nd sentence: Edit as follows, “. . . PAHs are similarly believed to be confined to the shallow subsurface based *on* their limited mobility . . .”

41. Section 9.0, 2nd paragraph, last sentence: The sentence references Figure 24 as a place to see the building on parcel 7351-033-034 and a nearby soil gas threshold exceedances location, but Figure 24 does not show the threshold exceedances. Figure 25 shows threshold exceedances, but not parcel numbers (which can be seen on Figure 6). Change the sentence to reference both Figure 6 and Figure 25.
42. Section 9.0, 3rd paragraph, 1st sentence: Correct misspelling “~~rteport~~ report.”
43. Section 9.0, 5th paragraph, 2nd sentence: Edit as follows, “. . ., as ~~explained~~ *mentioned* in Section 5.3.” Section 5.3 does not explain the PEL, PEL/20 concept any further; it only mentions the same thing that is stated in this sentence.
44. Section 10, 1st paragraph, 2nd sentence: Correct the last reference as follows, “(USEPA, 1999a).”
45. Section 11.2, 3rd paragraph, 6th sentence: Change the wording as follows, “. . . significant unknown peaks on the laboratory chromatograph were not ~~noted~~ *observed/present*, and . . .” The word “noted” does not sound certain enough.
46. Section 11.3, 4th paragraph, 4th sentence: Edit as follows, “Investigations to further evaluate the potential presence of NAPL at these facilities have not been conducted based on conditions at confirmed NAPL areas ~~indicating that the volume of free product that can be recovered, if any, is extremely limited~~ *providing sufficient data to evaluate remedial alternatives for all the areas.*” The primary purpose of the NAPL Screening Investigation was not to prove that there was limited free product recovery potential, it was to gather data for the evaluation of remedial alternatives.
47. Section 11.5.2, last paragraph, last sentence: Add a period after “0 to 13.7%.” That is the end of the sentence.
48. Section 12: Insert the table from Figure 58 into the report body between the second and third paragraphs. This section repeatedly references the table, and it would be beneficial to have it embedded in this section of the report body.
49. Section 13.1.1, 6th sentence: Edit as follows, to correct redundant use of the word, “. . . with ~~chemical~~ transfer of chemical occurring between these phases.”
50. Section 13.1.2, 1st paragraph, 4th sentence: Add a brief definition of the term “colloidal.”
51. Section 13.2.2, table footnote: The first sentence of the footnote misspelled the word “arsenic,” as “arsenic.” Correct this.
52. Section 13.2.3, 1st paragraph, 1st and 2nd sentences: Figure 60 and this section do not identify potential chemical sources or release mechanisms. Figure 60 just has a box that says “source” and one that says “product release.” Revise the first sentence accordingly, or delete it.
53. Section 14.2, 2nd paragraph, 2nd sentence: This sentence is unclear, as it says that the elevated dissolved VOC concentrations are generally found within the benzene plume, but benzene itself is a VOC. Clarify the intended meaning. Did you mean other non-benzene VOCs?

54. Section 14.2, 3rd paragraph, last sentence: Correct spelling and edit as follows, “~~Theses~~ *These* areas of shallow contamination are . . .”
55. Section 15: Revise the reference to the AOC (USEPA, 1992b) as follows, “~~Draft Final~~ *Administrative Order on Consent for Remedial Investigation/Feasibility Study and Focused Feasibility Study* ~~April 23~~ *May 7*, 1992.”

Figures

56. Figure 2: State on the figure the source of this information.
57. Figure 21: The building at 991 Francisco/19831 Magellan (corner of Francisco & Magellan) is missing. Add this building.
58. Figure 23: The area in the northwest corner of the copolymer plancor, which had been investigated as an area of open surface soil, is not marked in orange outlines. This is also noted in my comment regarding Section 4.3.7 of the main report. Mark this area in orange outlines.
59. Figure 38: Add to the figure a note stating that there were no detections exceeding screening levels (as done on Figure 39).

Appendix A

60. Appendix A: In the March 30, 2006 meeting between URS, EPA, and CH₂M Hill, it was agreed that mention would be made in the appropriate site history-related section that the Amoco Chemical Company off-site facility potentially had a second dry well. Appendix A discusses Amoco but does not include the agreed-upon statement regarding a second dry well. Add this statement to the section.
61. Appendix A: In the March 30, 2006 meeting, it was agreed that the Gardena Sump (Dump) and the American Chemsolve facilities would be mentioned in the appropriate site history-related section, but they were not included. Add this information to the section.

Appendix B

62. Appendix B: This appendix consists of a disk containing the data files for the RI, and a table (on paper) containing all the data. The intention is to provide EPA (and possibly DTSC) with both the disk and the paper version, but other report recipients will be provided only the disk. Currently, the disk only contains the data files in ascii text format. Provide on the disk electronic versions in pdf format, of the tables provided on paper, in addition to the ascii text formatted data files.
63. Appendix B, 1st page, 2nd paragraph, 2nd sentence: Edit the sentence as follows, “. . . ~~Table xx~~ *20* of this report.”

Appendix C

64. Appendix C: This appendix consists of a disk containing a pdf file of the boring logs from the 2003 addendum investigation. Provide EPA with a paper version of this appendix as well, in the final document.

Appendix D

65. Appendix D, Parcel 7351-034-043: As specified in my comments on your draft of this appendix (dated 11/28/05), state in the text any information you have regarding the two buildings and one tank shown on the map in the middle of the west side of the parcel. If you have none, then say so.
66. Appendix D, Parcel 7351-034-079: As specified in my comments on your draft, mention in the text the existence of the “fire training area,” noted on the map.

Appendix E

67. Appendix E, part 2, cover page: This cover page contains an unclear reference to the technical memorandum contained within. Provide a complete reference on this page, including author, addressee, etc. Correct the spelling of “evaluation” in the reference.

Appendix F

68. Appendix F, section entitled “MW-20 Area Hydrocarbon Log Sheets,” 2nd page, last paragraph, last sentence: The sentence states that an explanation of the hydrocarbon logs is provided below, but no further information was included before the presentation of the logs. Either provide the information or delete this sentence.

Appendix G (Response to Comments)

69. Appendix G, Response to Comments 3e-i: The response specifies that the report text was revised to include an imbedded table summarizing the investigation scope at each facility. No such imbedded table was included in the text (Table 8 provides this information in the table section at the end of the report). Provide this table embedded in the text.
70. Appendix G, Response to Comment 3o: The response discusses the ambient air data that was included in the 1993 draft RI report, Appendix F, indicating that the data primarily pertained to the waste pits area, and that the data has no bearing on the findings of the RI or risk assessment. I found no record in my notes or files of us having discussed or agreed upon this response; therefore, the original comment stands as not having been adequately addressed. Note that some of the data pertained to the MW-20 work, which is a part of this RI. As a matter of properly documenting the site record, was this data presented in any other document besides the 1993 draft RI (which was not approved by EPA)? If not, then at least the MW-20 portion of the data should be documented in this report.
71. Appendix G, Response to Comment 6: The response agrees to include a table with groundwater elevation data through 2004, as well as a figure illustrating groundwater elevation contours for 2000 and 2004. The figure was provided but the table was not. Provide this table.
72. Appendix G, Response to Comment 19: The comment had requested a citation for EPA’s approval of using non-PRG screening criteria for arsenic and iron during the 2003 investigation. The response indicated that the Respondents could not locate this citation. The citation is as follows (per my 4/29/05 email to URS): “4/4/03 final Meeting Minutes, RI/FS Monthly Oversight Meeting, March 12, 2003.” Add this citation to the report.

73. Appendix G, Response to Comment 26: The comment and response pertain to the issue of VOC concentrations exceeding 5 ppmv being indicative of groundwater contamination source areas, and how negative hits did not necessarily equate with a lack of VOC contamination at depth. According to my notes, the Respondents had agreed to offer some wording for qualifying the representativeness of any particular data point with respect to potential contamination lower down or further over. No such wording was provided. Provide such additional wording for this paragraph.
74. Appendix G, Response to Comment 61: The comment and response pertain to screening level exceedances at the pits and trenches feature. The response provided differs from the response previously agreed to (4/8/05 meeting re: draft responses to agencies' comments), which was to edit the table to say "*Pits & Trenches or Offsite properties to west.*" Make this change.
75. Appendix G, Response to Comment 73: The comment pertained to, among other things, the dates of the information represented in the subject figures, and the response agreed to add a note to Figures 4, 13, and 15 from the 2004 draft report. The note (indicating that the maps present the known facilities over the lifespan of the rubber plant but may not be 100% accurate for any single point in time) was not included on Figure 13 (from 2004 draft report), which corresponds to Figure 21 in the current report. Add this note to Figure 21.
76. Appendix G, Response to Comment 88: The comment pertained to building-specific discussion of the indoor air sampling results. Respondents had previously agreed to provide a lead-in paragraph to the section that refers readers to a new table, summarizing each building, what led to that buildings being sampled, the building results, ambient air, and other factors about the building that affected the results (4/8/05 meeting re: draft responses to agencies' comments). Such additions were not provided. Provide these additions, per agreement.
77. Appendix G, Response to Comment 90: The comment pertained to the presentation of NAPL-related data. The response specifies that the hydrocarbon saturation data, jar testing data, and ROST results will be included in Appendix B and referenced in Sections 10.4 and 10.5. I could not locate this data in Appendix B, nor the references to it in Sections 10.4 and 10.5. Hydrocarbon saturation data was only provided in Appendix F, in table and boring log format. ROST, UV fluorescence, and jar testing data were only provided in Appendix F as well, and only in boring log format. Provide this data in Appendix B as well, per agreement.
78. Appendix G, Response to Comment 92: The comment pertained to updating base map information on various figures. The agreed-upon updates were not made on all the figures. The following figures need to have the 204th Street houses removed that are no longer in existence: Figures 19, 21, 23, 55, 56, and 57.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

February 2, 2007

Mr. George Landreth
Shell Oil Company, OSP 1770B
P.O. Box 2463
Houston, TX 77252-2463

Re: Remedial Investigation Report, Administrative Order on Consent, Docket No. 92-13, Del Amo Superfund Site

Dear George:

EPA legal staff and other internal reviewers have reviewed the document entitled "*Draft Final Remedial Investigation Report, Soil and NAPL Operable Unit, Del Amo Superfund Site, Los Angeles, California,*" dated July 28, 2006. Attached are EPA's comments on this report resulting from this review. A few of the technical comments that I submitted to you on October 30, 2006, are changed by the comments herein. However, I am not revising my previous comment letter. The reader should just look at these new comments to ascertain EPA's final comment regarding any sentences that are affected by both sets of comments.

With this comment submittal, the Respondents have received all the agency comments and can proceed with completing their revision of the RI report. Pursuant to the AOC's Addendum to Attachment B – Schedule of Deliverables, the report revisions will be due two months after receipt of this comment submittal.

Please let me know if you have any questions or would like to discuss any of the attached comments. Thank you.

Sincerely,

Dante Rodriguez, P.E.
Del Amo Project Manager
U.S. EPA Region 9

cc: John Dudley, URS
Larry Bone, Dow
Safouh Sayed, DTSC

ADDITIONAL COMMENTS

on

Draft Final Remedial Investigation Report

Soil and NAPL Operable Unit

Del Amo Superfund Site

Los Angeles, California

July 28, 2006

Main Report

1. General Comment 1: Throughout the draft RI Report there are statements that there is no known history of the use or documentation of the use of TCE or PCE at the Del Amo Synthetic Rubber Plant. To the extent that soil, soil gas and other data can be interpreted as indicating a release of these hazardous substances within the boundaries of the Synthetic Rubber Plant, EPA disagrees with the conclusory statements about this made in the draft RI. Also as discussed below, the conclusions regarding the relations of TCE/PCE in soil to the operations of the Synthetic Rubber Plant which are presented in the draft RI were based only on information made available to URS. EPA's investigation of the use, handling, storage, disposal and release of these compounds within and outside of the Del Amo Plant boundaries is continuing. The following comments provide specific instructions for addressing this issue in the report.
2. General Comment 2: We need to strengthen our description of how the NAPL investigation fit into the overall RI project. Several of the following comments provide specific instructions for improving the description of our NAPL investigation efforts.
3. Section 1.0, Introduction, 2nd paragraph: Edit the paragraph as follows, "*The early RI documents were prepared with the understanding that a single RI report would incorporate findings regarding the soil, groundwater and NAPL operable units; however, USEPA subsequently required preparation of a Groundwater RI and separate Soil and NAPL RI. Therefore, portions of the above documents may not be applicable to this Soil and NAPL RI. This Soil and NAPL RI report presents all the data gathered for this operable unit. This includes some data that had been presented in the Groundwater RI report to the extent that such data relates to the characterization of the soil and NAPL at the site, provides basic background information about the site, or was used in the risk assessment for this operable unit. A comprehensive list of previously completed documents pertaining to soil and NAPL conditions at the site is presented in Table 1. All the data from those reports is presented in this RI report, although those documents contain more detailed descriptions of the investigation efforts than does this RI report.*"
4. Section 1.1, Purpose and Objectives, last paragraph: Edit the last sentence of the paragraph and add an additional sentence as follows, "*The risk assessment findings are subsequently used by USEPA to ascertain where remedial action may be*

necessary, which will be presented in the Feasibility Study report. The FS report will present and evaluate remedial action alternatives to address surface exposure pathways and the NAPL contamination of groundwater.”

5. Section 1.2.1, Location: Delete the first sentence (which begins “*Formal boundaries of Superfund Sites*”). The remainder of the paragraph is accurate in defining the Del Amo Plant boundaries as the boundaries of the study area covered in the RI and should be retained as drafted. It is inappropriate for the RI to attempt to limit the extent of a site as defined under the statute and National Contingency Plan.
6. Section 1.2.1, Location, and report overall: The fourth sentence defines the use of the terms “site” and “plant site.” Due to concerns about consistent use of the term “site” with respect to its NCP definition, we should not use the term when referring solely to the former plant property. Edit the sentence to read, “. . . *conditions within the area formerly occupied by the synthetic rubber plant, hereafter referred to as the ‘~~site~~ property’ or ‘plant ~~site~~ property’.*”

Review the text of the report overall and change the term “site” to “property” throughout. This includes use of the terms “onsite” and “offsite,” which should be changed to “on-property” and “off-property.”

7. Section 2.0, Site History, 3rd paragraph: The third paragraph indicates that URS prepared the RI Site History relying primarily on information provided by Shell. All documentation reviewed by URS to prepare the RI Site History must be forwarded to EPA at this time for inclusion in the EPA Del Amo Site file, except for information reviewed by URS which was drawn from “EPA file material.” Such detailed and primary information concerning the operation of the synthetic rubber plant may be needed by EPA in the future - for example, to determine the possible source of contamination found at a later date when a building that exists today is demolished. It is not necessary that EPA receive this information prior to finalization of the RI Report, but it is necessary that EPA receive it prior to issuance of the Administrative Record and Proposed Plan. Please contact the EPA project manager regarding schedule and arrangements for this activity.
8. Section 2.0, Site History, last paragraph: EPA has not undertaken to verify the conclusions reached in the RI report concerning the detailed information presented in the site history nor has EPA conducted a comprehensive evaluation and comparison of the detailed information presented in the RI site history with the primary source documents. While EPA believes that the general outlines of the site history are sufficient for the purposes of a remedial investigation report, approval of the RI report does not represent EPA approval of or agreement with any particular factual conclusions made in the RI report regarding site operational history. The RI report appropriately notes some of the major limitations of the Report’s discussion of site history in this paragraph. Add the following additional disclaimer at the end of the paragraph, “*EPA may issue subsequent amendments or addenda to the RI site operational history as EPA continues its overall investigation at the Del Amo Site.*”
9. Section 2.3.3.5, Administration, Shops and Laboratory subsection, last paragraph: Add the following sentence to the end of the paragraph, “*However, the preceding*

analysis and conclusions represent the views of Shell and not of US EPA. EPA's investigation of chlorinated solvent use at the Site is ongoing and continuing."

10. Section 4.1, Investigative Approach: Edit the first paragraph, 1st bullet, as follows, "Data was collected to adequately characterize *surface* exposure pathways *and NAPL impacts to groundwater*, and evaluate remedial alternatives in areas impacted by former rubber plant operations;"

Edit the last bullet as follows, "A dual "top-down" and "bottom-up approach" to data collection was emphasized and later integrated to identify groundwater contamination source areas *and potential NAPL areas*."

Edit the fourth paragraph, 1st sentence as shown, "The RI/FS sampling strategy considered potential *surface exposure* pathways ~~of exposure~~ to site-related chemicals."

Add a new paragraph after the fourth paragraph as follows, "*The NAPL investigation strategy began with investigating an area of known NAPL existence – well #MW20 and vicinity, where floating NAPL product was found. The NAPL investigation then examined groundwater chemical data from the water table zone, and soil and soil gas data from shallow soil (and some deep soil locations), to identify areas of potential NAPL existence. Further sampling and testing was then performed in the areas with the highest potential for NAPL existence, to characterize the properties of the NAPL.*"

With the edits above, the section would then read smoother if you move the last three paragraphs of the section and place them after the fifth paragraph. [The last three paragraphs start with the sentences "Multiple lines of evidence . . .", "The 'bottom-up' process started . . ." and "Using this combined top-down and bottom-up approach . . ." The fifth paragraph starts with "While the location of former facilities . . ."]

Edit the last paragraph, first sentence, as follows, "Using this combined top-down and bottom-up approach, groundwater contamination source areas *and potential NAPL locations* were identified."

11. Section 6.1.3, Areas of Vadose Zone Contamination, last paragraph: Add the following sentence to the end of the paragraph, "*The preceding analysis and conclusions represent the views of Shell and not of US EPA. EPA's investigation of chlorinated solvent use at the Site is ongoing and continuing.*"
12. Section 7.2.1, VOCs, last paragraph: Add the following sentence to the end of the paragraph, "*However, the preceding analysis and conclusions represent the views of Shell and not of US EPA. EPA's investigation of chlorinated solvent use at the Site is ongoing and continuing.*"
13. Section 8.1.2, Pits and Trenches, 5th paragraph: Edit the paragraph as indicated below.

"There is no documentation indicating the use of TCE or similar chlorinated solvents at the plant site. *Shell believes that it is unclear whether the elevated concentrations of TCE are associated with the pits and trenches feature since the maximum detected*

TCE concentration occurs outside of the pits and trenches footprint. Additionally, there are known, offsite TCE source areas immediately west and southwest of the pits and trenches features that are unrelated to the former rubber plant. ~~Data supporting the presence of these offsite source areas was provided to USEPA via email in a November 20, 2003 memorandum (URS, 2003b).~~ Shell believes that the elevated concentrations of TCE are not believed to be associated with the plant site or pits and trenches feature for the following reasons: . . .”

Note that the fourth sentence is deleted because reference to the URS November 20, 2003 email is not necessary given that the properties adjacent to the Plant Pits and Trenches were identified in the EPA Groundwater Record of Decision as a potential source area for chlorinated solvents (along with the Plant Pits and Trenches).

14. Section 8.1.2, Pits and Trenches, 6th paragraph, last sentence: Edit as follows, “*While attributable to offsite sources, the area has been identified as a groundwater contamination source area since TCE and PCE impacted shallow soil extends into the rubber plant site. However, the preceding analysis and conclusions represent the views of Shell and not of US EPA. EPA’s investigation of chlorinated solvent use at the Site is ongoing and continuing.*”

The sentence must be deleted for two reasons. First, it addresses groundwater conditions which are outside the scope of this RI. Secondly, EPA’s investigation as part of the remedial design process of chlorinated solvent sources is continuing and ongoing. The Plant Pits and Trenches remain under EPA investigation as a potential source of TCE contamination to groundwater.

15. Section 10.0, Groundwater Table VOC Data, 1st paragraph: Edit as follows, “*While soil and NAPL are the primary subjects of this RI, a limited discussion of groundwater conditions at the water table is appropriate ~~to the extent that~~ since the data ~~can~~ assisted in evaluating the potential for surface exposure from upward migration of vapor and in identification of groundwater contamination source areas and NAPL areas. A comprehensive presentation of groundwater conditions through 1995 is available in the Groundwater RI Report (D&M, 1998a) and in USEPA’s groundwater ROD (USEPA, 1999). This data was used to assist in identifying the potential groundwater contamination source areas and NAPL areas. Groundwater data from the 2000 monitoring event are presented in this report, as this data was used in the BRA. {Insert Paragraph Break}*

Data presented here are limited to VOCs since: . . .”

16. Section 11.1 and 11.2: The NAPL section needs to have better context. Currently, the description of our NAPL investigative approach is spread around various parts of the report. We should bring it all together in the NAPL section. Here are a few suggestions I have for accomplishing this by describing our approach closer to the front of the NAPL section. Any further ideas you have are welcome. We should discuss further after you draft up these changes.

Move the first paragraph of Section 11.2 to the end of Section 11.1.

Rename Section 11.2 to be “*NAPL Investigation.*”

Add the following paragraph to the beginning of Section 11.2: *“The NAPL investigation strategy began with investigating an area of known NAPL existence – well #MW20 and vicinity, where floating NAPL product was found during sampling of a groundwater well. The NAPL investigation then examined groundwater chemical data from the water table zone, and soil and soil gas data from shallow soil (and some deep soil locations), to identify other areas of potential NAPL existence. Further sampling and testing was then performed in the areas with the highest potential for NAPL existence during the NAPL Screening effort, to characterize the properties of the NAPL.”*

Edit the first sentence of the following paragraph to read, *“The physical methods of evaluating the presence of NAPL at the Del Amo site, during the MW-20 investigation and the NAPL Screening efforts, included laboratory measurements of hydrocarbon saturation (Dean Stark testing) and a relatively sensitive observational technique referred to as “jar testing”.*”

17. Section 11.2, NAPL Identification: Insert a paragraph after the sixth paragraph (which starts *“Rubber plant site areas . . .”*) as follow, *“These findings and conclusions are based, in part, on groundwater data through 2000. Subsequent groundwater monitoring data has not shown any change significant enough to alter the conclusions of this NAPL analysis. Any further refinement of the extent of the NAPL, based on subsequent data, can be made during the remedial design phase. Note that some new groundwater wells have been installed since 2000, located in the vicinity of 19785 Pacific Gateway (parcel #7351-34-57).”*
18. Section 11.3, Potential LNAPL and DNAPL Areas, 1st paragraph: Provide a brief explanation, justification, or reference for the 5% of saturation level that we used for a screening.
19. Section 11.3, Potential LNAPL and DNAPL Areas, 5th paragraph, 5th sentence: Edit as follows, *“Chlorobenzene is ~~present at XMW-13~~. Chlorobenzene is also associated with the Montrose superfund site . . .”*
20. Section 11.5.1, 3rd paragraph: Delete the fifth and sixth sentences (starting *“It was further concluded . . .”* and *“The MW-20 Pilot Program Report documents . . .”*). The effectiveness of remedial technologies are a subject for the FS, not the RI.
21. Section 14.1.1, VOCs, 1st paragraph, 3rd sentence: Delete the sentence, *“~~A# additional area of PCE and TCE contamination is present in the southwestern corner of the copolymer plant at the “pits and trenches” feature; however, there is no known history of use of these compounds at the former rubber plant.~~”* EPA disagrees with this sentence. The RI report states on page 79 that the pits and trenches appear on aerial photographs of the site but acknowledges that no other documentation *“indicating their use is known.”* With such limited information about the use of these pits and trenches (and given the limitations of delineation efforts discussed on page 81), EPA does not believe that it is appropriate to suggest, as this sentence does, that the TCE/PCE soil concentrations found where the pits and trenches were located could not have originated from releases within the Synthetic Rubber Plant boundaries.

22. Section 14.2, *Groundwater*, 1st paragraph: The paragraph states that groundwater data are only relevant to this report to the extent that there may be surface exposures from upward vapor migration. Groundwater data are also relevant to this RI for the purpose of assisting in NAPL identification. Therefore, edit the sentence as follows, “*Groundwater data are relevant to this report ~~only~~ to the extent that there may be exposures from upward migration of vapor **or as in indicator of potential NAPL occurrence.***”

FIGURES

23. Figure 57, *Potential NAPL Source Areas*: The scope of this draft RI report does not include analysis of any potential NAPL source of chlorinated solvents at the PACCAR or American Polystyrene properties. Also, EPA has not yet determined that such a NAPL source exists or is likely to exist at those properties. Accordingly, remove that information from this figure.

APPENDICES

24. Appendix A, *Additional Information Regarding Site and Vicinity Properties*: Remove this Appendix. It addresses conditions outside of the scope of the RI Report and presents analysis and conclusions which have not been reviewed, commented on or accepted by EPA. In order to save time in preparing the revised RI document, I recommend moving Appendix G and making it Appendix A. This will minimize the number of changes that would need to be made throughout the report as a result of removing Appendix A.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

February 26, 2007

Mr. George Landreth
Shell Oil Company, OSP 1770B
P.O. Box 2463
Houston, TX 77252-2463

Re: Remedial Investigation Report, Administrative Order on Consent, Docket No. 92-13, Del Amo Superfund Site

Dear George:

In my previous RI comment letter to you, dated February 2, 2007, comment #16 stated that the NAPL section needed better context, and some suggestions were provided to address this. On our February 6 RI/FS Monthly Call, I indicated that EPA was working on some further edits to address this need. EPA has completed its edits in this regard (see attached). These edits reference any comments from EPA's February 2 comment letter that pertain to the same text. They also include comments to provide further explanation of edits, as can be seen when viewed in WordPerfect.

Please contact me when your RI team is ready to discuss these edits. Thank you.

Sincerely,

Dante Rodriguez, P.E.
Del Amo Project Manager
U.S. EPA Region 9

cc: John Dudley, URS
Larry Bone, Dow
Safouh Sayed, DTSC

ADDITIONAL COMMENTS

on

Draft Final Remedial Investigation Report

Soil and NAPL Operable Unit

Del Amo Superfund Site

Los Angeles, California

July 28, 2006

1. Section 1.0, Introduction, 2nd paragraph^[d1]: Edit the paragraph and add the subsequent paragraphs as follows,

“The early RI documents were prepared with the understanding that a single RI report would incorporate findings regarding the soil, groundwater and NAPL operable units; however, USEPA subsequently required preparation of a Groundwater RI and separate Soil and NAPL RI. ~~Therefore, portions of the above documents may not be applicable to this Soil and NAPL RI.~~

In 1999, EPA issued the Record of Decision (ROD) for the Dual Site Groundwater Operable Unit. This ROD selected a remedial action for the contaminated groundwater at both the Del Amo and Montrose Chemical Superfund Sites. The ROD specified remedial standards and objectives for the dissolved phase contamination. It also required that a second phase of remedial decision-making be undertaken to evaluate whether and to what degree NAPL would be remediated at the two sites. Therefore, the NAPL remedy selection process is tied intrinsically with the groundwater remedy selection documented in the Dual Site ROD. Because RI work was not complete for the NAPL and soils at the Del Amo Site at the time of the groundwater ROD, EPA required that Shell produce a Groundwater RI Report which documented those elements of the overall RI effort necessary to support the remedy selection process for groundwater. The Groundwater RI Report, authored by Shell, was approved by EPA in 1998.

This Soil and NAPL RI Report is intended to provide the balance of the Remedial Investigation data and analysis completed to date in support of the remedy selection process for the soil and NAPL at the Del Amo Site. Some of the data and analysis previously presented in the Groundwater RI Report is also presented in this report. The Groundwater RI Report, however, is the more comprehensive presentation of information related to the groundwater conditions.

There has also been significant additional data gathering, including groundwater sampling and additional well installation, conducted during the remedial design phase of the groundwater remedy. This work is ongoing as of the date of this report. Some of this new information may be relevant and applicable to the remedy selection process for the Del Amo NAPL and soils. This information is being documented and made publicly available as it is completed. Although this information is not being included in this RI Report, it may nonetheless be utilized in the remedial decision-making process and subsequent remedial design process. Since NAPL provides a

continuous source of contamination to groundwater, data and evaluation of each will always be inextricably related.

[ew2] This RI Report, the Groundwater RI Report, the Record of Decision for the Dual Site Groundwater Operable Unit, the Baseline Groundwater Sampling Report(s), the various data acquisition and modeling documents being prepared as part of the Dual Site Groundwater Remedial Design, and any additional documents which may be prepared to supplement this RI Report at a later date, collectively document the investigation of the nature and extent of contamination for the soil and NAPL operable unit at the Del Amo site [ew3].

~~This Soil and NAPL RI report presents all the data gathered for this operable unit. This includes some data that had been presented in the Groundwater RI report to the extent that such data relates to the characterization of the soil and NAPL at the site, provides basic background information about the site, or was used in the risk assessment for this operable unit. A comprehensive list of previously completed documents pertaining to soil and NAPL conditions at the site is presented in Table 1. All the data from those reports is presented in this RI report, although those documents contain more detailed descriptions of the investigation efforts than does this RI report.~~ [ew4] [d5]

2. Section 11.0, NAPL Areas: Modify this section as specified in the Comment Attachment. [ew6] Comments are inserted at various locations to provide additional explanation, including correlating these changes with the previous comment letter dated 2/2/07. Modifications are shown in TRACK CHANGES (redline/strikeout) mode.
3. Section 14.2, Groundwater, 1st paragraph: [d7] The paragraph states that groundwater data are only relevant to this report to the extent that there may be surface exposures from upward vapor migration. Groundwater data are also relevant to this RI for the purpose of assisting in NAPL identification. Therefore, edit the sentence as follows, “Groundwater data are relevant to this report ~~only~~ to the extent that there may be exposures from upward migration of vapor or as an indicator of potential NAPL occurrence.” [ew8]

Add the following paragraph immediately thereafter: “The Groundwater RI Report, this RI Report, and the remedial design documents discussed in Section 1 collectively document the investigation of the nature and extent of groundwater contamination at the site. The ongoing groundwater remedial design process has included significant data acquisition activities. All of this information is pertinent to the characterization of NAPL at the site.” [ew9]

COMMENT ATTACHMENT

[Edits in TRACK CHANGES mode.]

11.1 NAPL DEFINITION AND MODES OF OCCURRENCE

NAPL refers to contamination that is present in a concentrated liquid phase rather than dissolved in groundwater or adsorbed onto soil. Although NAPL may dissolve into groundwater over time, while present, it is immiscible (incapable of being mixed) with groundwater. NAPL that is less dense than water, ~~and therefore capable of floating on the water table,~~ is referred to as a light non-aqueous phase liquid, or LNAPL. Benzene is an example of a LNAPL. In contrast, NAPL that is denser than water, ~~and therefore capable of sinking through the water table,~~ is referred to as a dense non-aqueous phase liquid (DNAPL). Chlorinated solvents such as TCE ~~and chlorobenzene are examples of DNAPL can form DNAPLs if released to the subsurface in sufficient volume.~~^[j10]

[j11]

With a static water table, LNAPL released to the subsurface in sufficient quantity will generally migrate downward to the water table, where it will float on the water table in the capillary space at the air/water interface. DNAPL released to the subsurface in sufficient quantity will generally migrate downward and continue to sink into the saturated zone. When NAPL encounters low-permeability layers during downward migration, its behavior will depend on several factors including the NAPL's own physical properties, the NAPL saturation when it arrives at the layer, the lithologic properties of the low-permeability layer, the surrounding soil layers, and the layer's water saturation.

NAPL saturation refers to the proportion of the space between soil particles that is occupied by NAPL, as opposed to water (if below the water table) or air/vapor (if above the water table). NAPL at high saturations can collect in pools on top of the water table (if LNAPL) and on perched low-permeability layers (either LNAPL or DNAPL). NAPL at lower saturations can be present in ganglia or "stringers" and can be trapped in discontinuous pore spaces in the soil matrix. NAPL in both forms results in continuous dissolution into groundwater and can result in contamination moving through aquifers both laterally and vertically.

[ew12]

The minimum volume of NAPL that must be present in a sample to trigger the identification or reporting of NAPL is not known to have been established or widely accepted. Even very small releases of NAPL products will result in the presence of NAPL in soil pore spaces that remain until removal through dissolution, volatilization, and degradation processes. Pools of NAPL that accumulate on top of the water table or impermeable layers clearly require the release of substantial volumes of NAPL.^[d13] [ew14]

While LNAPLs ~~and DNAPLs are~~ is commonly visualized as occurring in pools ~~and either~~

floating on top of the water table (LNAPL) or perched on low permeability layers below the water table (DNAPL), there are also other modes of occurrence. It can also be present below the water table, despite the fact that it is lighter than water. This mode of occurrence exists when the water table rises after LNAPL has pooled on top of it. As the groundwater rises, it exerts an upward buoyant force on the LNAPL, but a portion of the LNAPL is held in the submerged pore spaces by capillary forces. Given sufficient increases in groundwater levels, the LNAPL will no longer exist as a floating pool, but within a “smear zone” that corresponds to the amount of rise in the water table. The LNAPL is typically present discontinuously within the smear zone at or near residual saturation levels, meaning that it LNAPL at residual saturation is no longer capable of migrating or flowing under the existing those hydrologic conditions. [ew15] A long-term trend of rising groundwater at the site (see Section 3.3.1) and LNAPL smear-zones (see Section 11.3-4 below) have both been documented at the Del Amo site. This is further discussed below. [ew16]

11.2 NAPL IDENTIFICATION INVESTIGATION [d17]

The minimum volume of NAPL that must be present in a sample to trigger the identification or reporting of NAPL is not known to have been established or widely accepted. Even very small releases of NAPL products will result in the presence of NAPL in soil pore spaces that remain until removal through dissolution, volatilization, and degradation processes. Pools of NAPL that accumulate on top of the water table or impermeable layers clearly require the release of substantial volumes of NAPL. [j18]

The NAPL investigation strategy began with investigating an area of known NAPL existence – well #MW20 and vicinity, where floating NAPL product was found during sampling of a groundwater well. The NAPL investigation then examined groundwater chemical data from the water table zone, and soil and soil gas data from shallow soil (and some deep soil locations), to identify other areas of potential NAPL existence. Further sampling and testing was then performed in the areas with the highest potential for NAPL existence during the NAPL Screening effort, to characterize the properties of the NAPL. [d19]

Multiple lines of evidence were used during this remedial investigation to identify locations where NAPL may be present in the subsurface at the former Del Amo plant. [ew20] This was necessary due to the challenging nature of NAPL characterization. One of the most significant challenges is NAPL’s heterogeneity in the subsurface. It is important to note the following issues caused by its heterogeneity when discussing the NAPL-related data collected during the RI.

The distribution of NAPL saturation at most sites (the Del Amo site included) is extremely heterogeneous. NAPL saturation refers to the proportion of the space between soil particles that is occupied by NAPL, as opposed to water (if below the water table) or air/vapor (if above the water table). NAPL can be present in thin stringers and ganglia, and the absence of NAPL in a boring at one location does not indicate the absence of

NAPL in the vicinity. Likewise, NAPL can be present at relatively low saturations in one location and at higher saturations in close proximity.

One effect of such heterogeneity is that soil matrix samples (sorbed phase) collected from a boring may not always correlate well with physical NAPL identification tests (such as Dean Stark, ROST, or jar testing – discussed below). Such discrepancies between physical NAPL tests and soil samples do not imply that one or the other method is producing spurious results. Rather, using multiple lines of evidence from several data sources and tests is generally prudent. If any of the methods provides positive results, it could indicate the presence of NAPL at the site. Due to these complications, deriving a detailed, accurate, three-dimensional map of NAPL saturations is generally impracticable.

[ew21] In light of the above limitations, two points should be recognized with respect to the NAPL characterization at the Del Amo site:

1. The data is not sufficient to determine the precise NAPL distribution nor to conclude that NAPL is present at all locations at the former plant property at the saturations that were measured or inferred in the characterization; and
2. Physical NAPL identification methods (such as Dean Stark, ROST, or jar testing) were applied in only four of the ten areas of potential NAPL occurrence. [ew22] An inference was made that NAPL characteristics were similar at the other areas.

Within these limitations, the data collected during the NAPL characterization work provides useful insights and improves our understanding of the NAPL areas and their characteristics. The methods are discussed below.

An evaluation was performed to identify potential NAPL areas. The MW-20 area was not identified as part of this evaluation; it was identified by finding floating NAPL product inside the well during groundwater sampling activities. The evaluation for other potential NAPL areas consisted of comparing several lines of evidence, including the nature and location of historical facilities and analytical results for soil, soil gas, and groundwater. The evaluation resulted in the identification of twelve potential areas, shown on Figure 58¹. These areas were further screened to identify the three with the highest likelihood of having NAPL present (D&M, 1997a). The three areas identified were areas #6 (former tank farm area), #11 (benzene pipeline area), and #12 (former laboratory and underground pipelines area).

The physical mMethods of evaluating the presence of NAPL at the Del Amo site during the MW-20 investigation and the NAPL Screening efforts included use of the rapid optical scanning tool (ROST), visual observation under visible light and ultraviolet light,

¹ Originally presented in “Phase II Remedial Investigation Groundwater Contamination Source Areas Data Summary and Proposed Target Areas, Del Amo Study Area, Los Angeles, California,” Dames & Moore, November 17, 1995.

Sudan Red testing, laboratory measurements of hydrocarbon saturation (Dean Stark testing), and a relatively sensitive observational technique referred to as “jar testing”.

The ROST technique was used to develop qualitative information about hydrocarbon distribution within the vadose and saturated zones. This technique consisted of inserting into the subsurface a probe that emitted a laser, which stimulated the soil matrix to emit fluorescence. The intensity of the fluorescence indicated intervals containing hydrocarbons. Six such tests were conducted in Area 6 and three each in areas 11 and 12. Cone Penetrometer Tests were conducted along with the ROST profiles to collect lithologic data. Based on the ROST results, one continuous soil core in each of the three areas was taken. The continuous soil cores were taken adjacent to the location of the ROST profile for each area that exhibited the greatest magnitude and vertical distribution of hydrocarbons. Shallow soil samples were also taken adjacent to the soil cores for chemical analysis. The continuous soil cores were then evaluated visually by: (1) observing and photographing them under visible light; (2) observing and photographing under ultraviolet light; (3) developing geologic logs; and (4) jar testing. Based on the visual testing, samples from the cores were selected for hydrocarbon saturation testing.

[ew23]

This ~~latter~~ jar testing method consisted of carefully disaggregating an approximately 2-inch section of soil core into a small volume of water within a jar. If present, NAPL was released from the soil core and rose to the surface of the water. Using a light reflecting off the water surface toward the viewer, any sheen or minute droplets of NAPL could be observed using this technique. Very small NAPL droplets were only visible for a few seconds or less before dissolving into the water in some cases. Results presented in Summary of NAPL Screening Investigations report (D&M, 1998b) indicate that laboratory measured NAPL saturations of 1% and less were consistently observed through jar testing. Furthermore, traces of NAPL were often observed when laboratory-derived hydrocarbon saturation values were below measurable limits. Because jar testing is performed on small soil samples relative to the usual large variations in NAPL distribution, such findings are not unexpected. These tests at Del Amo did indicate that NAPL was present in the samples and thus, in the subsurface.

While subjective, observational data suggest the jar testing technique is likely more sensitive than the laboratory measurements of hydrocarbon saturation (Dean Stark testing) in detecting the presence of NAPL. Data presented in Appendix C of the NAPL Screening Investigations report (D&M, 1998b) further indicate that soil containing observable traces of NAPL does not always exhibit high contaminant concentrations, as reported by laboratory analyses. For example, hydrocarbon saturation testing, NAPL jar testing, and VOC analyses were completed for a section of soil core where a ROST profile indicated hydrocarbon was present at boring SBL0125 from an area in the butadiene plancor. Jar testing indicated the presence of NAPL and laboratory measured hydrocarbon saturation values ranged from 0.13 to 2.24%.

However, VOC/SVOC testing indicated the presence of only modest concentrations of contaminants: ethylbenzene at 37 mg/kg, sec-butylbenzene at 1 mg/kg, and dibutylphthalate at 0.33 mg/kg. Although it is conceivable that other non-target

compounds were present at much higher concentrations, significant unknown peaks on the laboratory chromatograph were not noted, and the rubber plant facilities that were formerly present in the area were benzene and ethylbenzene storage tanks. Furthermore, samples with higher hydrocarbon saturation values (for example, 13.69% for the sample from a depth of 27 feet at boring SBL0123 at source area #12) show the expected substantial increases in contaminant concentrations (total BTEX = 153 mg/kg, and unidentified C10-C23 compounds at 3,720 mg/kg) that are more typically associated with NAPL presence. The above discussion is intended to provide an appropriate context for subsequent summaries of locations where NAPL is present or suspected of being present at the Del Amo site. Recognizing the limitations in NAPL investigations discussed above~~In summary~~, the NAPL screening investigation and MW-20 Pilot Program results show that can be summarized as follows:

(1) Very small volumes of NAPL within ~~the~~ soil matrix at some locations were observed to have~~can have~~ measurable hydrocarbon saturations and/or can be observed with the proper technique.

(2) Sorbed phase cContaminant concentrations can be were observed at relatively low levels (tens of mg/kg or less) for in soil containing NAPL at trace or low saturation levels (several percent or less).

(3) Where present within the vadose zone ~~and~~ at residual saturations, NAPL is really no different thanvery similar to soil contamination, and is typically referred to and handled as such within the environmental industry. Such vadose zone soil contamination is known to be present at multiple areas at the Del Amo site.

(4) LNAPL is discontinuously present within a smear zone beneath the water table at some plant site locations. This mode of occurrence results where a past release has migrated to the water table and is subsequently affected by a rising water table. Normally, benzene is a light NAPL and will float on the water table. However, the water table in the plant site area has risen continually since adjudication of the Los Angeles basin in the 1960s. This resulted in the water table overtaking and trapping the floating NAPL below the water table.

(5) Pools of LNAPL floating on top of the water table or ~~DNAPL perched~~ on top of impermeable layers perched zones below the water table have not been observed and are not known to be present at the plant site. This is consistent with the fact that releases from the plant site occurred at a time when the water table was lower. Floating NAPL had been observed in monitoring well MW-20 but not in any others. In a pilot extraction test in the MFW-20 area, very little NAPL was recovered over a 6-month period.

(56) NAPL at the plant site appears to be largely presentwas observed at residual saturation in both the vadose and saturated zones. Residual saturation, meaning means it is no longer capable of migrating under natural conditions. NAPL at residual

~~saturation exists in both the vadose and saturated zones at the Del Amo site.~~
Residual saturation levels were found to correspond with saturations of 16% (fine to medium sand) to 50% (silt and clay) in soil samples from the MW-20 area (URS, 2003a).

[ew24] Considering the above findings ~~and recognizing the limitations of the investigation~~ [ew25], plant site areas have been separated into four categories:

(A) **Areas where NAPL has not been observed or measured and is not suspected** based on relatively low dissolved phase contaminant concentrations in groundwater.

(B) **Areas where NAPL is potentially present, but has never been observed or measured.** NAPL is judged to be “potentially present” based on dissolved concentrations at a significant fraction of applicable solubility limits (5% for LNAPL components, [j26] 1% for DNAPL components) and associations with former or existing facilities where VOCs are known or likely to have been used, stored, or disposed. Further discussion of these areas is presented in Section 11.3 below. ~~Note that the 5% saturation criterion is not considered a stand-alone criterion for the presence of NAPL; rather, its use in conjunction with the other characterization methods used is considered appropriate for this site.~~ [ew27]

(C) **Areas where NAPL has been directly observed** [ew28] ~~is present, but~~ at residual (non-mobile) saturations, as evident from soil core jar testing, laboratory measurements of hydrocarbon saturations, and the lack of any direct observation of NAPL accumulation at groundwater monitoring locations. Saturations of less than 16% are inferred to be indicative of residual levels, based on data presented in the MW-20 Pilot Program (URS, 2003a). All areas meeting these criteria lie entirely within a larger, potential NAPL area, as described in “B” above. Further discussion of residual saturation NAPL areas is presented in Section 11.4 below.

(D) **Areas where NAPL accumulations have been observed or measured within a monitoring well or temporary well point.** This occurrence is distinguished from categories A, B and C above in that remediation by direct NAPL removal techniques (NAPL pumping or bailing) will be evaluated as part of the FS process. NAPL accumulation areas are discussed in further detail in Section 11.5 below.

Rubber plant site areas corresponding to the categories B, C, and D above are indicated on Figure 57. NAPL is known to be present at saturations sufficient to enter a well ~~only~~ at the MW-20 area near the western plant site boundary, and in the vicinity of the former butadiene plant or laboratory and adjacent underground pipelines near the eastern plant site boundary ~~in the vicinity of the former butadiene plant or laboratory and adjacent underground pipelines~~. NAPL accumulations observed at the latter area were very small (less than ¼ inch within a sample bailer).

The salient aspects of each NAPL area are summarized below. Comprehensive NAPL

saturation (Dean Stark analysis) data are presented in Appendix F and a summary of the data is presented in Table 22. Hydrocarbon logs, including results of visual NAPL identification (jar testing, observation under visual and ultraviolet light), ROST measurements, and CPT measurements for each of the NAPL areas investigated are also included in Appendix F. Soil, soil gas, and groundwater data can be found in tables 11, 13, 16, and 18, and in Appendix B. In addition, Appendix D contains parcel-specific summaries of all the environmental data. [ew29] Further details regarding the individual NAPL investigation areas are available within the MW-20 Focused Investigation report (D&M, 1993b), the NAPL Screening Investigation report (D&M, 1998b) and the MW-20 Pilot Program report (URS, 2003a). Other documents containing information pertinent to the NAPL investigation include the Joint Groundwater Remedial Investigation, the Dual Site Groundwater Operable Unit Record of Decision, and more recent documents being produced in association with the Dual Site Groundwater Remedial Design effort. [ew30]

11.3 Note Regarding Ongoing Data Collection

These findings and conclusions are based, in part, on groundwater data through 2000. Subsequent groundwater monitoring data has not shown any change significant enough to alter the conclusions of this NAPL analysis. However, additional data pertinent to this analysis was obtained during well installation activities in the vicinity of 19785 Pacific Gateway (parcel #7341-34-57), as discussed below. Any further refinement of the extent of the NAPL, based on subsequent data, can be madereflected in the feasibility study or during the remedial design phase. Note that some new groundwater wells have been installed since 2000, located in the vicinity of 19785 Pacific Gateway (parcel #7351-34-57). [d31]

In 2006, monitoring well installation activities in support of the remedial design for the Dual Site groundwater remedy found unexpected high concentrations of benzene in the Middle Bellflower "C" Sand (approximately 160,000 µg/l in new monitoring well SWL0065) and in the Gage Aquifer (approximately 500 µg/l in new monitoring well SWL0063). These locations underlie previously-identified benzene concentrations of almost 300,000 µg/l (temporary well point CWL0012) in the water table stratigraphic units. All of these wells are located near or directly under the former ethylbenzene production units in the southwest portion of the styrene plant, in which large quantities of benzene were used. These locations are also a short distance east of the former Del Amo plant tank farm, which stored benzene and other raw materials in large above-ground storage tanks.

The high concentration of benzene in well SWL0065 (MBFC) amounts to approximately 15-20% of benzene's aqueous solubility, which is consistent with the presence of benzene NAPL. Previously, NAPL in that area was thought to have been limited to the Upper Bellflower and the Middle Bellflower "B" Sand, the two fine-grained units in which the water table occurs. While the presence of 500 µg/l benzene in well SWL0063 in the Gage Aquifer does not suggest that NAPL is present in the underlying Gage Aquifer, it does suggest a significant downward migration of dissolved phase contamination emanating from the NAPL in that vicinity.

The significance of this finding with regard to the groundwater remedial design was being evaluated at the time of this writing. Its significance will also be a consideration in the NAPL Feasibility Study. The Dual Site Groundwater ROD determined that benzene in the water table units appeared to be contained by intrinsic biodegradation processes. This biodegradation exists in the water table units because of the aerobic environment in these units. However, the deeper MBFC and Gage aquifers have different characteristics. These units are more anaerobic, display higher hydraulic conductivities, are more subject to downward pressure gradients, and lie closer to aquifers currently used for domestic water supplies.

The groundwater remedial design work mentioned above is ongoing and may reveal additional information pertinent to the NAPL Feasibility Study and the related remedy selection process. Any such information will be considered in that process in addition to the information in this report. New information can also be utilized during the remedial design phase for the Soil & NAPL Operable Unit.

[ew32]

11.3.4 POTENTIAL LNAPL AND DNAPL AREAS

Areas where LNAPL is potentially present (but has not been observed or measured) were identified on the basis of dissolved concentrations at a significant fraction of applicable solubility limits (5% or more of saturation) and associations with former or existing facilities where the chemicals of concern are known or likely to have been used, stored, or disposed. LNAPL components detected at concentrations in excess of the 5% criteria at plant site monitoring locations are limited to benzene and ethylbenzene.

NAPL is expected to be present in only a small percentage of the area where dissolved concentrations exceed 5% of saturation since concentrations immediately adjacent to NAPL would be at or near saturation and decrease with distance through diffusion, dispersion and other natural attenuation processes. The 5% criteria is somewhat subjective, but is judged to be conservative while allowing for sampling locations that may not be ideally located with respect to where the NAPL actually exists. Due to retention within soil pore spaces, NAPL is also most likely to be found in close proximity to its original release point. Therefore, while the area where water table concentrations exceeded 5% of saturation forms the basis for identifying the potential presence of LNAPL, the most likely location and origin of the potential LNAPL are refined through knowledge of former facility locations, locations of groundwater concentration maxima and NAPL screening investigation data.

Areas where DNAPL is potentially present (but has not been observed or measured) were evaluated similarly to LNAPL, except that a more conservative criterion of 1% of saturation was applied for dissolved concentrations. This criterion is appropriate in view of the potential for DNAPL component concentrations to increase with depth, and is consistent with USEPA guidance (USEPA, 1992a).

Table 23 and Figure 57 summarize the areas at which dissolved VOCs are found at concentrations in excess of the potential LNAPL and DNAPL solubility criteria described above. An area of potential LNAPL surrounds each of the areas of confirmed LNAPL, as

would be expected from the above criteria. The area of potential NAPL in the styrene plancor extends to the vicinity of additional former plant facilities, including a styrene finishing/benzene purification unit, two ethylbenzene production units, and utility storage tanks. Investigations to further evaluate the potential presence of NAPL at these facilities have not been conducted based on conditions at confirmed NAPL areas indicating that the volume of free product that can be recovered, if any, is extremely limited. Access to the vicinity of these former facilities is also limited due to the current building configurations. The remaining area of potential LNAPL is associated with the Waste Pit Area, for which a ROD has been previously issued.

DNAPL components present at concentrations in excess of the 1% of solubility criteria at one or more plant site monitoring locations include chlorobenzene, PCE and TCE. Plant site monitoring locations where dissolved concentrations in excess of the DNAPL screening occur are limited to monitoring wells XMW-13 (chlorobenzene) and PZL0016 (PCE and TCE). Well XMW-13 is located in the southwestern corner of the plant site, while PZL0016 is located further north, along the western plant site boundary (Figure 54). Both wells lie adjacent to, or near, offsite facilities that are known source areas for the compounds of concern. Chlorobenzene ~~is (present at XMW-13).~~ Chlorobenzene is also [d33] associated with the Montrose superfund site, and is known to be present in DNAPL at that site (USEPA, 1998). TCE and PCE are associated with the American Polystyrene Corporation (formerly AMOCO Chemical Corporation) and PACCAR Inc. (formerly Trico Industries) properties, which are both currently being investigated under the oversight of the California Regional Water Quality Control Board. A summary of available, non-RI groundwater data collected by other investigators showing dissolved TCE and PCE concentrations of up to 34,000 micrograms per liter ($\mu\text{g/l}$) and 19,000 $\mu\text{g/l}$ respectively at the PACCAR property was submitted to USEPA in a November 20, 2003 memorandum from URS (URS, 2003b).

11.4.5 AREAS OF RESIDUAL LNAPL

11.4.5.1 Styrene Plancor - VOC Tank Farm LNAPL

The LNAPL southeast from the MW-20 area was only observed at trace amounts, preventing collection and analysis of a NAPL sample to directly determine its composition. However, laboratory results for shallow soil samples (boring SBL0125), both shallow and deep soil gas samples (locations SGL0036 and SGL0034, among others) and groundwater (water table monitoring well XMW-21) from the area collectively indicate the NAPL is likely composed of benzene and ethylbenzene. The NAPL is inferred to be associated with releases from the former aboveground VOC storage tanks that were part of the tank farm near the western margin of the styrene plancor, as shown on Figure 57.

ROST profiles for the area show a hydrocarbon signature that is greatly reduced relative to other NAPL areas, and that is almost entirely limited to the vadose zone. Jar testing observations and hydrocarbon saturation tests were consistent with the ROST findings, and show the maximum hydrocarbon at approximately 10 to 14 feet bgs at SBL0125. The maximum hydrocarbon saturation in this interval was 2.24%, while laboratory VOC data

indicate an ethylbenzene concentration of 37 mg/kg (screening criteria = 8.9 mg/kg). Trace indications of hydrocarbon were observed throughout much of the remainder of the vadose zone, mostly at non-detectable levels of hydrocarbon saturation. Trace NAPL occurrences are much less frequent within the saturated zone, but continue sporadically to near the maximum depth of the soil boring at 90 feet bgs. NAPL saturation data range from 0 to 2.2% (Table 22), with an average value of 0.4%. The lateral extent of the LNAPL is inferred to be limited to the immediate vicinity of the VOC storage tanks. ROST, hydrocarbon saturation, and observational NAPL testing data from boring SBL0125 in the tank farm area are collectively summarized in a hydrocarbon log in Appendix F.

11.45.2 Butadiene Plancor - Benzene Feedstock Pipeline LNAPL

The LNAPL associated with the former benzene feedstock pipeline is known to be present based on soil core jar-testing observations and laboratory hydrocarbon saturation measurements. NAPL has not been observed in quantities sufficient to permit exclusive sampling and laboratory analysis. The NAPL is inferred to be composed primarily of benzene based on analyses of numerous soil and groundwater samples completed as part of RI and non-RI investigations. Portions of the soil data indicate that considerably lower quantities of toluene, ethylbenzene, and xylenes may also be present. The NAPL most likely originates from a leak in the pipeline that was used during the operational period of the rubber plant. The approximate location of the pipeline in the vicinity of the LNAPL is indicated on Figure 57.

ROST profiles from the area show an intermittent hydrocarbon distribution from near surface to approximately 85 feet bgs. Pronounced hydrocarbon signatures from 10 to 20 feet bgs within the vadose zone, and from approximately 50 to 75 feet bgs within the saturated zone, are apparent in two of the three ROST profiles for the area. While the lateral extent of the LNAPL has not been fully evaluated, the abrupt attenuation of dissolved benzene concentrations in the area suggests that the LNAPL is limited to the immediate vicinity of the benzene pipeline source area. A hydrocarbon log summarizing ROST, hydrocarbon saturation, and observational NAPL testing data for boring SBL0124 in the benzene feedstock pipeline is presented in Appendix F.

11.5.6 LNAPL ACCUMULATION AREAS

11.56.1 MW-20 LNAPL Accumulation

The MW-20 LNAPL is composed almost entirely (>95%) of benzene and extends laterally over an area of approximately 19,500 square feet, based on field and laboratory observations from monitoring wells and soil borings. The exhaustive investigation of conditions in this area completed for the MW-20 Pilot Program (URS, 2003a) and other investigations confirms that the LNAPL is present in only a limited portion of the “5% of solubility” area shown on Figure 57. Measurable accumulations of LNAPL have been consistently observed at monitoring wells XMW-20, SWL0001, and SWL0032 in the area during groundwater monitoring events completed on an at least annual basis between 1993 and 2000.

Observational and hydrocarbon saturation data for the MW-20 area indicate LNAPL at the MW-20 area is discontinuously present within an approximately 30-foot smear zone extending downward from the water table, from approximately 60 to 90 feet bgs. Laboratory NAPL saturation values range from <0.1 to 30%. (Table 22).

A pilot hydraulic extraction program was completed within the MW-20 NAPL area to evaluate the feasibility of NAPL recovery, as described within the MW-20 Pilot Program report (URS, 2003a). Approximately 1.2 million gallons of groundwater were pumped from a portion of the NAPL area over a period of seven months. Separate phase NAPL recovery during this period was limited to approximately 36 gallons, while an additional 1,420 gallons of benzene were recovered in the dissolved phase. ~~Whereas soil cores are limited in their ability to define NAPL distributions (as discussed earlier), pre- and post-extraction soil core evaluation indicates that hydraulic extraction did not result in any significant reduction in the subsurface NAPL distribution. It was further concluded based on experimentally derived equations published by independent researchers (Geller and Hunt, 1993) that even if 99% of the LNAPL present were to be removed, the remaining LNAPL would be present for in excess of 100 years. The MW 20 Pilot Program Report documents that hydraulic extraction was not judged to be an effective NAPL remediation method based on the lack of significant reductions in NAPL distribution and the inferred longevity of the NAPL.~~^[d34] ^[ew35]

11.56.2 Butadiene Plancor Laboratory LNAPL Accumulation

Identification of the butadiene plancor laboratory LNAPL accumulation is based on one-time (September 1997) observation of a thin (<1/4-inch) layer of NAPL in groundwater samples collected from near the water table (between 40 and 43 feet bgs) at temporary well points CWL0051 and CWL0054. The volume of LNAPL present was insufficient for sampling and direct laboratory analysis; therefore, the LNAPL composition was inferred from groundwater (temporary well point CWL0051) and soil boring (SBL0123) samples. High concentrations of benzene (260,000 µg/l), toluene (75,000 µg/l), ethylbenzene (4,000 µg/l), xylenes (22,000 µg/l), and styrene (17,000 µg/l) were detected in groundwater and are therefore inferred to be components of the LNAPL. The LNAPL may also include many additional compounds detected in soil core, including cyclohexane, naphthalene, 1,2,4-trimethylbenzene, 2-hexanone, methylisobutylketone, sec-butylketone, sec-butylbenzene, phenanthrene, pyrene, dimethylphthalate, and numerous unidentified compounds in the C10-C23 range. The lack of detection of these compounds in the groundwater samples that contained the visible LNAPL is likely due to elevated detection limits and/or low solubilities.

The possibility of butadiene in the NAPL and surrounding groundwater cannot be ruled out; however, butadiene is a gas under standard conditions and thus would rapidly volatilize from solutions released to the environment. For this reason, butadiene is unlikely to be a significant component of the LNAPL. The potential presence of butadiene in groundwater was evaluated in 2000 using a specially developed laboratory analytical method to achieve detection limits at or near tap water PRG values (there are no MCLs for butadiene). Data from the evaluation was subsequently rejected based on

USEPA's quality assurance concerns regarding the laboratory method, and is therefore excluded from the RI database.

The origin of the LNAPL is not known with certainty. The former rubber plant facilities closest to the area of known LNAPL are the butadiene plant laboratory building and multiple underground pipelines, but details regarding the use of these facilities and their waste products are not known.

A hydrocarbon log for boring SBL0123 presented in Appendix F summarizes ROST, observational NAPL data, and laboratory derived hydrocarbon saturation data in the vicinity of the former butadiene plant laboratory. These data indicate the LNAPL is discontinuously present in both the vadose and saturated zones, extending to a depth of at least 85 feet bgs. NAPL saturations range from 0 to 13.7%. The lateral extent of residual LNAPL is interpreted to be a fraction of the local "5% of solubility" area shown on Figure 57.