

FUDS



Mel Carnahan, Governor • David A. Shorr, Director

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF ENVIRONMENTAL QUALITY —
P.O. Box 176 Jefferson City, MO 65102-0176

April 29, 1996

Ms. Jana Ryan
(CEMRK-EP-EC)
U.S. Army Corps of Engineers
Kansas City District
700 Federal Building
601 East 12th Street
Kansas City MO 64108-2896

Dear Ms. Ryan:

Attached please find comments generated from a review of the "Workplan, Richards Gebaur Air Force Base, Belton MO" (Revised October 1995). Ms. Diana Travis with our Division of Geology and Land Survey has provided both general and specific comments on the document.

It is my understanding that Mr. Glenn Golson, our previous project manager, provided limited comments on the draft document September 22, 1995; however, we did not receive responses or the revised document until one was provided to Ms. Travis in April 1996. Although some field efforts have been initiated under this workplan, I ask that you review and respond to the comments provided.

Both Ms. Travis and I will be available following the Base Closure Team meeting at Richards-Gebaur, scheduled for Tuesday, May 2nd, to review and clarify any issues of concern. If you have any questions or will not be available at that time please contact me at (573) 751-3176 or Ms. Travis at (573) 368-2111.

Sincerely,

Robert Geller
Robert Geller, Chief
Federal Facilities Section

RG:le

c: Mark Esch, Richards Gebaur
Bob Koke, EPA
Diana Travis, DGLS
Joe Boland, ESP

RECEIVED

96-1002 13:10



Mel Carnahan, Governor • David A. Shorr, Director

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF GEOLOGY AND LAND SURVEY

P.O. Box 250 111 Fairgrounds Rd. Rolla, MO 65402-0250

(573) 368-2100

FAX (573) 368-2111

RECEIVED
APR 24 1996

MEMORANDUM

HAZARDOUS WASTE PROGRAM
MISSOURI DEPARTMENT OF
NATURAL RESOURCES

DATE: April 22, 1996

TO: Robert Geller, Chief, Federal Facilities Section, HWP, DNR

FROM: Diana Travis, Geologist, Environmental Geology Section, GSP, DGLS

SUBJECT: Work Plan, Richards Gebaur Air Force Base, Belton, Missouri (Revised October 1995)
Record of Telephone Conversation between Corps of Engineers (COE) (Jana Ryan, Jerry Montgomery, and Brad Brink) and DGLS (Diana Travis), April 10, 1996
Record of Telephone Conversation between COE (Jerry Montgomery) and DGLS (Diana Travis), April 17, 1996
Investigation Results from the "West Burn Area" (Report of Laboratory Analysis, September 03, 1993; Certificate of Analysis, 03 December 1993; Telephone Conversation Record, 1-26-94; Specifications for Waste Oil Removal, Richards-Gebaur Air Force Base, 2 February 1994; Laboratory Results, 9/22/94; and HTW Drilling Logs, 4/25/95)
Previous Comment Letter from Former State Project Manager (Comments Geophysical Plan, Monitoring Well Plan, Site Safety and Health Plan and Chemical Data Acquisition Plan dated November 1994, May 11, 1995; and Work Plan for Richards-Gebaur AFB, Belton, MO, September 22, 1995)

LOCATION: Belton 7.5-Minute Quadrangle, Jackson and Cass Counties, Missouri

The Division of Geology and Land Survey (DGLS) has completed a review of the subject documents. The following comments are provided for your consideration.

GENERAL COMMENTS

Results of Previous Work

1. Results of all field work, including soil gas surveys and geophysical surveys, performed at the Richards Gebaur Formerly Utilized Defense Sites (FUDS) should be provided.

2. It should be noted that previous "background" soil samples at both the South Landfill (Figure 2-7) and the Northeast Landfill (Figure 2-8) were found to be contaminated. Therefore, background sampling locations for this study should be chosen carefully.

Monitoring Wells

3. According to Section 5.5.2.1 (Page 5-17), the exact placement of monitoring wells at the Richards Gebaur FUDS is subject to the results of initial groundwater sampling. Although placement of groundwater monitoring wells is currently being discussed, initial groundwater sampling has apparently not yet been conducted. Please explain.
4. The well drilling and installation subcontractor should be identified. It should be noted that this subcontractor must possess a valid monitoring well installation contractor's permit issued by the State of Missouri, Department of Natural Resources, Division of Geology and Land Survey.
5. According to the text (Page 5-18, Section 5.5.3, Paragraph 2), "The design and construction of monitoring wells will follow as closely as practical to the design for properly installed, low-yield domestic water supply wells." It should be noted that the design and construction of monitoring wells must follow the appropriate guidelines set forth in the *Missouri Well Construction Rules*. These guidelines are not similar to those for domestic wells.
6. Monitoring wells will reportedly conform with the minimum requirements set forth in the Missouri Well Construction Rules dated December 1994. It should be noted that the latest version of the *Missouri Well Construction Rules* is dated March 1995.
7. Figure 5-4 contains a diagram illustrating the details of monitoring well construction. The following points should be noted:

- * The protective casing must extend from below frost level, but at least 3 feet below the surface to at least 2 inches above the riser pipe.
- * The pad must be composed of concrete or neat cement (not gravel) and must also be placed from below frost level but at least 3 feet below the surface.
- * Use of a 0.010-inch screen should be accompanied by the use of 20-40 (as opposed to 10-20) sand. Please see Section 5.5.3.8 (Page 5-21).
- * According to the footnote, dimensions of well components are subject to change in very shallow wells. It should be noted that, if the well is greater than 10 feet deep, the dimensions must conform to the *Missouri Well Construction Rules*, or a variance from those rules must be approved by the Missouri Department of Natural Resources, Division of Geology and Land Survey.

8. According to Section 5.5.3.13, the bottom of the protective casing will be cemented 2 feet below grade. See comment 7.
9. According to Section 5.5.6, Paragraph 3 (Page 5-29), two times the water used/lost during drilling and well installation will be removed from the well. The *Missouri Well Construction Rules* require that the volume of fluid removed during development be a multiplier (3 times minimum) of the amount of fluid lost to the formation during drilling or added to the well during development.
10. According to Section 5.5.3.1.4 (Page 5-23), "A ground elevation to the nearest 0.1 foot shall be obtained at each well." However, this section goes on to state that the elevation of the monitoring well shall reference the north point on the top of the casing and shall be surveyed to the nearest 0.01 foot. Please explain this apparent discrepancy.
11. According to Section 5.5.2.2, Paragraph 1 (Page 5-17), monitoring wells at Richards Gebaur are expected to be shallow wells which monitor the uppermost "alluvial" aquifer. The term "alluvial aquifer" refers to a water-bearing stream deposit. Monitoring wells at Richards Gebaur will, most likely, penetrate residual, rather than alluvial, materials. The residuum at Richards Gebaur is expected to be comprised of silts and clays which formed from in-situ weathering of underlying limestone and shale (see Page 5-18, Section 5.5.3, Paragraph 1).
12. The top of the well screen is to be positioned above the water table to account for seasonal fluctuations in water levels (Page 5-20, Section 5.3.3.5). Although positioning of the screen in this manner is appropriate where the chemical of concern is an aqueous phase liquid or a light non-aqueous phase liquid, the most effective placement of the well screen for the detection of chlorinated solvents (dense non-aqueous liquids) would likely be directly above a relatively impermeable subsurface layer.

Decontamination Procedures

13. Sections 5.5.5 (Page 5-28) and 5.9 (Page 5-45) both describe decontamination procedures for drilling equipment. However, the decontamination procedures described in Section 5.9 are more extensive than those described in Section 5.5.5. For example, Section 5.9 specifies that the drilling equipment be scrubbed with a lab-grade, phosphate-free detergent, rinsed with potable water, and allowed to air dry, while Section 5.5.5 mentions only the steam-cleaning of drilling equipment. Please explain.

SPECIFIC COMMENTS

South Landfill

14. The "General Location of South Landfill" is delineated by a hachured boundary on the map of Figure 2-7. The hachured boundary is, in turn, surrounded by an unlabeled, solid boundary. The significance of the solid boundary is unclear. In addition, the map of Figure 2-10 depicts a region referred to as the "Approximate Extent of Rubble Area" in the vicinity of the South Landfill. However, the area delineated in Figure 2-10 does not precisely correspond to either of the areas delineated in Figure 2-7. Although the text mentions that Rust Environment & Infrastructure discovered discarded materials in the area between the Man Made Lake and the previously-defined landfill and between the landfill and Bales Avenue during a field visit conducted in 1993, a complete description of the entire extent of the South Landfill should be provided.
15. According to Page 2-17, the South Landfill is underlain by the Lane Shale, which may effectively restrict vertical movement of groundwater. However, according to the geologic map of Figure 2-2, the South Landfill is underlain by the Wyandotte Formation.
16. The South Landfill is reportedly located on a thin cover of unconsolidated silts and clays, which is less than 8 feet thick (Page 2-13, Section 2.7, Paragraph 2). However, in some areas of the South Landfill, the depth of rubble piles was found to be 12 feet. Please provide additional discussion regarding the relative thicknesses of the unconsolidated material and the fill material.
17. According to Section 3.2, Page 3-12, previously collected soil and water samples show minimal contamination at the South Landfill. However, it should be noted that the only soil sample previously collected was from an upgradient location (see Figure 2-7 and Section 2.7, Page 2-17).
18. The solid boundary depicted on the map of Figure 2-7 serves as the limit of extent for both the geophysical survey (Figure 5-3) and the soil gas survey (Figure 5-9). The limits of such surveys should extend beyond the known limits of the fill material. See comment 14.
19. According to the Work Plan, a geophysical survey was to be conducted at the South Landfill in order to determine the extent of the fill material (Pages 3-13, 5-6, and 5-13). However, according to the COE (telephone conversation with DGLS on April 10, 1996), no geophysical survey was conducted at the South Landfill. Please explain.
20. According to the COE (telephone conversation with DGLS on April 10, 1996), the results of the soil gas survey indicated a "large anomaly" near the sewer line at the south end of the South Landfill. Please elaborate on what is known about the sewer line.

21. According to the COE (telephone conversation with DGLS on April 10, 1996), several groundwater screening samples were collected at the South Landfill. The sampling results should be provided.
22. Natural surface drainage ditches reportedly flow through the South Landfill into Scope Creek (Page 2-16, Paragraph 3). The locations of these ditches should be provided.
23. The Work Plan outlines surface water/sediment sampling at six locations near the South Landfill. However, according to the COE (telephone conversation with DGLS on April 10, 1996), several of the seeps previously designated for sampling are now dry. Therefore, the COE plans to sample alternate site(s). The number and location(s) of the sampling site(s) should be provided.
24. The COE is planning to install four monitoring wells at the South Landfill site--one background well, one side-gradient well, and two downgradient wells (per telephone conversation with DGLS on April 10, 1996). The locations of these wells should be provided.
25. "Wastes of concern" disposed at the South Landfill were excess paints, thinners, and strippers and spent solvents and oils (Page 2-16, Paragraph 4). Please explain the inclusion of cyanide as one of the analytes for surface water, sediment, and groundwater at the South Landfill (Page 3-13, Paragraph 1 and Table 5-2).

Northeast Landfill

26. Contamination was detected in groundwater and soil at the Northeast Landfill during previous investigations (Pages 2-19 to 2-20, Section 2.8, Paragraph 6). The specific locations of these detections should be provided.
27. Ecology & Environment, Inc. (E&E) reportedly installed five monitoring wells (MW-1, MW-2, MW-3, MW-5, and MW-6) at the Northeast Landfill site in 1986 (Page 2-19, Paragraph 4 and Figure 2-8). It is unclear whether a sixth well (MW-4) was ever installed. Please explain..
28. The Work Plan outlines surface water/sediment sampling at four locations along Scope Creek, to the south of the Northeast Landfill. However, the COE (per telephone conversation with DGLS on April 10, 1996) has proposed that the surface water/sediment sampling locations designated in the Work Plan be replaced by surface water/sediment sampling locations along the drainage ditch which runs east to west just south of the landfill (north of both Scope Creek and 151st Street). The location of the drainage ditch as well as the number and location(s) of the proposed sampling site(s) should be provided

29. Six monitoring wells have been installed in the vicinity of the Northeast Landfill (MW-1 [RGW-3], MW-2 [RGW-4], MW-3, MW-5, MW-6 [RGW-2], and RGW-6). Of these six wells, only two (MW-1 and MW-6) could be located. Therefore, the COE plans to install four additional monitoring wells, and then sample all six of the wells (per telephone conversation between COE and DGLS on April 10, 1996). A description of the level of effort involved in searching for wells MW-2, MW-3, MW-5 and RGW-6 should be provided. In addition, the proposed locations for the four replacement wells should also be provided.

30. Waste paints, thinners, strippers, oils, fuels, shop waste, and demolition debris from base operations were reportedly placed into trenches at the Northeast Landfill and burned. Please explain the inclusion of cyanide as one of the analytes for surface water, sediment, and groundwater at the Northeast Landfill (Page 3-14, Paragraph 1 and Table 5-2).

West Burn Area

31. From 1954 to 1955, the West Burn Area was reportedly located beyond Air Force property (Page 2-20, Section 2.9, Paragraphs 1 and 2). It is unclear where this off-site property is located. It is also unclear whether the property has previously been investigated.

32. According to the COE, the "West Burn Pit" or "Oil Pit," which was sampled in October 1993 (Certificate of Analysis, MRD Lab Project No. 2318) and excavated "last year" (telephone conversation with DGLS on April 10, 1996), was never actually used as a burn pit, but, rather, as a disposal pit for a tarry, asphaltic substance. However, according to the Work Plan, which is dated October 1995, (Page 2-20, Section 2.9, Paragraph 2), the West Burn Area, which "has not been previously investigated," was used as a fire training area from 1955 to 1969, and waste paint, thinners, solvents, oils, fuels, and tank sludge may have been burned at the site. It is, therefore, unclear whether the "West Burn Pit" or "Oil Pit" excavated by the COE and the "West Burn Area" discussed in the Work Plan are one in the same.

33. The *Report of Laboratory Analysis* produced by Pace, Inc. (dated September 03, 1993) presents the results of sampling at the "Burn Pit." Further description of the sampling location should be provided.

34. The Certificate of Analysis for MRD Lab Project No. 2318 (dated 03 December 1993) presents the results of sampling at the "Oil Pit." Further description of the sampling location should be provided.

35. The lab report produced by M.D. Chemical & Testing, Inc. (dated Sep-16-94) presents the results of sampling at Richards Gebaur Air Force Base. Further description

of the sampling location should be provided. It is unclear when this sample was taken relative to excavation of the "West Burn Pit."

36. COE drilling logs indicate that three trenches were excavated in the vicinity of "Burn Pit #4." The purpose of these excavations is unclear.

37. The date of excavation of the "West Burn Pit" is unclear.

38. Confirmatory sampling should have been conducted following excavation of the "West Burn Pit," and sampling results should be provided.

39. According to Section 2.9, Paragraph 4 (Page 2-20), drainage from the West Burn Area is to the south and southwest off the facility. Judging from Figures 2-6 and 2-9, drainage from the West Burn Area would appear to flow toward the east.

40. According to information presented in Table 5-2, surface water sampling will be conducted at the West Burn Area; however, the description of site characterization work for the West Burn Area (Page 3-16, Section 3.7) does not mention sampling of surface water. Please clarify whether surface water sampling will take place at the West Burn Area.

South Burn Area

41. The location of the South Burn Area provided on the map of Figure 2-6 does not correspond to the location provided for the South Burn Area on the map of Figure 2-10.

42. Although the map of Figure 2-10 indicates that the "Assumed Location of South Burn Area" is southwest of the South Landfill, the COE believes that the South Burn Area is actually located within the bounds of the South Landfill (telephone conversation with DGLS on April 10, 1996). The revised location of the South Burn Area should be provided.

43. The Work Plan called for 5-foot soil borings to be drilled in the immediate vicinity of the South Burn Area in the event that contamination was detected by the soil gas survey conducted at the South Burn Area (Page 3-17). Because the South Burn Area is apparently located within the South Landfill and the soil gas survey was apparently not conducted in the vicinity of the South Burn Area (see Comment 42), specific plans for further investigation of the South Burn Area are unclear. (Soil sampling was not previously planned for the South Landfill, and 5-foot soil borings at the South Burn Area may be of insufficient depth if the South Burn Area is buried by rubble from the South Landfill).

Radioactive Disposal Well

44. The location of the Radioactive Disposal Well provided on the map of Figure 2-6 does not correspond to the location provided for the Radioactive Disposal Well on the map of Figure 2-11.
45. According to the COE, construction details of the radioactive well are unknown. However, according to the previous State Project Manager (Previous Comment Letter from State Project Manager, dated May 11, 1995), radioactive well construction details are available. In addition, the Work Plan states that the radioactive well is 23 feet deep (Page 2-22, Section 2.11, Paragraph 1). Please discuss whether available well construction details are considered reliable.

Pesticide Burial Site

46. According to the text (Page 2-25, Section 2.12, Paragraph 1), a Civil Engineering Construction Permit locates the Pesticide Burial Site 60 feet east and 300 feet south of the former Airport Weather Facility Building 839. However, neither the "Possible Burial Location" delineated on the map of Figure 2-12 nor the "Geophysical Survey Area" delineated on the map of Figure 5-2 coincide with the stated location. Please explain.
47. Previous investigations at the Pesticide Burial Area included four surface soil samples and one surface water sample. No elevated levels of contaminants were found (see Section 2.12, Page 2-25). It should be noted that, if the pesticides were buried at a depth of 4 feet (as indicated by the COE in a telephone conversation with DGLS on April 10, 1996), contamination would not be expected in surface soils.

48. An electromagnetic (EM) survey (Page 5-11, Section 5.4.3.2) as well as a magnetic gradiometer survey (telephone conversation between COE and DGLS on April 10, 1996) were performed at the Pesticide Burial Site. Survey grid spacing was reportedly 10 feet (telephone conversation between COE and DGLS on April 10, 1996) or 15 feet (Work Plan, Page 5-13, Paragraph 1). Due to the relatively small size of the Pesticide Burial Site (6 feet by 8 feet), perhaps consideration should be given to the use of Ground Penetrating Radar (GPR) in locating the burial area. This geophysical survey method provides the highest lateral resolution of any of the available surface geophysical methods.

Paint Stripper Hangar

49. According to the map of Figure 5-11, the soil gas survey planned for the Paint Stripper Hangar was to be conducted entirely downgradient of the septic system leach fields. Survey areas were not designed to include the leach fields, areas immediately

adjacent to the building, or areas of stressed vegetation. However, according to the COE (telephone conversation with DGLS on April 17, 1996), septic system leach fields and areas adjacent to the building were included in the soil gas survey. The location of the soil gas survey grid should be provided.

Please contact Diana Travis at (573) 368-2124 with any questions regarding these comments.

DT:kb

MEMORANDUM

DATE: April 22, 1996

TO: Robert Geller, Chief, Federal Facilities Section, HWP, DEQ

FROM: Diana Travis, Geologist, Environmental Geology Section, GSP, DGLS

SUBJECT: Work Plan, Richards Gebaur Air Force Base, Belton, Missouri (Revised October 1995)
Record of Telephone Conversation between Corps of Engineers (COE) (Jana Ryan, Jerry Montgomery, and Brad Brink) and DGLS (Diana Travis), April 10, 1996
Record of Telephone Conversation between COE (Jerry Montgomery) and DGLS (Diana Travis), April 17, 1996
Investigation Results from the "West Burn Area" (Report of Laboratory Analysis, September 03, 1993; Certificate of Analysis, 03 December 1993; Telephone Conversation Record, 1-26-94; Specifications for Waste Oil Removal, Richards-Gebaur Air Force Base, 2 February 1994; Laboratory Results, 9/22/94; and HTW Drilling Logs, 4/25/95)
Previous Comment Letter from Former State Project Manager (Comments Geophysical Plan, Monitoring Well Plan, Site Safety and Health Plan and Chemical Data Acquisition Plan dated November 1994, May 11, 1995; and Work Plan for Richards-Gebaur AFB, Belton, MO, September 22, 1995)

LOCATION: Belton 7.5-Minute Quadrangle, Jackson and Cass Counties, Missouri

The Division of Geology and Land Survey (DGLS) has completed a review of the subject documents. The following comments are provided for your consideration.

GENERAL COMMENTS

Results of Previous Work

1. Results of all field work, including soil gas surveys and geophysical surveys, performed at the Richards Gebaur Formerly Utilized Defense Sites (FUDS) should be provided.

2. It should be noted that previous "background" soil samples at both the South Landfill (Figure 2-7) and the Northeast Landfill (Figure 2-8) were found to be contaminated. Therefore, background sampling locations for this study should be chosen carefully.

Monitoring Wells

3. According to Section 5.5.2.1 (Page 5-17), the exact placement of monitoring wells at the Richards Gebaur FUDS is subject to the results of initial groundwater sampling. Although placement of groundwater monitoring wells is currently being discussed, initial groundwater sampling has apparently not yet been conducted. Please explain.

4. The well drilling and installation subcontractor should be identified. It should be noted that this subcontractor must possess a valid monitoring well installation contractor's permit issued by the State of Missouri, Department of Natural Resources, Division of Geology and Land Survey.

5. According to the text (Page 5-18, Section 5.5.3, Paragraph 2), "The design and construction of monitoring wells will follow as closely as practical to the design for properly installed, low-yield domestic water supply wells." It should be noted that the design and construction of monitoring wells must follow the appropriate guidelines set forth in the *Missouri Well Construction Rules*. These guidelines are not similar to those for domestic wells.

6. Monitoring wells will reportedly conform with the minimum requirements set forth in the Missouri Well Construction Rules dated December 1994. It should be noted that the latest version of the *Missouri Well Construction Rules* is dated March 1995.

7. Figure 5-4 contains a diagram illustrating the details of monitoring well construction. The following points should be noted:

- * The protective casing must extend from below frost level, but at least 3 feet below the surface to at least 2 inches above the riser pipe.
- * The pad must be composed of concrete or neat cement (not gravel) and must also be placed from below frost level but at least 3 feet below the surface.
- * Use of a 0.010-inch screen should be accompanied by the use of 20-40 (as opposed to 10-20) sand. Please see Section 5.5.3.8 (Page 5-21).
- * According to the footnote, dimensions of well components are subject to change in very shallow wells. It should be noted that, if the well is greater than 10 feet deep, the dimensions must conform to the *Missouri Well Construction Rules*, or a variance from those rules must be approved by the Missouri Department of Natural Resources, Division of Geology and Land Survey.

8. According to Section 5.5.3.13, the bottom of the protective casing will be cemented 2 feet below grade. See comment 7.
9. According to Section 5.5.6, Paragraph 3 (Page 5-29), two times the water used/lost during drilling and well installation will be removed from the well. The *Missouri Well Construction Rules* require that the volume of fluid removed during development be a multiplier (3 times minimum) of the amount of fluid lost to the formation during drilling or added to the well during development.
10. According to Section 5.5.3.1.4 (Page 5-23), "A ground elevation to the nearest 0.1 foot shall be obtained at each well." However, this section goes on to state that the elevation of the monitoring well shall reference the north point on the top of the casing and shall be surveyed to the nearest 0.01 foot. Please explain this apparent discrepancy.
11. According to Section 5.5.2.2, Paragraph 1 (Page 5-17), monitoring wells at Richards Gebaur are expected to be shallow wells which monitor the uppermost "alluvial" aquifer. The term "alluvial aquifer" refers to a water-bearing stream deposit. Monitoring wells at Richards Gebaur will, most likely, penetrate residual, rather than alluvial, materials. The residuum at Richards Gebaur is expected to be comprised of silts and clays which formed from in-situ weathering of underlying limestone and shale (see Page 5-18, Section 5.5.3, Paragraph 1).
12. The top of the well screen is to be positioned above the water table to account for seasonal fluctuations in water levels (Page 5-20, Section 5.3.3.5). Although positioning of the screen in this manner is appropriate where the chemical of concern is an aqueous phase liquid or a light non-aqueous phase liquid, the most effective placement of the well screen for the detection of chlorinated solvents (dense non-aqueous liquids) would likely be directly above a relatively impermeable subsurface layer.

Decontamination Procedures

13. Sections 5.5.5 (Page 5-28) and 5.9 (Page 5-45) both describe decontamination procedures for drilling equipment. However, the decontamination procedures described in Section 5.9 are more extensive than those described in Section 5.5.5. For example, Section 5.9 specifies that the drilling equipment be scrubbed with a lab-grade, phosphate-free detergent, rinsed with potable water, and allowed to air dry, while Section 5.5.5 mentions only the steam-cleaning of drilling equipment. Please explain.

SPECIFIC COMMENTS

South Landfill

14. The "General Location of South Landfill" is delineated by a hachured boundary on the map of Figure 2-7. The hachured boundary is, in turn, surrounded by an unlabeled, solid boundary. The significance of the solid boundary is unclear. In addition, the map of Figure 2-10 depicts a region referred to as the "Approximate Extent of Rubble Area" in the vicinity of the South Landfill. However, the area delineated in Figure 2-10 does not precisely correspond to either of the areas delineated in Figure 2-7. Although the text mentions that Rust Environment & Infrastructure discovered discarded materials in the area between the Man Made Lake and the previously-defined landfill and between the landfill and Bales Avenue during a field visit conducted in 1993, a complete description of the entire extent of the South Landfill should be provided.
15. According to Page 2-17, the South Landfill is underlain by the Lane Shale, which may effectively restrict vertical movement of groundwater. However, according to the geologic map of Figure 2-2, the South Landfill is underlain by the Wyandotte Formation.
16. The South Landfill is reportedly located on a thin cover of unconsolidated silts and clays, which is less than 8 feet thick (Page 2-13, Section 2.7, Paragraph 2). However, in some areas of the South Landfill, the depth of rubble piles was found to be 12 feet. Please provide additional discussion regarding the relative thicknesses of the unconsolidated material and the fill material.
17. According to Section 3.2, Page 3-12, previously collected soil and water samples show minimal contamination at the South Landfill. However, it should be noted that the only soil sample previously collected was from an upgradient location (see Figure 2-7 and Section 2.7, Page 2-17).
18. The solid boundary depicted on the map of Figure 2-7 serves as the limit of extent for both the geophysical survey (Figure 5-3) and the soil gas survey (Figure 5-9). The limits of such surveys should extend beyond the known limits of the fill material. See comment 14.
19. According to the Work Plan, a geophysical survey was to be conducted at the South Landfill in order to determine the extent of the fill material (Pages 3-13, 5-6, and 5-13). However, according to the COE (telephone conversation with DGLS on April 10, 1996), no geophysical survey was conducted at the South Landfill. Please explain.
20. According to the COE (telephone conversation with DGLS on April 10, 1996), the results of the soil gas survey indicated a "large anomaly" near the sewer line at the south end of the South Landfill. Please elaborate on what is known about the sewer line.

21. According to the COE (telephone conversation with DGLS on April 10, 1996), several groundwater screening samples were collected at the South Landfill. The sampling results should be provided.
22. Natural surface drainage ditches reportedly flow through the South Landfill into Scope Creek (Page 2-16, Paragraph 3). The locations of these ditches should be provided.
23. The Work Plan outlines surface water/sediment sampling at six locations near the South Landfill. However, according to the COE (telephone conversation with DGLS on April 10, 1996), several of the seeps previously designated for sampling are now dry. Therefore, the COE plans to sample alternate site(s). The number and location(s) of the sampling site(s) should be provided.
24. The COE is planning to install four monitoring wells at the South Landfill site--one background well, one side-gradient well, and two downgradient wells (per telephone conversation with DGLS on April 10, 1996). The locations of these wells should be provided.
25. "Wastes of concern" disposed at the South Landfill were excess paints, thinners, and strippers and spent solvents and oils (Page 2-16, Paragraph 4). Please explain the inclusion of cyanide as one of the analytes for surface water, sediment, and groundwater at the South Landfill (Page 3-13, Paragraph 1 and Table 5-2).

Northeast Landfill

26. Contamination was detected in groundwater and soil at the Northeast Landfill during previous investigations (Pages 2-19 to 2-20, Section 2.8, Paragraph 6). The specific locations of these detections should be provided.
27. Ecology & Environment, Inc. (E&E) reportedly installed five monitoring wells (MW-1, MW-2, MW-3, MW-5, and MW-6) at the Northeast Landfill site in 1986 (Page 2-19, Paragraph 4 and Figure 2-8). It is unclear whether a sixth well (MW-4) was ever installed. Please explain.
28. The Work Plan outlines surface water/sediment sampling at four locations along Scope Creek, to the south of the Northeast Landfill. However, the COE (per telephone conversation with DGLS on April 10, 1996) has proposed that the surface water/sediment sampling locations designated in the Work Plan be replaced by surface water/sediment sampling locations along the drainage ditch which runs east to west just south of the landfill (north of both Scope Creek and 151st Street). The location of the drainage ditch as well as the number and location(s) of the proposed sampling site(s) should be provided

29. Six monitoring wells have been installed in the vicinity of the Northeast Landfill (MW-1 [RGW-3], MW-2 [RGW-4], MW-3, MW-5, MW-6 [RGW-2], and RGW-6). Of these six wells, only two (MW-1 and MW-6) could be located. Therefore, the COE plans to install four additional monitoring wells, and then sample all six of the wells (per telephone conversation between COE and DGLS on April 10, 1996). A description of the level of effort involved in searching for wells MW-2, MW-3, MW-5 and RGW-6 should be provided. In addition, the proposed locations for the four replacement wells should also be provided.

30. Waste paints, thinners, strippers, oils, fuels, shop waste, and demolition debris from base operations were reportedly placed into trenches at the Northeast Landfill and burned. Please explain the inclusion of cyanide as one of the analytes for surface water, sediment, and groundwater at the Northeast Landfill (Page 3-14, Paragraph 1 and Table 5-2).

West Burn Area

31. From 1954 to 1955, the West Burn Area was reportedly located beyond Air Force property (Page 2-20, Section 2.9, Paragraphs 1 and 2). It is unclear where this off-site property is located. It is also unclear whether the property has previously been investigated.

32. According to the COE, the "West Burn Pit" or "Oil Pit," which was sampled in October 1993 (Certificate of Analysis, MRD Lab Project No. 2318) and excavated "last year" (telephone conversation with DGLS on April 10, 1996), was never actually used as a burn pit, but, rather, as a disposal pit for a tarry, asphaltic substance. However, according to the Work Plan, which is dated October 1995, (Page 2-20, Section 2.9, Paragraph 2), the West Burn Area, which "has not been previously investigated," was used as a fire training area from 1955 to 1969, and waste paint, thinners, solvents, oils, fuels, and tank sludge may have been burned at the site. It is, therefore, unclear whether the "West Burn Pit" or "Oil Pit" excavated by the COE and the "West Burn Area" discussed in the Work Plan are one in the same.

33. The *Report of Laboratory Analysis* produced by Pace, Inc. (dated September 03, 1993) presents the results of sampling at the "Burn Pit." Further description of the sampling location should be provided.

34. The Certificate of Analysis for MRD Lab Project No. 2318 (dated 03 December 1993) presents the results of sampling at the "Oil Pit." Further description of the sampling location should be provided.

35. The lab report produced by M.D. Chemical & Testing, Inc. (dated Sep-16-94) presents the results of sampling at Richards Gebaur Air Force Base. Further description

of the sampling location should be provided. It is unclear when this sample was taken relative to excavation of the "West Burn Pit."

36. COE drilling logs indicate that three trenches were excavated in the vicinity of "Burn Pit #4." The purpose of these excavations is unclear.

37. The date of excavation of the "West Burn Pit" is unclear.

38. Confirmatory sampling should have been conducted following excavation of the "West Burn Pit," and sampling results should be provided.

39. According to Section 2.9, Paragraph 4 (Page 2-20), drainage from the West Burn Area is to the south and southwest off the facility. Judging from Figures 2-6 and 2-9, drainage from the West Burn Area would appear to flow toward the east.

40. According to information presented in Table 5-2, surface water sampling will be conducted at the West Burn Area; however, the description of site characterization work for the West Burn Area (Page 3-16, Section 3.7) does not mention sampling of surface water. Please clarify whether surface water sampling will take place at the West Burn Area.

South Burn Area

41. The location of the South Burn Area provided on the map of Figure 2-6 does not correspond to the location provided for the South Burn Area on the map of Figure 2-10.

42. Although the map of Figure 2-10 indicates that the "Assumed Location of South Burn Area" is southwest of the South Landfill, the COE believes that the South Burn Area is actually located within the bounds of the South Landfill (telephone conversation with DGLS on April 10, 1996). The revised location of the South Burn Area should be provided.

43. The Work Plan called for 5-foot soil borings to be drilled in the immediate vicinity of the South Burn Area in the event that contamination was detected by the soil gas survey conducted at the South Burn Area (Page 3-17). Because the South Burn Area is apparently located within the South Landfill and the soil gas survey was apparently not conducted in the vicinity of the South Burn Area (see Comment 42), specific plans for further investigation of the South Burn Area are unclear. (Soil sampling was not previously planned for the South Landfill, and 5-foot soil borings at the South Burn Area may be of insufficient depth if the South Burn Area is buried by rubble from the South Landfill).

Radioactive Disposal Well

44. The location of the Radioactive Disposal Well provided on the map of Figure 2-6 does not correspond to the location provided for the Radioactive Disposal Well on the map of Figure 2-11.

45. According to the COE, construction details of the radioactive well are unknown. However, according to the previous State Project Manager (Previous Comment Letter from State Project Manager, dated May 11, 1995), radioactive well construction details are available. In addition, the Work Plan states that the radioactive well is 23 feet deep (Page 2-22, Section 2.11, Paragraph 1). Please discuss whether available well construction details are considered reliable.

Pesticide Burial Site

46. According to the text (Page 2-25, Section 2.12, Paragraph 1), a Civil Engineering Construction Permit locates the Pesticide Burial Site 60 feet east and 300 feet south of the former Airport Weather Facility Building 839. However, neither the "Possible Burial Location" delineated on the map of Figure 2-12 nor the "Geophysical Survey Area" delineated on the map of Figure 5-2 coincide with the stated location. Please explain.

47. Previous investigations at the Pesticide Burial Area included four surface soil samples and one surface water sample. No elevated levels of contaminants were found (see Section 2.12, Page 2-25). It should be noted that, if the pesticides were buried at a depth of 4 feet (as indicated by the COE in a telephone conversation with DGLS on April 10, 1996), contamination would not be expected in surface soils.

48. An electromagnetic (EM) survey (Page 5-11, Section 5.4.3.2) as well as a magnetic gradiometer survey (telephone conversation between COE and DGLS on April 10, 1996) were performed at the Pesticide Burial Site. Survey grid spacing was reportedly 10 feet (telephone conversation between COE and DGLS on April 10, 1996) or 15 feet (Work Plan, Page 5-13, Paragraph 1). Due to the relatively small size of the Pesticide Burial Site (6 feet by 8 feet), perhaps consideration should be given to the use of Ground Penetrating Radar (GPR) in locating the burial area. This geophysical survey method provides the highest lateral resolution of any of the available surface geophysical methods.

Paint Stripper Hangar

49. According to the map of Figure 5-11, the soil gas survey planned for the Paint Stripper Hangar was to be conducted entirely downgradient of the septic system leach fields. Survey areas were not designed to include the leach fields, areas immediately

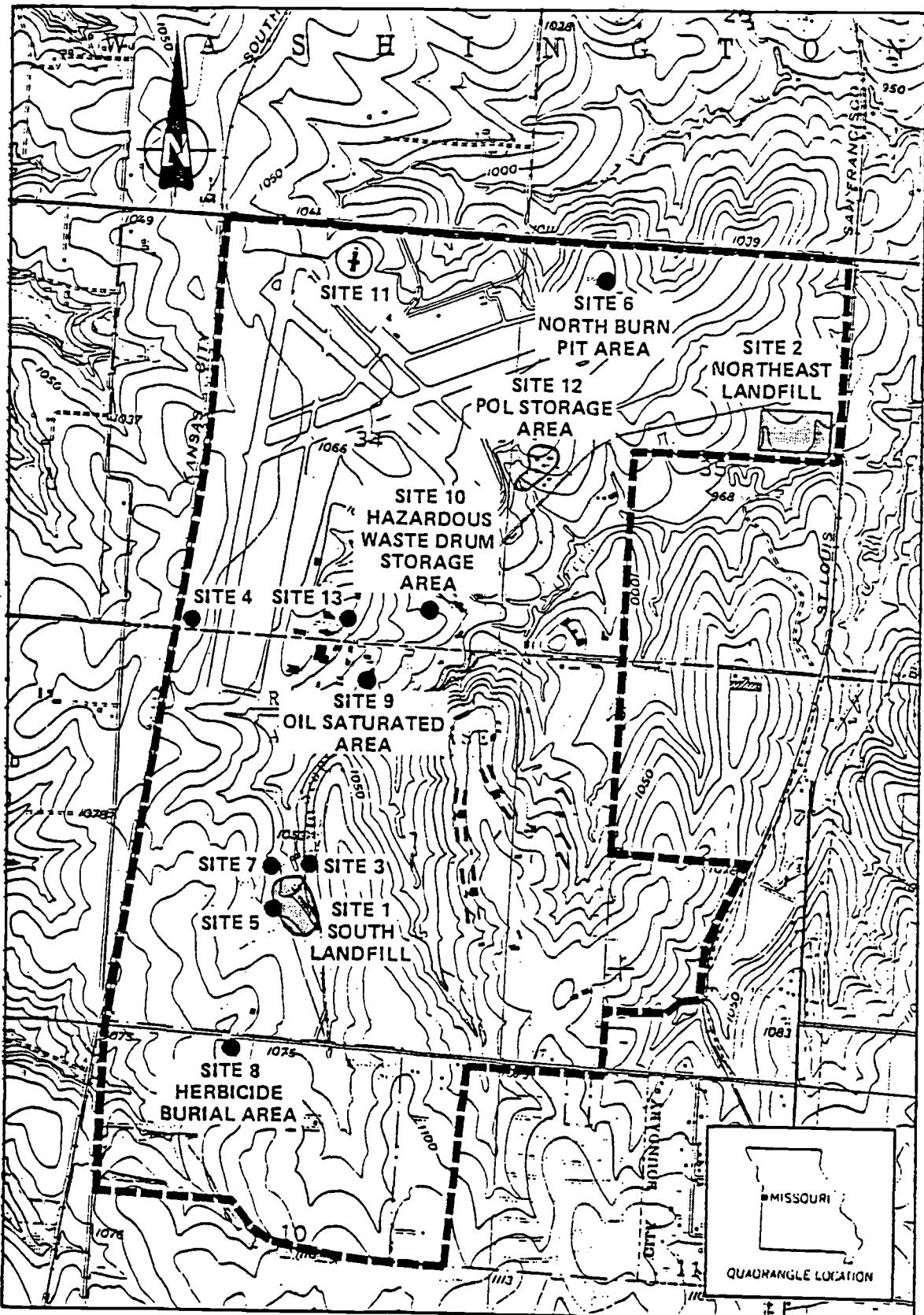
adjacent to the building, or areas of stressed vegetation. However, according to the COE (telephone conversation with DGLS on April 17, 1996), septic system leach fields and areas adjacent to the building were included in the soil gas survey. The location of the soil gas survey grid should be provided.

Please contact Diana Travis at (573) 368-2124 with any questions regarding these comments.

DT:kb

TABLE OF CONTENTS FOR COE SITES

SITE 1	SOUTH LANDFILL
SITE 2	NORTHEAST LANDFILL
SITE 3	RUBBLE BURIAL SITE
SITE 4	WEST BURN PIT
SITE 5	SOUTH BURN PIT
SITE 7	RADIOACTIVE DISPOSAL WELL
SITE 8	HERBICIDE BURIAL SITE



SOURCE: U.S.G.S. 7.5' Quadrangle, Belton, Mo.-Kans., 1975.

SCALE
0 $\frac{1}{4}$ 1 MILE

Figure 1 RICHARDS-GEBAUR AIR FORCE BASE IRP SITES



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098-6001

Lou 81-2
BLanca
fba

U.S. GOVERNMENT • UNITED STATES CONSTITUTION BICENTENNIAL
DEPARTMENT OF DEFENSE • 1776-1976

03 21 1 A 8 : 44

REPLY TO:
ATTN OF: DEPV

27 JUL 1989

SUBJECT: Installation Restoration Program (IRP), Richards-Gebaur Air Force Base, MO

TO: Superfund Section
Missouri Department of Natural Resources
Waste Management Program
P. O. Box 176
Jefferson City, MO 65102
ATTN: June Sullens

1. References:

- a. Your letter dated 2 May 1989 to Air Force Regional Civil Engineer - Central Region (atch 1)
- b. Kansas City District, Corps of Engineers letter dated 9 May 1989 (atch 2)
2. Attached are the Final Site Specific Sampling/Analysis Plan and Quality Assurance Quality Control Plan (atch 3) and Site Health and Safety Plan (atch 4) for the IRP effort at Richards-Gebaur AFB.
3. The following are the responses to your comments provided in reference 1a on the drafts of the above plans.

a. Site Health and Safety Plan.

(1) Page 2, Section 1.01, Site 6: Sentence wording has been changed to read MCL or related drinking water guidelines. The compounds and associated interim standards from the USEPA Drinking Water Health Advisory Office are; Chloroform, 100 ug/l; tetrachloroethylene, 5 ug/l; and methylene chloride, 1.5 mg/l.

(2) Page 12, Section 2.04, Personnel Monitoring and 6.04.2 Action Levels: Water will be applied to fugitive dust sources using a decontaminated hand-held mist sprayer or other suitable means.

(3) Page 24, Section 6.01, Initial Site Surveillance, Site 6: Refer to paragraph 3a(1) above.

(4) Page 25, Section 6.01, Initial Site Surveillance, Site 10: The standard used for barium is EPA's proposed MCL, which is 1 mg/l. The MCL standard for lead is .05 mg/l. Cadmium was not referenced in this section. Analysis will be for total metals.

(5) Page 35, Section 6.04.2, Action Levels: The specified action level to be used in the event that work is to be discontinued has been clarified. The action level has been set at 50 ppm per the manufacturers

recommendation using NIOSH-MESA values for full-face respirators which have a Protection Factor of 50. The PF in the Health and Safety Plan supersedes the 100 PF as noted in the Work Plan.

(6) Page 41 , Section 6.05.1: Reference to a half-face respirator has been removed from this section.

(7) Page 45, Section 6.06.2, Level C Decontamination Procedures: Decontamination fluids will be contained and stored on site. All decontamination fluids will be analyzed to determine the proper disposal method. All fluids which meet the criteria for disposal to the sanitary sewer will be disposed of in this manner.

(8) Page 46, Section 6.06.3, The water generated from the steam and high pressure wash will be contained, stored, and tested on-site. Refer to comment reply 3.a.(7) for disposal procedures.

(9) Page 47, Section 7.01, Emergency Telephone Numbers: The suggested numbers have been added to this section.

(10) Page 49, Section 7.05, Explosion: Richards-Gebaur personnel in conjunction with the US Army Corps of Engineers will contact the regional Explosive Ordnance Disposal Command Center.

(11) Page 50, Section 7.06.1 Stages of Evacuation: Reference to withdrawal from the work area has been deleted since evacuation from the site incorporates the work area. Two stages of evacuation will be used instead of three. If level C is exceeded, work will be discontinued and the state approved Base Emergency Response Plan will be implemented.

b. Site Specific Sampling/Analysis, Quality Control/Quality Assurance Plan.

(1) Page 11, Section 1.3, Site Toxic or Hazardous Substances: References to the State and Federal regulation criteria have been added. A significant level is one that exceeds the most conservative criteria.

(2) Page 30, Section 4.3.1, Sampling Equipment: Contaminated material generated during well installation and sampling will be contained on-site pending laboratory analyses. This has been clarified throughout the report.

(3) Page 31, Section 4.3.2, Sampling Protocol: Purged water will be contained on-site pending laboratory analysis.

(4) Page 44, Section 5.0, Sample Location and Frequency: Analyses listed in Table 3-3 represents a broad scope of investigation. Specific contaminants for each site cannot be narrowed down at this time with any certainty.

(5) General Comment on the Scope of Work: Site 12, Previous soil and surface water sampling locations by EEI cannot be confirmed and are therefore not shown on site sampling location maps. Please see 3.d for status of sites

2, 3, 4, 5, 7, 8, and 11. The general outline of the topography has been added to the Site Locations Map, Figure 4-1, page 26. Specific site topography will be determined by a survey as part of this investigation and will be available at a later date. Appendix B was never intended to be a stand-alone document, it is unfortunate that DGLS did not have the entire document to review, all comments were addressed in the main text. Information provided by DGLS is appreciated.

c. Appendix B, Site 6; Site Specific Sampling/Analysis Plan.

(1) Page 2, Section 1.3.1: We agree that the chert layer may be water bearing. Interpolating the geologic cross section prepared by Ecology and Environment, Inc to this site, it appears the chert layer varies by as much as five feet, with an undulating surface. There may be multiple chert layers present (reference boring BP-3). However, a groundwater gradient cannot be determined at this time given present information.

(2) Page 3, Section 1.4.1: No water was indicated during installation of MW-1, MW-2, and MW-3. Water sampling has since occurred in all three. There was some water inflow from an unknown source after well installation. Monitoring well MW-1 does not extend to the soil/rock interface, but the filter sand does extend up above the previously identified chert layer with the remainder of the sand/screen interval in plastic silty clay. Water may have come from the chert layer, but other sources cannot be ruled out since there is hydraulic communication along the entire length of the sand pack. The only "surface impoundment" at this site is the retention pond in the eastern portion of the site.

(3) Page 4, Section 2.1, Site 6: Proposed well GMW 607 is to be installed to the west-southwest. A deep well on the west side of the site will not produce data that would significantly alter nor enhance the data gathering potential of the current well siting proposal when used in conjunction with the data from the existing wells. The current proposal is sufficient to quantify the extent of contamination at this site. Should analysis indicate the need for additional monitoring wells, they will be installed at a later date.

(4) Page 6, Section 3.1.1: Groundwater sampling will be conducted no sooner than two weeks after the wells are developed. Wells will be drilled the week of August 7th. Statistically, one round of sampling is more accurate than two (but less than three or more). Additional rounds of sampling will depend on the results of this investigation.

(5) Page 6, Section 3.1.2: Two feet was chosen as the most likely depth to encounter this type of contamination from past experience. The actual depth and location of each soil sample will be determined using a HNu monitoring device coupled with visual inspection.

c. Appendix B, Site 12; Site Specific Sampling/Analysis Plan.

(1) Page 6, Figure 2-2, Site 12 Map: Structure 951 is a heating oil tank. Structure 953 is a JP-4 pump house. Structure 959 is the Kansas City

pump house. Structure 954 is an empty heating oil tank scheduled for removal in the near future. Structure 956 is a tank owned by Kansas City. Structures 955 and 957 are Air Force JP-4 tanks. Underground lines and utilities will be determined before field work commences. AV gas or AVGAS refers to aviation grade gasoline.

(2) Page 2, Section 1.3.2: MW4 will be located on Figure 2-2. Only one boring (MW-4) is available at this site, so the groundwater gradient can not be determined with any degree of certainty. The assumed southeast gradient is based on surface topography and typical hydrogeological characteristics associated with the underlying formations. The soil/rock interface is only one of many features analyzed in estimating the hydraulic gradient. The proposed wells have been located such that a definitive groundwater flow direction can be calculated at this site.

(3) Page 6, Section 1.4.2: The intent of this section is to provide information on what is expected when wells and borings are installed, not to summarize previous work. Details of the previous work can be found in earlier reports and were used to develop the plan for this investigation.

(4) Page 6, Section 2.2: Wells are going to be cored into the bedrock to ensure that groundwater at the soil/rock interface will be encountered and sampled.

(5) Page 7, Section 3.2: See paragraph 3b(4) above.

(6) Page 7, Section 3.2.2: Ten feet is the anticipated depth to the soil/rock interface. The marshy area to the northwest is presumed to be upgradient. Existing well MW-4, and a proposed soil boring, is in the area of the marsh.

d. Comments on Sites 2, 3, 4, 5, 7, 8, and 11: As discussed in reference 1b, these sites are on land no longer owned by the Air Force. As a result, responsibility for these sites rests with the Corps of Engineers under the Formerly Used Defense Site Program. We have, therefore, forwarded all of your comments and concerns to the Corps of Engineers. Any additional questions on these sites should be addressed to the Corps of Engineers. We will cooperate with the investigation of these sites as it proceeds.

4. If you have any questions please contact Roger Kittelson or Sheryl Faust-Beck at (912) 926-5598.

FOR THE COMMANDER

George A Romero
GEORGE A ROMERO, COL, USAF
DCS/Engineering & Services

4 Atch

1. MODER letter, 2 May 1989
2. US CoE letter, 9 May 1989
3. Sampling/Analysis and Quality Assurance Quality Control Plan
4. Health and Safety Plan

cc: 442 CSG/DE w/o atch
AFRCE-CR/ROV w/o atch
CEMRK-ED-TD w/o atch

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098-6001

*Rec IRP file 24 Mar 88
81-1
filed*

24 MAR 1988

DEPV

Formerly Owned Installation Restoration Program (IRP) Sites, Richards-Gebaur AFB, MO (Your Msg, 12 Feb 88)

HQ USAF/LEEV (Mr William Goins)

1. As requested in the referenced message, a map showing the former and existing USAF property boundaries at Richards-Gebaur AFB is attached. This map also shows the location of the IRP sites. The US Army Corps of Engineers (COE), Kansas City District were involved with the transference of real estate to the City of Kansas City and Belton in August 1985. All details of this property transaction are on file at the COE offices. As the COE, Kansas City District will also be responsible for these former DoD IRP sites, any special data or information they require is readily available.
2. If you have any questions, or require any further information, please call Sheryl Faust-Beck, AUTOVON 468-5598.

FOR THE COMMANDER

SIGNED

GERALD J. MCMAHON, Lt Col, USAF
Director of Programs
DCS/Engineering and Services

- 3 Atch
1. Richards-Gebaur Map (2)
 2. Disposal Site Map
 3. IRP Site Historical Summary

cc: 442 CSG/DE

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31093-6601

81-1
JF
1/2

25 JAN 1989

DEPV

Formerly DOD Owned Installation Restoration Program (IRP) Sites,
Richards-Gebaur AFB, MO

HQ USAF/LEEV

1. Reference our letter, 18 Jun 86, IRP Sites at Richards-Gebaur AFB, MO.
2. The referenced letter requested the transfer of seven off-base IRP sites at Richards-Gebaur AFB to the US Army Corps of Engineers for cleanup under the DOD Formerly Owned Program. No feedback has been received on this transfer and we are continuing on with the IRP Feasibility Study for only on-base sites. Therefore, these sites; south landfill, northeast landfill, contractor rubble site, west burn pit, south burn pit, radioactive disposal well, and herbicide burial site, still need to be included in the COE program.
3. An IRP Phase II Stage 2 has been completed for the south and northeast landfills, and herbicide burial site. Further investigation or remedial action was recommended for these three sites. The other sites were just included in the Phase I Records Search. The present owner of these areas would not allow access to the Air Force for Phase II field investigations.
4. IRP documentation is available from this office, and if you have any questions, please contact Sheryl Faust-Beck at AUTOVON 468-5598.

FOR THE COMMANDER

SIGNED

GERALD J. MCMAHON, Lt Col, USAF
Director of Programs
DCS/Engineering and Services

cc: 442 ESG/DE
AFRCE-CR/ROV

PAGE CIVIL
ENGINEERING

88 JAN 28 PM : 05

RECEIVED

DE/HURD/19076/PB/80086

~~82-2000~~
~~READ~~ 81-1 G
file

8 OCT 1986

DE

Installation Restoration Program (IRP)
(Ref my 3 JUN 1986 Ltr)

HQ AFRES/DEPV
Robins AFB GA 31098

Please advise status of my request to turn the off base IRP sites over
to the Army Corps of Engineers.

~~SIGNED~~

JOHN P. HURD, JR.
Base Civil Engineer

Atch

1. 442 CSG/DE Ltr.
3 Jun 86

Chronological
order

LKF
file
16C-30

3 JUN 1986

DE

Installation Restoration Program (IRP)

HQ AFRES/DEPU

Robins AFB, GA 31098

1. Request that the following identified Phase I IRP Sites be turned over to the Army Corps of Engineers (COE) for investigation and remedial actions required.

- a. South landfill.
- b. Northeast landfill.
- c. Contractor rubble burial site.
- d. West burn pit.
- e. South burn pit.
- f. Radioactive disposal well.
- g. Herbicide burial site.

2. These sites are located on property which has been sold or transferred to the Kansas City Aviation Department or City of Belton, MO. Please advise as to your decision to turn these sites over to the COE.

SIGNED

JOHN P. HURD, Jr.
Base Civil Engineer

Atch

Figure 6 of IRP Phase I Report w/Atch

Cy to: 442 CSG/CC/SGPB/DW

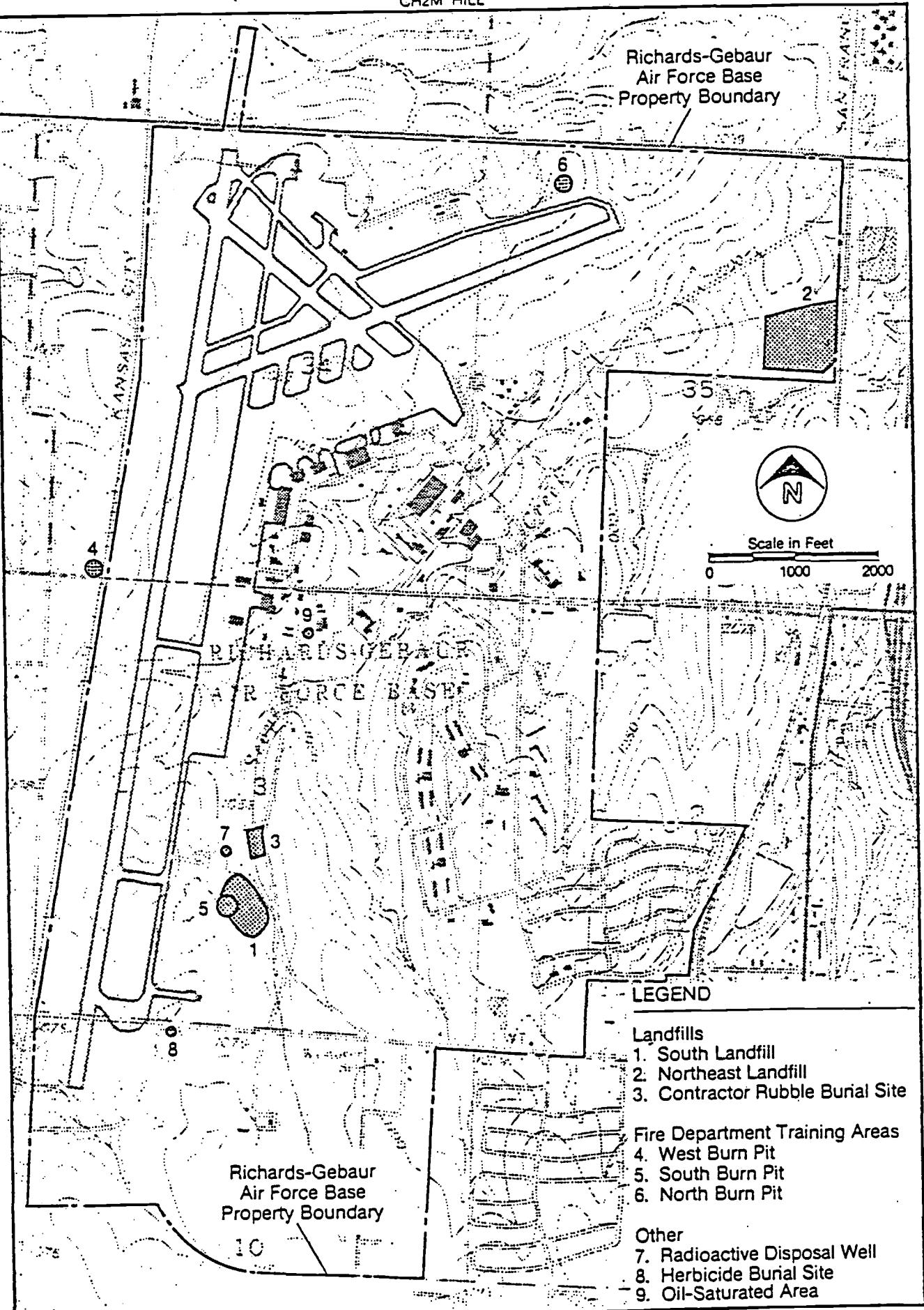


FIGURE 6. Identified disposal sites, Richards-Gebaur AFB, Missouri.



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098-6001

file
81-1 DE
JL

JUN 26 2 40 AM '86

18 JUN 1986

REPLY TO
ATTN OF:
DEPV

SUBJECT: Installation Restoration Program (IRP) Sites at Richards Gebaur AFB, MO

TO:
HQ USAF/LEEV

1. Since the IRP began at Richards Gebaur AFB, considerable real estate has been transferred to Kansas City, MO. The city has denied the Phase II contractors access to some of the sites and AFRES currently has its Phase II on hold.
2. Request that sites 1 - South landfill; 2 - Northeast landfill; 3 - Contractor Rubble Burial Site; 4 - West Burn Pit; 5 - South Burn Pit; 7 - Radioactive Disposal Well; and 8 - Herbicide burial Site, be returned over to the Army Corps of Engineers for investigation and remedial actions. All sites are located on property which has been sold or transferred to the Kansas City Aviation Department or to the city of Belton, MO.

FOR THE COMMANDER

SIGNED

LOUIS D. KJELDGAARD
Actg Director of Programs
DCS/Engineering & Services

1 Atch
Fig 6 of IRP Phase I Report

cc: 442 CSG/CC w/o Atch

CC-S-1
Mike S-1
KWT J
for IRP
18 JUN 1986
IRP 00-00-00-00-00-00
RE-00-00-00-00-00-00
1 DEPV
SGPB

DEPV

Installation Restoration Program (IRP) Sites at Richards Gebaur AFB, MO

HQ USAF/LAEV

1. Since the IRP began at Richards Gebaur AFB, considerable real estate has been transferred to Kansas City, MO. The city has denied the Phase II contractors access to some of the sites and AFRES currently has its Phase II on hold.
2. Request that sites 1 - South landfill; 2 - Northeast landfill; 3 - Contractor Mubble Burial Site; 4 - West Burn Pit; 5 - South Burn Pit; 7 - Radicactive Disposal Well; and 8 - Herbicide burial Site, be returned over to the Army Corps of Engineers for investigation and remedial actions. All sites are located on property which has been sold or transferred to the Kansas City Aviation Department or to the city of Belton, MO.

FOR THE COMMANDER

SIGNED

LOUIS D. KJELDGAARD
Actg Director of Programs
DCS/Engineering & Services

1 Atch
Fig 6 of IRP Phase I Report

cc: 442 CSG/CC w/o Atch
AFRES / SG PB

R-6

Phase II Stage I

1. South Landfill Site 1
2. N.E. Landfill Site 2
3. North Barn Area Site 6
4. Herbeville Burial area Site 8
5. Art Saturated Area Site 9
6. ~~A~~ Site 10 Drums Storage
7. POL Storage (Site 12)

P

Phase II ^{2nd} Preliminary Draft
due June 87

Sites to be turned over
to COE..

Site 1

2

4 West Barn Pit

5 South Barn Pit

7 Rad Disposal Well

8. Herbe. burial site

Sites total: Envoron concern

Possible surface water

~~possible~~ contamination

Little or no use of ground

IRP
HOC-30
file 81-1 fm

3 JUN 1986

DE

Installation Restoration Program (IRP)

HQ AFRES/DEPU
Robins AFB, GA 31098

1. Request that the following identified Phase I IRP Sites be turned over to the Army Corps of Engineers (COE) for investigation and remedial actions required.

- a. South landfill.
- b. Northeast landfill.
- c. Contractor rubble burial site.
- d. West burn pit.
- e. South burn pit.
- f. Radioactive disposal well.
- g. Herbicide burial site.

2. These sites are located on property which has been sold or transferred to the Kansas City Aviation Department or City of Belton, MO. Please advise as to your decision to turn these sites over to the COE.

SIGNED

JOHN P. HURD, Jr
Base Civil Engineer

Atch

Figure 6 of IRP Phase I Report w/Atch

Cy to: 442 CSG/CC/SGPB/DW

GN14849 S0

CH2M HILL

Richards-Gebaur
Air Force Base
Property Boundary

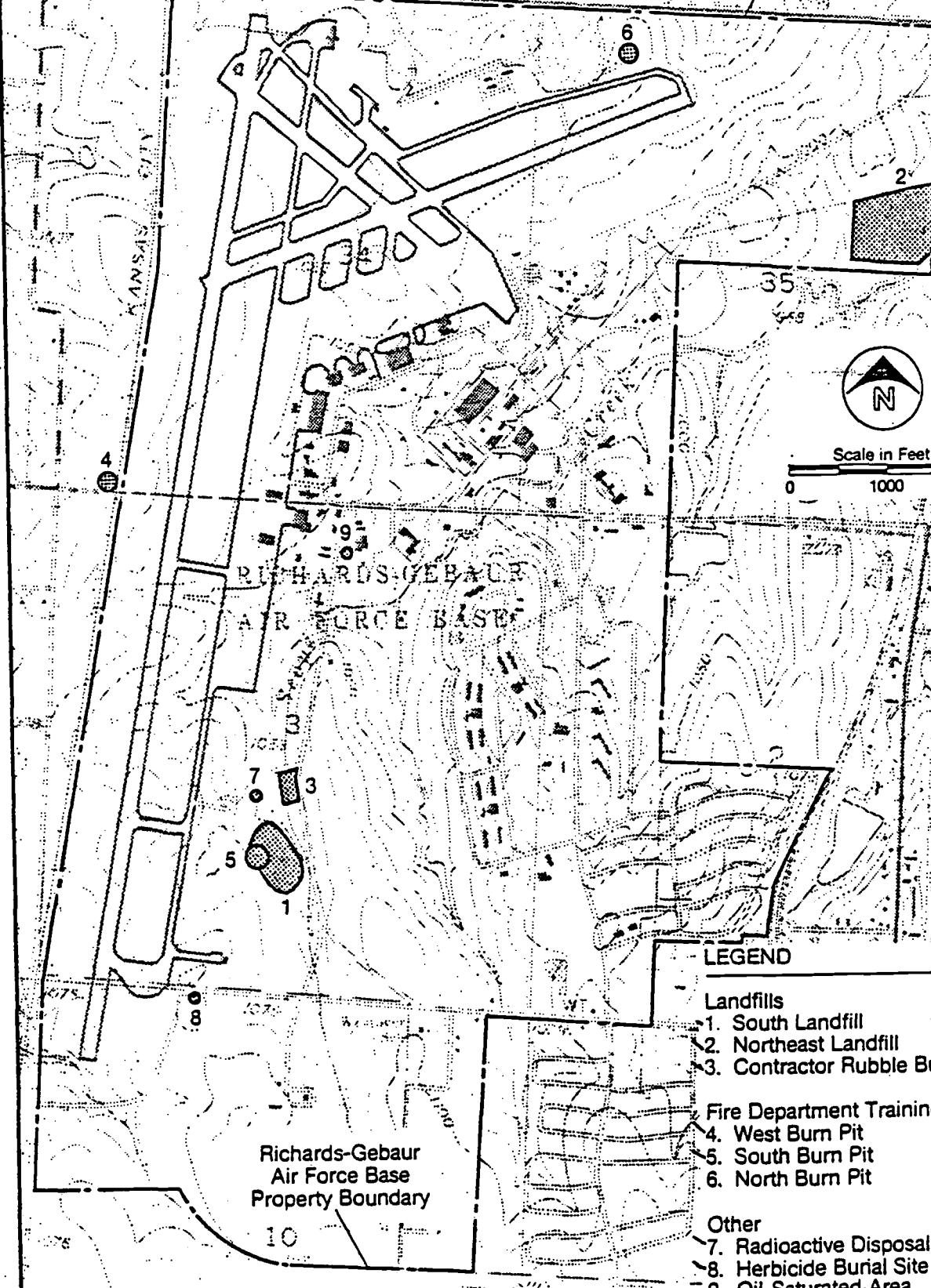


FIGURE 6. Identified disposal sites, Richards-Gebaur AFB, Missouri.

COE SITE 1, SOUTH LANDFILL

Section I. Installation Restoration Program Records Search

- A. Study Performed By: CH2M HILL
- B. Date Report Complete: March, 1983
- C. Significant Findings:

A small oil sheen was observed on the surface of a small area of Scope Creek just downstream of the landfill site suggesting the present of leachate. Scope Creek flows through the base and eventually discharges into the Little Blue River thereby providing a pathway to go beyond base property if it is in fact present.

D. Summary of Recommendations:

It was recommended the adjacent Scope Creek be monitored upstream and downstream of the site to determine if hazardous contaminants are leaching into the creek. It should be sampled on two occasions at least 30 days apart and analyzed.

COE SITE 1, SOUTH LANDFILL, Continued

Section II. Installation Restoration Program Phase II Confirmation/Quantification Stage 2

A. Study Performed By: Ecology and Environment, Inc.

B. Date Report Complete: November, 1987

C. Significant Findings:

No contamination was detected leaving this site via surface migration into Scope Creek, based on the analyses of surface soil and water samples. Relatively low concentrations of petroleum hydrocarbons were detected in the subsurface soils. The extractable organic compound DBP, the only organic compound detected, was at low concentrations, but it also appeared in the method blank. Consequently, DBP has been attributed to laboratory contaminants.

D. Summary of Recommendations:

No further action is recommended for this site since no contamination was found except for very low concentrations of petroleum bydrocarbons in the subsurface soil samples. The presence of petroleum bydrocarbons may be attributed to major oil production at locations just west of the site. Groundwater at the site could not be monitored due to the proximity of the landfill to Scope Creek. The surface water samples in the creek should have detected groundwater contamination, if present, as this is the most likely migration route of contamination.

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For
Richards-Gebaur Air Force Base,
Missouri



Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

MARCH 1983

forms are included in Appendix J, and a summary of the hazard ratings for the 9 sites is given in Table 6.

Shallow wells for domestic supplies are known to exist in Jackson and Cass Counties; however, the exact locations and depths of nearby wells could not be accurately determined. For the purpose of these ratings, it was assumed that the nearest well was between 3,000 feet and 1 mile from each site and that the total population served by all wells within a 3-mile radius is between 50 and 1,000. Due to the nearness of Scope Creek, the ground water in the uppermost limestone aquifers (Wyandotte and Iola Formations) flows laterally directly to the creek. It was therefore assumed in the ratings that the uppermost aquifer is not used as a source of water. No surface-water supplies are known to exist within 3 miles downstream of the base.

The following is a description of each site, including a brief discussion of the rating results. Figure 6 shows the approximate locations of these sites. Figure 7 presents a summary of the approximate dates that the major sites were in use.

1. Landfills

Sanitary landfill sites at Richards-Gebaur AFB were used intermittently since 1954, although off-base contract disposal of most solid waste has been the primary means of disposal since 1956. The three landfill sites are described below.

- o Site No. 1, the South Landfill, is located in the southern part of the base near the NDI lab and adjacent to Scope Creek. Between 1954 and 1956 this site was the main sanitary landfill for Richards-Gebaur AFB. In 1956, off-base contract

disposal of most common refuse was begun, although some wastes, including building rubble, yard debris, and waste from some industrial shop areas were actively disposed of at the site until about 1961. Materials which may have been disposed of in the landfill include small quantities of waste paints, thinners, strippers, solvents, and oils, although this was not standard procedure. Operation of the landfill included burning of the wastes disposed. Since 1961, the area has been used only intermittently for unauthorized dumping. Due to recent incidents of unauthorized dumping, including cleaning of tar pots and some household waste dumping, an earthen barricade has been erected at the entrance to the site.

A small section of Scope Creek downstream of the site was observed to have a small oil sheen on the surface of the water, suggesting the presence of leachate; no oil sheen was observed upstream and no evidence of soil contamination was visible on the edges of the landfill. Small quantities of hazardous materials may have been placed in this landfill; however, no significant hazardous waste quantities were reported.

The overall rating score for Site No. 1 was 55. Although the receptors subscore was low due to the lack of critical environments or population near the site, the indirect evidence of migration of hazardous contaminants indicated by possible leachate resulted in a high pathway subscore (80) and raised the overall rating.

- o Site No. 2, the Northeast Landfill, is located in the northeast portion of the base alongside Scope

V. CONCLUSIONS

- A. No direct evidence was found to indicate that migration of hazardous contaminants exists within or beyond Richards-Gebaur AFB boundaries. Indirect evidence of contamination was found at Site No. 1, the South Landfill, (a small oil sheen on the adjacent surface water).
- B. Information obtained through interviews with 27 past and present base personnel, base records, shop folders, and field observations indicate that hazardous wastes have been disposed of on Richards-Gebaur AFB property in the past.
- C. The potential for migration of hazardous contaminants exists because of the presence of a perched ground-water table with direct discharge to nearby creeks. The presence of low-permeability clays and shales below the ground surface reduces the potential for hazardous contaminant migration vertically into the ground water but increases the potential for migration into nearby surface waters.
- D. Table 7 presents a priority listing of the rated sites and their overall scores. The following sites were designated as areas showing the most significant potential (relative to other Richards-Gebaur sites) for environmental impact.

1. Site No. 1 (South Landfill)

This site was the main base sanitary landfill--used continuously from 1954 until 1956 and intermittently through 1982. From 1954 until about 1961 wastes, including building rubble, yard

debris, and waste from some industrial shop areas, were actively disposed of at this site. The probable path of migration of contaminants, if present at Site No. 1, is vertically downward to the perched ground-water table, then laterally eastward to discharge into Scope Creek. The relatively thick, impervious Lane Shale underlies the site and effectively restricts vertical movement of ground water. During the site visit a small oil sheen, suggesting the presence of leachate, was observed on the surface of a small area of Scope Creek just downstream of the landfill site; no oil sheen was observed upstream. No visible evidence of soil contamination was observed on the banks of Scope Creek at the edge of the landfill. Scope Creek flows through the base and eventually discharges into the Little Blue River, thereby providing a pathway for any hazardous contaminants in the leachate, if present, to enter surface-water bodies and migrate beyond base property.

2. Site No. 2 (Northeast Landfill)

This site was reportedly used between 1961 and 1971 for disposal of miscellaneous waste, including building rubble, yard debris, and wastes from some industrial shop areas. Reportedly, disposal of some waste paint and thinners by spreading of the liquid wastes onto the ground surface has been practiced at this site. Materials in open storage at the site currently include construction rubble, pipes, empty tanks, waste paints and thinners in drums and buckets, and empty 55-gallon drums. Of over 400 drums currently at the site, some contain unknown contents. The probable path of migration

VI. RECOMMENDATIONS

A. PHASE II PROGRAM

A limited Phase II monitoring program is suggested to confirm or rule out the presence and/or migration of hazardous contaminants. The priority for monitoring at Richards-Gebaur is considered moderate since no imminent hazard has been determined.

Tables 8 and 9 present a summary of recommended monitoring sites, parameters to be measured, and the rationale for the analyses. Specifically, monitoring is recommended for the South Landfill (Site No. 1) and the Northeast Landfill (Site No. 2).

1. South Landfill (Site No. 1)

It is recommended that the adjacent creek (Scope Creek) be monitored upstream and downstream of the site to determine if hazardous contaminants are leaching into the creek. The water samples should be analyzed for the parameters indicated in Table 8. The stream should be sampled on two occasions at least 30 days apart to determine the presence of contaminants.

2. Northeast Landfill (Site No. 2)

It is recommended that one shallow monitoring well be installed downgradient of the site to determine if hazardous contamination is present in the area ground water. The well should be drilled to the depth of the top of the underlying Chanute shale (approximately 30 feet deep at this site) and screened from the top of the shale to within

Table 8
RECOMMENDED ANALYSES

<u>Sample Type</u>	<u>Volatile Organic Compounds (VOC)</u>	<u>Heavy Metals</u>	<u>Pesticides</u>	<u>Phenols</u>	<u>pH, Specific Conductance COD, TOC, and Oil and Grease</u>
<u>Surface Water</u>					
South Landfill (Site No. 1)	X	X	X	X	X
<u>Monitoring Well</u>					
Northeast Landfill (Site No. 2)	X	X	X	X	X

GNR70

HAZARDOUS ASSESSMENT RATING FORM

Page 1 of 2

NAME OF SITE: 1. South Landfill

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: Continuous 1954-1961; Intermittent 1961-1982

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Primarily rubble; possible domestic refuse; oil/tar dumps

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface-water body	1	6	6	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	69	180

Receptors subscore (100 x factor score subtotal/maximum subtotal)

38

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large)

S

2. Confidence level (C = confirmed, S = suspected)

C

3. Hazard rating (H = high, M = medium, L = low)

H

Factor Subscore A (from 20 to 100 based on factor score matrix)

60

B. Apply persistence factor

Factor Subscore A x Persistence Factor = Subscore B

$$60 \times 0.8 = 48$$

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

$$48 \times 1.0 = \underline{\underline{48}}$$

III. PATHWAYS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	80
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108
Subscore (100 x factor score subtotal/maximum score subtotal)				59
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)	0	
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	1	8	8	24
Direct access to ground water	N/A	8	--	--
		Subtotals	30	90
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

	<u>Pathways Subscore</u>	<u>80</u>
IV. WASTE MANAGEMENT PRACTICES		
A. Average the three subscores for receptors, waste characteristics, and pathways.		
Receptors	38	
Waste Characteristics	48	
Pathways	80	
Total 166 divided by 3 =	55	
Gross Total		

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

INSTALLATION RESTORATION PROGRAM

PHASE II

CONFIRMATION/QUANTIFICATION

STAGE 2

**RICHARDS-GEBAUR AIR FORCE BASE
MISSOURI**

Prepared by:
ECOLOGY AND ENVIRONMENT, INC.
Buffalo Corporate Center
368 Pleasantview Drive
Lancaster, New York 14086

July 1988

FINAL REPORT
(September 1986 to November 1987)

VOLUME 1: TEXT

**Approved for Public Release:
Distribution is Unlimited**

Prepared for:
UNITED STATES AIR FORCE
Headquarters Air Force Reserve (HQ AFRES/SGPB)
Robins Air Force Base, Georgia 31098-6001

UNITED STATES AIR FORCE
**Occupational and Environmental Health Laboratory/
Technical Services Division (USAFOEHL/TS)**
Brooks Air Force Base, Texas 78235-5501

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
	EXECUTIVE SUMMARY	1
1	INTRODUCTION	1-1
	1.1 LOCATION AND HISTORY OF OPERATIONS	1-3
	1.2 SITE DESCRIPTIONS	1-6
	1.2.1 Site 1, South Landfill	1-6
	1.2.2 Site 2, Northeast Landfill	1-10
	1.2.3 Site 6, North Burn Pit Area	1-12
	1.2.4 Site 8, Herbicide Burial Area	1-12
	1.2.5 Site 9, Oil-Saturated Area	1-12
	1.2.6 Site 10, Hazardous Waste Drum Storage Area	1-16
	1.2.7 Site 12, POL Storage Yard	1-16
	1.3 SITES NOT INVESTIGATED DURING STAGE 2	1-19
	1.4 TYPES OF CONTAMINANTS INVESTIGATED	1-21
	1.5 FIELD PERSONNEL	1-28
	1.6 SUBCONTRACTORS	1-28
2	ENVIRONMENTAL SETTING	2-1
	2.1 GEOGRAPHIC SETTING	2-1
	2.1.1 Physiography	2-1
	2.1.2 Topography	2-1
	2.2 GEOLOGY	2-1
	2.2.1 Geologic Setting	2-1
	2.2.2 Soils	2-3
	2.2.3 Stratigraphy	2-3
	2.2.4 Structure	2-6

Table of Contents (Cont.)

<u>Section</u>	<u>Page</u>
2.3 HYDROLOGY AND WATER USE	2-6
2.3.1 Surface Water	2-6
2.3.2 Hydrogeology	2-8
2.4 CLIMATE	2-8
3 FIELD PROGRAM	3-1
3.1 PROGRAM DEVELOPMENT	3-1
3.2 FIELD INVESTIGATION	3-4
3.2.1 Schedule of Field Activities	3-4
3.2.2 Records Search	3-4
3.2.3 Geophysical Survey Procedures	3-6
3.2.4 Soil Gas Sampling	3-6
3.2.5 Soil, Sediment, and Water Sampling	3-6
3.2.6 Handling of Investigation-Derived Waste	3-16
3.2.7 Site-Specific Investigation Activities	3-18
3.2.8 Laboratory Program	3-29
3.2.9 Variations from Description of Work	3-32
4 RESULTS AND SIGNIFICANCE OF FINDINGS	4-1
4.1 INTRODUCTION	4-1
4.2 RESULTS	4-4
4.2.1 Site 1, South Landfill	4-4
4.2.2 Site 2, Northeast Landfill	4-7
4.2.3 Site 6, North Burn Pit Area	4-11
4.2.4 Site 8, Herbicide Burial Area	4-17
4.2.5 Site 9, Oil-Saturated Area	4-19
4.2.6 Site 10, Hazardous Waste Drum Storage Area	4-22
4.2.7 Site 12, POL Storage Yard	4-26
4.3 SIGNIFICANCE OF FINDINGS	4-30
4.3.1 Site 1, South Landfill	4-30
4.3.2 Site 2, Northeast Landfill	4-30
4.3.3 Site 6, North Burn Pit Area	4-30

Table of Contents (Cont.)

<u>Section</u>		<u>Page</u>
4.3.4	Site 8, Herbicide Burial Area	4-31
4.3.5	Site 9, Oil-Saturated Area	4-31
4.3.6	Site 10, Hazardous Waste Drum Storage Area	4-32
4.3.7	Site 12, POL Storage Yard	4-33
5	ALTERNATIVE MEASURES	5-1
5.1	SITE 1, SOUTH LANDFILL	5-1
5.2	SITE 2, NORTHEAST LANDFILL	5-2
5.3	SITE 6, NORTH BURN PIT AREA	5-2
5.4	SITE 8, HERBICIDE BURIAL AREA	5-3
5.5	SITE 9, OIL-SATURATED AREA	5-4
5.6	SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA	5-4
5.7	SITE 12, POL STORAGE YARD	5-4
6	RECOMMENDATIONS	6-1
6.1	SITE 1, SOUTH LANDFILL - CATEGORY I	6-1
6.2	SITE 2, NORTHEAST LANDFILL - CATEGORY III	6-5
6.3	SITE 4, WEST BURN AREA	6-5
6.4	SITE 6, NORTH BURN PIT AREA - CATEGORIES II AND III	6-6
6.5	SITE 8, HERBICIDE BURIAL AREA - CATEGORY II	6-6
6.6	SITE 9, OIL-SATURATED AREA - CATEGORY III	6-8
6.7	SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA - CATEGORY III	6-11
6.8	SITE 12, POL STORAGE YARD - CATEGORY II	6-11
6.9	WELL ABANDONMENT	6-11

Table 2
SUMMARY OF FIELDWORK/ANALYSES PERFORMED

Site	Fieldwork Performed	Analyses Performed
Site 1, South Landfill	<ul style="list-style-type: none"> • 1 borehole drilled • 7 soil samples collected • 4 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC, priority pollutants, common anions, phenols.
Site 2, Northeast Landfill	<ul style="list-style-type: none"> • geophysical survey • 4 boreholes drilled • 2 monitoring wells installed • 10 soil samples collected • 5 groundwater samples collected • 3 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC, priority pollutants, common anions, phenols
Site 6, North Burn Pit Area	<ul style="list-style-type: none"> • soil gas survey • 3 boreholes drilled • 3 monitoring wells installed • 15 soil samples collected • 3 groundwater sample collected • 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, VOC.
Site 8, Herbicide Burial Area	<ul style="list-style-type: none"> • 4 soil samples collected • 1 surface water sample collected 	Soils: pesticides, arsenic, mercury. Waters: TDS, pesticides, arsenic, mercury.
Site 9, Oil-Saturated Area	<ul style="list-style-type: none"> • 1 borehole drilled • 8 soil samples collected • 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC, lead. Waters: petroleum hydrocarbons, TDS, VOC, lead.
Site 10, Hazardous Waste Drum Storage Area	<ul style="list-style-type: none"> • 1 borehole drilled • 9 soil samples collected • 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC, EP TOX metals. Waters: petroleum hydrocarbons, TDS, priority pollutant metals, barium.
Site 12, POL Storage Yard	<ul style="list-style-type: none"> • 3 boreholes augered • 1 monitoring well installed • 1 soil sample collected • 4 groundwater samples collected • 2 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC.

Table 3
SUMMARY OF RECOMMENDATIONS

Site	Recommendation	Rationale
Site 1, South Landfill	Category I. No further action.	No significant contamination was found during the Stage 2 investigation.
Site 2, Northeast Landfill	Category III. Biannual monitoring for 2 years. Collect and analyze groundwater samples from five existing monitoring wells twice yearly.	To determine changes in groundwater quality because elevated sulphate concentrations were the only indicators of contamination above acceptable limits.
Site 4, West Burn Area	Category II. Perform a soil gas survey and geophysical survey. Install three monitoring wells and collect and analyze groundwater samples. Collect subsurface and surface soil samples.	To determine the exact location of the site and determine if hazardous constituents have migrated from the site.
Site 6, North Burn Pit Area	Category III and II. Biannual monitoring for 2 years. Install two more monitoring wells. Collect and analyze groundwater samples from five monitoring wells twice yearly.	To better characterize the organic contamination of the groundwater.
Site 8, Herbicide Burial Area	Category II. Additional geophysical surveys. Drill four boreholes and collect two soil samples from each borehole.	To determine exact location of trench and analyze soil from within the trench.
Site 9, Oil-Saturated Area	Category III. Excavate and remove contaminated soils.	To reduce risk of potential direct human contact to soils contaminated with petroleum hydrocarbons and lead.
Site 10, Hazardous Waste Drum Storage Area	Category III. Excavate and remove contaminated soils.	To reduce risk of potential direct human contact petroleum hydrocarbons.
Site 12, PQL Storage Yard	Category II. Install four monitoring wells. Collect and analyze groundwater samples twice yearly.	To determine if volatile organic compound contamination has migrated from the site.

- To define the magnitude and potential of contaminant migration, if possible; and
- To identify potential health and/or environmental hazards based on state or federal standards.

A Phase I Initial Records Search had been conducted by CH2M Hill as outlined in a report dated March 1983. The Phase I report identified sites with potential contamination problems and made recommendations for Phase II investigation. Based on these recommendations, a Phase II Stage 1 investigation was performed on the two sites, Site 1, the South Landfill, and Site 2, the Northeast Landfill, which ranked above 50 on the USAF Hazard Assessment Rating Methodology (HARM) scale ranking system. Preliminary investigation was performed by Water and Air Research, Inc. The results of this investigation were finalized in a report dated December 1983.

In 1985, Richards-Gebaur AFB was scheduled to be reevaluated under the IRP. A presurvey meeting was arranged and all past and current potential sites were visited and evaluated. The presurvey was conducted by E & E and their recommendations were provided in a Presurvey Report dated June 1985.

The sites included in that survey are:

- Site 1, South Landfill,
- Site 2, Northeast Landfill,
- Site 3, Contractor Rubble Burial Area,
- Site 4, West Burn Area,
- Site 5, South Burn Area,
- Site 6, North Burn Area,
- Site 7, Radioactive Disposal Well,
- Site 8, Herbicide Burial Area,
- Site 9, Oil-Saturated Area,
- Site 10, Hazardous Waste Drum Storage Area,
- Site 11, Paint Stripper Hangar,

- Site 12, Petroleum, Oils, and Lubricants (POL) Storage Yard, and
- Site 13, Hazardous Material Storage--Building 927.

Based on this report and after review by state and federal offices, the USAF contracted Phase II Stage 2 investigation of the following sites:

- Site 1, South Landfill,
- Site 2, Northeast Landfill,
- Site 6, North Burn Pit Area,
- Site 8, Herbicide Burial Area,
- Site 9, Oil-Saturated Area,
- Site 10, Hazardous Waste Drum Storage Area, and
- Site 12, POL Storage Yard.

1.1 LOCATION AND HISTORY OF OPERATIONS

The primary source of historical information on the base was the Phase I report by CH2M Hill (1983). The information was confirmed and updated by E & E as part of the Phase II Stage 2 investigation.

Richards-Gebaur AFB is located in west-central Missouri, 2.6 miles from the Kansas-Missouri state line (see Figure 1-1). The Jackson County and Cass County line runs east-west through the middle of the base. The base is bounded on the north by the City of Grandview, on the north and west by Kansas City, and on the south and east by the City of Belton. The base is about 18 miles southeast of downtown Kansas City. Access to the base is via U.S. Highway 71.

The legal description of the base includes the following ranges and townships:

<u>Range</u>	<u>Township</u>	<u>Sections</u>
R46N	T33W	2, 3, 10, 11
R47N	T33W	34, 35

occupation of the former base officer housing area; the U.S. Department of Agriculture Standardization Division; the U.S. Navy Seabee Reserve Mobile Construction Battalion No. 15; 308th Psychological Operations Company; nine U.S. Army reserve units; and the General Services Administration (GSA).

In October 1980, the majority of the base facilities and properties were accessed to the GSA in an interim lease, and joint use of the airport with Kansas City became effective. Base support facilities are currently shared by AFRES, Kansas City, and Talley Services, Inc.

A more detailed description of the base history and its mission can be found in the Phase I Records Search Report.

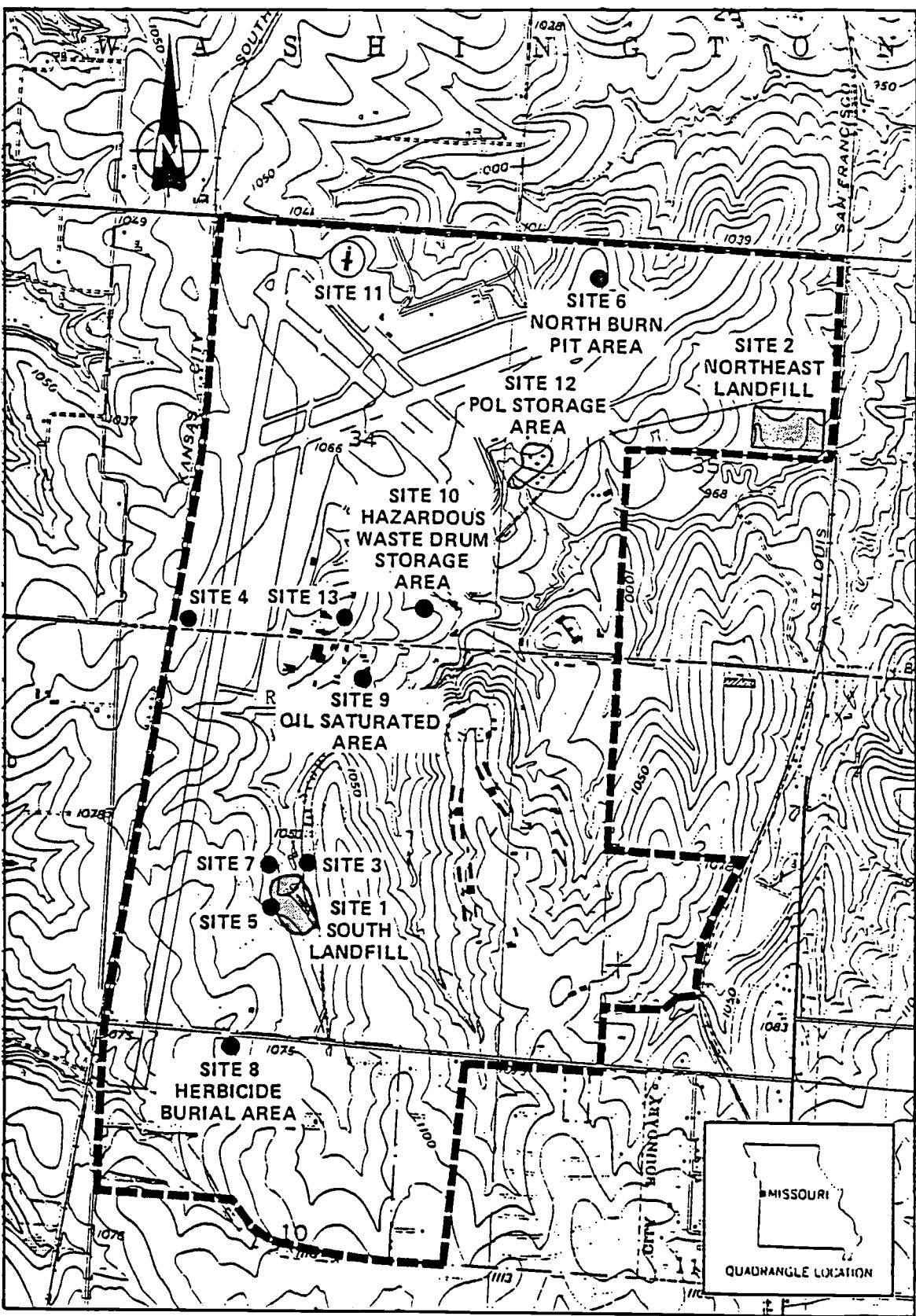
The Air Force controlled property at Richards-Gebaur AFB involves a fairly complex arrangement of ownership, permit use, leases, and easements. Figure 1-2 illustrates the current distribution of various land parcels within the base boundaries. Base property at the present time includes about 2,160 acres, of which 375 acres are retained by the USAF; 1,673 acres are leased to Kansas City and the City of Belton; 101 acres are being transferred to the Department of the Navy; and 11 acres have been transferred to the Department of the Army. An off-base drop zone, the Belton Training Annex, represents another 472 acres of land under the control of Richards-Gebaur AFB.

1.2 SITE DESCRIPTIONS

The primary source of information on the following site descriptions was the Phase I report prepared by CH2M Hill. The information was confirmed and updated by E & E as part of the Phase II Stage 2 investigation. The locations of the sites are shown on Figure 1-3.

1.2.1 Site 1, South Landfill

The South Landfill is located in the south-central part of the base near the nondestructive inspection (NDI) laboratory and adjacent to Scope Creek (see Figure 1-4). Between 1954 and 1956, this site was the main sanitary landfill for Richards-Gebaur AFB. In 1956, contract off-base disposal of most common refuse was begun, although some wastes, including building rubble, yard debris, and waste from some industrial shop areas, were disposed of at the site until about 1961. Materials



SOURCE: U.S.G.S. 7.5' Quadrangle, Belton, Mo.-Kans., 1975.

SCALE
0 % 1 MILE

Figure 1-3 RICHARDS-GEBAUR AIR FORCE BASE IRP SITES

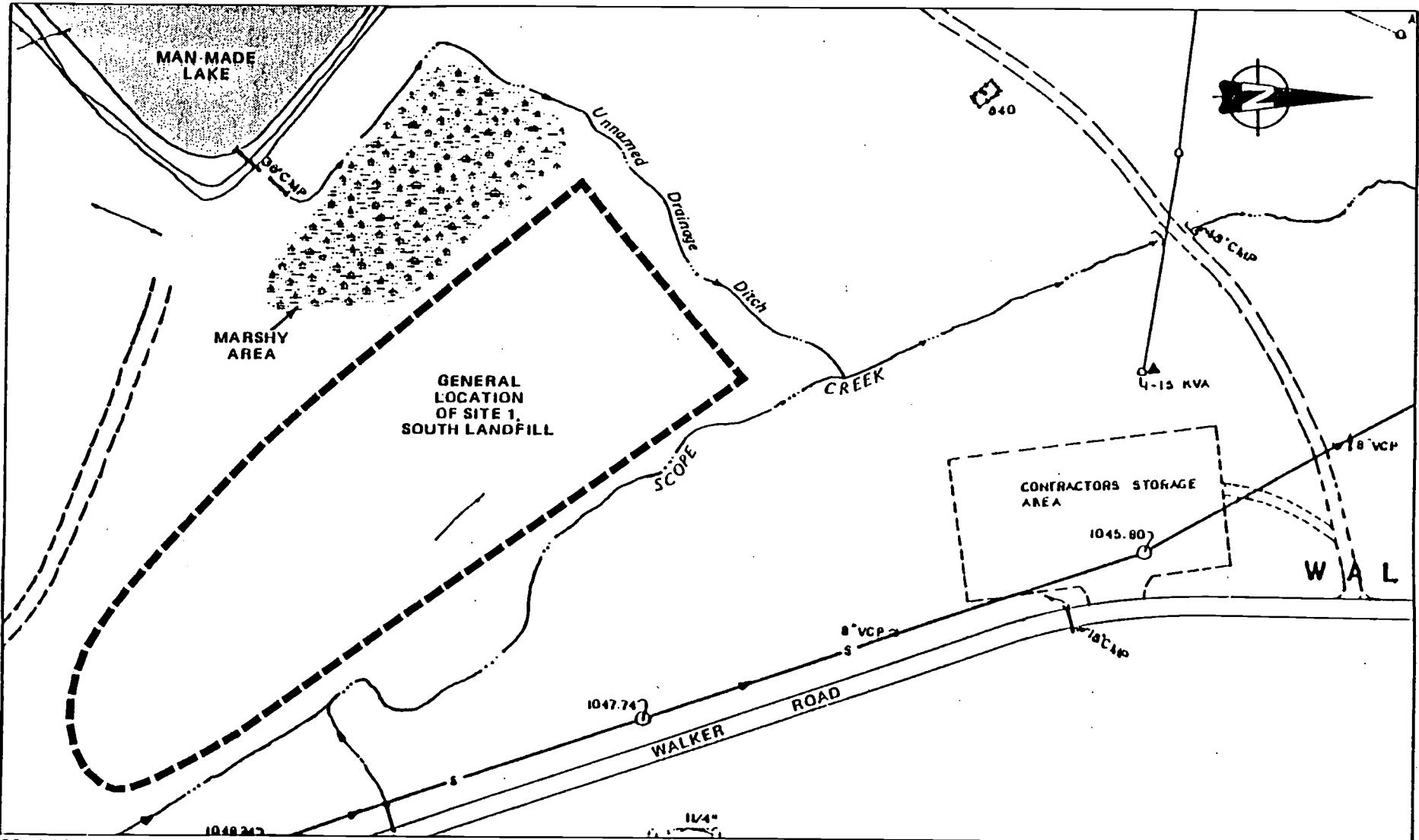


Figure 1-4 SITE 1, SOUTH LANDFILL LOCATION MAP

SCALE
0 60 100 200 300 FEET

which may have been disposed of in the South Landfill include small quantities of waste paints, thinners, strippers, solvents, and oils, although it was not standard procedure to dispose of such materials here. Operation of the landfill included burning of the disposed wastes. Since 1961, the area has been used only intermittently for unauthorized dumping, including residues from tar pots and some household wastes. Small quantities of hazardous wastes may have been placed in this landfill; however, no significant hazardous waste quantities were reported. An earthen barricade has been erected at the entrance to the site, and current access to the site is through a locked road gate.

Scope Creek runs along the eastern edge of the landfill and there is a small man-made lake directly west of and upgradient from the landfill. The northwest area of the landfill is marshy due to this lake, and seeps were observed in this area. Scope Creek empties into Little Blue River, which drains most of eastern Jackson County. The Little Blue River empties into the Missouri River.

1.2.2 Site 2, Northeast Landfill

The Northeast Landfill is located in the northeasternmost portion of the base adjacent to Scope Creek (see Figure 1-5). The site was used between 1961 and 1972 for the disposal of miscellaneous wastes, including building rubble, yard debris, and wastes from some industrial shop areas. The eastern portion of Site 2 was used for open storage of materials, including construction materials, pipes, empty tanks, waste paint and thinners in drums and buckets, and empty 55-gallon drums. As many as 400 drums were located in this area at one time. Less than 20 drums, mostly empty, were on-site as of 1986. The wastes were typically burned and buried in trenches. Most of the sanitary wastes at Richards-Gebaur AFB during this time were disposed of off-base through contract removal. Waste paints and thinners at the base were reportedly disposed of on the ground surface as late as 1978.

The Little Blue Valley Sewer District installed a 24-inch diameter reinforced concrete pipe (RCP) interceptor sewer line through the southeast corner of Site 2 in 1983. There was no indication that trash or other landfill material was encountered during construction. The

1.3 SITES NOT INVESTIGATED DURING STAGE 2

Several sites were not investigated during the Stage 2 program. The sites were deleted because they either could not be located or they were located on property leased to the Kansas City Aviation Department, which denied access to all sites on Kansas City Aviation land, except the South and Northeast landfills. Access was not granted because the Phase II Field Evaluation Report, dated December 1983, recommended no further action. The letters denying access to sites 3, 5, 7, and 11 are found in Appendix B. The reason Site 13 was not investigated is unknown. This site was not listed in the Description of Work. The following is a discussion of those sites.

Site 3, Contractor Rubble Burial Site

The Rubble Burial Site is located on the east bank of Scope Creek in the south-central part of the base. It reportedly was in operation from 1954 through 1978. The area is not posted or fenced and appears to have been used more recently than 1978. The area is fairly level and most of the debris is discharged over the bank at the treeline. During the presurvey visit, construction materials, including wood, concrete, masonry, and metal, were observed; however, dense foliage prevented a more thorough investigation. A 5-gallon sealed plastic container of an unidentified liquid was discovered at the base of the fill and brought to the attention of the Richards-Gebaur AFB civil engineer. This area is on land either sold or leased to the City of Kansas City. The Kansas City Aviation Department did not grant access to this site.

Site 4, West Burn Area

The West Burn Area was tentatively identified as being located off the base to the west on the west side of the railroad track and north of the Jackson County line. During the presurvey fieldwork, no evidence of this site could be found. Since the West Burn Area was in operation for only 1 year (1955) approximately 30 years ago, it was thought that there was no physical evidence of this site. However, since the Phase II Stage 2 Field Investigation, aerial photographs not previously available indicate the site may actually be located east of the railroad. During a familiarization tour on August 12, 1987, a material believed to be

tank sludge was found in an area just north of the county line and just east of the railroad tracks. At the time of the fieldwork, the site location was unknown and believed to be off base. Therefore, the site was not investigated.

Any impact that this site might have had will have to take into account the presence of the Knoche oil field 3,000 feet to the southeast. The uplands here are fairly level and the area of the site currently is farmed in corn. A tree nursery is located across the county line to the south.

This site should be investigated further if Kansas City will grant access.

Site 5, South Burn Area

The South Burn Area tentatively has been identified as being located to the southwest of the South Landfill (Site 1). During the presurvey fieldwork, no evidence of this site could be found. Since the South Burn Area was in operation for 10 years (1955 to 1965) approximately 20 years ago, it is possible that there will be no physical evidence of this site at all. Because of its proximity to the South Landfill, any environmental contamination detected at this site will be reviewed in light of findings from the South Landfill investigation. This site is believed to be on land either owned or leased by the City of Kansas City, Missouri. The Kansas City Aviation Department did not grant access for this investigation.

Site 7, Radioactive Disposal Well

The Radioactive Disposal Well is located north of the South Landfill and east of the major flight line. It is believed to have been operated from 1955 to 1970. Discussion during the presurvey visit indicated that low-level radioactive material, typically radium dials, were disposed into this cased well. The site currently is behind a locked gate in an open field. The well itself is very visible, standing 4 to 5 feet high and painted red. This well is located on land owned or leased by the City of Kansas City, Missouri. The Kansas City Aviation Department did not grant access for this investigation. Therefore, no work was performed at this site.

3. FIELD PROGRAM

3.1 PROGRAM DEVELOPMENT

A field program for the Phase II Stage 2 Confirmation/Quantification investigation was developed by E & E and presented in the Presurvey Report submitted on 7 June 1985. The program was reviewed and modified by the Air Force and set forth in the Description of Work for Contract F33615-83-D-4003, Task Order 13.

Elements of the field program included: a soil gas survey, a geophysical survey, sediment sampling, subsurface soil sampling, surface water sampling, installation of groundwater monitoring wells, and groundwater sampling. Various combinations of these program elements were performed at the various sites. Table 3-1 outlines the types of work conducted at each site. By site, the objectives of the fieldwork were:

Site 1 - South Landfill

- Determine if contaminated leachate from the landfill is entering Scope Creek.
- Evaluate potential for vertical migration of contamination.

Site 2 - Northeast Landfill

- Determine past disposal practices at the landfill.
- Delineate the locations of several suspected waste disposal trenches and determine if contamination has resulted.
- Expand monitoring well network to investigate migration of groundwater contamination from possible leaching of landfilled materials.

Table 3-1
FIELDWORK PERFORMED AT EACH SITE

	Geophysics	Boreholes	New Monitoring Wells	Soil Samples*	Groundwater Samples*	Surface Water Samples*
Site 1 - South Landfill	--	1	--	6	--	3
Site 2 - Northeast Landfill	MAG, EM	4	2	10	5	3
Site 6 - North Burn Pit Area	Soil Gas	3	3	15	3	1
Site 8 - Herbicide Burial Area	--	--	--	4	--	1
Site 9 - Oil-Saturated Area	--	1	--	9	--	1
Site 10 - Hazardous Waste Drum Storage Area	--	1	--	9	--	1
Site 12 - POL Storage Yard	--	4(h)	1	11	1	2
TOTALS		14	6	64	9	12

*Numbers do not include duplicates or blanks.

Key:
 MAG = Magnetometer survey
 EM = Electromagnetic survey
 (h) = Hand-augered boreholes

Site 6 - North Burn Pit Area

- Determine occurrence of contamination from the site using a soil gas survey.
- Determine occurrence of subsurface soil contamination.
- Determine whether groundwater contamination has occurred.

Site 8 - Herbicide Burial Area

- Identify actual burial area by examining available background information.
- Identify any contaminants in soil in the vicinity of the burial area.
- Evaluate extent of migration of any contaminants via surface drainage pathway.

Site 9 - Oil-Saturated Area

- Evaluate type and extent of surface and subsurface soil contamination.
- Determine if contaminants are migrating via surface drainage pathway.

Site 10 - Hazardous Waste Drum Storage Area

- Evaluate type and extent of surface and subsurface soil contamination.
- Evaluate potential migration of contaminants via surface drainage pathway.

Site 12 - POL Storage Yard

- Determine the extent of any subsurface soil contamination.
- Evaluate extent of migration of contaminants via buried drain lines and surface drainage pathways.
- Determine whether groundwater contamination has occurred and evaluate extent of contamination.

3.2 FIELD INVESTIGATION

The field investigation consisted of:

- Literature and aerial photograph records search;
- A magnetometer and electromagnetic (EM) terrain conductivity survey;
- A soil gas survey;
- The drilling of 10 boreholes;
- The installation of six monitoring wells; and
- Collection and analysis of 27 surface soil and sediment samples, 38 subsurface soil samples, 13 surface water samples, and 9 groundwater samples.

3.2.1 Schedule of Field Activities

Field activities were scheduled so as to optimize the utilization of manpower and resources. Field activities were coordinated with the USAFOEHL, the base Point of Contact (POC), and subcontractors to minimize delays and potential problems.

Throughout the course of the field activities, daily contact was maintained with the designated base personnel. The principal contact was Ms. Felipita Benson, R.N. Additional coordination was through Mr. John Hurd, Base Civil Engineer.

The fieldwork was completed during the period from 6 October 1986 to 4 November 1986. Table 3-2 provides the sequence of major field activities.

Health and safety protocols, as outlined in the Health and Safety Plan (see Appendix N), were followed throughout the project. Modifications of specific elements of the Health and Safety Plan were based on field conditions and executed only after discussion with E & E's Health and Safety Coordinator.

3.2.2 Records Search

During the course of the Phase II Stage 2 investigation, discussions were held with personnel from the Base Environmental Engineering Staff and the Base Civil Engineering Staff regarding past waste disposal practices and likely contaminants. Historical aerial photographs were

Table 3-2
SCHEDULE OF MAJOR FIELD ACTIVITIES
(October to November 1986)

6 October	Fieldwork begins with a reconnaissance of all sites and collection of surface soil samples.
6-8 October	Geophysical survey at Site 2, Northeast Landfill.
7-9 October	Soil gas survey at Site 6, North Burn Pit Area.
14 October	Drillers on site, set-up decontamination areas at Site 6, North Burn Pit Area and vehicle wash racks.
15 October	Three soil borings drilled, sampled, and grouted at Site 6, North Burn Pit Area.
16 October	Six monitoring wells drilled, pipe set, soil samples collected, and wells completed; three are at Site 6, North Burn Pit; two at Site 2, Northeast Landfill; and one at Site 12, POL Storage Yard. One well at Site 6, North Burn Pit Area was a borehole completed as a well.
17 October	Six soil borings drilled, samples collected, and the holes grouted, one at the Motor Pool Compound; one at the former hazardous waste storage yard; one at Site 1, South Landfill; and three at Site 2, Northeast Landfill.
18 October	Development of new wells and cleanup of drilling and staging areas.
21 October	Wells purged and groundwater samples collected.
23 October	The remaining surface soil and surface water samples collected from Site 2, Northeast Landfill; and Site 1, South Landfill.
28 October, 4 November	Hand-auger borings at Site 12, POL Storage Yard.
4 November	End of sampling.

examined to provide information on waste disposal practices at the base. Aerial photos were helpful in locating and delineating several sites which were not clearly visible during the Presurvey field trip. Table 3-3 lists the photos which were available for review.

3.2.3 Geophysical Survey Procedures

Magnetometer and EM surveys were performed concurrently at Site 2, Northeast Landfill, in an effort to locate what were thought to be discrete landfill trenches at this site, preliminary to placing groundwater monitoring wells. The magnetometer survey is designed to locate magnetically conductive materials in landfills, which are generally more conductive than the surrounding soils. Anomalies in magnetic flux are measured by the magnetometer and recorded in the field notebook. The EM conductivity survey measures the conductivity of the soil or any variations in the conductivity of the soil. Excavations for landfills change the natural conductivity by changing the porosity and density of the soils and altering the normal values of conducting fluids in the soils. Presumed locations of the trenches were delineated in a map provided by the Base Civil Engineer.

A Geometrics Model G-846 proton procession magnetometer with a sensitivity of 0.1 gammas and a Geonics Model EM-31 terrain conductivity meter with an effective exploration depth of 6 meters were used.

3.2.4 Soil Gas Sampling

A soil gas survey was performed at Site 6, the North Burn Pit Area, in an effort to identify potential residual contamination from the burning and handling of flammable liquids. The soil gas data were used to aid in locating the groundwater monitoring wells. The survey was performed by hand-driving perforated pipes in and around the compound. After capping each pipe and allowing it to stand for 15 minutes, the hole was monitored using an Organic Vapor Analyzer (OVA) to determine the presence or absence of volatile compounds.

3.2.5 Soil, Sediment, and Water Sampling

Soil, sediment, and water sampling protocols were followed as outlined in the Technical Operations Plan (Appendix N), except for

Table 3-3
SUMMARY OF HISTORIC AERIAL PHOTOGRAPHS
FOR AREA AROUND RICHARDS-GEBAUR AFB

Year	Scale	Source	Availability
1936	1:20,000	NARS	--
1940	1:20,000	MARC	--
1948	1:17,000	EROS, USGS	--
1950	1:70,000	EROS, USA	--
1953	1:20,000	ASCS	--
1955	1:13,000	EROS, USGS, USAF (shows West Burn Pit)	Reviewed
1957	1:20,000	ASCS	--
1959	1:12,000	COE	--
1960*	1:12,000	City of Grandview (shows borrow pits north of Northeast Landfill)	Reviewed
1963	1:18,000	USGS	Reviewed
1963	1:20,000	ASCS	--
1970	1:24,015	EDRS	--
1972*	1:12,000	City of Grandview (shows active North-east Landfill)	Reviewed
1975	1:40,000	EROS	--
1978	1:72,500	EROS	--
1980	1:80,000	EROS	--
1982	1:58,000	EROS	--
1982	1:80,000	EROS	--

Key:
 EROS = EROS Data Center, SD
 MARC = Mid America Regional Council, MO
 ASCA = American Soil Conservation Agency
 COOE = Army Corps of Engineers
 USGS = United States Geological Survey
 USA = United States Army
 NARS = National Archives

*Not on federal archive list; does not cover south half of base.

samples collected for volatile organic analysis (VOAs). These were discrete samples collected prior to homogenization (blended to result in a more uniform sample). The portion of the sample collected for VOAs was cut from the center of the sample and placed directly into 40-ml vials.

All samples were split in the field when enough sample material was available. Split samples were delivered to the base POC. The POC determined those splits which were to be submitted to OEHL/SA for analysis. The split samples for analysis were provided by the POC to E & E for shipment to OEHL/SA.

Sediment Sampling

Sediment sampling was conducted in association with Site 1, South Landfill; Site 6, North Burn Pit Area; Site 8, Herbicide Burial Area; Site 9, Oil-Saturated Area; Site 10, Hazardous Waste Drum Storage Area; and Site 12, POL Storage Yard. A total of 27 samples were collected and submitted for chemical analysis. Table 3-4 presents a summary of the samples collected.

Sediment samples were collected using shovels to loosen an 8-inch cube of sediment from which a vertical column was removed using a stainless steel spoon. The soil column was homogenized in a disposable aluminum pan and then splits were placed in two sampling containers. Spoons were decontaminated and all pans were disposed of after sample collection from each location.

Subsurface Soil Sampling

Subsurface soil samples were collected from 5-foot-long split-spoon samplers during the drilling of the boreholes and monitoring wells. Borehole and monitoring well drilling was performed by Geotechnology, Inc., of St. Louis, Missouri. Table 3-5 provides a summary of borehole depths.

Ten boreholes were drilled and 28 subsurface soil samples were collected and submitted for analysis. Boreholes were drilled for the specific purpose of obtaining subsurface soil samples; however, one borehole (Boring 4) was scheduled to be completed as a monitoring well. A total of 186.5 linear feet of drilling was accomplished using a Mobile

Table 3-4
SUMMARY OF SURFACE SOIL SAMPLING

Site No.	Field Sample No.	Sample Location and Description
1	DF4067	Scope Creek - Background at Markey and Bates
	DF4069	Scope Creek - Downstream of South Landfill
	DF4070	Scope Creek - Seep 1 east of South Landfill
	DF4077	Scope Creek - Seep 2 northeast of South Landfill
6	DF4001	North Burn - 100 feet east of eastern fence center
	DF4002	North Burn - 200 feet east of eastern fence center
	DF4003	North Burn - 100 feet north of northern fence drainage
	DF4004	North Burn - Southeast corner fence, 200-300 feet
	DF4005	North Burn - 25 feet south of southwestern corner of fence
	DF4014	North Burn - 100 feet northwest of northwest corner of fence
8	DF4015	Herbicide Burial Area - 300 feet south of Markey
	DF4016	Herbicide Burial Area - 25 feet east of DF4015
	DF4017	Herbicide Burial Area - 25 feet east of DF4016
	DF4018	Herbicide Burial Area - 100 feet south of Markey
9	DF4007	Oil-Saturated Area - Southwest corner of Motor Pool
	DF4008	Oil-Saturated Area - Southwest corner +25 feet
	DF4009	Oil-Saturated Area - Southwest corner +50 feet
	DF4010	Oil-Saturated Area - Outside southwest corner, 0-100 feet
	DF4011	Oil-Saturated Area - Outside southwest corner, 100-200 feet
	DF4012	Oil-Saturated Area - Outside southwest corner, 200-300 feet
10	DF4019	Hazardous Waste Drum Storage Area - Background from athletic field
	DF4020	Hazardous Waste Drum Storage Area - North of gate to compound
	DF4021	Hazardous Waste Drum Storage Area - West corner of fence, 0-26 feet
	DF4022	Hazardous Waste Drum Storage Area - West corner of fence, 26-60 feet
	DF4023	Hazardous Waste Drum Storage Area - West corner of fence, 60-120 feet
	DF4024	Hazardous Waste Drum Storage Area - South corner +25 feet
12	DF4088	POL Storage Yard - Culvert at Bldg. 952

Table 3-5
SUMMARY OF SOIL BORINGS

Site No.	Boring Designation	Total Depth (feet)
1	Boring #7	7.1
2	Boring #4	9.8
	Boring #8	7.9
	Boring #9	13.0
	Boring #10	8.5
3	Boring #1	12.9
	Boring #2	13.0
	Boring #3	14.5
5	Boring #5	16.5
6	Boring #6	15.0
7	Hand Boring #1	6.0
	Hand Boring #2	6.0
	Hand Boring #3	6.0
12	Hand Boring #4	6.0

alternatively, dispersed in Site 6, North Burn Pit Area. Development and purge waters were placed in the North Burn Pit to evaporate.

3.2.7 Site-Specific Investigation Activities

As discussed above, fieldwork at each site consisted of some combination of geophysics, soil boring, subsurface soil sampling, and groundwater sampling. Activities at the individual sites are discussed below.

Site 1, South Landfill

A single upgradient soil boring was drilled southwest of the landfill (Boring 7) and three subsurface soil samples collected. The actual eastern boundary of the landfill is the west bank of Scope Creek. Therefore, it was impossible to drill a boring downgradient without penetrating the waste and jeopardizing the integrity of the landfill. Four surface soil samples were collected: a background sample adjacent to Scope Creek upstream of the landfill; one at Seep 1 where the seep enters Scope Creek; one at Seep 2 where the seep enters Scope Creek; and one adjacent to Scope Creek downstream from the landfill. Four surface water samples were collected: from Seep 1 and Seep 2 where the seeps enter Scope Creek, and from Scope Creek at the upstream (background) and downstream sampling points.

Figure 3-1 shows the sampling locations for this site.

The four water samples were analyzed for petroleum hydrocarbons, total dissolved solids, halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols. The soil samples were analyzed for halogenated and aromatic organics and petroleum hydrocarbons.

Site 2, Northeast Landfill

Magnetometer and conductivity surveys were performed at this site to locate what were originally believed to be three discrete trenches. A grid system was staked over the survey area. The grid extended beyond the expected landfill boundaries in order to define the boundaries. The grid sections were 100 by 100 feet. Every 25 feet along each grid line, three readings were taken with the magnetometer and averaged, and one

times is provided in Appendix H. All samples were shipped to the E & E Analytical Services Center (ASC) or to OEHL/SA by overnight Federal Express. Analytical protocols are discussed in Appendix N.

3.2.9 Variations from Description of Work

During the execution of the fieldwork, several changes from the Description of Work were implemented due to field conditions and findings. Changes were implemented after discussion with and concurrence of the OEHL project manager. A site-specific summary of the variations follows.

All Sites

Subsurface soil borings were taken using a CME continuous sampler. This unit is essentially a 5-foot-long split-spoon soil sampler that is advanced ahead of the hollow-stem auger. It provides a continuous undisturbed sample of the sediment column.

Optional water samples, allocated in case groundwater was intersected during the borehole drilling for subsurface soil samples, were not utilized as no appreciable amounts of groundwater were observed in any boreholes.

Site 1, South Landfill

No modifications in the proposed scope of work occurred at this site.

Site 2, Northeast Landfill

The geophysical surveys were adjusted in the field to cover areas adjacent to the targeted area, based on instrument readings which indicated the entire targeted area as landfill. This was later corroborated based on aerial photographs.

Boring 7 was aborted after encountering the apparent edge of the landfill. Only one of the three scheduled soil samples from this borehole was collected.

An additional surface water sample was collected, from a flowing tributary to Scope Creek just before it enters the creek. This sample represented runoff from the landfill prior to dilution in Scope Creek.

The sample replaced a water sample which could not be taken at Site 6, where no water was encountered.

Site 6, North Burn Pit Area

Due to the absence of any appreciable amounts of water in two of the three monitoring wells at the site, analyses could only be performed for halogenated and aromatic organics. Petroleum hydrocarbons had to be omitted. Two additional attempts to collect sufficient sample volumes also failed.

No determination could be made as to upgradient versus downgradient with respect to monitoring wells. The facility is situated on the top of a ridge.

Site 8, Herbicide Burial Area

No modifications in the proposed scope of work were made at this site.

Site 9, Oil-Saturated Area

No modifications in the proposed scope of work occurred at this site.

Site 10, Hazardous Waste Drum Storage Area

An upstream surface water sample could not be obtained since no water was encountered.

Site 12, POL Storage Yard

A surface water sample from the outfall drain from Building 953 was allocated. However, there was no outfall from this building, and so no sample was collected.

Due to errors in sample labeling in the field, two analytical parameters listed in the Description of Work were inadvertently omitted. These errors affected the proposed analytical program as follows:

- Sample DF4045 - No TDS analysis was performed on this sample.

Table 4-3

**RESULTS OF SOIL SAMPLE ANALYSES
FOR SITE 1, SOUTH LANDFILL**

(mg/kg; all soil concentrations
expressed on an as received basis)

Parameter	Date Sampled: Boring: Depth: Field No.: Lab No.:	10/17 7 1-2' DF4047 8972	10/17 7 4-5' DF4048 8973	10/17 7 6-7' DF4049 8974	10/21 Upstream 0 - 6"	10/21 Downstream 0 - 6" DF4067 9090	10/21 Seep 1 0 - 6" DF4069 9091	10/21 Seep 2 0 - 6" DF4070 9092	10/21 Seep 2 0 - 6" DF4077 9236
Volatile Organic Compounds		ND	ND	ND	ND	ND	ND	ND	ND
Petroleum Hydrocarbons		ND	ND	1.2	ND	ND	1.9	16	

ND = Not Detected

Nearly all Organic Vapor Analyzer (OVA) readings were positive. The laboratory analyses indicated that none of the nine subsurface samples was contaminated with volatile organics. The probable explanation for the positive result in the soil gas survey and the negative result in the subsurface soil samples is that the OVA was detecting methane, which would not be detected in the soil samples. The fact that OVA readings remained constant when using a carbon filter further supports this conclusion.

The values for petroleum were also low and consistent among the samples (ND to 5.7 mg/kg), with the exception of sample DF4001, collected 100 feet east of the southeast corner of the fence line, which contained 34 mg/kg. Table 4-7 summarizes the results of the soil analyses.

4.2.4 Site 8, Herbicide Burial Area

Geology

Site 8, the Herbicide Burial Area, is similar in setting to Site 6, the North Burn Pit Area, and the Site 1, the South Landfill. The site is on an upland surface where silts and clays cover a weathered limestone bedrock. The original topography of the base has been modified by construction and extension of the major north-south runway. The area is nearly level, with broad shallow depressions and a small pond downgradient to the south.

A broad shallow depression was observed in the area of the suspected trench location based on AF 103. Water had ponded in this area and drained east into other wet areas. It is not known if the shallow depression was caused by possible subsidence of the 1971 trench or is due to construction activities since that date.

Hydrogeology

Based on observations made on other upland sites on the base, it can be assumed that the thickness of the unconsolidated deposits above the bedrock at this site is less than 7 feet. The burial trench was projected to be 6 feet in depth, which places the bottom of the trench very close to, if not directly on, the weathered bedrock surface. The hydrological implication is that the material that was buried, and

Table 4-9

RESULTS OF SOIL SAMPLE ANALYSES FOR
SITE 8, HERBICIDE BURIAL AREA

(mg/kg; all soil concentrations on an as received basis)

Parameter	Date Sampled: Boring#: Depth: Field No.: Lab No.:	10/10 HBAS-1 0-1' DF4015 8796	10/10 HBAS-2 0-1' DF4016 8797	10/10 HBAS-3 0-1' DF4017 8798	10/10 HBAS-4 0-1' DF4018 8799
Herbicides		ND	ND	ND	ND
Arsenic		1.83	5.0	ND	4.53
Mercury		ND	ND	ND	ND

ND = Not Detected

4.3 SIGNIFICANCE OF FINDINGS

4.3.1 Site 1, South Landfill

No contamination was detected leaving this site via surface migration into Scope Creek, based on the analyses of surface soil and water samples. Relatively low concentrations of petroleum hydrocarbons (1.2 mg/kg, 16 mg/kg) were detected in the subsurface soils. The extractable organic compound DBP, the only organic compound detected, was at low concentrations (10 to 16 µg/L), but it also appeared in the method blank (below 10 µg/L). Consequently, DBP has been attributed to laboratory contaminants.

4.3.2 Site 2, Northeast Landfill

With the exception of the extractable DBP, no organic chemicals or metals were reported in any water samples taken at the site. Because DBP was reported in concentrations (14 to 17 µg/L) minimally above sample blank value (13 µg/L), the presence of this chemical has been attributed to laboratory contamination.

Five anions were reported above detection limits. Only a single sample of sulfate at 280 µg/L exceeded a standard or criterion. Since this is a non-mandatory secondary standard set for aesthetic (taste and odor) considerations, the relatively minor exceedance, and the fact that there is no drinking water well nearby, should not represent any material threat to human health.

For soils, no metals exceeded normal ranges for western Missouri soils. The only detectable contaminant was petroleum hydrocarbons, reported at concentrations ranging from non-detectable to 440 mg/kg.

4.3.3 Site 6, North Burn Pit Area

Only three organics (chloroform, tetrachloroethylene, and methylene chloride) were detected in water samples from Site 6. Concentrations of two of the organics (below 1 µg/L) were significantly below EPA HAs. The third, methylene chloride, detected in a single groundwater sample, was well below the EPA HA.

No metals were reported above normal ranges for western Missouri soils. The only organic contaminant reported in soils above detection

have been associated with the storage of drummed hazardous materials here. These efforts included: overpacking drums, removal of stained soil, and scraping the asphalt surface. These efforts were undertaken as a result of a Notice of Violation issued by EPA.

4.3.7 Site 12, POL Storage Yard

The one groundwater and two surface water samples taken at Site 12, the POL Storage Yard, revealed no contamination above detection limits. In the 12 soil samples, petroleum hydrocarbon concentrations were relatively low (6.9 to 44 mg/kg). Removal of soils in the areas of the seven samples with higher concentrations (67 to 2,800 mg/kg) should be considered. In addition, a single sample collected near the drain pipe outlet for Building 953 at a depth of 3 feet contained concentrations of benzene (1.25 mg/kg), total xylenes (2.25 mg/kg), and ethylbenzene (6.25 mg/kg), indicative of contamination by gasoline or a similar petroleum hydrocarbon.

limits was petroleum hydrocarbons. Concentrations of petroleum hydrocarbons in 14 of the 15 samples taken at various depths ranged from non-detectable to 5.4 mg/kg. A single surface sample had a value of 34 mg/kg. In summary, the low concentrations found at the site indicate no undue risk to human health or the environment.

4.3.4 Site 8, Herbicide Burial Area

No detectable concentrations of any contaminant were reported in the single surface water sample taken at Site 8. Concentrations of metals in the four surface soil samples did not exceed the normal range of concentrations reported in western Missouri soils. In addition, no organic contamination was detected in the soil samples. Consequently, the data do not indicate that Site 8 presents an undue risk to human health or the environment.

4.3.5 Site 9, Oil-Saturated Area

No contaminants were detected in the single surface water sample at Site 9.

Results of the soil sample analyses indicate significant lead and petroleum hydrocarbon contamination of site soils. In six of nine samples, concentrations of lead fell within the normal range for western Missouri soils. In the same samples, petroleum hydrocarbon concentrations were relatively low (non-detectable to 9 mg/kg). In the remaining three samples, however, lead concentrations (117 to 343 mg/kg) greatly exceeded the normal range (10 to 20 mg/kg). In these same samples, petroleum hydrocarbons were also high (670 to 3,000 mg/kg). As these were samples taken from the surface (0- to 1-foot depth), humans would be subject to direct contact with high concentrations of lead from the site, warranting consideration of removal.

For the purpose of analyzing the potential human health risk related to lead exposure, it is assumed that humans ingest a maximum of 1 gram of soil daily during activities at the site. This number is extremely conservative (health protective), as it is based on the soil intake for small children--that segment of the population with highest soil intake as estimated by the Agency for Toxic Substances and Disease Registry (ATSDR 1986). Assuming 100% absorption of soil contaminants in

1 gram of soil, these intakes attributable to ingestion of onsite soils are then compared to the daily intake of lead regarded by EPA as acceptable as demonstrated by the current use of this limit in developing the RMCL of 20 $\mu\text{g}/\text{L}$ for lead.

An Acceptable Daily Intake (ADI) for adults related to soil lead ingestion has been derived based on the EPA proposed RMCL of 20 $\mu\text{g}/\text{L}$ and the following assumptions:

- Ingestion of 2 liters per day (L/day) for a 70-kg adult.
- Twenty percent of the ADI is contributed by water ingestion. This assumption is based on methodologies used to estimate revised drinking water standards (EPA 1985a).
- Intake of lead except by ingestion of drinking water and by the soil-related pathways is minimal.
For an adult:

$$20 \mu\text{g}/\text{L} \times 2 \text{ L/day} = 40 \mu\text{g}/\text{day} \text{ from ingestion of water}$$

$$40 \mu\text{g}/\text{day} + 0.2 = 200 \mu\text{g}/\text{day} \text{ from all sources}$$

$$200 \mu\text{g}/\text{day} - 40 \mu\text{g}/\text{day} = 160 \mu\text{g}/\text{day} \text{ from all sources excluding water ingestion, which is the Adjusted Acceptable Daily Intake (AADI) for soil for adults}$$

In order that the AADI not be exceeded, the corresponding soil concentration must be no higher than 160 mg/kg.

4.3.6 Site 10, Hazardous Waste Drum Storage Area

The storage of hazardous waste drums in this compound does not appear to have contaminated the surface and subsurface soils. The only contaminants in soil were petroleum hydrocarbons, with concentrations ranging from non-detectable to 1,900 mg/kg. In six of the nine samples, concentrations were low (less than 9 mg/kg). However, concentrations were high (670 to 3,000 mg/kg) in three samples taken at 0- to 1-foot intervals, and removal of soils from these areas should be considered. The single surface water sample contained barium (85 $\mu\text{g}/\text{L}$) and lead (5 $\mu\text{g}/\text{L}$) significantly below the EPA standards or criteria. No other contaminants were detected in the sample. It appears that the remedial efforts undertaken at this site have cleaned up any problems that may

5. ALTERNATIVE MEASURES

This section discusses the alternative measures that can be taken at each of the seven sites. The alternatives have been devised based on the results of the Phase II Stage 2 investigations. A "no-action" alternative is considered for each site. Recommendations as to the most appropriate alternatives are presented in Section 6.

5.1 SITE 1, SOUTH LANDFILL

No significant contamination of surface water, surface soils, or subsurface soils was found at this site. Minor amounts of petroleum hydrocarbons (less than 16 mg/kg) were detected in one of the surface runoff pathways and at the base of the borehole. No monitoring wells exist on this site.

Alternatives for this site include:

- No action. This alternative is applicable should it be decided that the levels of contaminants detected in the samples do not require further action.
- Long-term monitoring. Seasonal fluctuations in groundwater and rainfall could have accounted for the minor amount of seepage found in the Phase II Stage 2 investigation. Under this alternative, areas of the two known seeps would be resampled periodically and searches would be made for additional seeps.
- Installation of upgradient monitoring wells. Two wells could be installed in association with this landfill, one to the west and one to the south. The west well would test the marshy area which is the source for Seep 2; the south well would determine if sufficient recharge for water samples to be taken could be developed from the area of Borehole 7. This borehole showed a small amount of water and traces of hydrocarbons near its base. The south well

might also indicate whether contaminants have migrated from the South Burn Pit Area, an area that was never clearly located and was not part of the Phase II Stage 2 investigation. The South Burn Pit Area was believed to be located south of the South Landfill.

5.2 SITE 2, NORTHEAST LANDFILL

No significant contamination was detected in association with this site. The utilization of the site for landfilling operations is much more extensive than was previously thought. A soil sample taken from below the fill material indicates that the liquids in the landfill are not penetrating into underlying soil. In two samples at the 1- to 2-foot depth, petroleum hydrocarbons were reported at 78 and 440 mg/kg. This landfill, no longer USAF property, is leased to Kansas City Aviation Company and is being used to store excess property and large refuse items. The USAF should survey the perimeter of the landfill area and present this information to the current property owner and include it in the deed to the property. This will alert the owner as to any limitations on future uses of the land, including future construction and improvements. Already, a sewer line has been cut through the south edge of the landfill. It is not known what effect the intersection with the landfill will have on the integrity of that sewer system in the years to come.

Alternatives for this site include:

- No action. If it is determined that there is no threat to the surrounding environment, no further action would be necessary.
- Long-term monitoring. As part of the base groundwater sampling plan, the five wells at the landfill could be sampled to monitor the continued integrity of the landfill and as a check on the area groundwater quality.

5.3 SITE 6, NORTH BURN PIT AREA

Three volatile organics were detected in perched groundwater at this site--chloroform and tetrachloroethylene at concentrations significantly below drinking water standards or criteria, and methylene chloride in a single sample at a concentration of 37 µg/L, an order of magnitude below the EPA drinking water health advisory. There is very little groundwater, and no deep aquifers are threatened. Soil gas

readings indicated that organic vapor contamination is confined within the perimeter of the site. Soil contamination was limited to low concentrations of petroleum hydrocarbons, which were not found in any water sample.

Alternatives for this site include:

- No action. This alternative would be applicable if it is decided that the levels of contaminants detected in these samples do not warrant action. The concentrations observed have been below federal drinking water standards and there are no receptors.
- Long-term monitoring. Seasonal rainfall could recharge the two wells on this site which were essentially dry at the time of the Phase II Stage 2 investigation. The wells could be monitored for evidence of a contaminant plume by sampling for organic contamination.
- Installation of additional monitoring wells. The northeast monitoring well could be nested with a deeper well (drilled to bedrock) to determine if the organic contamination observed in the shallow wells is migrating along the weathered bedrock interface. A monitoring well could be installed outside the compound to the east, near the outfall from the oil-water separator. This would provide a check on the efficiency of this unit and could aid in locating seeps from lower stratigraphic units.

5.4 SITE 8, HERBICIDE BURIAL AREA

There is no conclusive data on the location of the trench or the characterization of this site. No soil borings were made and so no subsurface soil samples were collected.

Alternatives for this site include:

- No action. If it is determined on the basis of present information that the amounts of herbicides buried at this site and the mode of containment do not constitute an environmental problem, no further action would be necessary.
- Additional investigation. Additional effort to locate the trench should include locating and examining aerial photographs not previously available and performing a ground conductivity survey over the suspected area. Once the trench is located, testing and sampling could begin by drilling a series of 10-foot boreholes in the four corners of the trench area. Also, a sediment sample could be taken from the pond downgradient of the trench.

5.5 SITE 9, OIL-SATURATED AREA

Surface soil was found to be contaminated with petroleum hydrocarbons and lead. Levels of lead exceeded 160 mg/kg, the criterion derived for protection of human health (see Section 4.3.5). In addition, concentrations of petroleum hydrocarbons in three of the nine soil samples in the 0- to 1-foot depth were very high. Access to the site, and therefore to these materials, is limited.

Alternatives for this site include:

- No action. Since there is little chance of direct contact, it may be determined that the levels of contaminants detected do not warrant further action.
- Preparation for Phase IV actions. This action would require the removal of contaminated soils and gravel, after identifying the volume to be removed.

5.6 SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA

Only minor contamination of surface water was detected in association with this site. The concentrations of the two contaminants detected, lead and barium, were below drinking water standards. Petroleum hydrocarbon values were high (up to 1,900 mg/kg) along the south fence line. The sources may include spillage, dripping from the numerous heavy vehicles and smaller vehicles (grass mowers) now present in this compound. Storage of drums containing petroleum products in the compound may also have been a source.

Alternatives for this site include:

- No action. Due to the absence of detectable contamination resulting from the storage of hazardous waste drums at this site, no further action is warranted.
- Identification of petroleum hydrocarbon hot spots. This option would require delineating the areas of high petroleum hydrocarbon contamination, in preparation for removal actions (Phase IV).

5.7 SITE 12, POL STORAGE YARD

Site 12, the POL Storage Yard, is the distribution center for all fuels and propellants on the base. The groundwater south of the

facility is free from contamination. Soils inside the tank berms indicate significant petroleum hydrocarbon accumulations (concentrations ranged upwards to 2,800 mg/kg). Volatile organic contamination was detected in the subsurface outside of Building 953, a pumphouse. Additional pumphouses are present, but were not sampled. The contaminated soil sample came from an area where a broken drain pipe from the pumphouse is thought to be located.

Alternatives for this site include:

- No action. If the levels of contaminants identified are determined not to be excessive for present operation of the site, then no further action is warranted.
- Long-term monitoring. After the installation of a monitoring well during Phase II Stage 2, sampling and analysis of this well on a periodic basis would serve to monitor groundwater conditions at this site.
- Additional subsurface soil sampling. The area of greatest environmental concern is located east of the pumphouses. A series of shallow hand-auger borings could be taken in a grid pattern to determine the extent of organic contamination in the soil.

Table 6-1

LIST OF SITES BY CATEGORY

Category I - No Further Action Recommended

- Site 1: South Landfill

Category II - Additional Site Assessment Recommended

- Site 4: West Burn Area
- Site 6: North Burn Pit Area
- Site 8: Herbicide Burial Area
- Site 12: POL Storage Yard

Category III - Remedial Action Recommended

- Site 2: Northeast Landfill
 - Site 6: North Burn Pit Area
 - Site 9: Oil-Saturated Area
 - Site 10: Hazardous Waste Drum Storage Area
-

Table 6-2
SUMMARY OF RECOMMENDATIONS

Site 1 - South Landfill

- No further action.

Site 2 - Northeast Landfill

- Monitor five monitoring wells biannually for 2 years.
- Monitor land use at landfill biannually for 2 years.

Site 4 - West Burn Area

- Perform a soil gas survey to locate the site.
- Install three monitoring wells.
- Sample the surface and subsurface soils.

Site 6 - North Burn Pit Area

- Install two additional monitoring wells, a second well in northeast corner of site, well to be drilled to bedrock or 30 feet, and one outside the compound to the east (20 feet).
- Monitor five wells biannually for 2 years.

Site 8 - Herbicide Burial Area

- Locate the burial trench using aerial photos and a ground conductivity survey. Drill four shallow borings (10 feet) and sample soil for pesticides, mercury, and arsenic.
- Excavate and remove buried pesticides from trench.

Site 9 - Oil-Saturated Area

- Remove oil-contaminated sediments from along the fence line.

Sites 10 - Hazardous Waste Drum Storage Area

- Remove oil-contaminated surficial soils.

Site 12 - POL Storage Yard

- Install four monitoring wells to bedrock.
 - Monitor wells.
-

INSTALLATION RESTORATION PROGRAM

PHASE II

CONFIRMATION/QUANTIFICATION

STAGE 2

RICHARDS-GEBAUR AIR FORCE BASE

MISSOURI

Prepared by:

ECOLOGY AND ENVIRONMENT, INC.

Buffalo Corporate Center

368 Pleasantview Drive

Lancaster, New York 14086

July 1988

FINAL REPORT

(September 1986 to November 1987)

VOLUME 2: APPENDICES

Approved for Public Release:

Distribution is Unlimited

Prepared for:

UNITED STATES AIR FORCE

Headquarters Air Force Reserve (HQ AFRES/SGPB)

Robins Air Force Base, Georgia 31098-6001

UNITED STATES AIR FORCE

Occupational and Environmental Health Laboratory/

Technical Services Division (USAFOEHL/TS)

Brooks Air Force Base, Texas 78235-5501

APPENDIX E
CHAIN-OF-CUSTODY FORMS

ecology and environment, inc.

108 SULLIVAN ROAD, P.O. BOX D, BUFFALO, N.Y., 14226, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 2

Project No.: DF-4000			Project Name: Richards Gebau AFB			Project Manager: Paul R. Kopsick			REMARKS		
Samplers: (Signatures)			Field Team Leader: Paul R. Kopsick								
STATION NUMBER	DATE	TIME	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	Depth			DVA
			EXPECTED COMPOUNDS (Concentration)*								
DF-4000	10/16	1855	X	VOA, Pet. Hydro		NE LF Boring 4	3	2	1	1-2'	(5000)
37	10/16	1900	X				2	1		6-7'	5000
38	10/16	1905	X				2	1		8-10.5'	5000
39	10/17	1000	X	VOA, Pet. Hydro., Lead		OIL STAIN Area Boring 5	2	1		3-4	3900
40	10/17	1000	X				2	1		8-9	5000
41	10/17	1000	X				2	1		15.5-16.5'	3900
42	10/17	1010	X	VOA, Pet, Hydro, EPTOX metals		HWSA - Boring 6	2	1		.5 - 1.5'	4000
43	10/17	1100	X				2	1		9-10'	5000
44	10/17	1030	X				2	1		4.5 - 5.5'	5000
45	10/17	1130	X	VOA, Pet, Hydro		POL TANKS	2	1		upstream - H ₂ SO ₄	5000
46	10/17	1130	X	VOA, Pet. Hydro		POL TANKS	2	1		downstream - H ₂ SO ₄	5000
47	10/17	14	X	VOA, Pet. Hydro		SOUTH LF Boring 7	2	1			5000
48	10/17	14	X	VOA, Pet. Hydro			2	1			5000
49	10/17	14	X	VOA, Pet. Hydro			2	1			5000
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		Ship Via:	
<u>Paul R. Kopsick</u>			10/17/86	EPA EXP						Fed X	
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)			
										BL/Airbill Number:	
Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)			
<u>EPA EXP</u>			10/17/86	M. J. Murch						10/17/86	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055

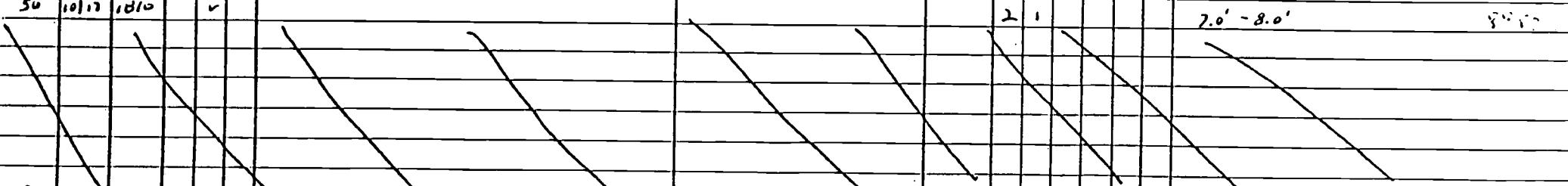
ecology and environment, inc.

106 SUGG ROAD, P.O. BOX 0, BUFFALO, N.Y., 14226, TEL. 716-632-4481
International Specialists in the Environment

recycled

CHAIN-OF-CUSTODY RECORD

Page 2 of 2

Project No.: DR4000	Project Name: RICHARDS - Gebrur AFIS			Project Manager: Paul Kopsick	Field Team Leader: Paul Kopsick	40' - 70' V.1 Dec 5th						REMARKS			
Sampler: (Signature) Paul Kopsick / Michael D. May Jr.															
STATION NUMBER	DATE	TIME	SAMPLE TYPE	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	DEPTH						
				COMP	GRAIN	AIR			EXPECTED COMPOUNDS (Concentration)*			2	1	2	1
DF4050	10/17	1500	/	VOL, Per Hydro			NE Lawrence Bridge 8		2	1				7.0' - 7.9'	8' 6"
DF4051	10/17	1550	/	VOL, PET Hydro			NE LF Boeing 9		2	1				4.0' - 5.0'	8' 4"
51	10/17	1540	/						2	1				6.0' - 7.0'	8' 6" "
52	10/17	1540	/						2	1				6.0' - 7.0' (Duplicata)	8' 6" "
53	10/17	1600	/						2	1				9.0' - 10.0'	8' 6" "
DF4054	10/17	1800	/	VOL, Per Hydro			NORTH NE LF Boeing 10		2	1				11.0' - 21.0'	8' 6" "
55	10/17	1805	/						2	1				4.0' - 5.0'	8' 6" "
56	10/17	1810	/						2	1				7.0' - 8.0'	8' 6" "
															
Relinquished By: (Signature) Paul Kopsick			Date/Time: 1830 10/17	Received By: (Signature) FED EXP			Relinquished By: (Signature)			Date/Time:	Received By: (Signature)			Ship Via: Fed Ex	
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)			Relinquished By: (Signature)			Date/Time:	Received By: (Signature)			BL/Airbill Number:	
Relinquished By: (Signature) FED EXP			Date/Time: 0900 10/18/86	Received For Laboratory By: (Signature) K. Marshall			Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)			Date: 10/17/86	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055

Ecology and environment, inc.

195 SUOO ROAD, P.O. BOX D, BUFFALO, N.Y., 14228, TEL. 716-632-4491
International Specialists In the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 2

Project No.:		Project Name:		Project Manager:			2 40 ml VOA 1 Liter Dist. water 1 Liter Ambe. 2L 1 Gg. Ambe. 2L 6oz SAR										REMARKS		
DF4000		Richards-Gebau AFB		PAUL KOPSICK															
Samplers: (Signatures)		<i>Mary M. Michael Mahonki</i> <i>Paul Kopsick</i> <i>John S. Chandler</i>		PAUL KOPSICK															
STATION NUMBER	DATE	TIME	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	PH	COND	Temp									
			SAMPLE TYPE	COMP	GRAB						AIR	EXPECTED COMPOUNDS (Concentration)*							
57	10/21		x	VOA, Petro Hydro	9076	North Burn NWMW	1	1/2								only 1 VOA			
58	10/21		x	VOA, Petro, Hydro	9077	North Burn NEMW	2	1	1							7.75 288 73.5			
59	10/21		x	VOA, Petro. Hydro	9078	North Burn SEMW	1	1/2								only 1 VOA			
60	10/21	1025	x	VOA, Petro. Hydro. TDS	9079	POL Monitoring Well	3	1	1	1									
61	10/21		x	VOA, Petro. Hydro, TDS, Extract, Anions, Pheno	9080	Northeast LF BKg. well	7	1	3	1	2					7.26 548 67.8			
62	10/21		x		9081	Gtgs. well 1	7	1	3	1	2					7.22 1207 65.4			
63	10/21	1330	x		9082	PIT well 1	6	1	3	1	2					7.24 554 67.0 phenol stg bottle			
64	10/21	1340	x		9083	PIT well 2	7	1	3	1	2					7.32 888 66.2			
65	10/21	1350	x		9084	PIT well 3	7	1	3	1	2					7.35 741 68.5			
66	10/21	1430	x		9085	South LF Monitoring Bkt	7	1	5	1	2					8.24 427 67.6 SLF BKG			
67	10/21	1430	x	VOA, Petr. Hydro	9090	MSLF BKGS	2	1			1					SLF BKG			
68	10/21	1530	x		9086	SLF DNW	7	1	3	1	2					7.34 684 700 SLFAN			
69	10/21	1530	x	VOA, Pet. Hydro	9091	SLF DNS	2	1			1					SLF DN			
70	10/21	1550	x	VOA, Pet. Hydro	9092	SLF SEEPS	2	1			1								
Relinquished By: (Signature)			Date/Time: 1980		Received By: (Signature)		Relinquished By: (Signature)		Date/Time:		Received By: (Signature)		Ship Via:						
<i>Paul Kopsick</i>			10/21/80		<i>Fcl. 1</i>														
Relinquished By: (Signature)			Date/Time:		Received By: (Signature)		Relinquished By: (Signature)		Date/Time:		Received By: (Signature)		BL/Airbill Number:						
<i>Fcl. 1</i>			10/21/80		<i>10/21/80</i>														
Relinquished By: (Signature)			Date/Time:		Received For Laboratory By: (Signature)		Relinquished By: (Signature)		Date/Time:		Received For Laboratory By: (Signature)		Date:						
<i>Fcl. 1</i>			10/21/80		<i>10/21/80</i>														

Institution: Original Accompanies Shipment; Copy to Coordinator Field Files
See CONCENTRATION RANGE on back of form.

234055

ecology and environment, inc.

188 SUGG ROAD, P.O. BOX 0, BUFFALO, N.Y., 14226, TEL 716-632-4491
International Specialists In the Environment

CHAIN-OF-CUSTODY RECORD

Page 2 of 2.

Project No.: DF4000	Project Name: Richards Gebau AFB	Project Manager: PAUL KOPSKICK													
Samplers: (Signature) Paul Kopsick			Field Team Leader: PAUL Kopsick			REMARKS 2 40ml VOA 1 100ml Poly 1 100ml Toluene 1 100ml Gelatinous pH Card Temp									
STATION NUMBER	DATE	TIME	SAMPLE INFORMATION												
			COMP	GRAB	AIR	EXPECTED COMPOUNDS (Concentration)									
04071	10/21	1550	X	VOA, RTHydro, TDS, EXT., PPmetals, Ammonium, Phenol,			SLFSEEPW 9087	7	1	3	1	2	8.00	567	67.4
72	10/21	1730	X	VOA Field Blank			9095	1	1						
Relinquished By: (Signature) Paul Kopsick Relinquished By: (Signature) Date/Time: 10/21/66 Received By: (Signature) F. L. Foyers Received By: (Signature) Relinquished By: (Signature) Date/Time: 10/21/66 Received By: (Signature) Relinquished By: (Signature) Date/Time: 10/21/66 Received For Laboratory By: (Signature) J. C. L. Foyers Date/Time: 10/21/66 Received For Laboratory By: (Signature) J. C. L. Foyers Ship Via: BL/Airbill Number: Date:															

Distribution: Original Accompanies Shipment; Copy to Coordinator Field File

* See CONCENTRATION RANGE on back of form.

ecology and environment, inc.

195 BUGG ROAD, P.O. BOX O, BUFFALO, N.Y., 14228, TEL. 716-632-4481
International Specialists in the Environment

CHAIN OF CUSTODY RECORD

Page 1 of 1

Project No.:	Project Name:			Project Manager:												
DF4000	Richards - Gebauer AFB			PAUL KOPSKY												
Samplers: (Signatures)			Field Team Leader:													
Michael Muehlebach <i>Joe Chandler</i> Mike Wipf			<i>Joe Chandler</i>													
STATION NUMBER	DATE	TIME	SAMPLE TYPE	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	REMARKS							
				COMP	GRAB	AIR									EXPECTED COMPOUNDS (Concentration)*	
DF40A	10/24	1050	X	VOA, Petroleum Hydrocarbons			POL TANK # 955	3	2	1	1	4				EPE #'s
80	10/24	1100	X				POL TANK # 955	3	2	1	1					DEPTH = 1.0'
81	10/24	1130	X				POL TANK # 955	3	2	1	1					" = 2' 10"
82	10/24	1330	X				POL TANK # 955	3	2	1	1					" = 6.0'
83	10/24	1345	X				POL TANK # 957	3	2	1	1					" = 1.0'
84	10/24	1415	X				POL TANK # 957	3	2	1	1					" = 2' 8"
85	10/24	1450	X				POL TANK # 957	3	2	1	1					" = 6.0'
86	10/24	1500	X				POL TANK # 951	3	2	1	1					" = 1.0'
87	10/24	1525	X				POL TANK # 954	3	2	1	1					" = 3.0'
88	10/24	1555	X				POL TANK # 954	3	2	1	1					" = 5.0'
89	10/24	1515	X	87 DUP			POL TANK # 955 drain	3	2	1	1					Calvert Rd Bld. 952 9353
							POL TANK # 954 (5)	2	1	1						Duplicate (5 ft.) 9352
Relinquished By: (Signature)				Date/Time: 10/24/86	Received By: (Signature)	Relinquished P	Signature				Date/Time:	Received By: (Signature)	Ship Via:			
Relinquished By: (Signature)				Date/Time:	Received By: (Signature)	Relinquished	Signature				Date/Time:	Received By: (Signature)	Fwd. Ex			
Relinquished By: (Signature)				Date/Time:	Received For Laboratory By: (Signature)	Relinquished	Signature				Date/Time:	Received For Laboratory By: (Signature)	BL/Airbill Number:			
Fed Express				10-24-16/10930	N.L.-J. M.C.								Date:			
Distribution: Original Accompanist Shipment: Copy to Coordinator Field Files																
CONCENTRATION RANGE on back of form.																

234055

ecology and environment, inc.

195 SUCC ROAD, P.O. BOX D, BUFFALO, N.Y., 14225. TEL. 716-632-4498
International Specialists In The Environment

REVIEW ARTICLE

Digitized by srujanika@gmail.com

ANSWER

cell

Project Name: _____

Pyknozoic (aka

FICHAS DEPARTAMENTO

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Distribution: Original Accompanying Shipments; Cook to Coordinates; Field File

CONCENTRATION RANGE as part of form

234055

ecology and environment, inc.

105 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14226. TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.: DF4100	Project Name: Richards Gebau AFB	Project Manager: PAUL Kopsick																					
Sampler: (Signature) Paul Kopsick			Field Team Leader: PAUL Kopsick			REMARKS																	
STATION NUMBER	DATE	TIME	SAMPLE TYPE	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	2-40-1 Van Viss 1-8-02 Joe														
				SOIL	WATER	AIR			EXPECTED COMPOUNDS (Concentration)*			all positive 0.00 reading)											
DF41027	10/15	1420	X	VCA, Petroleum Hydrocarbons			8894	NB Boeing 1 S-1	3	2	/												
DF41028		1430	X				8895	NB 1 S-2	3	2	/												7-5'
DF41029		1435	X				8896	NB 1 S-3	3	2	/												12-12.4'
DF41030		1510	+				8897	NB Boeing 2 S-1	3	2	/												2-3'
DF41031		1515	X				8898	NB 2 S-2	3	2	/												5-6'
DF41032		1520	+				8899	NB 2 S-3	3	2	/												11-12'
DF41033		1600	+				8901	NB Boeing 3 S-1	3	2	/												2-3'
DF41034		1605	+				8902	NB 3 S-2	3	2	/												5-6'
DF41035		1610	+				8903	NB 3 S-3	3	2	/												11-12'
DF41021		1520	+	8900 DUPLICATE				NB Boeing 2 S-3	3	2	/												11-12'
Relinquished By: (Signature) Paul Kopsick			Date/Time: 10/15 1700hr	Received By: (Signature) Joseph Chandler			Relinquished By: (Signature) Joseph Chandler	Date/Time: 10/15 1745	Received By: (Signature) Fed. Express			Ship Via: Federal Exp											
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)			Relinquished By: (Signature)	Date/Time:	Received By: (Signature)			BL/Airbill Number: Date:											
Relinquished By: (Signature) Fed. Express			Date/Time: 10/15 1800	Received For Laboratory By: (Signature) William H. Horan			Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)			10/15 1800											

Distribution: Original Accompanies Shipment; Copy to Coordinator, Field Files

*See CONCENTRATION RANGE on back of form.

234056

ecology and environment, inc.

196 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14226, TEL. 716-632-4481
International Specialists In the Environment

CHAIN OF CUSTODY RECORD

Page 1 of 1.

Distribution: Original Accompanies Shipment; Copy to Coordinator Field File

• See CONCENTRATION RANGE on back of form.

3:1405fa

Ecology and environment, inc.

195 BUGG ROAD, P.O. BOX 0, BUFFALO, N.Y. 14226, TEL. 716-632-4491
International Specialists In the Environment

Page 1 of 1

CHAIN-OF-CUSTODY RECORD

Project No.: DF-11CC	Project Name: RICHARDSON - GEMBAK AFB TRT	Project Manager: PAUL KOTICK											REMARKS						
Sampler: (Signature) <i>Paul Kotick</i>	Field Team Leader: PAUL KOTICK																		
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRAB AIR	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	1	2	3	4	5	6	7	8	9	10	
EXPECTED COMPOUNDS (Concentration)																			
D1001	10/10/81	1200	X	VOC, C-1-	8765	North of runway 51	3	2	1										Burnt out 100' F
4002	10/10/81	1210	X	VOC, C-1-	8766	-52	3	2	1										Burnt out 100' F
4003	10/10/81	1215	X	VOC, C-1-	8767	-53	3	2	1										No. 6 of F...
4004	10/10/81	1230	X	VOC, C-1-	8768	-54	3	2	1										No. 1 Line 100'-150' F
4005	10/10/81	1245	X	VOC, C-1-	8769	-55	3	2	1										Soil sample 1 ft...
4006	10/10/81	1250	X	VOC, C-1- no 8766 & 8767	8770	outfall area -1	5	2	1										pH 8.50 1600 mm 60°F
4007	10/10/81	1300	X	VOC, C-1-, Leaf	8770	C. L. Contaminated Area -51	3	1	1										Soil sample 1 ft...
4008	10/10/81	1310	X	VOC, C-1-, Leaf	8771	-52	3	2	1										Soil sample 1 ft...
4009	10/10/81	1320	X	VOC, C-1-, Leaf	8772	-53	3	2	1										Soil sample 1 ft...
4010	10/10/81	1330	X	VOC, C-1-, Leaf	8773	-54	3	2	1										Soil sample 1 ft...
4011	10/10/81	1340	X	VOC, C-1-, Leaf	8774	-55	3	2	1										Soil sample 1 ft...
4012	10/10/81	1350	X	VOC, C-1-, Leaf	8775	-56	3	2	1										Soil sample 1 ft...
4013	10/10/81	1350	X	VOC, C-1-, Leaf, TDS	8777	-51	5	2	1										pH 8.50 3600 mm 60°F
Relinquished By: (Signature) <i>Paul Kotick</i>			Date/Time: <u>10/10/81</u>	Received By: (Signature) <i>Paul Kotick</i>	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via:											
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via:	<i>Truck</i>										
Relinquished By: (Signature) <i>Express</i>			Date/Time: <u>10/10/81 / 0900</u>	Received For Laboratory By: (Signature) <i>Paul Kotick</i>	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	BL/Airbill Number:											
									<u>10/10/81</u>										

a: Original Accompanies Shipment; Copy to Coordinator Field Files

EXTRATION RANGE on back of form.

234055

Ecology and environment, inc.

308 SUCC ROAD, P.O. BOX D, BUFFALO, N.Y., 14225. TEL. 716-632-4491
International Specialists In the Environment

Received

Page 1 of 1

CHAIN-OF-CUSTODY RECORD

Project No.:	Project Name:			Project Manager:								REMARKS				
DF4000	Richards-Gebaur AFB IRP			Paul Kopsick												
Samplers: (Signatures)				Field Team Leader:												
<i>PK</i> Paul Kopsick, Bill Kwoka, Mike Michalowski				Paul Kopsick												
STATION NUMBER	DATE	TIME	SAMPLE TYPE	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CON. CONTAINERS	40 ml VOA vials (x2)							
				COMP	GRAB	AIR			EXPECTED COMPOUNDS (Concentration)*			1 liter poly				
DF4014	10/10	1120	X	VOA, O&G			North Burn Area S-6	2	1	1	1	1	1	1	West Drainage	
DF4015		1315	B	Herbicides, Arsenic, Mercury			Herbicide Burial S1	2			2					300' South of Road
DF4016		1320	X					-S-2	2			2				25' East of DF4015
DF4017		1330	X					-S-3	2			2				25 East of DF4016
DF4018		1340	X					-S-4	2			2				100' South of Road
DF4019		1445	X	VOA, EP Tox. (Metals), O&G			Haz. Waste Storage S-1	2	1	1	1					Background Soil
DF4020		1505	X					S-2	2	1	1	1				Gate of Compound
DF4021		1445	X					S-3	2	1	1	1				Fence corner O-Z6'
DF4022		1500	X					S-4	2	1	1	1				26 - 60'
DF4023		1500	X					S-5	2	1	1	1				60 - 120'
DF4024		1455	X					S-6	2	1	1	1				Opposite corner + 25'
DF4025		1515	W	VOA, TDS, O&G, PPMetals, Barium, Mercury			Cancelled per P Kopsick 10/13/86	W-1	4	1	2	1				Opposite corner + 25' / 9.27 PH 3670 mm 66°F
DF4026		1600	W					Field Blank	1	1	1	1				HWSA
DF4027		1315	W	Pesticides, TDS, Arsenic, Mercury			680	Herbicide Burial W-1	3	2	1					Pond in Field 65°F 1500 mm 62.7°F
Relinquished By: (Signature)				Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		Received By: (Signature)		Ship Via:		Federal Express	
<i>Paul Kopsick</i>				10/10/86 7000												
Relinquished By: (Signature)				Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		Received By: (Signature)		BL/Airbill Number:		Date:	
															10/10/86	
Distribution: Original accompanies Shipment; Copy to Coordinator Field Files																
*See CONCENTRATION RANGE on back of form.																
234055																

Provided on the following pages are sample receipt logs for the appropriate sample numbers as documentation of proper sample management and documentation procedures.


PACKAGE RECEIPT LOG
0843

recycled paper

E-13

industry and environment

ITEM NO.	CLIENT NAME and/or JOB NO.	DATE RECEIVED	RECEIVED FROM (e.g. carrier)	CARRIER I.D. NO. or INITIALS	SHIPPING INVOICE NO. (Place in / / /)	PACKAGE DESCRIPTION (e.g. 1 cooler, 1 jar, etc.)	PACK- AGE SE- CURED	MANNER PACKAGE SECURED				PACKAGE DISPOSITION		CUSTODIAN INITIAL			
								Yes	No	Supply Seal	Forgible Tape	Other	Differences	Explain and footnote if necessary. File deficiency report.	Sample Log pad	Temporary Secure Storage Area	ASC Custody Seal Aligned
4127	PVS Channel	10-9-86	L. ROE JL	ZK	none	1-Carboard Box											1-111
4128	Edgetooth Appliance	10-9-86	A. Pollock	AdD	none	1- Plastic Bag											1-111
4129	Amal Ambrose	10-9-86	Client	ZK	120112	1- Plastic Bucket											1-111
4130	Seller Thrifts Inc	10-9-86	Client	MMJL	none	1-Cooler											1-111
4131	Sterling Environmentals	10-9-86	Client	ZK	120112	3-16oz w/m poly											1-111
4132	Richards - Oklahoma AFB	10-10-86	Fed. Express	Flight 100	1533064816	1-Cooler											1-111
4133	CPC - Tommunda	10-10-86	Client	J.P. JV	none	1-Carboard Box											1-111
4134	New York Air Brake	10-10-86	U.S. Air	Flight 100	40-341-97	1-Cooler											1-111
4135	Richards - Oklahoma AFB	10-11-86	FED EXPRESS	J.M.	120112 306480	1-Cooler											1-111
4136	US EPA	10-11-86	Fed. Express	J.M.	120112 3064821	1-Cooler											1-111
4137	John J. Glass	10-13-86	Client	ZK	none	1-125ml poly											1-111
4138	Burbank-Ontario AFB	10-13-86	Shippers 11-1	ZK	See Time 10-13-86 4545	1-Cooler											1-111
4139	Frontier Evolution	10-13-86	Client	ZK	none	2- envelopes											1-111
4140	FMC - Middleport	10-13-86	Client	RAS	none	3- 1Lg 1/2L											1-111
4141	D.P.Zia Contractors	10-13-86	Client	G...	none	2- 125ml poly											1-111
4142	Power Management Div	10-13-86	Client	B.A.C.	none	1-glass bottle											1-111
4143	Springville Central Schol	10-13-86	W. Hall	W.D.	none	2 PLASTIC											1-111
4144	NFTA	10-14-86	Client	ZK	none	1- Fol. T.v											1-111

EXPLANATIONS:

105

111

SAMPLE RECEIPT LOG

PACK AGE RE CEIPT LOG ITEM NO.	ANALYTICAL SERVICES CENTER SAMPLE I.D. NO.				JOB NO.	DATE LOGGED	CLIENT SAMPLE I.D. (e.g. Well No., Boring No.)	PACK- ING LIST or CHAIN OF CUSTO- DODY RE- COHD	SAMPLE CONTAINER TYPE	MAN- NER OF SECUR- ING	SUBSAMPLES			REMARKS (If Subsampled, Indicate Page Reference If None, Make No Entry.)	CUS- TODAY SEAL AF FIXED	LABEL WITH NGO AND DATE AF FIXED	REMARKS (e.g. leak, breakage, discrep- ancy with packing list. File discrepancy report if necessary)	SE- CURE STOR- AGE AREA	CUSTO- DIAN'S INITIALS	DISPOSAL													
	Prinme Sample I.D. No.	Individ- ual Sample Container Index No.	Lab Gener- al Sub- multiple No.	Additional Sub- multiple No.							Yes/No	40 ml Vial	1/2 pt. Vial	1 pt. Poly	500 ml Poly	16 oz Jar	8 oz Jar	4 oz Jar	1 L Amm	250 ml Poly	1 pt. Vial	Other	Yes/No	Customer Seal	Fabricator Seal	Other	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No		
	Y	Y	Y	Y							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			
7141	8801	C2			U-4241	10-13-86	DF-4020	-	-	-																							
8801	4	C1					DF-4021	-	-	-																							
8802	4	C1					DF-4022	-	-	-																							
8803	4	C1					DF-4023	-	-	-																							
8804	4	C1					DF-4024	-	-	-																							
8805	4	C1					DF-4025	-	-	-																							
8806	4	C1			U-4242		DF-4025	-	-	-																							
8807	4	C1					DF-4026	-	-	-																							
8808	4	C1					DF-4027	-	-	-																							
8809	4	C1					DF-4028	-	-	-																							
8810	4	C1					DF-4029	-	-	-																							
8811	4	C1					DF-4030	-	-	-																							
8812	4	C1			U-4243		LCC	#1																									
8813	4	C1					LCC	#2																									
8814	4	C1					LCC	#3																									
8815	4	C1			U-4244		DF-4031	outfall																									
8816	4	C1					Teddy Creek																										
8817	4	C1					Elkuk																										
8818	4	C1			U-4245		Klara Rd.																										

* No packed individual container report ** Other 100mm evaluation

EXPLANATIONS:

SAMPLE RECEIPT LOG

If no, indicate undercapacity items; * If other, furnish explanation

XPLANATIONS ... YOU ARE FREE TO... , ...etc..... correlated, sample size good, ... etc....

COE SITE 2, NORTHEAST LANDFILL

Section I. Installation Restoration Program Records Search

- A. Study Performed By: CH2M HILL
- B. Date Report Complete: March, 1983
- C. Significant Findings:

Because of the known disposal of hazardous wastes at the site and the proximity of the site to Scope Creek, there is a moderate potential for migration of hazardous contaminants off-base.

- D. Summary of Recommendations:

It was recommended that one shallow monitoring well be installed downgradient of the site to determine if hazardous contamination is present in the area ground water.

COE SITE 2, NORTHEAST LANDFILL, Continued

Section II. Installation Restoration Program Phase II
Confirmation/Quantification Stage 2

A. Study Performed By: Ecology and Environment, Inc.

B. Date Report Complete: November, 1987

C. Significant Findings:

Five anions were reported above detection limits. Since it was relatively minor exceedance of the standard and the fact that there is no drinking water well nearby, there should not be any material threat to human health. For soils, no metals exceeded normal ranges. The only detectable contaminant was petroleum hydrocarbons.

D. Summary of Recommendations:

Long-term monitoring is recommended for this site to detect changes in groundwater quality. The results should be compared for two years. A detailed survey of the landfill should be made and provided to the landowner for inclusion with the deed to the property.

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For

Richards-Gebaur Air Force Base,
Missouri



Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

MARCH 1983

disposal of most common refuse was begun, although some wastes, including building rubble, yard debris, and waste from some industrial shop areas were actively disposed of at the site until about 1961. Materials which may have been disposed of in the landfill include small quantities of waste paints, thinners, strippers, solvents, and oils, although this was not standard procedure. Operation of the landfill included burning of the wastes disposed. Since 1961, the area has been used only intermittently for unauthorized dumping. Due to recent incidents of unauthorized dumping, including cleaning of tar pots and some household waste dumping, an earthen barricade has been erected at the entrance to the site.

A small section of Scope Creek downstream of the site was observed to have a small oil sheen on the surface of the water, suggesting the presence of leachate; no oil sheen was observed upstream and no evidence of soil contamination was visible on the edges of the landfill. Small quantities of hazardous materials may have been placed in this landfill; however, no significant hazardous waste quantities were reported.

The overall rating score for Site No. 1 was 55. Although the receptors subscore was low due to the lack of critical environments or population near the site, the indirect evidence of migration of hazardous contaminants indicated by possible leachate resulted in a high pathway subscore (80) and raised the overall rating.

- o Site No. 2, the Northeast Landfill, is located in the northeast portion of the base alongside Scope

Creek. The site was used between about 1961 and 1971 for the disposal of miscellaneous wastes including building rubble, yard debris, and waste from some industrial shop areas. The wastes were typically burned and buried in trenches. Most of the sanitary wastes at Richards-Gebaur AFB were disposed of off-base through contract removal during this time. One interviewee reported that disposal of waste paints and paint thinners at the site by spreading the wastes on the ground surface had been practiced in the past as late as 1978. The eastern portion of the site has been used for open storage of materials including construction materials, pipes, empty tanks, waste paint and thinners in drums and buckets, and empty 55-gallon drums. Over 400 55-gallon drums are currently stored at the site, most of which are empty, and some of which contain unknown contents.

The site received an overall rating score of 54 due primarily to the known disposal of hazardous wastes and a moderate potential for surface-water migration of contaminants off-base.

- o Site No. 3, the Contractor Rubble Burial Site, is also located adjacent to Scope Creek, just west of the golf course alongside Walker Road. The site was used intermittently during the time the regular Air Force was active on the base, between 1954 and 1978. The site was used primarily for disposal of contractor rubble and debris, although household debris was visible in the exposed portions of the landfill. One interviewee indicated that the site was also used as a sanitary landfill in lieu of Site No. 1 prior to 1961. The site has an overall rating score of 48; low subscores in

debris, and waste from some industrial shop areas, were actively disposed of at this site. The probable path of migration of contaminants, if present at Site No. 1, is vertically downward to the perched ground-water table, then laterally eastward to discharge into Scope Creek. The relatively thick, impervious Lane Shale underlies the site and effectively restricts vertical movement of ground water. During the site visit a small oil sheen, suggesting the presence of leachate, was observed on the surface of a small area of Scope Creek just downstream of the landfill site; no oil sheen was observed upstream. No visible evidence of soil contamination was observed on the banks of Scope Creek at the edge of the landfill. Scope Creek flows through the base and eventually discharges into the Little Blue River, thereby providing a pathway for any hazardous contaminants in the leachate, if present, to enter surface-water bodies and migrate beyond base property.

2. Site No. 2 (Northeast Landfill)

This site was reportedly used between 1961 and 1971 for disposal of miscellaneous waste, including building rubble, yard debris, and wastes from some industrial shop areas. Reportedly, disposal of some waste paint and thinners by spreading of the liquid wastes onto the ground surface has been practiced at this site. Materials in open storage at the site currently include construction rubble, pipes, empty tanks, waste paints and thinners in drums and buckets, and empty 55-gallon drums. Of over 400 drums currently at the site, some contain unknown contents. The probable path of migration

of contaminants is vertically downward to the perched water table present in the alluvial soils alongside Scope Creek, then laterally southeastward to discharge into Scope Creek. The relatively thick, impervious Chanute Shale underlies the site and effectively restricts vertical movement of ground water. Because of the known disposal of hazardous wastes at the site and the proximity of the site to Scope Creek, there is a moderate potential for migration of hazardous contaminants off-base.

- E. The remaining rated sites (Sites No. 3, 4, 5, 6, 7, 8, and 9) are not considered to present significant environmental concerns.

GNR70A

VI. RECOMMENDATIONS

A. PHASE II PROGRAM

A limited Phase II monitoring program is suggested to confirm or rule out the presence and/or migration of hazardous contaminants. The priority for monitoring at Richards-Gebaur is considered moderate since no imminent hazard has been determined.

Tables 8 and 9 present a summary of recommended monitoring sites, parameters to be measured, and the rationale for the analyses. Specifically, monitoring is recommended for the South Landfill (Site No. 1) and the Northeast Landfill (Site No. 2).

1. South Landfill (Site No. 1)

It is recommended that the adjacent creek (Scope Creek) be monitored upstream and downstream of the site to determine if hazardous contaminants are leaching into the creek. The water samples should be analyzed for the parameters indicated in Table 8. The stream should be sampled on two occasions at least 30 days apart to determine the presence of contaminants.

2. Northeast Landfill (Site No. 2)

It is recommended that one shallow monitoring well be installed downgradient of the site to determine if hazardous contamination is present in the area ground water. The well should be drilled to the depth of the top of the underlying Chanute shale (approximately 30 feet deep at this site) and screened from the top of the shale to within

Table 8
RECOMMENDED ANALYSES

<u>Sample Type</u>	<u>Volatile Organic Compounds (VOC)</u>	<u>Heavy Metals</u>	<u>Pesticides</u>	<u>Phenols</u>	<u>pH, Specific Conductance COD, TOC, and Oil and Grease</u>
<u>Surface Water</u>					
South Landfill (Site No. 1)	X	X	X	X	X
<u>Monitoring Well</u>					
Northeast Landfill (Site No. 2)	X	X	X	X	X

GNR70

5 feet of the ground surface. The well should be analyzed for the parameters indicated in Table 8. The well should be sampled on two occasions at least 30 days apart to determine the presence of contaminants.

B. OTHER ENVIRONMENTAL RECOMMENDATIONS

Other recommendations developed as a result of the records search include the following:

1. The status of abandoned POL storage tanks is not clear. Various tanks were reported as abandoned, but information was unclear as to whether the tanks had been deactivated according to procedure or simply abandoned. It is recommended that a survey be made to determine the current status of these tanks, e.g., whether they are empty, filled with water, contain residual POL, or are properly deactivated. Tanks should be locked to prevent unauthorized use.
2. The various containers stored aboveground at the Northeast Landfill should be inspected to determine the nature of their contents (old paints, thinners, POLs, etc.). If verified to contain potentially hazardous contaminants, the contents should be disposed of at an authorized hazardous waste facility.

GNR70

HAZARDOUS ASSESSMENT RATING FORM

Page 1 of 2

NAME OF SITE: 2. Northeast Landfill

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: Continuous 1961-1971; intermittent 1971-1982

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Reported rubble burial, land applied paint thinners; trash; visible drums with unknown contents

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface-water body	1	6	6	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	75	180

Receptors subscore (100 x factor score subtotal/maximum subtotal)

42

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large)

S

2. Confidence level (C = confirmed, S = suspected)

C

3. Hazard rating (H = high, M = medium, L = low)

H

Factor Subscore A (from 20 to 100 based on factor score matrix)

60

B. Apply persistence factor

Factor Subscore A x Persistence Factor = Subscore B

$$60 \times 1.0 = 60$$

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

$$60 \times 1.0 = \underline{\underline{60}}$$

III. PATHWAYS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	0
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108
Subscore (100 x factor score subtotal/maximum score subtotal)				59
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	1	8	8	24
Direct access to ground water	N/A	8	N/A	--
		Subtotals	30	90
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 59

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	42
Waste Characteristics	60
Pathways	59
Total 161 divided by 3 =	54
Gross Total	54

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

INSTALLATION RESTORATION PROGRAM

PHASE II

CONFIRMATION/QUANTIFICATION

STAGE 2

**RICHARDS-GEBAUR AIR FORCE BASE
MISSOURI**

Prepared by:
ECOLOGY AND ENVIRONMENT, INC.
Buffalo Corporate Center
368 Pleasantview Drive
Lancaster, New York 14086

July 1988

FINAL REPORT
(September 1986 to November 1987)

VOLUME 1: TEXT

**Approved for Public Release:
Distribution is Unlimited**

Prepared for:

UNITED STATES AIR FORCE
Headquarters Air Force Reserve (HQ AFRES/SGPB)
Robins Air Force Base, Georgia 31098-6001

UNITED STATES AIR FORCE
**Occupational and Environmental Health Laboratory/
Technical Services Division (USAFOEHL/TS)**
Brooks Air Force Base, Texas 78235-5501

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
EXECUTIVE SUMMARY	1
1 INTRODUCTION	1-1
1.1 LOCATION AND HISTORY OF OPERATIONS	1-3
1.2 SITE DESCRIPTIONS	1-6
1.2.1 Site 1, South Landfill	1-6
1.2.2 Site 2, Northeast Landfill	1-10
1.2.3 Site 6, North Burn Pit Area	1-12
1.2.4 Site 8, Herbicide Burial Area	1-12
1.2.5 Site 9, Oil-Saturated Area	1-12
1.2.6 Site 10, Hazardous Waste Drum Storage Area	1-16
1.2.7 Site 12, POL Storage Yard	1-16
1.3 SITES NOT INVESTIGATED DURING STAGE 2	1-19
1.4 TYPES OF CONTAMINANTS INVESTIGATED	1-21
1.5 FIELD PERSONNEL	1-28
1.6 SUBCONTRACTORS	1-28
2 ENVIRONMENTAL SETTING	2-1
2.1 GEOGRAPHIC SETTING	2-1
2.1.1 Physiography	2-1
2.1.2 Topography	2-1
2.2 GEOLOGY	2-1
2.2.1 Geologic Setting	2-1
2.2.2 Soils	2-3
2.2.3 Stratigraphy	2-3
2.2.4 Structure	2-6

Table of Contents (Cont.)

<u>Section</u>	<u>Page</u>
2.3 HYDROLOGY AND WATER USE	2-6
2.3.1 Surface Water	2-6
2.3.2 Hydrogeology	2-8
2.4 CLIMATE	2-8
 3 FIELD PROGRAM	 3-1
3.1 PROGRAM DEVELOPMENT	3-1
3.2 FIELD INVESTIGATION	3-4
3.2.1 Schedule of Field Activities	3-4
3.2.2 Records Search	3-4
3.2.3 Geophysical Survey Procedures	3-6
3.2.4 Soil Gas Sampling	3-6
3.2.5 Soil, Sediment, and Water Sampling	3-6
3.2.6 Handling of Investigation-Derived Waste	3-16
3.2.7 Site-Specific Investigation Activities	3-18
3.2.8 Laboratory Program	3-29
3.2.9 Variations from Description of Work	3-32
 4 RESULTS AND SIGNIFICANCE OF FINDINGS	 4-1
4.1 INTRODUCTION	4-1
4.2 RESULTS	4-4
4.2.1 Site 1, South Landfill	4-4
4.2.2 Site 2, Northeast Landfill	4-7
4.2.3 Site 6, North Burn Pit Area	4-11
4.2.4 Site 8, Herbicide Burial Area	4-17
4.2.5 Site 9, Oil-Saturated Area	4-19
4.2.6 Site 10, Hazardous Waste Drum Storage Area	4-22
4.2.7 Site 12, POL Storage Yard	4-26
4.3 SIGNIFICANCE OF FINDINGS	4-30
4.3.1 Site 1, South Landfill	4-30
4.3.2 Site 2, Northeast Landfill	4-30
4.3.3 Site 6, North Burn Pit Area	4-30

Table of Contents (Cont.)

<u>Section</u>	<u>Page</u>
4.3.4 Site 8, Herbicide Burial Area	4-31
4.3.5 Site 9, Oil-Saturated Area	4-31
4.3.6 Site 10, Hazardous Waste Drum Storage Area	4-32
4.3.7 Site 12, POL Storage Yard	4-33
5 ALTERNATIVE MEASURES	5-1
5.1 SITE 1, SOUTH LANDFILL	5-1
5.2 SITE 2, NORTHEAST LANDFILL	5-2
5.3 SITE 6, NORTH BURN PIT AREA	5-2
5.4 SITE 8, HERBICIDE BURIAL AREA	5-3
5.5 SITE 9, OIL-SATURATED AREA	5-4
5.6 SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA	5-4
5.7 SITE 12, POL STORAGE YARD	5-4
6 RECOMMENDATIONS	6-1
6.1 SITE 1, SOUTH LANDFILL - CATEGORY I	6-1
6.2 SITE 2, NORTHEAST LANDFILL - CATEGORY III	6-5
6.3 SITE 4, WEST BURN AREA	6-5
6.4 SITE 6, NORTH BURN PIT AREA - CATEGORIES II AND III	6-6
6.5 SITE 8, HERBICIDE BURIAL AREA - CATEGORY II	6-6
6.6 SITE 9, OIL-SATURATED AREA - CATEGORY III	6-8
6.7 SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA - CATEGORY III	6-11
6.8 SITE 12, POL STORAGE YARD - CATEGORY II	6-11
6.9 WELL ABANDONMENT	6-11

Table 2
SUMMARY OF FIELDWORK/ANALYSES PERFORMED

Site	Fieldwork Performed	Analyses Performed
Site 1, South Landfill	<ul style="list-style-type: none"> ● 1 borehole drilled ● 7 soil samples collected ● 4 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC, priority pollutants, common anions, phenols.
Site 2, Northeast Landfill	<ul style="list-style-type: none"> ● geophysical survey ● 4 boreholes drilled ● 2 monitoring wells installed ● 10 soil samples collected ● 5 groundwater samples collected ● 3 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC, priority pollutants, common anions, phenols
Site 6, North Burn Pit Area	<ul style="list-style-type: none"> ● soil gas survey ● 3 boreholes drilled ● 3 monitoring wells installed ● 15 soil samples collected ● 3 groundwater sample collected ● 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, VOC.
Site 8, Herbicide Burial Area	<ul style="list-style-type: none"> ● 4 soil samples collected ● 1 surface water sample collected 	Soils: pesticides, arsenic, mercury. Waters: TDS, pesticides, arsenic, mercury.
Site 9, Oil-Saturated Area	<ul style="list-style-type: none"> ● 1 borehole drilled ● 8 soil samples collected ● 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC, lead. Waters: petroleum hydrocarbons, TDS, VOC, lead.
Site 10, Hazardous Waste Drum Storage Area	<ul style="list-style-type: none"> ● 1 borehole drilled ● 9 soil samples collected ● 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC, EP TOX metals. Waters: petroleum hydrocarbons, TDS, priority pollutant metals, barium.
Site 12, POL Storage Yard	<ul style="list-style-type: none"> ● 3 boreholes augered ● 1 monitoring well installed ● 1 soil sample collected ● 4 groundwater samples collected ● 2 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC.

Table 3
SUMMARY OF RECOMMENDATIONS

Site	Recommendation	Rationale
Site 1, South Landfill	Category I. No further action.	No significant contamination was found during the Stage 2 investigation.
Site 2, Northeast Landfill	Category III. Biannual monitoring for 2 years. Collect and analyze groundwater samples from five existing monitoring wells twice yearly.	To determine changes in groundwater quality because elevated sulphate concentrations were the only indicators of contamination above acceptable limits.
Site 4, West Burn Area	Category II. Perform a soil gas survey and geophysical survey. Install three monitoring wells and collect and analyze groundwater samples. Collect subsurface and surface soil samples.	To determine the exact location of the site and determine if hazardous constituents have migrated from the site.
Site 6, North Burn Pit Area	Category III and II. Biannual monitoring for 2 years. Install two more monitoring wells. Collect and analyze groundwater samples from five monitoring wells twice yearly.	To better characterize the organic contamination of the groundwater.
Site 8, Herbicide Burial Area	Category II. Additional geophysical surveys. Drill four boreholes and collect two soil samples from each borehole.	To determine exact location of trench and analyze soil from within the trench.
Site 9, Oil-Saturated Area	Category III. Excavate and remove contaminated soils.	To reduce risk of potential direct human contact to soils contaminated with petroleum hydrocarbons and lead.
Site 10, Hazardous Waste Drum Storage Area	Category III. Excavate and remove contaminated soils.	To reduce risk of potential direct human contact petroleum hydrocarbons.
Site 12, POL Storage Yard	Category II. Install four monitoring wells. Collect and analyze groundwater samples twice yearly.	To determine if volatile organic compound contamination has migrated from the site.

- To define the magnitude and potential of contaminant migration, if possible; and
- To identify potential health and/or environmental hazards based on state or federal standards.

A Phase I Initial Records Search had been conducted by CH2M Hill as outlined in a report dated March 1983. The Phase I report identified sites with potential contamination problems and made recommendations for Phase II investigation. Based on these recommendations, a Phase II Stage 1 investigation was performed on the two sites, Site 1, the South Landfill, and Site 2, the Northeast Landfill, which ranked above 50 on the USAF Hazard Assessment Rating Methodology (HARM) scale ranking system. Preliminary investigation was performed by Water and Air Research, Inc. The results of this investigation were finalized in a report dated December 1983.

In 1985, Richards-Gebaur AFB was scheduled to be reevaluated under the IRP. A presurvey meeting was arranged and all past and current potential sites were visited and evaluated. The presurvey was conducted by E & E and their recommendations were provided in a Presurvey Report dated June 1985.

The sites included in that survey are:

- Site 1, South Landfill,
- Site 2, Northeast Landfill,
- Site 3, Contractor Rubble Burial Area,
- Site 4, West Burn Area,
- Site 5, South Burn Area,
- Site 6, North Burn Area,
- Site 7, Radioactive Disposal Well,
- Site 8, Herbicide Burial Area,
- Site 9, Oil-Saturated Area,
- Site 10, Hazardous Waste Drum Storage Area,
- Site 11, Paint Stripper Hangar,

- Site 12, Petroleum, Oils, and Lubricants (POL) Storage Yard, and
- Site 13, Hazardous Material Storage--Building 927.

Based on this report and after review by state and federal offices, the USAF contracted Phase II Stage 2 investigation of the following sites:

- Site 1, South Landfill,
- Site 2, Northeast Landfill,
- Site 6, North Burn Pit Area,
- Site 8, Herbicide Burial Area,
- Site 9, Oil-Saturated Area,
- Site 10, Hazardous Waste Drum Storage Area, and
- Site 12, POL Storage Yard.

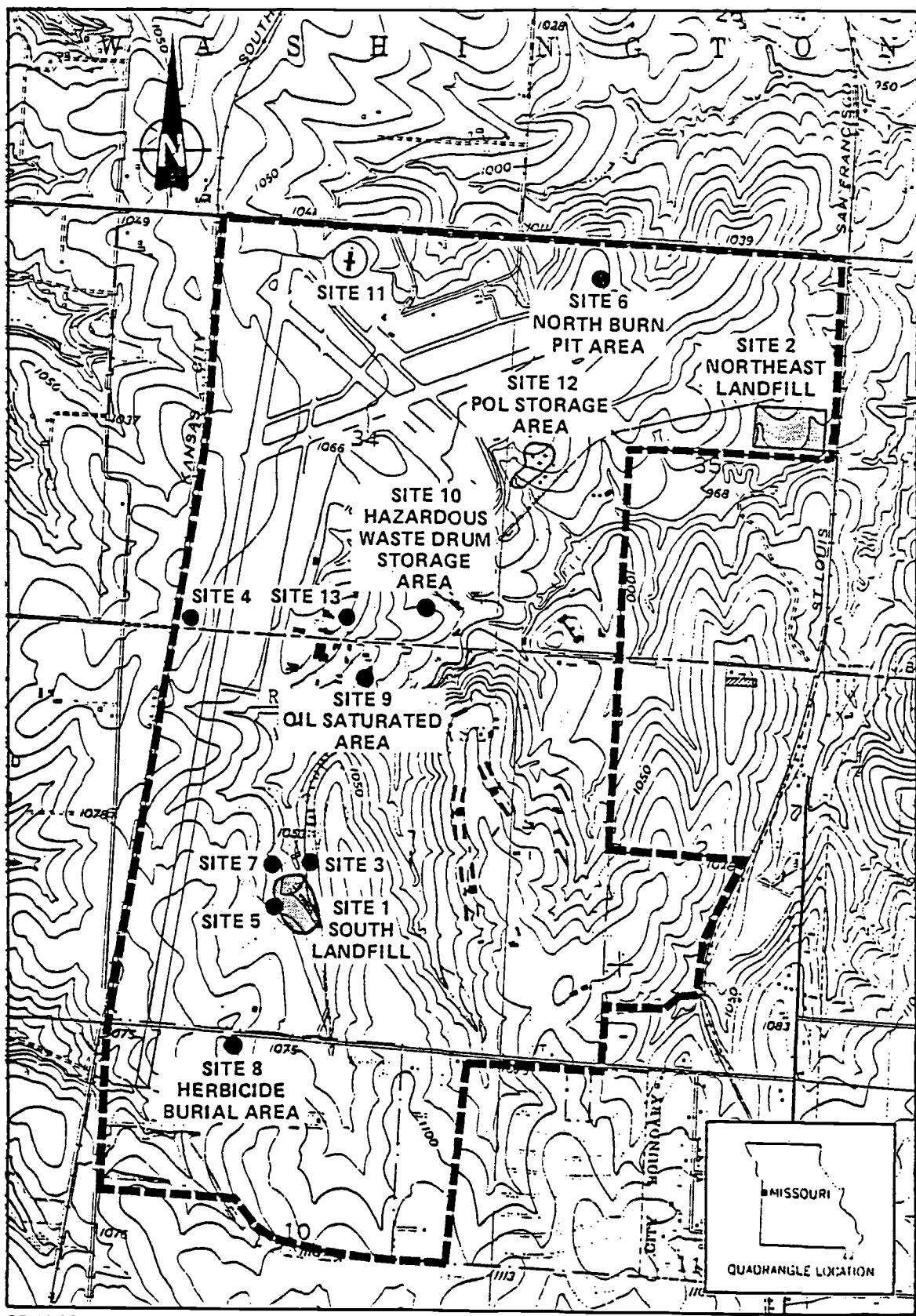
1.1 LOCATION AND HISTORY OF OPERATIONS

The primary source of historical information on the base was the Phase I report by CH2M Hill (1983). The information was confirmed and updated by E & E as part of the Phase II Stage 2 investigation.

Richards-Gebaur AFB is located in west-central Missouri, 2.6 miles from the Kansas-Missouri state line (see Figure 1-1). The Jackson County and Cass County line runs east-west through the middle of the base. The base is bounded on the north by the City of Grandview, on the north and west by Kansas City, and on the south and east by the City of Belton. The base is about 18 miles southeast of downtown Kansas City. Access to the base is via U.S. Highway 71.

The legal description of the base includes the following ranges and townships:

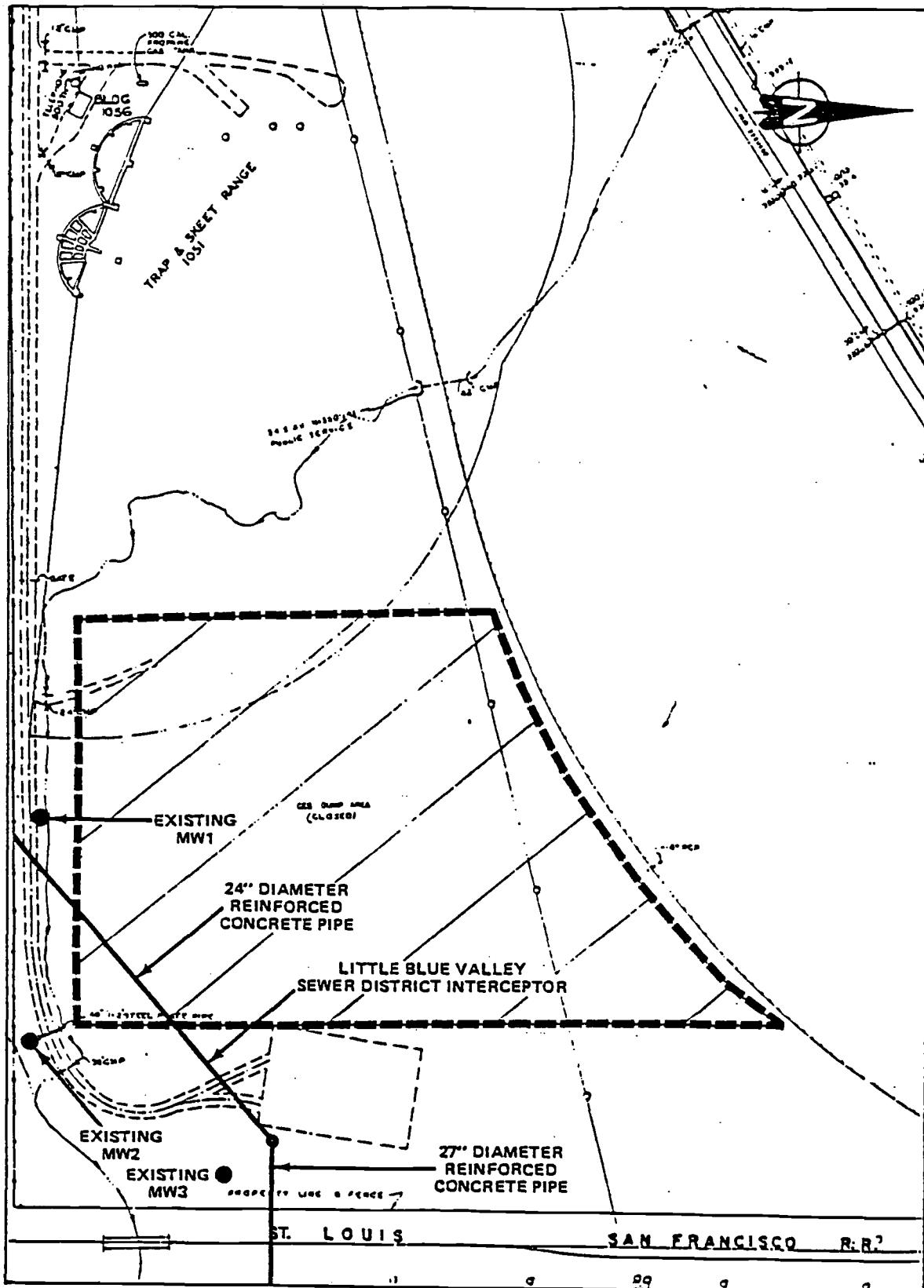
<u>Range</u>	<u>Township</u>	<u>Sections</u>
R46N	T33W	2, 3, 10, 11
R47N	T33W	34, 35



SOURCE: U.S.G.S. 7.5" Quadrangle, Belton, Mo.-Kans. 1975.

SCALE
0 $\frac{1}{4}$ 1 MILE

Figure 1-3 RICHARDS-GEBAUR AIR FORCE BASE IRP SITES



SOURCE: Department of the Air Force, Air Force Communications Service, August 1985, Detail Utility Map, Richards-Gebaur AFB, Missouri.

KEY: ■ Site Boundary — Surface Runoff Direction

SCALE
0 100 200 300 400 FEET

Figure 1-5 SITE 2, NORTHEAST LANDFILL LOCATION MAP

1.3 SITES NOT INVESTIGATED DURING STAGE 2

Several sites were not investigated during the Stage 2 program. The sites were deleted because they either could not be located or they were located on property leased to the Kansas City Aviation Department, which denied access to all sites on Kansas City Aviation land, except the South and Northeast landfills. Access was not granted because the Phase II Field Evaluation Report, dated December 1983, recommended no further action. The letters denying access to sites 3, 5, 7, and 11 are found in Appendix B. The reason Site 13 was not investigated is unknown. This site was not listed in the Description of Work. The following is a discussion of those sites.

Site 3, Contractor Rubble Burial Site

The Rubble Burial Site is located on the east bank of Scope Creek in the south-central part of the base. It reportedly was in operation from 1954 through 1978. The area is not posted or fenced and appears to have been used more recently than 1978. The area is fairly level and most of the debris is discharged over the bank at the treeline. During the presurvey visit, construction materials, including wood, concrete, masonry, and metal, were observed; however, dense foliage prevented a more thorough investigation. A 5-gallon sealed plastic container of an unidentified liquid was discovered at the base of the fill and brought to the attention of the Richards-Gebaur AFB civil engineer. This area is on land either sold or leased to the City of Kansas City. The Kansas City Aviation Department did not grant access to this site.

Site 4, West Burn Area

The West Burn Area was tentatively identified as being located off the base to the west on the west side of the railroad track and north of the Jackson County line. During the presurvey fieldwork, no evidence of this site could be found. Since the West Burn Area was in operation for only 1 year (1955) approximately 30 years ago, it was thought that there was no physical evidence of this site. However, since the Phase II Stage 2 Field Investigation, aerial photographs not previously available indicate the site may actually be located east of the railroad. During a familiarization tour on August 12, 1987, a material believed to be

tank sludge was found in an area just north of the county line and just east of the railroad tracks. At the time of the fieldwork, the site location was unknown and believed to be off base. Therefore, the site was not investigated.

Any impact that this site might have had will have to take into account the presence of the Knoche oil field 3,000 feet to the southeast. The uplands here are fairly level and the area of the site currently is farmed in corn. A tree nursery is located across the county line to the south.

This site should be investigated further if Kansas City will grant access.

Site 5, South Burn Area

The South Burn Area tentatively has been identified as being located to the southwest of the South Landfill (Site 1). During the presurvey fieldwork, no evidence of this site could be found. Since the South Burn Area was in operation for 10 years (1955 to 1965) approximately 20 years ago, it is possible that there will be no physical evidence of this site at all. Because of its proximity to the South Landfill, any environmental contamination detected at this site will be reviewed in light of findings from the South Landfill investigation. This site is believed to be on land either owned or leased by the City of Kansas City, Missouri. The Kansas City Aviation Department did not grant access for this investigation.

Site 7, Radioactive Disposal Well

The Radioactive Disposal Well is located north of the South Landfill and east of the major flight line. It is believed to have been operated from 1955 to 1970. Discussion during the presurvey visit indicated that low-level radioactive material, typically radium dials, were disposed into this cased well. The site currently is behind a locked gate in an open field. The well itself is very visible, standing 4 to 5 feet high and painted red. This well is located on land owned or leased by the City of Kansas City, Missouri. The Kansas City Aviation Department did not grant access for this investigation. Therefore, no work was performed at this site.

3. FIELD PROGRAM

3.1 PROGRAM DEVELOPMENT

A field program for the Phase II Stage 2 Confirmation/Quantification investigation was developed by E & E and presented in the Presurvey Report submitted on 7 June 1985. The program was reviewed and modified by the Air Force and set forth in the Description of Work for Contract F33615-83-D-4003, Task Order 13.

Elements of the field program included: a soil gas survey, a geophysical survey, sediment sampling, subsurface soil sampling, surface water sampling, installation of groundwater monitoring wells, and groundwater sampling. Various combinations of these program elements were performed at the various sites. Table 3-1 outlines the types of work conducted at each site. By site, the objectives of the fieldwork were:

Site 1 - South Landfill

- Determine if contaminated leachate from the landfill is entering Scope Creek.
- Evaluate potential for vertical migration of contamination.

Site 2 - Northeast Landfill

- Determine past disposal practices at the landfill.
- Delineate the locations of several suspected waste disposal trenches and determine if contamination has resulted.
- Expand monitoring well network to investigate migration of groundwater contamination from possible leaching of landfilled materials.

Table 3-1
FIELDWORK PERFORMED AT EACH SITE

	Geophysics	Boreholes	New Monitoring Wells	Soil Samples*	Groundwater Samples*	Surface Water Samples*
Site 1 - South Landfill	--	1	--	6	--	3
Site 2 - Northeast Landfill	MAG, EM	4	2	10	5	3
Site 6 - North Burn Pit Area	Soil Gas	3	3	15	3	1
Site 8 - Herbicide Burial Area	--	--	--	4	--	1
Site 9 - Oil-Saturated Area	--	1	--	9	--	1
Site 10 - Hazardous Waste Drum Storage Area	--	1	--	9	--	1
Site 12 - POL Storage Yard	--	4(h)	1	11	1	2
TOTALS		14	6	64	9	12

*Numbers do not include duplicates or blanks.

Key: MAG = Magnetometer survey
 EM = Electromagnetic survey
 (h) = Hand-augered boreholes

Site 6 - North Burn Pit Area

- Determine occurrence of contamination from the site using a soil gas survey.
- Determine occurrence of subsurface soil contamination.
- Determine whether groundwater contamination has occurred.

Site 8 - Herbicide Burial Area

- Identify actual burial area by examining available background information.
- Identify any contaminants in soil in the vicinity of the burial area.
- Evaluate extent of migration of any contaminants via surface drainage pathway.

Site 9 - Oil-Saturated Area

- Evaluate type and extent of surface and subsurface soil contamination.
- Determine if contaminants are migrating via surface drainage pathway.

Site 10 - Hazardous Waste Drum Storage Area

- Evaluate type and extent of surface and subsurface soil contamination.
- Evaluate potential migration of contaminants via surface drainage pathway.

Site 12 - POL Storage Yard

- Determine the extent of any subsurface soil contamination.
- Evaluate extent of migration of contaminants via buried drain lines and surface drainage pathways.
- Determine whether groundwater contamination has occurred and evaluate extent of contamination.

3.2 FIELD INVESTIGATION

The field investigation consisted of:

- Literature and aerial photograph records search;
- A magnetometer and electromagnetic (EM) terrain conductivity survey;
- A soil gas survey;
- The drilling of 10 boreholes;
- The installation of six monitoring wells; and
- Collection and analysis of 27 surface soil and sediment samples, 38 subsurface soil samples, 13 surface water samples, and 9 groundwater samples.

3.2.1 Schedule of Field Activities

Field activities were scheduled so as to optimize the utilization of manpower and resources. Field activities were coordinated with the USAFOEHL, the base Point of Contact (POC), and subcontractors to minimize delays and potential problems.

Throughout the course of the field activities, daily contact was maintained with the designated base personnel. The principal contact was Ms. Felipita Benson, R.N. Additional coordination was through Mr. John Hurd, Base Civil Engineer.

The fieldwork was completed during the period from 6 October 1986 to 4 November 1986. Table 3-2 provides the sequence of major field activities.

Health and safety protocols, as outlined in the Health and Safety Plan (see Appendix N), were followed throughout the project. Modifications of specific elements of the Health and Safety Plan were based on field conditions and executed only after discussion with E & E's Health and Safety Coordinator.

3.2.2 Records Search

During the course of the Phase II Stage 2 investigation, discussions were held with personnel from the Base Environmental Engineering Staff and the Base Civil Engineering Staff regarding past waste disposal practices and likely contaminants. Historical aerial photographs were

Table 3-2
SCHEDULE OF MAJOR FIELD ACTIVITIES
(October to November 1986)

6 October	Fieldwork begins with a reconnaissance of all sites and collection of surface soil samples.
6-8 October	Geophysical survey at Site 2, Northeast Landfill.
7-9 October	Soil gas survey at Site 6, North Burn Pit Area.
14 October	Drillers on site, set-up decontamination areas at Site 6, North Burn Pit Area and vehicle wash racks.
15 October	Three soil borings drilled, sampled, and grouted at Site 6, North Burn Pit Area.
16 October	Six monitoring wells drilled, pipe set, soil samples collected, and wells completed; three are at Site 6, North Burn Pit; two at Site 2, Northeast Landfill; and one at Site 12, POL Storage Yard. One well at Site 6, North Burn Pit Area was a borehole completed as a well.
17 October	Six soil borings drilled, samples collected, and the holes grouted, one at the Motor Pool Compound; one at the former hazardous waste storage yard; one at Site 1, South Landfill; and three at Site 2, Northeast Landfill.
18 October	Development of new wells and cleanup of drilling and staging areas.
21 October	Wells purged and groundwater samples collected.
25 October	The remaining surface soil and surface water samples collected from Site 2, Northeast Landfill; and Site 1, South Landfill.
28 October, 4 November	Hand-auger borings at Site 12, POL Storage Yard.
4 November	End of sampling.

examined to provide information on waste disposal practices at the base. Aerial photos were helpful in locating and delineating several sites which were not clearly visible during the Presurvey field trip. Table 3-3 lists the photos which were available for review.

3.2.3 Geophysical Survey Procedures

Magnetometer and EM surveys were performed concurrently at Site 2, Northeast Landfill, in an effort to locate what were thought to be discrete landfill trenches at this site, preliminary to placing groundwater monitoring wells. The magnetometer survey is designed to locate magnetically conductive materials in landfills, which are generally more conductive than the surrounding soils. Anomalies in magnetic flux are measured by the magnetometer and recorded in the field notebook. The EM conductivity survey measures the conductivity of the soil or any variations in the conductivity of the soil. Excavations for landfills change the natural conductivity by changing the porosity and density of the soils and altering the normal values of conducting fluids in the soils. Presumed locations of the trenches were delineated in a map provided by the Base Civil Engineer.

A Geometrics Model G-846 proton procession magnetometer with a sensitivity of 0.1 gammas and a Geonics Model EM-31 terrain conductivity meter with an effective exploration depth of 6 meters were used.

3.2.4 Soil Gas Sampling

A soil gas survey was performed at Site 6, the North Burn Pit Area, in an effort to identify potential residual contamination from the burning and handling of flammable liquids. The soil gas data were used to aid in locating the groundwater monitoring wells. The survey was performed by hand-driving perforated pipes in and around the compound. After capping each pipe and allowing it to stand for 15 minutes, the hole was monitored using an Organic Vapor Analyzer (OVA) to determine the presence or absence of volatile compounds.

3.2.5 Soil, Sediment, and Water Sampling

Soil, sediment, and water sampling protocols were followed as outlined in the Technical Operations Plan (Appendix N), except for

Table 3-3
SUMMARY OF HISTORIC AERIAL PHOTOGRAPHS
FOR AREA AROUND RICHARDS-GEBAUR AFB

Year	Scale	Source	Availability
1936	1:20,000	NARS	--
1940	1:20,000	MARC	--
1948	1:17,000	EROS, USGS	--
1950	1:70,000	EROS, USA	--
1953	1:20,000	ASCS	--
1955	1:13,000	EROS, USGS, USAF (shows West Burn Pit)	Reviewed
1957	1:20,000	ASCS	--
1959	1:12,000	COE	--
1960*	1:12,000	City of Grandview (shows borrow pits north of Northeast Landfill)	Reviewed
1963	1:18,000	USGS	Reviewed
1963	1:20,000	ASCS	--
1970	1:24,015	EDRS	--
1972*	1:12,000	City of Grandview (shows active Northeast Landfill)	Reviewed
1975	1:40,000	EROS	--
1978	1:72,500	EROS	--
1980	1:80,000	EROS	--
1982	1:58,000	EROS	--
1982	1:80,000	EROS	--

Key:
 EROS = EROS Data Center, SD
 MARC = Mid America Regional Council, MO
 ASCA = American Soil Conservation Agency
 COOE = Army Corps of Engineers
 USGS = United States Geological Survey
 USA = United States Army
 NARS = National Archives

*Not on federal archive list; does not cover south half of base.

samples collected for volatile organic analysis (VOAs). These were discrete samples collected prior to homogenization (blended to result in a more uniform sample). The portion of the sample collected for VOAs was cut from the center of the sample and placed directly into 40-ml vials.

All samples were split in the field when enough sample material was available. Split samples were delivered to the base POC. The POC determined those splits which were to be submitted to OEHL/SA for analysis. The split samples for analysis were provided by the POC to E & E for shipment to OEHL/SA.

Sediment Sampling

Sediment sampling was conducted in association with Site 1, South Landfill; Site 6, North Burn Pit Area; Site 8, Herbicide Burial Area; Site 9, Oil-Saturated Area; Site 10, Hazardous Waste Drum Storage Area; and Site 12, POL Storage Yard. A total of 27 samples were collected and submitted for chemical analysis. Table 3-4 presents a summary of the samples collected.

Sediment samples were collected using shovels to loosen an 8-inch cube of sediment from which a vertical column was removed using a stainless steel spoon. The soil column was homogenized in a disposable aluminum pan and then splits were placed in two sampling containers. Spoons were decontaminated and all pans were disposed of after sample collection from each location.

Subsurface Soil Sampling

Subsurface soil samples were collected from 5-foot-long split-spoon samplers during the drilling of the boreholes and monitoring wells. Borehole and monitoring well drilling was performed by Geotechnology, Inc., of St. Louis, Missouri. Table 3-5 provides a summary of borehole depths.

Ten boreholes were drilled and 28 subsurface soil samples were collected and submitted for analysis. Boreholes were drilled for the specific purpose of obtaining subsurface soil samples; however, one borehole (Boring 4) was scheduled to be completed as a monitoring well. A total of 186.5 linear feet of drilling was accomplished using a Mobile

Table 3-4
SUMMARY OF SURFACE SOIL SAMPLING

Site No.	Field Sample No.	Sample Location and Description
1	DF4067	Scope Creek - Background at Markey and Bates
	DF4069	Scope Creek - Downstream of South Landfill
	DF4070	Scope Creek - Seep 1 east of South Landfill
	DF4077	Scope Creek - Seep 2 northeast of South Landfill
6	DF4001	North Burn - 100 feet east of eastern fence center
	DF4002	North Burn - 200 feet east of eastern fence center
	DF4003	North Burn - 100 feet north of northern fence drainage
	DF4004	North Burn - Southeast corner fence, 200-300 feet
	DF4005	North Burn - 25 feet south of southwestern corner of fence
	DF4014	North Burn - 100 feet northwest of northwest corner of fence
8	DF4015	Herbicide Burial Area - 300 feet south of Markey
	DF4016	Herbicide Burial Area - 25 feet east of DF4015
	DF4017	Herbicide Burial Area - 25 feet east of DF4016
	DF4018	Herbicide Burial Area - 100 feet south of Markey
9	DF4007	Oil-Saturated Area - Southwest corner of Motor Pool
	DF4008	Oil-Saturated Area - Southwest corner +25 feet
	DF4009	Oil-Saturated Area - Southwest corner +50 feet
	DF4010	Oil-Saturated Area - Outside southwest corner, 0-100 feet
	DF4011	Oil-Saturated Area - Outside southwest corner, 100-200 feet
	DF4012	Oil-Saturated Area - Outside southwest corner, 200-300 feet
10	DF4019	Hazardous Waste Drum Storage Area - Background from athletic field
	DF4020	Hazardous Waste Drum Storage Area - North of gate to compound
	DF4021	Hazardous Waste Drum Storage Area - West corner of fence, 0-26 feet
	DF4022	Hazardous Waste Drum Storage Area - West corner of fence, 26-60 feet
	DF4023	Hazardous Waste Drum Storage Area - West corner of fence, 60-120 feet
	DF4024	Hazardous Waste Drum Storage Area - South corner +25 feet
12	DF4088	POL Storage Yard - Culvert at Bldg. 952

Table 3-5
SUMMARY OF SOIL BORINGS

Site No.	Boring Designation	Total Depth (feet)
1	Boring #7	7.1
2	Boring #4	9.8
	Boring #8	7.9
	Boring #9	13.0
	Boring #10	8.5
3	Boring #1	12.9
	Boring #2	13.0
	Boring #3	14.5
5	Boring #5	16.5
6	Boring #6	15.0
7	Hand Boring #1	6.0
	Hand Boring #2	6.0
	Hand Boring #3	6.0
12	Hand Boring #4	6.0

alternatively, dispersed in Site 6, North Burn Pit Area. Development and purge waters were placed in the North Burn Pit to evaporate.

3.2.7 Site-Specific Investigation Activities

As discussed above, fieldwork at each site consisted of some combination of geophysics, soil boring, subsurface soil sampling, and groundwater sampling. Activities at the individual sites are discussed below.

Site 1, South Landfill

A single upgradient soil boring was drilled southwest of the landfill (Boring 7) and three subsurface soil samples collected. The actual eastern boundary of the landfill is the west bank of Scope Creek. Therefore, it was impossible to drill a boring downgradient without penetrating the waste and jeopardizing the integrity of the landfill. Four surface soil samples were collected: a background sample adjacent to Scope Creek upstream of the landfill; one at Seep 1 where the seep enters Scope Creek; one at Seep 2 where the seep enters Scope Creek; and one adjacent to Scope Creek downstream from the landfill. Four surface water samples were collected: from Seep 1 and Seep 2 where the seeps enter Scope Creek, and from Scope Creek at the upstream (background) and downstream sampling points.

Figure 3-1 shows the sampling locations for this site.

The four water samples were analyzed for petroleum hydrocarbons, total dissolved solids, halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols. The soil samples were analyzed for halogenated and aromatic organics and petroleum hydrocarbons.

Site 2, Northeast Landfill

Magnetometer and conductivity surveys were performed at this site to locate what were originally believed to be three discrete trenches. A grid system was staked over the survey area. The grid extended beyond the expected landfill boundaries in order to define the boundaries. The grid sections were 100 by 100 feet. Every 25 feet along each grid line, three readings were taken with the magnetometer and averaged, and one

reading was taken with the EM-31. Background readings were taken periodically in an undisturbed area of the base. The geophysical survey revealed, rather than the three discrete landfill trenches, that the entire survey area had been landfilled. Additional historical aerial photos revealed landfill operations throughout the area delineated in Figure 3-2. The drilling program was modified based on this new understanding of Site 2. Four boreholes were drilled in areas adjacent to the presumed boundary of the landfill. Boring 4 was located near the southwest corner of the landfill. Borings 8 and 9 were located near the southeast corner of the site, downgradient from the landfill; and Boring 10 was located upgradient, across the railroad tracks to the north.

Three subsurface soil samples were collected from Borings 4, 9, and 10, and one was collected from Boring 8.

In addition to the three existing monitoring wells (MW1, directly south of the site; MW2, south of the site near the southeast corner; and MW3, east of the site, near the southeast corner), two new monitoring wells were installed: MW6, a completion of Boring 4, and MW5, in the northeast corner of the site. One groundwater sample was collected from each of the five wells.

Three surface water samples were collected. One from the surface drainage flowing off the landfill near the southeast corner of the landfill, and two from Scope Creek, one upstream of the landfill and one downstream.

Figure 3-3 shows the sampling locations for this site and the location of the geologic cross section. The cross section is presented in Appendix D.

The eight water samples were analyzed for petroleum hydrocarbons, total dissolved solids, halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols. The soil samples were analyzed for halogenated and aromatic organics and petroleum hydrocarbons.

Site 6, North Burn Pit Area

A soil gas survey was performed at this site to determine if organic vapor contamination exists in the subsoil and to delineate the extent of contamination in order to determine the placement of boreholes

times is provided in Appendix H. All samples were shipped to the E & E Analytical Services Center (ASC) or to OEHL/SA by overnight Federal Express. Analytical protocols are discussed in Appendix N.

3.2.9 Variations from Description of Work

During the execution of the fieldwork, several changes from the Description of Work were implemented due to field conditions and findings. Changes were implemented after discussion with and concurrence of the OEHL project manager. A site-specific summary of the variations follows.

All Sites

Subsurface soil borings were taken using a CME continuous sampler. This unit is essentially a 5-foot-long split-spoon soil sampler that is advanced ahead of the hollow-stem auger. It provides a continuous undisturbed sample of the sediment column.

Optional water samples, allocated in case groundwater was intersected during the borehole drilling for subsurface soil samples, were not utilized as no appreciable amounts of groundwater were observed in any boreholes.

Site 1, South Landfill

No modifications in the proposed scope of work occurred at this site.

Site 2, Northeast Landfill

The geophysical surveys were adjusted in the field to cover areas adjacent to the targeted area, based on instrument readings which indicated the entire targeted area as landfill. This was later corroborated based on aerial photographs.

Boring 7 was aborted after encountering the apparent edge of the landfill. Only one of the three scheduled soil samples from this borehole was collected.

An additional surface water sample was collected, from a flowing tributary to Scope Creek just before it enters the creek. This sample represented runoff from the landfill prior to dilution in Scope Creek.

The sample replaced a water sample which could not be taken at Site 6, where no water was encountered.

Site 6, North Burn Pit Area

Due to the absence of any appreciable amounts of water in two of the three monitoring wells at the site, analyses could only be performed for halogenated and aromatic organics. Petroleum hydrocarbons had to be omitted. Two additional attempts to collect sufficient sample volumes also failed.

No determination could be made as to upgradient versus downgradient with respect to monitoring wells. The facility is situated on the top of a ridge.

Site 8, Herbicide Burial Area

No modifications in the proposed scope of work were made at this site.

Site 9, Oil-Saturated Area

No modifications in the proposed scope of work occurred at this site.

Site 10, Hazardous Waste Drum Storage Area

An upstream surface water sample could not be obtained since no water was encountered.

Site 12, POL Storage Yard

A surface water sample from the outfall drain from Building 953 was allocated. However, there was no outfall from this building, and so no sample was collected.

Due to errors in sample labeling in the field, two analytical parameters listed in the Description of Work were inadvertently omitted. These errors affected the proposed analytical program as follows:

- Sample DF4045 - No TDS analysis was performed on this sample.

mg/kg) of petroleum hydrocarbons detected near the bottom of the borehole was thought to be associated with the permeable chert layer. A higher concentration (16 mg/kg) was found in a surface soil sample taken at Seep 2. This is not really a seep, however. The water is surface runoff from the upgradient lake and marshy area located along the west flank of the landfill. This area is adjacent to the runway and air traffic. It is possible that runoff from runway operations contributed to the higher concentration of petroleum hydrocarbons detected in the surface soil sample taken at Seep 2. Table 4-3 summarizes the results of the soil analyses.

4.2.2 Site 2, Northeast Landfill

Geophysics

A previous report (CH2M Hill 1985) showed Site 2, the Northeast Landfill, as consisting of three discrete trenches. In order to locate these trenches precisely, magnetometer and EMC geophysical surveys were conducted. No discrete trenches could be delineated from the geophysical data. Instead, the data indicated wide anomalies over the entire survey area. A historical aerial photograph was also found which showed the location of trenches as of 1970. This photo, like the geophysical survey data, contradicted the theory of three discrete trenches. The photo showed the Northeast Landfill in 1970 to be a series of trenches oriented north-south and east-west.

Based on the geophysical surveys and the aerial photo, the area delineated in Figure 4-1 was considered to have been trenched and landfilled. Further investigation, including the drilling of four boreholes, installation of two monitoring wells, and collection and analysis of soil samples and water samples, was based on the understanding of the trenched and landfilled area as delineated in Figure 4-1.

Geology

Based on published maps and observations made in the field during the Phase II investigation, Site 2, the Northeast Landfill, is situated on a thin cover of unconsolidated silts and clays overlying a gray to

Nearly all Organic Vapor Analyzer (OVA) readings were positive. The laboratory analyses indicated that none of the nine subsurface samples was contaminated with volatile organics. The probable explanation for the positive result in the soil gas survey and the negative result in the subsurface soil samples is that the OVA was detecting methane, which would not be detected in the soil samples. The fact that OVA readings remained constant when using a carbon filter further supports this conclusion.

The values for petroleum were also low and consistent among the samples (ND to 5.7 mg/kg), with the exception of sample DF4001, collected 100 feet east of the southeast corner of the fence line, which contained 34 mg/kg. Table 4-7 summarizes the results of the soil analyses.

4.2.4 Site 8, Herbicide Burial Area

Geology

Site 8, the Herbicide Burial Area, is similar in setting to Site 6, the North Burn Pit Area, and the Site 1, the South Landfill. The site is on an upland surface where silts and clays cover a weathered limestone bedrock. The original topography of the base has been modified by construction and extension of the major north-south runway. The area is nearly level, with broad shallow depressions and a small pond downgradient to the south.

A broad shallow depression was observed in the area of the suspected trench location based on AF 103. Water had ponded in this area and drained east into other wet areas. It is not known if the shallow depression was caused by possible subsidence of the 1971 trench or is due to construction activities since that date.

Hydrogeology

Based on observations made on other upland sites on the base, it can be assumed that the thickness of the unconsolidated deposits above the bedrock at this site is less than 7 feet. The burial trench was projected to be 6 feet in depth, which places the bottom of the trench very close to, if not directly on, the weathered bedrock surface. The hydrological implication is that the material that was buried, and

Table 4-9

RESULTS OF SOIL SAMPLE ANALYSES FOR
SITE 8, HERBICIDE BURIAL AREA

(mg/kg; all soil concentrations on an as received basis)

Parameter	Date Sampled: Boring#: Depth: Field No.: Lab No.:	10/10 HBAS-1 0-1' DF4015 8796	10/10 HBAS-2 0-1' DF4016 8797	10/10 HBAS-3 0-1' DF4017 8798	10/10 HBAS-4 0-1' DF4018 8799
Herbicides		ND	ND	ND	ND
Arsenic		1.83	5.0	ND	4.53
Mercury		ND	ND	ND	ND

ND = Not Detected

4.3 SIGNIFICANCE OF FINDINGS

4.3.1 Site 1, South Landfill

No contamination was detected leaving this site via surface migration into Scope Creek, based on the analyses of surface soil and water samples. Relatively low concentrations of petroleum hydrocarbons (1.2 mg/kg, 16 mg/kg) were detected in the subsurface soils. The extractable organic compound DBP, the only organic compound detected, was at low concentrations (10 to 16 µg/L), but it also appeared in the method blank (below 10 µg/L). Consequently, DBP has been attributed to laboratory contaminants.

4.3.2 Site 2, Northeast Landfill

With the exception of the extractable DBP, no organic chemicals or metals were reported in any water samples taken at the site. Because DBP was reported in concentrations (14 to 17 µg/L) minimally above sample blank value (13 µg/L), the presence of this chemical has been attributed to laboratory contamination.

Five anions were reported above detection limits. Only a single sample of sulfate at 280 µg/L exceeded a standard or criterion. Since this is a non-mandatory secondary standard set for aesthetic (taste and odor) considerations, the relatively minor exceedance, and the fact that there is no drinking water well nearby, should not represent any material threat to human health.

For soils, no metals exceeded normal ranges for western Missouri soils. The only detectable contaminant was petroleum hydrocarbons, reported at concentrations ranging from non-detectable to 440 mg/kg.

4.3.3 Site 6, North Burn Pit Area

Only three organics (chloroform, tetrachloroethylene, and methylene chloride) were detected in water samples from Site 6. Concentrations of two of the organics (below 1 µg/L) were significantly below EPA HAs. The third, methylene chloride, detected in a single groundwater sample, was well below the EPA HA.

No metals were reported above normal ranges for western Missouri soils. The only organic contaminant reported in soils above detection

have been associated with the storage of drummed hazardous materials here. These efforts included: overpacking drums, removal of stained soil, and scraping the asphalt surface. These efforts were undertaken as a result of a Notice of Violation issued by EPA.

4.3.7 Site 12, POL Storage Yard

The one groundwater and two surface water samples taken at Site 12, the POL Storage Yard, revealed no contamination above detection limits. In the 12 soil samples, petroleum hydrocarbon concentrations were relatively low (6.9 to 44 mg/kg). Removal of soils in the areas of the seven samples with higher concentrations (67 to 2,800 mg/kg) should be considered. In addition, a single sample collected near the drain pipe outlet for Building 953 at a depth of 3 feet contained concentrations of benzene (1.25 mg/kg), total xylenes (2.25 mg/kg), and ethylbenzene (6.25 mg/kg), indicative of contamination by gasoline or a similar petroleum hydrocarbon.

limits was petroleum hydrocarbons. Concentrations of petroleum hydrocarbons in 14 of the 15 samples taken at various depths ranged from non-detectable to 5.4 mg/kg. A single surface sample had a value of 34 mg/kg. In summary, the low concentrations found at the site indicate no undue risk to human health or the environment.

4.3.4 Site 8, Herbicide Burial Area

No detectable concentrations of any contaminant were reported in the single surface water sample taken at Site 8. Concentrations of metals in the four surface soil samples did not exceed the normal range of concentrations reported in western Missouri soils. In addition, no organic contamination was detected in the soil samples. Consequently, the data do not indicate that Site 8 presents an undue risk to human health or the environment.

4.3.5 Site 9, Oil-Saturated Area

No contaminants were detected in the single surface water sample at Site 9.

Results of the soil sample analyses indicate significant lead and petroleum hydrocarbon contamination of site soils. In six of nine samples, concentrations of lead fell within the normal range for western Missouri soils. In the same samples, petroleum hydrocarbon concentrations were relatively low (non-detectable to 9 mg/kg). In the remaining three samples, however, lead concentrations (117 to 343 mg/kg) greatly exceeded the normal range (10 to 20 mg/kg). In these same samples, petroleum hydrocarbons were also high (670 to 3,000 mg/kg). As these were samples taken from the surface (0- to 1-foot depth), humans would be subject to direct contact with high concentrations of lead from the site, warranting consideration of removal.

For the purpose of analyzing the potential human health risk related to lead exposure, it is assumed that humans ingest a maximum of 1 gram of soil daily during activities at the site. This number is extremely conservative (health protective), as it is based on the soil intake for small children--that segment of the population with highest soil intake as estimated by the Agency for Toxic Substances and Disease Registry (ATSDR 1986). Assuming 100% absorption of soil contaminants in

1 gram of soil, these intakes attributable to ingestion of onsite soils are then compared to the daily intake of lead regarded by EPA as acceptable as demonstrated by the current use of this limit in developing the RMCL of 20 µg/L for lead.

An Acceptable Daily Intake (ADI) for adults related to soil lead ingestion has been derived based on the EPA proposed RMCL of 20 µg/L and the following assumptions:

- Ingestion of 2 liters per day (L/day) for a 70-kg adult.
- Twenty percent of the ADI is contributed by water ingestion. This assumption is based on methodologies used to estimate revised drinking water standards (EPA 1985a).
- Intake of lead except by ingestion of drinking water and by the soil-related pathways is minimal.
For an adult:

$$20 \text{ } \mu\text{g}/\text{L} \times 2 \text{ L/day} = 40 \text{ } \mu\text{g}/\text{day} \text{ from ingestion of water}$$

$$40 \text{ } \mu\text{g}/\text{day} + 0.2 = 200 \text{ } \mu\text{g}/\text{day} \text{ from all sources}$$

$$200 \text{ } \mu\text{g}/\text{day} - 40 \text{ } \mu\text{g}/\text{day} = 160 \text{ } \mu\text{g}/\text{day} \text{ from all sources excluding water ingestion, which is the Adjusted Acceptable Daily Intake (AADI) for soil for adults}$$

In order that the AADI not be exceeded, the corresponding soil concentration must be no higher than 160 mg/kg.

4.3.6 Site 10, Hazardous Waste Drum Storage Area

The storage of hazardous waste drums in this compound does not appear to have contaminated the surface and subsurface soils. The only contaminants in soil were petroleum hydrocarbons, with concentrations ranging from non-detectable to 1,900 mg/kg. In six of the nine samples, concentrations were low (less than 9 mg/kg). However, concentrations were high (670 to 3,000 mg/kg) in three samples taken at 0- to 1-foot intervals, and removal of soils from these areas should be considered. The single surface water sample contained barium (85 µg/L) and lead (5 µg/L) significantly below the EPA standards or criteria. No other contaminants were detected in the sample. It appears that the remedial efforts undertaken at this site have cleaned up any problems that may

5. ALTERNATIVE MEASURES

This section discusses the alternative measures that can be taken at each of the seven sites. The alternatives have been devised based on the results of the Phase II Stage 2 investigations. A "no-action" alternative is considered for each site. Recommendations as to the most appropriate alternatives are presented in Section 6.

5.1 SITE 1, SOUTH LANDFILL

No significant contamination of surface water, surface soils, or subsurface soils was found at this site. Minor amounts of petroleum hydrocarbons (less than 16 mg/kg) were detected in one of the surface runoff pathways and at the base of the borehole. No monitoring wells exist on this site.

Alternatives for this site include:

- No action. This alternative is applicable should it be decided that the levels of contaminants detected in the samples do not require further action.
- Long-term monitoring. Seasonal fluctuations in groundwater and rainfall could have accounted for the minor amount of seepage found in the Phase II Stage 2 investigation. Under this alternative, areas of the two known seeps would be resampled periodically and searches would be made for additional seeps.
- Installation of upgradient monitoring wells. Two wells could be installed in association with this landfill, one to the west and one to the south. The west well would test the marshy area which is the source for Seep 2; the south well would determine if sufficient recharge for water samples to be taken could be developed from the area of Borehole 7. This borehole showed a small amount of water and traces of hydrocarbons near its base. The south well

might also indicate whether contaminants have migrated from the South Burn Pit Area, an area that was never clearly located and was not part of the Phase II Stage 2 investigation. The South Burn Pit Area was believed to be located south of the South Landfill.

5.2 SITE 2, NORTHEAST LANDFILL

No significant contamination was detected in association with this site. The utilization of the site for landfilling operations is much more extensive than was previously thought. A soil sample taken from below the fill material indicates that the liquids in the landfill are not penetrating into underlying soil. In two samples at the 1- to 2-foot depth, petroleum hydrocarbons were reported at 78 and 440 mg/kg. This landfill, no longer USAF property, is leased to Kansas City Aviation Company and is being used to store excess property and large refuse items. The USAF should survey the perimeter of the landfill area and present this information to the current property owner and include it in the deed to the property. This will alert the owner as to any limitations on future uses of the land, including future construction and improvements. Already, a sewer line has been cut through the south edge of the landfill. It is not known what effect the intersection with the landfill will have on the integrity of that sewer system in the years to come.

Alternatives for this site include:

- No action. If it is determined that there is no threat to the surrounding environment, no further action would be necessary.
- Long-term monitoring. As part of the base groundwater sampling plan, the five wells at the landfill could be sampled to monitor the continued integrity of the landfill and as a check on the area groundwater quality.

5.3 SITE 6, NORTH BURN PIT AREA

Three volatile organics were detected in perched groundwater at this site--chloroform and tetrachloroethylene at concentrations significantly below drinking water standards or criteria, and methylene chloride in a single sample at a concentration of 37 µg/L, an order of magnitude below the EPA drinking water health advisory. There is very little groundwater, and no deep aquifers are threatened. Soil gas

readings indicated that organic vapor contamination is confined within the perimeter of the site. Soil contamination was limited to low concentrations of petroleum hydrocarbons, which were not found in any water sample.

Alternatives for this site include:

- No action. This alternative would be applicable if it is decided that the levels of contaminants detected in these samples do not warrant action. The concentrations observed have been below federal drinking water standards and there are no receptors.
- Long-term monitoring. Seasonal rainfall could recharge the two wells on this site which were essentially dry at the time of the Phase II Stage 2 investigation. The wells could be monitored for evidence of a contaminant plume by sampling for organic contamination.
- Installation of additional monitoring wells. The northeast monitoring well could be nested with a deeper well (drilled to bedrock) to determine if the organic contamination observed in the shallow wells is migrating along the weathered bedrock interface. A monitoring well could be installed outside the compound to the east, near the outfall from the oil-water separator. This would provide a check on the efficiency of this unit and could aid in locating seeps from lower stratigraphic units.

5.4 SITE 8, HERBICIDE BURIAL AREA

There is no conclusive data on the location of the trench or the characterization of this site. No soil borings were made and so no subsurface soil samples were collected.

Alternatives for this site include:

- No action. If it is determined on the basis of present information that the amounts of herbicides buried at this site and the mode of containment do not constitute an environmental problem, no further action would be necessary.
- Additional investigation. Additional effort to locate the trench should include locating and examining aerial photographs not previously available and performing a ground conductivity survey over the suspected area. Once the trench is located, testing and sampling could begin by drilling a series of 10-foot boreholes in the four corners of the trench area. Also, a sediment sample could be taken from the pond downgradient of the trench.

5.5 SITE 9, OIL-SATURATED AREA

Surface soil was found to be contaminated with petroleum hydrocarbons and lead. Levels of lead exceeded 160 mg/kg, the criterion derived for protection of human health (see Section 4.3.5). In addition, concentrations of petroleum hydrocarbons in three of the nine soil samples in the 0- to 1-foot depth were very high. Access to the site, and therefore to these materials, is limited.

Alternatives for this site include:

- No action. Since there is little chance of direct contact, it may be determined that the levels of contaminants detected do not warrant further action.
- Preparation for Phase IV actions. This action would require the removal of contaminated soils and gravel, after identifying the volume to be removed.

5.6 SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA

Only minor contamination of surface water was detected in association with this site. The concentrations of the two contaminants detected, lead and barium, were below drinking water standards. Petroleum hydrocarbon values were high (up to 1,900 mg/kg) along the south fence line. The sources may include spillage, dripping from the numerous heavy vehicles and smaller vehicles (grass mowers) now present in this compound. Storage of drums containing petroleum products in the compound may also have been a source.

Alternatives for this site include:

- No action. Due to the absence of detectable contamination resulting from the storage of hazardous waste drums at this site, no further action is warranted.
- Identification of petroleum hydrocarbon hot spots. This option would require delineating the areas of high petroleum hydrocarbon contamination, in preparation for removal actions (Phase IV).

5.7 SITE 12, POL STORAGE YARD

Site 12, the POL Storage Yard, is the distribution center for all fuels and propellants on the base. The groundwater south of the

facility is free from contamination. Soils inside the tank berms indicate significant petroleum hydrocarbon accumulations (concentrations ranged upwards to 2,800 mg/kg). Volatile organic contamination was detected in the subsurface outside of Building 953, a pumphouse. Additional pumphouses are present, but were not sampled. The contaminated soil sample came from an area where a broken drain pipe from the pumphouse is thought to be located.

Alternatives for this site include:

- No action. If the levels of contaminants identified are determined not to be excessive for present operation of the site, then no further action is warranted.
- Long-term monitoring. After the installation of a monitoring well during Phase II Stage 2, sampling and analysis of this well on a periodic basis would serve to monitor groundwater conditions at this site.
- Additional subsurface soil sampling. The area of greatest environmental concern is located east of the pumphouses. A series of shallow hand-auger borings could be taken in a grid pattern to determine the extent of organic contamination in the soil.

Table 6-1

LIST OF SITES BY CATEGORY

Category I - No Further Action Recommended

- Site 1: South Landfill

Category II - Additional Site Assessment Recommended

- Site 4: West Burn Area
- Site 6: North Burn Pit Area
- Site 8: Herbicide Burial Area
- Site 12: POL Storage Yard

Category III - Remedial Action Recommended

- Site 2: Northeast Landfill
 - Site 6: North Burn Pit Area
 - Site 9: Oil-Saturated Area
 - Site 10: Hazardous Waste Drum Storage Area
-

Table 6-2
SUMMARY OF RECOMMENDATIONS

Site 1 - South Landfill

- No further action.

Site 2 - Northeast Landfill

- Monitor five monitoring wells biannually for 2 years.
- Monitor land use at landfill biannually for 2 years.

Site 4 - West Burn Area

- Perform a soil gas survey to locate the site.
- Install three monitoring wells.
- Sample the surface and subsurface soils.

Site 6 - North Burn Pit Area

- Install two additional monitoring wells, a second well in northeast corner of site, well to be drilled to bedrock or 30 feet, and one outside the compound to the east (20 feet).
- Monitor five wells biannually for 2 years.

Site 8 - Herbicide Burial Area

- Locate the burial trench using aerial photos and a ground conductivity survey. Drill four shallow borings (10 feet) and sample soil for pesticides, mercury, and arsenic.
- Excavate and remove buried pesticides from trench.

Site 9 - Oil-Saturated Area

- Remove oil-contaminated sediments from along the fence line.

Site 10 - Hazardous Waste Drum Storage Area

- Remove oil-contaminated surficial soils.

Site 12 - POL Storage Yard

- Install four monitoring wells to bedrock.
 - Monitor wells.
-

INSTALLATION RESTORATION PROGRAM

PHASE II

CONFIRMATION/QUANTIFICATION

STAGE 2

RICHARDS-GEBAUR AIR FORCE BASE

MISSOURI

Prepared by:

ECOLOGY AND ENVIRONMENT, INC.

Buffalo Corporate Center

368 Pleasantview Drive

Lancaster, New York 14086

July 1988

FINAL REPORT

(September 1986 to November 1987)

VOLUME 2: APPENDICES

Approved for Public Release:

Distribution is Unlimited

Prepared for:

UNITED STATES AIR FORCE

Headquarters Air Force Reserve (HQ AFRES/SGPB)

Robins Air Force Base, Georgia 31098-6001

UNITED STATES AIR FORCE

Occupational and Environmental Health Laboratory/

Technical Services Division (USAFOEHL/TS)

Brooks Air Force Base, Texas 78235-5501

APPENDIX E

CHAIN-OF-CUSTODY FORMS

Ecology and environment, inc.

105 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14226, TEL. 716-632-4491
International Specialists In the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 2

Project No.:	Project Name:			Project Manager:			REMARKS					
DF4000	Richards Gebau AFB			Paul R Kapsick								
Samplers: (Signature)			Field Team Leader:									
<i>Paul R Kapsick Mark Myer Michael M. Schmid</i>			Paul R. Kapsick									
STATION NUMBER	DATE	TIME	SAMPLE TYPE		SAMPLE INFORMATION		STATION LOCATION	NUMBER OF CONTAINERS	Depth		OVA	
			COMP	GARBAGE	AIR	EXPECTED COMPOUNDS (Concentration)*%						
DF-4036	10/16	1955	X			VOA, Pet. Hydro	NELF Boring 4	3	2 1		1-2'	(99.6%)
37	10/16	1900	X					2 1			6-7'	96.4
38	10/16	1905	X					2 1			8-10.5	94.5
39	10/17	1000	X			VOA, Pet. Hydro., Land	OIL STAIN Area Boring 5	2 1			3-4	99.6
40	10/17	1000	X					2 1			8-9	97.2
41	10/17	1000	X					2 1			15.5/16.5	97.8
42	10/17	1010	X			VOA, Pet. Hydro., EPTOX metals	HWSA - Boring 6	2 1			.5-1.5'	99.5
43	10/17	1100	X					2 1			9-10'	99.7
44	10/17	1030	X					2 1			4.5 - 5.5'	94.7
45	10/17	1130	X			VOA, Pet. Hydro	POL TANKS	2 & 1			upstream - H ₂ SO ₄	97.8
46	10/17	1330	X			VOA, Pet. Hydro	POL TANKS	2 & 1			downstream - H ₂ SO ₄	99.5
47	14	Y				VOA, Pet. Hydro	SOUTH LF Boring 7	2 1				99.7
48	14	X				VOA, Pet. Hydro		2 1				99.7
49	14	X				VOA, Pet. Hydro		2 1				99.7
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		Ship Via: <i>Fed X</i>		
<i>Paul R Kapsick</i>			10/17/86	EPA EXP								
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		BL/Airbill Number: <i>10117186</i>		
Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)				
<i>EPA EXP</i>			10/17/86	<i>McCracken</i>								

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055

ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14226. TEL. 716-632-4401
International Specialists in the Environment

RECEIVED
REC'D BY

Page 2 of 2.

CHAIN-OF-CUSTODY RECORD

Project No.: DP4000	Project Name: RICHARDS - GEBRUR AFB			Project Manager: Paul Kopsick				REMARKS
Samplers: (Signature) <i>Paul Kopsick / M. Mal Mayor</i>			Field Team Leader: Paul Kopsick					
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRA AIR	SAMPLE INFORMATION		STATION LOCATION	NUMBER OF CONTAINERS	DEPTH
				EXPECTED COMPOUNDS (Concentration)*				
DF4050	10/17	1500	/	VOA, PER Hydro		NE Landfill Boeing 8	2 1	7.0' - 7.5'
DF4051	10/17	1550	/	VOA, PET Hydro		NE LF Boeing 9	2 1	4.0' - 5.0'
31	10/17	1540	/				2 1	6.0' - 7.0'
52	10/17	1540	/				2 1	6.0' - 7.0' (Duplic. Conc.)
53	10/17	1600	/				2 1	9.0' - 10.0'
DF4054	10/17	1800	/	VOA, PER Hydro		NORTH NE LF Boeing 10	2 1	1.0' - 2.0'
55	10/17	1805	/				2 1	4.0' - 5.0'
56	10/17	1810	/				2 1	7.0' - 8.0'
Relinquished By: (Signature) <i>Paul Kopsick</i>		Date/Time: 1830 10/17	Received By: (Signature) FEA EXP	Relinquished By: (Signature) F		Date/Time:	Received By: (Signature)	Ship Via: Fed Ex
Relinquished By: (Signature)		Date/Time:	Received By: (Signature)	Relinquished By: (Signature)		Date/Time:	Received By: (Signature)	BL/Airbill Number:
Relinquished By: (Signature) FEA EXP		Date/Time: 0900 10/18/86	Received For Laboratory By: (Signature) K. Marshall	Relinquished By: (Signature)		Date/Time:	Received For Laboratory By: (Signature)	Date: 10/17/86

Distribution: Original Accompanies Shipment; Copy to Coordinator Field File

*See CONCENTRATION RANGE on back of form.

234056

ecology and environment, inc.

195 SUGO ROAD, P.O. BOX O, BUFFALO, N.Y. 14228, TEL. 716-632-4493
International Specialists In the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 2

Project No.:	Project Name:			Project Manager:			2 40 ML VOA 1 Liter Poly VOA 1 Liter Ambe 20% HCl 1/2 GL Ambe 20% HCl 60oz SAE						REMARKS		
DF4000	Richards-Gebau AFB			PAUL KOPSICK											
Samples: (Signatures)				Field Team Leader:			PAUL KOPSICK								
STATION NUMBER	DATE	TIME	SAMPLE TYPE	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	PH	COND	Temp				
				COMP	GRAB	AIR									
EXPECTED COMPOUNDS (Concentration)*															
57	10/21		X	VOA, Petro Hydro.			9076	North Burn NW MW	1	1/2					
58	10/21		X	VOA, Petro, Hydro			9077	North Burn NE MW	2	1	1		7.75 288 73.5		
59	10/21		X	VOA, Petro. Hydro			9078	North Burn SE MW	1	1/2			only 1 VOA		
60	10/21	1025	X	VOA, Petro. Hydro. TDS			9079	POL Monitoring Well	3	1	1		only, 1 VOA		
61	10/21		X	VOA, Petro, Hydro, TDS, Extract, Anions, Phenols			9080	Northeast LF Bkg well	7	1	3	1	7.26 548 67.8		
62	10/21		X				9081	Gatg well	7	1	3	1	7.22 1207 65.4		
63	10/21	1330	X				9082	PIT well 1	6	1	3	1	7.24 554 67.0 phenol sig break		
64	10/21	1340	X				9083	PIT well 2	7	1	3	1	7.32 888 66.2		
65	10/21	1350	X				9084	PIT well 3	7	1	3	1	7.35 741 68.5		
66	10/21	1430	X				9085	South LF Monitoring Bales	7	1	5	1	8.24 427 67.6 SLFBKG		
67	10/21	1430	X	VOA, Petr. Hydro			9090	44SLF BKGS	2	1			SLFBKG		
68	10/21	1530	X				9086	SLF DNW	7	1	3	1	7.34 684 700 SLFAN		
69	10/21	1530	X	VOA, Pet. Hydro			9091	SLF DNS	2	1			SLF DN		
70	10/21	1550	X	VOA, Pet Hydro			9092	SLF SEEPS	2	1			SLF SEEPS		
Relinquished By: (Signature)			Date/Time: 1900		Received By: (Signature)		Relinquished By: (Signature)		Date/Time:		Received By: (Signature)		Ship Via:		
<i>Paul Kopsick</i>			10/21/86		<i>FBI Lab</i>										
Relinquished By: (Signature)			Date/Time:		Received By: (Signature)		Relinquished By: (Signature)		Date/Time:		Received By: (Signature)		BL/Airbill Number:		
Relinquished By: (Signature)			Date/Time:		Received For Laboratory By: (Signature)		Relinquished By: (Signature)		Date/Time:		Received For Laboratory By: (Signature)		Date:		
<i>FBI Lab</i>			10-21-86 1000		<i>10-21-86 C</i>										

Distribution: Original Accompanier Shipment; Copy to Coordinator Field Files
See CONCENTRATION RANGE on back of form.

234055

recycled
ecology and environment, inc.

198 SUGO ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 2 of 2

Project No.: DF4000	Project Name: Richards Gebau AFB				Project Manager: PAUL KOPSKICK																	
				Field Team Leader: PAUL KOPSKICK	REMARKS																	
STATION NUMBER	DATE	TIME	SAMPLE TYPE	ICOMP	GRAB	AIR	SAMPLE INFORMATION			STATION LOCATION		NUMBER OF CONTAINERS										
							EXPECTED COMPOUNDS (Concentration)*															
04071	10/21	1550	X				VOA, RTH, dne, TDS, Ext, PPMetals, Anions, Phae, SLFSEEPW			9087	9095	7	1	3	1	2				pH Cond Temp		
72	10/21	1730	X				VOA Field Blank					1	1							8.00 567 674		
Relinquished By: (Signature)			Date/Time:		10/21/66		Received By: (Signature)					Relinquished By: (Signature)			Date/Time:		Received By: (Signature)			Ship Via:		
Paul Kopsick							Fel. Fager															
Relinquished By: (Signature)			Date/Time:				Received By: (Signature)					Relinquished By: (Signature)			Date/Time:		Received By: (Signature)			BL/Airbill Number:		
Relinquished By: (Signature)			Date/Time:		10-21-16/0900		Received For Laboratory By: (Signature)			J. W. H. 11/16/66 C		Relinquished By: (Signature)			Date/Time:		Received For Laboratory By: (Signature)			Date:		

Distribution: Original Accompanies Shipment; Copy to Coordinator Field File

*See CONCENTRATION RANGE on back of form.

234055

ecology and environment, inc.

195 SUGO ROAD, P.O. BOX D, BUFFALO, N.Y. 14228, TEL. 716-632-4481
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.:	Project Name:			Project Manager:													
DF4000	Richards - Gebaur AFB			PAUL KOPSKY													
Samples: (Signatures)			Field Team Leader:														
Michael Mularczyk Joe Chandler			Joe Chandler														
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRAB AIR	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	REMARKS								
				EXPECTED COMPOUNDS (Concentration)*					40ML VIALS (SET) 8oz SAR								
DF4009	10/24	1050	X	VOA, Petroleum Hydrocarbons			POL TANK # 955	3	2	1	1					EPEH's	
80	10/24	1100	X				POL TANK # 955	3	2	1	1					9343	
81	10/24	1130	X				POL TANK # 955	3	2	1	1					9344	
82	10/24	1330	X				POL TANK # 957	3	2	1	1					9345	
83	10/24	1345	X				POL TANK # 957	3	2	1	1					9346	
84	10/24	1415	Y				POL TANK # 957	3	2	1	1					9347	
85	10/24	1450	X				POL TANK # 957	3	2	1	1					9348	
86	10/24	1500	X				POL TANK # 954	3	2	1	1					9349	
87	10/24	1515	X				POL TANK # 954	3	2	1	1					9350	
48	10/24	1555	X				POL TANK # 954	3	2	1	1					9351	
88	10/24	1515	X	87 DUP			POL TANK # 954 drain	3	2	1	1					Calvert Rd. Bld. 952 9353	
							POL TANK # 954 (51)	3	2	1	1					Duplicate (5ft.) 9352	
Relinquished By: (Signature)				Date/Time: 10/24/86		Received By: (Signature)	Relinquished By: (Signature)	Signature				Date/Time:	Received By: (Signature)	Ship Via:			
Relinquished By: (Signature)				Date/Time:		Received By: (Signature)	Relinquished By: (Signature)	Signature				Date/Time:	Received By: (Signature)	Fed. Ex			
Relinquished By: (Signature)				Date/Time: 10-24-86 / 0930		Received For Laboratory By: (Signature)	Relinquished By: (Signature)	Signature				Date/Time:	Received For Laboratory By: (Signature)	BL/Airbill Number:	Date:		

tribution: Original Accompanist Shipment; Copy to Coordinator Field Files
CONCENTRATION RANGE on back of form.

234055

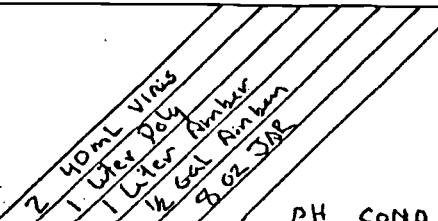
ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14228, TEL. 716-832-4481
International Specialists in the Environment

RECYCLED

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.:	Project Name:			Project Manager:									REMARKS				
DF-POC	Richards Gebaum AFB			PAUL KOPSKICK													
Samples: (Signatures)			Field Team Leader:			PAUL KOPSKICK											
STATION NUMBER	DATE	TIME	SAMPLE TYPE		SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	PH	COND	TEMP					
			COMP	GRAB	AIR	EXPECTED COMPOUNDS (Concentration)*											
73	10/23	1050	X	VOA, TDS, Phenol, Act Hydro, Ammonia, Ester, PPmetals			NELF culvert	PMI 8	7	1	3	1	2	7.92	61B	62.0	9230
74	10/23	1100	X				NELF Downstream	8	7	1	3	1	2	7.87	341	61.4	9231
75	10/23	1110	X				NELF Upstream	8	7	1	3	1	2	8.01	374	61.0	9232
76	10/23	1200	X				SLF SEEP 2	8	7	1	3	1	2	7.94	540	66.4	9233
77	10/23	1410	X	VOA, Pat. Hydro			SLF SEEP 2	3	2	1							9250
78	10/23	1620	X	VOA BLANK				PMI 1	1	1							9234
								PMI									9235
								PMI									
DF-403	10/23	1030	X	Phenols			NELF - M1	71	1						Replaces Broken set of 10/21 9235		
Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via:											
<i>Paul Kopsick</i>	1700 10/23	<i>FED EXP</i>				<i>Fed Exp</i>											
Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	BL/Airbill Number:											
Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Date:											
<i>K. Walsh</i>	10/24/86																

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files
See CONCENTRATION RANGE on back of form.

234055

Ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14226, TEL. 716-632-4491
International Specialists In the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.:	Project Name:			Project Manager:						REMARKS	
DF-1000	Richards Gebau AFB			PAUL Kopsick							
Sampler: (Signature)			Field Team Leader:			PAUL Kopsick					
STATION NUMBER	DATE	TIME	SAMPLE TYPE		SAMPLE INFORMATION		STATION LOCATION	NUMBER OF CONTAINERS	2-4051 Vol Vials 1-B-02 Tac		
			CMP	GRAB	AIR	EXPECTED COMPOUNDS (Concentration)*					
DF-1027	10/15	1420	X		VCA, Petroleum Hydrocarbons	8894	NB Boring 1 S-1	3	2	/	3.5-4.5
DF-1026		1430	X			8895	NB 1 S-2	3	2	/	7-8'
DF-1029		1435	X			8896	NB 1 S-3	3	2	/	12-12.4'
DF-1033		1510	+			8897	NB Boring 2 S-1	3	2	/	2-3'
DF-1031		1515	X			8898	NB 2 S-2	2	2	/	5-6'
DF-1032		1520	+			8899	NB 2 S-3	3	2	/	11-12'
DF-1033		1600	+			8901	NB Boring 3 S-1	3	2	/	2-3'
DF-1034		1605	+			8902	NB 3 S-2	3	2	/	5-6'
DF-1035		1610	+			8903	NB 3 S-3	3	2	/	11-12'
DF-1028		1525	+		8900	DUPPLICATE	NB Boring 2 S-3	3	2	1	11-12'
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		Ship Via:	
Paul Kopsick			10/15 1700hr	Joseph Charles		Joseph Charles	10/15 1745	Fed. Express		Federal Exp	
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		BL/Airbill Number:	
Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)		Date:	
Fed Express			10/16-16 10900	Nathan H. Horwitz						10/15/86	

Distribution: Original accompanies Shipment; Copy to Coordinator Field File

*See CONCENTRATION RANGE on back of form.

23405b



ecology and environment, inc.

196 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225. TEL 716-632-4491
International Specialists In The Environment

International Specialists in the Environment

Digitized by srujanika@gmail.com

CHAIN-OF-CUSTODY RECORD

Page 1 of 1.

Distribution: Original Accompanies Shipment; Copy to Coordinator Field File

*See CONCENTRATION RANGE on back of form.

340-6

Ecology and environment, inc.

105 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y. 14226. TEL. 716-632-4491

International Specialists In the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.:	Project Name:			Project Manager:									REMARKS						
DE-11000	RICHARDS - GEMINI APP TIP			PAUL KOTICK															
Samplers: (Signature)			Field Team Leader:			PAUL KOTICK			IC			LC			PC				
Paul Kotick MAILMAN									-51	-52	-53	-54	-55	-56	-57	-58	-59	-60	
STATION NUMBER	DATE	TIME	SAMPLE TYPE	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	IC			LC			PC				
			COMP	GRAB	AIR	EXPECTED COMPOUNDS (Concentration)			-51	-52	-53	-54	-55	-56	-57	-58	-59	-60	
40001	10/10/86	X	VCA, C-1-	8765			Wetland area -51	3	2	1								Burnt out 100' F	
40002	1210	X	VCA, C-1-	8766				-52	3	2	1							Burnt out 100' F	
40003	1215	X	VCA, C-1-	8767				-53	3	2	1							No. th of. F...	
40004	1230	X	VCA, C-1-	8768				-54	3	2	1							old fence 100'-150' F	
40005	1245	X	VCA, C-1-	8769				-55	3	2	1							soil sample at fence	
40006	1250	X	VCA, C-1-	8770			surficial area -51	5	2	1								pH 8.50 1900 m 60.5°C	
40007	1430	X	VCA, C-1-, Lead	8770			Cultivated area -51	3	1	1								clean up fence	
40008	1430	X	VCA, C-1-, Lead	8771				-52	3	1	1							clean up fence + 25'	
40009	1430	X	VCA, C-1-, Lead	8772				-53	3	1	1							clean up fence + 50'	
40010	1515	X	VCA, C-1-, Lead	8773				-54	3	1	1							extreme weathering 100' F	
40011	1530	X	VCA, C-1-, Lead	8774				-55	3	1	1							extreme weathering 100' F	
40012	1545	X	VCA, C-1-, Lead	8775				-56	3	1	1							outdoor cleaning fence 100'-150'	
40013	1530	X	VCA, C-1-, Lead, TDS	8777				-51	5	2	1							pH 8.50 3600 m 60.5°C	
																		RELEASING FENCE	
Relinquished By: (Signature)			Date/Time: 10/10/86	Received By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Relinquished By: (Signature)			Ship Via:	
Paul Kotick			10/10/86	Fed Express														Truck	
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Relinquished By: (Signature)			BL/Account Number:	
Paul Kotick																		10/10/86	
Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)			Date:	
Paul Kotick			10/10/86 / 0900	Will 21/10/86														10/10/86	

a: Original Accompanies Shipment; Copy to Coordinator Field File

NOTIFICATION RANGE on back of form.

234055

ecology and environment, inc.

86 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14226, TEL. 716-632-4491
International Specialists In the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.: DF4000	Project Name: Richards-Gebaur AFB IRP			Project Manager: Paul Kopsick									REMARKS		
Sampler: (Signature) <i>PK</i> Paul Kopsick, Bill Kwoka, Mike Michalowski			Field Team Leader: Paul Kopsick												
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRAB AIR	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS							
				EXPECTED COMPOUNDS (Concentration)*											
DF4014	10/10	1120	X	VOA, O&G 8795			North Burn Area S-6	2	1			1			West Drainage
DF4015		1315	X	Herbicides, Arsenic, Mercury 8796			Herbicide Burial S1	2				2			300' South of Road
DF4016		1320	X	{ 8797				-S-2	2				2		25' East of DF4015
DF4017		1330	X	{ 8798				-S-3	2				2		25 East of DF4016
DF4018		1340	X	{ 8799				-S-4	2				2		100' South of Road
DF4019		1445	X	VOA, EP Tox. (Metals), O&G 8800			Haz. Waste Storage S-1	2	1			1			Background Soil
DF4020		1505	X	8801				S-2	2	1			1		Gate of Compound
DF4021		1445	X	8802				S-3	2	1			1		Fence corner 0-26'
DF4022		1500	X	8803				S-4	2	1			1		26 - 60'
DF4023		1500	X	8804				S-5	2	1			1		60 - 120'
DF4024		1455	X	8805				S-6	2	1			1		Opposite corner + 25'
DF4025		1515	W	VOA, TDS, O&G, PPMetals, Barium, Mercury 8806			cancelled per P. Kopsick 10/15/86	W-1	4	1	2	1			Opposite corner + 25' 9.27 PH 30.70 mm 64°F
DF4026		1600	W	8807			Field Blank		1	1	2	4			HWUSA
DF4027		1315	W	Pesticides, TDS, Arsenic, Mercury 8808			Herbicide Burial W-1	3	2	1					Pond in Field 65°F 15°C mm 62.7°F
Relinquished By: (Signature) <i>Paul Kopsick</i>			Date/Time: 10/10/86 7000	Received By: (Signature)			Relinquished By: (Signature)	Date/Time:	Received By: (Signature)			Ship Via:			Federal Express
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)			Relinquished By: (Signature)	Date/Time:	Received By: (Signature)			BL/Airbill Number:			Date: 10/10/86
Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files															
*See CONCENTRATION RANGE on back of form.															

234055

Provided on the following pages are sample receipt logs for the appropriate sample numbers as documentation of proper sample management and documentation procedures.



PACKAGE RECEIPT LOG

0848

recycled paper

E-13

recycling and environment

ITEM NO.	CLIENT NAME and/or JOB NO.	DATE RECEIVED	RECEIVED FROM (e.g., carrier)	CARRIER I.D. NO. or INITIALS	SHIPPING INVOICE NO. (Place in file)	PACKAGE DESCRIPTION (e.g., 1 cooler, 1 jar, etc.)	PACK- AGE SEC- URED	MANNER PACKAGE SECURED			PACKAGE DISPOSITION		ASC Car body Seal At- tached	CUSTOMER INITIALS
								Yes	No	Comments	Sample Log Card	Temporary Secure Site Storage Area		
								Yes	No	Comments	Yes	No		
4332	PVS Chemical	10-9-86	L. Roesel	ZK	none	1-Cartboard Box								L-III
4321	Elgatreeh Apartments	10-9-86	A. Devere	ADP	none	1-Plastic Bag								L-III
4337	Team of Ambars	10-9-86	Client	ZK	12011	1-Plastic Bucket								L-III
4340	SellerTheta Inc	10-9-86	Client	ZK	none	1-Cooler								L-III
4341	Sterling Environmental	10-9-86	Client	ZK	12011	3-16oz. vials-poly								L-III
4342	Richards-Gebauer AFB	10-10-86	Fed Express	ZK	A.C. 153 30641816	1-Cooler								L-III
4343	CPC - Tomorowland	10-10-86	Client	ZK	11011	1-Cartboard Box								L-III
4344	New York Air Brake	10-10-86	U.S. Air	ZK	Flight 14-34-97	1-Cooler								L-III
4345	Richards-Gebauer AFB	10-11-86	FED EXPRESS	ZK	AIRPORT 13004700	1-Cooler							H.O.	L-III
4346	US EPA	10-13-86	Fed Express	ZK	AIRPORT 7208519521	1-Cooler								L-III
4347	John T. C. 1023	10-13-86	Client	ZK	11011	1-125ml poly								L-III
4348	Bisbala-Gebauer AFB	10-13-86	Shippers 145	ZK	See TT# 4345	1-Cooler								L-III
4349	Frontier Foundation	10-13-86	Client	ZK	none	2-1.5v. tapes								L-III
4350	FMC - Middleport	10-13-86	Client	ZK	none	3-1L glass								L-III
4351	D.P. 2.0 Construction	10-13-86	Client	ZK	none	2-125ml poly								L-III
4352	Hour Management Inc	10-13-86	Client	ZK	none	1-glass bottle								L-III
4353	Springville Central School	10-13-86	W. Hall	ZK	none	2 PLASTIC								L-III
4354	V.F.T.A.	10-14-86	Client	ZK	none	1-Foam T.v.								L-III

EXPLANATIONS:

105

1111

SAMPLE RECEIPT LOG

PACK AGE RE CEIPT LOG ITEM NO.	ANALYTICAL SERVICES CENTER SAMPLE I.D. NO.				JOB NO.	DATE LOGGED	CLIENT SAMPLE I.D. Loc. Well No., Boring No.	PACK- ING LIST OR CHAIN OF CIS TODAY RE CORD	SAMPLE CONTAINER TYPE										REMARKS (III) Subsamples Generated, Indicate Page Reference II Name, Make No Entry.)	REMARKS (e.g., leaks, breakage, discrep- ancies with packing list. File discrepancy report if necessary)	SE- CURE STOR- AGE AREA	CUSTO- DIANS INITIALS	DISPOSITION			
	Phone Sample I.D. No.	Individual Sample Container No.	Lab Generated Sub sample No.	Address and Substr. No.					Vials Y/N	Glass Jars Y/N	Plastic Jars Y/N	500 ml Fibro Ply Y/N	16 oz Bor Jars Y/N	4 oz Bor Jars Y/N	1/4 pt Bor Jars Y/N	250 ml Fibro Ply Y/N	1/2 pt Bor Jars Y/N	Other Y/N	Unspec Y/N	Fibro Ply Y/N	Other Y/N	CUS- TODAY SEAL OF FIXED	LABEL WITH NO AND DATE OF FIXED			
	Y/N	Y/N	Y/N	Y/N					Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	
741 cont'd)	8801 1 03	62			0-4181	10-12-86	DF-4020 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	E A2	LHH	DEC	
	8802 1	01					DF-4021 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F E A2			
	8803 1	02					DF-4022 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F F A2			
	8804 1	03					DF-4023 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F E A2			
	8805 1	01					DF-4024 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F E A2			
	8806 1	02			0-4182		DF-4025 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F E A33			
	8807 1	03					DF-4026 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F E A33			
	8808 1	04					DF-4027 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F E A33			
	8809 1	05					DF-4028 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F E A33			
	8810 1	01			0-4183	10-12-86	JPL #1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G WHD	WHD	DEC	
	8811 1	01					JPL #2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G WHD		
	8812 1	01			0-4184		JPL #3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
	8813 1	01					LCL #1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
	8814 1	02					LCL #2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
	8815 1	01			0-4185	10-12-86	DF-4029 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A26	LHH		
	8816 1	01					Jickle Creek Rkuk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
	8817 1	01					Rkuk Rd.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
	8818 1	01			0-4186	10-12-86	LCL #3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A26	LHH		

(III) packed in containers other than original

(IV) other explanation

EXPLANATIONS:

SAMPLE RECEIPT LOG

"No. 1000, microanalytical efficiency chart." "No. 1000, technical explanation."

EXPLANATIONS. VCO 112 JEE 71 Jet etc... connected, Sample was good, no drift

EXPLANATIONS: X-GAMMA-21: The alpha-1b Subunit of the G-protein

COE SITE 3, RUBBLE BURIAL SITE

Section I. Installation Restoration Program Records Search

- A. Study Performed By: CH2M HILL
- B. Date Report Complete: March, 1983
- C. Significant Findings:

The site was used primarily for disposal of contractor rubble and debris, although household debris was visible in the exposed portions of the landfill. It was suspected that disposal of small quantities of hazardous wastes occurred here.

- D. Summary of Recommendations:

None stated.

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For
Richards-Gebaur Air Force Base,
Missouri



Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

MARCH 1983

Creek. The site was used between about 1961 and 1971 for the disposal of miscellaneous wastes including building rubble, yard debris, and waste from some industrial shop areas. The wastes were typically burned and buried in trenches. Most of the sanitary wastes at Richards-Gebaur AFB were disposed of off-base through contract removal during this time. One interviewee reported that disposal of waste paints and paint thinners at the site by spreading the wastes on the ground surface had been practiced in the past as late as 1978. The eastern portion of the site has been used for open storage of materials including construction materials, pipes, empty tanks, waste paint and thinners in drums and buckets, and empty 55-gallon drums. Over 400 55-gallon drums are currently stored at the site, most of which are empty, and some of which contain unknown contents.

The site received an overall rating score of 54 due primarily to the known disposal of hazardous wastes and a moderate potential for surface-water migration of contaminants off-base.

- o Site No. 3, the Contractor Rubble Burial Site, is also located adjacent to Scope Creek, just west of the golf course alongside Walker Road. The site was used intermittently during the time the regular Air Force was active on the base, between 1954 and 1978. The site was used primarily for disposal of contractor rubble and debris, although household debris was visible in the exposed portions of the landfill. One interviewee indicated that the site was also used as a sanitary landfill in lieu of Site No. 1 prior to 1961. The site has an overall rating score of 48; low subscores in

the receptors and waste characteristics categories were due to the lack of critical environments or population near the site, and the suspected disposal of small quantities of hazardous wastes. A moderate to high pathways subscore (67) was due to the proximity of Scope Creek and the steep banks of the landfill.

2. Fire Department Training Areas

- o Site No. 4, the West Burn Pit, is located just north of the Cass County-Jackson County line and just west of the base property. The site was originally used for fire department training between 1954 and 1955, but was abandoned in 1955 when it was discovered that the site was located off-base. No significant quantities of residual hazardous waste materials are suspected at the site, resulting in a low overall score of 42.
- o Site No. 5, the South Burn Pit, is located just west of the South Landfill near the NDI Lab and was used for fire department training between 1955 and 1965. Wastes used in training exercises included waste oils, solvents, and fuels. The wastes were stored in drums at the facility until training exercises were begun. The burn pit was unlined and had no oil/water separator. Small quantities of hazardous materials are known to have been disposed of at the site, resulting in a moderate overall score of 48.
- o Site No. 6, the North Burn Pit, is located north of the flightline and has been used for fire department training since 1965. The burn pit was unlined and accepted waste oils, solvents, and

HAZARDOUS ASSESSMENT RATING FORM

Page 1 of 2

NAME OF SITE: 3. Contractor Rubble Burial Site

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: Interim 1954-1978

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Contractor's rubble; household debris

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

I. RECEPTORS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface-water body	1	6	6	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		<u>Subtotals</u>	<u>69</u>	<u>180</u>

Receptors subscore (100 x factor score subtotal/maximum subtotal)

38

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large)

S

2. Confidence level (C = confirmed, S = suspected)

S

3. Hazard rating (H = high, M = medium, L = low)

H

Factor Subscore A (from 20 to 100 based on factor score matrix)

40

B. Apply persistence factor

Factor Subscore A x Persistence Factor = Subscore B

$$40 \times 1.0 = 40$$

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

$$40 \times 1.0 = \underline{\underline{40}}$$

III. PATHWAYS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				Subscore
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	72	108
Subscore (100 x factor score subtotal/maximum score subtotal)				67
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	1	8	8	24
Direct access to ground water	N/A	8	N/A	--
		Subtotals	30	90
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 67

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	38
Waste Characteristics	40
Pathways	67
Total 145 divided by 3 =	48
Gross Total	48

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

COE SITE 4, WEST BURN PIT

Section I. Installation Restoration Program Records Search

- A. Study Performed By: CH2M HILL
- B. Date Report Complete: March, 1983
- C. Significant Findings:

The site was originally used for fire department training between 1954 and 1955, but was abandoned in 1955 when it was discovered that the site was located off-base. No significant quantities of residual hazardous waste materials are suspected at the site.

- D. Summary of Recommendations:

None stated.

4

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For
Richards-Gebaur Air Force Base,
Missouri



Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

MARCH 1983

the receptors and waste characteristics categories were due to the lack of critical environments or population near the site, and the suspected disposal of small quantities of hazardous wastes. A moderate to high pathways subscore (67) was due to the proximity of Scope Creek and the steep banks of the landfill.

2. Fire Department Training Areas

- o Site No. 4, the West Burn Pit, is located just north of the Cass County-Jackson County line and just west of the base property. The site was originally used for fire department training between 1954 and 1955, but was abandoned in 1955 when it was discovered that the site was located off-base. No significant quantities of residual hazardous waste materials are suspected at the site, resulting in a low overall score of 42.
- o Site No. 5, the South Burn Pit, is located just west of the South Landfill near the NDI Lab and was used for fire department training between 1955 and 1965. Wastes used in training exercises included waste oils, solvents, and fuels. The wastes were stored in drums at the facility until training exercises were begun. The burn pit was unlined and had no oil/water separator. Small quantities of hazardous materials are known to have been disposed of at the site, resulting in a moderate overall score of 48.
- o Site No. 6, the North Burn Pit, is located north of the flightline and has been used for fire department training since 1965. The burn pit was unlined and accepted waste oils, solvents, and

HAZARDOUS ASSESSMENT RATING FORM

Page 1 of 2

NAME OF SITE: 4. West Burn Pit
 LOCATION: Richards-Gebaur AFB
 DATE OF OPERATION OR OCCURRENCE: 1954-1955
 OWNER/OPERATOR: Richards-Gebaur AFB
 COMMENTS/DESCRIPTION: Fire Training Area 1954-1955
 SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

I. RECEPTORS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface-water body	1	6	6	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		<u>Subtotals</u>	<u>76</u>	<u>180</u>

Receptors subscore (100 x factor score subtotal/maximum subtotal)

42

II. WASTE CHARACTERISTICS

- A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.
1. Waste quantity (S = small, M = medium, L = large) S
 2. Confidence level (C = confirmed, S = suspected) S
 3. Hazard rating (H = high, M = medium, L = low) H
- Factor Subscore A (from 20 to 100 based on factor score matrix) 40

- B. Apply persistence factor
 Factor Subscore A x Persistence Factor = Subscore B

$$40 \times 0.8 = 32$$

- C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

$$32 \times 1.0 = \underline{\underline{32}}$$

III. PATHWAYS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
Subscore				
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	56	108
Subscore (100 x factor score subtotal/maximum score subtotal)				52
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	N/A	8	N/A	--
		Subtotals	22	90
Subscore (100 x factor score subtotal/maximum score subtotal)				24

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 52

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	42
Waste Characteristics	32
Pathways	52
Total 126 divided by 3 =	42
Gross Total	42

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

COE SITE 5, SOUTH BURN PIT

Section I. Installation Restoration Program Records Search

- A. Study Performed By: CH2M HILL
- B. Date Report Complete: March, 1983
- C. Significance:
- D. Significant Findings:

This site was used for fire department training between 1955 and 1965. Wastes used in training exercises included waste oils, solvents, and fuels. The wastes were stored in drums at the facility until training exercises were begun. The burn pit was unlined and had no oil/water separator. Small quantities of hazardous materials were known to have been disposed of at the site.

- E. Summary of Recommendations:
- None stated.

5

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For
Richards-Gebaur Air Force Base,
Missouri



Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

MARCH 1983

the receptors and waste characteristics categories were due to the lack of critical environments or population near the site, and the suspected disposal of small quantities of hazardous wastes. A moderate to high pathways subscore (67) was due to the proximity of Scope Creek and the steep banks of the landfill.

2. Fire Department Training Areas

- o Site No. 4, the West Burn Pit, is located just north of the Cass County-Jackson County line and just west of the base property. The site was originally used for fire department training between 1954 and 1955, but was abandoned in 1955 when it was discovered that the site was located off-base. No significant quantities of residual hazardous waste materials are suspected at the site, resulting in a low overall score of 42.
- o Site No. 5, the South Burn Pit, is located just west of the South Landfill near the NDI Lab and was used for fire department training between 1955 and 1965. Wastes used in training exercises included waste oils, solvents, and fuels. The wastes were stored in drums at the facility until training exercises were begun. The burn pit was unlined and had no oil/water separator. Small quantities of hazardous materials are known to have been disposed of at the site, resulting in a moderate overall score of 48.
- o Site No. 6, the North Burn Pit, is located north of the flightline and has been used for fire department training since 1965. The burn pit was unlined and accepted waste oils, solvents, and

HAZARDOUS ASSESSMENT RATING FORM

Page 1 of 2

NAME OF SITE: S. South Burn Pit

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: 1955-1965

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Fire Training Area, 1955-1965

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface-water body	1	6	6	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	69	180

Receptors subscore (100 x factor score subtotal/maximum subtotal)

38

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large)

S

2. Confidence level (C = confirmed, S = suspected)

C

3. Hazard rating (H = high, M = medium, L = low)

H

Factor Subscore A (from 20 to 100 based on factor score matrix)

60

B. Apply persistence factor

Factor Subscore A x Persistence Factor = Subscore B

$$60 \times 0.8 = 48$$

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

$$48 \times 1.0 = \underline{\underline{48}}$$

III. PATHWAYS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	0
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108
Subscore (100 x factor score subtotal/maximum score subtotal)				59
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	N/A	8	N/A	N/A
		Subtotals	22	90
Subscore (100 x factor score subtotal/maximum score subtotal)				24

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 59

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	38
Waste Characteristics	48
Pathways	59
Total 145 divided by 3 =	48
Gross Total	48

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

J - 10

48 x 1.0 =

48

COE SITE 7, RADIOACTIVE DISPOSAL WELL

Section I. Installation Restoration Program Records Search

- A. Study Performed By: CH2M HILL
- B. Date Report Complete: March, 1983
- C. Significant Findings:

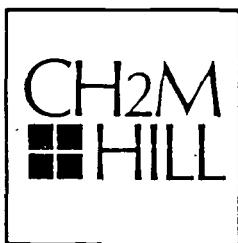
This site was used intermittently between 1955 and about 1970 for disposal of low-level radioactive materials, primarily dosimeters. Levels of radioactivity in the vicinity of the well have been measured and found to be at or near back-ground levels.

- D. Summary of Recommendations:
 - None stated.

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For

Richards-Gebaur Air Force Base,
Missouri



Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

MARCH 1983

fuels until about 1969. In 1969, the area was lined with a concrete slab and an oil/water separator was installed; only contaminated JP-4 fuel has been used in training exercises since 1969. The site received an overall rating score of 45 due to the known disposal of hazardous materials and the partial containment provided by the lined facility.

- o Site No. 7, the Radioactive Disposal Well located west of Scope Creek in the southern portion of the base, was used intermittently between 1955 and about 1970 for disposal of low-level radioactive materials, primarily dosimeters. Levels of radioactivity in the vicinity of the well have been measured and found to be at or near background levels. The well has been tested and capped. An overall rating score of 4 is due to the low levels of radioactivity and full containment of small waste quantities.

3. Other Sites

- o Site No. 8, the Herbicide Burial Site located at the south end of the runway, is an area where about 4 cases of a mercury-containing herbicide in plastic pint-sized bottles were buried in 1971. An overall score of 51 reflects the known disposal of hazardous materials at the site and a moderate potential for surface water migration; however, the small quantity of herbicide (estimated to be less than 50 pounds) and the low-permeability clay soils indicate a low potential for ground-water contamination or migration.

HAZARDOUS ASSESSMENT RATING FORM

Page 1 of 2

NAME OF SITE: 7. Radioactive Disposal Well
 LOCATION: Richards-Gebaur AFB
 DATE OF OPERATION OR OCCURRENCE: Constructed 1955; intermittent to present
 OWNER/OPERATOR: Richards-Gebaur AFB
 COMMENTS/DESCRIPTION: Disposal well for solid radioactive materials
 SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

I. RECEPTORS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface-water body	1	6	6	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	69	180

Receptors subscore (100 x factor score subtotal/maximum subtotal)

38

II. WASTE CHARACTERISTICS

- A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.
1. Waste quantity (S = small, M = medium, L = large)
 2. Confidence level (C = confirmed, S = suspected)
 3. Hazard rating (H = high, M = medium, L = low)
- Factor Subscore A (from 20 to 100 based on factor score matrix) 30

- B. Apply persistence factor
 Factor Subscore A x Persistence Factor = Subscore B

$$30 \times 1.0 = 30$$

- C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

$$30 \times 0.5 = \underline{15}$$

III. PATHWAYS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	0
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108
Subscore (100 x factor score subtotal/maximum score subtotal)				59
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	3	8	24	24
Direct access to ground water	N/A	8	N/A	N/A
		Subtotals	46	90
Subscore (100 x factor score subtotal/maximum score subtotal)				51
C. Highest pathway subscore				
Enter the highest subscore value from A, B-1, B-2, or B-3 above.				
		Pathways Subscore		<u>59</u>

IV. WASTE MANAGEMENT PRACTICES

- A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	38
Waste Characteristics	15
Pathways	59
Total 112 divided by 3 =	37
Gross Total	37

- B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

COE SITE 8, HERBICIDE BURIAL SITE

Section I. Installation Restoration Program Records Search

- A. Study Performed By: CH2M HILL
- B. Date Report Complete: March, 1983
- C. Significant Findings:

This is an area where about 4 cases of a mercury-containing herbicide in plastic pint-sized bottles were buried in 1971. There is a known disposal of hazardous materials at the site and a moderate potential for surface water migration; however, the small quantity of herbicide (estimated to be less than 50 pounds) and the low-permeability clay soils indicate a low potential for ground-water contamination or migration.

- D. Summary of Recommendations:

None stated.

COE SITE 8, HERBICIDE BURIAL SITE, Continued

Section II. Installation Restoration Program Phase II
Confirmation/Quantification Stage 2

A. Study Performed By: Ecology and Environment, Inc.

B. Date Report Complete: November, 1987

C. Significant Findings:

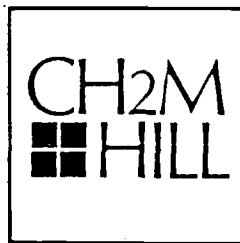
No detectable concentrations of any contaminant were reported in the single surface water sample taken at this site. Concentrations of metals in the four surface soil samples did not exceed the normal range of concentrations reported in western Missouri soils. In addition, no organic contamination was detected in the soil samples. Consequently, the data do not indicate that Site 8 presents an undue risk to human health or the environment.

D. Summary of Recommendations:

Since there is no direct evidence of the location of Site 8, additional investigations are recommended. It is recommended that a soil conductivity survey be run over a grid pattern designed to precisely locate a 10- by 10-foot trench.

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For
Richards-Gebaur Air Force Base,
Missouri



Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

MARCH 1983

fuels until about 1969. In 1969, the area was lined with a concrete slab and an oil/water separator was installed; only contaminated JP-4 fuel has been used in training exercises since 1969. The site received an overall rating score of 45 due to the known disposal of hazardous materials and the partial containment provided by the lined facility.

- o Site No. 7, the Radioactive Disposal Well located west of Scope Creek in the southern portion of the base, was used intermittently between 1955 and about 1970 for disposal of low-level radioactive materials, primarily dosimeters. Levels of radioactivity in the vicinity of the well have been measured and found to be at or near background levels. The well has been tested and capped. An overall rating score of 4 is due to the low levels of radioactivity and full containment of small waste quantities.

3. Other Sites

- o Site No. 8, the Herbicide Burial Site located at the south end of the runway, is an area where about 4 cases of a mercury-containing herbicide in plastic pint-sized bottles were buried in 1971. An overall score of 51 reflects the known disposal of hazardous materials at the site and a moderate potential for surface water migration; however, the small quantity of herbicide (estimated to be less than 50 pounds) and the low-permeability clay soils indicate a low potential for ground-water contamination or migration.

HAZARDOUS ASSESSMENT RATING FORM

Page 1 of 2

NAME OF SITE: 8. Herbicide Burial Site

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: August, 1971

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Unused herbicide (reportedly contained mercury) buried

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

I. RECEPTORS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface-water body	1	6	6	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		<u>Subtotals</u>	<u>73</u>	<u>180</u>

Receptors subscore (100 x factor score subtotal/maximum subtotal)

41

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large)

S

2. Confidence level (C = confirmed, S = suspected)

C

3. Hazard rating (H = high, M = medium, L = low)

H

Factor Subscore A (from 20 to 100 based on factor score matrix)

60

B. Apply persistence factor

Factor Subscore A x Persistence Factor = Subscore B

$$60 \times 1.0 = 60$$

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

$$60 \times 1.0 = \underline{\underline{60}}$$

III. PATHWAYS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	0
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	1	6	6	16
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	56	108
Subscore (100 x factor score subtotal/maximum score subtotal)				52
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	N/A	8	N/A	--
		Subtotals	22	90
Subscore (100 x factor score subtotal/maximum score subtotal)				24
C. Highest pathway subscore				
Enter the highest subscore value from A, B-1, B-2, or B-3 above.				
		Pathways Subscore		<u>52</u>

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	41
Waste Characteristics	60
Pathways	52
Total 153 divided by 3 =	51
Gross Total	

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

INSTALLATION RESTORATION PROGRAM

PHASE II

CONFIRMATION/QUANTIFICATION

STAGE 2

RICHARDS-GEBAUR AIR FORCE BASE
MISSOURI

Prepared by:

ECOLOGY AND ENVIRONMENT, INC.
Buffalo Corporate Center
368 Pleasantview Drive
Lancaster, New York 14086

July 1988

FINAL REPORT
(September 1986 to November 1987)

VOLUME 1: TEXT

Approved for Public Release:
Distribution is Unlimited

Prepared for:

UNITED STATES AIR FORCE
Headquarters Air Force Reserve (HQ AFRES/SGPB)
Robins Air Force Base, Georgia 31098-6001

UNITED STATES AIR FORCE
Occupational and Environmental Health Laboratory/
Technical Services Division (USAFOEHL/TS)
Brooks Air Force Base, Texas 78235-5501

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
	EXECUTIVE SUMMARY	1
1	INTRODUCTION	1-1
1.1	LOCATION AND HISTORY OF OPERATIONS	1-3
1.2	SITE DESCRIPTIONS	1-6
1.2.1	Site 1, South Landfill	1-6
1.2.2	Site 2, Northeast Landfill	1-10
1.2.3	Site 6, North Burn Pit Area	1-12
1.2.4	Site 8, Herbicide Burial Area	1-12
1.2.5	Site 9, Oil-Saturated Area	1-12
1.2.6	Site 10, Hazardous Waste Drum Storage Area	1-16
1.2.7	Site 12, POL Storage Yard	1-16
1.3	SITES NOT INVESTIGATED DURING STAGE 2	1-19
1.4	TYPES OF CONTAMINANTS INVESTIGATED	1-21
1.5	FIELD PERSONNEL	1-28
1.6	SUBCONTRACTORS	1-28
2	ENVIRONMENTAL SETTING	2-1
2.1	GEOGRAPHIC SETTING	2-1
2.1.1	Physiography	2-1
2.1.2	Topography	2-1
2.2	GEOLOGY	2-1
2.2.1	Geologic Setting	2-1
2.2.2	Soils	2-3
2.2.3	Stratigraphy	2-3
2.2.4	Structure	2-6

Table of Contents (Cont.)

<u>Section</u>	<u>Page</u>
2.3 HYDROLOGY AND WATER USE	2-6
2.3.1 Surface Water	2-6
2.3.2 Hydrogeology	2-8
2.4 CLIMATE	2-8
 3 FIELD PROGRAM	 3-1
3.1 PROGRAM DEVELOPMENT	3-1
3.2 FIELD INVESTIGATION	3-4
3.2.1 Schedule of Field Activities	3-4
3.2.2 Records Search	3-4
3.2.3 Geophysical Survey Procedures	3-6
3.2.4 Soil Gas Sampling	3-6
3.2.5 Soil, Sediment, and Water Sampling	3-6
3.2.6 Handling of Investigation-Derived Waste	3-16
3.2.7 Site-Specific Investigation Activities	3-18
3.2.8 Laboratory Program	3-29
3.2.9 Variations from Description of Work	3-32
 4 RESULTS AND SIGNIFICANCE OF FINDINGS	 4-1
4.1 INTRODUCTION	4-1
4.2 RESULTS	4-4
4.2.1 Site 1, South Landfill	4-4
4.2.2 Site 2, Northeast Landfill	4-7
4.2.3 Site 6, North Burn Pit Area	4-11
4.2.4 Site 8, Herbicide Burial Area	4-17
4.2.5 Site 9, Oil-Saturated Area	4-19
4.2.6 Site 10, Hazardous Waste Drum Storage Area	4-22
4.2.7 Site 12, POL Storage Yard	4-26
4.3 SIGNIFICANCE OF FINDINGS	4-30
4.3.1 Site 1, South Landfill	4-30
4.3.2 Site 2, Northeast Landfill	4-30
4.3.3 Site 6, North Burn Pit Area	4-30

Table of Contents (Cont.)

<u>Section</u>	<u>Page</u>
4.3.4 Site 8, Herbicide Burial Area	4-31
4.3.5 Site 9, Oil-Saturated Area	4-31
4.3.6 Site 10, Hazardous Waste Drum Storage Area	4-32
4.3.7 Site 12, POL Storage Yard	4-33
5 ALTERNATIVE MEASURES	5-1
5.1 SITE 1, SOUTH LANDFILL	5-1
5.2 SITE 2, NORTHEAST LANDFILL	5-2
5.3 SITE 6, NORTH BURN PIT AREA	5-2
5.4 SITE 8, HERBICIDE BURIAL AREA	5-3
5.5 SITE 9, OIL-SATURATED AREA	5-4
5.6 SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA	5-4
5.7 SITE 12, POL STORAGE YARD	5-4
6 RECOMMENDATIONS	6-1
6.1 SITE 1, SOUTH LANDFILL - CATEGORY I	6-1
6.2 SITE 2, NORTHEAST LANDFILL - CATEGORY III	6-5
6.3 SITE 4, WEST BURN AREA	6-5
6.4 SITE 6, NORTH BURN PIT AREA - CATEGORIES II AND III	6-6
6.5 SITE 8, HERBICIDE BURIAL AREA - CATEGORY II	6-6
6.6 SITE 9, OIL-SATURATED AREA - CATEGORY III	6-8
6.7 SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA - CATEGORY III	6-11
6.8 SITE 12, POL STORAGE YARD - CATEGORY II	6-11
6.9 WELL ABANDONMENT	6-11

Table 2
SUMMARY OF FIELDWORK/ANALYSES PERFORMED

Site	Fieldwork Performed	Analyses Performed
Site 1, South Landfill	<ul style="list-style-type: none"> • 1 borehole drilled • 7 soil samples collected • 4 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC, priority pollutants, common anions, phenols.
Site 2, Northeast Landfill	<ul style="list-style-type: none"> • geophysical survey • 4 boreholes drilled • 2 monitoring wells installed • 10 soil samples collected • 5 groundwater samples collected • 3 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC, priority pollutants, common anions, phenols
Site 6, North Burn Pit Area	<ul style="list-style-type: none"> • soil gas survey • 3 boreholes drilled • 3 monitoring wells installed • 15 soil samples collected • 3 groundwater sample collected • 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, VOC.
Site 8, Herbicide Burial Area	<ul style="list-style-type: none"> • 4 soil samples collected • 1 surface water sample collected 	Soils: pesticides, arsenic, mercury. Waters: TDS, pesticides, arsenic, mercury.
Site 9, Oil-Saturated Area	<ul style="list-style-type: none"> • 1 borehole drilled • 8 soil samples collected • 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC, lead. Waters: petroleum hydrocarbons, TDS, VOC, lead.
Site 10, Hazardous Waste Drum Storage Area	<ul style="list-style-type: none"> • 1 borehole drilled • 9 soil samples collected • 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC, EP TOX metals. Waters: petroleum hydrocarbons, TDS, priority pollutant metals, barium.
Site 12, POL Storage Yard	<ul style="list-style-type: none"> • 3 boreholes augered • 1 monitoring well installed • 1 soil sample collected • 4 groundwater samples collected • 2 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC.

Table 3
SUMMARY OF RECOMMENDATIONS

Site	Recommendation	Rationale
Site 1, South Landfill	Category I. No further action.	No significant contamination was found during the Stage 2 investigation.
Site 2, Northeast Landfill	Category III. Biannual monitoring for 2 years. Collect and analyze groundwater samples from five existing monitoring wells twice yearly.	To determine changes in groundwater quality because elevated sulphate concentrations were the only indicators of contamination above acceptable limits.
Site 4, West Burn Area	Category II. Perform a soil gas survey and geophysical survey. Install three monitoring wells and collect and analyze groundwater samples. Collect subsurface and surface soil samples.	To determine the exact location of the site and determine if hazardous constituents have migrated from the site.
Site 6, North Burn Pit Area	Category III and II. Biannual monitoring for 2 years. Install two more monitoring wells. Collect and analyze groundwater samples from five monitoring wells twice yearly.	To better characterize the organic contamination of the groundwater.
Site 8, Herbicide Burial Area	Category II. Additional geophysical surveys. Drill four boreholes and collect two soil samples from each borehole.	To determine exact location of trench and analyze soil from within the trench.
Site 9, Oil-Saturated Area	Category III. Excavate and remove contaminated soils.	To reduce risk of potential direct human contact to soils contaminated with petroleum hydrocarbons and lead.
Site 10, Hazardous Waste Drum Storage Area	Category III. Excavate and remove contaminated soils.	To reduce risk of potential direct human contact petroleum hydrocarbons.
Site 12, PCL Storage Yard	Category II. Install four monitoring wells. Collect and analyze groundwater samples twice yearly.	To determine if volatile organic compound contamination has migrated from the site.

- To define the magnitude and potential of contaminant migration, if possible; and
- To identify potential health and/or environmental hazards based on state or federal standards.

A Phase I Initial Records Search had been conducted by CH2M Hill as outlined in a report dated March 1983. The Phase I report identified sites with potential contamination problems and made recommendations for Phase II investigation. Based on these recommendations, a Phase II Stage 1 investigation was performed on the two sites, Site 1, the South Landfill, and Site 2, the Northeast Landfill, which ranked above 50 on the USAF Hazard Assessment Rating Methodology (HARM) scale ranking system. Preliminary investigation was performed by Water and Air Research, Inc. The results of this investigation were finalized in a report dated December 1983.

In 1985, Richards-Gebaur AFB was scheduled to be reevaluated under the IRP. A presurvey meeting was arranged and all past and current potential sites were visited and evaluated. The presurvey was conducted by E & E and their recommendations were provided in a Presurvey Report dated June 1985.

The sites included in that survey are:

- Site 1, South Landfill,
- Site 2, Northeast Landfill,
- Site 3, Contractor Rubble Burial Area,
- Site 4, West Burn Area,
- Site 5, South Burn Area,
- Site 6, North Burn Area,
- Site 7, Radioactive Disposal Well,
- Site 8, Herbicide Burial Area,
- Site 9, Oil-Saturated Area,
- Site 10, Hazardous Waste Drum Storage Area,
- Site 11, Paint Stripper Hangar,

- Site 12, Petroleum, Oils, and Lubricants (POL) Storage Yard, and
- Site 13, Hazardous Material Storage--Building 927.

Based on this report and after review by state and federal offices, the USAF contracted Phase II Stage 2 investigation of the following sites:

- Site 1, South Landfill,
- Site 2, Northeast Landfill,
- Site 6, North Burn Pit Area,
- Site 8, Herbicide Burial Area,
- Site 9, Oil-Saturated Area,
- Site 10, Hazardous Waste Drum Storage Area, and
- Site 12, POL Storage Yard.

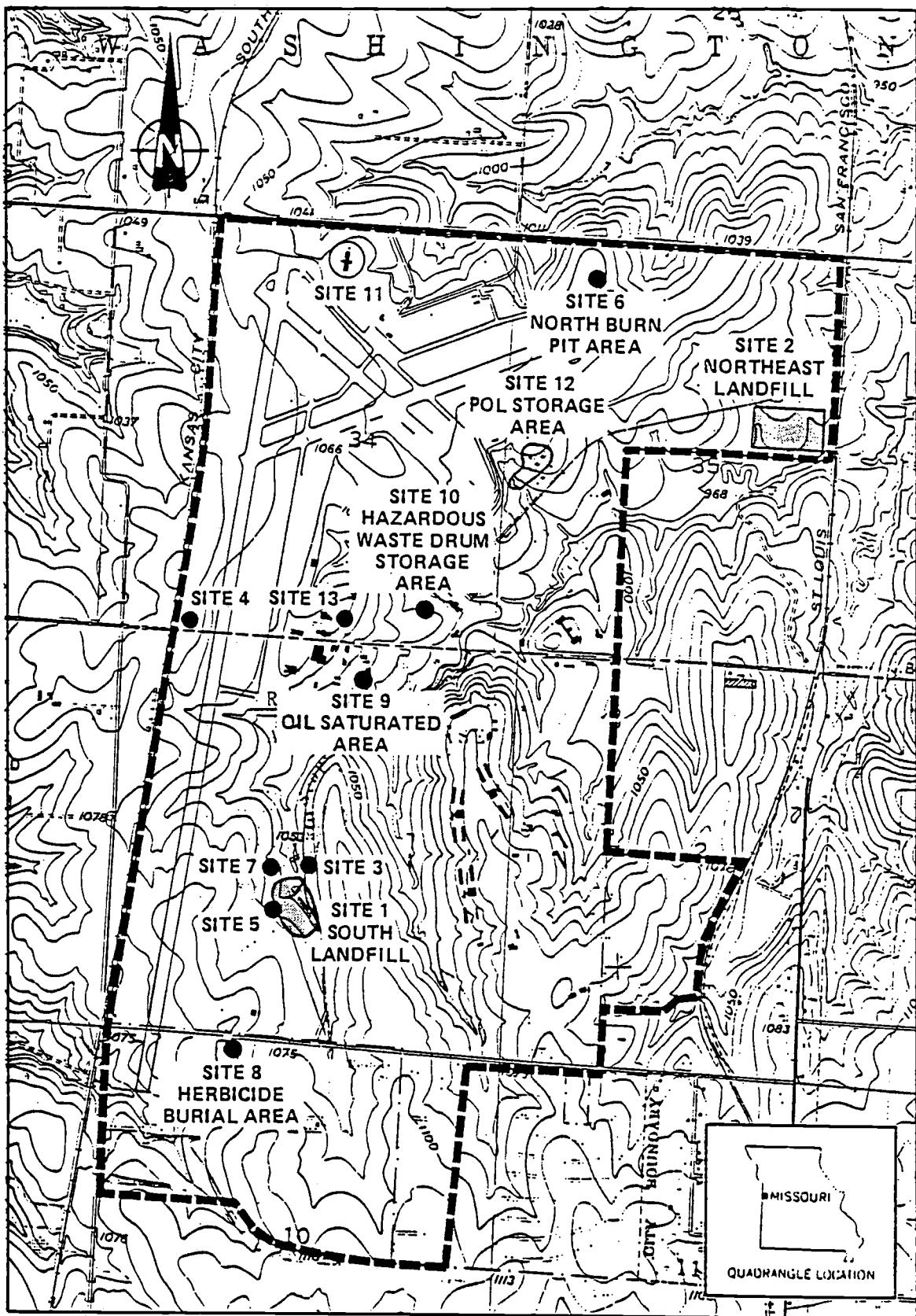
1.1 LOCATION AND HISTORY OF OPERATIONS

The primary source of historical information on the base was the Phase I report by CH2M Hill (1983). The information was confirmed and updated by E & E as part of the Phase II Stage 2 investigation.

Richards-Gebaur AFB is located in west-central Missouri, 2.6 miles from the Kansas-Missouri state line (see Figure 1-1). The Jackson County and Cass County line runs east-west through the middle of the base. The base is bounded on the north by the City of Grandview, on the north and west by Kansas City, and on the south and east by the City of Belton. The base is about 18 miles southeast of downtown Kansas City. Access to the base is via U.S. Highway 71.

The legal description of the base includes the following ranges and townships:

<u>Range</u>	<u>Township</u>	<u>Sections</u>
R46N	T33W	2, 3, 10, 11
R47N	T33W	34, 35



SOURCE: U.S.G.S. 7.5' Quadrangle, Belton, Mo.-Kans. 1975.

SCALE
0 1 MILE

Figure 1-3 RICHARDS-GEBAUR AIR FORCE BASE IRP SITES

average depth of the line is 15 feet and the excavation width at the surface was 90 to 100 feet. Figure 1-5 shows the location of the interceptor.

1.2.3 Site 6, North Burn Pit Area

Site 6, the North Burn Pit Area, is located north of the flight line, just below the northern boundary of the base (see Figure 1-6). It was built in 1965 and is used for fire department training. A recent improvement to the facility is a 6-inch concrete rim around a concrete-lined burn pit, which is a circle with a radius of 50 feet. The drain that carries runoff from the pit is equipped with an oil-water separator. At least one incident of failure of the separator has been noted. In 1985-86, a chain-link fence was constructed around this facility. A slight depression was formed on the east side of the site as a result of the fence addition. During wet weather, some water is ponded in this area.

Fuel for the fire department training fires consisted of waste oils and possibly solvents, mixed with JP-4 fuel. An aboveground fuel storage tank is located in the southwest corner of the facility near the access gate. Reportedly, small quantities of fuel have been spilled during fuel transfer.

1.2.4 Site 8, Herbicide Burial Area

In 1971, about four cases of herbicide, reportedly containing mercury, in plastic pint-sized bottles, were reportedly buried in a trench near the south end of the runway (see Figure 1-7). Previous studies located this site in the general area of the south end and approximately 1,000 feet east of the original north-south runway. Since the city of Kansas City took over the air field, this runway has been extended approximately 3,000 feet. Vegetation stress was noted in the area at the time of the presurvey meeting. A small pond is located about 150 feet southeast of the supposed burial area.

1.2.5 Site 9, Oil-Saturated Area

Site 9, the Oil-Saturated Area, is located in the southwest corner of the Motor Pool Compound (Building 704) (see Figure 1-8). This

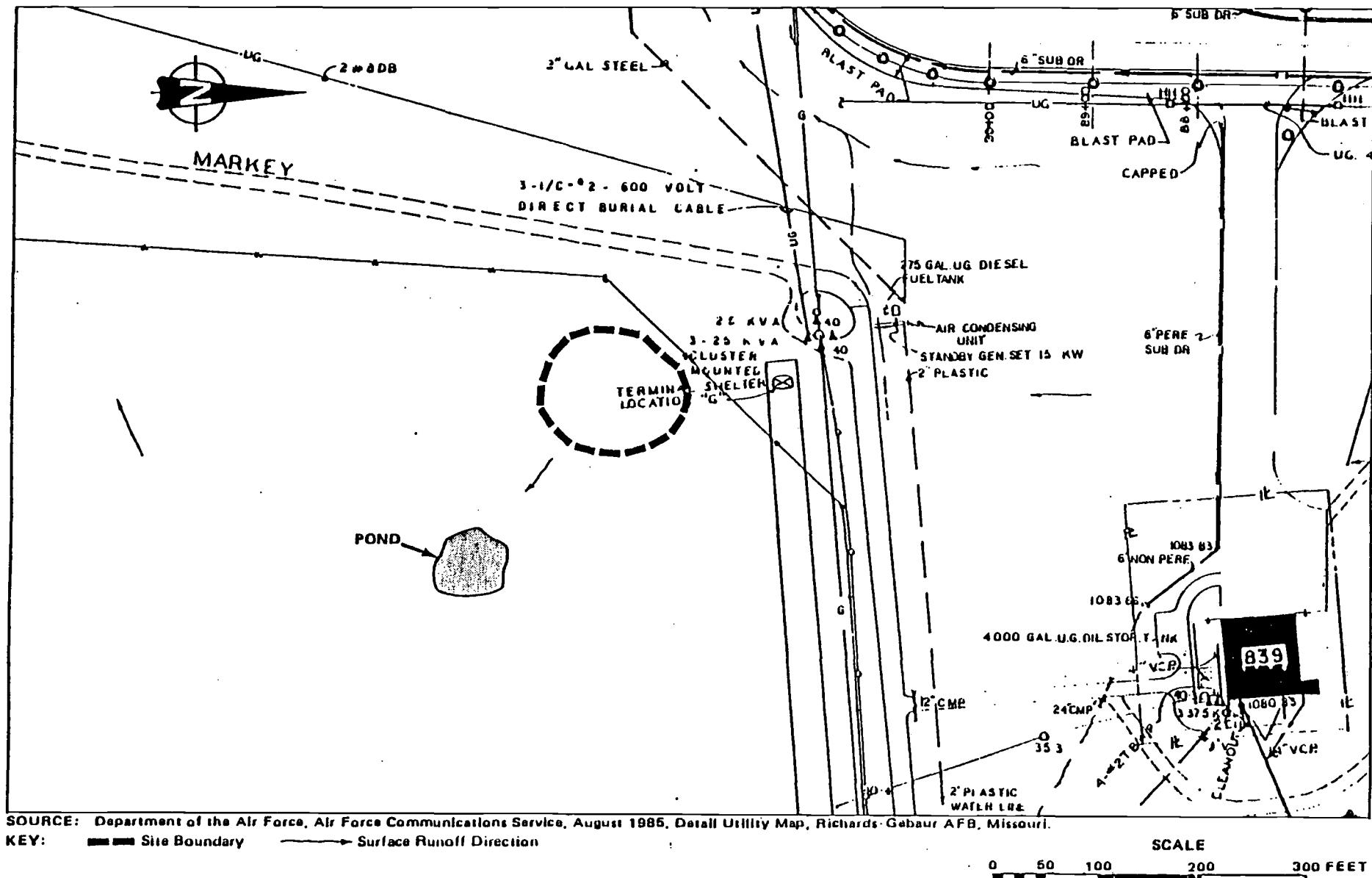


Figure 1-7 SITE 8, HERBICIDE BURIAL AREA LOCATION MAP

1.3 SITES NOT INVESTIGATED DURING STAGE 2

Several sites were not investigated during the Stage 2 program. The sites were deleted because they either could not be located or they were located on property leased to the Kansas City Aviation Department, which denied access to all sites on Kansas City Aviation land, except the South and Northeast landfills. Access was not granted because the Phase II Field Evaluation Report, dated December 1983, recommended no further action. The letters denying access to sites 3, 5, 7, and 11 are found in Appendix B. The reason Site 13 was not investigated is unknown. This site was not listed in the Description of Work. The following is a discussion of those sites.

Site 3, Contractor Rubble Burial Site

The Rubble Burial Site is located on the east bank of Scope Creek in the south-central part of the base. It reportedly was in operation from 1954 through 1978. The area is not posted or fenced and appears to have been used more recently than 1978. The area is fairly level and most of the debris is discharged over the bank at the treeline. During the presurvey visit, construction materials, including wood, concrete, masonry, and metal, were observed; however, dense foliage prevented a more thorough investigation. A 5-gallon sealed plastic container of an unidentified liquid was discovered at the base of the fill and brought to the attention of the Richards-Gebaur AFB civil engineer. This area is on land either sold or leased to the City of Kansas City. The Kansas City Aviation Department did not grant access to this site.

Site 4, West Burn Area

The West Burn Area was tentatively identified as being located off the base to the west on the west side of the railroad track and north of the Jackson County line. During the presurvey fieldwork, no evidence of this site could be found. Since the West Burn Area was in operation for only 1 year (1955) approximately 30 years ago, it was thought that there was no physical evidence of this site. However, since the Phase II Stage 2 Field Investigation, aerial photographs not previously available indicate the site may actually be located east of the railroad. During a familiarization tour on August 12, 1987, a material believed to be

tank sludge was found in an area just north of the county line and just east of the railroad tracks. At the time of the fieldwork, the site location was unknown and believed to be off base. Therefore, the site was not investigated.

Any impact that this site might have had will have to take into account the presence of the Knoche oil field 3,000 feet to the south-east. The uplands here are fairly level and the area of the site currently is farmed in corn. A tree nursery is located across the county line to the south.

This site should be investigated further if Kansas City will grant access.

Site 5, South Burn Area

The South Burn Area tentatively has been identified as being located to the southwest of the South Landfill (Site 1). During the presurvey fieldwork, no evidence of this site could be found. Since the South Burn Area was in operation for 10 years (1955 to 1965) approximately 20 years ago, it is possible that there will be no physical evidence of this site at all. Because of its proximity to the South Landfill, any environmental contamination detected at this site will be reviewed in light of findings from the South Landfill investigation. This site is believed to be on land either owned or leased by the City of Kansas City, Missouri. The Kansas City Aviation Department did not grant access for this investigation.

Site 7, Radioactive Disposal Well

The Radioactive Disposal Well is located north of the South Landfill and east of the major flight line. It is believed to have been operated from 1955 to 1970. Discussion during the presurvey visit indicated that low-level radioactive material, typically radium dials, were disposed into this cased well. The site currently is behind a locked gate in an open field. The well itself is very visible, standing 4 to 5 feet high and painted red. This well is located on land owned or leased by the City of Kansas City, Missouri. The Kansas City Aviation Department did not grant access for this investigation. Therefore, no work was performed at this site.

3. FIELD PROGRAM

3.1 PROGRAM DEVELOPMENT

A field program for the Phase II Stage 2 Confirmation/Quantification investigation was developed by E & E and presented in the Presurvey Report submitted on 7 June 1985. The program was reviewed and modified by the Air Force and set forth in the Description of Work for Contract F33615-83-D-4003, Task Order 13.

Elements of the field program included: a soil gas survey, a geophysical survey, sediment sampling, subsurface soil sampling, surface water sampling, installation of groundwater monitoring wells, and groundwater sampling. Various combinations of these program elements were performed at the various sites. Table 3-1 outlines the types of work conducted at each site. By site, the objectives of the fieldwork were:

Site 1 - South Landfill

- Determine if contaminated leachate from the landfill is entering Scope Creek.
- Evaluate potential for vertical migration of contamination.

Site 2 - Northeast Landfill

- Determine past disposal practices at the landfill.
- Delineate the locations of several suspected waste disposal trenches and determine if contamination has resulted.
- Expand monitoring well network to investigate migration of groundwater contamination from possible leaching of landfilled materials.

Table 3-1
FIELDWORK PERFORMED AT EACH SITE

	Geophysics	Boreholes	New Monitoring Wells	Soil Samples*	Groundwater Samples*	Surface Water Samples*
Site 1 - South Landfill	--	1	--	6	--	3
Site 2 - Northeast Landfill	MAG, EM	4	2	10	5	3
Site 6 - North Burn Pit Area	Soil Gas	3	3	15	3	1
Site 8 - Herbicide Burial Area	--	--	--	4	--	1
Site 9 - Oil-Saturated Area	--	1	--	9	--	1
Site 10 - Hazardous Waste Drum Storage Area	--	1	--	9	--	1
Site 12 - POL Storage Yard	--	4(h)	1	11	1	2
TOTALS		14	6	64	9	12

*Numbers do not include duplicates or blanks.

Key: MAG = Magnetometer survey
 EM = Electromagnetic survey
 (h) = Hand-augered boreholes

Site 6 - North Burn Pit Area

- Determine occurrence of contamination from the site using a soil gas survey.
- Determine occurrence of subsurface soil contamination.
- Determine whether groundwater contamination has occurred.

Site 8 - Herbicide Burial Area

- Identify actual burial area by examining available background information.
- Identify any contaminants in soil in the vicinity of the burial area.
- Evaluate extent of migration of any contaminants via surface drainage pathway.

Site 9 - Oil-Saturated Area

- Evaluate type and extent of surface and subsurface soil contamination.
- Determine if contaminants are migrating via surface drainage pathway.

Site 10 - Hazardous Waste Drum Storage Area

- Evaluate type and extent of surface and subsurface soil contamination.
- Evaluate potential migration of contaminants via surface drainage pathway.

Site 12 - POL Storage Yard

- Determine the extent of any subsurface soil contamination.
- Evaluate extent of migration of contaminants via buried drain lines and surface drainage pathways.
- Determine whether groundwater contamination has occurred and evaluate extent of contamination.

3.2 FIELD INVESTIGATION

The field investigation consisted of:

- Literature and aerial photograph records search;
- A magnetometer and electromagnetic (EM) terrain conductivity survey;
- A soil gas survey;
- The drilling of 10 boreholes;
- The installation of six monitoring wells; and
- Collection and analysis of 27 surface soil and sediment samples, 38 subsurface soil samples, 13 surface water samples, and 9 groundwater samples.

3.2.1 Schedule of Field Activities

Field activities were scheduled so as to optimize the utilization of manpower and resources. Field activities were coordinated with the USAFOEHL, the base Point of Contact (POC), and subcontractors to minimize delays and potential problems.

Throughout the course of the field activities, daily contact was maintained with the designated base personnel. The principal contact was Ms. Felipita Benson, R.N. Additional coordination was through Mr. John Hurd, Base Civil Engineer.

The fieldwork was completed during the period from 6 October 1986 to 4 November 1986. Table 3-2 provides the sequence of major field activities.

Health and safety protocols, as outlined in the Health and Safety Plan (see Appendix N), were followed throughout the project. Modifications of specific elements of the Health and Safety Plan were based on field conditions and executed only after discussion with E & E's Health and Safety Coordinator.

3.2.2 Records Search

During the course of the Phase II Stage 2 investigation, discussions were held with personnel from the Base Environmental Engineering Staff and the Base Civil Engineering Staff regarding past waste disposal practices and likely contaminants. Historical aerial photographs were

Table 3-2
SCHEDULE OF MAJOR FIELD ACTIVITIES
(October to November 1986)

6 October	Fieldwork begins with a reconnaissance of all sites and collection of surface soil samples.
6-8 October	Geophysical survey at Site 2, Northeast Landfill.
7-9 October	Soil gas survey at Site 6, North Burn Pit Area.
14 October	Drillers on site, set-up decontamination areas at Site 6, North Burn Pit Area and vehicle wash racks.
15 October	Three soil borings drilled, sampled, and grouted at Site 6, North Burn Pit Area.
16 October	Six monitoring wells drilled, pipe set, soil samples collected, and wells completed; three are at Site 6, North Burn Pit; two at Site 2, Northeast Landfill; and one at Site 12, POL Storage Yard. One well at Site 6, North Burn Pit Area was a borehole completed as a well.
17 October	Six soil borings drilled, samples collected, and the holes grouted, one at the Motor Pool Compound; one at the former hazardous waste storage yard; one at Site 1, South Landfill; and three at Site 2, Northeast Landfill.
18 October	Development of new wells and cleanup of drilling and staging areas.
21 October	Wells purged and groundwater samples collected.
23 October	The remaining surface soil and surface water samples collected from Site 2, Northeast Landfill; and Site 1, South Landfill.
28 October, 4 November	Hand-auger borings at Site 12, POL Storage Yard.
4 November	End of sampling.

examined to provide information on waste disposal practices at the base. Aerial photos were helpful in locating and delineating several sites which were not clearly visible during the Presurvey field trip. Table 3-3 lists the photos which were available for review.

3.2.3 Geophysical Survey Procedures

Magnetometer and EM surveys were performed concurrently at Site 2, Northeast Landfill, in an effort to locate what were thought to be discrete landfill trenches at this site, preliminary to placing groundwater monitoring wells. The magnetometer survey is designed to locate magnetically conductive materials in landfills, which are generally more conductive than the surrounding soils. Anomalies in magnetic flux are measured by the magnetometer and recorded in the field notebook. The EM conductivity survey measures the conductivity of the soil or any variations in the conductivity of the soil. Excavations for landfills change the natural conductivity by changing the porosity and density of the soils and altering the normal values of conducting fluids in the soils. Presumed locations of the trenches were delineated in a map provided by the Base Civil Engineer.

A Geometrics Model G-846 proton procession magnetometer with a sensitivity of 0.1 gammas and a Geonics Model EM-31 terrain conductivity meter with an effective exploration depth of 6 meters were used.

3.2.4 Soil Gas Sampling

A soil gas survey was performed at Site 6, the North Burn Pit Area, in an effort to identify potential residual contamination from the burning and handling of flammable liquids. The soil gas data were used to aid in locating the groundwater monitoring wells. The survey was performed by hand-driving perforated pipes in and around the compound. After capping each pipe and allowing it to stand for 15 minutes, the hole was monitored using an Organic Vapor Analyzer (OVA) to determine the presence or absence of volatile compounds.

3.2.5 Soil, Sediment, and Water Sampling

Soil, sediment, and water sampling protocols were followed as outlined in the Technical Operations Plan (Appendix N), except for

Table 3-3
SUMMARY OF HISTORIC AERIAL PHOTOGRAPHS
FOR AREA AROUND RICHARDS-GEBAUR AFB

Year	Scale	Source	Availability
1936	1:20,000	NARS	--
1940	1:20,000	MARC	--
1948	1:17,000	EROS, USGS	--
1950	1:70,000	EROS, USA	--
1953	1:20,000	ASCS	--
1955	1:13,000	EROS, USGS, USAF (shows West Burn Pit)	Reviewed
1957	1:20,000	ASCS	--
1959	1:12,000	COE	--
1960*	1:12,000	City of Grandview (shows borrow pits north of Northeast Landfill)	Reviewed
1963	1:18,000	USGS	Reviewed
1963	1:20,000	ASCS	--
1970	1:24,015	EORS	--
1972*	1:12,000	City of Grandview (shows active North-east Landfill)	Reviewed
1975	1:40,000	EROS	--
1978	1:72,500	EROS	--
1980	1:80,000	EROS	--
1982	1:58,000	EROS	--
1982	1:80,000	EROS	--

Key:
 EROS = EROS Data Center, SD
 MARC = Mid America Regional Council, MO
 ASCA = American Soil Conservation Agency
 COOE = Army Corps of Engineers
 USGS = United States Geological Survey
 USA = United States Army
 NARS = National Archives

*Not on federal archive list; does not cover south half of base.

samples collected for volatile organic analysis (VOAs). These were discrete samples collected prior to homogenization (blended to result in a more uniform sample). The portion of the sample collected for VOAs was cut from the center of the sample and placed directly into 40-ml vials.

All samples were split in the field when enough sample material was available. Split samples were delivered to the base POC. The POC determined those splits which were to be submitted to OEHL/SA for analysis. The split samples for analysis were provided by the POC to E & E for shipment to OEHL/SA.

Sediment Sampling

Sediment sampling was conducted in association with Site 1, South Landfill; Site 6, North Burn Pit Area; Site 8, Herbicide Burial Area; Site 9, Oil-Saturated Area; Site 10, Hazardous Waste Drum Storage Area; and Site 12, POL Storage Yard. A total of 27 samples were collected and submitted for chemical analysis. Table 3-4 presents a summary of the samples collected.

Sediment samples were collected using shovels to loosen an 8-inch cube of sediment from which a vertical column was removed using a stainless steel spoon. The soil column was homogenized in a disposable aluminum pan and then splits were placed in two sampling containers. Spoons were decontaminated and all pans were disposed of after sample collection from each location.

Subsurface Soil Sampling

Subsurface soil samples were collected from 5-foot-long split-spoon samplers during the drilling of the boreholes and monitoring wells. Borehole and monitoring well drilling was performed by Geotechnology, Inc., of St. Louis, Missouri. Table 3-5 provides a summary of borehole depths.

Ten boreholes were drilled and 28 subsurface soil samples were collected and submitted for analysis. Boreholes were drilled for the specific purpose of obtaining subsurface soil samples; however, one borehole (Boring 4) was scheduled to be completed as a monitoring well. A total of 186.5 linear feet of drilling was accomplished using a Mobile

Table 3-4
SUMMARY OF SURFACE SOIL SAMPLING

Site No.	Field Sample No.	Sample Location and Description
1	DF4067	Scope Creek - Background at Markey and Bates
	DF4069	Scope Creek - Downstream of South Landfill
	DF4070	Scope Creek - Seep 1 east of South Landfill
	DF4077	Scope Creek - Seep 2 northeast of South Landfill
6	DF4001	North Burn - 100 feet east of eastern fence center
	DF4002	North Burn - 200 feet east of eastern fence center
	DF4003	North Burn - 100 feet north of northern fence drainage
	DF4004	North Burn - Southeast corner fence, 200-300 feet
	DF4005	North Burn - 25 feet south of southwestern corner of fence
	DF4014	North Burn - 100 feet northwest of northwest corner of fence
8	DF4015	Herbicide Burial Area - 300 feet south of Markey
	DF4016	Herbicide Burial Area - 25 feet east of DF4015
	DF4017	Herbicide Burial Area - 25 feet east of DF4016
	DF4018	Herbicide Burial Area - 100 feet south of Markey
9	DF4007	Oil-Saturated Area - Southwest corner of Motor Pool
	DF4008	Oil-Saturated Area - Southwest corner +25 feet
	DF4009	Oil-Saturated Area - Southwest corner +50 feet
	DF4010	Oil-Saturated Area - Outside southwest corner, 0-100 feet
	DF4011	Oil-Saturated Area - Outside southwest corner, 100-200 feet
	DF4012	Oil-Saturated Area - Outside southwest corner, 200-300 feet
10	DF4019	Hazardous Waste Drum Storage Area - Background from athletic field
	DF4020	Hazardous Waste Drum Storage Area - North of gate to compound
	DF4021	Hazardous Waste Drum Storage Area - West corner of fence, 0-26 feet
	DF4022	Hazardous Waste Drum Storage Area - West corner of fence, 26-60 feet
	DF4023	Hazardous Waste Drum Storage Area - West corner of fence, 60-120 feet
	DF4024	Hazardous Waste Drum Storage Area - South corner +25 feet
12	DF4088	POL Storage Yard - Culvert at Bldg. 952

Table 3-5
SUMMARY OF SOIL BORINGS

Site No.	Boring Designation	Total Depth (feet)
1	Boring #7	7.1
2	Boring #4	9.8
	Boring #8	7.9
	Boring #9	13.0
	Boring #10	8.5
3	Boring #1	12.9
	Boring #2	13.0
	Boring #3	14.5
5	Boring #5	16.5
6	Boring #6	15.0
7	Hand Boring #1	6.0
	Hand Boring #2	6.0
	Hand Boring #3	6.0
12	Hand Boring #4	6.0

and monitoring wells and soil and water sampling points. Twenty-seven soil gas probe locations were tested with an OVA. Figure 3-4 shows the location of the soil gas sampling points.

Based on the results of the soil gas sampling and previous data on the site, three soil boreholes were drilled outside the perimeter of the concrete burn pit; three subsurface soil samples were collected from each borehole; and three monitoring wells were installed within the fenced area. One groundwater sample was taken from each monitoring well, although only MW1, the only well which did not reach bedrock, had sufficient recharge for all the proposed analyses. MW2 and MW3 yielded only one 40-mL sample each.

Six surface soil samples were collected from outside the burn area. One surface water sample was collected from an area of standing water inside the fence line. OVA readings were also taken during the drilling of the boreholes and monitoring wells.

Figure 3-5 shows the sampling locations for this site and the location of the geologic cross section. The cross section is located in Appendix D.

The surface water sample and the groundwater sample from MW1 were analyzed for halogenated and aromatic volatile organics. The surface water sample was also analyzed for petroleum hydrocarbons. The groundwater samples from MW2 and MW3, which yielded only small amounts of water, were analyzed only for volatile organic compounds. The 15 soil samples were analyzed for halogenated and aromatic organics and petroleum hydrocarbons.

Site 8, Herbicide Burial Area

Air Force Civil Engineer's Construction Permit (AF 103), dated 6 August 1971, documents the location of a burial pit 6 feet long by 6 feet wide by 6 feet deep 100 yards south of a weather station at the south end of the runway. The weather station (known as Facility 847) no longer exists. However, a concrete foundation near the south end of the runway is thought to be the remains of the weather station.

A broad, shallow depression was observed in the area of the suspected trench location based on AF 103.

Four composite surface soil samples were collected from the area where the burial pit is thought to be located based on AF 103 and previous evidence of vegetation stress. A single surface water sample was collected from a small pond located downgradient from the soil sampling area.

Figure 3-6 shows the sampling locations for this site.

The water sample was analyzed for total dissolved solids, arsenic, mercury, pesticides, and herbicides. The soil samples were analyzed for herbicides, arsenic, and mercury.

Site 9, Oil-Saturated Area

A single soil boring was drilled immediately adjacent to the stained area, to the northeast. Three subsurface soil samples were collected from this borehole. No sample was taken from the top 3 feet of the borehole, however, because of the presence of coarse fill and gravel. Six surface soil samples were collected downgradient from the oil-saturated area of the motor pool complex. Three of these surface soil samples were taken from the natural drainage path to the south of the area. One surface water sample was collected from the drainage ditch adjacent to a stained area. Two surface water samples were allocated for this site, however, there was only one small pool of standing water available to be sampled at the time of the field investigation.

Figure 3-7 shows sampling locations for this site.

The surface water sample was analyzed for petroleum hydrocarbons, total dissolved solids, halogenated and aromatic volatile organics, and lead. The soil samples were analyzed for halogenated and aromatic organics, petroleum hydrocarbons, and lead.

Site 10, Hazardous Waste Drum Storage Area

A single soil boring was drilled outside the site. The boring location was determined to be the most likely to be contaminated due to natural drainage patterns in the area. Three subsurface soil samples were collected from this borehole. Six surface soil samples were collected at and downgradient from the site. One surface water sample was collected from the drainage ditch downgradient of the site.

times is provided in Appendix H. All samples were shipped to the E & E Analytical Services Center (ASC) or to OEHL/SA by overnight Federal Express. Analytical protocols are discussed in Appendix N.

3.2.9 Variations from Description of Work

During the execution of the fieldwork, several changes from the Description of Work were implemented due to field conditions and findings. Changes were implemented after discussion with and concurrence of the OEHL project manager. A site-specific summary of the variations follows.

All Sites

Subsurface soil borings were taken using a CME continuous sampler. This unit is essentially a 5-foot-long split-spoon soil sampler that is advanced ahead of the hollow-stem auger. It provides a continuous undisturbed sample of the sediment column.

Optional water samples, allocated in case groundwater was intersected during the borehole drilling for subsurface soil samples, were not utilized as no appreciable amounts of groundwater were observed in any boreholes.

Site 1, South Landfill

No modifications in the proposed scope of work occurred at this site.

Site 2, Northeast Landfill

The geophysical surveys were adjusted in the field to cover areas adjacent to the targeted area, based on instrument readings which indicated the entire targeted area as landfill. This was later corroborated based on aerial photographs.

Boring 7 was aborted after encountering the apparent edge of the landfill. Only one of the three scheduled soil samples from this borehole was collected.

An additional surface water sample was collected, from a flowing tributary to Scope Creek just before it enters the creek. This sample represented runoff from the landfill prior to dilution in Scope Creek.

The sample replaced a water sample which could not be taken at Site 6, where no water was encountered.

Site 6, North Burn Pit Area

Due to the absence of any appreciable amounts of water in two of the three monitoring wells at the site, analyses could only be performed for halogenated and aromatic organics. Petroleum hydrocarbons had to be omitted. Two additional attempts to collect sufficient sample volumes also failed.

No determination could be made as to upgradient versus downgradient with respect to monitoring wells. The facility is situated on the top of a ridge.

Site 8, Herbicide Burial Area

No modifications in the proposed scope of work were made at this site.

Site 9, Oil-Saturated Area

No modifications in the proposed scope of work occurred at this site.

Site 10, Hazardous Waste Drum Storage Area

An upstream surface water sample could not be obtained since no water was encountered.

Site 12, POL Storage Yard

A surface water sample from the outfall drain from Building 953 was allocated. However, there was no outfall from this building, and so no sample was collected.

Due to errors in sample labeling in the field, two analytical parameters listed in the Description of Work were inadvertently omitted. These errors affected the proposed analytical program as follows:

- Sample DF4045 - No TDS analysis was performed on this sample.

Nearly all Organic Vapor Analyzer (OVA) readings were positive. The laboratory analyses indicated that none of the nine subsurface samples was contaminated with volatile organics. The probable explanation for the positive result in the soil gas survey and the negative result in the subsurface soil samples is that the OVA was detecting methane, which would not be detected in the soil samples. The fact that OVA readings remained constant when using a carbon filter further supports this conclusion.

The values for petroleum were also low and consistent among the samples (ND to 5.7 mg/kg), with the exception of sample DF4001, collected 100 feet east of the southeast corner of the fence line, which contained 34 mg/kg. Table 4-7 summarizes the results of the soil analyses.

4.2.4 Site 8, Herbicide Burial Area

Geology

Site 8, the Herbicide Burial Area, is similar in setting to Site 6, the North Burn Pit Area, and the Site 1, the South Landfill. The site is on an upland surface where silts and clays cover a weathered limestone bedrock. The original topography of the base has been modified by construction and extension of the major north-south runway. The area is nearly level, with broad shallow depressions and a small pond downgradient to the south.

A broad shallow depression was observed in the area of the suspected trench location based on AF 103. Water had ponded in this area and drained east into other wet areas. It is not known if the shallow depression was caused by possible subsidence of the 1971 trench or is due to construction activities since that date.

Hydrogeology

Based on observations made on other upland sites on the base, it can be assumed that the thickness of the unconsolidated deposits above the bedrock at this site is less than 7 feet. The burial trench was projected to be 6 feet in depth, which places the bottom of the trench very close to, if not directly on, the weathered bedrock surface. The hydrological implication is that the material that was buried, and

Table 4-9

RESULTS OF SOIL SAMPLE ANALYSES FOR
SITE 8, HERBICIDE BURIAL AREA

(mg/kg; all soil concentrations on an as received basis)

Parameter	Date Sampled: Boring#: Depth: Field No.: Lab No.:	10/10 HBAS-1 0-1' DF4015 8796	10/10 HBAS-2 0-1' DF4016 8797	10/10 HBAS-3 0-1' DF4017 8798	10/10 HBAS-4 0-1' DF4018 8799
Herbicides		ND	ND	ND	ND
Arsenic		1.83	5.0	ND	4.53
Mercury		ND	ND	ND	ND

ND = Not Detected

4.3 SIGNIFICANCE OF FINDINGS

4.3.1 Site 1, South Landfill

No contamination was detected leaving this site via surface migration into Scope Creek, based on the analyses of surface soil and water samples. Relatively low concentrations of petroleum hydrocarbons (1.2 mg/kg, 16 mg/kg) were detected in the subsurface soils. The extractable organic compound DBP, the only organic compound detected, was at low concentrations (10 to 16 µg/L), but it also appeared in the method blank (below 10 µg/L). Consequently, DBP has been attributed to laboratory contaminants.

4.3.2 Site 2, Northeast Landfill

With the exception of the extractable DBP, no organic chemicals or metals were reported in any water samples taken at the site. Because DBP was reported in concentrations (14 to 17 µg/L) minimally above sample blank value (13 µg/L), the presence of this chemical has been attributed to laboratory contamination.

Five anions were reported above detection limits. Only a single sample of sulfate at 280 µg/L exceeded a standard or criterion. Since this is a non-mandatory secondary standard set for aesthetic (taste and odor) considerations, the relatively minor exceedance, and the fact that there is no drinking water well nearby, should not represent any material threat to human health.

For soils, no metals exceeded normal ranges for western Missouri soils. The only detectable contaminant was petroleum hydrocarbons, reported at concentrations ranging from non-detectable to 440 mg/kg.

4.3.3 Site 6, North Burn Pit Area

Only three organics (chloroform, tetrachloroethylene, and methylene chloride) were detected in water samples from Site 6. Concentrations of two of the organics (below 1 µg/L) were significantly below EPA HAs. The third, methylene chloride, detected in a single groundwater sample, was well below the EPA HA.

No metals were reported above normal ranges for western Missouri soils. The only organic contaminant reported in soils above detection

have been associated with the storage of drummed hazardous materials here. These efforts included: overpacking drums, removal of stained soil, and scraping the asphalt surface. These efforts were undertaken as a result of a Notice of Violation issued by EPA.

4.3.7 Site 12, POL Storage Yard

The one groundwater and two surface water samples taken at Site 12, the POL Storage Yard, revealed no contamination above detection limits. In the 12 soil samples, petroleum hydrocarbon concentrations were relatively low (6.9 to 44 mg/kg). Removal of soils in the areas of the seven samples with higher concentrations (67 to 2,800 mg/kg) should be considered. In addition, a single sample collected near the drain pipe outlet for Building 953 at a depth of 3 feet contained concentrations of benzene (1.25 mg/kg), total xylenes (2.25 mg/kg), and ethylbenzene (6.25 mg/kg), indicative of contamination by gasoline or a similar petroleum hydrocarbon.

limits was petroleum hydrocarbons. Concentrations of petroleum hydrocarbons in 14 of the 15 samples taken at various depths ranged from non-detectable to 5.4 mg/kg. A single surface sample had a value of 34 mg/kg. In summary, the low concentrations found at the site indicate no undue risk to human health or the environment.

4.3.4 Site 8, Herbicide Burial Area

No detectable concentrations of any contaminant were reported in the single surface water sample taken at Site 8. Concentrations of metals in the four surface soil samples did not exceed the normal range of concentrations reported in western Missouri soils. In addition, no organic contamination was detected in the soil samples. Consequently, the data do not indicate that Site 8 presents an undue risk to human health or the environment.

4.3.5 Site 9, Oil-Saturated Area

No contaminants were detected in the single surface water sample at Site 9.

Results of the soil sample analyses indicate significant lead and petroleum hydrocarbon contamination of site soils. In six of nine samples, concentrations of lead fell within the normal range for western Missouri soils. In the same samples, petroleum hydrocarbon concentrations were relatively low (non-detectable to 9 mg/kg). In the remaining three samples, however, lead concentrations (117 to 343 mg/kg) greatly exceeded the normal range (10 to 20 mg/kg). In these same samples, petroleum hydrocarbons were also high (670 to 3,000 mg/kg). As these were samples taken from the surface (0- to 1-foot depth), humans would be subject to direct contact with high concentrations of lead from the site, warranting consideration of removal.

For the purpose of analyzing the potential human health risk related to lead exposure, it is assumed that humans ingest a maximum of 1 gram of soil daily during activities at the site. This number is extremely conservative (health protective), as it is based on the soil intake for small children--that segment of the population with highest soil intake as estimated by the Agency for Toxic Substances and Disease Registry (ATSDR 1986). Assuming 100% absorption of soil contaminants in

1 gram of soil, these intakes attributable to ingestion of onsite soils are then compared to the daily intake of lead regarded by EPA as acceptable as demonstrated by the current use of this limit in developing the RMCL of 20 µg/L for lead.

An Acceptable Daily Intake (ADI) for adults related to soil lead ingestion has been derived based on the EPA proposed RMCL of 20 µg/L and the following assumptions:

- Ingestion of 2 liters per day (L/day) for a 70-kg adult.
- Twenty percent of the ADI is contributed by water ingestion. This assumption is based on methodologies used to estimate revised drinking water standards (EPA 1985a).
- Intake of lead except by ingestion of drinking water and by the soil-related pathways is minimal.

For an adult:

$$20 \text{ µg/L} \times 2 \text{ L/day} = 40 \text{ µg/day from ingestion of water}$$

$$40 \text{ µg/day} + 0.2 = 200 \text{ µg/day from all sources}$$

$$200 \text{ µg/day} - 40 \text{ µg/day} = 160 \text{ µg/day from all sources excluding water ingestion, which is the Adjusted Acceptable Daily Intake (AADI) for soil for adults}$$

In order that the AADI not be exceeded, the corresponding soil concentration must be no higher than 160 mg/kg.

4.3.6 Site 10, Hazardous Waste Drum Storage Area

The storage of hazardous waste drums in this compound does not appear to have contaminated the surface and subsurface soils. The only contaminants in soil were petroleum hydrocarbons, with concentrations ranging from non-detectable to 1,900 mg/kg. In six of the nine samples, concentrations were low (less than 9 mg/kg). However, concentrations were high (670 to 3,000 mg/kg) in three samples taken at 0- to 1-foot intervals, and removal of soils from these areas should be considered. The single surface water sample contained barium (85 µg/L) and lead (5 µg/L) significantly below the EPA standards or criteria. No other contaminants were detected in the sample. It appears that the remedial efforts undertaken at this site have cleaned up any problems that may

5. ALTERNATIVE MEASURES

This section discusses the alternative measures that can be taken at each of the seven sites. The alternatives have been devised based on the results of the Phase II Stage 2 investigations. A "no-action" alternative is considered for each site. Recommendations as to the most appropriate alternatives are presented in Section 6.

5.1 SITE 1, SOUTH LANDFILL

No significant contamination of surface water, surface soils, or subsurface soils was found at this site. Minor amounts of petroleum hydrocarbons (less than 16 mg/kg) were detected in one of the surface runoff pathways and at the base of the borehole. No monitoring wells exist on this site.

Alternatives for this site include:

- No action. This alternative is applicable should it be decided that the levels of contaminants detected in the samples do not require further action.
- Long-term monitoring. Seasonal fluctuations in groundwater and rainfall could have accounted for the minor amount of seepage found in the Phase II Stage 2 investigation. Under this alternative, areas of the two known seeps would be resampled periodically and searches would be made for additional seeps.
- Installation of upgradient monitoring wells. Two wells could be installed in association with this landfill, one to the west and one to the south. The west well would test the marshy area which is the source for Seep 2; the south well would determine if sufficient recharge for water samples to be taken could be developed from the area of Borehole 7. This borehole showed a small amount of water and traces of hydrocarbons near its base. The south well

might also indicate whether contaminants have migrated from the South Burn Pit Area, an area that was never clearly located and was not part of the Phase II Stage 2 investigation. The South Burn Pit Area was believed to be located south of the South Landfill.

5.2 SITE 2, NORTHEAST LANDFILL

No significant contamination was detected in association with this site. The utilization of the site for landfilling operations is much more extensive than was previously thought. A soil sample taken from below the fill material indicates that the liquids in the landfill are not penetrating into underlying soil. In two samples at the 1- to 2-foot depth, petroleum hydrocarbons were reported at 78 and 440 mg/kg. This landfill, no longer USAF property, is leased to Kansas City Aviation Company and is being used to store excess property and large refuse items. The USAF should survey the perimeter of the landfill area and present this information to the current property owner and include it in the deed to the property. This will alert the owner as to any limitations on future uses of the land, including future construction and improvements. Already, a sewer line has been cut through the south edge of the landfill. It is not known what effect the intersection with the landfill will have on the integrity of that sewer system in the years to come.

Alternatives for this site include:

- No action. If it is determined that there is no threat to the surrounding environment, no further action would be necessary.
- Long-term monitoring. As part of the base groundwater sampling plan, the five wells at the landfill could be sampled to monitor the continued integrity of the landfill and as a check on the area groundwater quality.

5.3 SITE 6, NORTH BURN PIT AREA

Three volatile organics were detected in perched groundwater at this site--chloroform and tetrachloroethylene at concentrations significantly below drinking water standards or criteria, and methylene chloride in a single sample at a concentration of 37 µg/L, an order of magnitude below the EPA drinking water health advisory. There is very little groundwater, and no deep aquifers are threatened. Soil gas

readings indicated that organic vapor contamination is confined within the perimeter of the site. Soil contamination was limited to low concentrations of petroleum hydrocarbons, which were not found in any water sample.

Alternatives for this site include:

- No action. This alternative would be applicable if it is decided that the levels of contaminants detected in these samples do not warrant action. The concentrations observed have been below federal drinking water standards and there are no receptors.
- Long-term monitoring. Seasonal rainfall could recharge the two wells on this site which were essentially dry at the time of the Phase II Stage 2 investigation. The wells could be monitored for evidence of a contaminant plume by sampling for organic contamination.
- Installation of additional monitoring wells. The northeast monitoring well could be nested with a deeper well (drilled to bedrock) to determine if the organic contamination observed in the shallow wells is migrating along the weathered bedrock interface. A monitoring well could be installed outside the compound to the east, near the outfall from the oil-water separator. This would provide a check on the efficiency of this unit and could aid in locating seeps from lower stratigraphic units.

5.4 SITE 8, HERBICIDE BURIAL AREA

There is no conclusive data on the location of the trench or the characterization of this site. No soil borings were made and so no subsurface soil samples were collected.

Alternatives for this site include:

- No action. If it is determined on the basis of present information that the amounts of herbicides buried at this site and the mode of containment do not constitute an environmental problem, no further action would be necessary.
- Additional investigation. Additional effort to locate the trench should include locating and examining aerial photographs not previously available and performing a ground conductivity survey over the suspected area. Once the trench is located, testing and sampling could begin by drilling a series of 10-foot boreholes in the four corners of the trench area. Also, a sediment sample could be taken from the pond downgradient of the trench.

5.5 SITE 9, OIL-SATURATED AREA

Surface soil was found to be contaminated with petroleum hydrocarbons and lead. Levels of lead exceeded 160 mg/kg, the criterion derived for protection of human health (see Section 4.3.5). In addition, concentrations of petroleum hydrocarbons in three of the nine soil samples in the 0- to 1-foot depth were very high. Access to the site, and therefore to these materials, is limited.

Alternatives for this site include:

- No action. Since there is little chance of direct contact, it may be determined that the levels of contaminants detected do not warrant further action.
- Preparation for Phase IV actions. This action would require the removal of contaminated soils and gravel, after identifying the volume to be removed.

5.6 SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA

Only minor contamination of surface water was detected in association with this site. The concentrations of the two contaminants detected, lead and barium, were below drinking water standards. Petroleum hydrocarbon values were high (up to 1,900 mg/kg) along the south fence line. The sources may include spillage, dripping from the numerous heavy vehicles and smaller vehicles (grass mowers) now present in this compound. Storage of drums containing petroleum products in the compound may also have been a source.

Alternatives for this site include:

- No action. Due to the absence of detectable contamination resulting from the storage of hazardous waste drums at this site, no further action is warranted.
- Identification of petroleum hydrocarbon hot spots. This option would require delineating the areas of high petroleum hydrocarbon contamination, in preparation for removal actions (Phase IV).

5.7 SITE 12, POL STORAGE YARD

Site 12, the POL Storage Yard, is the distribution center for all fuels and propellants on the base. The groundwater south of the

facility is free from contamination. Soils inside the tank berms indicate significant petroleum hydrocarbon accumulations (concentrations ranged upwards to 2,800 mg/kg). Volatile organic contamination was detected in the subsurface outside of Building 953, a pumphouse. Additional pumphouses are present, but were not sampled. The contaminated soil sample came from an area where a broken drain pipe from the pumphouse is thought to be located.

Alternatives for this site include:

- No action. If the levels of contaminants identified are determined not to be excessive for present operation of the site, then no further action is warranted.
- Long-term monitoring. After the installation of a monitoring well during Phase II Stage 2, sampling and analysis of this well on a periodic basis would serve to monitor groundwater conditions at this site.
- Additional subsurface soil sampling. The area of greatest environmental concern is located east of the pumphouses. A series of shallow hand-auger borings could be taken in a grid pattern to determine the extent of organic contamination in the soil.

Table 6-1

LIST OF SITES BY CATEGORY

Category I - No Further Action Recommended

- Site 1: South Landfill

Category II - Additional Site Assessment Recommended

- Site 4: West Burn Area
- Site 6: North Burn Pit Area
- Site 8: Herbicide Burial Area
- Site 12: POL Storage Yard

Category III - Remedial Action Recommended

- Site 2: Northeast Landfill
 - Site 6: North Burn Pit Area
 - Site 9: Oil-Saturated Area
 - Site 10: Hazardous Waste Drum Storage Area
-

Table 6-2
SUMMARY OF RECOMMENDATIONS

Site 1 - South Landfill

- No further action.

Site 2 - Northeast Landfill

- Monitor five monitoring wells biannually for 2 years.
- Monitor land use at landfill biannually for 2 years.

Site 4 - West Burn Area

- Perform a soil gas survey to locate the site.
- Install three monitoring wells.
- Sample the surface and subsurface soils.

Site 6 - North Burn Pit Area

- Install two additional monitoring wells, a second well in northeast corner of site, well to be drilled to bedrock or 30 feet, and one outside the compound to the east (20 feet).
- Monitor five wells biannually for 2 years.

Site 8 - Herbicide Burial Area

- Locate the burial trench using aerial photos and a ground conductivity survey. Drill four shallow borings (10 feet) and sample soil for pesticides, mercury, and arsenic.
- Excavate and remove buried pesticides from trench.

Site 9 - Oil-Saturated Area

- Remove oil-contaminated sediments from along the fence line.

Site 10 - Hazardous Waste Drum Storage Area

- Remove oil-contaminated surficial soils.

Site 12 - POL Storage Yard

- Install four monitoring wells to bedrock.
 - Monitor wells.
-

INSTALLATION RESTORATION PROGRAM

PHASE II CONFIRMATION/QUANTIFICATION

STAGE 2

**RICHARDS-GEBAUR AIR FORCE BASE
MISSOURI**

Prepared by:

**ECOLOGY AND ENVIRONMENT, INC.
Buffalo Corporate Center
368 Pleasantview Drive
Lancaster, New York 14086**

July 1988

FINAL REPORT

(September 1986 to November 1987)

VOLUME 2: APPENDICES

**Approved for Public Release:
Distribution is Unlimited**

Prepared for:

**UNITED STATES AIR FORCE
Headquarters Air Force Reserve (HQ AFRES/SGPB)
Robins Air Force Base, Georgia 31098-6001**

**UNITED STATES AIR FORCE
Occupational and Environmental Health Laboratory/
Technical Services Division (USAFOEHL/TS)
Brooks Air Force Base, Texas 78235-5501**

APPENDIX E

CHAIN-OF-CUSTODY FORMS

Ecology and environment, inc.

106 SULLIVAN ROAD, P.O. BOX D, BUFFALO, N.Y. 14226, TEL. 716-832-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 2

Project No.:	Project Name:			Project Manager:										
DF4000	Richards Gebau AFB			Paul R. Kopsick										
Samplers: (Signature)			Field Team Leader:											
Paul R. Kopsick Mark Myr M. J. Malachuk			Paul R. Kopsick											
STATION NUMBER	DATE	TIME	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	REMARKS						
			CMP	GRA	AIR			EXPECTED COMPOUNDS (Concentration)*:						
DF-4036	10/16	1955	X	VOA, Pet. Hydro			NE LF Boring 4	3	2	1			1-2'	1976
37	10/16	1900	X						2	1			6-7'	9014
38	10/16	1905	X						2	1			8-8.5	9405
39	10/17	1000	X	VOA, Pet. Hydro., Land			OIL STAIN AREA Boring 5	2	1				3-4	3906
40	10/17	1000	X						2	1			8-9	9707
41	10/17	1000	X						2	1			15.5/16.5	9708
42	10/17	1010	X	VOA, Pet. Hydro, EP Tox metals			HWSA - Boring 6	2	1				.5-1.5'	9035
43	10/17	1100	X						2	1			9-10'	9036
44	10/17	1030	X						2	1			4.5-5.5'	9477
45	10/17	1130	X	VOA, Pet. Hydro			POL TANKS	2	1				pet. Hydro upstream - H ₂ SO ₄	9478
46	10/17	1330	X	VOA, Pet. Hydro			POL TANKS	2	1				downstream - H ₂ SO ₄	9037
47		14	X	VOA, Pet. Hydro			SOUTH LF Boring 7	2	1					9072
48		14	X	VOA, Pet. Hydro				2	1					9073
49		14	X	VOA, Pet. Hydro				2	1					9074
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		Ship Via:				
Paul R. Kopsick			10/17/83	S.E. EXP						Fool X				
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		BL/Airbill Number:				
Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)		Date:				
S.E. EXP			11/9/83	J. L. Smith						10/17/86				

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055

ecology and environment, inc.

198 SUGAR ROAD, P.O. BOX D, BUFFALO, N.Y., 14226, TEL. 716-632-4491
International Specialists in the Environment

Project No.: DR4000

Page 2 of 2

CHAIN-OF-CUSTODY RECORD

Project No.: DR4000	Project Name: RICHARDS - GEBAUER AFB			Project Manager: Paul Kapsick									
Samplers: (Signatures) <i>Paul Kapsick / Michael M. May Jr.</i>			Field Team Leader: Paul Kapsick										
STATION NUMBER	DATE	TIME	SAMPLE TYPE	SAMPLE INFORMATION		STATION LOCATION	NUMBER OF CONTAINERS	REMARKS					
				COMP	GRAV			AIR	EXPECTED COMPOUNDS (Concentration)*				
DF4050	10/17	1500	/	VOA, PER Hydro		NE Landfill Building 8	2	DEPTD 7.0' - 7.9'					
DF4051	10/17	1550	/	VOA, PET Hydro		NE LF Building 9	2	4.0' - 5.0'					
51	10/17	1540	/				2	6.0' - 7.0'					
52	10/17	1540	/				2	6.0' - 7.0' (Duplicate)					
53	10/17	1600	/				2	9.0' - 10.0'					
DF4054	10/17	1800	/	VOA, PER Hydro		NORTHEAST NE LF Building 10	2	10.0' - 21.0'					
55	10/17	1805	/				2	4.0' - 5.0'					
50	10/17	1810	/				2	7.0' - 8.0'					
Relinquished By: (Signature) <i>Paul Kapsick</i>		Date/Time: 1830 10/17	Received By: (Signature) FED EXP		Relinquished By: (Signature) F	Date/Time:	Received By: (Signature)		Ship Via: Fed Ex				
Relinquished By: (Signature)		Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		BL/Airbill Number:				
Relinquished By: (Signature) FED EXP		Date/Time: 0900 10/18/86	Received For Laboratory By: (Signature) T. Marshall		Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)		Date: 10/17/86				

Distribution: Original Accompanier Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055



ecology and environment, inc.

195 SUGG ROAD, P.O. BOX O, BUFFALO, N.Y. 14225, TEL. 716-632-4499
International Specialists In The Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 2

Project No.: DF4000		Project Name: Richards - Gebau AFB			Project Manager: PAUL KOPSICK			REMARKS				
Samplers: (Signatures)		Michael Mabiorchi Paul Kopsick, Jennifer See Chamber			Field Team Leader: PAUL KOPSICK							
STATION NUMBER	DATE	TIME	SAMPLE TYPE		SAMPLE INFORMATION		STATION LOCATION	NUMBER OF CONTAINERS	PH	COND	Temp	
			COMP	GRAB	AIR	EXPECTED COMPOUNDS (Concentration)*						
57	10/21		X			VOA, Petro Hydro	9076	North Burn NEMW	1	1/2		
58	10/21		X			VOA, Petro, Hydro	9077	North Burn NEMW	2	1	1	7.75 288 75.5
59	10/21		X			VOA, Petro. Hydro	9078	North Burn SEMW	1	1/2		
60	10/21	1025	X			VOA, Petro. Hydro. TDS	9079	POL Monitoring Well	3	1 1.1		only 1 VOA
61	10/21		X			VOA, Petro, Hydro, TDS, Extract, Anions, Phenols, ^{metals} 9080		Northeast LF Bkg well	7	1 3 1 2	7.26 548 67.8	
62	10/21		X				9081	Gates Wall	7	1 3 1 2	7.22 1207 65.4	
63	10/21	1330	X				9082	PII well 1	6	1 3 1 2	7.24 554 67.0	phenol sig bkgd
64	10/21	1340	X				9083	PII well 2	7	1 3 1 2	7.32 888 66.2	
65	10/21	1350	X				9084	PII well 3	7	1 3 1 2	7.35 741 68.5	
66	10/21	1430	X				9085	South LF Marking & Bals	7	1 3 1 2	8.24 427 67.6 SLF BKG	
67	10/21	1430	X			VOA, Petr. Hydro	9090	SLF BKGs	2	1	1	SLF BKG
68	10/21	1530	X				9086	SLF DNW	7	1 3 1 2	7.34 684 700 SLFAN	
69	10/21	1530	X			VOA, Pet. Hydro	9091	SLF DNG	2	1	1	
70	10/21	1550	X			VOA, Pet Hydro	9092	SLF SEEPS	2	1	1	SLF DN
Relinquished By: (Signature)			Date/Time: 1400		Received By: (Signature)		Relinquished By: (Signature)		Date/Time:		Received By: (Signature)	
<i>Paul Kopsick</i>			10/21/86		<i>Frcl. 1/1/11</i>						Ship Via:	
Relinquished By: (Signature)			Date/Time:		Received By: (Signature)		Relinquished By: (Signature)		Date/Time:		Received By: (Signature)	
Relinquished By: (Signature)			Date/Time:		Received For Laboratory By: (Signature)		Relinquished By: (Signature)		Date/Time:		Received For Laboratory By: (Signature)	
<i>J. L. Lippman</i>			10-21-11 10:00		<i>11/11/11 C</i>						BL/Address Number:	
											Date:	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field File
See CONCENTRATION RANGE on page 14

~~See CONCENTRATION RANGE on back of form~~

214055

Ecology and environment, inc.

195 GUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists In the Environment

RECYCLED

Page 2 of 2

CHAIN-OF-CUSTODY RECORD

Project No.: DF4000	Project Name: Richards Gebau AFB			Project Manager: PAUL KOPSICK											REMARKS								
Samplers: (Signatures) <i>Paul R Kopsick</i>			Field Team Leader: PAUL Kopsick																				
STATION NUMBER	DATE	TIME	SAMPLE TYPE		SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	Z - VOA, RT Hydro, TDS, Ext, PPmetals, Anion, Phenol													
			COMP	GRAB	AIR	EXPECTED COMPOUNDS (Concentration)*				1 - VOA Poly													
04071	10/21	1550	X			VOC Field Blank	SLFSEEPW	9087	7	1	3	1	2	2 - VOA, RT Hydro, TDS, Ext, PPmetals, Anion, Phenol									
72	10/21	1730	X				9095		1	1				3 - VOA Gel Amber									
														pH Cond Temp 8.00 56.7 67.4									
Relinquished By: (Signature) <i>Paul R Kopsick</i>			Date/Time: 10/21/66		Received By: (Signature) <i>Paul Kopsick</i>		Relinquished By: (Signature)			Date/Time:		Received By: (Signature)		Ship Via:									
Relinquished By: (Signature)			Date/Time:		Received By: (Signature)		Relinquished By: (Signature)			Date/Time:		Received By: (Signature)											
Relinquished By: (Signature) <i>Paul R Kopsick</i>			Date/Time: 10/21/66		Received For Laboratory By: (Signature) <i>Paul Kopsick</i>		Relinquished By: (Signature)			Date/Time:		Received For Laboratory By: (Signature)		BL/Airbill Number: _____ Date: _____									

Distribution: Original Accompanies Shipment; Copy to Coordinator, Field Files

*See CONCENTRATION RANGE on back of form.

234055

Ecology and environment, inc.

198 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.:	Project Name:			Project Manager:			REMARKS				
DF4000	Richards - Gebaur AFB			PAUL KOPSKY							
Samplers: (Signatures)			Field Team Leader:			Joe Charder					
Mahesh Mukherjee Joe Charder Mike Wey											
STATION NUMBER	DATE	TIME	SAMPLE INFORMATION		STATION LOCATION	NUMBER OF CON. CONTAINERS	40 ML VIALS (SET)				
			COMP	GRAB						%	EXPECTED COMPOUNDS (Concentration)*
DF409	10/26	1050	X		POL TANK # 955	3	2	1	1	DEPTH = 1.0'	9343
80	10/26	1100	X		POL TANK # 955	3	2	1	1	" = 2' 10"	9344
81	10/26	1130	X		POL TANK # 955	3	2	1	1	" = 6.0'	9345
82	10/26	1330	X		POL TANK # 957	3	2	1	1	" = 1.0'	9346
83	10/26	1345	X		POL TANK # 957	3	2	1	1	" = 2' 8"	9347
84	10/26	1415	Y		POL TANK # 957	3	2	1	1	" = 6.0'	9348
85	10/26	1450	X		POL TANK # 951	3	2	1	1	" = 1.0'	9349
86	10/26	1500	X		PC. TANK # 954	3	2	1	1	" = 1.0'	9350
87	10/26	1525	X		PC. TANK # 954	3	2	1	1	" = 5.0'	9351
88	10/26	1555	X		B. 955 drain	3	2	1	1	Calvert Rd Blvd. 952	9353
89	10/26	1575	X	87 DUP	POL TANK # 954 (5')	2	1	1		Duplicate (5ft) 9352	
Relinquished By: (Signature)			Date/Time: 1030		Received By: (Signature)		Relinquished P			Ship Via:	
Joe Charder			10/26/86							Fwd. Ex	
Relinquished By: (Signature)			Date/Time:		Received By: (Signature)		Relinquished			BL/Airbill Number:	
Relinquished By: (Signature)			Date/Time:		Received For Laboratory By: (Signature)		Relinquished			Date:	
Fed Express			10-26-86 / 0930		N.Y.L - 11/11/C						
Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files											
See CONCENTRATION RANGE on back of form.											

234055

ecology and environment, inc.

190 SUNG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4481
International Specialists In The Environment

recycled

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.: DF4000	Project Name: Richards Gebau AFB			Project Manager: PAUL KOPSICK									
Sampler: (Signature): <i>Paul Kopsick</i>	Field Team Leader: <i>Joe Giardina</i> <i>Mark M. Moulton</i>			PAUL KOPSICK									
STATION NUMBER	DATE	TIME	SAMPLE TYPE GRAB AIR	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	REMARKS				
				EXPECTED COMPOUNDS (Concentration)*									
73	10/23	1050	X	VOA, TDS, Phenol, Pet.Hydro, Anions, Etc., ppm			NELF culvert	7	1 3 1 2	7.92	61B	62.0	9230
74	10/23	1100	X				NELF Downstream	8	1 3 1 2	7.87	341	61.4	9231
75	10/23	1110	X				NELF upstream	8	1 3 1 2	8.01	374	61.0	9232
76	10/23	1200	X				SLF SEEP 2	8	1 3 1 2	7.94	540	66.4	9233
77	10/23	1210	X	VOA, Pet. Hydro			SLF SEEP 2	3	2 1				9256
78	10/23	1220	X	VOA BLANK			SLF SEEP 2	1	1				9254
													9235
DF4003	10/23	1030	X	Phenols			NELF M1	1	1	Replaces Broken jar of 10121			9235
Relinquished By: (Signature): <i>Paul Kopsick</i>	Date/Time:	1700 10/23	Received By: (Signature): FFA EXP	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via:						
Relinquished By: (Signature)	Date/Time:		Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	<i>Fed Exp</i>						
Relinquished By: (Signature)	Date/Time: 10/24/86	Received For Laboratory By: (Signature): <i>K. Walsh</i>	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	BL/Airbill Number:	Date:						

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files
See CONCENTRATION RANGE on back of form.

234055

Ecology and environment, inc.

108 SUGO ROAD, P.O. BOX D, BUFFALO, N.Y. 14226, TEL. 716-632-4491
International Specialists in the Environment

Page 1 of 1

CHAIN-OF-CUSTODY RECORD

Project No.: DF-1000	Project Name: Richards Gebau AFB	Project Manager: PAUL KOPSKICK	<i>2-40ml vials</i> <i>1-B oz Jars</i>																		
Samples: (Signatures)	Field Team Leader: PAUL KOPSKICK																				
STATION NUMBER	DATE	TIME	SAMPLE INFORMATION		EXPECTED COMPOUNDS (Concentration)*	STATION LOCATION	NUMBER OF CONTAINERS	REMARKS													
			COMP	GRAB				AIR													
DF-1020	10/15	1420	X		VCA, Petroleum Hydrocarbons	8874	NB Building 1 S-1	3	2	1										all positive 0.0A reading	
DF-1020		1430	X			8895	NB 1 S-2	3	2	1											7-5'
DF-1020		1435	X			8896	NB 1 S-3	3	2	1											12-12.4'
DF-1030		1510	+			8897	NB Building 2 S-1	3	2	1											2-3'
DF-1031		1515	X			8898	NB 2 S-2	3	2	1											5-6'
DF-1032		1520	+			8899	NB 2 S-3	3	2	1											11-12'
DF-1033		1600	+			8901	NB Building 3 S-1	3	2	1											2-3'
DF-1034		1605	+			8902	NB 3 S-2	3	2	1											5-6'
DF-1035		1610	+			8903	NB 3 S-3	3	2	1											11-12'
DF-1020		1720	+		8900 DUPLICATE	NB Building 2 S-3	3	2	1												11-12'
Relinquished By: (Signature) <i>Paul Kopsick</i>			Date/Time: 10/15 1700h	Received By: (Signature) <i>Joseph Charles</i>	Relinquished By: (Signature) <i>Joseph Charles</i>	Date/Time: 10/15 1745	Received By: (Signature) <i>Fed. Express</i>	Ship Via: <i>Federal Exp</i>													
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)														
Relinquished By: (Signature) <i>Fed Express</i>			Date/Time: 10/16-17 0900	Received For Laboratory By: (Signature) <i>Walter H. Horwitz</i>	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	BL/Airbill Number: Date: 10/15/86													

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234056



ecology and environment, inc.

196 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14226, TEL. 716-632-4481
International Specialists In the Environment

International Specialists in the Environment

CHAIN OF CUSTODY RECORD

Page 1 of 1

Distribution: Original Accompanies Shipment; Copy to Coordinator Field File

See CONCENTRATION RANGE on back of form.

240tts

Ecology and environment, inc.

198 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y. 14226, TEL. 716-632-4481
International Specialists In the Environment

Page 1 of 1

CHAIN-OF-CUSTODY RECORD

Project No.: DF-1000	Project Name: RICHARDSON - GE BANK AFB TRIP			Project Manager: PAUL KEDSICK								REMARKS												
Samples: (Signature) <i>P. Kedsick MAILNAG</i>				Field Team Leader: PAUL KEDSICK																				
STATION NUMBER	DATE	TIME	SAMPLE TYPE	COMP	GRAB	AIR	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CON-TAINERS	1	2	3	4	5	6	7	8					
EXPECTED COMPOUNDS (Concentration)*									1			2	3	4	5	6	7	8						
40001	10/24/81	12:00	X		VCA, C-1-		8765	Northwest Hilltop			3	2	1	1	1	1	1	1	1	1	Burnett 100' E			
40002		12:10	X		VCA, C-1-		8766	-52			3	2	1	1	1	1	1	1	1	1	Bluff at 666'			
40003		12:15	X		VCA, C-1-		8767	-53			3	2	1	1	1	1	1	1	1	1	No. th of. F...			
40004		12:20	X		VCA, C-1-		8768	-54			3	2	1	1	1	1	1	1	1	1	out back C-100' E			
40005		12:15	X		VCA, C-1-	<i>and 8769</i>	8769	-55			3	2	1	1	1	1	1	1	1	1	out front of front			
40006		12:15	X		VCA, C-1-	<i>and 8770</i>	8770	out back 100'			5	2	1	1	1	1	1	1	1	1	pH 8.50, 1910 mm (C-100)			
40007		12:30	X		VCA, C-1-, Lead		8770	C-1, northeast hilltop			3	2	1	1	1	1	1	1	1	1	out front of front			
40008		12:30	X		VCA, C-1-, Lead		8771	-56			3	2	1	1	1	1	1	1	1	1	out front of front + 25'			
40009		12:30	X		VCA, C-1-, Lead		8772	-57			3	2	1	1	1	1	1	1	1	1	out front of front + 50'			
40010		12:30	X		VCA, C-1-, Lead		8773	-58			3	2	1	1	1	1	1	1	1	1	out back of front 100'			
40011		12:30	X		VCA, C-1-, Lead		8774	-59			3	2	1	1	1	1	1	1	1	1	out back of front 100' (C-100)			
40012		12:30	X		VCA, C-1-, Lead		8775	-60			3	2	1	1	1	1	1	1	1	1	out back of front 100' (C-100)			
40013		12:30	X		VCA, C-1-, Lead, TDS		8777	-61			5	2	2	1	1	1	1	1	1	1	pH 8.50, 3600 mm (C-100)			
																		CONT'D						
Relinquished By: (Signature) <i>Ecology Inc.</i>			Date/Time: 10/24/81	Received By: (Signature) <i>Fed Express</i>	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)			Ship Via: <i>FedEx</i>												
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)			BL/Airbill Number:												
Relinquished By: (Signature) <i>Ecology Inc.</i>			Date/Time: 10/10/81 / 0900	Received For Laboratory By: (Signature) <i>Paul Kedsick</i>	Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)			Date: <i>10/10/81</i>												

*: Original Accompanies Shipment; Copy to Coordinator Field Files

INTEGRATION RANGE on back of form.

234056

ecology and environment, inc.

395 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.: DF4000	Project Name: Richards-Gebaur AFB IRP			Project Manager: Paul Kopsick										
Samplers: (Signatures) <i>PK</i> Paul Kopsick, Bill Kwoka, Mike Michalowski			Field Team Leader: Paul Kopsick											
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRAB AIR	SAMPLE INFORMATION		STATION LOCATION	NUMBER OF CON. CONTAINERS	REMARKS						
				EXPECTED COMPOUNDS (Concentration)*										
DF4014	10/10	1120	X	VOA, O&G	8795	North Burn Area S-6	2	1			1			West Drainage
DF4015		1315	X	Pesticides, Arsenic, Mercury	8796	Herbicide Burial S1	2				2			300' South of Road
DF4016		1320	X		8797		-S-2	2				2		25' East of DF4015
DF4017		1330	X		8798		-S-3	2				2		25' East of DF4016
DF4018		1340	X		8799		-S-4	2				2		100' South of Road
DF4019		1445	X	VOA, EP Tox. (Metals), O&G	8800	Haz. Waste Storage S-1	2	1			1			Background Soil
DF4020		1505	X		8801		S-2	2	1		1			Gate of Compound
DF4021		1445	X		8802		S-3	2	1		1			Fence corner O-26'
DF4022		1500	X		8803		S-4	2	1		1			26-60'
DF4023		1500	X		8804		S-5	2	1		1			60-120'
DF4024		1455	X		8805		S-6	2	1		1			Opposite corner + 25'
DF4025		1615	W	VOA, TDS, O&G, PPMetals, Barium, Mercury	8806	Cancelled by P. Kopsick 10/13/86 W-1	4	1	2	1				Opposite corner + 25' 4.27 PH 36.70 mm 66°F
DF4026		1600	W		8807	Field Blank	1	1	2	1				HWSA
DF4027		1315	W	Pesticides, TDS, Arsenic, Mercury	8808	Herbicide Burial W-1	3	2	1					Pond in Field 65°F 15°C mm 62.7°F
Relinquished By: (Signature) <i>Paul Kopsick</i>	Date/Time: 10/10/86, 7000	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via:	Federal Express							
Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)									
Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	BL/Airbill Number:	Date: 10/10/86							

Distribution: Original accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055

Provided on the following pages are sample receipt logs for the appropriate sample numbers as documentation of proper sample management and documentation procedures.



PACKAGE RECEIPT LOG

0843

recycled paper.

E-12

recycling and environment

ITEM NO.	CLIENT NAME and/or JOB NO.	DATE RECEIVED	RECEIVED FROM (e.g. carrier)	CARRIER I.D. NO. or INITIALS	SHIPPING INVOICE NO. (Place in (ld))	PACKAGE DESCRIPTION (e.g. 1 cooler, 1 jar, etc.)	PACK- AGE SEC- URED Y/N	MANNER PACKAGE SECURED				SAMPLE LOG GED Y/N	PACKAGE DISPOSITION		ASC Cu- lody Seal At- tach ed Y/N
								Cont'd Seal G	Flor/Plas Tape F	Other O	Deficiency D		Temporary Secure Storage Area Y/N	Y/N	
4332	PVS Chemical	10-9-84	L. ROEDL	ZK	none	1-Cardboard Box	✓						✓		1-111
7228	Edgetooth Apartments	10-9-84	A. Devereux	Ad-D	none	1-Plastic Bag							✓		1-111
4337	Team of Ambulances	10-9-84	Client	ZK	none	1-Plastic Bucket							✓		1-111
4340	S-Hotel Thru, Inc. Assoc	10-9-84	Client	ZK	none	1-Cooler							✓		1-111
4341	Steering Environmentals	10-9-84	Client	ZK	none	3-16x24x36 poly							✓		1-111
5242	Richards-Gebauer AFB	10-10-84	FED Express	ZK	A-1011 1533064816	1-Cardboard Box	✓						✓		1-111
4343	C.P.C. - Tannenbaum	10-10-84	Client	ZK	none	1-Cardboard Box	✓						✓		1-111
4344	New York Air Brakes	10-10-84	U.S. Air	ZK	Flight Tr. 1011 10-14-84	1-Cardboard Box							✓		1-111
4345	Richards-Gebauer AFB	10-11-84	FED Express	ZK	A-1011 1533064800	1-Cardboard Box	✓						✓		1-111
4346	U.S. EPRI	10-12-84	Fed. Express	ZK	A-1011 1208519521	1-Cooler	✓						✓		1-111
4347	John J. Glass	10-13-84	Client	ZK	none	1-125ml poly							✓		1-111
7248	Birkdale-Gebauer AFB	10-13-84	Shawnee, IL	ZK/H.H.	See Item # 4345	1-Cooler	✓						✓		1-111
4349	Frontier Foundation	10-13-84	Client	ZK	none	2-16x16x36							✓		1-111
4350	FMC - M. deLepeurt	10-13-84	Client	ZK/S	none	3-16x16x36							✓		1-111
7251	D.P.R.D. Centerline	10-13-84	Client	ZK	none	2-125ml poly							✓		1-111
7252	How Management Inc.	10-13-84	Client	ZK/C	none	1-glass bottle							✓		1-111
4353	Springville Central School	10-13-84	W. Hall	ZK	none	2 PLASTIC							✓		1-111
4354	V.F.T.A.	10-14-84	Client	ZK	none	1-foam							✓		1-111

EXPLANATIONS:

JAS

1111

SAMPLE RECEIPT LOG

10. The present nomenclature is proposed to be used in the future.

EXPLANATIONS

EXPLANATIONS

SAMPLE RECEIPT LOG

11. **What is the primary purpose of the study?**

Y6 in T11 Det 6 connected Sanphy and seed with

EXPLANATION

VOUCHER NO.	DATE	DESCRIPTION	DATE COMPLETED	UNIT OF MEASURE SF		COST	TOTAL COST
				AMOUNT	TOTAL		
126-73	24 Oct 72	condition code exchange "1to2" BALANCES FORWARDED	24 Oct 72	-0-	64	-0-	378 99
374-73	30 Jun 73	Type/Constr ch to 'P'	30 Jun 73	-0-	64	-0-	378 99
517-73	30 AUG 1974	PHYSICAL INVENTORY	AUG 1974				
518-74	30 SEP 1974	PHYSICAL INVENTORY	SEP 1974				
002-78	15 DEC 1977	CHANGE COMMAND CODE	OCT 1977				
001-81	23 FEB 1981 23 JAN 1981	CHANGE COMMAND CODE	23 FEB 1981				
		BALANCES FORWARDED					

FACILITY NUMBER	AF-HBT		CONSTR		COND		CONTROL CODE		COMMAND CODE		ADEQUACY		NO. BDRMS	
	1	P	1	E	b01	CODE								
831-172 DSPL RADACT NST														
FACILITY UTILIZATION RECORD														
CURRENT UTILIZATION DESCRIPTION	FACILITY AREA		OUT-GRANT LEASE		TOTAL		OTHER		INTEREST		COST TO GOVERNMENT (\$000)		YEAR COMPLETE	CONTROL NUMBER
	AMOUNT	UNIT	UNIT	PAID	RCVD	ESTIMATE VALUE DONATED LEASED (\$000)	LEASED (\$000)							
	64 SF	1 KG										1	55	
													53040	

940

2 APR 975

DEED (Mr. Mann, 2711)

Radioactive Waste Disposal Sites (Our Ltr, 8 Aug 1974)

USAF Hospital/SGPM

The sign identifying our radioactive burial site has
been installed.

SIGNED

HAROLD R. EARL, JR.
Deputy Base Civil Engineer

Cy To: 1840 ABW/DEPE

Mann/VLN/6 Aug 74

8 AUG 1974

DEED (Mr. Mann, 2711)

Radioactive Waste Disposal Sites (HQUSAF/SG Ltr, 16 July 1974)

USAF Hospital/SGPM

1. In response to subject letter, the following actions have been or will be taken:

a. Tab C-1 of the Base Master Plan has been checked, and Facility #840 is still shown.

b. Job Orders SM-10, PA-28, and PX-4 have been generated to fabricate and install the required sign. On 31 July 1974, the sheet metal job order (SM-10) was forwarded to our Material Control Section for their action. We will advise you when the sign has been installed.

c. Copies of all correspondence on this subject will be forwarded to our Real Property Section for their file.

SIGNED

ALBERT R. TRAUTMANN, Lt Col, USAF
Base Civil Engineer

DEED

Mann (6)

DEE

Sgt

DEA

Gray (1)

DE

C126
(9)

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C. 20314



REPLY TO
ATTN OF: SG

16 JUL 1974

SUBJECT: Radioactive Waste Disposal Sites

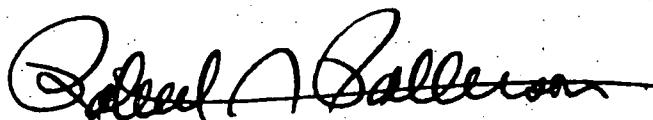
TO: AAC	AFLC	ATC	CINCSAC	MAC	USAFSO
ADC	AFRES	AU	CINCUSAFE	TAC	USAFSS
(AFCS)	AFSC	CINCPACAF	HQ COMD USAF	USAFA	

(Surgeon/Civil Engineer)

1. In the early 1950's it was common practice in the United States to bury radioactive waste. The Air Force adopted this practice and developed a technical order (TO 00-110A-1) which specified procedures to be followed. In 1959 the general authority to bury radioactive waste was rescinded and the Air Force converted to a contractor disposal system (TO 00-110N-2).
2. This headquarters directed an Air Force-wide survey to determine the location of these burial sites. Forty-six bases were identified as possessing radioactive burial sites (see Atch 1). This study also indicated there were no records of the exact type or quantity of radioactive material disposed of in the sites. Generally, the buried radioactive waste could be categorized into (a) electron tubes containing radionuclides (b) low level radioactive wastes generated in nuclear weapons maintenance operations, and (c) radioluminescent materials containing radium.
3. Disinterment of all radioactive burial sites is not considered necessary or practical. Removal of buried waste should only be accomplished when there is a mission essential need for the site. When the site location is disposed of as excess property, an attempt will be made to obtain a permanent easement for the burial site. If the prospective property owner is not agreeable to this condition, the site will be disinterred. The Base Civil Engineer, in conjunction with the USAF Radiological Health Laboratory, is responsible for developing disinterment procedures which are consistent with good health physics practices. Material removed will be disposed of in accordance with TO 00-110N-2. Unless there are specific records indicating buried radioactive material was licensed by the Atomic Energy Commission (AEC), no license for the disinterment process will be requested from the AEC. All disinterment actions require prior approval of this headquarters.
4. All existing burial sites will be located on Tab C-1 of the Base Master Plan and accounted for on real property records. Each site will be permanently posted with an appropriate warning sign (see Atch 2).

5. Appropriate Air Force directives will be revised to reflect the policy.
This letter expires on 1 July 1975 unless sooner rescinded or superseded.

FOR THE CHIEF OF STAFF



ROBERT A. PATTERSON, Lt General, USAF, MC
Surgeon General

2 Atch

1. List of AF Burial Sites
2. Burial Site Warning Sign

Copy to: AFISC/SG
AFISC/SEL
AFISC/IGM
NGB/SG
AFMPC/SG
ARPC/SG
AFDSDC/SG
AFAFC
DMAAC
USAFSAM/EDEO
AFSC/VN

List of Air Force Bases Having Radioactive
Waste Burial Sites

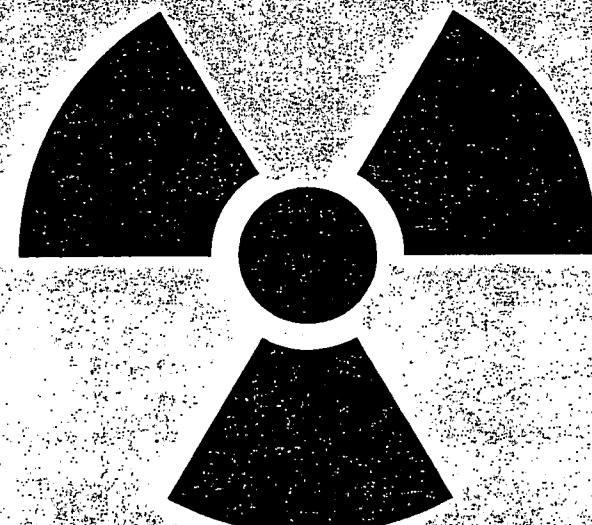
Altus AFB	*Loring AFB
Andrews AFB	Lowry AFB
*Barksdale AFB	Luke AFB
Bergstrom AFB	McCoy AFB
Carswell AFB	McGuire AFB
Columbus AFB	Moody AFB
Craig AFB	Mountain Home AFB
Davis-Monthan AFB	*Nellis AFB
Eglin AFB	Patrick AFB
*Ellsworth AFB	Perrin AFB
Elmendorf AFB	Randolph AFB
England AFB	Richards-Gebaur AFB
*Fairchild AFB	Robins AFB
George AFB	Scott AFB
Hamilton AFB	Sheppard AFB
Holloman AFB	Sundance AFS
Johnston Atoll AFB	Tinker AFB
Keesler AFB	*Travis AFB
Kelly AFB	Vandenberg AFB
Kincheloe AFB	*Westover AFB
*Kirtland AFB	Whiteman AFB
*Lackland AFB	Williams AFB
Laredo AFB	Wright-Patterson AFB

*Former AEC Facilities

Atch 1

CAUTION

**RADIOACTIVE WASTE
BURIAL SITE**



**DIGGING IN THIS AREA IS PROHIBITED WITHOUT APPROVAL
THE BASE CIVIL ENGINEER AND DIRECTOR OF BASE
CAL SERVICES.**



840

RICHARDS-GEBAUR AFB, MO.			31 Oct 56	n/a	840	UEBL 1516	58096-2 [REDACTED]	DISP RADIOACT. WASTE
INSTALLATION NAME AND NO. UEBL 1516			DATE	DRAWING NO.	FACILITY NO.	RP ACCOUNT NO.		MENCLATURE
DIMENSIONS			FIRE PROTECTION					
LENGTH	WIDTH	HEIGHT	NO.	TYPE				
UTILITY CONNECTIONS			HEATING					
WATER			SOURCE					
SEWER			TYPE					
ELECTRIC			FUEL					
GAS			FOUNDATION					
STEAM			FLOOR					
CONDENSATE			WALL					
COMPRESSED AIR			ROOF					
VOUCHER NO.	DATE	DESCRIPTION		DATE COMPLETED	SF	UNIT OF MEASURE	COST	TOTAL COST
15-57	22 Mar 57	Orig. structure		See 600 11 Aug 54	1	1	378.99	378.99
6-59	11-Aug 58	Chg Code No. (control code)		See 167 11 Aug 58	-0-	1	-0-	378.99
120-59	30 June 59	Phys Inventory-Servionics		Gen file #4 N/C 6 June 59	-0-	1	-0-	378.99
2-60	20 Apr 60	Code Changeover (ADCM 85-2)		See 112 15 Sep 59	-0-	64	-0-	378.99
26-63	7 Sept 62	Phys. Inventory		Gen file #12 7 Sept 62	-0-	64	-0-	378.99
189-69	18 Feb 69	Physical Inventory		18 Feb 69 Accountable date transferred to REAMS - reas 34 proper to date bank by RP Voucher No. 300-71	0	APR 10 1971	378.99	
BALANCES FORWARDED								

		FACILITY UTILIZATION RECORD			INTEREST			CONTROL NUMBER	
		AREA			OTHER			YEAR COMPLETE	
		TOTAL			UNIT AMOUNT UNIT PAID RCV'D			COST TO GOVERNMENT ('000)	
		OUT-GRANT LEASE						ESTIMATE VALUE DONATED LEASED ('000)	
								YEAR COMPLETE	
								CONTROL NUMBER	
840		CURRENT UTILIZATION			DESCRIPTION			155 53040	
831-172 DSPL RADACT NST		CATEGORY							
1 P 1 E b0		CODE							
FACILITY NUMBER									
AF-HIT									
CONSTR									
COND									
CONTROL CODE									
COMMAND CODE									
ADEQUACY									
NO. BDRMS									

2 APR 975

DEED (Mr. Mann, 2711)

Radioactive Waste Disposal Sites (Our Ltr, 8 Aug 1974)

USAF Hospital/SGPM

The sign identifying our radioactive burial site has
been installed.

SIGNED

HAROLD R. EARL, JR.
Deputy Base Civil Engineer

Cy To: 1840 ABW/DEPE

Mann/VLN/6 Aug 74

8 AUG 1974

DEED (Mr. Mann, 2711)

Radioactive Waste Disposal Sites (HQUSAF/SG Ltr, 16 July
1974)

USAF Hospital/SGPM

1. In response to subject letter, the following actions have been or will be taken:

a. Tab C-1 of the Base Master Plan has been checked, and Facility #840 is still shown.

b. Job Orders SM-10, PA-28, and PX-4 have been generated to fabricate and install the required sign. On 31 July 1974, the sheet metal job order (SM-10) was forwarded to our Material Control Section for their action. We will advise you when the sign has been installed.

c. Copies of all correspondence on this subject will be forwarded to our Real Property Section for their file.

SIGNED

ALBERT R. TRAUTMANN, Lt Col, USAF
Base Civil Engineer

DEED

Mann (6)

DEE

Sad
7

DEA

Gray
①

DE

GK6
9

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C. 20314



REPLY TO
ATTN OF: SG

16 JUL 1974

SUBJECT: Radioactive Waste Disposal Sites

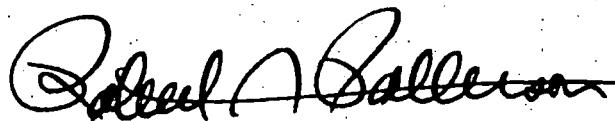
TO: AAC	AFLC	ATC	CINCSAC	MAC	USAFSO
ADC	AFRES	AU	CINCUSAFAE	TAC	USAFSS
(AFCS)	AFSC	CINCPACAF	HQ COMD USAF	USAFA	

(Surgeon/Civil Engineer)

1. In the early 1950's it was common practice in the United States to bury radioactive waste. The Air Force adopted this practice and developed a technical order (TO 00-110A-1) which specified procedures to be followed. In 1959 the general authority to bury radioactive waste was rescinded and the Air Force converted to a contractor disposal system (TO 00-110N-2).
2. This headquarters directed an Air Force-wide survey to determine the location of these burial sites. Forty-six bases were identified as possessing radioactive burial sites (see Atch 1). This study also indicated there were no records of the exact type or quantity of radioactive material disposed of in the sites. Generally, the buried radioactive waste could be categorized into (a) electron tubes containing radionuclides (b) low level radioactive wastes generated in nuclear weapons maintenance operations, and (c) radioluminescent materials containing radium.
3. Disinterment of all radioactive burial sites is not considered necessary or practical. Removal of buried waste should only be accomplished when there is a mission essential need for the site. When the site location is disposed of as excess property, an attempt will be made to obtain a permanent easement for the burial site. If the prospective property owner is not agreeable to this condition, the site will be disinterred. The Base Civil Engineer, in conjunction with the USAF Radiological Health Laboratory, is responsible for developing disinterment procedures which are consistent with good health physics practices. Material removed will be disposed of in accordance with TO 00-110N-2. Unless there are specific records indicating buried radioactive material was licensed by the Atomic Energy Commission (AEC), no license for the disinterment process will be requested from the AEC. All disinterment actions require prior approval of this headquarters.
4. All existing burial sites will be located on Tab C-1 of the Base Master Plan and accounted for on real property records. Each site will be permanently posted with an appropriate warning sign (see Atch 2).

5. Appropriate Air Force directives will be revised to reflect the policy.
This letter expires on 1 July 1975 unless sooner rescinded or superseded.

FOR THE CHIEF OF STAFF



ROBERT A. PATTERSON, Lt General, USAF, MC
Surgeon General

2 Atch

1. List of AF Burial Sites
2. Burial Site Warning Sign

Copy to: AFISC/SG
AFISC/SEL
AFISC/IGM
NGB/SG
AFMPC/SG
ARPC/SG
AFDSDC/SG
AFAFC
DMAAC
USAFSAM/EDEO
AFSC/VN

List of Air Force Bases Having Radioactive
Waste Burial Sites

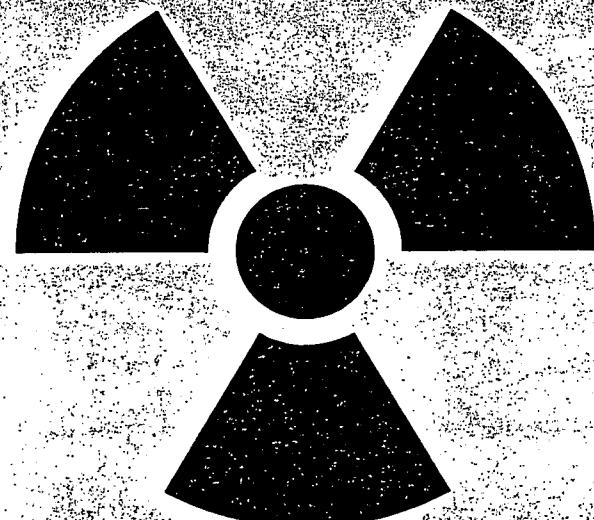
Altus AFB	*Loring AFB
Andrews AFB	Lowry AFB
*Barksdale AFB	Luke AFB
Bergstrom AFB	McCoy AFB
Carswell AFB	McGuire AFB
Columbus AFB	Moody AFB
Craig AFB	Mountain Home AFB
Davis-Monthan AFB	*Nellis AFB
Eglin AFB	Patrick AFB
*Ellsworth AFB	Perrin AFB
Elmendorf AFB	Randolph AFB
England AFB	Richards-Gebaur AFB
*Fairchild AFB	Robins AFB
George AFB	Scott AFB
Hamilton AFB	Sheppard AFB
Holloman AFB	Sundance AFS
Johnston Atoll AFB	Tinker AFB
Keesler AFB	*Travis AFB
Kelly AFB	Vandenberg AFB
Kincheloe AFB	*Westover AFB
*Kirtland AFB	Whiteman AFB
*Lackland AFB	Williams AFB
Laredo AFB	Wright-Patterson AFB

*Former AEC Facilities

Atch 1

CAUTION

**RADIOACTIVE WASTE
BURIAL SITE**



**DIGGING IN THIS AREA IS PROHIBITED WITHOUT APPROVAL
THE BASE CIVIL ENGINEER AND DIRECTOR OF BASE
CAL SERVICES.**



840

RICHARDS-GEBEUR AFB, MO.

INSTALLATION NAME AND NO. UEBL 1516

31 Oct 56

n/a

840

UEBL

1516

DRAWING NO.

FACILITY NO.

RP ACCOUNT NO.

50005-2

DISP RADIOACT WASTE

MENCLATURE

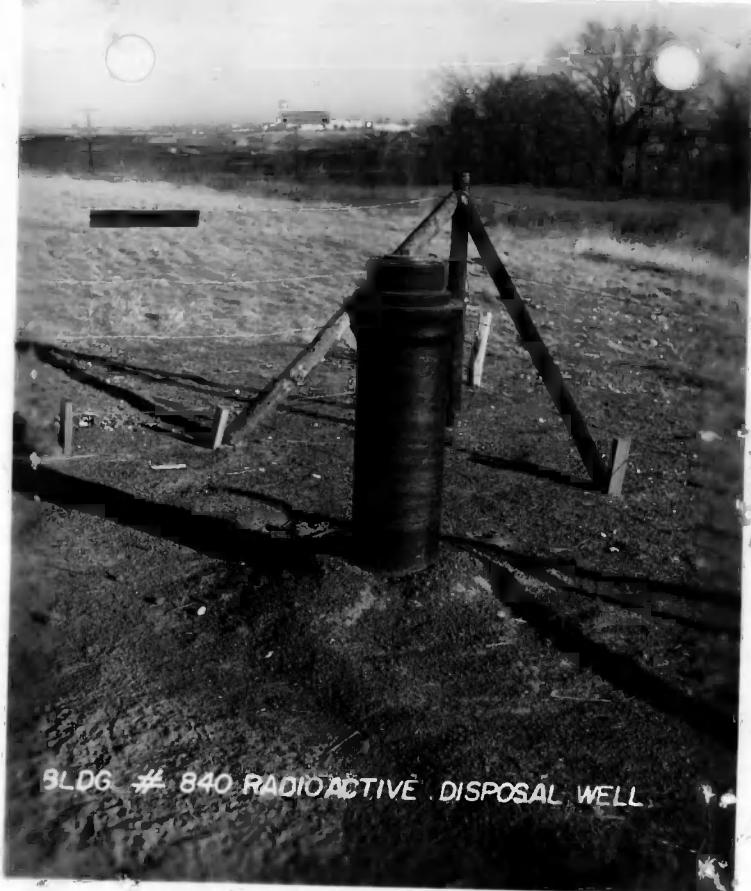
CODE

DIMENSIONS

FIRE PROTECTION

LENGTH	WIDTH	HEIGHT	NO.	TYPE	STATE	Missouri	CODE
UTILITY CONNECTIONS			HEATING		ASSIGNMENT	AIR FORCE MAC ARTHUR	26-29
WATER			SOURCE		CONDITION	Usable Sub-Standards	1
SEWER			TYPE		OCCUPANCY	Air Force	24-00
ELECTRIC			FUEL		AIR FORCE INTEREST	Owned	1
GAS			FOUNDATION		UNIT OF MEASURE (Other than area)	Capacity	7D
STEAM			FLOOR		Sq.Ft.	(Thous.of Gal per day)	SF
CONDENSATE			WALL		QUANTITY		64
COMPRESSED AIR			ROOF		CATEGORY		831-172
			MATERIALS		REMARKS	Disp. well for solid radioactive waste materials 18" diameter and 23' deep--consists of 24' of 12" cast iron pipe. Area secured with 4 ft. barb wire fence (RPV 113-56). Not a bldg or an enclosed bldg or fac.	
					D/C/C	11-3-57	
					U. of meas. formerly	ADM 85-27, 1	
					ST	ATM 85-27, 1	
					TD	(2)	

VOUCHER NO.	DATE	DESCRIPTION	DATE COMPLETED	SF UNIT OF MEASURE		COST	TOTAL COST
				AMOUNT	TOTAL		
15-57	22 Mar 57	Orig. structure	See Code 11-2-4	22 Sept 55	1	378.99	378.99
6-59	11-Aug 58	Chg Code No. (control code)	See 107	11 Aug 58	-0-	378.99	378.99
120-59	30 June 59	Phys Inventory-Servionics	New Code N/C	6 June 59	-0-	378.99	378.99
2-60	20 Apr 60	u.meas chg also Code Changeover (ADCM 85-2)	See 44	15 Sep 59	-0-	64	378.99
26-63	7 Sept 62	Phys. Inventory	See 11-2-12	7 Sept 62	-0-	64	378.99
189-69	18 Feb 69	Physical Inventory	See 11-2-12	18 Feb 69	0	378.99	378.99
BALANCES FORWARDED				Accountable date transferred	BEAMS ready for property data		
bank by RP Voucher No.				\$300.57	dated APR 10 1974		



BLDG. # 840 RADIOACTIVE DISPOSAL WELL

840

2 APR 1975

DEED (Mr. Mann, 2711)

Radioactive Waste Disposal Sites (Our Ltr, 8 Aug 1974)

USAF Hospital/SGPM

The sign identifying our radioactive burial site has been installed.

SIGNED

HAROLD R. EARL, JR.
Deputy Base Civil Engineer

Cy To: 1840 ABW/DEPE

Mann/VLN/6 Aug 74

8 AUG 1974

DEED (Mr. Mann, 2711)

Radioactive Waste Disposal Sites (HQUSAF/SG Ltr, 16 July 1974)

USAF Hospital/SGPM

1. In response to subject letter, the following actions have been or will be taken:

a. Tab C-1 of the Base Master Plan has been checked, and Facility #840 is still shown.

b. Job Orders SM-10, PA-28, and PX-4 have been generated to fabricate and install the required sign. On 31 July 1974, the sheet metal job order (SM-10) was forwarded to our Material Control Section for their action. We will advise you when the sign has been installed.

c. Copies of all correspondence on this subject will be forwarded to our Real Property Section for their file.

SIGNED

ALBERT R. TRAUTMANN, Lt Col, USAF
Base Civil Engineer

DEED

Mann (6)

DEE

Sad

DFA

Gray (1)

DE

OCB (9)

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C. 20314



REPLY TO
ATTN OF: SG

16 JUL 1974

SUBJECT: Radioactive Waste Disposal Sites

TO: AAC AFLC ATC CINCSAC MAC USAFSO
ADC AFRES AU CINCUSAFE TAC USAFSS
AFCS AFSC CINCPACAF HQ COMD USAF USAFA

(Surgeon/Civil Engineer)

1. In the early 1950's it was common practice in the United States to bury radioactive waste. The Air Force adopted this practice and developed a technical order (TO 00-110A-1) which specified procedures to be followed. In 1959 the general authority to bury radioactive waste was rescinded and the Air Force converted to a contractor disposal system (TO 00-110N-2).
2. This headquarters directed an Air Force-wide survey to determine the location of these burial sites. Forty-six bases were identified as possessing radioactive burial sites (see Atch 1). This study also indicated there were no records of the exact type or quantity of radioactive material disposed of in the sites. Generally, the buried radioactive waste could be categorized into (a) electron tubes containing radionuclides (b) low level radioactive wastes generated in nuclear weapons maintenance operations, and (c) radioluminescent materials containing radium.
3. Disinterment of all radioactive burial sites is not considered necessary or practical. Removal of buried waste should only be accomplished when there is a mission essential need for the site. When the site location is disposed of as excess property, an attempt will be made to obtain a permanent easement for the burial site. If the prospective property owner is not agreeable to this condition, the site will be disinterred. The Base Civil Engineer, in conjunction with the USAF Radiological Health Laboratory, is responsible for developing disinterment procedures which are consistent with good health physics practices. Material removed will be disposed of in accordance with TO 00-110N-2. Unless there are specific records indicating buried radioactive material was licensed by the Atomic Energy Commission (AEC), no license for the disinterment process will be requested from the AEC. All disinterment actions require prior approval of this headquarters.
4. All existing burial sites will be located on Tab C-1 of the Base Master Plan and accounted for on real property records. Each site will be permanently posted with an appropriate warning sign (see Atch 2).

5. Appropriate Air Force directives will be revised to reflect the policy.
This letter expires on 1 July 1975 unless sooner rescinded or superseded.

FOR THE CHIEF OF STAFF



ROBERT A. PATTERSON, Lt General, USAF, MC
Surgeon General

2 Atch

1. List of AF Burial Sites
2. Burial Site Warning Sign

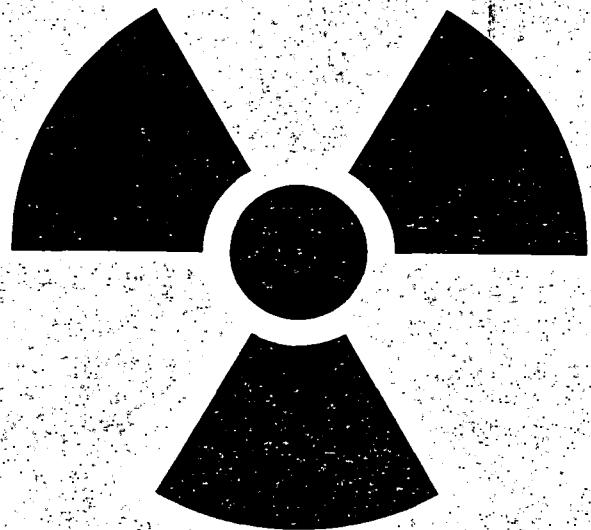
Copy to: AFISC/SG
AFISC/SEL
AFISC/IGM
NGB/SG
AFMPC/SG
ARPC/SG
AFDSDC/SG
AFAFC
DMAAC
USAFSAM/EDEO
AFSC/VN

List of Air Force Bases Having Radioactive
Waste Burial Sites

Altus AFB	*Loring AFB
Andrews AFB	Lowry AFB
*Barksdale AFB	Luke AFB
Bergstrom AFB	McCoy AFB
Carswell AFB	McGuire AFB
Columbus AFB	Moody AFB
Craig AFB	Mountain Home AFB
Davis-Monthan AFB	*Nellis AFB
Eglin AFB	Patrick AFB
*Ellsworth AFB	Perrin AFB
Elmendorf AFB	Randolph AFB
England AFB	Richards-Gebaur AFB
*Fairchild AFB	Robins AFB
George AFB	Scott AFB
Hamilton AFB	Sheppard AFB
Holloman AFB	Sundance AFS
Johnston Atoll AFB	Tinker AFB
Keesler AFB	*Travis AFB
Kelly AFB	Vandenberg AFB
Kincheloe AFB	*Westover AFB
*Kirtland AFB	Whiteman AFB
*Lackland AFB	Williams AFB
Laredo AFB	Wright-Patterson AFB

*Former AEC Facilities

CAUTION
**RADIOACTIVE WASTE
BURIAL SITE**



**DIGGING IN THIS AREA IS PROHIBITED WITHOUT APPROVAL
OF THE BASE CIVIL ENGINEER AND DIRECTOR OF BASE
MEDICAL SERVICES.**

JOHN ASHCROFT
Governor
G. TRACY MEHAN, III
~~KRKKERXXXXXAXXXXXXX~~
Director



82-374-1
34-224
Division of Energy
Division of Environmental Quality
Division of Geology and Land Survey
Division of Management Services
Division of Parks, Recreation,
and Historic Preservation

99 003 A10 STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF ENVIRONMENTAL QUALITY

P.O. Box 176
Jefferson City, MO 65102

January 31, 1989

Mr. Larry McGee
Richards Gabour AFB
442 CSG/DE
Richards Gabour AFB, MO 64030-5000

Dear Mr. McGee:

RE: Special Waste Disposal, Southeast SLF, Operating Permit No. 109515.

This is in response to the special waste disposal request received by the Waste Management Program (WMP) January 19, 1989 regarding the disposal of soil and gravel contaminated with #6 fuel oil. The disposal request has been approved per the enclosed letter.

Approval to dispose of this waste at Southeast Sanitary Landfill is contingent upon it not being a hazardous waste per 10 CSR 25-4.261. WMP's review of this disposal request did not extend beyond a review of data submitted by EPIC Company, Inc. for Richards Gabour Air Force Base. This data indicates that this waste is not a hazardous waste as per 10 CSR 25-4.261. Ultimate responsibility, though, of identifying a waste as hazardous resides with the waste generator. If this waste is a hazardous waste, Richards Gabour Air Force Base is required to manage it in accordance with Missouri Hazardous Waste Management Law, Rules and Regulations.

If there are questions concerning this, I may be contacted at (314) 751-3176. Also, if a copy of 10 CSR 25-4.261 is needed, please contact the Waste Management Program at (314) 751-3176.

Sincerely,

DIVISION OF ENVIRONMENTAL QUALITY

Susanne L. Ranard

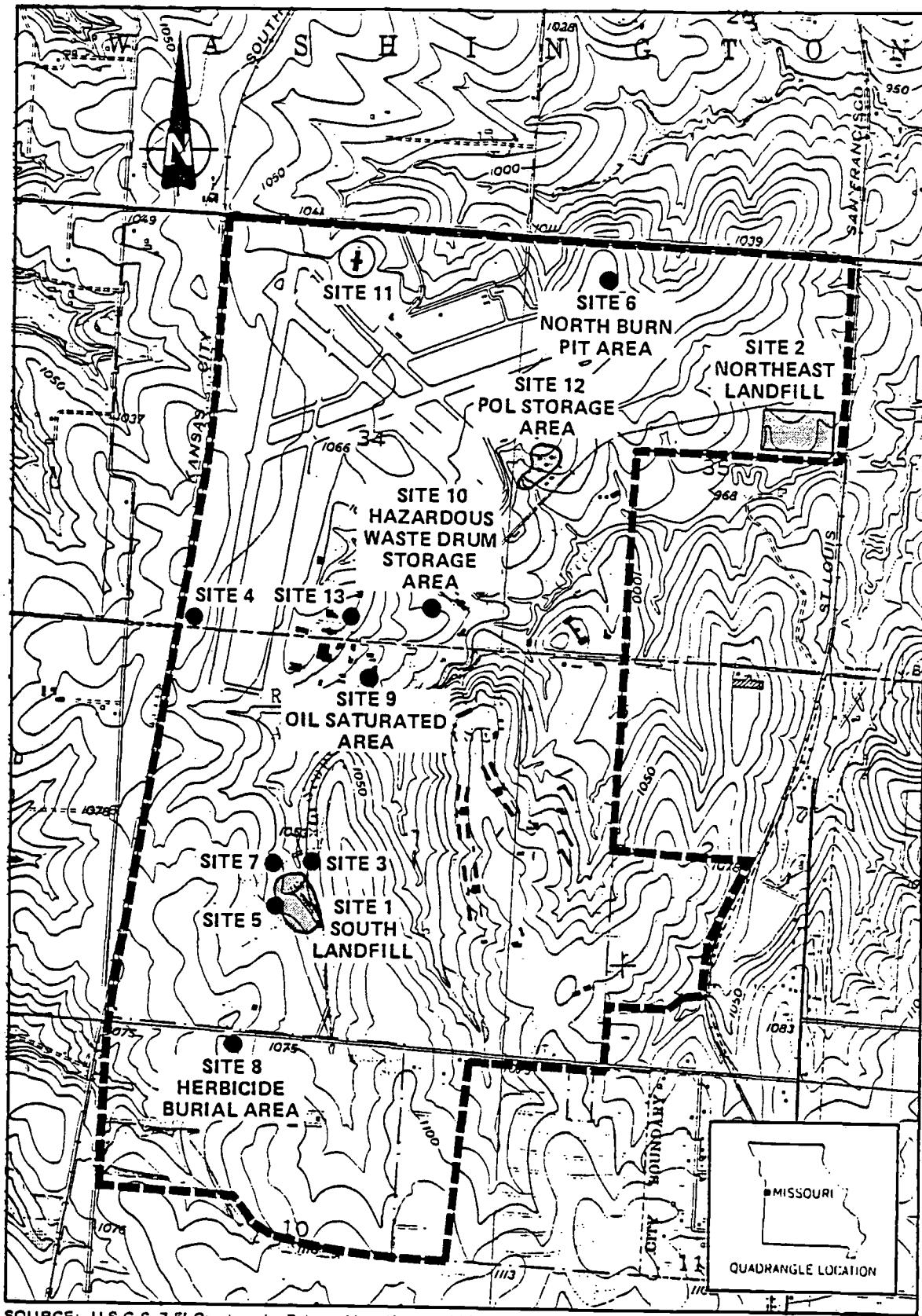
Susanne L. Ranard
Environmental Engineer
Waste Management Program

SLR:lh

Enclosure

TABLE OF CONTENTS FOR COE SITES

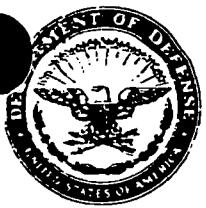
SITE 1	SOUTH LANDFILL
SITE 2	NORTHEAST LANDFILL
SITE 3	RUBBLE BURIAL SITE
SITE 4	WEST BURN PIT
SITE 5	SOUTH BURN PIT
SITE 7	RADIOACTIVE DISPOSAL WELL
SITE 8	HERBICIDE BURIAL SITE



SOURCE: U.S.G.S. 7.5' Quadrangle, Belton, Mo.-Kans. 1975.

SCALE
0 $\frac{1}{4}$ 1 MILE

Figure 1 RICHARDS-GEBAUR AIR FORCE BASE IRP SITES



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098-6001

Lou RWS 81-3
BLA 54
f/b
81-3
UNITED STATES CONSTITUTION SECURED
DEPARTMENT OF DEFENSE 2001-2002

09 JUL 1 A 8 : 44

REPLY TO:
ATTN OF: DEPV

27 JUL 1989

SUBJECT: Installation Restoration Program (IRP), Richards-Gebaur Air Force Base, MO

TO: Superfund Section
Missouri Department of Natural Resources
Waste Management Program
P. O. Box 176
Jefferson City, MO 65102
ATTN: June Sullens

1. References:

- a. Your letter dated 2 May 1989 to Air Force Regional Civil Engineer - Central Region (atch 1)
- b. Kansas City District, Corps of Engineers letter dated 9 May 1989 (atch 2)
2. Attached are the Final Site Specific Sampling/Analysis Plan and Quality Assurance Quality Control Plan (atch 3) and Site Health and Safety Plan (atch 4) for the IRP effort at Richards-Gebaur AFB.
3. The following are the responses to your comments provided in reference 1a on the drafts of the above plans.

a. Site Health and Safety Plan.

(1) Page 2, Section 1.01, Site 6: Sentence wording has been changed to read MCL or related drinking water guidelines. The compounds and associated interim standards from the USEPA Drinking Water Health Advisory Office are; Chloroform, 100 ug/l; tetrachloroethylene, 5 ug/l; and methylene chloride, 1.5 mg/l.

(2) Page 12, Section 2.04, Personnel Monitoring and 6.04.2 Action Levels: Water will be applied to fugitive dust sources using a decontaminated hand-held mist sprayer or other suitable means.

(3) Page 24, Section 6.01, Initial Site Surveillance, Site 6: Refer to paragraph 3a(1) above.

(4) Page 25, Section 6.01, Initial Site Surveillance, Site 10: The standard used for barium is EPA's proposed MCL, which is 1 mg/l. The MCL standard for lead is .05 mg/l. Cadmium was not referenced in this section. Analysis will be for total metals.

(5) Page 35, Section 6.04.2, Action Levels: The specified action level to be used in the event that work is to be discontinued has been clarified. The action level has been set at 50 ppm per the manufacturers

recommendation using NIOSH-MESA values for full-face respirators which have a Protection Factor of 50. The PF in the Health and Safety Plan supersedes the 100 PF as noted in the Work Plan.

(6) Page 41, Section 6.05.1: Reference to a half-face respirator has been removed from this section.

(7) Page 45, Section 6.06.2, Level C Decontamination Procedures: Decontamination fluids will be contained and stored on site. All decontamination fluids will be analyzed to determine the proper disposal method. All fluids which meet the criteria for disposal to the sanitary sewer will be disposed of in this manner.

(8) Page 46, Section 6.06.3, The water generated from the steam and high pressure wash will be contained, stored, and tested on-site. Refer to comment reply 3.a.(7) for disposal procedures.

(9) Page 47, Section 7.01, Emergency Telephone Numbers: The suggested numbers have been added to this section.

(10) Page 49, Section 7.05, Explosion: Richards-Gebaur personnel in conjunction with the US Army Corps of Engineers will contact the regional Explosive Ordnance Disposal Command Center.

(11) Page 50, Section 7.06.1 Stages of Evacuation: Reference to withdrawal from the work area has been deleted since evacuation from the site incorporates the work area. Two stages of evacuation will be used instead of three. If level C is exceeded, work will be discontinued and the state approved Base Emergency Response Plan will be implemented.

b. Site Specific Sampling/Analysis, Quality Control/Quality Assurance Plan.

(1) Page 11, Section 1.3, Site Toxic or Hazardous Substances: References to the State and Federal regulation criteria have been added. A significant level is one that exceeds the most conservative criteria.

(2) Page 30, Section 4.3.1, Sampling Equipment: Contaminated material generated during well installation and sampling will be contained on-site pending laboratory analyses. This has been clarified throughout the report.

(3) Page 31, Section 4.3.2, Sampling Protocol: Purged water will be contained on-site pending laboratory analysis.

(4) Page 44, Section 5.0, Sample Location and Frequency: Analyses listed in Table 3-3 represents a broad scope of investigation. Specific contaminants for each site cannot be narrowed down at this time with any certainty.

(5) General Comment on the Scope of Work: Site 12, Previous soil and surface water sampling locations by EEI cannot be confirmed and are therefore not shown on site sampling location maps. Please see 3.d for status of sites

2, 3, 4, 5, 7, 8, and 11. The general outline of the topography has been added to the Site Locations Map, Figure 4-1, page 26. Specific site topography will be determined by a survey as part of this investigation and will be available at a later date. Appendix B was never intended to be a stand-alone document, it is unfortunate that DGLS did not have the entire document to review, all comments were addressed in the main text. Information provided by DGLS is appreciated.

c. Appendix B, Site 6; Site Specific Sampling/Analysis Plan.

(1) Page 2, Section 1.3.1: We agree that the chert layer may be water bearing. Interpolating the geologic cross section prepared by Ecology and Environment, Inc to this site, it appears the chert layer varies by as much as five feet, with an undulating surface. There may be multiple chert layers present (reference boring BP-3). However, a groundwater gradient cannot be determined at this time given present information.

(2) Page 3, Section 1.4.1: No water was indicated during installation of MW-1, MW-2, and MW-3. Water sampling has since occurred in all three. There was some water inflow from an unknown source after well installation. Monitoring well MW-1 does not extend to the soil/rock interface, but the filter sand does extend up above the previously identified chert layer with the remainder of the sand/screen interval in plastic silty clay. Water may have come from the chert layer, but other sources cannot be ruled out since there is hydraulic communication along the entire length of the sand pack. The only "surface impoundment" at this site is the retention pond in the eastern portion of the site.

(3) Page 4, Section 2.1, Site 6: Proposed well GMW 607 is to be installed to the west-southwest. A deep well on the west side of the site will not produce data that would significantly alter nor enhance the data gathering potential of the current well siting proposal when used in conjunction with the data from the existing wells. The current proposal is sufficient to quantify the extent of contamination at this site. Should analysis indicate the need for additional monitoring wells, they will be installed at a later date.

(4) Page 6, Section 3.1.1: Groundwater sampling will be conducted no sooner than two weeks after the wells are developed. Wells will be drilled the week of August 7th. Statistically, one round of sampling is more accurate than two (but less than three or more). Additional rounds of sampling will depend on the results of this investigation.

(5) Page 6, Section 3.1.2: Two feet was chosen as the most likely depth to encounter this type of contamination from past experience. The actual depth and location of each soil sample will be determined using a HNu monitoring device coupled with visual inspection.

c. Appendix B, Site 12; Site Specific Sampling/Analysis Plan.

(1) Page 6, Figure 2-2, Site 12 Map: Structure 951 is a heating oil tank. Structure 953 is a JP-4 pump house. Structure 959 is the Kansas City

pump house. Structure 954 is an empty heating oil tank scheduled for removal in the near future. Structure 956 is a tank owned by Kansas City. Structures 955 and 957 are Air Force JP-4 tanks. Underground lines and utilities will be determined before field work commences. AV gas or AVGAS refers to aviation grade gasoline.

(2) Page 2, Section 1.3.2: MW4 will be located on Figure 2-2. Only one boring (MW-4) is available at this site, so the groundwater gradient can not be determined with any degree of certainty. The assumed southeast gradient is based on surface topography and typical hydrogeological characteristics associated with the underlying formations. The soil/rock interface is only one of many features analyzed in estimating the hydraulic gradient. The proposed wells have been located such that a definitive groundwater flow direction can be calculated at this site.

(3) Page 6, Section 1.4.2: The intent of this section is to provide information on what is expected when wells and borings are installed, not to summarize previous work. Details of the previous work can be found in earlier reports and were used to develop the plan for this investigation.

(4) Page 6, Section 2.2: Wells are going to be cored into the bedrock to ensure that groundwater at the soil/rock interface will be encountered and sampled.

(5) Page 7, Section 3.2: See paragraph 3b(4) above.

(6) Page 7, Section 3.2.2: Ten feet is the anticipated depth to the soil/rock interface. The marshy area to the northwest is presumed to be upgradient. Existing well MW-4, and a proposed soil boring, is in the area of the marsh.

d. Comments on Sites 2, 3, 4, 5, 7, 8, and 11: As discussed in reference 1b, these sites are on land no longer owned by the Air Force. As a result, responsibility for these sites rests with the Corps of Engineers under the Formerly Used Defense Site Program. We have, therefore, forwarded all of your comments and concerns to the Corps of Engineers. Any additional questions on these sites should be addressed to the Corps of Engineers. We will cooperate with the investigation of these sites as it proceeds.

4. If you have any questions please contact Roger Kittelson or Sheryl Faust-Beck at (912) 926-5598.

FOR THE COMMANDER

George A. Romero
GEORGE A ROMERO, COL, USAF
DCS/Engineering & Services

4 Atch

1. MODER letter, 2 May 1989
2. US CoE letter, 9 May 1989
3. Sampling/Analysis and Quality Assurance Quality Control Plan
4. Health and Safety Plan

cc: 442 CSG/DE w/o attach
AFRCE-CR/ROV w/o attach
CEMRK-ED-TD w/o attach

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098-6001

*Rec'd
IRP file 2/24/88
81-1
filed*

24 MAR 1988

DEPV

Formerly Owned Installation Restoration Program (IRP) Sites, Richards-Gebaur AFB, MO (Your Msg, 12 Feb 88)

HQ USAF/LEEV (Mr William Goins)

1. As requested in the referenced message, a map showing the former and existing USAF property boundaries at Richards-Gebaur AFB is attached. This map also shows the location of the IRP sites. The US Army Corps of Engineers (COE), Kansas City District were involved with the transference of real estate to the City of Kansas City and Belton in August 1985. All details of this property transaction are on file at the COE offices. As the COE, Kansas City District will also be responsible for these former DoD IRP sites, any special data or information they require is readily available.
2. If you have any questions, or require any further information, please call Sheryl Faust-Beck, AUTOVON 468-5598.

FOR THE COMMANDER

SIGNED

GERALD J. MCMAHON, Lt Col, USAF
Director of Programs
DCS/Engineering and Services

- 3 Atch
1. Richards-Gebaur Map (2)
 2. Disposal Site Map
 3. IRP Site Historical Summary

cc: 442 CSG/DE

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31092-6001

81-1

files

all sites

25 JAN 1988

DEPV

Formerly DOD Owned Installation Restoration Program (IRP) Sites,
Richards-Gebaur AFB, MO

HQ USAF/LEEV

1. Reference our letter, 18 Jun 86, IRP Sites at Richards-Gebaur AFB, MO.
2. The referenced letter requested the transfer of seven off-base IRP sites at Richards-Gebaur AFB to the US Army Corps of Engineers for cleanup under the DOD Formerly Owned Program. No feedback has been received on this transfer and we are continuing on with the IRP Feasibility Study for only on-base sites. Therefore, these sites; south landfill, northeast landfill, contractor rubble site, west burn pit, south burn pit, radioactive disposal well, and herbicide burial site, still need to be included in the COE program.
3. An IRP Phase II Stage 2 has been completed for the south and northeast landfills, and herbicide burial site. Further investigation or remedial action was recommended for these three sites. The other sites were just included in the Phase I Records Search. The present owner of these areas would not allow access to the Air Force for Phase II field investigations.
4. IRP documentation is available from this office, and if you have any questions, please contact Sheryl Faust-Beck at AUTOVON 468-5598.

FOR THE COMMANDER

SIGNED

GERALD J. MCMAHON, Lt Col, USAF
Director of Programs
DCS/Engineering and Services

cc: 442 CSE/DE EDR
AFRCE-CR/ROVZ

RECEIVED
CIVIL ENGINEERING

88 JAN 28 PM : 05

DE/HARD 12076 / PAB/80086

~~82-0002~~
~~READ~~ 81-1
file

8 OCT 1986

DE

Installation Restoration Program (IRP)
(Ref my 3 JUN 1986 Ltr)

HQ AFRES/DEPV
Robins AFB GA 31098

Please advise status of my request to turn the off base IRP sites over
to the Army Corps of Engineers.

SIGNED

JOHN P. HURD, JR.
Base Civil Engineer

Atch

1. 442 CSG/DE Ltr.
3 Jun 86

Chronological
order

LKF
JUN 1986
616C-30

3 JUN 1986

DE

Installation Restoration Program (IRP)**HQ AFRES/DEPU
Robins AFB, GA 31098**

1. Request that the following identified Phase I IRP Sites be turned over to the Army Corps of Engineers (COE) for investigation and remedial actions required.

- a. South landfill.
- b. Northeast landfill.
- c. Contractor rubble burial site.
- d. West burn pit.
- e. South burn pit.
- f. Radioactive disposal well.
- g. Herbicide burial site.

2. These sites are located on property which has been sold or transferred to the Kansas City Aviation Department or City of Belton, MO. Please advise as to your decision to turn these sites over to the COE.

SIGNED**JOHN P. HURD, Jr
Base Civil Engineer**

Atch

Figure 6 of IRP Phase I Report w/Atch

Cy to: 442 CSG/CC/SGPB/DW

GN14649.S0

CH2M HILL

Richards-Gebaur
Air Force Base
Property Boundary

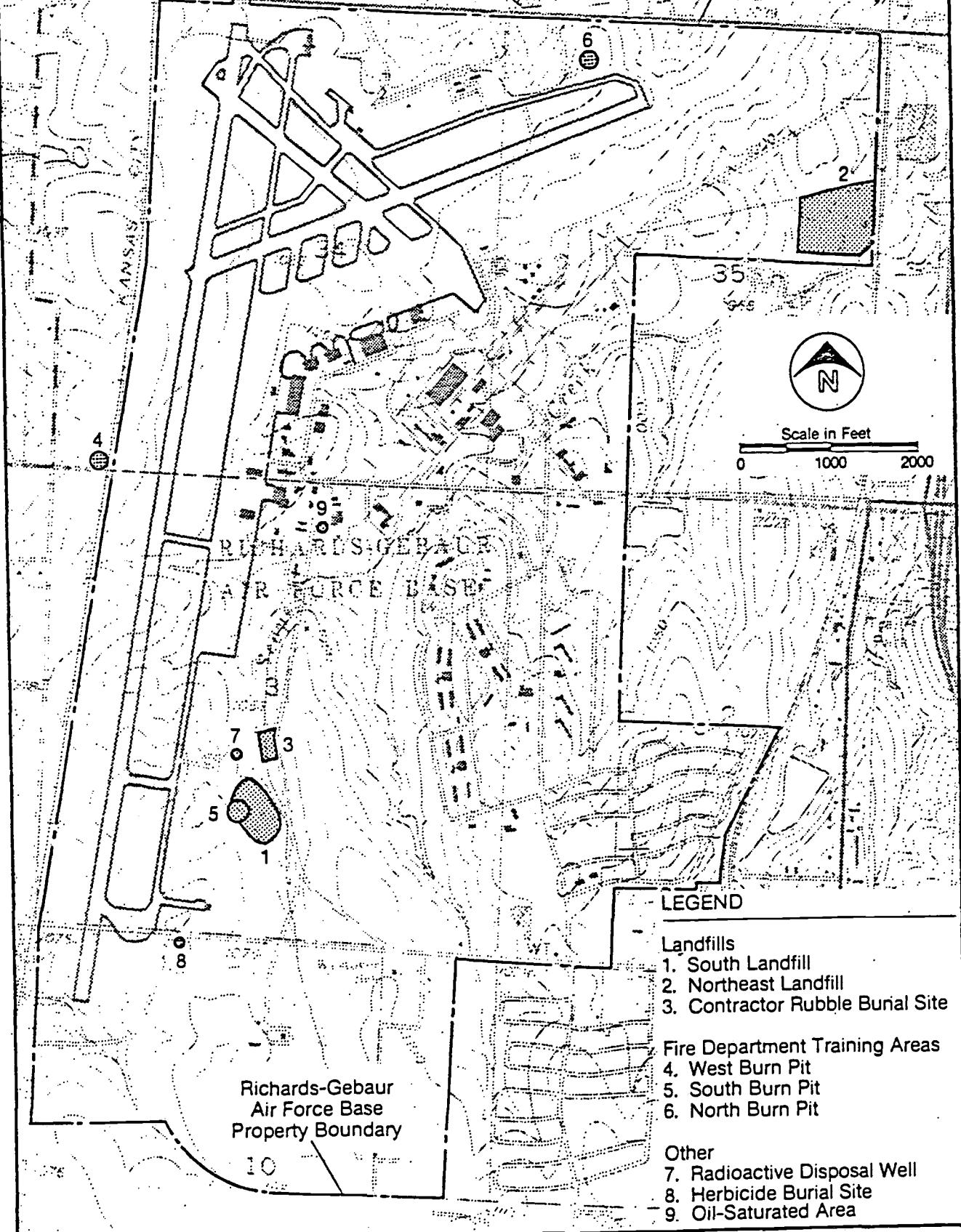


FIGURE 6. Identified disposal sites, Richards-Gebaur AFB, Missouri.



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098-6001

file
81-1

DE
JL

JUN 26 2 40 AM '86

18 JUN 1986

REPLY TO
ATTN OF:
DEPV

SUBJECT: Installation Restoration Program (IRP) Sites at Richards Gebaur AFB, MO

TO:
HQ USAF/LEEV

1. Since the IRP began at Richards Gebaur AFB, considerable real estate has been transferred to Kansas City, MO. The city has denied the Phase II contractors access to some of the sites and AFRES currently has its Phase II on hold.
2. Request that sites 1 - South landfill; 2 - Northeast landfill; 3 - Contractor Rubble Burial Site; 4 - West Burn Pit; 5 - South Burn Pit; 7 - Radioactive Disposal Well; and 8 - Herbicide burial Site, be returned over to the Army Corps of Engineers for investigation and remedial actions. All sites are located on property which has been sold or transferred to the Kansas City Aviation Department or to the city of Belton, MO.

FOR THE COMMANDER

SIGNED

LOUIS D. KJELDGAARD
Actg Director of Programs
DCS/Engineering & Services

1 Atch
Fig 6 of IRP Phase I Report

cc: 442 CSG/CC w/o Atch

DEPV

18 JUN 1986

DEPV

SGPB

Installation Restoration Program (IRP) Sites at Richards Gebaur AFB, MO

HQ USAF/LEEV

1. Since the IRP began at Richards Gebaur AFB, considerable real estate has been transferred to Kansas City, MO. The city has denied the Phase II contractors access to some of the sites and AFRES currently has its Phase II on hold.
2. Request that sites 1 - South landfill; 2 - Northeast landfill; 3 - Contractor Rubble Burial Site; 4 - West Burn Pit; 5 - South Burn Pit; 6 - Radioactive Disposal Well; and 8 - Herbicide burial Site, be returned over to the Army Corps of Engineers for investigation and remedial actions. All sites are located on property which has been sold or transferred to the Kansas City Aviation Department or to the city of Belton, MO.

FOR THE COMMANDER

SIGNED

LOUIS D. KJELDGAARD
Actg Director of Programs
DCS/Engineering & Services

1 Atch
Fig 6 of IRP Phase I Report

cc: 442 CGG/CC w/o Atch
AFRES / SGPB

R-6

Phase II Stage 2

1. South Landfill Site 1
2. N.E. Landfill Site 2
3. North Barn Area Site 6
4. Herbride Burial Area Site 8
5. Art Saturated Area Site 9
6. ~~#~~ Site 10 Drums Storage
7. POL Storage (Site 12)

P

Phase II Preliminary Draft
due June 87

Sites to be turned over
to COE..

Sites 1

2

4 West Barn Pit

5 South Barn Pit

7 Rad Disposal Well

8. Herba. burial site

Bsites total: Envirocon concern

Possible a surface water

~~contamination~~ contamination

~~Little or no use of ground~~

file
IRP
file 81-1 fm
file 81-1 fm

3 JUN 1986

DE

Installation Restoration Program (IRP)

HQ AFRES/DEPU
Robins AFB, GA 31098

1. Request that the following identified Phase I IRP Sites be turned over to the Army Corps of Engineers (COE) for investigation and remedial actions required.

- a. South landfill.
- b. Northeast landfill.
- c. Contractor rubble burial site.
- d. West burn pit.
- e. South burn pit.
- f. Radioactive disposal well.
- g. Herbicide burial site.

2. These sites are located on property which has been sold or transferred to the Kansas City Aviation Department or City of Belton, MO. Please advise as to your decision to turn these sites over to the COE.

SIGNED

JOHN P. HURD, Jr
Base Civil Engineer

Atch
Figure 6 of IRP Phase I Report w/Atch

Cy to: 442 CSG/CC/SGPB/DW

GN14649 S0

CH2M HILL

Richards-Gebaur
Air Force Base
Property Boundary

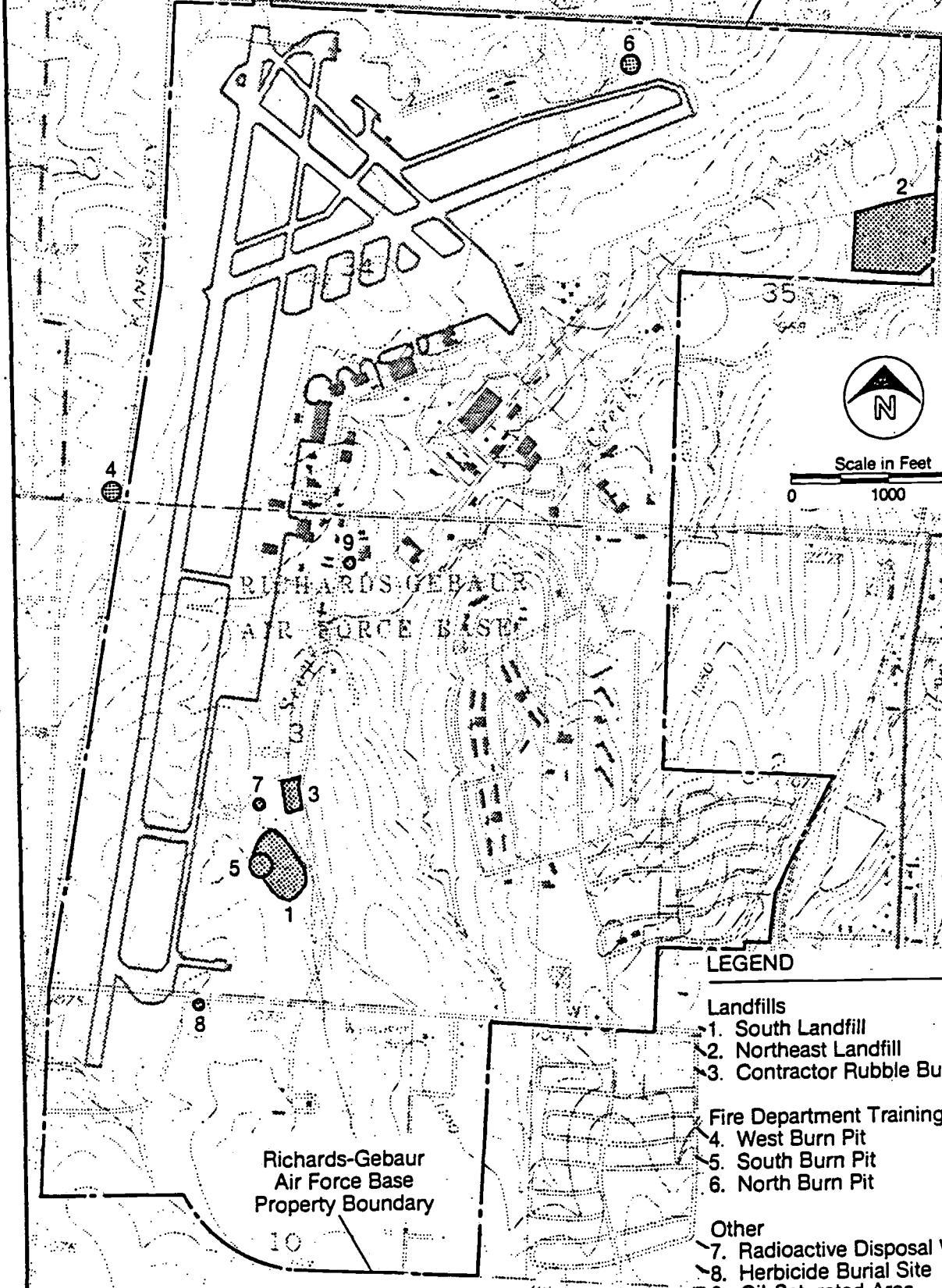


FIGURE 6. Identified disposal sites, Richards-Gebaur AFB, Missouri.

7

COE SITE 1, SOUTH LANDFILL

Section I. Installation Restoration Program Records Search

- A. Study Performed By: CH2M HILL
- B. Date Report Complete: March, 1983
- C. Significant Findings:

A small oil sheen was observed on the surface of a small area of Scope Creek just downstream of the landfill site suggesting the present of leachate. Scope Creek flows through the base and eventually discharges into the Little Blue River thereby providing a pathway to go beyond base property if it is in fact present.

D. Summary of Recommendations:

It was recommended the adjacent Scope Creek be monitored upstream and downstream of the site to determine if hazardous contaminants are leaching into the creek. It should be sampled on two occasions at least 30 days apart and analyzed.

COE SITE 1, SOUTH LANDFILL, Continued

Section II. Installation Restoration Program Phase II
Confirmation/Quantification Stage 2

A. Study Performed By: Ecology and Environment, Inc.

B. Date Report Complete: November, 1987

C. Significant Findings:

No contamination was detected leaving this site via surface migration into Scope Creek, based on the analyses of surface soil and water samples. Relatively low concentrations of petroleum hydrocarbons were detected in the subsurface soils. The extractable organic compound DBP, the only organic compound detected, was at low concentrations, but it also appeared in the method blank. Consequently, DBP has been attributed to laboratory contaminants.

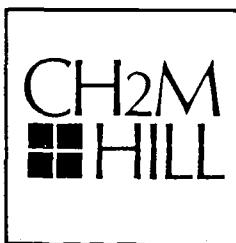
D. Summary of Recommendations:

No further action is recommended for this site since no contamination was found except for very low concentrations of petroleum hydrocarbons in the subsurface soil samples. The presence of petroleum hydrocarbons may be attributed to major oil production at locations just west of the site. Groundwater at the site could not be monitored due to the proximity of the landfill to Scope Creek. The surface water samples in the creek should have detected groundwater contamination, if present, as this is the most likely migration route of contamination.

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For

Richards-Gebaur Air Force Base,
Missouri



Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

MARCH 1983

18

forms are included in Appendix J, and a summary of the hazard ratings for the 9 sites is given in Table 6.

Shallow wells for domestic supplies are known to exist in Jackson and Cass Counties; however, the exact locations and depths of nearby wells could not be accurately determined. For the purpose of these ratings, it was assumed that the nearest well was between 3,000 feet and 1 mile from each site and that the total population served by all wells within a 3-mile radius is between 50 and 1,000. Due to the nearness of Scope Creek, the ground water in the uppermost limestone aquifers (Wyandotte and Iola Formations) flows laterally directly to the creek. It was therefore assumed in the ratings that the uppermost aquifer is not used as a source of water. No surface-water supplies are known to exist within 3 miles downstream of the base.

The following is a description of each site, including a brief discussion of the rating results. Figure 6 shows the approximate locations of these sites. Figure 7 presents a summary of the approximate dates that the major sites were in use.

1. Landfills

Sanitary landfill sites at Richards-Gebaur AFB were used intermittently since 1954, although off-base contract disposal of most solid waste has been the primary means of disposal since 1956. The three landfill sites are described below.

- Site No. 1, the South Landfill, is located in the southern part of the base near the NDI lab and adjacent to Scope Creek. Between 1954 and 1956 this site was the main sanitary landfill for Richards-Gebaur AFB. In 1956, off-base contract

disposal of most common refuse was begun, although some wastes, including building rubble, yard debris, and waste from some industrial shop areas were actively disposed of at the site until about 1961. Materials which may have been disposed of in the landfill include small quantities of waste paints, thinners, strippers, solvents, and oils, although this was not standard procedure. Operation of the landfill included burning of the wastes disposed. Since 1961, the area has been used only intermittently for unauthorized dumping. Due to recent incidents of unauthorized dumping, including cleaning of tar pots and some household waste dumping, an earthen barricade has been erected at the entrance to the site.

A small section of Scope Creek downstream of the site was observed to have a small oil sheen on the surface of the water, suggesting the presence of leachate; no oil sheen was observed upstream and no evidence of soil contamination was visible on the edges of the landfill. Small quantities of hazardous materials may have been placed in this landfill; however, no significant hazardous waste quantities were reported.

The overall rating score for Site No. 1 was 55. Although the receptors subscore was low due to the lack of critical environments or population near the site, the indirect evidence of migration of hazardous contaminants indicated by possible leachate resulted in a high pathway subscore (80) and raised the overall rating.

- Site No. 2, the Northeast Landfill, is located in the northeast portion of the base alongside Scope

V. CONCLUSIONS

- A. No direct evidence was found to indicate that migration of hazardous contaminants exists within or beyond Richards-Gebaur AFB boundaries. Indirect evidence of contamination was found at Site No. 1, the South Landfill, (a small oil sheen on the adjacent surface water).
- B. Information obtained through interviews with 27 past and present base personnel, base records, shop folders, and field observations indicate that hazardous wastes have been disposed of on Richards-Gebaur AFB property in the past.
- C. The potential for migration of hazardous contaminants exists because of the presence of a perched ground-water table with direct discharge to nearby creeks. The presence of low-permeability clays and shales below the ground surface reduces the potential for hazardous contaminant migration vertically into the ground water but increases the potential for migration into nearby surface waters.
- D. Table 7 presents a priority listing of the rated sites and their overall scores. The following sites were designated as areas showing the most significant potential (relative to other Richards-Gebaur sites) for environmental impact.

1. Site No. 1 (South Landfill)

This site was the main base sanitary landfill--used continuously from 1954 until 1956 and intermittently through 1982. From 1954 until about 1961 wastes, including building rubble, yard

debris, and waste from some industrial shop areas, were actively disposed of at this site. The probable path of migration of contaminants, if present at Site No. 1, is vertically downward to the perched ground-water table, then laterally eastward to discharge into Scope Creek. The relatively thick, impervious Lane Shale underlies the site and effectively restricts vertical movement of ground water. During the site visit a small oil sheen, suggesting the presence of leachate, was observed on the surface of a small area of Scope Creek just downstream of the landfill site; no oil sheen was observed upstream. No visible evidence of soil contamination was observed on the banks of Scope Creek at the edge of the landfill. Scope Creek flows through the base and eventually discharges into the Little Blue River, thereby providing a pathway for any hazardous contaminants in the leachate, if present, to enter surface-water bodies and migrate beyond base property.

2. Site No. 2 (Northeast Landfill)

This site was reportedly used between 1961 and 1971 for disposal of miscellaneous waste, including building rubble, yard debris, and wastes from some industrial shop areas. Reportedly, disposal of some waste paint and thinners by spreading of the liquid wastes onto the ground surface has been practiced at this site. Materials in open storage at the site currently include construction rubble, pipes, empty tanks, waste paints and thinners in drums and buckets, and empty 55-gallon drums. Of over 400 drums currently at the site, some contain unknown contents. The probable path of migration

VI. RECOMMENDATIONS

A. PHASE II PROGRAM

A limited Phase II monitoring program is suggested to confirm or rule out the presence and/or migration of hazardous contaminants. The priority for monitoring at Richards-Gebaur is considered moderate since no imminent hazard has been determined.

Tables 8 and 9 present a summary of recommended monitoring sites, parameters to be measured, and the rationale for the analyses. Specifically, monitoring is recommended for the South Landfill (Site No. 1) and the Northeast Landfill (Site No. 2).

1. South Landfill (Site No. 1)

It is recommended that the adjacent creek (Scope Creek) be monitored upstream and downstream of the site to determine if hazardous contaminants are leaching into the creek. The water samples should be analyzed for the parameters indicated in Table 8. The stream should be sampled on two occasions at least 30 days apart to determine the presence of contaminants.

2. Northeast Landfill (Site No. 2)

It is recommended that one shallow monitoring well be installed downgradient of the site to determine if hazardous contamination is present in the area ground water. The well should be drilled to the depth of the top of the underlying Chanute shale (approximately 30 feet deep at this site) and screened from the top of the shale to within

Table 8
RECOMMENDED ANALYSES

<u>Sample Type</u>	<u>Volatile Organic Compounds (VOC)</u>	<u>Heavy Metals</u>	<u>Pesticides</u>	<u>Phenols</u>	<u>pH, Specific Conductance COD, TOC, and Oil and Grease</u>
<u>Surface Water</u>					
South Landfill (Site No. 1)	X	X	X	X	X
<u>Monitoring Well</u>					
Northeast Landfill (Site No. 2)	X	X	X	X	X

GNR70

HAZARDOUS ASSESSMENT RATING FORM

Page 1 of 2

NAME OF SITE: 1. South Landfill

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: Continuous 1954-1961; Intermittent 1961-1982

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Primarily rubble; possible domestic refuse; oil/tar dumps

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

I. RECEPTORS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface-water body	1	6	6	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		<u>Subtotals</u>	<u>69</u>	<u>180</u>

Receptors subscore (100 x factor score subtotal/maximum subtotal)

38

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large)

S

2. Confidence level (C = confirmed, S = suspected)

C

3. Hazard rating (H = high, M = medium, L = low)

H

Factor Subscore A (from 20 to 100 based on factor score matrix)

60

B. Apply persistence factor

Factor Subscore A x Persistence Factor = Subscore B

$$60 \times 0.8 = 48$$

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

$$48 \times 1.0 = \underline{\underline{48}}$$

III. PATHWAYS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	80
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108
Subscore (100 x factor score subtotal/maximum score subtotal)				59
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	1	8	8	24
Direct access to ground water	N/A	8	--	--
		Subtotals	30	90
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 80

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	38
Waste Characteristics	48
Pathways	80
Total 166 divided by 3 =	55
Gross Total	55

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

INSTALLATION RESTORATION PROGRAM

PHASE II

CONFIRMATION/QUANTIFICATION

STAGE 2

**RICHARDS-GEBAUR AIR FORCE BASE
MISSOURI**

Prepared by:
ECOLOGY AND ENVIRONMENT, INC.
Buffalo Corporate Center
368 Pleasantview Drive
Lancaster, New York 14086

July 1988

FINAL REPORT
(September 1986 to November 1987)

VOLUME 1: TEXT

**Approved for Public Release:
Distribution is Unlimited**

Prepared for:

UNITED STATES AIR FORCE
Headquarters Air Force Reserve (HQ AFRES/SGPB)
Robins Air Force Base, Georgia 31098-6001

UNITED STATES AIR FORCE
**Occupational and Environmental Health Laboratory/
Technical Services Division (USAFOEHL/TS)**
Brooks Air Force Base, Texas 78235-5501

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
	EXECUTIVE SUMMARY	1
1	INTRODUCTION	1-1
	1.1 LOCATION AND HISTORY OF OPERATIONS	1-3
	1.2 SITE DESCRIPTIONS	1-6
	1.2.1 Site 1, South Landfill	1-6
	1.2.2 Site 2, Northeast Landfill	1-10
	1.2.3 Site 6, North Burn Pit Area	1-12
	1.2.4 Site 8, Herbicide Burial Area	1-12
	1.2.5 Site 9, Oil-Saturated Area	1-12
	1.2.6 Site 10, Hazardous Waste Drum Storage Area	1-16
	1.2.7 Site 12, POL Storage Yard	1-16
	1.3 SITES NOT INVESTIGATED DURING STAGE 2	1-19
	1.4 TYPES OF CONTAMINANTS INVESTIGATED	1-21
	1.5 FIELD PERSONNEL	1-28
	1.6 SUBCONTRACTORS	1-28
2	ENVIRONMENTAL SETTING	2-1
	2.1 GEOGRAPHIC SETTING	2-1
	2.1.1 Physiography	2-1
	2.1.2 Topography	2-1
	2.2 GEOLOGY	2-1
	2.2.1 Geologic Setting	2-1
	2.2.2 Soils	2-3
	2.2.3 Stratigraphy	2-3
	2.2.4 Structure	2-6

Table of Contents (Cont.)

<u>Section</u>	<u>Page</u>
2.3 HYDROLOGY AND WATER USE	2-6
2.3.1 Surface Water	2-6
2.3.2 Hydrogeology	2-8
2.4 CLIMATE	2-8
 3 FIELD PROGRAM	 3-1
3.1 PROGRAM DEVELOPMENT	3-1
3.2 FIELD INVESTIGATION	3-4
3.2.1 Schedule of Field Activities	3-4
3.2.2 Records Search	3-4
3.2.3 Geophysical Survey Procedures	3-6
3.2.4 Soil Gas Sampling	3-6
3.2.5 Soil, Sediment, and Water Sampling	3-6
3.2.6 Handling of Investigation-Derived Waste	3-16
3.2.7 Site-Specific Investigation Activities	3-18
3.2.8 Laboratory Program	3-29
3.2.9 Variations from Description of Work	3-32
 4 RESULTS AND SIGNIFICANCE OF FINDINGS	 4-1
4.1 INTRODUCTION	4-1
4.2 RESULTS	4-4
4.2.1 Site 1, South Landfill	4-4
4.2.2 Site 2, Northeast Landfill	4-7
4.2.3 Site 6, North Burn Pit Area	4-11
4.2.4 Site 8, Herbicide Burial Area	4-17
4.2.5 Site 9, Oil-Saturated Area	4-19
4.2.6 Site 10, Hazardous Waste Drum Storage Area	4-22
4.2.7 Site 12, POL Storage Yard	4-26
4.3 SIGNIFICANCE OF FINDINGS	4-30
4.3.1 Site 1, South Landfill	4-30
4.3.2 Site 2, Northeast Landfill	4-30
4.3.3 Site 6, North Burn Pit Area	4-30

Table of Contents (Cont.)

<u>Section</u>		<u>Page</u>
4.3.4	Site 8, Herbicide Burial Area	4-31
4.3.5	Site 9, Oil-Saturated Area	4-31
4.3.6	Site 10, Hazardous Waste Drum Storage Area	4-32
4.3.7	Site 12, POL Storage Yard	4-33
5	ALTERNATIVE MEASURES	5-1
5.1	SITE 1, SOUTH LANDFILL	5-1
5.2	SITE 2, NORTHEAST LANDFILL	5-2
5.3	SITE 6, NORTH BURN PIT AREA	5-2
5.4	SITE 8, HERBICIDE BURIAL AREA	5-3
5.5	SITE 9, OIL-SATURATED AREA	5-4
5.6	SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA	5-4
5.7	SITE 12, POL STORAGE YARD	5-4
6	RECOMMENDATIONS	6-1
6.1	SITE 1, SOUTH LANDFILL - CATEGORY I	6-1
6.2	SITE 2, NORTHEAST LANDFILL - CATEGORY III	6-5
6.3	SITE 4, WEST BURN AREA	6-5
6.4	SITE 6, NORTH BURN PIT AREA - CATEGORIES II AND III	6-6
6.5	SITE 8, HERBICIDE BURIAL AREA - CATEGORY II	6-6
6.6	SITE 9, OIL-SATURATED AREA - CATEGORY III	6-8
6.7	SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA - CATEGORY III	6-11
6.8	SITE 12, POL STORAGE YARD - CATEGORY II	6-11
6.9	WELL ABANDONMENT	6-11

Table 2
SUMMARY OF FIELDWORK/ANALYSES PERFORMED

Site	Fieldwork Performed	Analyses Performed
Site 1, South Landfill	<ul style="list-style-type: none"> ● 1 borehole drilled ● 7 soil samples collected ● 4 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC, priority pollutants, common anions, phenols.
Site 2, Northeast Landfill	<ul style="list-style-type: none"> ● geophysical survey ● 4 boreholes drilled ● 2 monitoring wells installed ● 10 soil samples collected ● 5 groundwater samples collected ● 3 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC, priority pollutants, common anions, phenols
Site 6, North Burn Pit Area	<ul style="list-style-type: none"> ● soil gas survey ● 3 boreholes drilled ● 3 monitoring wells installed ● 15 soil samples collected ● 3 groundwater sample collected ● 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, VOC.
Site 8, Herbicide Burial Area	<ul style="list-style-type: none"> ● 4 soil samples collected ● 1 surface water sample collected 	Soils: pesticides, arsenic, mercury. Waters: TDS, pesticides, arsenic, mercury.
Site 9, Oil-Saturated Area	<ul style="list-style-type: none"> ● 1 borehole drilled ● 8 soil samples collected ● 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC, lead. Waters: petroleum hydrocarbons, TDS, VOC, lead.
Site 10, Hazardous Waste Drum Storage Area	<ul style="list-style-type: none"> ● 1 borehole drilled ● 9 soil samples collected ● 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC, EP TOX metals. Waters: petroleum hydrocarbons, TDS, priority pollutant metals, barium.
Site 12, POL Storage Yard	<ul style="list-style-type: none"> ● 3 boreholes augered ● 1 monitoring well installed ● 1 soil sample collected ● 4 groundwater samples collected ● 2 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC.

Table 3
SUMMARY OF RECOMMENDATIONS

Site	Recommendation	Rationale
Site 1, South Landfill	Category I. No further action.	No significant contamination was found during the Stage 2 investigation.
Site 2, Northeast Landfill	Category III. Biannual monitoring for 2 years. Collect and analyze groundwater samples from five existing monitoring wells twice yearly.	To determine changes in groundwater quality because elevated sulphate concentrations were the only indicators of contamination above acceptable limits.
Site 4, West Burn Area	Category II. Perform a soil gas survey and geophysical survey. Install three monitoring wells and collect and analyze groundwater samples. Collect subsurface and surface soil samples.	To determine the exact location of the site and determine if hazardous constituents have migrated from the site.
Site 6, North Burn Pit Area	Category III and II. Biannual monitoring for 2 years. Install two more monitoring wells. Collect and analyze groundwater samples from five monitoring wells twice yearly.	To better characterize the organic contamination of the groundwater.
Site 8, Herbicide Burial Area	Category II. Additional geophysical surveys. Drill four boreholes and collect two soil samples from each borehole.	To determine exact location of trench and analyze soil from within the trench.
Site 9, Oil-Saturated Area	Category III. Excavate and remove contaminated soils.	To reduce risk of potential direct human contact to soils contaminated with petroleum hydrocarbons and lead.
Site 10, Hazardous Waste Drum Storage Area	Category III. Excavate and remove contaminated soils.	To reduce risk of potential direct human contact petroleum hydrocarbons.
Site 12, PQL Storage Yard	Category II. Install four monitoring wells. Collect and analyze groundwater samples twice yearly.	To determine if volatile organic compound contamination has migrated from the site.

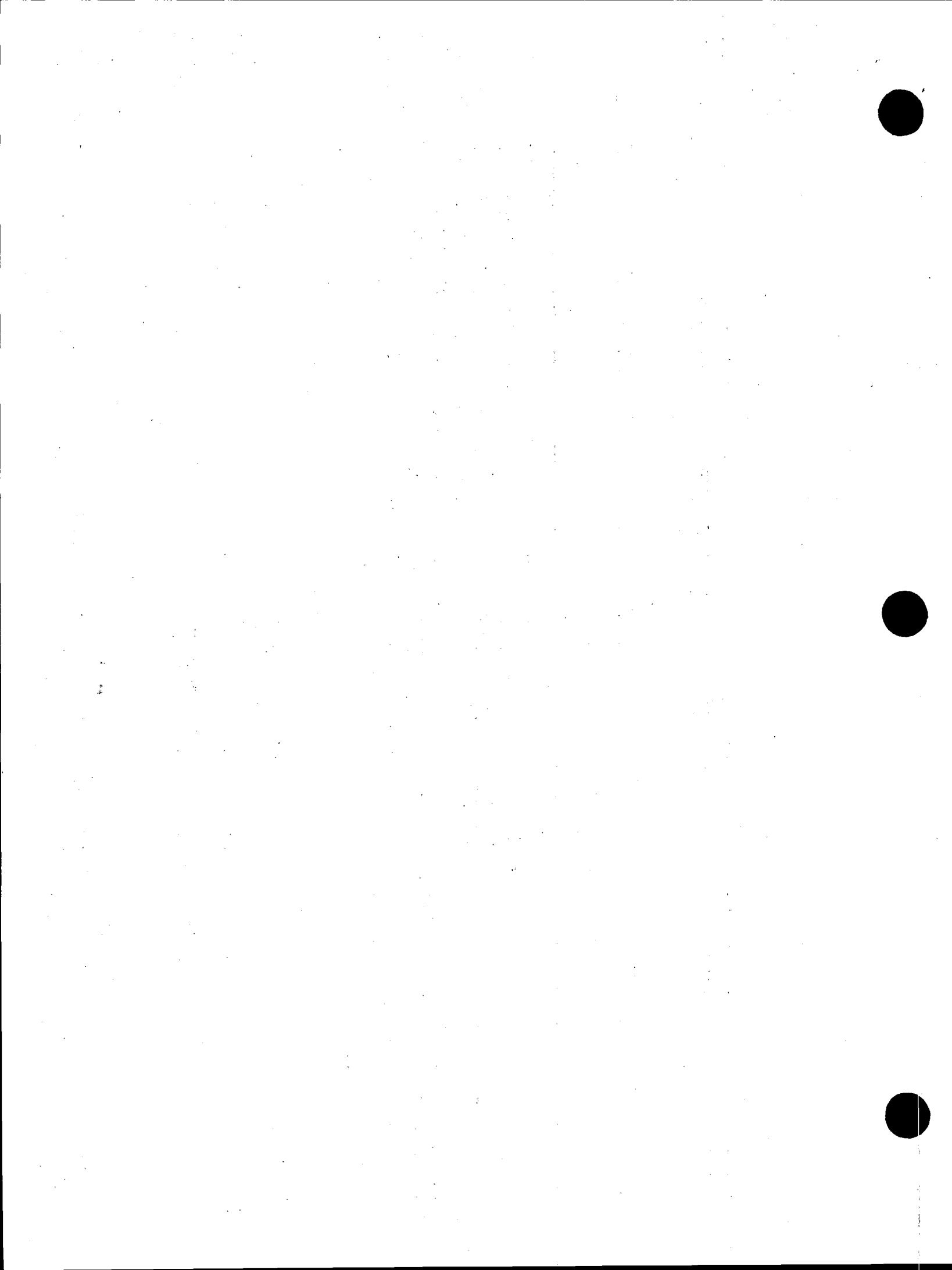
- To define the magnitude and potential of contaminant migration, if possible; and
- To identify potential health and/or environmental hazards based on state or federal standards.

A Phase I Initial Records Search had been conducted by CH2M Hill as outlined in a report dated March 1983. The Phase I report identified sites with potential contamination problems and made recommendations for Phase II investigation. Based on these recommendations, a Phase II Stage 1 investigation was performed on the two sites, Site 1, the South Landfill, and Site 2, the Northeast Landfill, which ranked above 50 on the USAF Hazard Assessment Rating Methodology (HARM) scale ranking system. Preliminary investigation was performed by Water and Air Research, Inc. The results of this investigation were finalized in a report dated December 1983.

In 1985, Richards-Gebaur AFB was scheduled to be reevaluated under the IRP. A presurvey meeting was arranged and all past and current potential sites were visited and evaluated. The presurvey was conducted by E & E and their recommendations were provided in a Presurvey Report dated June 1985.

The sites included in that survey are:

- Site 1, South Landfill,
- Site 2, Northeast Landfill,
- Site 3, Contractor Rubble Burial Area,
- Site 4, West Burn Area,
- Site 5, South Burn Area,
- Site 6, North Burn Area,
- Site 7, Radioactive Disposal Well,
- Site 8, Herbicide Burial Area,
- Site 9, Oil-Saturated Area,
- Site 10, Hazardous Waste Drum Storage Area,
- Site 11, Paint Stripper Hangar,



- Site 12, Petroleum, Oils, and Lubricants (POL) Storage Yard, and
- Site 13, Hazardous Material Storage--Building 927.

Based on this report and after review by state and federal offices, the USAF contracted Phase II Stage 2 investigation of the following sites:

- Site 1, South Landfill,
- Site 2, Northeast Landfill,
- Site 6, North Burn Pit Area,
- Site 8, Herbicide Burial Area,
- Site 9, Oil-Saturated Area,
- Site 10, Hazardous Waste Drum Storage Area, and
- Site 12, POL Storage Yard.

1.1 LOCATION AND HISTORY OF OPERATIONS

The primary source of historical information on the base was the Phase I report by CH2M Hill (1983). The information was confirmed and updated by E & E as part of the Phase II Stage 2 investigation.

Richards-Gebaur AFB is located in west-central Missouri, 2.6 miles from the Kansas-Missouri state line (see Figure 1-1). The Jackson County and Cass County line runs east-west through the middle of the base. The base is bounded on the north by the City of Grandview, on the north and west by Kansas City, and on the south and east by the City of Belton. The base is about 18 miles southeast of downtown Kansas City. Access to the base is via U.S. Highway 71.

The legal description of the base includes the following ranges and townships:

<u>Range</u>	<u>Township</u>	<u>Sections</u>
R46N	T33W	2, 3, 10, 11
R47N	T33W	34, 35

occupation of the former base officer housing area; the U.S. Department of Agriculture Standardization Division; the U.S. Navy Seabee Reserve Mobile Construction Battalion No. 15; 308th Psychological Operations Company; nine U.S. Army reserve units; and the General Services Administration (GSA).

In October 1980, the majority of the base facilities and properties were accessed to the GSA in an interim lease, and joint use of the airport with Kansas City became effective. Base support facilities are currently shared by AFRES, Kansas City, and Talley Services, Inc.

A more detailed description of the base history and its mission can be found in the Phase I Records Search Report.

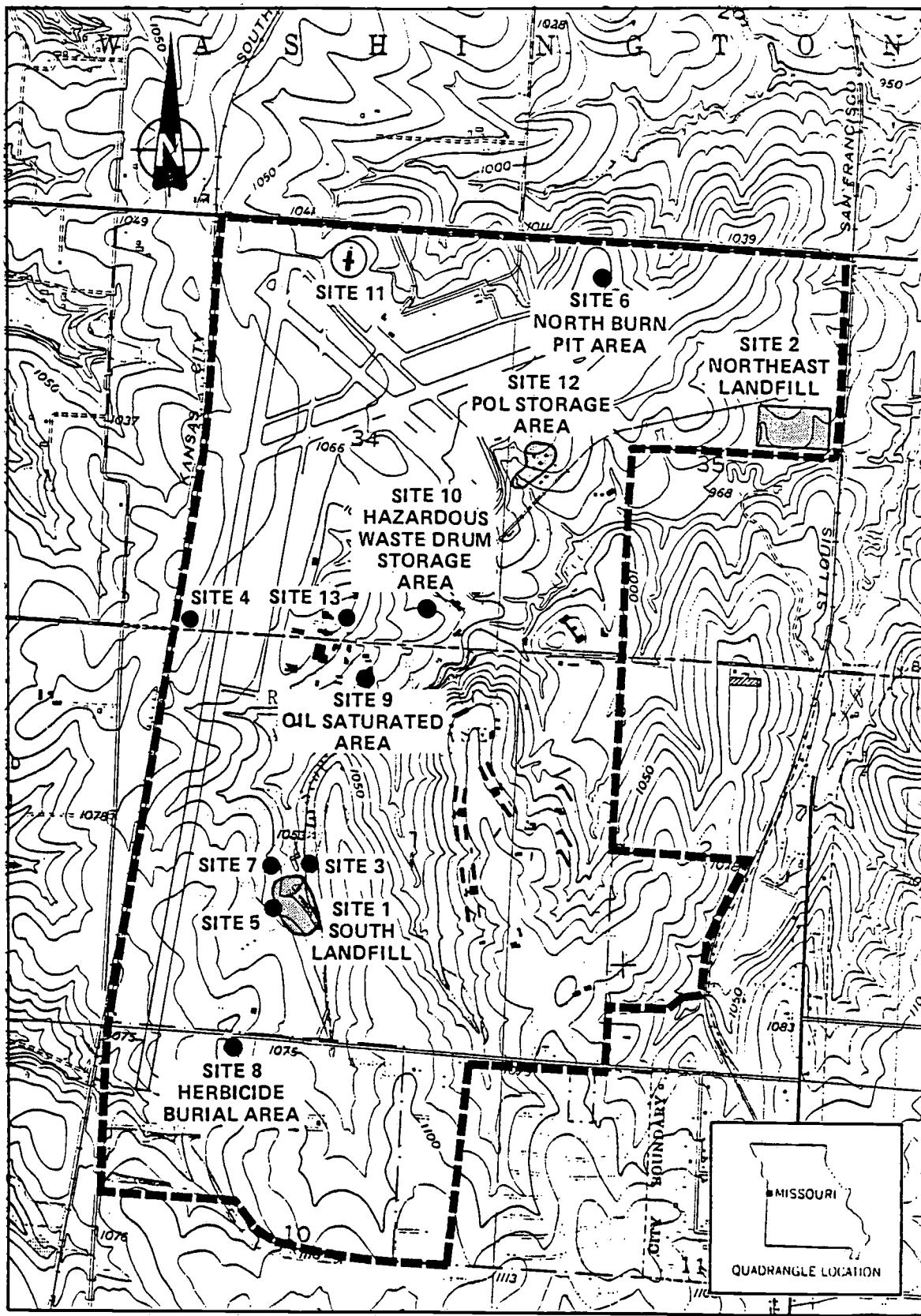
The Air Force controlled property at Richards-Gebaur AFB involves a fairly complex arrangement of ownership, permit use, leases, and easements. Figure 1-2 illustrates the current distribution of various land parcels within the base boundaries. Base property at the present time includes about 2,160 acres, of which 375 acres are retained by the USAF; 1,673 acres are leased to Kansas City and the City of Belton; 101 acres are being transferred to the Department of the Navy; and 11 acres have been transferred to the Department of the Army. An off-base drop zone, the Belton Training Annex, represents another 472 acres of land under the control of Richards-Gebaur AFB.

1.2 SITE DESCRIPTIONS

The primary source of information on the following site descriptions was the Phase I report prepared by CH2M Hill. The information was confirmed and updated by E & E as part of the Phase II Stage 2 investigation. The locations of the sites are shown on Figure 1-3.

1.2.1 Site 1, South Landfill

The South Landfill is located in the south-central part of the base near the nondestructive inspection (NDI) laboratory and adjacent to Scope Creek (see Figure 1-4). Between 1954 and 1956, this site was the main sanitary landfill for Richards-Gebaur AFB. In 1956, contract off-base disposal of most common refuse was begun, although some wastes, including building rubble, yard debris, and waste from some industrial shop areas, were disposed of at the site until about 1961. Materials



SOURCE: U.S.G.S. 7.5' Quadrangle, Belton, Mo.-Kans., 1975.

SCALE
0 $\frac{1}{4}$ 1 MILE

Figure 1-3 RICHARDS-GEBAUR AIR FORCE BASE IRP SITES

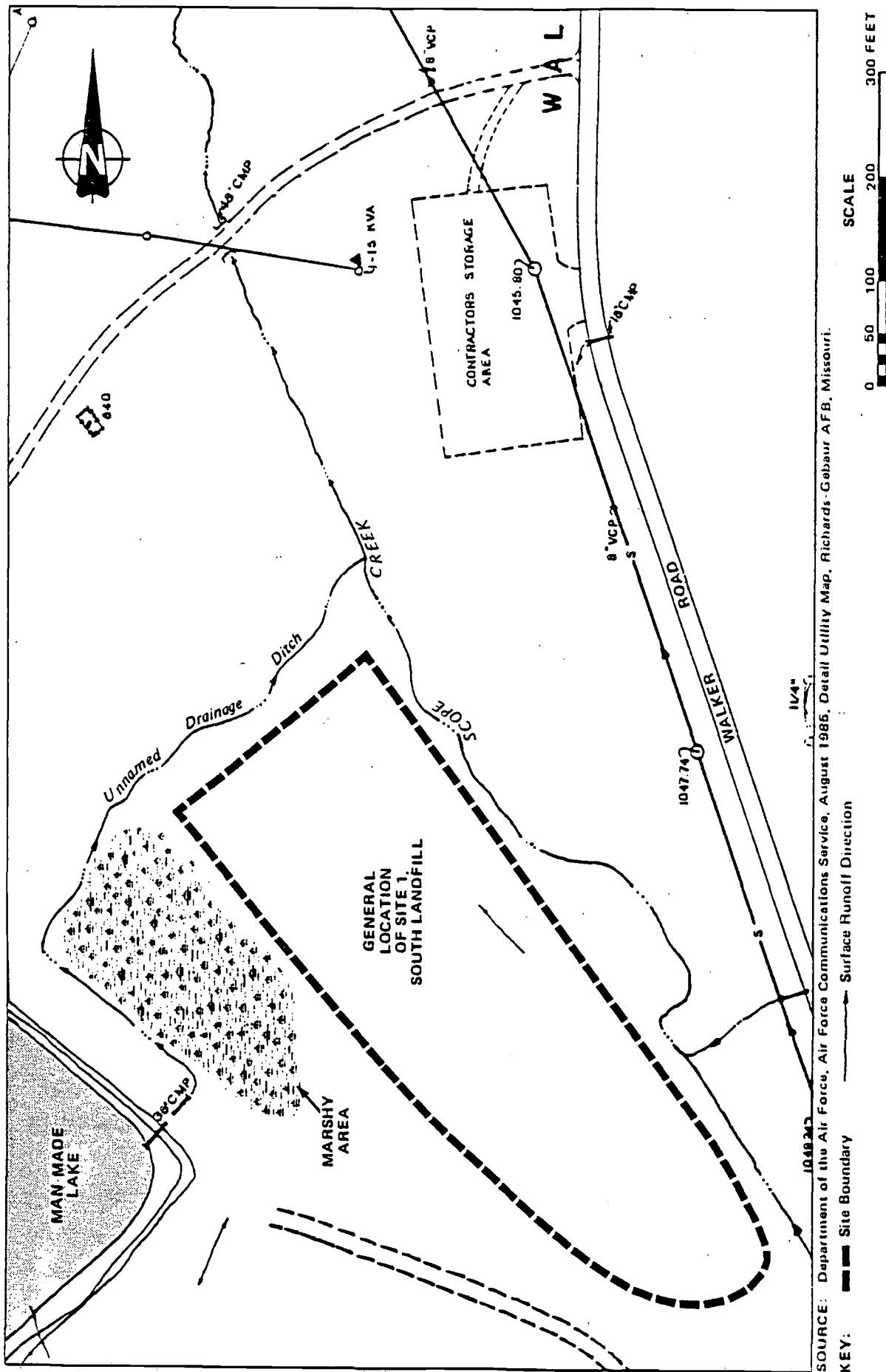


Figure 1-4 SITE 1, SOUTH LANDFILL LOCATION MAP

which may have been disposed of in the South Landfill include small quantities of waste paints, thinners, strippers, solvents, and oils, although it was not standard procedure to dispose of such materials here. Operation of the landfill included burning of the disposed wastes. Since 1961, the area has been used only intermittently for unauthorized dumping, including residues from tar pots and some household wastes. Small quantities of hazardous wastes may have been placed in this landfill; however, no significant hazardous waste quantities were reported. An earthen barricade has been erected at the entrance to the site, and current access to the site is through a locked road gate.

Scope Creek runs along the eastern edge of the landfill and there is a small man-made lake directly west of and upgradient from the landfill. The northwest area of the landfill is marshy due to this lake, and seeps were observed in this area. Scope Creek empties into Little Blue River, which drains most of eastern Jackson County. The Little Blue River empties into the Missouri River.

1.2.2 Site 2, Northeast Landfill

The Northeast Landfill is located in the northeasternmost portion of the base adjacent to Scope Creek (see Figure 1-5). The site was used between 1961 and 1972 for the disposal of miscellaneous wastes, including building rubble, yard debris, and wastes from some industrial shop areas. The eastern portion of Site 2 was used for open storage of materials, including construction materials, pipes, empty tanks, waste paint and thinners in drums and buckets, and empty 55-gallon drums. As many as 400 drums were located in this area at one time. Less than 20 drums, mostly empty, were on-site as of 1986. The wastes were typically burned and buried in trenches. Most of the sanitary wastes at Richards-Gebaur AFB during this time were disposed of off-base through contract removal. Waste paints and thinners at the base were reportedly disposed of on the ground surface as late as 1978.

The Little Blue Valley Sewer District installed a 24-inch diameter reinforced concrete pipe (RCP) interceptor sewer line through the southeast corner of Site 2 in 1983. There was no indication that trash or other landfill material was encountered during construction. The

1.3 SITES NOT INVESTIGATED DURING STAGE 2

Several sites were not investigated during the Stage 2 program. The sites were deleted because they either could not be located or they were located on property leased to the Kansas City Aviation Department, which denied access to all sites on Kansas City Aviation land, except the South and Northeast landfills. Access was not granted because the Phase II Field Evaluation Report, dated December 1983, recommended no further action. The letters denying access to sites 3, 5, 7, and 11 are found in Appendix B. The reason Site 13 was not investigated is unknown. This site was not listed in the Description of Work. The following is a discussion of those sites.

Site 3, Contractor Rubble Burial Site

The Rubble Burial Site is located on the east bank of Scope Creek in the south-central part of the base. It reportedly was in operation from 1954 through 1978. The area is not posted or fenced and appears to have been used more recently than 1978. The area is fairly level and most of the debris is discharged over the bank at the treeline. During the presurvey visit, construction materials, including wood, concrete, masonry, and metal, were observed; however, dense foliage prevented a more thorough investigation. A 5-gallon sealed plastic container of an unidentified liquid was discovered at the base of the fill and brought to the attention of the Richards-Gebaur AFB civil engineer. This area is on land either sold or leased to the City of Kansas City. The Kansas City Aviation Department did not grant access to this site.

Site 4, West Burn Area

The West Burn Area was tentatively identified as being located off the base to the west on the west side of the railroad track and north of the Jackson County line. During the presurvey fieldwork, no evidence of this site could be found. Since the West Burn Area was in operation for only 1 year (1955) approximately 30 years ago, it was thought that there was no physical evidence of this site. However, since the Phase II Stage 2 Field Investigation, aerial photographs not previously available indicate the site may actually be located east of the railroad. During a familiarization tour on August 12, 1987, a material believed to be

tank sludge was found in an area just north of the county line and just east of the railroad tracks. At the time of the fieldwork, the site location was unknown and believed to be off base. Therefore, the site was not investigated.

Any impact that this site might have had will have to take into account the presence of the Knoche oil field 3,000 feet to the south-east. The uplands here are fairly level and the area of the site currently is farmed in corn. A tree nursery is located across the county line to the south.

This site should be investigated further if Kansas City will grant access.

Site 5, South Burn Area

The South Burn Area tentatively has been identified as being located to the southwest of the South Landfill (Site 1). During the presurvey fieldwork, no evidence of this site could be found. Since the South Burn Area was in operation for 10 years (1955 to 1965) approximately 20 years ago, it is possible that there will be no physical evidence of this site at all. Because of its proximity to the South Landfill, any environmental contamination detected at this site will be reviewed in light of findings from the South Landfill investigation. This site is believed to be on land either owned or leased by the City of Kansas City, Missouri. The Kansas City Aviation Department did not grant access for this investigation.

Site 7, Radioactive Disposal Well

The Radioactive Disposal Well is located north of the South Landfill and east of the major flight line. It is believed to have been operated from 1955 to 1970. Discussion during the presurvey visit indicated that low-level radioactive material, typically radium dials, were disposed into this cased well. The site currently is behind a locked gate in an open field. The well itself is very visible, standing 4 to 5 feet high and painted red. This well is located on land owned or leased by the City of Kansas City, Missouri. The Kansas City Aviation Department did not grant access for this investigation. Therefore, no work was performed at this site.

3. FIELD PROGRAM

3.1 PROGRAM DEVELOPMENT

A field program for the Phase II Stage 2 Confirmation/Quantification investigation was developed by E & E and presented in the Presurvey Report submitted on 7 June 1985. The program was reviewed and modified by the Air Force and set forth in the Description of Work for Contract F33615-83-D-4003, Task Order 13.

Elements of the field program included: a soil gas survey, a geophysical survey, sediment sampling, subsurface soil sampling, surface water sampling, installation of groundwater monitoring wells, and groundwater sampling. Various combinations of these program elements were performed at the various sites. Table 3-1 outlines the types of work conducted at each site. By site, the objectives of the fieldwork were:

Site 1 - South Landfill

- Determine if contaminated leachate from the landfill is entering Scope Creek.
- Evaluate potential for vertical migration of contamination.

Site 2 - Northeast Landfill

- Determine past disposal practices at the landfill.
- Delineate the locations of several suspected waste disposal trenches and determine if contamination has resulted.
- Expand monitoring well network to investigate migration of groundwater contamination from possible leaching of landfilled materials.

Table 3-1
FIELDWORK PERFORMED AT EACH SITE

Geophysics	Boreholes	New Monitoring Wells			Soil Samples*	Groundwater Samples*	Surface Water Samples*
Site 1 - South Landfill	--	1	--	--	6	--	3
Site 2 - Northeast Landfill	MAG, EM	4	2	10	5	5	3
Site 6 - North Burn Pit Area	Soil Gas	3	3	15	3	1	1
Site 8 - Herbicide Burial Area	--	--	--	4	--	--	1
Site 9 - Oil-Saturated Area	--	1	--	9	--	--	1
Site 10 - Hazardous Waste Drum Storage Area	--	1	--	9	--	--	1
Site 12 - POU Storage Yard	--	4(h)	1	11	1	1	2
TOTALS		14	6	64	9	12	

*Numbers do not include duplicates or blanks.

Key:
 MAG = Magnetometer survey
 EM = Electromagnetic survey
 (h) = Hand-augered boreholes

Site 6 - North Burn Pit Area

- Determine occurrence of contamination from the site using a soil gas survey.
- Determine occurrence of subsurface soil contamination.
- Determine whether groundwater contamination has occurred.

Site 8 - Herbicide Burial Area

- Identify actual burial area by examining available background information.
- Identify any contaminants in soil in the vicinity of the burial area.
- Evaluate extent of migration of any contaminants via surface drainage pathway.

Site 9 - Oil-Saturated Area

- Evaluate type and extent of surface and subsurface soil contamination.
- Determine if contaminants are migrating via surface drainage pathway.

Site 10 - Hazardous Waste Drum Storage Area

- Evaluate type and extent of surface and subsurface soil contamination.
- Evaluate potential migration of contaminants via surface drainage pathway.

Site 12 - POL Storage Yard

- Determine the extent of any subsurface soil contamination.
- Evaluate extent of migration of contaminants via buried drain lines and surface drainage pathways.
- Determine whether groundwater contamination has occurred and evaluate extent of contamination.

3.2 FIELD INVESTIGATION

The field investigation consisted of:

- Literature and aerial photograph records search;
- A magnetometer and electromagnetic (EM) terrain conductivity survey;
- A soil gas survey;
- The drilling of 10 boreholes;
- The installation of six monitoring wells; and
- Collection and analysis of 27 surface soil and sediment samples, 38 subsurface soil samples, 13 surface water samples, and 9 groundwater samples.

3.2.1 Schedule of Field Activities

Field activities were scheduled so as to optimize the utilization of manpower and resources. Field activities were coordinated with the USAFOEHL, the base Point of Contact (POC), and subcontractors to minimize delays and potential problems.

Throughout the course of the field activities, daily contact was maintained with the designated base personnel. The principal contact was Ms. Felipita Benson, R.N. Additional coordination was through Mr. John Hurd, Base Civil Engineer.

The fieldwork was completed during the period from 6 October 1986 to 4 November 1986. Table 3-2 provides the sequence of major field activities.

Health and safety protocols, as outlined in the Health and Safety Plan (see Appendix N), were followed throughout the project. Modifications of specific elements of the Health and Safety Plan were based on field conditions and executed only after discussion with E & E's Health and Safety Coordinator.

3.2.2 Records Search

During the course of the Phase II Stage 2 investigation, discussions were held with personnel from the Base Environmental Engineering Staff and the Base Civil Engineering Staff regarding past waste disposal practices and likely contaminants. Historical aerial photographs were

Table 3-2
SCHEDULE OF MAJOR FIELD ACTIVITIES
(October to November 1986)

6 October	Fieldwork begins with a reconnaissance of all sites and collection of surface soil samples.
6-8 October	Geophysical survey at Site 2, Northeast Landfill.
7-9 October	Soil gas survey at Site 6, North Burn Pit Area.
14 October	Drillers on site, set-up decontamination areas at Site 6, North Burn Pit Area and vehicle wash racks.
15 October	Three soil borings drilled, sampled, and grouted at Site 6, North Burn Pit Area.
16 October	Six monitoring wells drilled, pipe set, soil samples collected, and wells completed; three are at Site 6, North Burn Pit; two at Site 2, Northeast Landfill; and one at Site 12, POL Storage Yard. One well at Site 6, North Burn Pit Area was a borehole completed as a well.
17 October	Six soil borings drilled, samples collected, and the holes grouted, one at the Motor Pool Compound; one at the former hazardous waste storage yard; one at Site 1, South Landfill; and three at Site 2, Northeast Landfill.
18 October	Development of new wells and cleanup of drilling and staging areas.
21 October	Wells purged and groundwater samples collected.
23 October	The remaining surface soil and surface water samples collected from Site 2, Northeast Landfill; and Site 1, South Landfill.
28 October, 4 November	Hand-auger borings at Site 12, POL Storage Yard.
4 November	End of sampling.

examined to provide information on waste disposal practices at the base. Aerial photos were helpful in locating and delineating several sites which were not clearly visible during the Presurvey field trip. Table 3-3 lists the photos which were available for review.

3.2.3 Geophysical Survey Procedures

Magnetometer and EM surveys were performed concurrently at Site 2, Northeast Landfill, in an effort to locate what were thought to be discrete landfill trenches at this site, preliminary to placing groundwater monitoring wells. The magnetometer survey is designed to locate magnetically conductive materials in landfills, which are generally more conductive than the surrounding soils. Anomalies in magnetic flux are measured by the magnetometer and recorded in the field notebook. The EM conductivity survey measures the conductivity of the soil or any variations in the conductivity of the soil. Excavations for landfills change the natural conductivity by changing the porosity and density of the soils and altering the normal values of conducting fluids in the soils. Presumed locations of the trenches were delineated in a map provided by the Base Civil Engineer.

A Geometrics Model G-846 proton procession magnetometer with a sensitivity of 0.1 gammas and a Geonics Model EM-31 terrain conductivity meter with an effective exploration depth of 6 meters were used.

3.2.4 Soil Gas Sampling

A soil gas survey was performed at Site 6, the North Burn Pit Area, in an effort to identify potential residual contamination from the burning and handling of flammable liquids. The soil gas data were used to aid in locating the groundwater monitoring wells. The survey was performed by hand-driving perforated pipes in and around the compound. After capping each pipe and allowing it to stand for 15 minutes, the hole was monitored using an Organic Vapor Analyzer (OVA) to determine the presence or absence of volatile compounds.

3.2.5 Soil, Sediment, and Water Sampling

Soil, sediment, and water sampling protocols were followed as outlined in the Technical Operations Plan (Appendix N), except for

Table 3-3
SUMMARY OF HISTORIC AERIAL PHOTOGRAPHS
FOR AREA AROUND RICHARDS-GEBAUR AFB

Year	Scale	Source	Availability
1936	1:20,000	NARS	--
1940	1:20,000	MARC	--
1948	1:17,000	EROS, USGS	--
1950	1:70,000	EROS, USA	--
1953	1:20,000	ASCS	--
1955	1:13,000	EROS, USGS, USAF (shows West Burn Pit)	Reviewed
1957	1:20,000	ASCS	--
1959	1:12,000	COE	--
1960*	1:12,000	City of Grandview (shows borrow pits north of Northeast Landfill)	Reviewed
1963	1:18,000	USGS	Reviewed
1963	1:20,000	ASCS	--
1970	1:24,015	EORS	--
1972*	1:12,000	City of Grandview (shows active Northeast Landfill)	Reviewed
1975	1:40,000	EROS	--
1978	1:72,500	EROS	--
1980	1:80,000	EROS	--
1982	1:58,000	EROS	--
1982	1:80,000	EROS	--

Key:
 EROS = EROS Data Center, SD
 MARC = Mid America Regional Council, MO
 ASCA = American Soil Conservation Agency
 COOE = Army Corps of Engineers
 USGS = United States Geological Survey
 USA = United States Army
 NARS = National Archives

*Not on federal archive list; does not cover south half of base.

samples collected for volatile organic analysis (VOAs). These were discrete samples collected prior to homogenization (blended to result in a more uniform sample). The portion of the sample collected for VOAs was cut from the center of the sample and placed directly into 40-ml vials.

All samples were split in the field when enough sample material was available. Split samples were delivered to the base POC. The POC determined those splits which were to be submitted to OEHL/SA for analysis. The split samples for analysis were provided by the POC to E & E for shipment to OEHL/SA.

Sediment Sampling

Sediment sampling was conducted in association with Site 1, South Landfill; Site 6, North Burn Pit Area; Site 8, Herbicide Burial Area; Site 9, Oil-Saturated Area; Site 10, Hazardous Waste Drum Storage Area; and Site 12, POL Storage Yard. A total of 27 samples were collected and submitted for chemical analysis. Table 3-4 presents a summary of the samples collected.

Sediment samples were collected using shovels to loosen an 8-inch cube of sediment from which a vertical column was removed using a stainless steel spoon. The soil column was homogenized in a disposable aluminum pan and then splits were placed in two sampling containers. Spoons were decontaminated and all pans were disposed of after sample collection from each location.

Subsurface Soil Sampling

Subsurface soil samples were collected from 5-foot-long split-spoon samplers during the drilling of the boreholes and monitoring wells. Borehole and monitoring well drilling was performed by Geotechnology, Inc., of St. Louis, Missouri. Table 3-5 provides a summary of borehole depths.

Ten boreholes were drilled and 28 subsurface soil samples were collected and submitted for analysis. Boreholes were drilled for the specific purpose of obtaining subsurface soil samples; however, one borehole (Boring 4) was scheduled to be completed as a monitoring well. A total of 186.5 linear feet of drilling was accomplished using a Mobile

Table 3-4
SUMMARY OF SURFACE SOIL SAMPLING

Site No.	Field Sample No.	Sample Location and Description
1	DF4067	Scope Creek - Background at Markey and Bates
	DF4069	Scope Creek - Downstream of South Landfill
	DF4070	Scope Creek - Seep 1 east of South Landfill
	DF4077	Scope Creek - Seep 2 northeast of South Landfill
6	DF4001	North Burn - 100 feet east of eastern fence center
	DF4002	North Burn - 200 feet east of eastern fence center
	DF4003	North Burn - 100 feet north of northern fence drainage
	DF4004	North Burn - Southeast corner fence, 200-300 feet
	DF4005	North Burn - 25 feet south of southwestern corner of fence
	DF4014	North Burn - 100 feet northwest of northwest corner of fence
8	DF4015	Herbicide Burial Area - 300 feet south of Markey
	DF4016	Herbicide Burial Area - 25 feet east of DF4015
	DF4017	Herbicide Burial Area - 25 feet east of DF4016
	DF4018	Herbicide Burial Area - 100 feet south of Markey
9	DF4007	Oil-Saturated Area - Southwest corner of Motor Pool
	DF4008	Oil-Saturated Area - Southwest corner +25 feet
	DF4009	Oil-Saturated Area - Southwest corner +50 feet
	DF4010	Oil-Saturated Area - Outside southwest corner, 0-100 feet
	DF4011	Oil-Saturated Area - Outside southwest corner, 100-200 feet
	DF4012	Oil-Saturated Area - Outside southwest corner, 200-300 feet
10	DF4019	Hazardous Waste Drum Storage Area - Background from athletic field
	DF4020	Hazardous Waste Drum Storage Area - North of gate to compound
	DF4021	Hazardous Waste Drum Storage Area - West corner of fence, 0-26 feet
	DF4022	Hazardous Waste Drum Storage Area - West corner of fence, 26-60 feet
	DF4023	Hazardous Waste Drum Storage Area - West corner of fence, 60-120 feet
	DF4024	Hazardous Waste Drum Storage Area - South corner +25 feet
12	DF4088	POL Storage Yard - Culvert at Bldg. 952

Table 3-5
SUMMARY OF SOIL BORINGS

Site No.	Boring Designation	Total Depth (feet)
1	Boring #7	7.1
2	Boring #4	9.8
	Boring #8	7.9
	Boring #9	13.0
	Boring #10	8.5
3	Boring #1	12.9
	Boring #2	13.0
	Boring #3	14.5
5	Boring #5	16.5
6	Boring #6	15.0
7	Hand Boring #1	6.0
	Hand Boring #2	6.0
	Hand Boring #3	6.0
12	Hand Boring #4	6.0

alternatively, dispersed in Site 6, North Burn Pit Area. Development and purge waters were placed in the North Burn Pit to evaporate.

3.2.7 Site-Specific Investigation Activities

As discussed above, fieldwork at each site consisted of some combination of geophysics, soil boring, subsurface soil sampling, and groundwater sampling. Activities at the individual sites are discussed below.

Site 1, South Landfill

A single upgradient soil boring was drilled southwest of the landfill (Boring 7) and three subsurface soil samples collected. The actual eastern boundary of the landfill is the west bank of Scope Creek. Therefore, it was impossible to drill a boring downgradient without penetrating the waste and jeopardizing the integrity of the landfill. Four surface soil samples were collected: a background sample adjacent to Scope Creek upstream of the landfill; one at Seep 1 where the seep enters Scope Creek; one at Seep 2 where the seep enters Scope Creek; and one adjacent to Scope Creek downstream from the landfill. Four surface water samples were collected: from Seep 1 and Seep 2 where the seeps enter Scope Creek, and from Scope Creek at the upstream (background) and downstream sampling points.

Figure 3-1 shows the sampling locations for this site.

The four water samples were analyzed for petroleum hydrocarbons, total dissolved solids, halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols. The soil samples were analyzed for halogenated and aromatic organics and petroleum hydrocarbons.

Site 2, Northeast Landfill

Magnetometer and conductivity surveys were performed at this site to locate what were originally believed to be three discrete trenches. A grid system was staked over the survey area. The grid extended beyond the expected landfill boundaries in order to define the boundaries. The grid sections were 100 by 100 feet. Every 25 feet along each grid line, three readings were taken with the magnetometer and averaged, and one

times is provided in Appendix H. All samples were shipped to the E & E Analytical Services Center (ASC) or to OEHL/SA by overnight Federal Express. Analytical protocols are discussed in Appendix N.

3.2.9 Variations from Description of Work

During the execution of the fieldwork, several changes from the Description of Work were implemented due to field conditions and findings. Changes were implemented after discussion with and concurrence of the OEHL project manager. A site-specific summary of the variations follows.

All Sites

Subsurface soil borings were taken using a CME continuous sampler. This unit is essentially a 5-foot-long split-spoon soil sampler that is advanced ahead of the hollow-stem auger. It provides a continuous undisturbed sample of the sediment column.

Optional water samples, allocated in case groundwater was intersected during the borehole drilling for subsurface soil samples, were not utilized as no appreciable amounts of groundwater were observed in any boreholes.

Site 1, South Landfill

No modifications in the proposed scope of work occurred at this site.

Site 2, Northeast Landfill

The geophysical surveys were adjusted in the field to cover areas adjacent to the targeted area, based on instrument readings which indicated the entire targeted area as landfill. This was later corroborated based on aerial photographs.

Boring 7 was aborted after encountering the apparent edge of the landfill. Only one of the three scheduled soil samples from this borehole was collected.

An additional surface water sample was collected, from a flowing tributary to Scope Creek just before it enters the creek. This sample represented runoff from the landfill prior to dilution in Scope Creek.

The sample replaced a water sample which could not be taken at Site 6, where no water was encountered.

Site 6, North Burn Pit Area

Due to the absence of any appreciable amounts of water in two of the three monitoring wells at the site, analyses could only be performed for halogenated and aromatic organics. Petroleum hydrocarbons had to be omitted. Two additional attempts to collect sufficient sample volumes also failed.

No determination could be made as to upgradient versus downgradient with respect to monitoring wells. The facility is situated on the top of a ridge.

Site 8, Herbicide Burial Area

No modifications in the proposed scope of work were made at this site.

Site 9, Oil-Saturated Area

No modifications in the proposed scope of work occurred at this site.

Site 10, Hazardous Waste Drum Storage Area

An upstream surface water sample could not be obtained since no water was encountered.

Site 12, POL Storage Yard

A surface water sample from the outfall drain from Building 953 was allocated. However, there was no outfall from this building, and so no sample was collected.

Due to errors in sample labeling in the field, two analytical parameters listed in the Description of Work were inadvertently omitted. These errors affected the proposed analytical program as follows:

- Sample DF4045 - No TDS analysis was performed on this sample.

Table 4-3

RESULTS OF SOIL SAMPLE ANALYSES
FOR SITE 1, SOUTH LANDFILL(mg/kg; all soil concentrations
expressed on an as received basis)

Parameter	Date Sampled:	10/17	10/17	10/17	10/21 Upstream	10/21 Downstream	10/21 Seep 1	10/21 Seep 2
Boring:	7	7	7					
Depth:	1-2'	4-5'	6-7'	0 - 6"	0 - 6"			
Field No.:	DF4047	DF4048	DF4049	DF4067	DF4069	DF4070	DF4077	
Lab No.:	8972	8973	8974	9090	9091	9092	9236	
<hr/>								
Volatile Organic Compounds		ND	ND	ND	ND	ND	ND	ND
Petroleum Hydrocarbons		ND	ND	1.2	ND	ND	1.9	16

ND = Not Detected

Nearly all Organic Vapor Analyzer (OVA) readings were positive. The laboratory analyses indicated that none of the nine subsurface samples was contaminated with volatile organics. The probable explanation for the positive result in the soil gas survey and the negative result in the subsurface soil samples is that the OVA was detecting methane, which would not be detected in the soil samples. The fact that OVA readings remained constant when using a carbon filter further supports this conclusion.

The values for petroleum were also low and consistent among the samples (ND to 5.7 mg/kg), with the exception of sample DF4001, collected 100 feet east of the southeast corner of the fence line, which contained 34 mg/kg. Table 4-7 summarizes the results of the soil analyses.

4.2.4 Site 8, Herbicide Burial Area

Geology

Site 8, the Herbicide Burial Area, is similar in setting to Site 6, the North Burn Pit Area, and the Site 1, the South Landfill. The site is on an upland surface where silts and clays cover a weathered limestone bedrock. The original topography of the base has been modified by construction and extension of the major north-south runway. The area is nearly level, with broad shallow depressions and a small pond downgradient to the south.

A broad shallow depression was observed in the area of the suspected trench location based on AF 103. Water had ponded in this area and drained east into other wet areas. It is not known if the shallow depression was caused by possible subsidence of the 1971 trench or is due to construction activities since that date.

Hydrogeology

Based on observations made on other upland sites on the base, it can be assumed that the thickness of the unconsolidated deposits above the bedrock at this site is less than 7 feet. The burial trench was projected to be 6 feet in depth, which places the bottom of the trench very close to, if not directly on, the weathered bedrock surface. The hydrological implication is that the material that was buried, and

Table 4-9
 RESULTS OF SOIL SAMPLE ANALYSES FOR
 SITE 8, HERBICIDE BURIAL AREA
 (mg/kg; all soil concentrations on an as received basis)

Parameter	Date Sampled:	10/10	10/10	10/10	10/10
	Boring#:	HBAS-1	HBAS-2	HBAS-3	HBAS-4
	Depth:	0-1'	0-1'	0-1'	0-1'
	Field No.:	DF4015	DF4016	DF4017	DF4018
	Lab No.:	8796	8797	8798	8799
<hr/>					
Herbicides		ND	ND	ND	ND
Arsenic		1.83	5.0	ND	4.53
Mercury		ND	ND	ND	ND
<hr/>					

ND = Not Detected

4.3 SIGNIFICANCE OF FINDINGS

4.3.1 Site 1, South Landfill

No contamination was detected leaving this site via surface migration into Scope Creek, based on the analyses of surface soil and water samples. Relatively low concentrations of petroleum hydrocarbons (1.2 mg/kg, 16 mg/kg) were detected in the subsurface soils. The extractable organic compound DBP, the only organic compound detected, was at low concentrations (10 to 16 µg/L), but it also appeared in the method blank (below 10 µg/L). Consequently, DBP has been attributed to laboratory contaminants.

4.3.2 Site 2, Northeast Landfill

With the exception of the extractable DBP, no organic chemicals or metals were reported in any water samples taken at the site. Because DBP was reported in concentrations (14 to 17 µg/L) minimally above sample blank value (13 µg/L), the presence of this chemical has been attributed to laboratory contamination.

Five anions were reported above detection limits. Only a single sample of sulfate at 280 µg/L exceeded a standard or criterion. Since this is a non-mandatory secondary standard set for aesthetic (taste and odor) considerations, the relatively minor exceedance, and the fact that there is no drinking water well nearby, should not represent any material threat to human health.

For soils, no metals exceeded normal ranges for western Missouri soils. The only detectable contaminant was petroleum hydrocarbons, reported at concentrations ranging from non-detectable to 440 mg/kg.

4.3.3 Site 6, North Burn Pit Area

Only three organics (chloroform, tetrachloroethylene, and methylene chloride) were detected in water samples from Site 6. Concentrations of two of the organics (below 1 µg/L) were significantly below EPA HAs. The third, methylene chloride, detected in a single groundwater sample, was well below the EPA HA.

No metals were reported above normal ranges for western Missouri soils. The only organic contaminant reported in soils above detection

have been associated with the storage of drummed hazardous materials here. These efforts included: overpacking drums, removal of stained soil, and scraping the asphalt surface. These efforts were undertaken as a result of a Notice of Violation issued by EPA.

4.3.7 Site 12, POL Storage Yard

The one groundwater and two surface water samples taken at Site 12, the POL Storage Yard, revealed no contamination above detection limits. In the 12 soil samples, petroleum hydrocarbon concentrations were relatively low (6.9 to 44 mg/kg). Removal of soils in the areas of the seven samples with higher concentrations (67 to 2,800 mg/kg) should be considered. In addition, a single sample collected near the drain pipe outlet for Building 953 at a depth of 3 feet contained concentrations of benzene (1.25 mg/kg), total xylenes (2.25 mg/kg), and ethylbenzene (6.25 mg/kg), indicative of contamination by gasoline or a similar petroleum hydrocarbon.

limits was petroleum hydrocarbons. Concentrations of petroleum hydrocarbons in 14 of the 15 samples taken at various depths ranged from non-detectable to 5.4 mg/kg. A single surface sample had a value of 34 mg/kg. In summary, the low concentrations found at the site indicate no undue risk to human health or the environment.

4.3.4 Site 8, Herbicide Burial Area

No detectable concentrations of any contaminant were reported in the single surface water sample taken at Site 8. Concentrations of metals in the four surface soil samples did not exceed the normal range of concentrations reported in western Missouri soils. In addition, no organic contamination was detected in the soil samples. Consequently, the data do not indicate that Site 8 presents an undue risk to human health or the environment.

4.3.5 Site 9, Oil-Saturated Area

No contaminants were detected in the single surface water sample at Site 9.

Results of the soil sample analyses indicate significant lead and petroleum hydrocarbon contamination of site soils. In six of nine samples, concentrations of lead fell within the normal range for western Missouri soils. In the same samples, petroleum hydrocarbon concentrations were relatively low (non-detectable to 9 mg/kg). In the remaining three samples, however, lead concentrations (117 to 343 mg/kg) greatly exceeded the normal range (10 to 20 mg/kg). In these same samples, petroleum hydrocarbons were also high (670 to 3,000 mg/kg). As these were samples taken from the surface (0- to 1-foot depth), humans would be subject to direct contact with high concentrations of lead from the site, warranting consideration of removal.

For the purpose of analyzing the potential human health risk related to lead exposure, it is assumed that humans ingest a maximum of 1 gram of soil daily during activities at the site. This number is extremely conservative (health protective), as it is based on the soil intake for small children--that segment of the population with highest soil intake as estimated by the Agency for Toxic Substances and Disease Registry (ATSDR 1986). Assuming 100% absorption of soil contaminants in

1 gram of soil, these intakes attributable to ingestion of onsite soils are then compared to the daily intake of lead regarded by EPA as acceptable as demonstrated by the current use of this limit in developing the RMCL of 20 µg/L for lead.

An Acceptable Daily Intake (ADI) for adults related to soil lead ingestion has been derived based on the EPA proposed RMCL of 20 µg/L and the following assumptions:

- Ingestion of 2 liters per day (L/day) for a 70-kg adult.
- Twenty percent of the ADI is contributed by water ingestion. This assumption is based on methodologies used to estimate revised drinking water standards (EPA 1985a).
- Intake of lead except by ingestion of drinking water and by the soil-related pathways is minimal.

For an adult:

$$20 \text{ } \mu\text{g/L} \times 2 \text{ L/day} = 40 \text{ } \mu\text{g/day from ingestion of water}$$

$$40 \text{ } \mu\text{g/day} + 0.2 = 200 \text{ } \mu\text{g/day from all sources}$$

$$200 \text{ } \mu\text{g/day} - 40 \text{ } \mu\text{g/day} = 160 \text{ } \mu\text{g/day from all sources excluding water ingestion, which is the Adjusted Acceptable Daily Intake (AADI) for soil for adults}$$

In order that the AADI not be exceeded, the corresponding soil concentration must be no higher than 160 mg/kg.

4.3.6 Site 10, Hazardous Waste Drum Storage Area

The storage of hazardous waste drums in this compound does not appear to have contaminated the surface and subsurface soils. The only contaminants in soil were petroleum hydrocarbons, with concentrations ranging from non-detectable to 1,900 mg/kg. In six of the nine samples, concentrations were low (less than 9 mg/kg). However, concentrations were high (670 to 3,000 mg/kg) in three samples taken at 0- to 1-foot intervals, and removal of soils from these areas should be considered. The single surface water sample contained barium (85 µg/L) and lead (5 µg/L) significantly below the EPA standards or criteria. No other contaminants were detected in the sample. It appears that the remedial efforts undertaken at this site have cleaned up any problems that may

5. ALTERNATIVE MEASURES

This section discusses the alternative measures that can be taken at each of the seven sites. The alternatives have been devised based on the results of the Phase II Stage 2 investigations. A "no-action" alternative is considered for each site. Recommendations as to the most appropriate alternatives are presented in Section 6.

5.1 SITE 1, SOUTH LANDFILL

No significant contamination of surface water, surface soils, or subsurface soils was found at this site. Minor amounts of petroleum hydrocarbons (less than 16 mg/kg) were detected in one of the surface runoff pathways and at the base of the borehole. No monitoring wells exist on this site.

Alternatives for this site include:

- No action. This alternative is applicable should it be decided that the levels of contaminants detected in the samples do not require further action.
- Long-term monitoring. Seasonal fluctuations in groundwater and rainfall could have accounted for the minor amount of seepage found in the Phase II Stage 2 investigation. Under this alternative, areas of the two known seeps would be resampled periodically and searches would be made for additional seeps.
- Installation of upgradient monitoring wells. Two wells could be installed in association with this landfill, one to the west and one to the south. The west well would test the marshy area which is the source for Seep 2; the south well would determine if sufficient recharge for water samples to be taken could be developed from the area of Borehole 7. This borehole showed a small amount of water and traces of hydrocarbons near its base. The south well

might also indicate whether contaminants have migrated from the South Burn Pit Area, an area that was never clearly located and was not part of the Phase II Stage 2 investigation. The South Burn Pit Area was believed to be located south of the South Landfill.

5.2 SITE 2, NORTHEAST LANDFILL

No significant contamination was detected in association with this site. The utilization of the site for landfilling operations is much more extensive than was previously thought. A soil sample taken from below the fill material indicates that the liquids in the landfill are not penetrating into underlying soil. In two samples at the 1- to 2-foot depth, petroleum hydrocarbons were reported at 78 and 440 mg/kg. This landfill, no longer USAF property, is leased to Kansas City Aviation Company and is being used to store excess property and large refuse items. The USAF should survey the perimeter of the landfill area and present this information to the current property owner and include it in the deed to the property. This will alert the owner as to any limitations on future uses of the land, including future construction and improvements. Already, a sewer line has been cut through the south edge of the landfill. It is not known what effect the intersection with the landfill will have on the integrity of that sewer system in the years to come.

Alternatives for this site include:

- No action. If it is determined that there is no threat to the surrounding environment, no further action would be necessary.
- Long-term monitoring. As part of the base groundwater sampling plan, the five wells at the landfill could be sampled to monitor the continued integrity of the landfill and as a check on the area groundwater quality.

5.3 SITE 6, NORTH BURN PIT AREA

Three volatile organics were detected in perched groundwater at this site--chloroform and tetrachloroethylene at concentrations significantly below drinking water standards or criteria, and methylene chloride in a single sample at a concentration of 37 µg/L, an order of magnitude below the EPA drinking water health advisory. There is very little groundwater, and no deep aquifers are threatened. Soil gas

readings indicated that organic vapor contamination is confined within the perimeter of the site. Soil contamination was limited to low concentrations of petroleum hydrocarbons, which were not found in any water sample.

Alternatives for this site include:

- No action. This alternative would be applicable if it is decided that the levels of contaminants detected in these samples do not warrant action. The concentrations observed have been below federal drinking water standards and there are no receptors.
- Long-term monitoring. Seasonal rainfall could recharge the two wells on this site which were essentially dry at the time of the Phase II Stage 2 investigation. The wells could be monitored for evidence of a contaminant plume by sampling for organic contamination.
- Installation of additional monitoring wells. The northeast monitoring well could be nested with a deeper well (drilled to bedrock) to determine if the organic contamination observed in the shallow wells is migrating along the weathered bedrock interface. A monitoring well could be installed outside the compound to the east, near the outfall from the oil-water separator. This would provide a check on the efficiency of this unit and could aid in locating seeps from lower stratigraphic units.

5.4 SITE 8, HERBICIDE BURIAL AREA

There is no conclusive data on the location of the trench or the characterization of this site. No soil borings were made and so no subsurface soil samples were collected.

Alternatives for this site include:

- No action. If it is determined on the basis of present information that the amounts of herbicides buried at this site and the mode of containment do not constitute an environmental problem, no further action would be necessary.
- Additional investigation. Additional effort to locate the trench should include locating and examining aerial photographs not previously available and performing a ground conductivity survey over the suspected area. Once the trench is located, testing and sampling could begin by drilling a series of 10-foot boreholes in the four corners of the trench area. Also, a sediment sample could be taken from the pond downgradient of the trench.

5.5 SITE 9, OIL-SATURATED AREA

Surface soil was found to be contaminated with petroleum hydrocarbons and lead. Levels of lead exceeded 160 mg/kg, the criterion derived for protection of human health (see Section 4.3.5). In addition, concentrations of petroleum hydrocarbons in three of the nine soil samples in the 0- to 1-foot depth were very high. Access to the site, and therefore to these materials, is limited.

Alternatives for this site include:

- No action. Since there is little chance of direct contact, it may be determined that the levels of contaminants detected do not warrant further action.
- Preparation for Phase IV actions. This action would require the removal of contaminated soils and gravel, after identifying the volume to be removed.

5.6 SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA

Only minor contamination of surface water was detected in association with this site. The concentrations of the two contaminants detected, lead and barium, were below drinking water standards. Petroleum hydrocarbon values were high (up to 1,900 mg/kg) along the south fence line. The sources may include spillage, dripping from the numerous heavy vehicles and smaller vehicles (grass mowers) now present in this compound. Storage of drums containing petroleum products in the compound may also have been a source.

Alternatives for this site include:

- No action. Due to the absence of detectable contamination resulting from the storage of hazardous waste drums at this site, no further action is warranted.
- Identification of petroleum hydrocarbon hot spots. This option would require delineating the areas of high petroleum hydrocarbon contamination, in preparation for removal actions (Phase IV).

5.7 SITE 12, POL STORAGE YARD

Site 12, the POL Storage Yard, is the distribution center for all fuels and propellants on the base. The groundwater south of the

facility is free from contamination. Soils inside the tank berms indicate significant petroleum hydrocarbon accumulations (concentrations ranged upwards to 2,800 mg/kg). Volatile organic contamination was detected in the subsurface outside of Building 953, a pumphouse. Additional pumphouses are present, but were not sampled. The contaminated soil sample came from an area where a broken drain pipe from the pumphouse is thought to be located.

Alternatives for this site include:

- No action. If the levels of contaminants identified are determined not to be excessive for present operation of the site, then no further action is warranted.
- Long-term monitoring. After the installation of a monitoring well during Phase II Stage 2, sampling and analysis of this well on a periodic basis would serve to monitor groundwater conditions at this site.
- Additional subsurface soil sampling. The area of greatest environmental concern is located east of the pumphouses. A series of shallow hand-auger borings could be taken in a grid pattern to determine the extent of organic contamination in the soil.

Table 6-1

LIST OF SITES BY CATEGORY

Category I - No Further Action Recommended

- Site 1: South Landfill

Category II - Additional Site Assessment Recommended

- Site 4: West Burn Area
- Site 6: North Burn Pit Area
- Site 8: Herbicide Burial Area
- Site 12: POL Storage Yard

Category III - Remedial Action Recommended

- Site 2: Northeast Landfill
 - Site 6: North Burn Pit Area
 - Site 9: Oil-Saturated Area
 - Site 10: Hazardous Waste Drum Storage Area
-

Table 6-2
SUMMARY OF RECOMMENDATIONS

Site 1 - South Landfill

- No further action.

Site 2 - Northeast Landfill

- Monitor five monitoring wells biannually for 2 years.
- Monitor land use at landfill biannually for 2 years.

Site 4 - West Burn Area

- Perform a soil gas survey to locate the site.
- Install three monitoring wells.
- Sample the surface and subsurface soils.

Site 6 - North Burn Pit Area

- Install two additional monitoring wells, a second well in northeast corner of site, well to be drilled to bedrock or 30 feet, and one outside the compound to the east (20 feet).
- Monitor five wells biannually for 2 years.

Site 8 - Herbicide Burial Area

- Locate the burial trench using aerial photos and a ground conductivity survey. Drill four shallow borings (10 feet) and sample soil for pesticides, mercury, and arsenic.
- Excavate and remove buried pesticides from trench.

Site 9 - Oil-Saturated Area

- Remove oil-contaminated sediments from along the fence line.

Site 10 - Hazardous Waste Drum Storage Area

- Remove oil-contaminated surficial soils.

Site 12 - POL Storage Yard

- Install four monitoring wells to bedrock.
 - Monitor wells.
-

INSTALLATION RESTORATION PROGRAM

PHASE II

CONFIRMATION/QUANTIFICATION

STAGE 2

**RICHARDS-GEBAUR AIR FORCE BASE
MISSOURI**

Prepared by:
ECOLOGY AND ENVIRONMENT, INC.
Buffalo Corporate Center
368 Pleasantview Drive
Lancaster, New York 14086
July 1988

FINAL REPORT
(September 1986 to November 1987)

VOLUME 2: APPENDICES

**Approved for Public Release:
Distribution is Unlimited**

Prepared for:

UNITED STATES AIR FORCE
Headquarters Air Force Reserve (HQ AFRES/SGPB)
Robins Air Force Base, Georgia 31098-6001

UNITED STATES AIR FORCE
**Occupational and Environmental Health Laboratory/
Technical Services Division (USAFOEHL/TS)**
Brooks Air Force Base, Texas 78235-5501

APPENDIX E
CHAIN-OF-CUSTODY FORMS



ecology and environment, inc.

195 SUNG ROAD, P.O. BOX D, BUFFALO, N.Y., 14226. TEL. 716-632-4491
International Specialists In The Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 2.

Project No.: DF4000	Project Name: Richards Gebau AFB	Project Manager: Paul R Kopsick									
Samplers: (Signatures)			Field Team Leader:								
<i>Paul R Kopsick Mark Myer Mike Winkler</i>			<i>Paul R. Kopsick</i>								
STATION NUMBER	DATE	TIME	SAMPLE TYPE	SAMPLE INFORMATION		STATION LOCATION	NUMBER OF CONTAINERS	REMARKS			
			COMP	GRAB	AIR			EXPECTED COMPOUNDS (Concentration)*:		Depth	
35-4036	10/16	1955	X	VOA, Pet. hydro		NE LF Boring 4	3	2	1	1-2'	(2963)
37	10/16	1900	X					2	1	6-7'	8674
38	10/16	1905	X					2	1	8-8.5'	8465
39	10/17	1000	X	VOA, Pet. Hydro., Lead		OIL STAIN Area Boring 5	2	2	1	3-4'	8906
40	10/17	1000	X					2	1	8-9'	8787
41	10/17	1000	X					2	1	15.5/16.5'	8368
42	10/17	1010	X	VOA, Pet, Hydro, EPTOX metals		HWSA - Boring 6	2	2	1	.5-1.5'	8057
43	10/17	1100	X					2	1	9-10'	8673
44	10/17	1030	X					2	1	4.5-5.5'	8771
45	10/17	1330	X	VOA, Pet, Hydro		POL TANKS	2	2	1	pet. Hydro upstream - H ₂ SO ₄	8582
46	10/17	1330	X	VOA, Pet. Hydro		POL TANKS	2	2	1	downstream - H ₂ SO ₄	8051
47	10/17	14	X	VOA, Pet. Hydro		SOUTH LF Boring 7	2	2	1		8072
48	10/17	14	X	VOA, Pet. Hydro				2	1		8473
49	10/17	14	X	VOA, Pet. Hydro				2	1		8772
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via: <i>Fed X</i>			
<i>Paul R Kopsick</i>			10/17/86	<i>ED EXP</i>							
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	BL/Airbill Number: <i>10117186</i>			
Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Date: <i>10/17/86</i>			
<i>ED EXP</i>			10/17/86	<i>ED EXP</i>							

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

Ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14226, TEL. 716-632-4491
International Specialists in the Environment

RECEIVED

Page 2 of 2

CHAIN-OF-CUSTODY RECORD

Project No.: DF4000	Project Name: RICHARDS - GEBRUR AFIS			Project Manager: Paul Kopsick									
Samplers: (Signatures)				Field Team Leader: Paul Kopsick			REMARKS						
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMB AIR	SAMPLE INFORMATION									
				GRADE	EXPECTED COMPOUNDS (Concentration)*	VOA, Per Hydro	40' - 50'	VOA	50' - 60'				
DF4050	10/17	1500	/	VOA, Per Hydro	NE Landfill Boring 8	2	7.0' - 7.9'						
DF4050	10/17	1550	/	VOA, PET Hydro	NE LF Boring 9	2	4.0' - 5.0'						
52	10/17	1540	/			2	6.0' - 7.0'						
53	10/17	1600	/			2	0.0' - 7.0' (Dipole GATE)						
53	10/17	1605	/			2	9.0' - 10.0'						
DF4054	10/17	1800	/	VOA, PET Hydro	NORTH NE LF Boring 10	2	1.0' - 2.0'						
55	10/17	1805	/			2	4.0' - 5.0'						
56	10/17	1810	/			2	7.0' - 8.0'						
Relinquished By: (Signature)		Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via:						
Paul Kopsick		1830 10/17	FEA EXP	/			Fed Ex						
Relinquished By: (Signature)		Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	BL/Airbill Number:						
/													
Relinquished By: (Signature)		Date/Time: 0900	Received For Laboratory By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Date:						
FEA EXP		10/18/86	K. Marshall				10/17/86						

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055

Ecology and environment, inc.

105 SUGG ROAD, P.O. BOX O, BUFFALO, N.Y., 14226, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

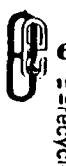
Page 1 of 2

Project No.:	Project Name:			Project Manager:			2 40 ml VOA 1 Liter 204 1 Liter Amber 204 1 Gg Amber 204 602 SPK 100ml VOA 1 Liter Amber 204 1 Gg Amber 204 602 SPK 100ml VOA 1 Liter Amber 204 1 Gg Amber 204 602 SPK						REMARKS				
DF4000	Richards-Gebau AFB			PAUL KOPSICK													
Samplers: (Signatures)			Field Team Leader:			PAUL KOPSICK											
STATION NUMBER	DATE	TIME	SAMPLE TYPE		SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CON. TAINERS	PH	COND	Temp					
			COMP	GRAB	AIR	EXPECTED COMPOUNDS (Concentration)*											
57	10/21		X			VOA, Petro Hydro	9076	North Burn NWMW	1	1/2						only 1 VOA	
58	10/21		X			VOA, Petro. Hydro	9077	North Burn NEMW	2	1	1					7.75 288 73.5	
59	10/21		X			VOA, Petro. Hydro	9078	North Burn SEMW	1	1/2						only 1 VOA	
60	10/21	1025	X			VOA, Petro. Hydro. TDS	9079	POL Monitoring Well	3	1	1						
61	10/21		X			VOA, Petro, Hydro, TDS, Extracts, Antimony, Phenols	9080	Northeast LF Bkg well	7	1	3	1	2			7.26 548 67.8	
62	10/21		X				9081	Gate Wall	7	1	3	1	2			7.22 1207 65.4	
63	10/21	1330	X				9082	PIT well 1	6	1	3	1	2			7.24 554 67.0 phenol jug broke	
64	10/21	1340	X				9083	PIT well 2	7	1	3	1	2			7.32 888 66.2	
65	10/21	1350	X				9084	PIT well 3	7	1	3	1	2			7.35 741 68.5	
66	10/21	1430	X				9085	South LF Markey & Ballo	7	1	5	1	2			8.24 427 67.6 SLF BKG	
67	10/21	1430	X			VOA, Petr. Hydro	9090	44SLF BKGs	23	1			1			SLF BKG	
68	10/21	1530	X				9086	SLF DNW	7	1	3	1	2			7.34 684 700 SLFAN	
69	10/21	1530	X			VOA, Pet. Hydro	9091	SLF DNS	2	1			1			SLF DN	
70	10/21	1550	X			VOA, Pet. Hydro	9092	SLF SEEPs	2	1			1				
Relinquished By: (Signature)			Date/Time: 1900		Received By: (Signature)		Relinquished By: (Signature)		Date/Time:		Received By: (Signature)		Ship Via:				
Paul Kopsick			10/21/86		Frel 11/11/86												
Relinquished By: (Signature)			Date/Time:		Received By: (Signature)		Relinquished By: (Signature)		Date/Time:		Received By: (Signature)		BL/Airbill Number:				
Relinquished By: (Signature)			Date/Time:		Received For Laboratory By: (Signature)		Relinquished By: (Signature)		Date/Time:		Received For Laboratory By: (Signature)		Date:				
Frel 11/11/86			10-12-86 10500		11-11-86 11000 C												

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234056



ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 2 of 2

Project No.: DF4000	Project Name: Richards Gebau AFB			Project Manager: PAUL KOPSKICK												
Samplers: (Signatures) <i>Paul R Kopsick</i>			Field Team Leader: PAUL KOPSKICK													
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRAB AIR	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	REMARKS							
				EXPECTED COMPOUNDS (Concentration)*					pH Cond Temp							
04071	10/21	1550	X	VOA, RT Hydro, TDS, Ext, PPmetals, Ammonium, Phenols			SLFSEEPW	9087	7	1	3	1	2	8.00	56.7	67.4
72	10/21	1730	X	VOA Field Blank				9095	1	1						
Relinquished By: (Signature) <i>Paul R Kopsick</i>			Date/Time: 1000 10/21/66	Received By: (Signature) <i>Fred. Foyrus</i>	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Ship Via:						
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	BL/Airbill Number:						
Relinquished By: (Signature) <i>Fred. Foyrus</i>			Date/Time: 10-13 16/0466	Received For Laboratory By: (Signature) <i>10/21/66 C</i>	Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)	Date:						

Distribution: Original accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055

Ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.:	Project Name:			Project Manager:											
DF4000	Richards - Gebair AFB			PAUL KOPSKY											
Samplers: (Signatures)				Field Team Leader:											
<i>Mahal Muthukrishna Joe Chandler Mike May</i>				<i>Joe Chandler</i>											
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRAB AIR	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CON. TAINERS	REMARKS						
				EXPECTED COMPOUND (Concentration)*											
DF400A	10/24	1050	X	VOA, Petroleum Hydrocarbons			POL TANK # 955	3	2	1	1				EPA #'s
80	10/24	1100	X				POL TANK # 955	3	2	1	1				9343
81	10/24	1130	X				POL TANK # 955	3	2	1	1				9344
82	10/24	1330	X				POL TANK # 955	3	2	1	1				9345
83	10/24	1345	X				POL TANK # 957	3	2	1	1				9346
84	10/24	1415	X				POL TANK # 957	3	2	1	1				9347
85	10/24	1450	X				POL TANK # 957	3	2	1	1				9348
86	10/24	1500	X				POL TANK # 951	3	2	1	1				9349
87	10/24	1525	X				POL TANK # 954	3	2	1	1				9350
88	10/24	1555	X				POL TANK # 954	3	2	1	1				9351
89	10/24	1515	-	87 DUP			B. 955 drain	3	2	1	1				Calvert Rd Bld. 952 9353
							POL TANK # 954 (5')	2	1	1					Duplicate (5ft) 9352
Relinquished By: (Signature)				Date/Time: 10/28/86	Received By: (Signature)	Relinquished P	Received By: (Signature)			Ship Via: Fed. Ex					
Relinquished By: (Signature)				Date/Time:	Received By: (Signature)	Relinquished	Received By: (Signature)								
Relinquished By: (Signature)				Date/Time: 10-29-86 / 0930	Received For Laboratory By: (Signature)	Relinquished	Received By: (Signature)			BL/Airbill Number: Date: 234055..					
Distribution: Original Accompanies Shipment: Copy to Coordinator Field Files															

*See CONCENTRATION RANGE on back of form.

ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

recycles

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.: DF4000	Project Name: Richards Gebaum AFB			Project Manager: PAUL KOPSICK						REMARKS							
Sampler: (Signature) <i>Paul Kopsick</i>			Field Team Leader: (Signature) <i>Joe Gobanby</i> <i>Mark McMurtry</i>														
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRAB AIR	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	PH	COND	TEMP						
				EXPECTED COMPOUNDS (Concentration)*													
73	10/23	1050	X	VOA, TDS, Phenol, Pet Hydro, Amines, Esters, PPmetals			NELF culvert	7	1	3	1	2	7.92	618	62.0	9230	
74	10/23	1100	X				NELF Downstream	8	7	1	3	1	2	7.87	341	61.4	9231
75	10/23	1110	X				NELF upstream	8	7	1	3	1	2	8.01	374	61.0	9232
76	10/23	1200	X				SLF SEEP 2	8	7	1	3	1	2	7.94	540	66.4	9233
77	10/23	1210	X	VOA, Pet. Hydro			SLF SEEP 2	3	2	1							9234
78	10/23	1620	X	VOA BLANK			SLF SEEP 2	1	1								9235
DF4063	10/23	1030	X	Phenols			NE LF m1	1					1	Replaces Broken jar of 10/21 9235			
Relinquished By: (Signature) <i>Paul Kopsick</i>			Date/Time: 1700 10/23	Received By: (Signature) FED EXP	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)			Ship Via: FED EXP					
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)			BL/Airbill Number:					
Relinquished By: (Signature)			Date/Time: 1930 10/24/86	Received For Laboratory By: K. Marsh	Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)			Date:					

Distribution: Original Accompanier Shipment: Copy to Coordinator Field File

*See CONCENTRATION RANGE on back of form.

234055



ecology and environment, inc.
195 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists In the Environment

Page 1 of 1

CHAIN-OF-CUSTODY RECORD

Project No.:	Project Name:			Project Manager:			<i>2-40-1 Var Vials 1-82 Jan</i>			REMARKS	
DF4000	Richards Gebau AFB			PAUL Kopsick							
Samplers: (Signatures)				Field Team Leader:			PAUL Kopsick				
STATION NUMBER	DATE	TIME	SAMPLE TYPE	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS			
				SO	B O A C H A G	AIR					EXPECTED COMPOUNDS (Concentration)*
DF4027	10/15	1420	X	VCA, Petroleum Hydrocarbons 8844			NB Burin, 1 S-1	3	2	/	ext 3.5-4.5 UVN reading
DF4026		1430	X	8845			NB 1 S-2	3	2	/	ext 7-8'
DF4029		1435	X	8846			NB 1 S-3	3	2	/	12-12.4'
DF4030		1510	+	8847			NB Burin, 2 S-1	3	2	/	2-3'
DF4031		1515	+	8848			NB 2 S-2	2	2	/	5-6'
DF4032		1520	+	8849			NB 2 S-3	3	2	/	11-12'
DF4033		1600	+	8901			NB Burin, 3 S-1	3	2	/	2-3'
DF4034		1605	+	8902			NB 3 S-2	3	2	/	5-6'
DF4035		1610	+	8903			NB 3 S-3	3	2	/	11-12'
DF4028		1720	+	8900 DUPLICATE			NB Burin, 2 S-3	3	2	/	11-12'
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		Ship Via:	
<i>Paul Kopsick</i>			10/15 1700h	<i>Joseph Charles</i>		<i>Joseph Charles</i>	10/15 1745	<i>Fed. Express</i>		<i>Federal Exp</i>	
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		BL/Airbill Number:	Date:
<i>Fed Express</i>			10/16/86 1000	<i>Walter H. Howard</i>							10/15/86

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234056



ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists In the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1.

Distribution: Original Accompanies Shipment; Copy to Coordinator Field File

*See CONCENTRATION RANGE on back of form.

234053



ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14226. TEL. 716-632-4491
International Specialists In the Environment

CHAIN-OF-CUSTODY RECORD

Page _____ of _____

4: Original Accompanies Shipment: Copy to Coordinator Field File

VTRATION RANGE on back of form.

Ecology and environment, inc.

395 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

RECEIVED
Project No.: DF4000

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.:		Project Name:		Project Manager:		40 ml VOA vials (x2) 1 liter poly 1 liter Amber 1/2 gal Amber 8 oz Jar						REMARKS								
DF4000		Richards-Gebaur AFB IRP		Paul Kopsick																
Samplers: (Signatures)				Field Team Leader:																
<i>PK</i> Paul Kopsick, Bill Kwoka, Mike Michalowski				Paul Kopsick																
STATION NUMBER	DATE	TIME	SAMPLE TYPE	COMP	GRAB	AIR	SAMPLE INFORMATION						STATION LOCATION	NUMBER OF CONTAINERS						
DF4014	10/10	1120	X				VOA, O&G	8795	North Burn Area S-6	2	1	1		West Drainage						
DF4015		1315	X				Pesticides, Arsenic, Mercury	8796	Herbicide Burial S1	2		2		300' South of Road						
DF4016		1320	X					8797		-S-2	2		2	25' East of DF4015						
DF4017		1330	X					8798		-S-3	2		2	25 East of DF4016						
DF4018		1340	X					8799		-S-4	2		2	100' South of Road						
DF4019		1445	X				VOA, EP Tox. (Metals), O&G	8800	Haz. Waste Storage S-1	2	1	1		Background Soil						
DF4020		1505	X					8801		S-2	2	1	1	Gate of Compound						
DF4021		1445	X					8802		S-3	2	1	1	Fence corner 0-26'						
DF4022		1500	X					8803		S-4	2	1	1	26 - 60'						
DF4023		1500	X					8804		S-5	2	1	1	60 - 120'						
DF4024		1455	X					8805		S-6	2	1	1	Opposite corner + 25'						
DF4025		1515	W				VOA, TDS, O&G, PPMetals, Barium, Mercury	8806	Cancelled per P. Kopsick 10/15/86	W-1	4	1	2	Opposite corner + 25' 9.27 pH 30°C 66°F						
DF4026		1600	W							W-1	1	1	2	HWSA						
DF4027		1315	W				Pesticides, TDS, Arsenic, Mercury	8807	Field Blank	3	2	1		Pond in Field 6.51 pH 19°C 61.4°F						
Relinquished By: (Signature)		Date/Time:		Received By: (Signature)		Relinquished By: (Signature)		Date/Time:	Received By: (Signature)		Ship Via: Federal Express									
<i>Paul Kopsick</i>		10/10/86 7:000																		
Relinquished By: (Signature)		Date/Time:		Received By: (Signature)		Relinquished By: (Signature)		Date/Time:	Received By: (Signature)		BL/Airbill Number: Date:									
Relinquished By: (Signature)		Date/Time:		Received For Laboratory By: (Signature)		Relinquished By: (Signature)		Date/Time:	Received For Laboratory By: (Signature)											

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055

Provided on the following pages are sample receipt logs for the appropriate sample numbers as documentation of proper sample management and documentation procedures.



PACKAGE RECEIPT LOG

0243

recycled paper

E-13

ecology and environment

ITEM NO.	CLIENT NAME and/or JOB NO.	DATE RECEIVED	RECEIVED FROM (e.g. carrier)	CARRIER I.D. NO. or INITIALS	SHIPPING INVOICE NO. (Place in file)	PACKAGE DESCRIPTION (e.g. 1 cooler, 1 jar, etc.)	MANNER PACKAGE SECURED			PACKAGE DISPOSITION			CUSTODIAL INITIALS	
							PACK- AGE SE- CURED	Custody Seal	Fiberglass Tape	Other	Deficiencies	Explain and footnote if necessary. File deficiency report.		
								Yes	No	Yes	No	Yes	No	
4832	PUS Channel	10-9-86	L. Roedl	ZR	none	1-Cardboard Box	✓							LHH
7228	Edgetooth Appliance	10-9-86	A. Psalms	ADP	none	1-Plastic Bag		✓						LHH
4837	Name of Ambrose	10-9-86	Client	Client	120116	1-Plastic Bucket								LHH
4340	Seller Thru Its Assoc	10-9-86	Client	Client	none	1-Cooler								LHH
4841	Sterling Environmental	10-9-86	Client	Client	120116	3-16.02 WM poly								LHH
4842	Richards-Gebauer AFB	10-10-86	Fed. Express	FM	1533064816	1-Cooler	✓		✓					LHH
4343	CPC-Toronto	10-10-86	Client	M.H.V	110116	1-Cardboard Box	✓							LHH
4344	New York Air Brake	10-10-86	U.S. Air	Flight 40	40-54-97	1-Cooler								LHH
4345	Richards-Gebauer AFB	10-11-86	FED EXPRESS	D.M	1-33364700	1-Cooler	✓							LHH
4346	U.S. EPA	10-13-86	Fed. Express	J.M.	110116	1-Cooler	✓		✓					LHH
4347	John J. Glass	10-13-86	Client	Client	110116	1-125ml poly								LHH
7348	Bickford-Gebauer AFB	10-13-86	Storage 100	100	See TTR # 4345	1-Cooler	✓							LHH
4349	Frontier Insulation	10-13-86	Client	FLIC	none	2-1000cc								LHH
4350	FMC-M. deLapey	10-13-86	Client	RAS	none	3-1L glass								LHH
4351	D. P. Zia Constantine	10-13-86	Client	G.J.	none	2-125ml poly	✓							LHH
4352	Hour Management Inc	10-13-86	Client	BAC	none	1-glass bottle	✓							LHH
4353	Springville Central School	10-13-86	W. Hall	W.H.	none	2 PLASTIC	✓							LHH
4354	V.F.T.A.	10-14-86	Client	S.P.Y.	none	1-foz J-r								LHH

EXPLANATIONS:

10/5

11/11

SAMPLE RECEIPT LOG

11 DE JUNHO DE 1964 - 50 ANOS DA INDEPENDÊNCIA

11.9.1.1. Testcase or Unit Tests

SAMPLE RECEIPT LOG

II no. traces, discolorancy deficiency stains

It gives famous epithet

EXPLANATIONS

Y@ in the "I" junction connected sample was good except

COE SITE 2, NORTHEAST LANDFILL

Section I. Installation Restoration Program Records Search

- A. Study Performed By: CH2M HILL
- B. Date Report Complete: March, 1983
- C. Significant Findings:

Because of the known disposal of hazardous wastes at the site and the proximity of the site to Scope Creek, there is a moderate potential for migration of hazardous contaminants off-base.

- D. Summary of Recommendations:

It was recommended that one shallow monitoring well be installed downgradient of the site to determine if hazardous contamination is present in the area ground water.

COE SITE 2, NORTHEAST LANDFILL, Continued

Section II. Installation Restoration Program Phase II
Confirmation/Quantification Stage 2

A. Study Performed By: Ecology and Environment, Inc.

B. Date Report Complete: November, 1987

C. Significant Findings:

Five anions were reported above detection limits. Since it was relatively minor exceedance of the standard and the fact that there is no drinking water well nearby, there should not be any material threat to human health. For soils, no metals exceeded normal ranges. The only detectable contaminant was petroleum hydrocarbons.

D. Summary of Recommendations:

Long-term monitoring is recommended for this site to detect changes in groundwater quality. The results should be compared for two years. A detailed survey of the landfill should be made and provided to the landowner for inclusion with the deed to the property.

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For
Richards-Gebaur Air Force Base,
Missouri



Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

MARCH 1983

disposal of most common refuse was begun, although some wastes, including building rubble, yard debris, and waste from some industrial shop areas were actively disposed of at the site until about 1961. Materials which may have been disposed of in the landfill include small quantities of waste paints, thinners, strippers, solvents, and oils, although this was not standard procedure. Operation of the landfill included burning of the wastes disposed. Since 1961, the area has been used only intermittently for unauthorized dumping. Due to recent incidents of unauthorized dumping, including cleaning of tar pots and some household waste dumping, an earthen barricade has been erected at the entrance to the site.

A small section of Scope Creek downstream of the site was observed to have a small oil sheen on the surface of the water, suggesting the presence of leachate; no oil sheen was observed upstream and no evidence of soil contamination was visible on the edges of the landfill. Small quantities of hazardous materials may have been placed in this landfill; however, no significant hazardous waste quantities were reported.

The overall rating score for Site No. 1 was 55. Although the receptors subscore was low due to the lack of critical environments or population near the site, the indirect evidence of migration of hazardous contaminants indicated by possible leachate resulted in a high pathway subscore (80) and raised the overall rating.

- o Site No. 2, the Northeast Landfill, is located in the northeast portion of the base alongside Scope

Creek. The site was used between about 1961 and 1971 for the disposal of miscellaneous wastes including building rubble, yard debris, and waste from some industrial shop areas. The wastes were typically burned and buried in trenches. Most of the sanitary wastes at Richards-Gebaur AFB were disposed of off-base through contract removal during this time. One interviewee reported that disposal of waste paints and paint thinners at the site by spreading the wastes on the ground surface had been practiced in the past as late as 1978. The eastern portion of the site has been used for open storage of materials including construction materials, pipes, empty tanks, waste paint and thinners in drums and buckets, and empty 55-gallon drums. Over 400 55-gallon drums are currently stored at the site, most of which are empty, and some of which contain unknown contents.

The site received an overall rating score of 54 due primarily to the known disposal of hazardous wastes and a moderate potential for surface-water migration of contaminants off-base.

- o Site No. 3, the Contractor Rubble Burial Site, is also located adjacent to Scope Creek, just west of the golf course alongside Walker Road. The site was used intermittently during the time the regular Air Force was active on the base, between 1954 and 1978. The site was used primarily for disposal of contractor rubble and debris, although household debris was visible in the exposed portions of the landfill. One interviewee indicated that the site was also used as a sanitary landfill in lieu of Site No. 1 prior to 1961. The site has an overall rating score of 48; low subscores in

debris, and waste from some industrial shop areas, were actively disposed of at this site. The probable path of migration of contaminants, if present at Site No. 1, is vertically downward to the perched ground-water table, then laterally eastward to discharge into Scope Creek. The relatively thick, impervious Lane Shale underlies the site and effectively restricts vertical movement of ground water. During the site visit a small oil sheen, suggesting the presence of leachate, was observed on the surface of a small area of Scope Creek just downstream of the landfill site; no oil sheen was observed upstream. No visible evidence of soil contamination was observed on the banks of Scope Creek at the edge of the landfill. Scope Creek flows through the base and eventually discharges into the Little Blue River, thereby providing a pathway for any hazardous contaminants in the leachate, if present, to enter surface-water bodies and migrate beyond base property.

2. Site No. 2 (Northeast Landfill)

This site was reportedly used between 1961 and 1971 for disposal of miscellaneous waste, including building rubble, yard debris, and wastes from some industrial shop areas. Reportedly, disposal of some waste paint and thinners by spreading of the liquid wastes onto the ground surface has been practiced at this site. Materials in open storage at the site currently include construction rubble, pipes, empty tanks, waste paints and thinners in drums and buckets, and empty 55-gallon drums. Of over 400 drums currently at the site, some contain unknown contents. The probable path of migration

of contaminants is vertically downward to the perched water table present in the alluvial soils alongside Scope Creek, then laterally southeastward to discharge into Scope Creek. The relatively thick, impervious Chanute Shale underlies the site and effectively restricts vertical movement of ground water. Because of the known disposal of hazardous wastes at the site and the proximity of the site to Scope Creek, there is a moderate potential for migration of hazardous contaminants off-base.

- E. The remaining rated sites (Sites No. 3, 4, 5, 6, 7, 8, and 9) are not considered to present significant environmental concerns.

GNR70A

VI. RECOMMENDATIONS

A. PHASE II PROGRAM

A limited Phase II monitoring program is suggested to confirm or rule out the presence and/or migration of hazardous contaminants. The priority for monitoring at Richards-Gebaur is considered moderate since no imminent hazard has been determined.

Tables 8 and 9 present a summary of recommended monitoring sites, parameters to be measured, and the rationale for the analyses. Specifically, monitoring is recommended for the South Landfill (Site No. 1) and the Northeast Landfill (Site No. 2).

1. South Landfill (Site No. 1)

It is recommended that the adjacent creek (Scope Creek) be monitored upstream and downstream of the site to determine if hazardous contaminants are leaching into the creek. The water samples should be analyzed for the parameters indicated in Table 8. The stream should be sampled on two occasions at least 30 days apart to determine the presence of contaminants.

2. Northeast Landfill (Site No. 2)

It is recommended that one shallow monitoring well be installed downgradient of the site to determine if hazardous contamination is present in the area ground water. The well should be drilled to the depth of the top of the underlying Chanute shale (approximately 30 feet deep at this site) and screened from the top of the shale to within

Table 8
RECOMMENDED ANALYSES

<u>Sample Type</u>	<u>Volatile Organic Compounds (VOC)</u>	<u>Heavy Metals</u>	<u>Pesticides</u>	<u>Phenols</u>	<u>pH, Specific Conductance COD, TOC, and Oil and Grease</u>
<u>Surface Water</u>					
South Landfill (Site No. 1)	X	X	X	X	X
<u>Monitoring Well</u>					
Northeast Landfill (Site No. 2)	X	X	X	X	X

VI
1
2

GNR70

5 feet of the ground surface. The well should be analyzed for the parameters indicated in Table 8. The well should be sampled on two occasions at least 30 days apart to determine the presence of contaminants.

B. OTHER ENVIRONMENTAL RECOMMENDATIONS

Other recommendations developed as a result of the records search include the following:

1. The status of abandoned POL storage tanks is not clear. Various tanks were reported as abandoned, but information was unclear as to whether the tanks had been deactivated according to procedure or simply abandoned. It is recommended that a survey be made to determine the current status of these tanks, e.g., whether they are empty, filled with water, contain residual POL, or are properly deactivated. Tanks should be locked to prevent unauthorized use.
2. The various containers stored aboveground at the Northeast Landfill should be inspected to determine the nature of their contents (old paints, thinners, POLs, etc.). If verified to contain potentially hazardous contaminants, the contents should be disposed of at an authorized hazardous waste facility.

GNR70

HAZARDOUS ASSESSMENT RATING FORM

Page 1 of 2

NAME OF SITE: 2. Northeast Landfill

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: Continuous 1961-1971; intermittent 1971-1982

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Reported rubble burial, land applied paint thinners; trash; visible drums with unknown contents

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface-water body	1	6	6	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	75	180

Receptors subscore (100 x factor score subtotal/maximum subtotal)

42

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large)

S

2. Confidence level (C = confirmed, S = suspected)

C

3. Hazard rating (H = high, M = medium, L = low)

H

Factor Subscore A (from 20 to 100 based on factor score matrix)

60

B. Apply persistence factor

Factor Subscore A x Persistence Factor = Subscore B

$$60 \times 1.0 = 60$$

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

$$60 \times 1.0 = \underline{\underline{60}}$$

III. PATHWAYS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	0
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108
Subscore (100 x factor score subtotal/maximum score subtotal)				59
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	1	8	8	24
Direct access to ground water	N/A	8	N/A	--
		Subtotals	30	90
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 59

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	42
Waste Characteristics	60
Pathways	59
Total 161 divided by 3 =	54
Gross Total	54

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

INSTALLATION RESTORATION PROGRAM

PHASE II

CONFIRMATION/QUANTIFICATION

STAGE 2

**RICHARDS-GEBAUR AIR FORCE BASE
MISSOURI**

Prepared by:
ECOLOGY AND ENVIRONMENT, INC.
Buffalo Corporate Center
368 Pleasantview Drive
Lancaster, New York 14086

July 1988

FINAL REPORT
(September 1986 to November 1987)

VOLUME 1: TEXT

**Approved for Public Release:
Distribution is Unlimited**

Prepared for:

UNITED STATES AIR FORCE
Headquarters Air Force Reserve (HQ AFRES/SGPB)
Robins Air Force Base, Georgia 31098-6001

UNITED STATES AIR FORCE
**Occupational and Environmental Health Laboratory/
Technical Services Division (USAFOEHL/TS)**
Brooks Air Force Base, Texas 78235-5501

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
	EXECUTIVE SUMMARY	1
1	INTRODUCTION	1-1
	1.1 LOCATION AND HISTORY OF OPERATIONS	1-3
	1.2 SITE DESCRIPTIONS	1-6
	1.2.1 Site 1, South Landfill	1-6
	1.2.2 Site 2, Northeast Landfill	1-10
	1.2.3 Site 6, North Burn Pit Area	1-12
	1.2.4 Site 8, Herbicide Burial Area	1-12
	1.2.5 Site 9, Oil-Saturated Area	1-12
	1.2.6 Site 10, Hazardous Waste Drum Storage Area	1-16
	1.2.7 Site 12, POL Storage Yard	1-16
	1.3 SITES NOT INVESTIGATED DURING STAGE 2	1-19
	1.4 TYPES OF CONTAMINANTS INVESTIGATED	1-21
	1.5 FIELD PERSONNEL	1-28
	1.6 SUBCONTRACTORS	1-28
2	ENVIRONMENTAL SETTING	2-1
	2.1 GEOGRAPHIC SETTING	2-1
	2.1.1 Physiography	2-1
	2.1.2 Topography	2-1
	2.2 GEOLOGY	2-1
	2.2.1 Geologic Setting	2-1
	2.2.2 Soils	2-3
	2.2.3 Stratigraphy	2-3
	2.2.4 Structure	2-6

Table of Contents (Cont.)

<u>Section</u>	<u>Page</u>
2.3 HYDROLOGY AND WATER USE	2-6
2.3.1 Surface Water	2-6
2.3.2 Hydrogeology	2-8
2.4 CLIMATE	2-8
 3 FIELD PROGRAM	3-1
3.1 PROGRAM DEVELOPMENT	3-1
3.2 FIELD INVESTIGATION	3-4
3.2.1 Schedule of Field Activities	3-4
3.2.2 Records Search	3-4
3.2.3 Geophysical Survey Procedures	3-6
3.2.4 Soil Gas Sampling	3-6
3.2.5 Soil, Sediment, and Water Sampling	3-6
3.2.6 Handling of Investigation-Derived Waste	3-16
3.2.7 Site-Specific Investigation Activities	3-18
3.2.8 Laboratory Program	3-29
3.2.9 Variations from Description of Work	3-32
 4 RESULTS AND SIGNIFICANCE OF FINDINGS	4-1
4.1 INTRODUCTION	4-1
4.2 RESULTS	4-4
4.2.1 Site 1, South Landfill	4-4
4.2.2 Site 2, Northeast Landfill	4-7
4.2.3 Site 6, North Burn Pit Area	4-11
4.2.4 Site 8, Herbicide Burial Area	4-17
4.2.5 Site 9, Oil-Saturated Area	4-19
4.2.6 Site 10, Hazardous Waste Drum Storage Area	4-22
4.2.7 Site 12, POL Storage Yard	4-26
4.3 SIGNIFICANCE OF FINDINGS	4-30
4.3.1 Site 1, South Landfill	4-30
4.3.2 Site 2, Northeast Landfill	4-30
4.3.3 Site 6, North Burn Pit Area	4-30

Table of Contents (Cont.)

<u>Section</u>	<u>Page</u>
4.3.4 Site 8, Herbicide Burial Area	4-31
4.3.5 Site 9, Oil-Saturated Area	4-31
4.3.6 Site 10, Hazardous Waste Drum Storage Area	4-32
4.3.7 Site 12, POL Storage Yard	4-33
5 ALTERNATIVE MEASURES	5-1
5.1 SITE 1, SOUTH LANDFILL	5-1
5.2 SITE 2, NORTHEAST LANDFILL	5-2
5.3 SITE 6, NORTH BURN PIT AREA	5-2
5.4 SITE 8, HERBICIDE BURIAL AREA	5-3
5.5 SITE 9, OIL-SATURATED AREA	5-4
5.6 SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA	5-4
5.7 SITE 12, POL STORAGE YARD	5-4
6 RECOMMENDATIONS	6-1
6.1 SITE 1, SOUTH LANDFILL - CATEGORY I	6-1
6.2 SITE 2, NORTHEAST LANDFILL - CATEGORY III	6-5
6.3 SITE 4, WEST BURN AREA	6-5
6.4 SITE 6, NORTH BURN PIT AREA - CATEGORIES II AND III	6-6
6.5 SITE 8, HERBICIDE BURIAL AREA - CATEGORY II	6-6
6.6 SITE 9, OIL-SATURATED AREA - CATEGORY III	6-8
6.7 SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA - CATEGORY III	6-11
6.8 SITE 12, POL STORAGE YARD - CATEGORY II	6-11
6.9 WELL ABANDONMENT	6-11

Table 2
SUMMARY OF FIELDWORK/ANALYSES PERFORMED

Site	Fieldwork Performed	Analyses Performed
Site 1, South Landfill	<ul style="list-style-type: none"> ● 1 borehole drilled ● 7 soil samples collected ● 4 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC, priority pollutants, common anions, phenols.
Site 2, Northeast Landfill	<ul style="list-style-type: none"> ● geophysical survey ● 4 boreholes drilled ● 2 monitoring wells installed ● 10 soil samples collected ● 5 groundwater samples collected ● 3 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC, priority pollutants, common anions, phenols
Site 6, North Burn Pit Area	<ul style="list-style-type: none"> ● soil gas survey ● 3 boreholes drilled ● 3 monitoring wells installed ● 15 soil samples collected ● 3 groundwater sample collected ● 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, VOC.
Site 8, Herbicide Burial Area	<ul style="list-style-type: none"> ● 4 soil samples collected ● 1 surface water sample collected 	Soils: pesticides, arsenic, mercury. Waters: TDS, pesticides, arsenic, mercury.
Site 9, Oil-Saturated Area	<ul style="list-style-type: none"> ● 1 borehole drilled ● 8 soil samples collected ● 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC, lead. Waters: petroleum hydrocarbons, TDS, VOC, lead.
Site 10, Hazardous Waste Drum Storage Area	<ul style="list-style-type: none"> ● 1 borehole drilled ● 9 soil samples collected ● 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC, EP TOX metals. Waters: petroleum hydrocarbons, TDS, priority pollutant metals, barium.
Site 12, POL Storage Yard	<ul style="list-style-type: none"> ● 3 boreholes augered ● 1 monitoring well installed ● 1 soil sample collected ● 4 groundwater samples collected ● 2 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC.

Table 3
SUMMARY OF RECOMMENDATIONS

Site	Recommendation	Rationale
Site 1, South Landfill	Category I. No further action.	No significant contamination was found during the Stage 2 investigation.
Site 2, Northeast Landfill	Category III. Biannual monitoring for 2 years. Collect and analyze groundwater samples from five existing monitoring wells twice yearly.	To determine changes in groundwater quality because elevated sulphate concentrations were the only indicators of contamination above acceptable limits.
Site 4, West Burn Area	Category II. Perform a soil gas survey and geophysical survey. Install three monitoring wells and collect and analyze groundwater samples. Collect subsurface and surface soil samples.	To determine the exact location of the site and determine if hazardous constituents have migrated from the site.
Site 6, North Burn Pit Area	Category III and II. Biannual monitoring for 2 years. Install two more monitoring wells. Collect and analyze groundwater samples from five monitoring wells twice yearly.	To better characterize the organic contamination of the groundwater.
Site 8, Herbicide Burial Area	Category II. Additional geophysical surveys. Drill four boreholes and collect two soil samples from each borehole.	To determine exact location of trench and analyze soil from within the trench.
Site 9, Oil-Saturated Area	Category III. Excavate and remove contaminated soils.	To reduce risk of potential direct human contact to soils contaminated with petroleum hydrocarbons and lead.
Site 10, Hazardous Waste Drum Storage Area	Category III. Excavate and remove contaminated soils.	To reduce risk of potential direct human contact petroleum hydrocarbons.
Site 12, PQL Storage Yard	Category II. Install four monitoring wells. Collect and analyze groundwater samples twice yearly.	To determine if volatile organic compound contamination has migrated from the site.

- To define the magnitude and potential of contaminant migration, if possible; and
- To identify potential health and/or environmental hazards based on state or federal standards.

A Phase I Initial Records Search had been conducted by CH2M Hill as outlined in a report dated March 1983. The Phase I report identified sites with potential contamination problems and made recommendations for Phase II investigation. Based on these recommendations, a Phase II Stage 1 investigation was performed on the two sites, Site 1, the South Landfill, and Site 2, the Northeast Landfill, which ranked above 50 on the USAF Hazard Assessment Rating Methodology (HARM) scale ranking system. Preliminary investigation was performed by Water and Air Research, Inc. The results of this investigation were finalized in a report dated December 1983.

In 1985, Richards-Gebaur AFB was scheduled to be reevaluated under the IRP. A presurvey meeting was arranged and all past and current potential sites were visited and evaluated. The presurvey was conducted by E & E and their recommendations were provided in a Presurvey Report dated June 1985.

The sites included in that survey are:

- Site 1, South Landfill,
- Site 2, Northeast Landfill,
- Site 3, Contractor Rubble Burial Area,
- Site 4, West Burn Area,
- Site 5, South Burn Area,
- Site 6, North Burn Area,
- Site 7, Radioactive Disposal Well,
- Site 8, Herbicide Burial Area,
- Site 9, Oil-Saturated Area,
- Site 10, Hazardous Waste Drum Storage Area,
- Site 11, Paint Stripper Hangar,

- Site 12, Petroleum, Oils, and Lubricants (POL) Storage Yard, and
- Site 13, Hazardous Material Storage--Building 927.

Based on this report and after review by state and federal offices, the USAF contracted Phase II Stage 2 investigation of the following sites:

- Site 1, South Landfill,
- Site 2, Northeast Landfill,
- Site 6, North Burn Pit Area,
- Site 8, Herbicide Burial Area,
- Site 9, Oil-Saturated Area,
- Site 10, Hazardous Waste Drum Storage Area, and
- Site 12, POL Storage Yard.

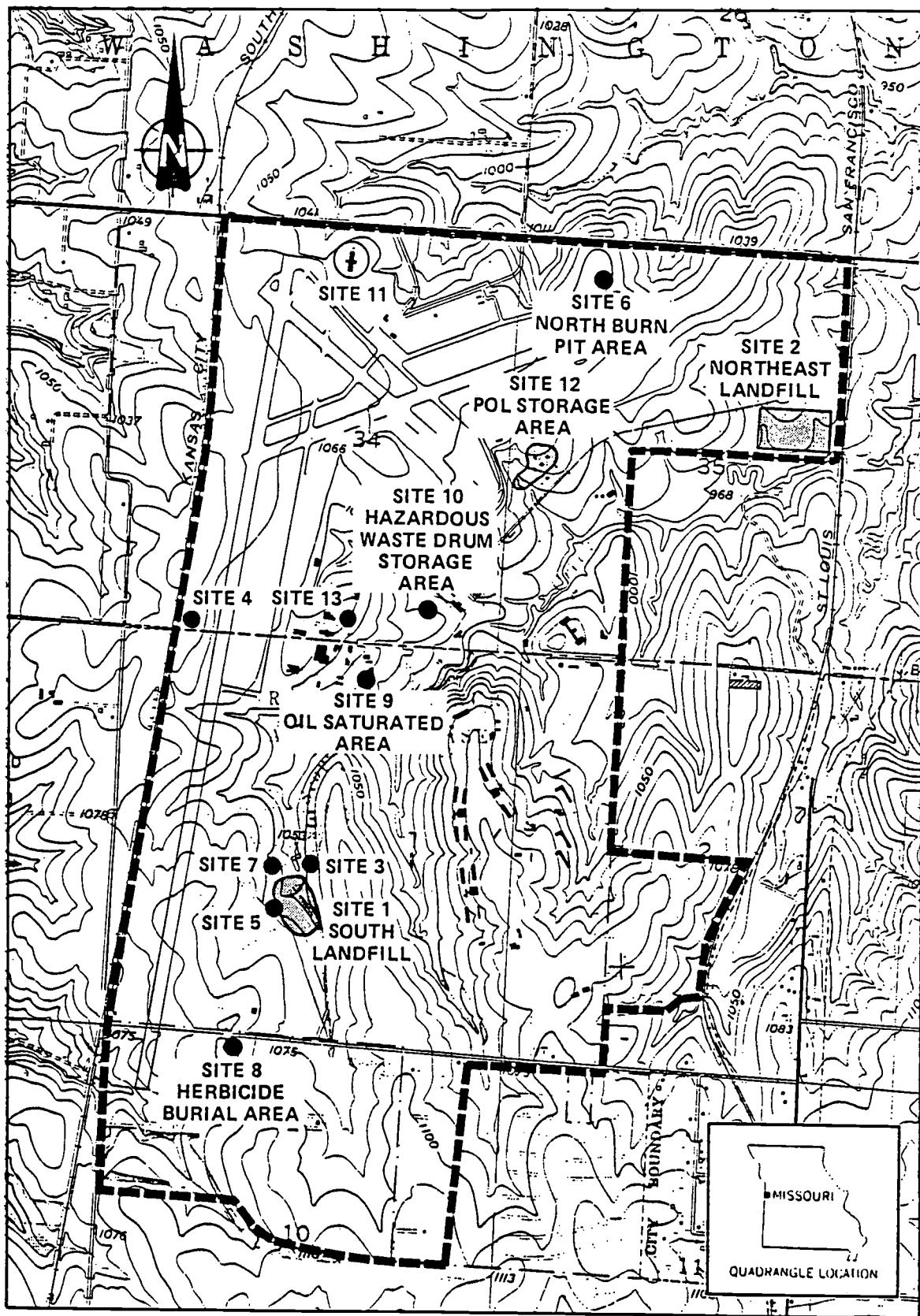
1.1 LOCATION AND HISTORY OF OPERATIONS

The primary source of historical information on the base was the Phase I report by CH2M Hill (1983). The information was confirmed and updated by E & E as part of the Phase II Stage 2 investigation.

Richards-Gebaur AFB is located in west-central Missouri, 2.6 miles from the Kansas-Missouri state line (see Figure 1-1). The Jackson County and Cass County line runs east-west through the middle of the base. The base is bounded on the north by the City of Grandview, on the north and west by Kansas City, and on the south and east by the City of Belton. The base is about 18 miles southeast of downtown Kansas City. Access to the base is via U.S. Highway 71.

The legal description of the base includes the following ranges and townships:

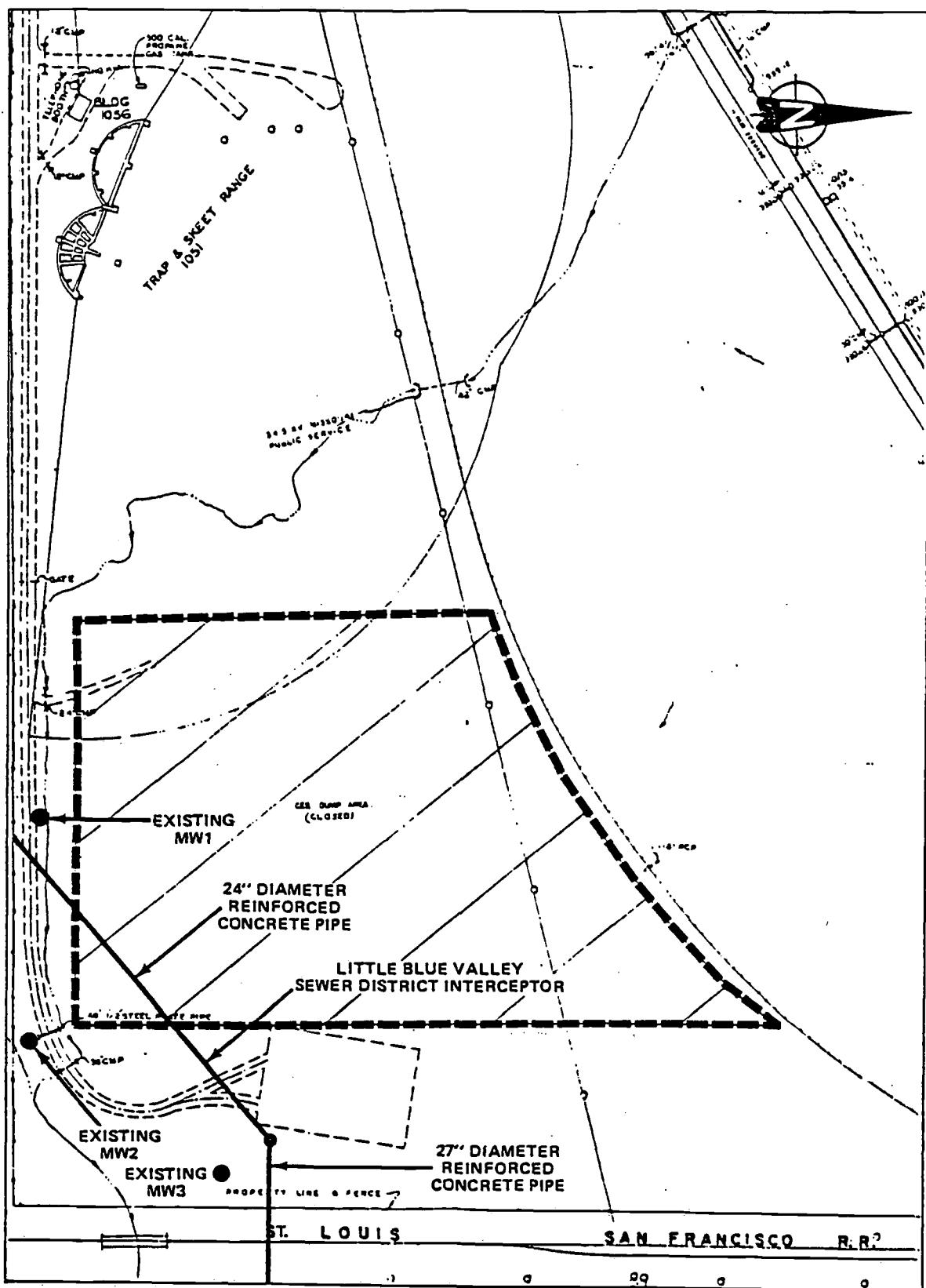
<u>Range</u>	<u>Township</u>	<u>Sections</u>
R46N	T33W	2, 3, 10, 11
R47N	T33W	34, 35



SOURCE: U.S.G.S. 7.5' Quadrangle, Belton, Mo.-Kans., 1975.

SCALE
0 1 MILE

Figure 1-3 RICHARDS-GEBAUR AIR FORCE BASE IRP SITES



SOURCE: Department of the Air Force, Air Force Communications Service, August 1985, Detail Utility Map, Richards-Gebaur AFB, Missouri.

KEY: ■■■ Site Boundary ————— Surface Runoff Direction

SCALE
0 100 200 300 400 FEET

Figure 1-5 SITE 2, NORTHEAST LANDFILL LOCATION MAP

1.3 SITES NOT INVESTIGATED DURING STAGE 2

Several sites were not investigated during the Stage 2 program. The sites were deleted because they either could not be located or they were located on property leased to the Kansas City Aviation Department, which denied access to all sites on Kansas City Aviation land, except the South and Northeast landfills. Access was not granted because the Phase II Field Evaluation Report, dated December 1983, recommended no further action. The letters denying access to sites 3, 5, 7, and 11 are found in Appendix B. The reason Site 13 was not investigated is unknown. This site was not listed in the Description of Work. The following is a discussion of those sites.

Site 3, Contractor Rubble Burial Site

The Rubble Burial Site is located on the east bank of Scope Creek in the south-central part of the base. It reportedly was in operation from 1954 through 1978. The area is not posted or fenced and appears to have been used more recently than 1978. The area is fairly level and most of the debris is discharged over the bank at the treeline. During the presurvey visit, construction materials, including wood, concrete, masonry, and metal, were observed; however, dense foliage prevented a more thorough investigation. A 5-gallon sealed plastic container of an unidentified liquid was discovered at the base of the fill and brought to the attention of the Richards-Gebaur AFB civil engineer. This area is on land either sold or leased to the City of Kansas City. The Kansas City Aviation Department did not grant access to this site.

Site 4, West Burn Area

The West Burn Area was tentatively identified as being located off the base to the west on the west side of the railroad track and north of the Jackson County line. During the presurvey fieldwork, no evidence of this site could be found. Since the West Burn Area was in operation for only 1 year (1955) approximately 30 years ago, it was thought that there was no physical evidence of this site. However, since the Phase II Stage 2 Field Investigation, aerial photographs not previously available indicate the site may actually be located east of the railroad. During a familiarization tour on August 12, 1987, a material believed to be

tank sludge was found in an area just north of the county line and just east of the railroad tracks. At the time of the fieldwork, the site location was unknown and believed to be off base. Therefore, the site was not investigated.

Any impact that this site might have had will have to take into account the presence of the Knoche oil field 3,000 feet to the south-east. The uplands here are fairly level and the area of the site currently is farmed in corn. A tree nursery is located across the county line to the south.

This site should be investigated further if Kansas City will grant access.

Site 5, South Burn Area

The South Burn Area tentatively has been identified as being located to the southwest of the South Landfill (Site 1). During the presurvey fieldwork, no evidence of this site could be found. Since the South Burn Area was in operation for 10 years (1955 to 1965) approximately 20 years ago, it is possible that there will be no physical evidence of this site at all. Because of its proximity to the South Landfill, any environmental contamination detected at this site will be reviewed in light of findings from the South Landfill investigation. This site is believed to be on land either owned or leased by the City of Kansas City, Missouri. The Kansas City Aviation Department did not grant access for this investigation.

Site 7, Radioactive Disposal Well

The Radioactive Disposal Well is located north of the South Landfill and east of the major flight line. It is believed to have been operated from 1955 to 1970. Discussion during the presurvey visit indicated that low-level radioactive material, typically radium dials, were disposed into this cased well. The site currently is behind a locked gate in an open field. The well itself is very visible, standing 4 to 5 feet high and painted red. This well is located on land owned or leased by the City of Kansas City, Missouri. The Kansas City Aviation Department did not grant access for this investigation. Therefore, no work was performed at this site.

3. FIELD PROGRAM

3.1 PROGRAM DEVELOPMENT

A field program for the Phase II Stage 2 Confirmation/Quantification investigation was developed by E & E and presented in the Presurvey Report submitted on 7 June 1985. The program was reviewed and modified by the Air Force and set forth in the Description of Work for Contract F33615-83-D-4003, Task Order 13.

Elements of the field program included: a soil gas survey, a geophysical survey, sediment sampling, subsurface soil sampling, surface water sampling, installation of groundwater monitoring wells, and groundwater sampling. Various combinations of these program elements were performed at the various sites. Table 3-1 outlines the types of work conducted at each site. By site, the objectives of the fieldwork were:

Site 1 - South Landfill

- Determine if contaminated leachate from the landfill is entering Scope Creek.
- Evaluate potential for vertical migration of contamination.

Site 2 - Northeast Landfill

- Determine past disposal practices at the landfill.
- Delineate the locations of several suspected waste disposal trenches and determine if contamination has resulted.
- Expand monitoring well network to investigate migration of groundwater contamination from possible leaching of landfilled materials.

Table 3-1
FIELDWORK PERFORMED AT EACH SITE

	Geophysics	Boreholes	New Monitoring Wells	Soil Samples*	Groundwater Samples*	Surface Water Samples*
Site 1 - South Landfill	--	1	--	6	--	3
Site 2 - Northeast Landfill	MAG, EM	4	2	10	5	3
Site 6 - North Burn Pit Area	Soil Gas	3	3	15	3	1
Site 8 - Herbicide Burial Area	--	--	--	4	--	1
Site 9 - Oil-Saturated Area	--	1	--	9	--	1
Site 10 - Hazardous Waste Drum Storage Area	--	1	--	9	--	1
Site 12 - POL Storage Yard	--	4(h)	1	11	1	2
TOTALS		14	6	64	9	12

*Numbers do not include duplicates or blanks.

Key: MAG = Magnetometer survey
 EM = Electromagnetic survey
 (h) = Hand-augered boreholes

Site 6 - North Burn Pit Area

- Determine occurrence of contamination from the site using a soil gas survey.
- Determine occurrence of subsurface soil contamination.
- Determine whether groundwater contamination has occurred.

Site 8 - Herbicide Burial Area

- Identify actual burial area by examining available background information.
- Identify any contaminants in soil in the vicinity of the burial area.
- Evaluate extent of migration of any contaminants via surface drainage pathway.

Site 9 - Oil-Saturated Area

- Evaluate type and extent of surface and subsurface soil contamination.
- Determine if contaminants are migrating via surface drainage pathway.

Site 10 - Hazardous Waste Drum Storage Area

- Evaluate type and extent of surface and subsurface soil contamination.
- Evaluate potential migration of contaminants via surface drainage pathway.

Site 12 - POL Storage Yard

- Determine the extent of any subsurface soil contamination.
- Evaluate extent of migration of contaminants via buried drain lines and surface drainage pathways.
- Determine whether groundwater contamination has occurred and evaluate extent of contamination.

3.2 FIELD INVESTIGATION

The field investigation consisted of:

- Literature and aerial photograph records search;
- A magnetometer and electromagnetic (EM) terrain conductivity survey;
- A soil gas survey;
- The drilling of 10 boreholes;
- The installation of six monitoring wells; and
- Collection and analysis of 27 surface soil and sediment samples, 38 subsurface soil samples, 13 surface water samples, and 9 groundwater samples.

3.2.1 Schedule of Field Activities

Field activities were scheduled so as to optimize the utilization of manpower and resources. Field activities were coordinated with the USAFOEHL, the base Point of Contact (POC), and subcontractors to minimize delays and potential problems.

Throughout the course of the field activities, daily contact was maintained with the designated base personnel. The principal contact was Ms. Felipita Benson, R.N. Additional coordination was through Mr. John Hurd, Base Civil Engineer.

The fieldwork was completed during the period from 6 October 1986 to 4 November 1986. Table 3-2 provides the sequence of major field activities.

Health and safety protocols, as outlined in the Health and Safety Plan (see Appendix N), were followed throughout the project. Modifications of specific elements of the Health and Safety Plan were based on field conditions and executed only after discussion with E & E's Health and Safety Coordinator.

3.2.2 Records Search

During the course of the Phase II Stage 2 investigation, discussions were held with personnel from the Base Environmental Engineering Staff and the Base Civil Engineering Staff regarding past waste disposal practices and likely contaminants. Historical aerial photographs were

Table 3-2
SCHEDULE OF MAJOR FIELD ACTIVITIES
(October to November 1986)

6 October	Fieldwork begins with a reconnaissance of all sites and collection of surface soil samples.
6-8 October	Geophysical survey at Site 2, Northeast Landfill.
7-9 October	Soil gas survey at Site 6, North Burn Pit Area.
14 October	Drillers on site, set-up decontamination areas at Site 6, North Burn Pit Area and vehicle wash racks.
15 October	Three soil borings drilled, sampled, and grouted at Site 6, North Burn Pit Area.
16 October	Six monitoring wells drilled, pipe set, soil samples collected, and wells completed; three are at Site 6, North Burn Pit; two at Site 2, Northeast Landfill; and one at Site 12, POL Storage Yard. One well at Site 6, North Burn Pit Area was a borehole completed as a well.
17 October	Six soil borings drilled, samples collected, and the holes grouted, one at the Motor Pool Compound; one at the former hazardous waste storage yard; one at Site 1, South Landfill; and three at Site 2, Northeast Landfill.
18 October	Development of new wells and cleanup of drilling and staging areas.
21 October	Wells purged and groundwater samples collected.
23 October	The remaining surface soil and surface water samples collected from Site 2, Northeast Landfill; and Site 1, South Landfill.
28 October, 4 November	Hand-auger borings at Site 12, POL Storage Yard.
4 November	End of sampling.

examined to provide information on waste disposal practices at the base. Aerial photos were helpful in locating and delineating several sites which were not clearly visible during the Presurvey field trip. Table 3-3 lists the photos which were available for review.

3.2.3 Geophysical Survey Procedures

Magnetometer and EM surveys were performed concurrently at Site 2, Northeast Landfill, in an effort to locate what were thought to be discrete landfill trenches at this site, preliminary to placing groundwater monitoring wells. The magnetometer survey is designed to locate magnetically conductive materials in landfills, which are generally more conductive than the surrounding soils. Anomalies in magnetic flux are measured by the magnetometer and recorded in the field notebook. The EM conductivity survey measures the conductivity of the soil or any variations in the conductivity of the soil. Excavations for landfills change the natural conductivity by changing the porosity and density of the soils and altering the normal values of conducting fluids in the soils. Presumed locations of the trenches were delineated in a map provided by the Base Civil Engineer.

A Geometrics Model G-846 proton procession magnetometer with a sensitivity of 0.1 gammas and a Geonics Model EM-31 terrain conductivity meter with an effective exploration depth of 6 meters were used.

3.2.4 Soil Gas Sampling

A soil gas survey was performed at Site 6, the North Burn Pit Area, in an effort to identify potential residual contamination from the burning and handling of flammable liquids. The soil gas data were used to aid in locating the groundwater monitoring wells. The survey was performed by hand-driving perforated pipes in and around the compound. After capping each pipe and allowing it to stand for 15 minutes, the hole was monitored using an Organic Vapor Analyzer (OVA) to determine the presence or absence of volatile compounds.

3.2.5 Soil, Sediment, and Water Sampling

Soil, sediment, and water sampling protocols were followed as outlined in the Technical Operations Plan (Appendix N), except for

Table 3-3
SUMMARY OF HISTORIC AERIAL PHOTOGRAPHS
FOR AREA AROUND RICHARDS-GEBAUR AFB

Year	Scale	Source	Availability
1936	1:20,000	NARS	--
1940	1:20,000	MARC	--
1948	1:17,000	EROS, USGS	--
1950	1:70,000	EROS, USA	--
1953	1:20,000	ASCS	--
1955	1:13,000	EROS, USGS, USAF (shows West Burn Pit)	Reviewed
1957	1:20,000	ASCS	--
1959	1:12,000	COE	--
1960*	1:12,000	City of Grandview (shows borrow pits north of Northeast Landfill)	Reviewed
1963	1:18,000	USGS	Reviewed
1963	1:20,000	ASCS	--
1970	1:24,015	EORS	--
1972*	1:12,000	City of Grandview (shows active Northeast Landfill)	Reviewed
1975	1:40,000	EROS	--
1978	1:72,500	EROS	--
1980	1:80,000	EROS	--
1982	1:58,000	EROS	--
1982	1:80,000	EROS	--

Key:
 EROS = EROS Data Center, SD
 MARC = Mid America Regional Council, MO
 ASCS = American Soil Conservation Agency
 COE = Army Corps of Engineers
 USGS = United States Geological Survey
 USA = United States Army
 NARS = National Archives

*Not on federal archive list; does not cover south half of base.

samples collected for volatile organic analysis (VOAs). These were discrete samples collected prior to homogenization (blended to result in a more uniform sample). The portion of the sample collected for VOAs was cut from the center of the sample and placed directly into 40-ml vials.

All samples were split in the field when enough sample material was available. Split samples were delivered to the base POC. The POC determined those splits which were to be submitted to OEHL/SA for analysis. The split samples for analysis were provided by the POC to E & E for shipment to OEHL/SA.

Sediment Sampling

Sediment sampling was conducted in association with Site 1, South Landfill; Site 6, North Burn Pit Area; Site 8, Herbicide Burial Area; Site 9, Oil-Saturated Area; Site 10, Hazardous Waste Drum Storage Area; and Site 12, POL Storage Yard. A total of 27 samples were collected and submitted for chemical analysis. Table 3-4 presents a summary of the samples collected.

Sediment samples were collected using shovels to loosen an 8-inch cube of sediment from which a vertical column was removed using a stainless steel spoon. The soil column was homogenized in a disposable aluminum pan and then splits were placed in two sampling containers. Spoons were decontaminated and all pans were disposed of after sample collection from each location.

Subsurface Soil Sampling

Subsurface soil samples were collected from 5-foot-long split-spoon samplers during the drilling of the boreholes and monitoring wells. Borehole and monitoring well drilling was performed by Geotechnology, Inc., of St. Louis, Missouri. Table 3-5 provides a summary of borehole depths.

Ten boreholes were drilled and 28 subsurface soil samples were collected and submitted for analysis. Boreholes were drilled for the specific purpose of obtaining subsurface soil samples; however, one borehole (Boring 4) was scheduled to be completed as a monitoring well. A total of 186.5 linear feet of drilling was accomplished using a Mobile

Table 3-4
SUMMARY OF SURFACE SOIL SAMPLING

Site No.	Field Sample No.	Sample Location and Description
1	DF4067	Scope Creek - Background at Markey and Bates
	DF4069	Scope Creek - Downstream of South Landfill
	DF4070	Scope Creek - Seep 1 east of South Landfill
	DF4077	Scope Creek - Seep 2 northeast of South Landfill
6	DF4001	North Burn - 100 feet east of eastern fence center
	DF4002	North Burn - 200 feet east of eastern fence center
	DF4003	North Burn - 100 feet north of northern fence drainage
	DF4004	North Burn - Southeast corner fence, 200-300 feet
	DF4005	North Burn - 25 feet south of southwestern corner of fence
	DF4014	North Burn - 100 feet northwest of northwest corner of fence
8	DF4015	Herbicide Burial Area - 300 feet south of Markey
	DF4016	Herbicide Burial Area - 25 feet east of DF4015
	DF4017	Herbicide Burial Area - 25 feet east of DF4016
	DF4018	Herbicide Burial Area - 100 feet south of Markey
9	DF4007	Oil-Saturated Area - Southwest corner of Motor Pool
	DF4008	Oil-Saturated Area - Southwest corner +25 feet
	DF4009	Oil-Saturated Area - Southwest corner +50 feet
	DF4010	Oil-Saturated Area - Outside southwest corner, 0-100 feet
	DF4011	Oil-Saturated Area - Outside southwest corner, 100-200 feet
	DF4012	Oil-Saturated Area - Outside southwest corner, 200-300 feet
10	DF4019	Hazardous Waste Drum Storage Area - Background from athletic field
	DF4020	Hazardous Waste Drum Storage Area - North of gate to compound
	DF4021	Hazardous Waste Drum Storage Area - West corner of fence, 0-26 feet
	DF4022	Hazardous Waste Drum Storage Area - West corner of fence, 26-60 feet
	DF4023	Hazardous Waste Drum Storage Area - West corner of fence, 60-120 feet
	DF4024	Hazardous Waste Drum Storage Area - South corner +25 feet
12	DF4088	POL Storage Yard - Culvert at Bldg. 952

Table 3-5
SUMMARY OF SOIL BORINGS

Site No.	Boring Designation	Total Depth (feet)
1	Boring #7	7.1
2	Boring #4	9.8
	Boring #8	7.9
	Boring #9	13.0
	Boring #10	8.5
3	Boring #1	12.9
	Boring #2	13.0
	Boring #3	14.5
5	Boring #5	16.5
6	Boring #6	15.0
7	Hand Boring #1	6.0
	Hand Boring #2	6.0
	Hand Boring #3	6.0
12	Hand Boring #4	6.0

alternatively, dispersed in Site 6, North Burn Pit Area. Development and purge waters were placed in the North Burn Pit to evaporate.

3.2.7 Site-Specific Investigation Activities

As discussed above, fieldwork at each site consisted of some combination of geophysics, soil boring, subsurface soil sampling, and groundwater sampling. Activities at the individual sites are discussed below.

Site 1, South Landfill

A single upgradient soil boring was drilled southwest of the landfill (Boring 7) and three subsurface soil samples collected. The actual eastern boundary of the landfill is the west bank of Scope Creek. Therefore, it was impossible to drill a boring downgradient without penetrating the waste and jeopardizing the integrity of the landfill. Four surface soil samples were collected: a background sample adjacent to Scope Creek upstream of the landfill; one at Seep 1 where the seep enters Scope Creek; one at Seep 2 where the seep enters Scope Creek; and one adjacent to Scope Creek downstream from the landfill. Four surface water samples were collected: from Seep 1 and Seep 2 where the seeps enter Scope Creek, and from Scope Creek at the upstream (background) and downstream sampling points.

Figure 3-1 shows the sampling locations for this site.

The four water samples were analyzed for petroleum hydrocarbons, total dissolved solids, halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols. The soil samples were analyzed for halogenated and aromatic organics and petroleum hydrocarbons.

Site 2, Northeast Landfill

Magnetometer and conductivity surveys were performed at this site to locate what were originally believed to be three discrete trenches. A grid system was staked over the survey area. The grid extended beyond the expected landfill boundaries in order to define the boundaries. The grid sections were 100 by 100 feet. Every 25 feet along each grid line, three readings were taken with the magnetometer and averaged, and one

reading was taken with the EM-31. Background readings were taken periodically in an undisturbed area of the base. The geophysical survey revealed, rather than the three discrete landfill trenches, that the entire survey area had been landfilled. Additional historical aerial photos revealed landfill operations throughout the area delineated in Figure 3-2. The drilling program was modified based on this new understanding of Site 2. Four boreholes were drilled in areas adjacent to the presumed boundary of the landfill. Boring 4 was located near the southwest corner of the landfill. Borings 8 and 9 were located near the southeast corner of the site, downgradient from the landfill; and Boring 10 was located upgradient, across the railroad tracks to the north.

Three subsurface soil samples were collected from Borings 4, 9, and 10, and one was collected from Boring 8.

In addition to the three existing monitoring wells (MW1, directly south of the site; MW2, south of the site near the southeast corner; and MW3, east of the site, near the southeast corner), two new monitoring wells were installed: MW6, a completion of Boring 4, and MW5, in the northeast corner of the site. One groundwater sample was collected from each of the five wells.

Three surface water samples were collected. One from the surface drainage flowing off the landfill near the southeast corner of the landfill, and two from Scope Creek, one upstream of the landfill and one downstream.

Figure 3-3 shows the sampling locations for this site and the location of the geologic cross section. The cross section is presented in Appendix D.

The eight water samples were analyzed for petroleum hydrocarbons, total dissolved solids, halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols. The soil samples were analyzed for halogenated and aromatic organics and petroleum hydrocarbons.

Site 6, North Burn Pit Area

A soil gas survey was performed at this site to determine if organic vapor contamination exists in the subsoil and to delineate the extent of contamination in order to determine the placement of boreholes

times is provided in Appendix H. All samples were shipped to the E & E Analytical Services Center (ASC) or to OEHL/SA by overnight Federal Express. Analytical protocols are discussed in Appendix N.

3.2.9 Variations from Description of Work

During the execution of the fieldwork, several changes from the Description of Work were implemented due to field conditions and findings. Changes were implemented after discussion with and concurrence of the OEHL project manager. A site-specific summary of the variations follows.

All Sites

Subsurface soil borings were taken using a CME continuous sampler. This unit is essentially a 5-foot-long split-spoon soil sampler that is advanced ahead of the hollow-stem auger. It provides a continuous undisturbed sample of the sediment column.

Optional water samples, allocated in case groundwater was intersected during the borehole drilling for subsurface soil samples, were not utilized as no appreciable amounts of groundwater were observed in any boreholes.

Site 1, South Landfill

No modifications in the proposed scope of work occurred at this site.

Site 2, Northeast Landfill

The geophysical surveys were adjusted in the field to cover areas adjacent to the targeted area, based on instrument readings which indicated the entire targeted area as landfill. This was later corroborated based on aerial photographs.

Boring 7 was aborted after encountering the apparent edge of the landfill. Only one of the three scheduled soil samples from this borehole was collected.

An additional surface water sample was collected, from a flowing tributary to Scope Creek just before it enters the creek. This sample represented runoff from the landfill prior to dilution in Scope Creek.

The sample replaced a water sample which could not be taken at Site 6, where no water was encountered.

Site 6, North Burn Pit Area

Due to the absence of any appreciable amounts of water in two of the three monitoring wells at the site, analyses could only be performed for halogenated and aromatic organics. Petroleum hydrocarbons had to be omitted. Two additional attempts to collect sufficient sample volumes also failed.

No determination could be made as to upgradient versus downgradient with respect to monitoring wells. The facility is situated on the top of a ridge.

Site 8, Herbicide Burial Area

No modifications in the proposed scope of work were made at this site.

Site 9, Oil-Saturated Area

No modifications in the proposed scope of work occurred at this site.

Site 10, Hazardous Waste Drum Storage Area

An upstream surface water sample could not be obtained since no water was encountered.

Site 12, POL Storage Yard

A surface water sample from the outfall drain from Building 953 was allocated. However, there was no outfall from this building, and so no sample was collected.

Due to errors in sample labeling in the field, two analytical parameters listed in the Description of Work were inadvertently omitted. These errors affected the proposed analytical program as follows:

- Sample DF4045 - No TDS analysis was performed on this sample.

mg/kg) of petroleum hydrocarbons detected near the bottom of the borehole was thought to be associated with the permeable chert layer. A higher concentration (16 mg/kg) was found in a surface soil sample taken at Seep 2. This is not really a seep, however. The water is surface runoff from the upgradient lake and marshy area located along the west flank of the landfill. This area is adjacent to the runway and air traffic. It is possible that runoff from runway operations contributed to the higher concentration of petroleum hydrocarbons detected in the surface soil sample taken at Seep 2. Table 4-3 summarizes the results of the soil analyses.

4.2.2 Site 2, Northeast Landfill

Geophysics

A previous report (CH2M Hill 1985) showed Site 2, the Northeast Landfill, as consisting of three discrete trenches. In order to locate these trenches precisely, magnetometer and EMC geophysical surveys were conducted. No discrete trenches could be delineated from the geophysical data. Instead, the data indicated wide anomalies over the entire survey area. A historical aerial photograph was also found which showed the location of trenches as of 1970. This photo, like the geophysical survey data, contradicted the theory of three discrete trenches. The photo showed the Northeast Landfill in 1970 to be a series of trenches oriented north-south and east-west.

Based on the geophysical surveys and the aerial photo, the area delineated in Figure 4-1 was considered to have been trenched and landfilled. Further investigation, including the drilling of four boreholes, installation of two monitoring wells, and collection and analysis of soil samples and water samples, was based on the understanding of the trenched and landfilled area as delineated in Figure 4-1.

Geology

Based on published maps and observations made in the field during the Phase II investigation, Site 2, the Northeast Landfill, is situated on a thin cover of unconsolidated silts and clays overlying a gray to

Nearly all Organic Vapor Analyzer (OVA) readings were positive. The laboratory analyses indicated that none of the nine subsurface samples was contaminated with volatile organics. The probable explanation for the positive result in the soil gas survey and the negative result in the subsurface soil samples is that the OVA was detecting methane, which would not be detected in the soil samples. The fact that OVA readings remained constant when using a carbon filter further supports this conclusion.

The values for petroleum were also low and consistent among the samples (ND to 5.7 mg/kg), with the exception of sample DF4001, collected 100 feet east of the southeast corner of the fence line, which contained 34 mg/kg. Table 4-7 summarizes the results of the soil analyses.

4.2.4 Site 8, Herbicide Burial Area

Geology

Site 8, the Herbicide Burial Area, is similar in setting to Site 6, the North Burn Pit Area, and the Site 1, the South Landfill. The site is on an upland surface where silts and clays cover a weathered limestone bedrock. The original topography of the base has been modified by construction and extension of the major north-south runway. The area is nearly level, with broad shallow depressions and a small pond downgradient to the south.

A broad shallow depression was observed in the area of the suspected trench location based on AF 103. Water had ponded in this area and drained east into other wet areas. It is not known if the shallow depression was caused by possible subsidence of the 1971 trench or is due to construction activities since that date.

Hydrogeology

Based on observations made on other upland sites on the base, it can be assumed that the thickness of the unconsolidated deposits above the bedrock at this site is less than 7 feet. The burial trench was projected to be 6 feet in depth, which places the bottom of the trench very close to, if not directly on, the weathered bedrock surface. The hydrological implication is that the material that was buried, and

Table 4-9

RESULTS OF SOIL SAMPLE ANALYSES FOR
SITE 8, HERBICIDE BURIAL AREA

(mg/kg; all soil concentrations on an as received basis)

Parameter	Date Sampled: Boring#: Depth: Field No.: Lab No.:	10/10 HBAS-1 0-1' DF4015 8796	10/10 HBAS-2 0-1' DF4016 8797	10/10 HBAS-3 0-1' DF4017 8798	10/10 HBAS-4 0-1' DF4018 8799
Herbicides		ND	ND	ND	ND
Arsenic		1.83	5.0	ND	4.53
Mercury		ND	ND	ND	ND

ND = Not Detected

4.3 SIGNIFICANCE OF FINDINGS

4.3.1 Site 1, South Landfill

No contamination was detected leaving this site via surface migration into Scope Creek, based on the analyses of surface soil and water samples. Relatively low concentrations of petroleum hydrocarbons (1.2 mg/kg, 16 mg/kg) were detected in the subsurface soils. The extractable organic compound DBP, the only organic compound detected, was at low concentrations (10 to 16 µg/L), but it also appeared in the method blank (below 10 µg/L). Consequently, DBP has been attributed to laboratory contaminants.

4.3.2 Site 2, Northeast Landfill

With the exception of the extractable DBP, no organic chemicals or metals were reported in any water samples taken at the site. Because DBP was reported in concentrations (14 to 17 µg/L) minimally above sample blank value (13 µg/L), the presence of this chemical has been attributed to laboratory contamination.

Five anions were reported above detection limits. Only a single sample of sulfate at 280 µg/L exceeded a standard or criterion. Since this is a non-mandatory secondary standard set for aesthetic (taste and odor) considerations, the relatively minor exceedance, and the fact that there is no drinking water well nearby, should not represent any material threat to human health.

For soils, no metals exceeded normal ranges for western Missouri soils. The only detectable contaminant was petroleum hydrocarbons, reported at concentrations ranging from non-detectable to 440 mg/kg.

4.3.3 Site 6, North Burn Pit Area

Only three organics (chloroform, tetrachloroethylene, and methylene chloride) were detected in water samples from Site 6. Concentrations of two of the organics (below 1 µg/L) were significantly below EPA HAs. The third, methylene chloride, detected in a single groundwater sample, was well below the EPA HA.

No metals were reported above normal ranges for western Missouri soils. The only organic contaminant reported in soils above detection

have been associated with the storage of drummed hazardous materials here. These efforts included: overpacking drums, removal of stained soil, and scraping the asphalt surface. These efforts were undertaken as a result of a Notice of Violation issued by EPA.

4.3.7 Site 12, POL Storage Yard

The one groundwater and two surface water samples taken at Site 12, the POL Storage Yard, revealed no contamination above detection limits. In the 12 soil samples, petroleum hydrocarbon concentrations were relatively low (6.9 to 44 mg/kg). Removal of soils in the areas of the seven samples with higher concentrations (67 to 2,800 mg/kg) should be considered. In addition, a single sample collected near the drain pipe outlet for Building 953 at a depth of 3 feet contained concentrations of benzene (1.25 mg/kg), total xylenes (2.25 mg/kg), and ethylbenzene (6.25 mg/kg), indicative of contamination by gasoline or a similar petroleum hydrocarbon.

limits was petroleum hydrocarbons. Concentrations of petroleum hydrocarbons in 14 of the 15 samples taken at various depths ranged from non-detectable to 5.4 mg/kg. A single surface sample had a value of 34 mg/kg. In summary, the low concentrations found at the site indicate no undue risk to human health or the environment.

4.3.4 Site 8, Herbicide Burial Area

No detectable concentrations of any contaminant were reported in the single surface water sample taken at Site 8. Concentrations of metals in the four surface soil samples did not exceed the normal range of concentrations reported in western Missouri soils. In addition, no organic contamination was detected in the soil samples. Consequently, the data do not indicate that Site 8 presents an undue risk to human health or the environment.

4.3.5 Site 9, Oil-Saturated Area

No contaminants were detected in the single surface water sample at Site 9.

Results of the soil sample analyses indicate significant lead and petroleum hydrocarbon contamination of site soils. In six of nine samples, concentrations of lead fell within the normal range for western Missouri soils. In the same samples, petroleum hydrocarbon concentrations were relatively low (non-detectable to 9 mg/kg). In the remaining three samples, however, lead concentrations (117 to 343 mg/kg) greatly exceeded the normal range (10 to 20 mg/kg). In these same samples, petroleum hydrocarbons were also high (670 to 3,000 mg/kg). As these were samples taken from the surface (0- to 1-foot depth), humans would be subject to direct contact with high concentrations of lead from the site, warranting consideration of removal.

For the purpose of analyzing the potential human health risk related to lead exposure, it is assumed that humans ingest a maximum of 1 gram of soil daily during activities at the site. This number is extremely conservative (health protective), as it is based on the soil intake for small children--that segment of the population with highest soil intake as estimated by the Agency for Toxic Substances and Disease Registry (ATSDR 1986). Assuming 100% absorption of soil contaminants in

1 gram of soil, these intakes attributable to ingestion of onsite soils are then compared to the daily intake of lead regarded by EPA as acceptable as demonstrated by the current use of this limit in developing the RMCL of 20 $\mu\text{g}/\text{L}$ for lead.

An Acceptable Daily Intake (ADI) for adults related to soil lead ingestion has been derived based on the EPA proposed RMCL of 20 $\mu\text{g}/\text{L}$ and the following assumptions:

- Ingestion of 2 liters per day (L/day) for a 70-kg adult.
- Twenty percent of the ADI is contributed by water ingestion. This assumption is based on methodologies used to estimate revised drinking water standards (EPA 1985a).
- Intake of lead except by ingestion of drinking water and by the soil-related pathways is minimal.

For an adult:

$$20 \mu\text{g}/\text{L} \times 2 \text{ L/day} = 40 \mu\text{g}/\text{day} \text{ from ingestion of water}$$

$$40 \mu\text{g}/\text{day} + 0.2 = 200 \mu\text{g}/\text{day} \text{ from all sources}$$

$$200 \mu\text{g}/\text{day} - 40 \mu\text{g}/\text{day} = 160 \mu\text{g}/\text{day} \text{ from all sources}$$

excluding water ingestion, which
is the Adjusted Acceptable Daily
Intake (AADI) for soil for adults

In order that the AADI not be exceeded, the corresponding soil concentration must be no higher than 160 mg/kg.

4.3.6 Site 10, Hazardous Waste Drum Storage Area

The storage of hazardous waste drums in this compound does not appear to have contaminated the surface and subsurface soils. The only contaminants in soil were petroleum hydrocarbons, with concentrations ranging from non-detectable to 1,900 mg/kg. In six of the nine samples, concentrations were low (less than 9 mg/kg). However, concentrations were high (670 to 3,000 mg/kg) in three samples taken at 0- to 1-foot intervals, and removal of soils from these areas should be considered. The single surface water sample contained barium (85 $\mu\text{g}/\text{L}$) and lead (5 $\mu\text{g}/\text{L}$) significantly below the EPA standards or criteria. No other contaminants were detected in the sample. It appears that the remedial efforts undertaken at this site have cleaned up any problems that may

5. ALTERNATIVE MEASURES

This section discusses the alternative measures that can be taken at each of the seven sites. The alternatives have been devised based on the results of the Phase II Stage 2 investigations. A "no-action" alternative is considered for each site. Recommendations as to the most appropriate alternatives are presented in Section 6.

5.1 SITE 1, SOUTH LANDFILL

No significant contamination of surface water, surface soils, or subsurface soils was found at this site. Minor amounts of petroleum hydrocarbons (less than 16 mg/kg) were detected in one of the surface runoff pathways and at the base of the borehole. No monitoring wells exist on this site.

Alternatives for this site include:

- No action. This alternative is applicable should it be decided that the levels of contaminants detected in the samples do not require further action.
- Long-term monitoring. Seasonal fluctuations in groundwater and rainfall could have accounted for the minor amount of seepage found in the Phase II Stage 2 investigation. Under this alternative, areas of the two known seeps would be resampled periodically and searches would be made for additional seeps.
- Installation of upgradient monitoring wells. Two wells could be installed in association with this landfill, one to the west and one to the south. The west well would test the marshy area which is the source for Seep 2; the south well would determine if sufficient recharge for water samples to be taken could be developed from the area of Borehole 7. This borehole showed a small amount of water and traces of hydrocarbons near its base. The south well

might also indicate whether contaminants have migrated from the South Burn Pit Area, an area that was never clearly located and was not part of the Phase II Stage 2 investigation. The South Burn Pit Area was believed to be located south of the South Landfill.

5.2 SITE 2, NORTHEAST LANDFILL

No significant contamination was detected in association with this site. The utilization of the site for landfilling operations is much more extensive than was previously thought. A soil sample taken from below the fill material indicates that the liquids in the landfill are not penetrating into underlying soil. In two samples at the 1- to 2-foot depth, petroleum hydrocarbons were reported at 78 and 440 mg/kg. This landfill, no longer USAF property, is leased to Kansas City Aviation Company and is being used to store excess property and large refuse items. The USAF should survey the perimeter of the landfill area and present this information to the current property owner and include it in the deed to the property. This will alert the owner as to any limitations on future uses of the land, including future construction and improvements. Already, a sewer line has been cut through the south edge of the landfill. It is not known what effect the intersection with the landfill will have on the integrity of that sewer system in the years to come.

Alternatives for this site include:

- No action. If it is determined that there is no threat to the surrounding environment, no further action would be necessary.
- Long-term monitoring. As part of the base groundwater sampling plan, the five wells at the landfill could be sampled to monitor the continued integrity of the landfill and as a check on the area groundwater quality.

5.3 SITE 6, NORTH BURN PIT AREA

Three volatile organics were detected in perched groundwater at this site--chloroform and tetrachloroethylene at concentrations significantly below drinking water standards or criteria, and methylene chloride in a single sample at a concentration of 37 µg/L, an order of magnitude below the EPA drinking water health advisory. There is very little groundwater, and no deep aquifers are threatened. Soil gas

readings indicated that organic vapor contamination is confined within the perimeter of the site. Soil contamination was limited to low concentrations of petroleum hydrocarbons, which were not found in any water sample.

Alternatives for this site include:

- No action. This alternative would be applicable if it is decided that the levels of contaminants detected in these samples do not warrant action. The concentrations observed have been below federal drinking water standards and there are no receptors.
- Long-term monitoring. Seasonal rainfall could recharge the two wells on this site which were essentially dry at the time of the Phase II Stage 2 investigation. The wells could be monitored for evidence of a contaminant plume by sampling for organic contamination.
- Installation of additional monitoring wells. The northeast monitoring well could be nested with a deeper well (drilled to bedrock) to determine if the organic contamination observed in the shallow wells is migrating along the weathered bedrock interface. A monitoring well could be installed outside the compound to the east, near the outfall from the oil-water separator. This would provide a check on the efficiency of this unit and could aid in locating seeps from lower stratigraphic units.

5.4 SITE 8, HERBICIDE BURIAL AREA

There is no conclusive data on the location of the trench or the characterization of this site. No soil borings were made and so no subsurface soil samples were collected.

Alternatives for this site include:

- No action. If it is determined on the basis of present information that the amounts of herbicides buried at this site and the mode of containment do not constitute an environmental problem, no further action would be necessary.
- Additional investigation. Additional effort to locate the trench should include locating and examining aerial photographs not previously available and performing a ground conductivity survey over the suspected area. Once the trench is located, testing and sampling could begin by drilling a series of 10-foot boreholes in the four corners of the trench area. Also, a sediment sample could be taken from the pond downgradient of the trench.

5.5 SITE 9, OIL-SATURATED AREA

Surface soil was found to be contaminated with petroleum hydrocarbons and lead. Levels of lead exceeded 160 mg/kg, the criterion derived for protection of human health (see Section 4.3.5). In addition, concentrations of petroleum hydrocarbons in three of the nine soil samples in the 0- to 1-foot depth were very high. Access to the site, and therefore to these materials, is limited.

Alternatives for this site include:

- No action. Since there is little chance of direct contact, it may be determined that the levels of contaminants detected do not warrant further action.
- Preparation for Phase IV actions. This action would require the removal of contaminated soils and gravel, after identifying the volume to be removed.

5.6 SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA

Only minor contamination of surface water was detected in association with this site. The concentrations of the two contaminants detected, lead and barium, were below drinking water standards. Petroleum hydrocarbon values were high (up to 1,900 mg/kg) along the south fence line. The sources may include spillage, dripping from the numerous heavy vehicles and smaller vehicles (grass mowers) now present in this compound. Storage of drums containing petroleum products in the compound may also have been a source.

Alternatives for this site include:

- No action. Due to the absence of detectable contamination resulting from the storage of hazardous waste drums at this site, no further action is warranted.
- Identification of petroleum hydrocarbon hot spots. This option would require delineating the areas of high petroleum hydrocarbon contamination, in preparation for removal actions (Phase IV).

5.7 SITE 12, POL STORAGE YARD

Site 12, the POL Storage Yard, is the distribution center for all fuels and propellants on the base. The groundwater south of the

facility is free from contamination. Soils inside the tank berms indicate significant petroleum hydrocarbon accumulations (concentrations ranged upwards to 2,800 mg/kg). Volatile organic contamination was detected in the subsurface outside of Building 953, a pumphouse. Additional pumphouses are present, but were not sampled. The contaminated soil sample came from an area where a broken drain pipe from the pumphouse is thought to be located.

Alternatives for this site include:

- No action. If the levels of contaminants identified are determined not to be excessive for present operation of the site, then no further action is warranted.
- Long-term monitoring. After the installation of a monitoring well during Phase II Stage 2, sampling and analysis of this well on a periodic basis would serve to monitor groundwater conditions at this site.
- Additional subsurface soil sampling. The area of greatest environmental concern is located east of the pumphouses. A series of shallow hand-auger borings could be taken in a grid pattern to determine the extent of organic contamination in the soil.

Table 6-1

LIST OF SITES BY CATEGORY

Category I - No Further Action Recommended

- Site 1: South Landfill

Category II - Additional Site Assessment Recommended

- Site 4: West Burn Area
- Site 6: North Burn Pit Area
- Site 8: Herbicide Burial Area
- Site 12: POL Storage Yard

Category III - Remedial Action Recommended

- Site 2: Northeast Landfill
 - Site 6: North Burn Pit Area
 - Site 9: Oil-Saturated Area
 - Site 10: Hazardous Waste Drum Storage Area
-

Table 6-2
SUMMARY OF RECOMMENDATIONS

Site 1 - South Landfill

- No further action.

Site 2 - Northeast Landfill

- Monitor five monitoring wells biannually for 2 years.
- Monitor land use at landfill biannually for 2 years.

Site 4 - West Burn Area

- Perform a soil gas survey to locate the site.
- Install three monitoring wells.
- Sample the surface and subsurface soils.

Site 6 - North Burn Pit Area

- Install two additional monitoring wells, a second well in northeast corner of site, well to be drilled to bedrock or 50 feet, and one outside the compound to the east (20 feet).
- Monitor five wells biannually for 2 years.

Site 8 - Herbicide Burial Area

- Locate the burial trench using aerial photos and a ground conductivity survey. Drill four shallow borings (10 feet) and sample soil for pesticides, mercury, and arsenic.
- Excavate and remove buried pesticides from trench.

Site 9 - Oil-Saturated Area

- Remove oil-contaminated sediments from along the fence line.

Site 10 - Hazardous Waste Drum Storage Area

- Remove oil-contaminated surficial soils.

Site 12 - POL Storage Yard

- Install four monitoring wells to bedrock.
 - Monitor wells.
-

INSTALLATION RESTORATION PROGRAM

PHASE II

CONFIRMATION/QUANTIFICATION

STAGE 2

**RICHARDS-GEBAUR AIR FORCE BASE
MISSOURI**

Prepared by:
ECOLOGY AND ENVIRONMENT, INC.
Buffalo Corporate Center
368 Pleasantview Drive
Lancaster, New York 14086
July 1988

FINAL REPORT
(September 1986 to November 1987)

VOLUME 2: APPENDICES

**Approved for Public Release:
Distribution is Unlimited**

Prepared for:

UNITED STATES AIR FORCE
Headquarters Air Force Reserve (HQ AFRES/SGPB)
Robins Air Force Base, Georgia 31098-6001

UNITED STATES AIR FORCE
**Occupational and Environmental Health Laboratory/
Technical Services Division (USAFOEHL/TS)**
Brooks Air Force Base, Texas 78235-5501

APPENDIX E
CHAIN-OF-CUSTODY FORMS

Ecology and environment, inc.

105 SUGG ROAD, P.O. BOX O, BUFFALO, N.Y., 14226, TEL. 716-632-4491
International Specialists In the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 2

Project No.:	Project Name:			Project Manager:							REMARKS			
DF4000	Richards Gebau AFB			Paul R. Kopsick										
Samplers: (Signatures)				Field Team Leader:			Paul R. Kopsick							
STATION NUMBER	DATE	TIME	SAMPLE TYPE		SAMPLE INFORMATION		STATION LOCATION	NUMBER OF CONTAINERS	40 ML	100 ML	250 ML	500 ML	Depth	OVA
			COMP	GRAIN	AIR	EXPECTED COMPOUNDS (Concentration)*:								
DF4036	10/16	1855	X			VOA, Pet. hydro	NELF Boring 4	3	2	1		1-2'	(2963)	
37	10/16	1900	X						2	1		6-7'	3964	
38	10/16	1905	X						2	1		8-10.5'	3965	
39	10/17	1000	X			VOA, Pet. Hydro, Land	OIL STAIN AREA Boring 5	2	1			3-4	3966	
40	10/17	1000	X						2	1		8-9	3967	
41	10/17	1000	X						2	1		15.5-16.5'	3968	
42	10/17	1000	X			VOA, Pet, Hydro, EPTOX metals	HWSA - Boring 6	2	1			5-1.5'	3969	
43	10/17	1100	X						2	1		9-10'	3970	
44	10/17	1030	X						2	1		4.5-5.5'	3971	
45	10/17	1030	X			VOA, Pet, Hydro	POL TANKS	2	1			pet. Hydro	3972	
46	10/17	1030	X			VOA, Pet. Hydro	POL TANKS	2	1			upstream - H ₂ SO ₄	3973	
47	14	X				VOA, Pet. Hydro	SOUTH LF Boring 7	2	1			downstream - H ₂ SO ₄	3974	
48	14	X				VOA, Pet. Hydro		2	1				3975	
49	14	X				VOA, Pet. Hydro		2	1				3976	
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		Ship Via: Fed X				
Paul R. Kopsick			10/17/86	EPA EXP										
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		BL/Airbill Number: Date:				
Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)		Date:				
EPA EXP			10/17/86	J. M. Clark										

Distribution: Original Accompanies Shipment: Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055

ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

RECYCLED

CHAIN-OF-CUSTODY RECORD

Page 2 of 2

Project No.:	Project Name:			Project Manager:											
DF4000	RICHARDS - GEBAUER AFIS			Paul Kopsick											
Samplers: (Signatures)				Field Team Leader:											
<i>Paul Kopsick/M. W. May Jr.</i>				<i>Paul Kopsick</i>											
STATION NUMBER	DATE	TIME	SAMPLE TYPE	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	DEPTH						REMARKS
				COMP	GRAB	AIR			EXPECTED COMPOUNDS (Concentration)*						
DF4050	10/17	1500	/	VOL, PET Hydro			NE Landfill Boring 8	2	1	7.0' - 7.9'	84774				
DF4051	10/17	1550	/	VOL, PET Hydro			NE LF Boring 9	2	1	4.0' - 5.0'	84775				
52	10/17	1540	/					2	1	6.0' - 7.0'	84777				
520	10/17	1540	/					2	1	6.0' - 7.0' (DUPLICATE)	84778				
53	10/17	1600	/					2	1	9.0' - 10.0'	84779				
DF4054	10/17	1800	/	VOL, PET Hydro			NORTH OF NE LF Boring 10	2	1	1.0' - 2.0'	84780				
55	10/17	1805	/					2	1	4.0' - 5.0'	84781				
56	10/17	1810	/					2	1	7.0' - 8.0'	84782				
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		Ship Via:					
<i>Paul Kopsick</i>			1830 10/17	<i>FED EXP</i>		<i>F</i>				<i>Fed Ex</i>					
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		BL/Airbill Number:			Date:		
<i></i>													10/17/86		
Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)							
<i>FED EXP</i>			0900 10/18/86	<i>T. Marshall</i>											

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055



ecology and environment, inc.

195 SUGG ROAD, P.O. BOX 0, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists In The Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 2.

Distribution: Original Accompanier Shipment; Copy to Coordinator Field Files
*See CONCENTRATION RANGE on back of form

*See CONCENTRATION RANGE on back of form.

ecology and environment, inc.

196 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14228, TEL. 716-632-4491
International Specialists In the Environment

RECYCLED

CHAIN-OF-CUSTODY RECORD

Page 2 of 2

Project No.: DF 1000	Project Name: Richards Gebauern AFB			Project Manager: PAUL KOPSKICK	Field Team Leader: PAUL Kopsick			REMARKS					
Samplers: (Signatures) <i>Paul Kopsick</i>													
STATION NUMBER	DATE	TIME	SAMPLE TYPE	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	40ML VOA	1L Poly	1L Tex Amber	64L Amber	
				COMP	GRAB	AIR							EXPECTED COMPOUNDS (Concentration)*
044071	10/21	1550	X	VOA, pH Hydro, TDS, Ext, PPmetals, Anions, Phenols			SLFSEEPW 9087	7	1	3	1	2	8.00 56.7 67.4
72	10/21	1730	X	VOA Field Blank			9095	1	1				
Relinquished By: (Signature) <i>Paul Kopsick</i>	Date/Time: 10/21/66	Received By: (Signature) <i>Fel. Fyrus</i>	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via:							
Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	BL/Airbill Number:							
Relinquished By: (Signature) <i>J. C. L. - 10/21/66</i>	Date/Time: 10-21-66/0900	Received For Laboratory By: (Signature) <i>J. C. L. 10/21/66 C</i>	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Date:							

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055

ecology and environment, inc.

195 BUGG ROAD, P.O. BOX O, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.:	Project Name:			Project Manager:			REMARKS									
DF4000	Richards - Gebair AFB			PAUL KOPSICK												
Samplers: (Signatures)				Field Team Leader:												
<i>Mahal Muburkhi, Joe Chandler, Mark Myr</i>				<i>Joe Chandler</i>												
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRAB AIR	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	40ML VIALS (SET)			80Z SAR				
				EXPECTED COMPOUNDS (Concentration)*												
DF400A	10/24	1050	X	VOA, Petroleum Hydrocarbons			POL TANK # 955	3	2	1	1				DEPTH = 1.0'	9343
80	10/24	1100	X				POL TANK # 955	3	2	1	1				" = 2' 10"	9344
81	10/24	1130	X				POL TANK # 955	3	2	1	1				" = 6.0'	9345
82	10/24	1330	X				POL TANK # 957	3	2	1	1				" = 1.0'	9346
83	10/24	1345	X				POL TANK # 957	3	2	1	1				" = 2' 8"	9347
84	10/24	1415	X				POL TANK # 957	3	2	1	1				" = 6.0'	9348
85	10/24	1450	X				POL TANK # 957	3	2	1	1				" = 1.0'	9349
86	10/24	1500	X				POL TANK # 954	3	2	1	1				" = 3.0'	9350
87	10/24	1525	X				POL TANK # 954	3	2	1	1				" = 5.0'	9351
48	10/24	1555	X				B. 955 drain	3	2	1	1				Carhart 62 Bld. 952	9353
870	10/24	1515	+	87 DUP			Carhart 62 Bld. 952	2	1	1					Duplicate (5 ft) / 9352	
Relinquished By: (Signature)				Date/Time: 10/24/86	Received By: (Signature)	Relinquished P	Signature			Date/Time:			Received By: (Signature)			Ship Via:
Relinquished By: (Signature)				Date/Time:	Received By: (Signature)	Relinquished	Signature			Date/Time:			Received By: (Signature)			Fed. Ex
Relinquished By: (Signature)				Date/Time:	Received For Laboratory By: (Signature)	Relinquished	Signature			Date/Time:			Received For Laboratory By: (Signature)			BL/Airbill Number:
Fct. Express				10-24-86 / 0930	N/L-11 MHC											Date:

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files
*See CONCENTRATION RANGE on back of form.

234055

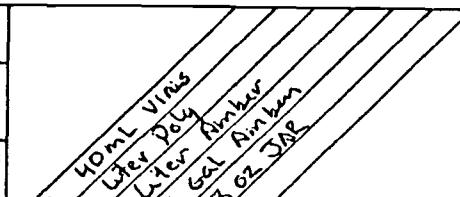
Ecology and environment, inc.

198 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225. TEL. 716-632-4491

International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.: DF4000	Project Name: Richards Gebaum AFB			Project Manager: PAUL KOPSICK	 1. HONL Virus 2. Liver Poly 3. Liver Amine 4. GEL Amine 5. 902 JAR												
Samplers: (Signatures)			Field Team Leader: PAUL KOPSICK														
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRAB AIR	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	REMARKS								
				EXPECTED COMPOUNDS (Concentration)*					PH COND TEMP								
73	10/23	1050	X	VOA, TDS, Phenol, Pet Hydro, Anions, Extra ppm's			NELF culvert	7	1	3	1	2		7.92	61B	62.0	9230
74	10/23	1100	X				NELF Downstream	8	7	1	3	1	2	7.87	341	61.4	9231
75	10/23	1110	X				NELF Upstream	8	7	1	3	1	2	8.01	374	61.0	9232
76	10/23	1200	X				SLF SEEP 2	8	7	1	3	1	2	7.94	540	66.4	9233
77	10/23	1210	X	VOA, Pet. Hydro			SLF SEEP 2	3	2	1							9234
78	10/23	1220	X	VOA BLANK			NELF m1	1	1								9235
DF4063	10/23	1030	X	Phenols			NELF m1	11	1					Replaces Broken jar of 10121 9235			
Relinquished By: (Signature)			Date/Time: 1700 10/23	Received By: (Signature)		Relinquished By: (Signature)		Date/Time:	Received By: (Signature)		Ship Via:		Fed Exp				
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)		Date/Time:	Received By: (Signature)		BL/Airbill Number:					Date:	
Relinquished By: (Signature)			Date/Time: 1930 10/24/86	Received For Laboratory By: (Signature)		Relinquished By: (Signature)		Date/Time:	Received For Laboratory By: (Signature)								

Distribution: Original Accompanies Shipment: Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055

Ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14226, TEL. 716-632-4491
International Specialists in the Environment

Page 1 of 1

CHAIN-OF-CUSTODY RECORD

Project No.: DF4000	Project Name: Richards Gebau AFB			Project Manager: PAUL Kopsick			<i>2-40-1 Var Jars</i> <i>1-8-82 Soc</i>			REMARKS	
Samplers: (Signatures)			Field Team Leader: PAUL Kopsick								
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRAB AIR	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS			
				EXPECTED COMPOUNDS (Concentration)*							
DF4027	10/15	1420	X	VCA, Petroleum Hydrocarbons 8844			NB Boring 1 S-1	3	2 /	8844 3.5-4.5	all positive O&A reading
DF4026		1430	X	8895			NB 1 S-2	3	2 /	7-8'	
DF4029		1435	X	8896			NB 1 S-3	3	2 /	12-12.4'	
DF4031		1510	+	8897			NB Boring 2 S-1	3	2 /	2-3'	
DF4031		1515	+	8898			NB 2 S-2	3	2 /	5.6'	
DF4032		1520	+	8899			NB 2 S-3	3	2 /	11-12'	
DF4033		1600	+	8901			NB Boring 3 S-1	3	2 /	2-3'	
DF4034		1605	+	8902			NB 3 S-2	3	2 /	5.6'	
DF4035		1610	+	8903			NB 3 S-3	3	2 /	11-12'	
DF4021		1720	+	8900 DUPLICATE			NB Boring 2 S-3	3	2 /	11-12'	
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		Ship Via:	
<i>Paul Kopsick</i>			10/15 1700hr	<i>Joseph Charles</i>		<i>Joseph Charles</i>	10/15 1745	Fed. Express		<i>Federal Exp</i>	
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		BL/Airbill Number:	
<i>Fed Express</i>			10-16-86 10500	<i>W. W. H. Howard</i>						10115186	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field File

*See CONCENTRATION RANGE on back of form.

234056



ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists In the Environment

CHAIN-OF-CUSTODY RECORD

Page _____ of _____.

Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via:
<i>Joe Channer</i>	1330	Fed. Express				<i>Federal Express</i>
Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	BL/Airbill Number:
						Date:
Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	
<i>Fed. Express</i>	11-5-96 / 0900	<i>Willie W. Head</i>				

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

* See CONCENTRATION RANGE on back of form.

234056



ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.: DF-41CCC	Project Name: RICHARDSON - GFBANK AFB TRP	Project Manager: PAUL KOTPSICK																																																																																																																																																																																																																								
Samplers: (Signatures)													Field Team Leader: PAUL KOTPSICK																																																																																																																																																																																																													
<p><i>P. Kotpsick MAILNAR</i></p> <table border="1"> <thead> <tr> <th rowspan="2">STATION NUMBER</th> <th rowspan="2">DATE</th> <th rowspan="2">TIME</th> <th colspan="3">SAMPLE INFORMATION</th> <th rowspan="2">STATION LOCATION</th> <th rowspan="2">NUMBER OF CONTAINERS</th> <th colspan="5">REMARKS</th> </tr> <tr> <th>COMP</th> <th>GRAB</th> <th>AIR</th> <th colspan="3">EXPECTED COMPOUNDS (Concentration)*</th> <th colspan="5"></th> </tr> </thead> <tbody> <tr> <td>DF-41C-1</td> <td>10/9/81</td> <td>1200</td> <td>X</td> <td>VCA, C-1-C-</td> <td></td> <td></td> <td>8765</td> <td>Wetland Area - S1</td> <td>3</td> <td>2</td> <td>1</td> <td></td> <td>Buoy at 100' E</td> </tr> <tr> <td>40002</td> <td>10/9/81</td> <td>1210</td> <td>X</td> <td>VCA, C-1-C-</td> <td></td> <td></td> <td>8766</td> <td>-S2</td> <td>3</td> <td>2</td> <td>1</td> <td></td> <td>BUOY AT 100' E</td> </tr> <tr> <td>40003</td> <td>10/9/81</td> <td>1215</td> <td>X</td> <td>VCA, C-1-C-</td> <td></td> <td></td> <td>8767</td> <td>-S3</td> <td>3</td> <td>2</td> <td>1</td> <td></td> <td>No. thal. Form.</td> </tr> <tr> <td>40004</td> <td>10/9/81</td> <td>1230</td> <td>X</td> <td>VCA, C-1-C-</td> <td></td> <td></td> <td>8768</td> <td>-S4</td> <td>3</td> <td>2</td> <td>1</td> <td></td> <td>NE Line CCA - 100' F</td> </tr> <tr> <td>40005</td> <td>10/9/81</td> <td>1245</td> <td>X</td> <td>VCA, C-1-C-</td> <td></td> <td></td> <td>8769</td> <td>-S5</td> <td>3</td> <td>2</td> <td>1</td> <td></td> <td>SW Line CCA - Form.</td> </tr> <tr> <td>40006</td> <td>10/9/81</td> <td>1245</td> <td>X</td> <td>VCA, C-1-C- no GDBP no VCA</td> <td></td> <td></td> <td>8770</td> <td>Surf W-BB</td> <td>5</td> <td>2</td> <td>1</td> <td></td> <td>pH 8.50 1400 m.w. 100.5°C.</td> </tr> <tr> <td>40007</td> <td>10/9/81</td> <td>1430</td> <td>X</td> <td>VCA, C-1-C-, Lead</td> <td></td> <td></td> <td>8770</td> <td>C. Continental Area - S1</td> <td>3</td> <td>1</td> <td>1</td> <td></td> <td>CO. of form.</td> </tr> <tr> <td>40008</td> <td>10/9/81</td> <td>1430</td> <td>X</td> <td>VCA, C-1-C-, Lead</td> <td></td> <td></td> <td>8771</td> <td>-S2</td> <td>3</td> <td>1</td> <td>1</td> <td></td> <td>CCNEN of form + 25°</td> </tr> <tr> <td>40009</td> <td>10/9/81</td> <td>1430</td> <td>X</td> <td>VCA, C-1-C-, Lead</td> <td></td> <td></td> <td>8772</td> <td>-S3</td> <td>3</td> <td>2</td> <td>1</td> <td></td> <td>CCNEN of form + 50°</td> </tr> <tr> <td>40010</td> <td>10/9/81</td> <td>1515</td> <td>X</td> <td>VCA, C-1-C-, Lead</td> <td></td> <td></td> <td>8773</td> <td>-S4</td> <td>3</td> <td>2</td> <td>1</td> <td></td> <td>outside m.w. of form 100°</td> </tr> <tr> <td>40011</td> <td>10/9/81</td> <td>1530</td> <td>X</td> <td>VCA, C-1-C-, Lead</td> <td></td> <td></td> <td>8774</td> <td>-S5</td> <td>3</td> <td>2</td> <td>1</td> <td></td> <td>outside m.w. of form 100°</td> </tr> <tr> <td>40012</td> <td>10/9/81</td> <td>1545</td> <td>X</td> <td>VCA, C-1-C-, Lead</td> <td></td> <td></td> <td>8775</td> <td>-S6</td> <td>3</td> <td>2</td> <td>1</td> <td></td> <td>outside m.w. of form 100°</td> </tr> <tr> <td>40013</td> <td>10/9/81</td> <td>1545</td> <td>X</td> <td>VCA, C-1-C-, Lead, TDS</td> <td></td> <td></td> <td>8777</td> <td>-S1</td> <td>5</td> <td>2</td> <td>1</td> <td></td> <td>pH 8.50 1400 m.w. 100.5°C. CONTINENTAL FORM</td> </tr> </tbody> </table>													STATION NUMBER	DATE	TIME	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	REMARKS					COMP	GRAB	AIR	EXPECTED COMPOUNDS (Concentration)*								DF-41C-1	10/9/81	1200	X	VCA, C-1-C-			8765	Wetland Area - S1	3	2	1		Buoy at 100' E	40002	10/9/81	1210	X	VCA, C-1-C-			8766	-S2	3	2	1		BUOY AT 100' E	40003	10/9/81	1215	X	VCA, C-1-C-			8767	-S3	3	2	1		No. thal. Form.	40004	10/9/81	1230	X	VCA, C-1-C-			8768	-S4	3	2	1		NE Line CCA - 100' F	40005	10/9/81	1245	X	VCA, C-1-C-			8769	-S5	3	2	1		SW Line CCA - Form.	40006	10/9/81	1245	X	VCA, C-1-C- no GDBP no VCA			8770	Surf W-BB	5	2	1		pH 8.50 1400 m.w. 100.5°C.	40007	10/9/81	1430	X	VCA, C-1-C-, Lead			8770	C. Continental Area - S1	3	1	1		CO. of form.	40008	10/9/81	1430	X	VCA, C-1-C-, Lead			8771	-S2	3	1	1		CCNEN of form + 25°	40009	10/9/81	1430	X	VCA, C-1-C-, Lead			8772	-S3	3	2	1		CCNEN of form + 50°	40010	10/9/81	1515	X	VCA, C-1-C-, Lead			8773	-S4	3	2	1		outside m.w. of form 100°	40011	10/9/81	1530	X	VCA, C-1-C-, Lead			8774	-S5	3	2	1		outside m.w. of form 100°	40012	10/9/81	1545	X	VCA, C-1-C-, Lead			8775	-S6	3	2	1		outside m.w. of form 100°	40013	10/9/81	1545	X	VCA, C-1-C-, Lead, TDS			8777	-S1	5	2	1		pH 8.50 1400 m.w. 100.5°C. CONTINENTAL FORM
STATION NUMBER	DATE	TIME	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	REMARKS																																																																																																																																																																																																																		
			COMP	GRAB	AIR			EXPECTED COMPOUNDS (Concentration)*																																																																																																																																																																																																																		
DF-41C-1	10/9/81	1200	X	VCA, C-1-C-			8765	Wetland Area - S1	3	2	1		Buoy at 100' E																																																																																																																																																																																																													
40002	10/9/81	1210	X	VCA, C-1-C-			8766	-S2	3	2	1		BUOY AT 100' E																																																																																																																																																																																																													
40003	10/9/81	1215	X	VCA, C-1-C-			8767	-S3	3	2	1		No. thal. Form.																																																																																																																																																																																																													
40004	10/9/81	1230	X	VCA, C-1-C-			8768	-S4	3	2	1		NE Line CCA - 100' F																																																																																																																																																																																																													
40005	10/9/81	1245	X	VCA, C-1-C-			8769	-S5	3	2	1		SW Line CCA - Form.																																																																																																																																																																																																													
40006	10/9/81	1245	X	VCA, C-1-C- no GDBP no VCA			8770	Surf W-BB	5	2	1		pH 8.50 1400 m.w. 100.5°C.																																																																																																																																																																																																													
40007	10/9/81	1430	X	VCA, C-1-C-, Lead			8770	C. Continental Area - S1	3	1	1		CO. of form.																																																																																																																																																																																																													
40008	10/9/81	1430	X	VCA, C-1-C-, Lead			8771	-S2	3	1	1		CCNEN of form + 25°																																																																																																																																																																																																													
40009	10/9/81	1430	X	VCA, C-1-C-, Lead			8772	-S3	3	2	1		CCNEN of form + 50°																																																																																																																																																																																																													
40010	10/9/81	1515	X	VCA, C-1-C-, Lead			8773	-S4	3	2	1		outside m.w. of form 100°																																																																																																																																																																																																													
40011	10/9/81	1530	X	VCA, C-1-C-, Lead			8774	-S5	3	2	1		outside m.w. of form 100°																																																																																																																																																																																																													
40012	10/9/81	1545	X	VCA, C-1-C-, Lead			8775	-S6	3	2	1		outside m.w. of form 100°																																																																																																																																																																																																													
40013	10/9/81	1545	X	VCA, C-1-C-, Lead, TDS			8777	-S1	5	2	1		pH 8.50 1400 m.w. 100.5°C. CONTINENTAL FORM																																																																																																																																																																																																													
Relinquished By: (Signature)			Date/Time: 10/10/81 1000	Received By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)			Ship Via:																																																																																																																																																																																																														
<i>Paul Kotpsick</i>			10/10/81 1000	<i>Fed Express</i>								<i>Fed Express</i>																																																																																																																																																																																																														
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)			BL/Airbill Number:																																																																																																																																																																																																														
Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)			Date:																																																																																																																																																																																																														
<i>Express 1</i>			10-10-81 / 0900	<i>Paul Kotpsick</i>								10/10/81																																																																																																																																																																																																														

a: Original Accompanies Shipment; Copy to Coordinator Field Files

INSTRUMENTATION RANGE on back of form.

234055

Ecology and environment, inc.

395 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

Project No. DF4000

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.: DF4000 Project Name: Richards-Gebaur AFB IRP				Project Manager: Paul Kopsick				REMARKS			
Samplers: (Signature) <i>PK</i> Paul Kopsick, Bill Kwoka, Mike Michalowski				Field Team Leader: Paul Kopsick							
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRAB AIR	SAMPLE INFORMATION		STATION LOCATION	NUMBER OF CONTAINERS	40 ml VOA vials (x2)			
				EXPECTED COMPOUNDS (Concentration)*				1 liter poly	1 liter Amber	1/2 gal Amber	8 oz Jar
DF4014	10/10	1120	X	VOA, O&G	8795	North Burn Area S-6	2	1	1		
DF4015		1315	X	Pesticides, Arsenic, Mercury	8796	Herbicide Burial S1	2		2		300' South of Road
DF4016		1320	X		8797		-S-2	2		2	25' East of DF4015
DF4017		1330	X		8798		-S-3	2		2	25 East of DF4016
DF4018		1340	X		8799		-S-4	2		2	100' South of Road
DF4019		1445	X	VOA, EP Tox. (Metals), O&G	8800	Haz. Waste Storage S-1	2	1	1		Background Soil
DF4020		1505	X		8801		S-2	2	1	1	Gate of Compound
DF4021		1445	X		8802		S-3	2	1	1	Fence corner 0-26'
DF4022		1500	X		8803		S-4	2	1	1	26-60'
DF4023		1500	X		8804		S-5	2	1	1	60-120'
DF4024		1455	X		8805		S-6	2	1	1	Opposite corner + 25'
DF4025		1515	W	VOA, TDS, O&G, PPMetals, Barium, Mercury	8806	Cancelled per P. Kopsick 10/15/86	W-1	4	1	2	1
DF4026		1600	W	Herb.	8808	Field Blank		1	1	1	1
DF4027		1315	W	Pesticides, TDS, Arsenic, Mercury	8809	Herbicide Burial W-1	3	2	1		Pond in Field 65°F 15°C 62.7°F
Relinquished By: (Signature) <i>Paul Kopsick</i>		Date/Time: 10/10/86 7000		Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		Ship Via: Federal Express	
Relinquished By: (Signature)		Date/Time:		Received By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received By: (Signature)		BL/Airbill Number:	
Relinquished By: (Signature)		Date/Time:		Received For Laboratory By: (Signature)		Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)		Date: 10/10/86	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field File

*See CONCENTRATION RANGE on back of form.

234055

Provided on the following pages are sample receipt logs for the appropriate sample numbers as documentation of proper sample management and documentation procedures.



PACKAGE RECEIPT LOG

0243

recycled paper

E-13

"reduces" and environment

ITEM NO.	CLIENT NAME and/or JOB NO.	DATE RECEIVED	RECEIVED FROM (e.g., carrier)	CARRIER I.D. NO. or INITIALS	SHIPPING INVOICE NO. (Place in file)	PACKAGE DESCRIPTION (e.g., 1 cooler, 1 jar, etc.)	PACK- AGE SEC- URED	MANNER PACKAGE SECURED				PACKAGE DISPOSITION		CUSTODIAL INITIALS	
								Yes	No	Custodianship	Flight/airline	Type	Other	Deficiencies	
4332	PDS Chemical	10-9-86	L.Rotell	ZK	none	1-Cartboard Box		v							LHH
4328	Edgetreach Appliance	10-9-86	A. Devereux	ADJ	none	1-Plastic Bag									LHH
4337	Marine Ambrose	10-9-86	Client	JKL	120112	1-Plastic Bucket									LHH
4340	Seller Thewalt Motor	10-9-86	Client	JIP/JL	none	1-Cooler									LHH
4341	Sterling Environmental	10-9-86	Client	ZK	none	3-16oz v.m. poly									LHH
4342	Richards-Gebauer AFB	10-10-86	Fed Express	MM	Act# 1533064816	1-Cooler		v	-						LHH
4343	C.P.C - Tonawanda	10-10-86	Client	JKL/V	110112	1-Cartboard Box		v							LHH
4344	New York Air Brake	10-10-86	U.S. Air	JKL	Flight 4634-97	1-Cooler									LHH
4345	Richards-Gebauer AFB	10-11-86	FED EXPRESS	D.M	110112 1533064816	1-Cooler		v	-					H.O	LHH
4346	US EPA	10-12-86	Fed Express	JKL	120112 1205115521	1-Cooler		v	-						LHH
4347	John J. Glass	10-13-86	Client	JKL	110112	1-125ml poly									LHH
4348	Bickert-Gebauer AFB	10-13-86	Shippers 116	JKL/H	See Item # 4345	1-Cooler		v	-						LHH
4349	Frontier Insulation	10-13-86	Client	JKL	none	2-16oz jugs									LHH
4350	FMC - M. deLepeurt	10-13-86	Client	RAS	none	3-1L glass									LHH
4351	D. Pizzi Construction	10-13-86	Client	JKL	none	2-125ml poly		v							LHH
4352	House Management Div	10-13-86	Client	BAC	none	1-glass bottle		v							LHH
4353	Springville Central School	10-13-86	W.Hall	W.H	none	2 PLASTIC		v							LHH
4354	V.F.T.A.	10-14-86	Client	JKL	none	1-foam T.v.		v							LHH

EXPLANATIONS:

LHS

HII

SAMPLE RECEIPT LOG

"One process as it appears in a client's report" - "It often contains explanation

EXPLANATIONS

EXPLANATIONS

SAMPLE RECEIPT LOG

11 no. (ences) discrepancy/deficiency report: 12 (one), team-one explanation:

EXPLANATIONS.

Y@ in file "n" Job was completed, sample was good - write

COE SITE 3, RUBBLE BURIAL SITE

Section I. Installation Restoration Program Records Search

- A. Study Performed By: CH2M HILL
- B. Date Report Complete: March, 1983
- C. Significant Findings:

The site was used primarily for disposal of contractor rubble and debris, although household debris was visible in the exposed portions of the landfill. It was suspected that disposal of small quantities of hazardous wastes occurred here.

- D. Summary of Recommendations:

None stated.

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For
Richards-Gebaur Air Force Base,
Missouri



Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

MARCH 1983

Creek. The site was used between about 1961 and 1971 for the disposal of miscellaneous wastes including building rubble, yard debris, and waste from some industrial shop areas. The wastes were typically burned and buried in trenches. Most of the sanitary wastes at Richards-Gebaur AFB were disposed of off-base through contract removal during this time. One interviewee reported that disposal of waste paints and paint thinners at the site by spreading the wastes on the ground surface had been practiced in the past as late as 1978. The eastern portion of the site has been used for open storage of materials including construction materials, pipes, empty tanks, waste paint and thinners in drums and buckets, and empty 55-gallon drums. Over 400 55-gallon drums are currently stored at the site, most of which are empty, and some of which contain unknown contents.

The site received an overall rating score of 54 due primarily to the known disposal of hazardous wastes and a moderate potential for surface-water migration of contaminants off-base.

- Site No. 3, the Contractor Rubble Burial Site, is also located adjacent to Scope Creek, just west of the golf course alongside Walker Road. The site was used intermittently during the time the regular Air Force was active on the base, between 1954 and 1978. The site was used primarily for disposal of contractor rubble and debris, although household debris was visible in the exposed portions of the landfill. One interviewee indicated that the site was also used as a sanitary landfill in lieu of Site No. 1 prior to 1961. The site has an overall rating score of 48; low subscores in

the receptors and waste characteristics categories were due to the lack of critical environments or population near the site, and the suspected disposal of small quantities of hazardous wastes. A moderate to high pathways subscore (67) was due to the proximity of Scope Creek and the steep banks of the landfill.

2. Fire Department Training Areas

- Site No. 4, the West Burn Pit, is located just north of the Cass County-Jackson County line and just west of the base property. The site was originally used for fire department training between 1954 and 1955, but was abandoned in 1955 when it was discovered that the site was located off-base. No significant quantities of residual hazardous waste materials are suspected at the site, resulting in a low overall score of 42.
- Site No. 5, the South Burn Pit, is located just west of the South Landfill near the NDI Lab and was used for fire department training between 1955 and 1965. Wastes used in training exercises included waste oils, solvents, and fuels. The wastes were stored in drums at the facility until training exercises were begun. The burn pit was unlined and had no oil/water separator. Small quantities of hazardous materials are known to have been disposed of at the site, resulting in a moderate overall score of 48.
- Site No. 6, the North Burn Pit, is located north of the flightline and has been used for fire department training since 1965. The burn pit was unlined and accepted waste oils, solvents, and

HAZARDOUS ASSESSMENT RATING FORM

Page 1 of 2

NAME OF SITE: 3. Contractor Rubble Burial Site

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: Interim 1954-1978

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Contractor's rubble; household debris

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

I. RECEPTORS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface-water body	1	6	6	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		<u>Subtotals</u>	<u>69</u>	<u>180</u>

Receptors subscore (100 x factor score subtotal/maximum subtotal)

38

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large)

S

2. Confidence level (C = confirmed, S = suspected)

S

3. Hazard rating (H = high, M = medium, L = low)

H

Factor Subscore A (from 20 to 100 based on factor score matrix)

40

B. Apply persistence factor

Factor Subscore A x Persistence Factor = Subscore B

$$40 \times 1.0 = 40$$

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

$$40 \times 1.0 = \underline{\underline{40}}$$

III. PATHWAYS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
Subscore				
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	72	108
Subscore (100 x factor score subtotal/maximum score subtotal)				67
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)	0	
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	1	8	8	24
Direct access to ground water	N/A	8	N/A	--
		Subtotals	30	90
Subscore (100 x factor score subtotal/maximum score subtotal)				33

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 67

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	38
Waste Characteristics	40
Pathways	67
Total 145 divided by 3 =	48
Gross Total	48

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

COE SITE 4, WEST BURN PIT

Section I. Installation Restoration Program Records Search

- A. Study Performed By:** CH2M HILL
- B. Date Report Complete:** March, 1983
- C. Significant Findings:**

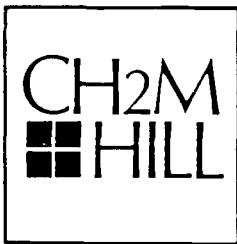
The site was originally used for fire department training between 1954 and 1955, but was abandoned in 1955 when it was discovered that the site was located off-base. No significant quantities of residual hazardous waste materials are suspected at the site.

- D. Summary of Recommendations:**

None stated.

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For
Richards-Gebaur Air Force Base,
Missouri



Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

MARCH 1983

the receptors and waste characteristics categories were due to the lack of critical environments or population near the site, and the suspected disposal of small quantities of hazardous wastes. A moderate to high pathways subscore (67) was due to the proximity of Scope Creek and the steep banks of the landfill.

2. Fire Department Training Areas

- Site No. 4, the West Burn Pit, is located just north of the Cass County-Jackson County line and just west of the base property. The site was originally used for fire department training between 1954 and 1955, but was abandoned in 1955 when it was discovered that the site was located off-base. No significant quantities of residual hazardous waste materials are suspected at the site, resulting in a low overall score of 42.
- Site No. 5, the South Burn Pit, is located just west of the South Landfill near the NDI Lab and was used for fire department training between 1955 and 1965. Wastes used in training exercises included waste oils, solvents, and fuels. The wastes were stored in drums at the facility until training exercises were begun. The burn pit was unlined and had no oil/water separator. Small quantities of hazardous materials are known to have been disposed of at the site, resulting in a moderate overall score of 48.
- Site No. 6, the North Burn Pit, is located north of the flightline and has been used for fire department training since 1965. The burn pit was unlined and accepted waste oils, solvents, and

HAZARDOUS ASSESSMENT RATING FORM

Page 1 of 2

NAME OF SITE: 4. West Burn Pit
 LOCATION: Richards-Gebaur AFB
 DATE OF OPERATION OR OCCURRENCE: 1954-1955
 OWNER/OPERATOR: Richards-Gebaur AFB
 COMMENTS/DESCRIPTION: Fire Training Area 1954-1955
 SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

I. RECEPTORS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface-water body	1	6	6	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		<u>Subtotals</u>	<u>76</u>	<u>180</u>

Receptors subscore (100 x factor score subtotal/maximum subtotal)

42

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large)

S

2. Confidence level (C = confirmed, S = suspected)

S

3. Hazard rating (H = high, M = medium, L = low)

H

Factor Subscore A (from 20 to 100 based on factor score matrix)

40

B. Apply persistence factor

Factor Subscore A x Persistence Factor = Subscore B

$$40 \times 0.8 = 32$$

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

$$32 \times 1.0 = \underline{\underline{32}}$$

III. PATHWAYS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	56	108
Subscore (100 x factor score subtotal/maximum score subtotal)				52
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)	0	
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	N/A	8	N/A	--
		Subtotals	22	90
Subscore (100 x factor score subtotal/maximum score subtotal)				24

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 52

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	42
Waste Characteristics	32
Pathways	52
Total 126 divided by 3 =	42
Gross Total	42

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

COE SITE 5, SOUTH BURN PIT

Section I. Installation Restoration Program Records Search

- A. Study Performed By: CH2M HILL
- B. Date Report Complete: March, 1983
- C. Significant Findings:

This site was used for fire department training between 1955 and 1965. Wastes used in training exercises included waste oils, solvents, and fuels. The wastes were stored in drums at the facility until training exercises were begun. The burn pit was unlined and had no oil/water separator. Small quantities of hazardous materials were known to have been disposed of at the site.

- D. Summary of Recommendations:
None stated.

5

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For
Richards-Gebaur Air Force Base,
Missouri



Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

MARCH 1983

the receptors and waste characteristics categories were due to the lack of critical environments or population near the site, and the suspected disposal of small quantities of hazardous wastes. A moderate to high pathways subscore (67) was due to the proximity of Scope Creek and the steep banks of the landfill.

2. Fire Department Training Areas

- Site No. 4, the West Burn Pit, is located just north of the Cass County-Jackson County line and just west of the base property. The site was originally used for fire department training between 1954 and 1955, but was abandoned in 1955 when it was discovered that the site was located off-base. No significant quantities of residual hazardous waste materials are suspected at the site, resulting in a low overall score of 42.
- Site No. 5, the South Burn Pit, is located just west of the South Landfill near the NDI Lab and was used for fire department training between 1955 and 1965. Wastes used in training exercises included waste oils, solvents, and fuels. The wastes were stored in drums at the facility until training exercises were begun. The burn pit was unlined and had no oil/water separator. Small quantities of hazardous materials are known to have been disposed of at the site, resulting in a moderate overall score of 48.
- Site No. 6, the North Burn Pit, is located north of the flightline and has been used for fire department training since 1965. The burn pit was unlined and accepted waste oils, solvents, and

HAZARDOUS ASSESSMENT RATING FORM

Page 1 of 2

NAME OF SITE: 5. South Burn Pit
 LOCATION: Richards-Gebaur AFB
 DATE OF OPERATION OR OCCURRENCE: 1955-1965
 OWNER/OPERATOR: Richards-Gebaur AFB
 COMMENTS/DESCRIPTION: Fire Training Area, 1955-1965
 SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

I. RECEPTORS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface-water body	1	6	6	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		<u>Subtotals</u>	<u>69</u>	<u>180</u>

Receptors subscore (100 x factor score subtotal/maximum subtotal)

38

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large)
2. Confidence level (C = confirmed, S = suspected)
3. Hazard rating (H = high, M = medium, L = low)

S

C

H

Factor Subscore A (from 20 to 100 based on factor score matrix)

60

B. Apply persistence factor
 Factor Subscore A x Persistence Factor = Subscore B

$$60 \times 0.8 = 48$$

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

$$48 \times 1.0 = \underline{\underline{48}}$$

III. PATHWAYS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	0
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108
Subscore (100 x factor score subtotal/maximum score subtotal)				59
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)	0	
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	N/A	8	N/A	N/A
		Subtotals	22	90
Subscore (100 x factor score subtotal/maximum score subtotal)				24

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 59

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	38
Waste Characteristics	48
Pathways	59
Total 145 divided by 3 =	48
Gross Total	48

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

COE SITE 7, RADIOACTIVE DISPOSAL WELL

Section I. Installation Restoration Program Records Search

- A. Study Performed By: CH2M HILL
- B. Date Report Complete: March, 1983
- C. Significant Findings:

This site was used intermittently between 1955 and about 1970 for disposal of low-level radioactive materials, primarily dosimeters. Levels of radioactivity in the vicinity of the well have been measured and found to be at or near back-ground levels.

- D. Summary of Recommendations:

None stated.

7

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For
Richards-Gebaur Air Force Base,
Missouri



Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

MARCH 1983

fuels until about 1969. In 1969, the area was lined with a concrete slab and an oil/water separator was installed; only contaminated JP-4 fuel has been used in training exercises since 1969. The site received an overall rating score of 45 due to the known disposal of hazardous materials and the partial containment provided by the lined facility.

- o Site No. 7, the Radioactive Disposal Well located west of Scope Creek in the southern portion of the base, was used intermittently between 1955 and about 1970 for disposal of low-level radioactive materials, primarily dosimeters. Levels of radioactivity in the vicinity of the well have been measured and found to be at or near background levels. The well has been tested and capped. An overall rating score of 4 is due to the low levels of radioactivity and full containment of small waste quantities.

3. Other Sites

- o Site No. 8, the Herbicide Burial Site located at the south end of the runway, is an area where about 4 cases of a mercury-containing herbicide in plastic pint-sized bottles were buried in 1971. An overall score of 51 reflects the known disposal of hazardous materials at the site and a moderate potential for surface water migration; however, the small quantity of herbicide (estimated to be less than 50 pounds) and the low-permeability clay soils indicate a low potential for ground-water contamination or migration.

HAZARDOUS ASSESSMENT RATING FORM

Page 1 of 2

NAME OF SITE: 7. Radioactive Disposal Well

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: Constructed 1955; intermittent to present

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Disposal well for solid radioactive materials

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface-water body	1	6	6	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	69	180

Receptors subscore (100 x factor score subtotal/maximum subtotal)

38

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large)

S

2. Confidence level (C = confirmed, S = suspected)

C

3. Hazard rating (H = high, M = medium, L = low)

L

Factor Subscore A (from 20 to 100 based on factor score matrix)

30

B. Apply persistence factor

Factor Subscore A x Persistence Factor = Subscore B

$$30 \times 1.0 = 30$$

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

$$30 \times 0.5 = \underline{15}$$

III. PATHWAYS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	0
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108
Subscore (100 x factor score subtotal/maximum score subtotal)				59
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)	0	
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	3	8	24	24
Direct access to ground water	N/A	8	N/A	N/A
		Subtotals	46	90
Subscore (100 x factor score subtotal/maximum score subtotal)				51

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 59**IV. WASTE MANAGEMENT PRACTICES****A. Average the three subscores for receptors, waste characteristics, and pathways.**

Receptors	38
Waste Characteristics	15
Pathways	59
Total 112 divided by 3 =	37
	Gross Total

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

COE SITE 8, HERBICIDE BURIAL SITE

Section I. Installation Restoration Program Records Search

- A. Study Performed By: CH2M HILL
- B. Date Report Complete: March, 1983
- C. Significant Findings:

This is an area where about 4 cases of a mercury-containing herbicide in plastic pint-sized bottles were buried in 1971. There is a known disposal of hazardous materials at the site and a moderate potential for surface water migration; however, the small quantity of herbicide (estimated to be less than 50 pounds) and the low-permeability clay soils indicate a low potential for ground-water contamination or migration.

- D. Summary of Recommendations:

None stated.

COE SITE 8, HERBICIDE BURIAL SITE, Continued

Section II. Installation Restoration Program Phase II
Confirmation/Quantification Stage 2

A. Study Performed By: Ecology and Environment, Inc.

B. Date Report Complete: November, 1987

C. Significant Findings:

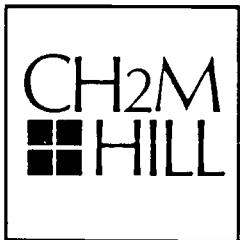
No detectable concentrations of any contaminant were reported in the single surface water sample taken at this site. Concentrations of metals in the four surface soil samples did not exceed the normal range of concentrations reported in western Missouri soils. In addition, no organic contamination was detected in the soil samples. Consequently, the data do not indicate that Site 8 presents an undue risk to human health or the environment.

D. Summary of Recommendations:

Since there is no direct evidence of the location of Site 8, additional investigations are recommended. It is recommended that a soil conductivity survey be run over a grid pattern designed to precisely locate a 10- by 10-foot trench.

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For
Richards-Gebaur Air Force Base,
Missouri



Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR FORCE RESERVE
ROBINS AIR FORCE BASE, GEORGIA 31098

MARCH 1983

fuels until about 1969. In 1969, the area was lined with a concrete slab and an oil/water separator was installed; only contaminated JP-4 fuel has been used in training exercises since 1969. The site received an overall rating score of 45 due to the known disposal of hazardous materials and the partial containment provided by the lined facility.

- Site No. 7, the Radioactive Disposal Well located west of Scope Creek in the southern portion of the base, was used intermittently between 1955 and about 1970 for disposal of low-level radioactive materials, primarily dosimeters. Levels of radioactivity in the vicinity of the well have been measured and found to be at or near background levels. The well has been tested and capped. An overall rating score of 4 is due to the low levels of radioactivity and full containment of small waste quantities.

3. Other Sites

- Site No. 8, the Herbicide Burial Site located at the south end of the runway, is an area where about 4 cases of a mercury-containing herbicide in plastic pint-sized bottles were buried in 1971. An overall score of 51 reflects the known disposal of hazardous materials at the site and a moderate potential for surface water migration; however, the small quantity of herbicide (estimated to be less than 50 pounds) and the low-permeability clay soils indicate a low potential for ground-water contamination or migration.

HAZARDOUS ASSESSMENT RATING FORM

Page 1 of 2

NAME OF SITE: 8. Herbicide Burial Site

LOCATION: Richards-Gebaur AFB

DATE OF OPERATION OR OCCURRENCE: August, 1971

OWNER/OPERATOR: Richards-Gebaur AFB

COMMENTS/DESCRIPTION: Unused herbicide (reportedly contained mercury) buried

SITE RATED BY: Dave Moccia, Bruce Haas, Liz Dodge

I. RECEPTORS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface-water body	1	6	6	18
G. Ground-water use of uppermost aquifer	0	9	0	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		<u>Subtotals</u>	<u>73</u>	<u>180</u>

Receptors subscore (100 x factor score subtotal/maximum subtotal)

41

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large)

S

2. Confidence level (C = confirmed, S = suspected)

C

3. Hazard rating (H = high, M = medium, L = low)

H

Factor Subscore A (from 20 to 100 based on factor score matrix)

60

B. Apply persistence factor

Factor Subscore A x Persistence Factor = Subscore B

$$60 \times 1.0 = 60$$

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

$$60 \times 1.0 = \underline{\underline{60}}$$

III. PATHWAYS

<u>Rating Factor</u>	<u>Factor Rating (0-3)</u>	<u>Multiplier</u>	<u>Factor Score</u>	<u>Maximum Possible Score</u>
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	0
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	1	6	6	18
Surface erosion	0	8	0	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	56	108
Subscore (100 x factor score subtotal/maximum score subtotal)				52
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	N/A	8	N/A	--
		Subtotals	22	90
Subscore (100 x factor score subtotal/maximum score subtotal)				24

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 52

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	41
Waste Characteristics	60
Pathways	52
Total 153 divided by 3 =	51
Gross Total Score	51

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

INSTALLATION RESTORATION PROGRAM

PHASE II

CONFIRMATION/QUANTIFICATION

STAGE 2

RICHARDS-GEBAUR AIR FORCE BASE
MISSOURI

Prepared by:

ECOLOGY AND ENVIRONMENT, INC.
Buffalo Corporate Center
368 Pleasantview Drive
Lancaster, New York 14086

July 1988

FINAL REPORT
(September 1986 to November 1987)

VOLUME 1: TEXT

Approved for Public Release:
Distribution is Unlimited

Prepared for:

UNITED STATES AIR FORCE
Headquarters Air Force Reserve (HQ AFRES/SGPB)
Robins Air Force Base, Georgia 31098-6001

UNITED STATES AIR FORCE
Occupational and Environmental Health Laboratory/
Technical Services Division (USAFOEHL/TS)
Brooks Air Force Base, Texas 78235-5501

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
EXECUTIVE SUMMARY	1
1 INTRODUCTION	1-1
1.1 LOCATION AND HISTORY OF OPERATIONS	1-3
1.2 SITE DESCRIPTIONS	1-6
1.2.1 Site 1, South Landfill	1-6
1.2.2 Site 2, Northeast Landfill	1-10
1.2.3 Site 6, North Burn Pit Area	1-12
1.2.4 Site 8, Herbicide Burial Area	1-12
1.2.5 Site 9, Oil-Saturated Area	1-12
1.2.6 Site 10, Hazardous Waste Drum Storage Area	1-16
1.2.7 Site 12, POL Storage Yard	1-16
1.3 SITES NOT INVESTIGATED DURING STAGE 2	1-19
1.4 TYPES OF CONTAMINANTS INVESTIGATED	1-21
1.5 FIELD PERSONNEL	1-28
1.6 SUBCONTRACTORS	1-28
2 ENVIRONMENTAL SETTING	2-1
2.1 GEOGRAPHIC SETTING	2-1
2.1.1 Physiography	2-1
2.1.2 Topography	2-1
2.2 GEOLOGY	2-1
2.2.1 Geologic Setting	2-1
2.2.2 Soils	2-3
2.2.3 Stratigraphy	2-3
2.2.4 Structure	2-6

Table of Contents (Cont.)

<u>Section</u>	<u>Page</u>
2.3 HYDROLOGY AND WATER USE	2-6
2.3.1 Surface Water	2-6
2.3.2 Hydrogeology	2-8
2.4 CLIMATE	2-8
 3 FIELD PROGRAM	 3-1
3.1 PROGRAM DEVELOPMENT	3-1
3.2 FIELD INVESTIGATION	3-4
3.2.1 Schedule of Field Activities	3-4
3.2.2 Records Search	3-4
3.2.3 Geophysical Survey Procedures	3-6
3.2.4 Soil Gas Sampling	3-6
3.2.5 Soil, Sediment, and Water Sampling	3-6
3.2.6 Handling of Investigation-Derived Waste	3-16
3.2.7 Site-Specific Investigation Activities	3-18
3.2.8 Laboratory Program	3-29
3.2.9 Variations from Description of Work	3-32
 4 RESULTS AND SIGNIFICANCE OF FINDINGS	 4-1
4.1 INTRODUCTION	4-1
4.2 RESULTS	4-4
4.2.1 Site 1, South Landfill	4-4
4.2.2 Site 2, Northeast Landfill	4-7
4.2.3 Site 6, North Burn Pit Area	4-11
4.2.4 Site 8, Herbicide Burial Area	4-17
4.2.5 Site 9, Oil-Saturated Area	4-19
4.2.6 Site 10, Hazardous Waste Drum Storage Area	4-22
4.2.7 Site 12, POL Storage Yard	4-26
4.3 SIGNIFICANCE OF FINDINGS	4-30
4.3.1 Site 1, South Landfill	4-30
4.3.2 Site 2, Northeast Landfill	4-30
4.3.3 Site 6, North Burn Pit Area	4-30

Table of Contents (Cont.)

<u>Section</u>		<u>Page</u>
4.3.4	Site 8, Herbicide Burial Area	4-31
4.3.5	Site 9, Oil-Saturated Area	4-31
4.3.6	Site 10, Hazardous Waste Drum Storage Area	4-32
4.3.7	Site 12, POL Storage Yard	4-33
5	ALTERNATIVE MEASURES	5-1
5.1	SITE 1, SOUTH LANDFILL	5-1
5.2	SITE 2, NORTHEAST LANDFILL	5-2
5.3	SITE 6, NORTH BURN PIT AREA	5-2
5.4	SITE 8, HERBICIDE BURIAL AREA	5-3
5.5	SITE 9, OIL-SATURATED AREA	5-4
5.6	SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA	5-4
5.7	SITE 12, POL STORAGE YARD	5-4
6	RECOMMENDATIONS	6-1
6.1	SITE 1, SOUTH LANDFILL - CATEGORY I	6-1
6.2	SITE 2, NORTHEAST LANDFILL - CATEGORY III	6-5
6.3	SITE 4, WEST BURN AREA	6-5
6.4	SITE 6, NORTH BURN PIT AREA - CATEGORIES II AND III	6-6
6.5	SITE 8, HERBICIDE BURIAL AREA - CATEGORY II	6-6
6.6	SITE 9, OIL-SATURATED AREA - CATEGORY III	6-8
6.7	SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA - CATEGORY III	6-11
6.8	SITE 12, POL STORAGE YARD - CATEGORY II	6-11
6.9	WELL ABANDONMENT	6-11

Table 2
SUMMARY OF FIELDWORK/ANALYSES PERFORMED

Site	Fieldwork Performed	Analyses Performed
Site 1, South Landfill	<ul style="list-style-type: none"> ● 1 borehole drilled ● 7 soil samples collected ● 4 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC, priority pollutants, common anions, phenols.
Site 2, Northeast Landfill	<ul style="list-style-type: none"> ● geophysical survey ● 4 boreholes drilled ● 2 monitoring wells installed ● 10 soil samples collected ● 5 groundwater samples collected ● 3 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC, priority pollutants, common anions, phenols
Site 6, North Burn Pit Area	<ul style="list-style-type: none"> ● soil gas survey ● 3 boreholes drilled ● 3 monitoring wells installed ● 15 soil samples collected ● 3 groundwater sample collected ● 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, VOC.
Site 8, Herbicide Burial Area	<ul style="list-style-type: none"> ● 4 soil samples collected ● 1 surface water sample collected 	Soils: pesticides, arsenic, mercury. Waters: TDS, pesticides, arsenic, mercury.
Site 9, Oil-Saturated Area	<ul style="list-style-type: none"> ● 1 borehole drilled ● 8 soil samples collected ● 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC, lead. Waters: petroleum hydrocarbons, TDS, VOC, lead.
Site 10, Hazardous Waste Drum Storage Area	<ul style="list-style-type: none"> ● 1 borehole drilled ● 9 soil samples collected ● 1 surface water sample collected 	Soils: petroleum hydrocarbons, VOC, EP TOX metals. Waters: petroleum hydrocarbons, TDS, priority pollutant metals, barium.
Site 12, POL Storage Yard	<ul style="list-style-type: none"> ● 3 boreholes augered ● 1 monitoring well installed ● 1 soil sample collected ● 4 groundwater samples collected ● 2 surface water samples collected 	Soils: petroleum hydrocarbons, VOC. Waters: petroleum hydrocarbons, TDS, VOC.

Table 3
SUMMARY OF RECOMMENDATIONS

Site	Recommendation	Rationale
Site 1, South Landfill	Category I. No further action.	No significant contamination was found during the Stage 2 investigation.
Site 2, Northeast Landfill	Category III. Biannual monitoring for 2 years. Collect and analyze groundwater samples from five existing monitoring wells twice yearly.	To determine changes in groundwater quality because elevated sulphate concentrations were the only indicators of contamination above acceptable limits.
Site 4, West Burn Area	Category II. Perform a soil gas survey and geophysical survey. Install three monitoring wells and collect and analyze groundwater samples. Collect subsurface and surface soil samples.	To determine the exact location of the site and determine if hazardous constituents have migrated from the site.
Site 6, North Burn Pit Area	Category III and II. Biannual monitoring for 2 years. Install two more monitoring wells. Collect and analyze groundwater samples from five monitoring wells twice yearly.	To better characterize the organic contamination of the groundwater.
Site 8, Herbicide Burial Area	Category II. Additional geophysical surveys. Drill four boreholes and collect two soil samples from each borehole.	To determine exact location of trench and analyze soil from within the trench.
Site 9, Oil-Saturated Area	Category III. Excavate and remove contaminated soils.	To reduce risk of potential direct human contact to soils contaminated with petroleum hydrocarbons and lead.
Site 10, Hazardous Waste Drum Storage Area	Category III. Excavate and remove contaminated soils.	To reduce risk of potential direct human contact petroleum hydrocarbons.
Site 12, POL Storage Yard	Category II. Install four monitoring wells. Collect and analyze groundwater samples twice yearly.	To determine if volatile organic compound contamination has migrated from the site.

- To define the magnitude and potential of contaminant migration, if possible; and
- To identify potential health and/or environmental hazards based on state or federal standards.

A Phase I Initial Records Search had been conducted by CH2M Hill as outlined in a report dated March 1983. The Phase I report identified sites with potential contamination problems and made recommendations for Phase II investigation. Based on these recommendations, a Phase II Stage 1 investigation was performed on the two sites, Site 1, the South Landfill, and Site 2, the Northeast Landfill, which ranked above 50 on the USAF Hazard Assessment Rating Methodology (HARM) scale ranking system. Preliminary investigation was performed by Water and Air Research, Inc. The results of this investigation were finalized in a report dated December 1983.

In 1985, Richards-Gebaur AFB was scheduled to be reevaluated under the IRP. A presurvey meeting was arranged and all past and current potential sites were visited and evaluated. The presurvey was conducted by E & E and their recommendations were provided in a Presurvey Report dated June 1985.

The sites included in that survey are:

- Site 1, South Landfill,
- Site 2, Northeast Landfill,
- Site 3, Contractor Rubble Burial Area,
- Site 4, West Burn Area,
- Site 5, South Burn Area,
- Site 6, North Burn Area,
- Site 7, Radioactive Disposal Well,
- Site 8, Herbicide Burial Area,
- Site 9, Oil-Saturated Area,
- Site 10, Hazardous Waste Drum Storage Area,
- Site 11, Paint Stripper Hangar,

- Site 12, Petroleum, Oils, and Lubricants (POL) Storage Yard, and
- Site 13, Hazardous Material Storage--Building 927.

Based on this report and after review by state and federal offices, the USAF contracted Phase II Stage 2 investigation of the following sites:

- Site 1, South Landfill,
- Site 2, Northeast Landfill,
- Site 6, North Burn Pit Area,
- Site 8, Herbicide Burial Area,
- Site 9, Oil-Saturated Area,
- Site 10, Hazardous Waste Drum Storage Area, and
- Site 12, POL Storage Yard.

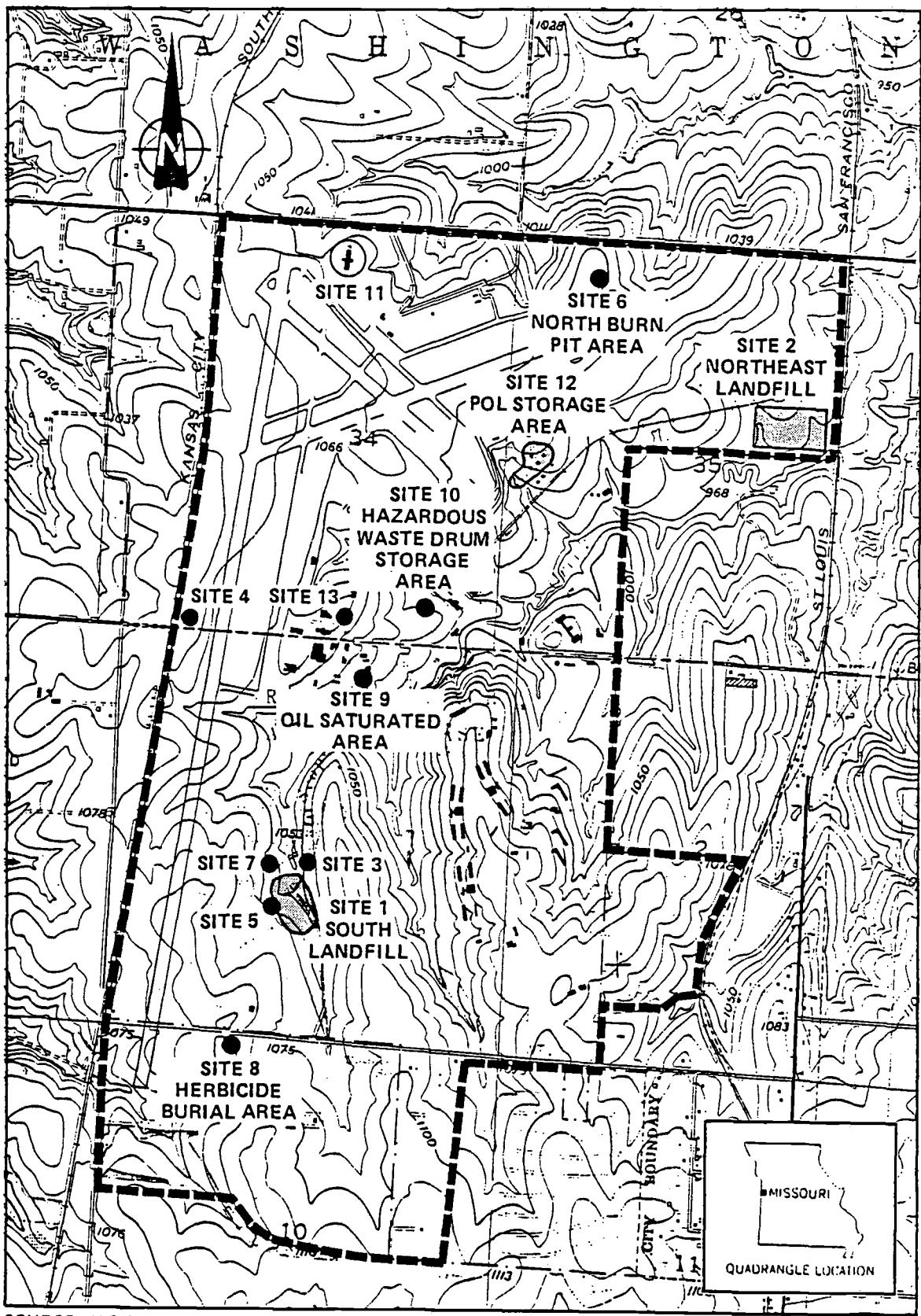
1.1 LOCATION AND HISTORY OF OPERATIONS

The primary source of historical information on the base was the Phase I report by CH2M Hill (1983). The information was confirmed and updated by E & E as part of the Phase II Stage 2 investigation.

Richards-Gebaur AFB is located in west-central Missouri, 2.6 miles from the Kansas-Missouri state line (see Figure 1-1). The Jackson County and Cass County line runs east-west through the middle of the base. The base is bounded on the north by the City of Grandview, on the north and west by Kansas City, and on the south and east by the City of Belton. The base is about 18 miles southeast of downtown Kansas City. Access to the base is via U.S. Highway 71.

The legal description of the base includes the following ranges and townships:

<u>Range</u>	<u>Township</u>	<u>Sections</u>
R46N	T33W	2, 3, 10, 11
R47N	T33W	34, 35



SOURCE: U.S.G.S. 7.5' Quadrangle, Belton, Mo.-Kans., 1975.

SCALE
0 $\frac{1}{4}$ 1 MILE

Figure 1-3 RICHARDS-GEBAUR AIR FORCE BASE IRP SITES

average depth of the line is 15 feet and the excavation width at the surface was 90 to 100 feet. Figure 1-5 shows the location of the interceptor.

1.2.3 Site 6, North Burn Pit Area

Site 6, the North Burn Pit Area, is located north of the flight line, just below the northern boundary of the base (see Figure 1-6). It was built in 1965 and is used for fire department training. A recent improvement to the facility is a 6-inch concrete rim around a concrete-lined burn pit, which is a circle with a radius of 50 feet. The drain that carries runoff from the pit is equipped with an oil-water separator. At least one incident of failure of the separator has been noted. In 1985-86, a chain-link fence was constructed around this facility. A slight depression was formed on the east side of the site as a result of the fence addition. During wet weather, some water is ponded in this area.

Fuel for the fire department training fires consisted of waste oils and possibly solvents, mixed with JP-4 fuel. An aboveground fuel storage tank is located in the southwest corner of the facility near the access gate. Reportedly, small quantities of fuel have been spilled during fuel transfer.

1.2.4 Site 8, Herbicide Burial Area

In 1971, about four cases of herbicide, reportedly containing mercury, in plastic pint-sized bottles, were reportedly buried in a trench near the south end of the runway (see Figure 1-7). Previous studies located this site in the general area of the south end and approximately 1,000 feet east of the original north-south runway. Since the city of Kansas City took over the air field, this runway has been extended approximately 3,000 feet. Vegetation stress was noted in the area at the time of the presurvey meeting. A small pond is located about 150 feet southeast of the supposed burial area.

1.2.5 Site 9, Oil-Saturated Area

Site 9, the Oil-Saturated Area, is located in the southwest corner of the Motor Pool Compound (Building 704) (see Figure 1-8). This

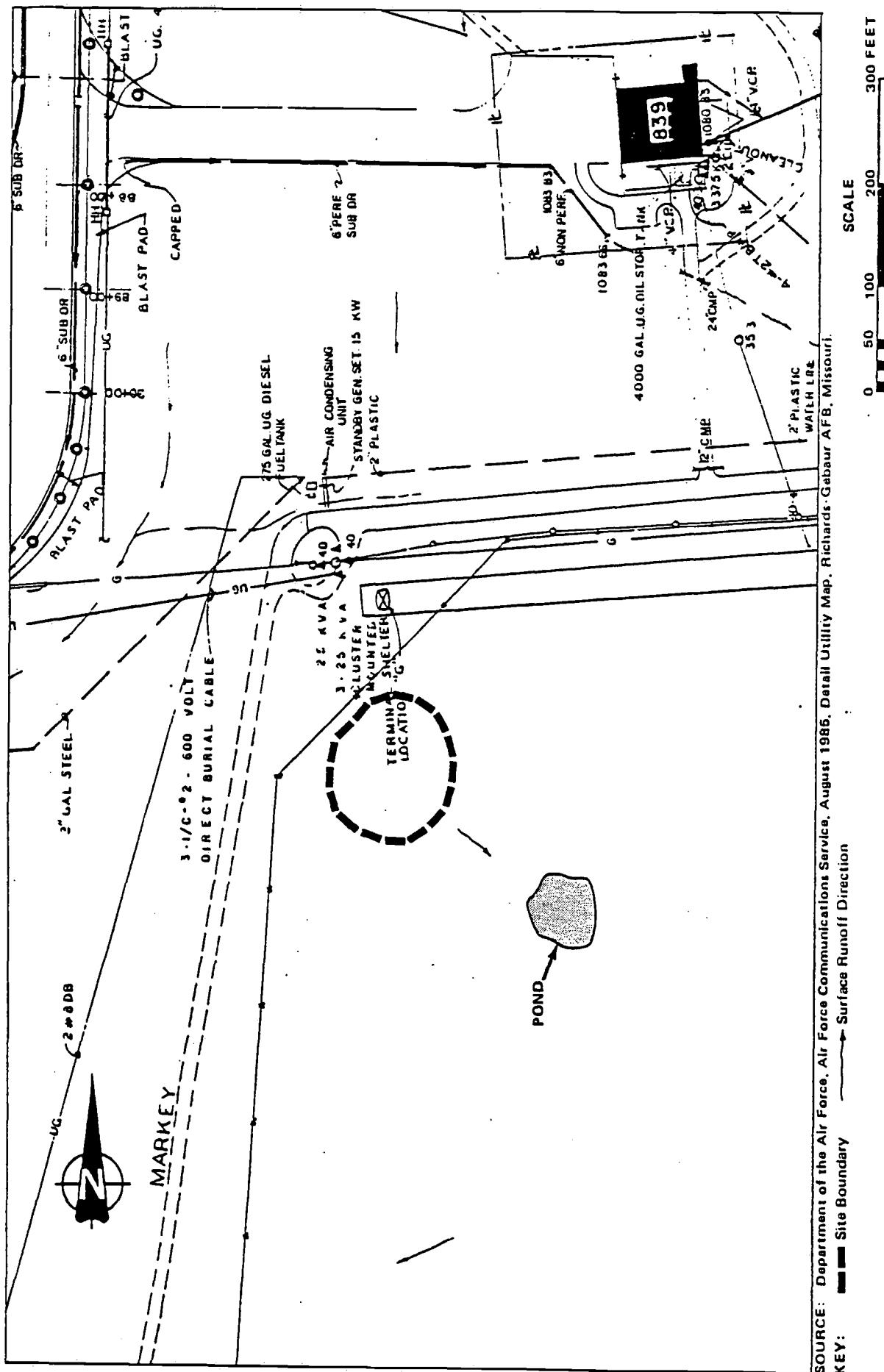


Figure 1-7 SITE 8, HERBICIDE BURIAL AREA LOCATION MAP

1.3 SITES NOT INVESTIGATED DURING STAGE 2

Several sites were not investigated during the Stage 2 program. The sites were deleted because they either could not be located or they were located on property leased to the Kansas City Aviation Department, which denied access to all sites on Kansas City Aviation land, except the South and Northeast landfills. Access was not granted because the Phase II Field Evaluation Report, dated December 1983, recommended no further action. The letters denying access to sites 3, 5, 7, and 11 are found in Appendix B. The reason Site 13 was not investigated is unknown. This site was not listed in the Description of Work. The following is a discussion of those sites.

Site 3, Contractor Rubble Burial Site

The Rubble Burial Site is located on the east bank of Scope Creek in the south-central part of the base. It reportedly was in operation from 1954 through 1978. The area is not posted or fenced and appears to have been used more recently than 1978. The area is fairly level and most of the debris is discharged over the bank at the treeline. During the presurvey visit, construction materials, including wood, concrete, masonry, and metal, were observed; however, dense foliage prevented a more thorough investigation. A 5-gallon sealed plastic container of an unidentified liquid was discovered at the base of the fill and brought to the attention of the Richards-Gebaur AFB civil engineer. This area is on land either sold or leased to the City of Kansas City. The Kansas City Aviation Department did not grant access to this site.

Site 4, West Burn Area

The West Burn Area was tentatively identified as being located off the base to the west on the west side of the railroad track and north of the Jackson County line. During the presurvey fieldwork, no evidence of this site could be found. Since the West Burn Area was in operation for only 1 year (1955) approximately 30 years ago, it was thought that there was no physical evidence of this site. However, since the Phase II Stage 2 Field Investigation, aerial photographs not previously available indicate the site may actually be located east of the railroad. During a familiarization tour on August 12, 1987, a material believed to be

tank sludge was found in an area just north of the county line and just east of the railroad tracks. At the time of the fieldwork, the site location was unknown and believed to be off base. Therefore, the site was not investigated.

Any impact that this site might have had will have to take into account the presence of the Knoche oil field 3,000 feet to the southeast. The uplands here are fairly level and the area of the site currently is farmed in corn. A tree nursery is located across the county line to the south.

This site should be investigated further if Kansas City will grant access.

Site 5, South Burn Area

The South Burn Area tentatively has been identified as being located to the southwest of the South Landfill (Site 1). During the presurvey fieldwork, no evidence of this site could be found. Since the South Burn Area was in operation for 10 years (1955 to 1965) approximately 20 years ago, it is possible that there will be no physical evidence of this site at all. Because of its proximity to the South Landfill, any environmental contamination detected at this site will be reviewed in light of findings from the South Landfill investigation. This site is believed to be on land either owned or leased by the City of Kansas City, Missouri. The Kansas City Aviation Department did not grant access for this investigation.

Site 7, Radioactive Disposal Well

The Radioactive Disposal Well is located north of the South Landfill and east of the major flight line. It is believed to have been operated from 1955 to 1970. Discussion during the presurvey visit indicated that low-level radioactive material, typically radium dials, were disposed into this cased well. The site currently is behind a locked gate in an open field. The well itself is very visible, standing 4 to 5 feet high and painted red. This well is located on land owned or leased by the City of Kansas City, Missouri. The Kansas City Aviation Department did not grant access for this investigation. Therefore, no work was performed at this site.

3. FIELD PROGRAM

3.1 PROGRAM DEVELOPMENT

A field program for the Phase II Stage 2 Confirmation/Quantification investigation was developed by E & E and presented in the Presurvey Report submitted on 7 June 1985. The program was reviewed and modified by the Air Force and set forth in the Description of Work for Contract F33615-83-D-4003, Task Order 13.

Elements of the field program included: a soil gas survey, a geophysical survey, sediment sampling, subsurface soil sampling, surface water sampling, installation of groundwater monitoring wells, and groundwater sampling. Various combinations of these program elements were performed at the various sites. Table 3-1 outlines the types of work conducted at each site. By site, the objectives of the fieldwork were:

Site 1 - South Landfill

- Determine if contaminated leachate from the landfill is entering Scope Creek.
- Evaluate potential for vertical migration of contamination.

Site 2 - Northeast Landfill

- Determine past disposal practices at the landfill.
- Delineate the locations of several suspected waste disposal trenches and determine if contamination has resulted.
- Expand monitoring well network to investigate migration of groundwater contamination from possible leaching of landfilled materials.

Table 3-1
FIELDWORK PERFORMED AT EACH SITE

	Geophysics	Boreholes	New Monitoring Wells	Soil Samples*	Groundwater Samples*	Surface Water Samples*
Site 1 - South Landfill	--	1	--	6	--	3
Site 2 - Northeast Landfill	MAG, EM	4	2	10	5	3
Site 6 - North Burn Pit Area	Soil Gas	3	3	15	3	1
Site 8 - Herbicide Burial Area	--	--	--	4	--	1
Site 9 - Oil-Saturated Area	--	1	--	9	--	1
Site 10 - Hazardous Waste Drum Storage Area	--	1	--	9	--	1
Site 12 - POT Storage Yard	--	4(h)	1	11	1	2
TOTALS		14	6	64	9	12

*Numbers do not include duplicates or blanks.

Key: MAG = Magnetometer survey
 EM = Electromagnetic survey
 (h) = Hand-augered boreholes

Site 6 - North Burn Pit Area

- Determine occurrence of contamination from the site using a soil gas survey.
- Determine occurrence of subsurface soil contamination.
- Determine whether groundwater contamination has occurred.

Site 8 - Herbicide Burial Area

- Identify actual burial area by examining available background information.
- Identify any contaminants in soil in the vicinity of the burial area.
- Evaluate extent of migration of any contaminants via surface drainage pathway.

Site 9 - Oil-Saturated Area

- Evaluate type and extent of surface and subsurface soil contamination.
- Determine if contaminants are migrating via surface drainage pathway.

Site 10 - Hazardous Waste Drum Storage Area

- Evaluate type and extent of surface and subsurface soil contamination.
- Evaluate potential migration of contaminants via surface drainage pathway.

Site 12 - POL Storage Yard

- Determine the extent of any subsurface soil contamination.
- Evaluate extent of migration of contaminants via buried drain lines and surface drainage pathways.
- Determine whether groundwater contamination has occurred and evaluate extent of contamination.

3.2 FIELD INVESTIGATION

The field investigation consisted of:

- Literature and aerial photograph records search;
- A magnetometer and electromagnetic (EM) terrain conductivity survey;
- A soil gas survey;
- The drilling of 10 boreholes;
- The installation of six monitoring wells; and
- Collection and analysis of 27 surface soil and sediment samples, 38 subsurface soil samples, 13 surface water samples, and 9 groundwater samples.

3.2.1 Schedule of Field Activities

Field activities were scheduled so as to optimize the utilization of manpower and resources. Field activities were coordinated with the USAFOEHL, the base Point of Contact (POC), and subcontractors to minimize delays and potential problems.

Throughout the course of the field activities, daily contact was maintained with the designated base personnel. The principal contact was Ms. Felipita Benson, R.N. Additional coordination was through Mr. John Hurd, Base Civil Engineer.

The fieldwork was completed during the period from 6 October 1986 to 4 November 1986. Table 3-2 provides the sequence of major field activities.

Health and safety protocols, as outlined in the Health and Safety Plan (see Appendix N), were followed throughout the project. Modifications of specific elements of the Health and Safety Plan were based on field conditions and executed only after discussion with E & E's Health and Safety Coordinator.

3.2.2 Records Search

During the course of the Phase II Stage 2 investigation, discussions were held with personnel from the Base Environmental Engineering Staff and the Base Civil Engineering Staff regarding past waste disposal practices and likely contaminants. Historical aerial photographs were

Table 3-2
SCHEDULE OF MAJOR FIELD ACTIVITIES
(October to November 1986)

6 October	Fieldwork begins with a reconnaissance of all sites and collection of surface soil samples.
6-8 October	Geophysical survey at Site 2, Northeast Landfill.
7-9 October	Soil gas survey at Site 6, North Burn Pit Area.
14 October	Drillers on site, set-up decontamination areas at Site 6, North Burn Pit Area and vehicle wash racks.
15 October	Three soil borings drilled, sampled, and grouted at Site 6, North Burn Pit Area.
16 October	Six monitoring wells drilled, pipe set, soil samples collected, and wells completed; three are at Site 6, North Burn Pit; two at Site 2, Northeast Landfill; and one at Site 12, POL Storage Yard. One well at Site 6, North Burn Pit Area was a borehole completed as a well.
17 October	Six soil borings drilled, samples collected, and the holes grouted, one at the Motor Pool Compound; one at the former hazardous waste storage yard; one at Site 1, South Landfill; and three at Site 2, Northeast Landfill.
18 October	Development of new wells and cleanup of drilling and staging areas.
21 October	Wells purged and groundwater samples collected.
23 October	The remaining surface soil and surface water samples collected from Site 2, Northeast Landfill; and Site 1, South Landfill.
28 October, 4 November	Hand-auger borings at Site 12, POL Storage Yard.
4 November	End of sampling.

examined to provide information on waste disposal practices at the base. Aerial photos were helpful in locating and delineating several sites which were not clearly visible during the Presurvey field trip. Table 3-3 lists the photos which were available for review.

3.2.3 Geophysical Survey Procedures

Magnetometer and EM surveys were performed concurrently at Site 2, Northeast Landfill, in an effort to locate what were thought to be discrete landfill trenches at this site, preliminary to placing groundwater monitoring wells. The magnetometer survey is designed to locate magnetically conductive materials in landfills, which are generally more conductive than the surrounding soils. Anomalies in magnetic flux are measured by the magnetometer and recorded in the field notebook. The EM conductivity survey measures the conductivity of the soil or any variations in the conductivity of the soil. Excavations for landfills change the natural conductivity by changing the porosity and density of the soils and altering the normal values of conducting fluids in the soils. Presumed locations of the trenches were delineated in a map provided by the Base Civil Engineer.

A Geometrics Model G-846 proton procession magnetometer with a sensitivity of 0.1 gammas and a Geonics Model EM-31 terrain conductivity meter with an effective exploration depth of 6 meters were used.

3.2.4 Soil Gas Sampling

A soil gas survey was performed at Site 6, the North Burn Pit Area, in an effort to identify potential residual contamination from the burning and handling of flammable liquids. The soil gas data were used to aid in locating the groundwater monitoring wells. The survey was performed by hand-driving perforated pipes in and around the compound. After capping each pipe and allowing it to stand for 15 minutes, the hole was monitored using an Organic Vapor Analyzer (OVA) to determine the presence or absence of volatile compounds.

3.2.5 Soil, Sediment, and Water Sampling

Soil, sediment, and water sampling protocols were followed as outlined in the Technical Operations Plan (Appendix N), except for

Table 3-3
SUMMARY OF HISTORIC AERIAL PHOTOGRAPHS
FOR AREA AROUND RICHARDS-GEBAUR AFB

Year	Scale	Source	Availability
1936	1:20,000	NARS	--
1940	1:20,000	MARC	--
1948	1:17,000	EROS, USGS	--
1950	1:70,000	EROS, USA	--
1953	1:20,000	ASCS	--
1955	1:13,000	EROS, USGS, USAF (shows West Burn Pit)	Reviewed
1957	1:20,000	ASCS	--
1959	1:12,000	COE	--
1960*	1:12,000	City of Grandview (shows borrow pits north of Northeast Landfill)	Reviewed
1963	1:18,000	USGS	Reviewed
1963	1:20,000	ASCS	--
1970	1:24,015	EORS	--
1972*	1:12,000	City of Grandview (shows active Northeast Landfill)	Reviewed
1975	1:40,000	EROS	--
1978	1:72,500	EROS	--
1980	1:80,000	EROS	--
1982	1:58,000	EROS	--
1982	1:80,000	EROS	--

Key:
 EROS = EROS Data Center, SD
 MARC = Mid America Regional Council, MO
 ASCA = American Soil Conservation Agency
 COOE = Army Corps of Engineers
 USGS = United States Geological Survey
 USA = United States Army
 NARS = National Archives

*Not on federal archive list; does not cover south half of base.

samples collected for volatile organic analysis (VOAs). These were discrete samples collected prior to homogenization (blended to result in a more uniform sample). The portion of the sample collected for VOAs was cut from the center of the sample and placed directly into 40-ml vials.

All samples were split in the field when enough sample material was available. Split samples were delivered to the base POC. The POC determined those splits which were to be submitted to OEHL/SA for analysis. The split samples for analysis were provided by the POC to E & E for shipment to OEHL/SA.

Sediment Sampling

Sediment sampling was conducted in association with Site 1, South Landfill; Site 6, North Burn Pit Area; Site 8, Herbicide Burial Area; Site 9, Oil-Saturated Area; Site 10, Hazardous Waste Drum Storage Area; and Site 12, POL Storage Yard. A total of 27 samples were collected and submitted for chemical analysis. Table 3-4 presents a summary of the samples collected.

Sediment samples were collected using shovels to loosen an 8-inch cube of sediment from which a vertical column was removed using a stainless steel spoon. The soil column was homogenized in a disposable aluminum pan and then splits were placed in two sampling containers. Spoons were decontaminated and all pans were disposed of after sample collection from each location.

Subsurface Soil Sampling

Subsurface soil samples were collected from 5-foot-long split-spoon samplers during the drilling of the boreholes and monitoring wells. Borehole and monitoring well drilling was performed by Geotechnology, Inc., of St. Louis, Missouri. Table 3-5 provides a summary of borehole depths.

Ten boreholes were drilled and 28 subsurface soil samples were collected and submitted for analysis. Boreholes were drilled for the specific purpose of obtaining subsurface soil samples; however, one borehole (Boring 4) was scheduled to be completed as a monitoring well. A total of 186.5 linear feet of drilling was accomplished using a Mobile

Table 3-4
SUMMARY OF SURFACE SOIL SAMPLING

Site No.	Field Sample No.	Sample Location and Description
1	DF4067	Scope Creek - Background at Markey and Bates
	DF4069	Scope Creek - Downstream of South Landfill
	DF4070	Scope Creek - Seep 1 east of South Landfill
	DF4077	Scope Creek - Seep 2 northeast of South Landfill
6	DF4001	North Burn - 100 feet east of eastern fence center
	DF4002	North Burn - 200 feet east of eastern fence center
	DF4003	North Burn - 100 feet north of northern fence drainage
	DF4004	North Burn - Southeast corner fence, 200-300 feet
	DF4005	North Burn - 25 feet south of southwestern corner of fence
	DF4014	North Burn - 100 feet northwest of northwest corner of fence
8	DF4015	Herbicide Burial Area - 300 feet south of Markey
	DF4016	Herbicide Burial Area - 25 feet east of DF4015
	DF4017	Herbicide Burial Area - 25 feet east of DF4016
	DF4018	Herbicide Burial Area - 100 feet south of Markey
9	DF4007	Oil-Saturated Area - Southwest corner of Motor Pool
	DF4008	Oil-Saturated Area - Southwest corner +25 feet
	DF4009	Oil-Saturated Area - Southwest corner +50 feet
	DF4010	Oil-Saturated Area - Outside southwest corner, 0-100 feet
	DF4011	Oil-Saturated Area - Outside southwest corner, 100-200 feet
	DF4012	Oil-Saturated Area - Outside southwest corner, 200-300 feet
10	DF4019	Hazardous Waste Drum Storage Area - Background from athletic field
	DF4020	Hazardous Waste Drum Storage Area - North of gate to compound
	DF4021	Hazardous Waste Drum Storage Area - West corner of fence, 0-26 feet
	DF4022	Hazardous Waste Drum Storage Area - West corner of fence, 26-60 feet
	DF4023	Hazardous Waste Drum Storage Area - West corner of fence, 60-120 feet
	DF4024	Hazardous Waste Drum Storage Area - South corner +25 feet
12	DF4088	POL Storage Yard - Culvert at Bldg. 952

Table 3-5
SUMMARY OF SOIL BORINGS

Site No.	Boring Designation	Total Depth (feet)
1	Boring #7	7.1
2	Boring #4	9.8
	Boring #8	7.9
	Boring #9	13.0
	Boring #10	8.5
3	Boring #1	12.9
	Boring #2	13.0
	Boring #3	14.5
5	Boring #5	16.5
6	Boring #6	15.0
7	Hand Boring #1	6.0
	Hand Boring #2	6.0
	Hand Boring #3	6.0
12	Hand Boring #4	6.0

and monitoring wells and soil and water sampling points. Twenty-seven soil gas probe locations were tested with an OVA. Figure 3-4 shows the location of the soil gas sampling points.

Based on the results of the soil gas sampling and previous data on the site, three soil boreholes were drilled outside the perimeter of the concrete burn pit; three subsurface soil samples were collected from each borehole; and three monitoring wells were installed within the fenced area. One groundwater sample was taken from each monitoring well, although only MW1, the only well which did not reach bedrock, had sufficient recharge for all the proposed analyses. MW2 and MW3 yielded only one 40-mL sample each.

Six surface soil samples were collected from outside the burn area. One surface water sample was collected from an area of standing water inside the fence line. OVA readings were also taken during the drilling of the boreholes and monitoring wells.

Figure 3-5 shows the sampling locations for this site and the location of the geologic cross section. The cross section is located in Appendix D.

The surface water sample and the groundwater sample from MW1 were analyzed for halogenated and aromatic volatile organics. The surface water sample was also analyzed for petroleum hydrocarbons. The groundwater samples from MW2 and MW3, which yielded only small amounts of water, were analyzed only for volatile organic compounds. The 15 soil samples were analyzed for halogenated and aromatic organics and petroleum hydrocarbons.

Site 8, Herbicide Burial Area

Air Force Civil Engineer's Construction Permit (AF 103), dated 6 August 1971, documents the location of a burial pit 6 feet long by 6 feet wide by 6 feet deep 100 yards south of a weather station at the south end of the runway. The weather station (known as Facility 847) no longer exists. However, a concrete foundation near the south end of the runway is thought to be the remains of the weather station.

A broad, shallow depression was observed in the area of the suspected trench location based on AF 103.

Four composite surface soil samples were collected from the area where the burial pit is thought to be located based on AF 103 and previous evidence of vegetation stress. A single surface water sample was collected from a small pond located downgradient from the soil sampling area.

Figure 3-6 shows the sampling locations for this site.

The water sample was analyzed for total dissolved solids, arsenic, mercury, pesticides, and herbicides. The soil samples were analyzed for herbicides, arsenic, and mercury.

Site 9, Oil-Saturated Area

A single soil boring was drilled immediately adjacent to the stained area, to the northeast. Three subsurface soil samples were collected from this borehole. No sample was taken from the top 3 feet of the borehole, however, because of the presence of coarse fill and gravel. Six surface soil samples were collected downgradient from the oil-saturated area of the motor pool complex. Three of these surface soil samples were taken from the natural drainage path to the south of the area. One surface water sample was collected from the drainage ditch adjacent to a stained area. Two surface water samples were allocated for this site, however, there was only one small pool of standing water available to be sampled at the time of the field investigation.

Figure 3-7 shows sampling locations for this site.

The surface water sample was analyzed for petroleum hydrocarbons, total dissolved solids, halogenated and aromatic volatile organics, and lead. The soil samples were analyzed for halogenated and aromatic organics, petroleum hydrocarbons, and lead.

Site 10, Hazardous Waste Drum Storage Area

A single soil boring was drilled outside the site. The boring location was determined to be the most likely to be contaminated due to natural drainage patterns in the area. Three subsurface soil samples were collected from this borehole. Six surface soil samples were collected at and downgradient from the site. One surface water sample was collected from the drainage ditch downgradient of the site.

times is provided in Appendix H. All samples were shipped to the E & E Analytical Services Center (ASC) or to OEHL/SA by overnight Federal Express. Analytical protocols are discussed in Appendix N.

3.2.9 Variations from Description of Work

During the execution of the fieldwork, several changes from the Description of Work were implemented due to field conditions and findings. Changes were implemented after discussion with and concurrence of the OEHL project manager. A site-specific summary of the variations follows.

All Sites

Subsurface soil borings were taken using a CME continuous sampler. This unit is essentially a 5-foot-long split-spoon soil sampler that is advanced ahead of the hollow-stem auger. It provides a continuous undisturbed sample of the sediment column.

Optional water samples, allocated in case groundwater was intersected during the borehole drilling for subsurface soil samples, were not utilized as no appreciable amounts of groundwater were observed in any boreholes.

Site 1, South Landfill

No modifications in the proposed scope of work occurred at this site.

Site 2, Northeast Landfill

The geophysical surveys were adjusted in the field to cover areas adjacent to the targeted area, based on instrument readings which indicated the entire targeted area as landfill. This was later corroborated based on aerial photographs.

Boring 7 was aborted after encountering the apparent edge of the landfill. Only one of the three scheduled soil samples from this borehole was collected.

An additional surface water sample was collected, from a flowing tributary to Scope Creek just before it enters the creek. This sample represented runoff from the landfill prior to dilution in Scope Creek.

The sample replaced a water sample which could not be taken at Site 6, where no water was encountered.

Site 6, North Burn Pit Area

Due to the absence of any appreciable amounts of water in two of the three monitoring wells at the site, analyses could only be performed for halogenated and aromatic organics. Petroleum hydrocarbons had to be omitted. Two additional attempts to collect sufficient sample volumes also failed.

No determination could be made as to upgradient versus downgradient with respect to monitoring wells. The facility is situated on the top of a ridge.

Site 8, Herbicide Burial Area

No modifications in the proposed scope of work were made at this site.

Site 9, Oil-Saturated Area

No modifications in the proposed scope of work occurred at this site.

Site 10, Hazardous Waste Drum Storage Area

An upstream surface water sample could not be obtained since no water was encountered.

Site 12, POL Storage Yard

A surface water sample from the outfall drain from Building 953 was allocated. However, there was no outfall from this building, and so no sample was collected.

Due to errors in sample labeling in the field, two analytical parameters listed in the Description of Work were inadvertently omitted. These errors affected the proposed analytical program as follows:

- Sample DF4045 - No TDS analysis was performed on this sample.

Nearly all Organic Vapor Analyzer (OVA) readings were positive. The laboratory analyses indicated that none of the nine subsurface samples was contaminated with volatile organics. The probable explanation for the positive result in the soil gas survey and the negative result in the subsurface soil samples is that the OVA was detecting methane, which would not be detected in the soil samples. The fact that OVA readings remained constant when using a carbon filter further supports this conclusion.

The values for petroleum were also low and consistent among the samples (ND to 5.7 mg/kg), with the exception of sample DF4001, collected 100 feet east of the southeast corner of the fence line, which contained 34 mg/kg. Table 4-7 summarizes the results of the soil analyses.

4.2.4 Site 8, Herbicide Burial Area

Geology

Site 8, the Herbicide Burial Area, is similar in setting to Site 6, the North Burn Pit Area, and the Site 1, the South Landfill. The site is on an upland surface where silts and clays cover a weathered limestone bedrock. The original topography of the base has been modified by construction and extension of the major north-south runway. The area is nearly level, with broad shallow depressions and a small pond downgradient to the south.

A broad shallow depression was observed in the area of the suspected trench location based on AF 103. Water had ponded in this area and drained east into other wet areas. It is not known if the shallow depression was caused by possible subsidence of the 1971 trench or is due to construction activities since that date.

Hydrogeology

Based on observations made on other upland sites on the base, it can be assumed that the thickness of the unconsolidated deposits above the bedrock at this site is less than 7 feet. The burial trench was projected to be 6 feet in depth, which places the bottom of the trench very close to, if not directly on, the weathered bedrock surface. The hydrological implication is that the material that was buried, and

Table 4-9
 RESULTS OF SOIL SAMPLE ANALYSES FOR
 SITE 8, HERBICIDE BURIAL AREA
 (mg/kg; all soil concentrations on an as received basis)

Parameter	Date Sampled:	10/10	10/10	10/10	10/10
	Boring#:	HBAS-1	HBAS-2	HBAS-3	HBAS-4
	Depth:	0-1'	0-1'	0-1'	0-1'
	Field No.:	DF4015	DF4016	DF4017	DF4018
	Lab No.:	8796	8797	8798	8799
Herbicides		ND	ND	ND	ND
Arsenic		1.83	5.0	ND	4.53
Mercury		ND	ND	ND	ND

ND = Not Detected

4.3 SIGNIFICANCE OF FINDINGS

4.3.1 Site 1, South Landfill

No contamination was detected leaving this site via surface migration into Scope Creek, based on the analyses of surface soil and water samples. Relatively low concentrations of petroleum hydrocarbons (1.2 mg/kg, 16 mg/kg) were detected in the subsurface soils. The extractable organic compound DBP, the only organic compound detected, was at low concentrations (10 to 16 µg/L), but it also appeared in the method blank (below 10 µg/L). Consequently, DBP has been attributed to laboratory contaminants.

4.3.2 Site 2, Northeast Landfill

With the exception of the extractable DBP, no organic chemicals or metals were reported in any water samples taken at the site. Because DBP was reported in concentrations (14 to 17 µg/L) minimally above sample blank value (13 µg/L), the presence of this chemical has been attributed to laboratory contamination.

Five anions were reported above detection limits. Only a single sample of sulfate at 280 µg/L exceeded a standard or criterion. Since this is a non-mandatory secondary standard set for aesthetic (taste and odor) considerations, the relatively minor exceedance, and the fact that there is no drinking water well nearby, should not represent any material threat to human health.

For soils, no metals exceeded normal ranges for western Missouri soils. The only detectable contaminant was petroleum hydrocarbons, reported at concentrations ranging from non-detectable to 440 mg/kg.

4.3.3 Site 6, North Burn Pit Area

Only three organics (chloroform, tetrachloroethylene, and methylene chloride) were detected in water samples from Site 6. Concentrations of two of the organics (below 1 µg/L) were significantly below EPA HAs. The third, methylene chloride, detected in a single groundwater sample, was well below the EPA HA.

No metals were reported above normal ranges for western Missouri soils. The only organic contaminant reported in soils above detection

have been associated with the storage of drummed hazardous materials here. These efforts included: overpacking drums, removal of stained soil, and scraping the asphalt surface. These efforts were undertaken as a result of a Notice of Violation issued by EPA.

4.3.7 Site 12, POL Storage Yard

The one groundwater and two surface water samples taken at Site 12, the POL Storage Yard, revealed no contamination above detection limits. In the 12 soil samples, petroleum hydrocarbon concentrations were relatively low (6.9 to 44 mg/kg). Removal of soils in the areas of the seven samples with higher concentrations (67 to 2,800 mg/kg) should be considered. In addition, a single sample collected near the drain pipe outlet for Building 953 at a depth of 3 feet contained concentrations of benzene (1.25 mg/kg), total xylenes (2.25 mg/kg), and ethylbenzene (6.25 mg/kg), indicative of contamination by gasoline or a similar petroleum hydrocarbon.

limits was petroleum hydrocarbons. Concentrations of petroleum hydrocarbons in 14 of the 15 samples taken at various depths ranged from non-detectable to 5.4 mg/kg. A single surface sample had a value of 34 mg/kg. In summary, the low concentrations found at the site indicate no undue risk to human health or the environment.

4.3.4 Site 8, Herbicide Burial Area

No detectable concentrations of any contaminant were reported in the single surface water sample taken at Site 8. Concentrations of metals in the four surface soil samples did not exceed the normal range of concentrations reported in western Missouri soils. In addition, no organic contamination was detected in the soil samples. Consequently, the data do not indicate that Site 8 presents an undue risk to human health or the environment.

4.3.5 Site 9, Oil-Saturated Area

No contaminants were detected in the single surface water sample at Site 9.

Results of the soil sample analyses indicate significant lead and petroleum hydrocarbon contamination of site soils. In six of nine samples, concentrations of lead fell within the normal range for western Missouri soils. In the same samples, petroleum hydrocarbon concentrations were relatively low (non-detectable to 9 mg/kg). In the remaining three samples, however, lead concentrations (117 to 343 mg/kg) greatly exceeded the normal range (10 to 20 mg/kg). In these same samples, petroleum hydrocarbons were also high (670 to 3,000 mg/kg). As these were samples taken from the surface (0- to 1-foot depth), humans would be subject to direct contact with high concentrations of lead from the site, warranting consideration of removal.

For the purpose of analyzing the potential human health risk related to lead exposure, it is assumed that humans ingest a maximum of 1 gram of soil daily during activities at the site. This number is extremely conservative (health protective), as it is based on the soil intake for small children--that segment of the population with highest soil intake as estimated by the Agency for Toxic Substances and Disease Registry (ATSDR 1986). Assuming 100% absorption of soil contaminants in

1 gram of soil, these intakes attributable to ingestion of onsite soils are then compared to the daily intake of lead regarded by EPA as acceptable as demonstrated by the current use of this limit in developing the RMCL of 20 $\mu\text{g}/\text{L}$ for lead.

An Acceptable Daily Intake (ADI) for adults related to soil lead ingestion has been derived based on the EPA proposed RMCL of 20 $\mu\text{g}/\text{L}$ and the following assumptions:

- Ingestion of 2 liters per day (L/day) for a 70-kg adult.
- Twenty percent of the ADI is contributed by water ingestion. This assumption is based on methodologies used to estimate revised drinking water standards (EPA 1985a).
- Intake of lead except by ingestion of drinking water and by the soil-related pathways is minimal.

For an adult:

$$20 \mu\text{g}/\text{L} \times 2 \text{ L/day} = 40 \mu\text{g}/\text{day} \text{ from ingestion of water}$$

$$40 \mu\text{g}/\text{day} + 0.2 = 200 \mu\text{g}/\text{day} \text{ from all sources}$$

$$200 \mu\text{g}/\text{day} - 40 \mu\text{g}/\text{day} = 160 \mu\text{g}/\text{day} \text{ from all sources}$$

excluding water ingestion, which
is the Adjusted Acceptable Daily
Intake (AADI) for soil for adults

In order that the AADI not be exceeded, the corresponding soil concentration must be no higher than 160 mg/kg.

4.3.6 Site 10, Hazardous Waste Drum Storage Area

The storage of hazardous waste drums in this compound does not appear to have contaminated the surface and subsurface soils. The only contaminants in soil were petroleum hydrocarbons, with concentrations ranging from non-detectable to 1,900 mg/kg. In six of the nine samples, concentrations were low (less than 9 mg/kg). However, concentrations were high (670 to 3,000 mg/kg) in three samples taken at 0- to 1-foot intervals, and removal of soils from these areas should be considered. The single surface water sample contained barium (85 $\mu\text{g}/\text{L}$) and lead (5 $\mu\text{g}/\text{L}$) significantly below the EPA standards or criteria. No other contaminants were detected in the sample. It appears that the remedial efforts undertaken at this site have cleaned up any problems that may

5. ALTERNATIVE MEASURES

This section discusses the alternative measures that can be taken at each of the seven sites. The alternatives have been devised based on the results of the Phase II Stage 2 investigations. A "no-action" alternative is considered for each site. Recommendations as to the most appropriate alternatives are presented in Section 6.

5.1 SITE 1, SOUTH LANDFILL

No significant contamination of surface water, surface soils, or subsurface soils was found at this site. Minor amounts of petroleum hydrocarbons (less than 16 mg/kg) were detected in one of the surface runoff pathways and at the base of the borehole. No monitoring wells exist on this site.

Alternatives for this site include:

- No action. This alternative is applicable should it be decided that the levels of contaminants detected in the samples do not require further action.
- Long-term monitoring. Seasonal fluctuations in groundwater and rainfall could have accounted for the minor amount of seepage found in the Phase II Stage 2 investigation. Under this alternative, areas of the two known seeps would be resampled periodically and searches would be made for additional seeps.
- Installation of upgradient monitoring wells. Two wells could be installed in association with this landfill, one to the west and one to the south. The west well would test the marshy area which is the source for Seep 2; the south well would determine if sufficient recharge for water samples to be taken could be developed from the area of Borehole 7. This borehole showed a small amount of water and traces of hydrocarbons near its base. The south well

might also indicate whether contaminants have migrated from the South Burn Pit Area, an area that was never clearly located and was not part of the Phase II Stage 2 investigation. The South Burn Pit Area was believed to be located south of the South Landfill.

5.2 SITE 2, NORTHEAST LANDFILL

No significant contamination was detected in association with this site. The utilization of the site for landfilling operations is much more extensive than was previously thought. A soil sample taken from below the fill material indicates that the liquids in the landfill are not penetrating into underlying soil. In two samples at the 1- to 2-foot depth, petroleum hydrocarbons were reported at 78 and 440 mg/kg. This landfill, no longer USAF property, is leased to Kansas City Aviation Company and is being used to store excess property and large refuse items. The USAF should survey the perimeter of the landfill area and present this information to the current property owner and include it in the deed to the property. This will alert the owner as to any limitations on future uses of the land, including future construction and improvements. Already, a sewer line has been cut through the south edge of the landfill. It is not known what effect the intersection with the landfill will have on the integrity of that sewer system in the years to come.

Alternatives for this site include:

- No action. If it is determined that there is no threat to the surrounding environment, no further action would be necessary.
- Long-term monitoring. As part of the base groundwater sampling plan, the five wells at the landfill could be sampled to monitor the continued integrity of the landfill and as a check on the area groundwater quality.

5.3 SITE 6, NORTH BURN PIT AREA

Three volatile organics were detected in perched groundwater at this site--chloroform and tetrachloroethylene at concentrations significantly below drinking water standards or criteria, and methylene chloride in a single sample at a concentration of 37 µg/L, an order of magnitude below the EPA drinking water health advisory. There is very little groundwater, and no deep aquifers are threatened. Soil gas

readings indicated that organic vapor contamination is confined within the perimeter of the site. Soil contamination was limited to low concentrations of petroleum hydrocarbons, which were not found in any water sample.

Alternatives for this site include:

- No action. This alternative would be applicable if it is decided that the levels of contaminants detected in these samples do not warrant action. The concentrations observed have been below federal drinking water standards and there are no receptors.
- Long-term monitoring. Seasonal rainfall could recharge the two wells on this site which were essentially dry at the time of the Phase II Stage 2 investigation. The wells could be monitored for evidence of a contaminant plume by sampling for organic contamination.
- Installation of additional monitoring wells. The northeast monitoring well could be nested with a deeper well (drilled to bedrock) to determine if the organic contamination observed in the shallow wells is migrating along the weathered bedrock interface. A monitoring well could be installed outside the compound to the east, near the outfall from the oil-water separator. This would provide a check on the efficiency of this unit and could aid in locating seeps from lower stratigraphic units.

5.4 SITE 8, HERBICIDE BURIAL AREA

There is no conclusive data on the location of the trench or the characterization of this site. No soil borings were made and so no subsurface soil samples were collected.

Alternatives for this site include:

- No action. If it is determined on the basis of present information that the amounts of herbicides buried at this site and the mode of containment do not constitute an environmental problem, no further action would be necessary.
- Additional investigation. Additional effort to locate the trench should include locating and examining aerial photographs not previously available and performing a ground conductivity survey over the suspected area. Once the trench is located, testing and sampling could begin by drilling a series of 10-foot boreholes in the four corners of the trench area. Also, a sediment sample could be taken from the pond downgradient of the trench.

5.5 SITE 9, OIL-SATURATED AREA

Surface soil was found to be contaminated with petroleum hydrocarbons and lead. Levels of lead exceeded 160 mg/kg, the criterion derived for protection of human health (see Section 4.3.5). In addition, concentrations of petroleum hydrocarbons in three of the nine soil samples in the 0- to 1-foot depth were very high. Access to the site, and therefore to these materials, is limited.

Alternatives for this site include:

- No action. Since there is little chance of direct contact, it may be determined that the levels of contaminants detected do not warrant further action.
- Preparation for Phase IV actions. This action would require the removal of contaminated soils and gravel, after identifying the volume to be removed.

5.6 SITE 10, HAZARDOUS WASTE DRUM STORAGE AREA

Only minor contamination of surface water was detected in association with this site. The concentrations of the two contaminants detected, lead and barium, were below drinking water standards. Petroleum hydrocarbon values were high (up to 1,900 mg/kg) along the south fence line. The sources may include spillage, dripping from the numerous heavy vehicles and smaller vehicles (grass mowers) now present in this compound. Storage of drums containing petroleum products in the compound may also have been a source.

Alternatives for this site include:

- No action. Due to the absence of detectable contamination resulting from the storage of hazardous waste drums at this site, no further action is warranted.
- Identification of petroleum hydrocarbon hot spots. This option would require delineating the areas of high petroleum hydrocarbon contamination, in preparation for removal actions (Phase IV).

5.7 SITE 12, POL STORAGE YARD

Site 12, the POL Storage Yard, is the distribution center for all fuels and propellants on the base. The groundwater south of the

facility is free from contamination. Soils inside the tank berms indicate significant petroleum hydrocarbon accumulations (concentrations ranged upwards to 2,800 mg/kg). Volatile organic contamination was detected in the subsurface outside of Building 953, a pumphouse. Additional pumphouses are present, but were not sampled. The contaminated soil sample came from an area where a broken drain pipe from the pumphouse is thought to be located.

Alternatives for this site include:

- No action. If the levels of contaminants identified are determined not to be excessive for present operation of the site, then no further action is warranted.
- Long-term monitoring. After the installation of a monitoring well during Phase II Stage 2, sampling and analysis of this well on a periodic basis would serve to monitor groundwater conditions at this site.
- Additional subsurface soil sampling. The area of greatest environmental concern is located east of the pumphouses. A series of shallow hand-auger borings could be taken in a grid pattern to determine the extent of organic contamination in the soil.

Table 6-1

LIST OF SITES BY CATEGORY

Category I - No Further Action Recommended

- Site 1: South Landfill

Category II - Additional Site Assessment Recommended

- Site 4: West Burn Area
- Site 6: North Burn Pit Area
- Site 8: Herbicide Burial Area
- Site 12: POL Storage Yard

Category III - Remedial Action Recommended

- Site 2: Northeast Landfill
 - Site 6: North Burn Pit Area
 - Site 9: Oil-Saturated Area
 - Site 10: Hazardous Waste Drum Storage Area
-

Table 6-2
SUMMARY OF RECOMMENDATIONS

Site 1 - South Landfill

- No further action.

Site 2 - Northeast Landfill

- Monitor five monitoring wells biannually for 2 years.
- Monitor land use at landfill biannually for 2 years.

Site 4 - West Burn Area

- Perform a soil gas survey to locate the site.
- Install three monitoring wells.
- Sample the surface and subsurface soils.

Site 6 - North Burn Pit Area

- Install two additional monitoring wells, a second well in northeast corner of site, well to be drilled to bedrock or 30 feet, and one outside the compound to the east (20 feet).
- Monitor five wells biannually for 2 years.

Site 8 - Herbicide Burial Area

- Locate the burial trench using aerial photos and a ground conductivity survey. Drill four shallow borings (10 feet) and sample soil for pesticides, mercury, and arsenic.
- Excavate and remove buried pesticides from trench.

Site 9 - Oil-Saturated Area

- Remove oil-contaminated sediments from along the fence line.

Site 10 - Hazardous Waste Drum Storage Area

- Remove oil-contaminated surficial soils.

Site 12 - PQL Storage Yard

- Install four monitoring wells to bedrock.
 - Monitor wells.
-

INSTALLATION RESTORATION PROGRAM

PHASE II

CONFIRMATION/QUANTIFICATION

STAGE 2

**RICHARDS-GEBAUR AIR FORCE BASE
MISSOURI**

Prepared by:
ECOLOGY AND ENVIRONMENT, INC.
Buffalo Corporate Center
368 Pleasantview Drive
Lancaster, New York 14086
July 1988

FINAL REPORT
(September 1986 to November 1987)

VOLUME 2: APPENDICES

**Approved for Public Release:
Distribution is Unlimited**

Prepared for:

UNITED STATES AIR FORCE
Headquarters Air Force Reserve (HQ AFRES/SGPB)
Robins Air Force Base, Georgia 31098-6001

UNITED STATES AIR FORCE
Occupational and Environmental Health Laboratory/
Technical Services Division (USAFOEHL/TS)
Brooks Air Force Base, Texas 78235-5501

APPENDIX E
CHAIN-OF-CUSTODY FORMS

Ecology and environment, inc.

105 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14226, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 2

Project No.:		Project Name:			Project Manager:			REMARKS											
DF4000		Richards Gebau AFB			Paul R Kopsick														
Samplers: (Signatures)		Paul R Kopsick Mark Myr Michael Minkowski			Field Team Leader: Paul R. Kopsick														
STATION NUMBER	DATE	TIME	SAMPLE TYPE	COMB GRA AIR	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	40 ML VOA	8oz JAR	1L AMX	Depth	OVA					
					EXPECTED COMPOUNDS (Concentration)*:														
DF-4000	10/16	1855	X	AIR	VOA, Pet. Hydro			NELF Boring 4	3	2	1		1-2'	(9063)					
37	10/16	1900	X							2	1		6-7'	9064					
38	10/16	1905	X							2	1		8-10.5	9065					
39	10/17	1000	X		VOA, Pet. Hydro, Lead			OIL STAIN Area Boring 5		2	1		3-4	9066					
40	10/17	1000	X							2	1		8-9	9067					
41	10/17	1000	X							2	1		15.5/10.5	9068					
42	10/17	1010	X		VOA, Pet. Hydro, Ep Tox metals			HWSA - Boring 6		2	1		.5-1.5'	9069					
43	10/17	1100	X							2	1		9-10'	9070					
44	10/17	1030	X							2	1		4.5-5.5'	9071					
45	10/17	1130	X		VOA, Pet. Hydro			POL TANKS		2	1		pet. Hydro upstream - H ₂ SO ₄	9072					
46	10/17	1330	X		VOA, Pet. Hydro			POL TANKS		2	1		downstream - H ₂ SO ₄	9073					
47	14	14	X		VOA, Pet. Hydro			SOUTH LF Boring 7		2	1			9074					
48	14	X			VOA, Pet. Hydro					2	1			9075					
49	14	X			VOA, Pet. Hydro					2	1			9076					
Relinquished By: (Signature)		Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via:												
Paul R Kopsick		10/17/86	551 EXP				Fed X												
Relinquished By: (Signature)		Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	BL/Airbill Number:												
Relinquished By: (Signature)		Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Date:												
EPA EXP		10/19/86	Mark				10/17/86												

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055

ecology and environment, inc.

198 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

recycled

Page 2 of 2

CHAIN-OF-CUSTODY RECORD

Project No.: DF4000	Project Name: RICHARDS - Gebarur AFIS				Project Manager: Paul Kapsick										
Samplers: (Signatures)				Field Team Leader: Paul Kapsick											
STATION NUMBER	DATE	TIME	SAMPLE TYPE	SAMPLE INFORMATION		STATION LOCATION	NUMBER OF CONTAINERS	REMARKS							
				COMP	GRAB			AIR	EXPECTED COMPOUNDS (Concentration)*		DEPTHS				
DF4050	10/17	1500	/	VOA, Per Hydro		NE Landfill Boring 8	2	1	40'	30'	20'	10'	7.0' - 7.9'	7.0' - 7.9'	
DF4050	10/17	1550	/	VOA, PET Hydro		NE LF Boring 9	2	1	40'	30'	20'	10'	4.0' - 5.0'	4.0' - 5.0'	
520	10/17	1540	/				2	1	40'	30'	20'	10'	6.0' - 7.0'	6.0' - 7.0'	
53	10/17	1600	/				2	1	40'	30'	20'	10'	6.0' - 7.0' (Dipol. CATE)	6.0' - 7.0' (Dipol. CATE)	
DF4051	10/17	1800	/	VOA, PET Hydro		NE LF Boring 10	2	1	40'	30'	20'	10'	9.0' - 10.0'	9.0' - 10.0'	
55	10/17	1805	/				2	1	40'	30'	20'	10'	1.0' - 2.0'	1.0' - 2.0'	
56	10/17	1810	/				2	1	40'	30'	20'	10'	4.0' - 5.0'	4.0' - 5.0'	
							2	1	40'	30'	20'	10'	7.0' - 8.0'	7.0' - 8.0'	
Relinquished By: (Signature)				Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via: FedEx						
Relinquished By: (Signature)				Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	BL/Airbill Number:						
Relinquished By: (Signature)				Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Date:						
Distribution: Original accompanies Shipment; Copy to Coordinator Field Files															
*See CONCENTRATION RANGE on back of form.															

234055

Ecology and environment, inc.

195 SUGG ROAD, P.O. BOX O, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 2

Project No.: DF4000	Project Name: Richards-Gebau AFB	Project Manager: PAUL KOPSICK														
Samplers: (Signatures)	Field Team Leader: PAUL KOPSICK															
STATION NUMBER	DATE	TIME	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CON. CONTAINERS	PH			COND			REMARKS		
			COMP	GRAB	AIR			EXPECTED COMPOUNDS (Concentration)*								
57	10/21		x	VOA, Petro Hydro.	9076	North Burn NWMW	1	$\frac{1}{2}$								only 1 VOA
58	10/21		x	VOA, Petro. Hydro	9077	North Burn NEMW	2	1	1							7.75 288 73.5
59	10/21		x	VOA, Petro. Hydro	9078	North Burn SEMW	1	$\frac{1}{2}$								only 1 VOA
60	10/21	1025	x	VOA, Petro. Hydro. TDS	9079	POL Monitoring Well	3	1	1	1						
61	10/21		x	VOA, Petro, Hydro, TDS, Extract, Antons, Phenols, ppmetals	9080	Northeast LF Bkg well	7	1	3	1	2					7.26 548 67.8
62	10/21		x	9081	Gate Wall	7	1	3	1	2						7.22 1207 65.4
63	10/21	1330	x	9082	PII well 1	6	1	3	1	2						7.24 554 67.0 phenol sing break
64	10/21	1340	x	9083	PII well 2	7	1	3	1	2						7.32 888 66.2
65	10/21	1350	x	9084	PII well 3	7	1	3	1	2						7.35 741 68.5
66	10/21	1430	x	9085	South LF Marketing Bales	7	1	5	1	2						8.24 427 67.6 SLF BKG
67	10/21	1430	x	VOA, Petr. Hydro	9090	44SLF BKGs	2	1			1					SLF BKG
68	10/21	1530	x	9086	SLF DNW	7	1	3	1	2						7.34 684 700 SLFAN
69	10/21	1530	x	VOA, Pet. Hydro	9091	SLF DNS	2	1			1					SLF DN?
70	10/21	1550	x	VOA, Pet. Hydro	9092	SLF SEEPs	2	1			1					
Relinquished By: (Signature)			Date/Time: 1900 10/21/86	Received By: (Signature) Fcl. Enviro	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)			Ship Via:				
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	BL/Airbill Number:			Date:			
Relinquished By: (Signature) Fcl. Enviro			Date/Time: 10-21-86 10500	Received For Laboratory By: A. J. H. J. H. C.	Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)							

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files
*See CONCENTRATION RANGE on back of form.

234055

ecology and environment, inc.

106 SUGG ROAD, P.O. BOX O, BUFFALO, N.Y., 14226, TEL. 716-632-4491
International Specialists in the Environment

Page 2 of 2

CHAIN-OF-CUSTODY RECORD

Project No.: DFH 1000	Project Name: Richards Gebauern AFB			Project Manager: PAUL KOPSKICK	Field Team Leader: PAUL Kopsick			REMARKS 2 - 40ml VOA 1 - 40ml Poly 1 - 40ml Amine 1 - 40ml Amber pH Cond Temp 8.00 56.7 67.4													
Samplers: (Signatures) <i>Paul R Kopsick</i>																					
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRAB AIR	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS													
				EXPECTED COMPOUNDS (Concentration)*																	
044071	10/21	1550	X	VOA, pH, H ₂ O, TDS, Ext., PPmetals, Anions, Phenols,			SLFSEEPW	9087	7	1	3	1	2								
72	10/21	1730	X	VOA Field Blank				9095	1	1											
Relinquished By: (Signature) <i>Paul R Kopsick</i>	Date/Time: 10/21/66	Received By: (Signature) <i>Fac. Enviro</i>	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via:															
Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)																
Relinquished By: (Signature) <i>Fac. Enviro</i>	Date/Time: 10-21-66/0900	Received For Laboratory By: (Signature) <i>10-21-66/1000 C</i>	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	BL/Airbill Number: _____ Date: _____															

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055

Ecology and environment, inc.

195 SUGG ROAD, P.O. BOX O, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.:	Project Name:			Project Manager:			REMARKS													
DF4000	Richards - Gebair AFB			PAUL KOPSKY																
Samplers: (Signatures)			Field Team Leader:																	
<i>Michael Muhlbury Joe Chandler Mike Myr</i>			<i>Joe Chandler</i>																	
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRAB AIR 4	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	40 AL VIALS (SET)			80 AL SAR			50 AL SAR					
				EXPECTED COMPOUNDS (Concentration)*																
DF4009	10/26	1050	X	VOA, Petroleum Hydrocarbons			POL TANK # 955	3	2	1	1							4	EDET's	
80	10/26	1100	X				POL TANK # 955	3	2	1	1								DEPTH = 1.0'	9343
81	10/26	1130	X				POL TANK # 955	3	2	1	1								" = 2' 10"	9344
82	10/26	1330	X				POL TANK # 955	3	2	1	1								" = 6.0'	9345
83	10/26	1345	X				POL TANK # 957	3	2	1	1								" = 1.0'	9346
84	10/26	1415	X				POL TANK # 957	3	2	1	1								" = 2' 8"	9347
85	10/26	1450	X				POL TANK # 957	3	2	1	1								" = 6.0'	9348
86	10/26	1500	X				POL TANK # 954	3	2	1	1								" = 1.0'	9349
87	10/26	1525	X				POL TANK # 954	3	2	1	1								" = 3.0'	9350
48	10/26	1555	X				POL TANK # 954	3	2	1	1								" = 5.0'	9351
87	10/26	1515	+	87 DUP			B. 955 drain	3	2	1	1								Calvert @ Bld. 952	9353
							POL TANK # 954 (5)	2	1	1									Duplicate (5 ft.)	1/9352
Relinquished By: (Signature)	Date/Time: 1030	Received By: (Signature)	Relinquished P	Signature	Date/Time:	Received By: (Signature)	Ship Via:	BL/Airbill Number:						Date:						
<i>Joe Chandler</i>	10/26/86			Signature	Date/Time:	Received By: (Signature)	<i>Fed. Ex</i>													
Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished	Signature	Date/Time:	Received By: (Signature)														
Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Relinquished	Signature	Date/Time:	Received For Laboratory By: (Signature)														
<i>Fed. Express</i>	10-29-86/10930	<i>N.L. - 1/17.1.C</i>		<i>Signature</i>	<i>Date/Time</i>	<i>Received For Laboratory By: (Signature)</i>														

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files
*See CONCENTRATION RANGE on back of form.

234055

ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists In the Environment

RECYCLED

Page 1 of 1

CHAIN-OF-CUSTODY RECORD

Project No.: DF41000	Project Name: Richards Gebau AFB			Project Manager: PAUL KOPSICK								
Samplers: (Signatures) <i>Paul R Kopsick</i> <i>Joe Gandy</i> <i>M. Lee Marshall</i>				Field Team Leader: PAUL KOPSICK								
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRA AIR	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	REMARKS			
				EXPECTED COMPOUNDS (Concentration)*								
73	10/23	1050	X	VOA, TDS, Phenol, Pet Hydro, Ammonia, Extra PPM's			NELF culvert	1 P.M. 8	7	1 3 1 2		7.92 61B 62.0 9230
74	10/23	1100	X				NELF Downstream	8	7	1 3 1 2		7.87 341 61.4 9231
75	10/23	1116	X				NELF upstream	8	7	1 3 1 2		8.01 374 61.0 9232
76	10/23	1200	X				SLF SEEP 2	8	7	1 3 1 2		7.94 540 66.4 9233
77	10/23	1210	X	VOA, Pet. Hydro			SLF SEEP 2	3	2	1	1	
78	10/23	1620	X	VOA BLANK			NELF M1	1	1			9234
												9235
DF41063	10/23	1030	X	Phenols			NELF M1	1	1			Replaces Broken jar of 10121 9235
Relinquished By: (Signature)		Date/Time:	Received By: (Signature)	Relinquished By: (Signature)		Date/Time:	Received By: (Signature)	Ship Via:				
<i>Paul R Kopsick</i>		1700 10/23	<i>FED EXP</i>					<i>Fed Exp</i>				
Relinquished By: (Signature)		Date/Time:	Received By: (Signature)	Relinquished By: (Signature)		Date/Time:	Received By: (Signature)					
Relinquished By: (Signature)		Date/Time: 1930 10/24/86	Received For Laboratory By: (Signature) <i>A. Marsh</i>	Relinquished By: (Signature)		Date/Time:	Received For Laboratory By: (Signature)	BL/Airbill Number:			Date:	

Distribution: Original Accompanies Shipment. Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234055

Ecology and environment, inc.

195 SUGG ROAD, P.O. BOX O, BUFFALO, N.Y., 14226, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.: DF4000	Project Name: Richards Gebau AFB	Project Manager: PAUL Kopsick	<i>2-40-1 von Vials</i> <i>2-40-1 von Vials</i> <i>1-B-02 Joe</i>																			
Samplers: (Signatures)		Field Team Leader: PAUL Kopsick																				
STATION NUMBER	DATE	TIME	SAMPLE INFORMATION		STATION LOCATION	NUMBER OF CONTAINERS	REMARKS															
			COMP	TYPE			LB	GR	AIR	EXPECTED COMPOUNDS (Concentration)*												
DF4027	10/15	1420	X		VCA, Petroleum Hydrocarbons	8844	NB Boring 1 S-1	3	2	/									all positive			
DF4025		1430	X			8845	NB 1 S-2	3	2	/									UV-A reading			
DF4029		1435	X			8846	NB 1 S-3	3	2	/									7-5'			
DF4032		1510	+			8847	NB Boring 2 S-1	3	2	/									12-12.4'			
DF4031		1515	X			8848	NB 2 S-2	3	2	/									5.6'			
DF4032		1520	+			8849	NB 2 S-3	3	2	/									11-12'			
DF4033		1600	+			8901	NB Boring 3 S-1	3	2	/									2-3'			
DF4034		1605	+			8902	NB 3 S-2	3	2	/									5.6'			
DF4035		1610	+			8903	NB 3 S-3	3	2	/									11-12'			
DF4021		1520	+		8900 duplicate	NB Boring 2 S-3	3	2	/										11-12'			
Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via:																
Paul Kopsick	10/15 1700h	Joseph Chandler	Joseph Chandler	10/15 1745	Fed. Express	Federal Exp																
Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	BL/Airbill Number:																
Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Date:																
Fed Express	10/16-86 10900	William H. Johnson				10/15/86																

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

234056



ecology and environment, inc.

195 SUGG ROAD, P.O. BOX O, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1.

Distribution: Original Accompanies Shipment; Copy to Coordinator Field File

*See CONCENTRATION RANGE on back of form.

2140вк

Ecology and environment, inc.

195 SUGG ROAD, P.O. BOX O, BUFFALO, N.Y., 14225. TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.: DF-41000	Project Name: RICHARDSON - GIBBON AFB TRT			Project Manager: PAUL KOTKICK								REMARKS				
Sampler: (Signatures)			Field Team Leader: PAUL KOTKICK													
STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP GRAB AIR	SAMPLE INFORMATION			STATION LOCATION	NUMBER OF CONTAINERS	Chain-of-Custody Log							
				EXPECTED COMPOUNDS (Concentration)*					1. REC'D. 2. REC'D. 3. REC'D. 4. REC'D. 5. REC'D. 6. REC'D. 7. REC'D. 8. REC'D.							
DF-41000-1	10/10/84	1200	X	VCA, C-1-	8765	North Island Annex	3	2	1	Bunker 100 F						
40001	1210	X	VCA, C-1-	8766	-52	3	2	1	Bunker at 660 F							
40003	1215	X	VCA, C-1-	8767	-53	3	2	1	No. 6 of F...							
40001	1230	X	VCA, C-1-	8768	-54	3	2	1	No. 1 Line 100-300 F							
40002	1245	X	VCA, C-1-	8769	-55	3	2	1	Soil sample at fence							
40004	1245	X	VCA, C-1-	8770	-56	5	2	1	pH 8.50 1900 mm 10.5°C							
40001	1430	X	VCA, C-1-, Lead	8770	C.I. Contracted Area -51	3	2	1	Soil sample at fence							
40008	1430	X	VCA, C-1-, Lead	8771	-52	3	2	1	Soil sample at fence + 25°							
40001	1430	X	VCA, C-1-, Lead	8772	-53	3	2	1	Soil sample at fence + 50°							
40010	1515	X	VCA, C-1-, Lead	8773	-54	3	2	1	Outside perimeter fence 100°							
40011	1530	X	VCA, C-1-, Lead	8774	-55	3	2	1	Outside perimeter fence 100-200°							
40012	1545	X	VCA, C-1-, Lead	8775	-56	3	2	1	Outside perimeter fence 100-300°							
40013	1430	X	VCA, C-1-, Lead, TDS	8777	-51	5	2	1	pH 8.50 3600 mm 60°C CONTAINING FENCE							
Relinquished By: (Signature)			Date/Time: 10/10/84	Received By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Ship Via: Tractor						
Relinquished By: (Signature)			Date/Time:	Received By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received By: (Signature)							
Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)			Date/Time:	Received For Laboratory By: (Signature)	BL/Airbill Number: Date: 10/10/84						

*: Original Accompanies Shipment; Copy to Coordinator Field Files

INTEGRATION RANGE on back of form.

234055

ecology and environment, inc.

395 SUGG ROAD, P.O. BOX O, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.:		Project Name:			Project Manager:			REMARKS											
DF4000		Richards-Gebaur AFB IRP			Paul Kopsick														
Sampler: (Signature)					Field Team Leader:														
<i>PK</i>		Paul Kopsick, Bill Kwoka, Mike Michalowski			Paul Kopsick														
STATION NUMBER	DATE	TIME	SAMPLE TYPE	COMP	GRAB	AIR	SAMPLE INFORMATION			STATION LOCATION		NUMBER OF CONTAINERS							
EXPECTED COMPOUNDS (Concentration)*																			
DF4014	10/10	1120	X				VOA, O&G	8795	North Burn Area S-6	Z	1		1	West Drainage					
DF4015		1315	X				Herbicides, Arsenic, Mercury	8746	Herbicide Burial S1	Z			2	300' South of Road					
DF4016		1320	X					8797		-S-2	Z			25' East of DF4015					
DF4017		1330	X					8798		-S-3	Z			25 East of DF4016					
DF4018		1340	X					8799		-S-4	Z			100' South of Road					
DF4019		1445	X				VOA, EP Tox. (Metals), O&G	8800	Haz. Waste Storage S-1	Z	1		1	Background Soil					
DF4020		1505	X					8801		S-2	Z	1		Gate of Compound					
DF4021		1445	X					8802		S-3	Z	1		Fence corner 0-26'					
DF4022		1500	X					8803		S-4	Z	1		26-60'					
DF4023		1500	X					8804		S-5	Z	1		60-120'					
DF4024		1455	X					8805		S-6	Z	1		Opposite corner + 25'					
DF4025		1515	W				VOA, TDS, O&G, PPMetals, Barium, Mercury	8806	Cancelled by PK 10/15 KWD	W-1	4	1	2	Opposite corner + 25' 9.27 PH 46°F 30°C 46°F					
DF4026		1600	W					8808	Field Blank		1	1	2	HWSA					
DF4027		1315	W				Pesticides, TDS, Arsenic, Mercury	8809	Herbicide Burial W-1	3	2	1		Pond in Field 6.5 PH 46°C 46°F					
Relinquished By: (Signature)		Date/Time:		Received By: (Signature)		Relinquished By: (Signature)		Date/Time:		Received By: (Signature)		Ship Via: Federal Express							
<i>Paul Kopsick</i>		10/10/86 7000																	
Relinquished By: (Signature)		Date/Time:		Received By: (Signature)		Relinquished By: (Signature)		Date/Time:		Received By: (Signature)		BL/Airbill Number: 10/10/86							
Relinquished By: (Signature)		Date/Time:		Received For Laboratory By: (Signature)		Relinquished By: (Signature)		Date/Time:		Received For Laboratory By: (Signature)									

Distribution: Original Accompanies Shipment; Copy to Coordinator Field File

*See CONCENTRATION RANGE on back of form.

234055

Provided on the following pages are sample receipt logs for the appropriate sample numbers as documentation of proper sample management and documentation procedures.



PACKAGE RECEIPT LOG

0243

recycled paper

E-13

Quality and environment

ITEM NO.	CLIENT NAME and/or JOB NO.	DATE RECEIVED	RECEIVED FROM (e.g., carrier)	CARRIER I.D. NO. or INITIALS	SHIPPING INVOICE NO. (Place in file)	PACKAGE DESCRIPTION (e.g., 1 cooler, 1 jar, etc.)	PACK- AGE SEC- URED	MANNER PACKAGE SECURED				PACKAGE DISPOSITION			CUSTODIAL INITIALS	
								Yes	No	Custodianship Seal	Fibreglass Tape	Other	Deficiencies	Explain and footnote if necessary. File deficiency report.	Sam- ple Log- ged	
4332	PVS Chemical	10-9-86	L. Rodel	ZR	none	1-Cooler	✓									LPH
4333	Edgetooth Apartments	10-9-86	A. Devereux	ADJ	none	1-Plastic Bag	✓									LPH
4337	Team of Architects	10-9-86	Client	✓	120112	1-Plastic Bucket	✓									LPH
4340	SellerTherm Inc.	10-9-86	Client	✓	none	1-Cooler	✓									LPH
4341	Sterling Environmental	10-9-86	Client	✓	120112	3-16oz WM poly	✓									LPH
4342	Richards-Gebauer AFB	10-10-86	Fed. Express	✓	1533064816	1-Cooler	✓									LPH
4343	C.P.C. - Tannawanda	10-10-86	Client	✓	120112	1-Cooler	✓									LPH
4344	New York Air Brake	10-10-86	U.S. Air	✓	Flight 10-H-11 40-34-97	1-Cooler	✓									LPH
4345	Richards-Gebauer AFB	10-11-86	FED EXPRESS	DM	1233064706	1-Cooler	✓								H-O	LPH
4346	U.S. EPA	10-13-86	Fed. Express	FM	120815521	1-Cooler	✓									LPH
4347	John J. L. 1-623	10-13-86	Client	✓	116112	1-125ml poly	✓									LPH
4348	Richards-Gebauer AFB	10-13-86	Shippers 11-63	✓	See TT# 4345	1-Cooler	✓									LPH
4349	Frontier Insulation	10-13-86	Client	✓	none	2-16oz bottles	✓									LPH
4350	FMC - M. de le penet	10-13-86	Client	RAS	none	3-1Lg 16oz	✓									LPH
4351	D. P. Z. C. - C. Testino	10-13-86	Client	GD	none	2-125ml poly	✓									LPH
4352	How Management Inc.	10-13-86	Client	BAC	none	1-glass bottle	✓									LPH
4353	Springville Central School	10-13-86	W. H. 11	WHD	none	2 PLASTIC	✓									LPH
4354	V.F.T.A.	10-14-86	Client	✓	none	1-foam T.v.	✓									LPH

EXPLANATIONS:

105

111

SAMPLE RECEIPT LOG

PACK AGE RE CEIPT LOG ITEM NO.	ANALYTICAL SERVICES CENTER SAMPLE I.D. NO.				JOB NO.	DATE LOGGED	CLIENT SAMPLE I.D. (e.g. Well No., Boring No.)	PACK- ING LIST OR CHAIN OF CUS- TODY RE CORS	SAMPLE CONTAINER TYPE				MAN- NER SAMPLE SECURE- D ON RE- CEIPT	SUBSAMPLES			REMARKS (If Subsamples Generated, Indicate Page Reference, If Name, Make No Entry.)	REMARKS: (e.g., leaks, breakage, discrep- ancies with packing list. File discrepancy report if necessary.)	SE- CURE STOR- AGE AREA	CUSTO- DIANS INITIALS	DISPOSITIVE								
	Prin Sample I.D. No.	Individ ual Sample Con- tainer No.	Lab Gener- ated Sub- sample No.	Addi- tion- al Suffix No.					Yes	No	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	New Sub- sam- ples	Deliverer's Initials (Footnote if not generator)	CUS- TODY SEAL AF FIXED	LABEL WITH NO AND DATE AF FIXED	Con- sumed	Com- bined	Left
	Con- sumed	Com- bined	Left	Retained in Client					Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No			
4441 (4441)	8801 4	c2 c3			U-4781	10-13-86	DF-4020 1	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	E	I-HH	
	8802 1	c1 c2 c3					DF-4021 1	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	F	A-2	
	8803 1	c1 c2 c3					DF-4022 1	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	E	H-2	
	8804 1	c1 c2 c3					DF-4023 1	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	F	A-2	
	8805 1	c1 c2 c3					DF-4024 1	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	F	I-2	
	8806 1	c1 c2 c3 c4 c5			U-482		DF-4025 1	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	F	E	A-33
	8807 1	c1 c2 c3 c4 c5					DF-4027 1	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	F	E	A-33
	8808 1	c1 c2					DF-4026 1	FRM	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	F	E	I-HH
4444	8809 c1				U-4783	10-13-86	JP-L #1	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	G	V-111	
	8810 c1						JP-L #2	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	G	V-111	
	8811 c1						JP-L #3	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	G	V-111	
	8812 c1						LCC #1	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	G	V-111	
	8813 c1						LCC #2	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	G	V-111	
	8814 c1						LCC #3	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	G	V-111	
4446	8815 c1				U-4785	10-13-86	DF-4026 artell Tadde Creek	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	A-26	I-HH	
	8816 c1						DKK	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	A-26	I-HH	
	8817 c1						Klein Rd.	-	-	-	4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	A-26	I-HH	
	8818 c1										4 ml Vial	1/2 gal Amber	1L Poly	500 ml Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1 ml Vial	250 ml Poly	Customer Seal	Fingerprints/Tape	Other	-	-	-	-	A-26	I-HH	

• If no process accuracy/vulnerability report, then point to no explanation

EXPLANATION

EXPLANATIONS

SAMPLE RECEIPT LOG

If no, indicate - WHICH WORKSHEET IS IT? _____

www.Ivete.com.br

EXPLANATIONS

Y0 in Jet n, Jet eta corrected. Sample size good with