FINAL
CLOSURE REPORT

LOW-LEVEL RADIOACTIVE DISPOSAL CELL EXHUMATION, TRANSPORTATION, AND DISPOSAL FORMER RICHARDS-GEBAUR AIR FORCE BASE

Prepared for:

U.S. Army Corps of Engineers
Kansas City District
601 East 12th Street
Kansas City, Missouri 64106-2896

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1.0 SUMMARY

Environmental Chemical Corporation was contracted to locate, exhume, package, and transport a low-level radioactive waste disposal storage cell (LLRDC) located on the former Richards - Gebaur Air Force Base, Belton, Missouri.

Prior to breaking ground the site was prepared and work zones demarcated in accordance with the USACE approved Work Plan. On September 15, 1997, the excavation commenced. An area to the east of the pipe was excavated to a depth of 24 feet. The pipe was successfully removed and remained intact throughout. The pipe was secondarily packaged into a 25 foot steel pipe. The void space was filled with sand to a minimum capacity of 85%.

The pipe waste package was loaded onto a transport vehicle on September 17, 1997. The package was transported to a R.M Wester & Associates Facility in St. Peters, Missouri. R.M. Wester & Associates is licensed by the State of Missouri for the temporary storage of radium (See Appendix C). The waste package was held at this location pending the completion of the State of Washington Site Use Permit issued for the Richards-Gebaur Site. During this period the packaging integrity was reviewed and ensured by Wester and U.S Ecology personnel.

Radiologic surveying, monitoring, and characterization took place throughout the project activities. Field instrument monitoring did not indicate any incidence of personnel or equipment contamination. Soil monitoring with field survey instruments did not indicate that any contamination spread from LLRDC to the surrounding soil. Gamma Spectroscopy characterization was performed in the field and indicated the sole presence of Ra-226. Air monitoring results proved that the generation of dust contaminated with radioactive materials did not occur. Personnel exposure monitoring yielded non-detectable exposures for all individuals monitored.

Soil sampling proceeded during the excavation in accordance with the USACE approved Sampling and Analysis Plan. The preliminary laboratory results indicate the presence of a single anomaly. Isotopic Uranium Analysis results show elevated levels in sample # RGS21-24. Further analysis was performed on this sample and the results confirmed the elevated uranium levels.

2.0 PROJECT BACKGROUND

2.1 Location

The project was located at Richard - Gebaur AFB, off of Highway 71 and Highway 150 south of Kansas City, Missouri, near the town of Belton. The LLRDC was located in an open field approximately 450 feet north of the base lake, 200 feet east of the Tactical Air Navigation System Building (Building 841) and about 300 feet west of Scope Creek. See Figure 4, Site Map.

2.2 History

The Base facility was originally leased by the Aerospace Defense Command in 1952 and transferred to the U.S. Government in 1953. The base was used by various branches of the U.S. Air Force. Beginning in 1979, control of many facility functions were gradually transferred to the City of Kansas City as part of an eventual closure of the base. The grounds and facilities are currently owned, leased, used, or being offered for future use by the City, various Federal and city government organizations, as well as civic and business organizations.

The LLRDC consisted of a ten to twelve inch diameter cast-iron pipe casing that stood approximately 5.5 feet above ground surface. The exact depth of the disposal cell was unknown, but an unverified United States Air Force-Air Logistics Command report indicated that the cell was 23 feet long and with concrete caps. The cell was believed to have been used intermittently from 1955 to 1970 for the disposal of dosimeter badges, and radium dials and gauges replaced during routine aircraft maintenance. The Air Force Bio-Engineering staff monitored disposal of these materials. Standard USAF operating procedures indicate that the contents of the pipe were "slurried" with concrete prior to capping and sealing of the pipe. Previous monitoring for radioactivity at the site was completed externally at the well cap in 1983 and 1993. The activity counts were reported to be at, or near, background levels.

2.3 Purpose and Scope

The goal of this project was to remove, assay, package and dispose of a ten to twelve inch diameter cast- iron pipe that was reportedly twenty-three feet long. The LLR disposal cell (reported to contain radioactive aircraft components, i.e. electron tubes and luminescent dials, and dosimeter badges), any associated soils contaminated with radioactive isotopes, and any investigation derived waste contaminated with radioactive isotopes were to be properly disposed. It was anticipated that the site would be released for "unrestricted use" following the removal action. The entire scope of activities proceeded in a manner that would prevent or minimize the spread of radioactive

contamination (if encountered), and provide for the safety of the on-site personnel through administrative controls and appropriate PPE. ECC provided the on-site services to complete the exhumation of the LLRDC, environmental sampling, waste profile characterization, and site reconditioning.

Site activities were coordinated through the USACE, Kansas City District, and Richards - Gebaur. Project documentation includes the Work Plan that incorporated the Site Safety and Health Plan (SSHP) and the Sampling and Analysis Plan (SAP), and this Closure Report.

During excavation activities removed soils were to be segregated and protected until the LLRDC cell was removed. All soils which passed the field screening meaurements were returned to the excavation as backfill, compacted to 95% maximum density as determined by ASTM D 698.

Several assumptions were made in the preparation of the Work Plan The more salient of these assumptions are described below:

- The radioactive materials would be naturally occurring radioactive material (NORM).
- Work would not commence until a NORM determination and Site Use Permit was issued by the State of Washington*.
- Contaminated groundwater was considered beyond the scope of this project.
- The LLRDC retained full integrity during excavation.
- Diffuse contamination was limited to an impact volume of ten (10) cubic yards of soil.
- Richards -Gebaur would provide a secured, safe storage location for the exhumed vault upon discovery of byproduct material or refusal for disposal by U.S. Ecology until arrangements for transfer to an active licensee, if necessary.
- Richards-Gebaur would provide solid waste disposal services for uncontaminated solid waste.

* Although the permit had yet to been issued, the application process was initiated; therefore, work commenced.

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3.0 DAILY ACTIVITIES SUMMARIES

3.1 September 8, 1997

ECC employees met at the Whiteman Inn, Knob Noster, Missouri at 900. Dr. Clarence Styron of R.M.Wester and Associates also arrived at 900. Radioactive Materials training commenced in the conference room at 1000 and continued until 1500. At the end of this training session, a quiz was administered to the participants and was reviewed with Dr. Styron.

3.2 September 11, 1997

All ECC personnel and equipment mobilized to site.

3.3 September 12, 1997

All personnel arrived at site at 900. The work site was divided into 3 zones. An Exclusion Zone (EZ) was established to encompass the excavation. Orange snow fencing was utilized to mark the outer perimeter of the EZ. A designated Contamination Reduction Zone (CRZ) was provided for a frisking/decon station and a protective barrier to the Support Zone (SZ). The outer perimeter of the CRZ was marked with caution tape. 'Caution Radioactive Materials' signs were posted at several locations around the CRZ. (See Figure 5, Site Diagram)

The Radiation Safety Officer (RSO) performed a background determination survey.

At 1200, Setup was completed and personnel departed the site.

3.4 September 15, 1997

All ECC personnel arrived at site at 530. A tailgate safety meeting was held to discuss the concerns of the day. Special attention was given to the hazards associated with the movement and operation of heavy equipment, working around an excavated area, and handling potentially radioactive materials and soils. Each individual was then issued a TLD (Thermo Luminescent Dosimeter). All equipment was the thoroughly inspected by the operators. All Health and Safety documents are presented in Appendix A.

USACE and MDNR Personnel arrived to observe operations throughout the day. See Visitor Sign-in Sheet in Appendix A.

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A high volume air sampler was set up at the northeast corner of the site, at the perimeter of the CRZ, to monitor for the release of airborne contaminants. The filter was scanned throughout the day using the alpha detection probe. The above ground portion of the LLRDC was anchored to the loader and dozer using heavy-duty straps. Excavation began on the eastern (down slope) side. Soil contamination monitoring was performed by the RSO on every third bucket of soil removed. Soil samples were collected by the QC Officer throughout the excavation activities.

The area around the LLRDC was excavated to a depth of 18 ft. The area was then benched back to allow for partial descent and to provide an area to lay the cell horizontally. Visqueen sheeting was placed on the sloped portion. The LLRDC was then fitted with chains and straps and secured to the excavator. It was lifted from it's vertical position and gently placed on the sloped area. The cell was then re-strapped and secured on both ends. It was determined to be completely intact. A staging area was prepared on the southern side of the EZ. At 1015, the LLRDC was removed from the excavation to the staging area and remained intact throughout the procedure.

During excavation activities the presence of small quantities of water was noted. No known water pipe sources were in the vacinity. The water was believed to have originated from pockets or perched water around the tree immediately west of the LLRDC.

Once dry, the pipe exterior was scanned for alpha contamination using the alpha scinitillation detector. No surface contamination was detected on the pipe. The site RSO and USACE-HP began Gamma Spectroscopy Analysis operations. Radiological characterization was completed at 1430.

Prior to backfilling, two more soil samples were collected from the bottom of the excavation. No contamination was detected on these samples or on any of the samples taken previously. These two samples were composited along with the four (4) other samples taken at a depth of 21-24 feet. An area to the southwest of the site was then chosen by USACE Geologist for collection of background samples. A 15 ft. hole was dug and samples were collected from the shovel of the excavator. Backfill commenced and was completed at 1500. (See Figure 5, Site Diagram)

A 25 ft. steel pipe was prepared for overpack of the LLRDC. Windows were cut into the pipe to aid with the filling of void spaces. One end of the LLRDC was propped up and the overpack pipe was slipped around it. The LLRDC remained intact throughout the overpack procedure. Small quantities of dirt/ rust were shaken off and re-surveyed. No contamination was detected. Sand was then used to fill the void spaces to 85% capacity. At 1700, the windows and ends of the overpack pipe were welded shut. The RSO performed a swipe test on the waste package to determine if the removable alpha contamination was within NRC Guide 1.86 standards (<20 dpm / 100 cm^2). Removable alpha levels were determined to be below this level.

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The site was compacted and leveled with dozer and excavator. The final survey of all materials and personnel was performed. No contamination was detected. All soil samples were composited correctly, site cleanup was completed, and the pipe waste package was labeled and staged for transport.

All personnel departed the site at 1800.

3.5 September 16, 1997

The RSO and QC Officer prepared the shipping documents. All samples were sent for analysis.

3.6 September 17, 1997

All personnel met at site at 1000. Following a safety meeting and equipment inspection, the waste package was moved to the parking lot north of the site. At 1200, the transport vehicle arrived. The package was loaded and well braced. The package and vehicle were surveyed by the RSO.

The QC Officer, USACE representative, and driver reviewed all shipping documentation. Following confirmation of the drivers qualifications the shipping papers were signed and the vehicle left the site at 1330.

4.0 HEALTH PHYSICS ACTIVITIES

4.1 Equipment Inventory

The radiological equipment and standards that were transported to the field to provide Health Physics support are listed in Tables 1 and 2.

Table 1
Radiological Equipment

SHORT NAME	METERS			DETECTORS			CAL. DATE	RADIATION DETECTED
	MFG.	MODEL	SN	MFG.	MODEL	SN		
Survey Meter #1	Ludlum	3 Survey Meter	106312	Ludlum	44-9	PR105396	6/17/97	Alpha, Beta, Gamma
Survey Meter #2	Ludlum	3 Survey Meter	66839	Ludlum	44-9	PR063659 PR086884	4/23/97	Alpha, Beta, Gamma
Gamma Probe	Ludlum	2350 Data Logger	79049	Ludlum	44-10	PR040484	7/23/97	Gamma
Alpha Probe	Ludlum	2350 Data Logger	101652	Ludlum	43-1	PR101995 PR101996	6/27/97	Alpha
MCA	The Nucleus	256D Multi-channel Analyzer with Model 800A MCA	8703-1801	Teledyne Isotopes	S-1212-1 3 x 3 inch NaI(Tl) Detector	C6771	As Used	Gamma

Table 2
Radiological Standards

RADIONUCLIDE	ACTIVITY	ACTIVITY (dpm)	MFG.	MODEL	SN
Cs-137	1.0 uCi	2.2200E06	The Source	Check	0893 2334
Ra-226	0.96 uCi	2.1312E06	Amersham	184100	2B76
Th-230	7,432 pCi	16,500	The Source	47 mm disk	93TH4703193

4.2 Equipment Calibration

Calibrations were verified for equipment in the laboratory at R. M. Wester and Associates, Inc., using an NIST traceable source before transport to the field site. Results are reported in calibration certificates presented in Appendix B.

Operation checks were also conducted in the field to ensure that equipment was performing correctly. A thorough check was conducted for each instrument before excavations commenced as well as at intervals during the work day. (Tables 3-11)

The survey meter serves a dual purpose; as an exposure meter, to directly measure radiation levels in units of mR/hr and by detecting surface radionuclide contamination responding to alpha, beta and gamma radiation. One survey meter was stationed at the egress point for the Exclusion Zone for personnel monitoring; the second was used to monitor equipment, soil, etc.

Calculations follow the recommendations of HASL-300.
Efficiency = Net Sample cpm / Standard dpm
Lower Limit of Detection (LLD) = (2.71 * Background cpm)$^{-½}$ / Efficiency
Minimum Detectable Activity (MDA) = LLD / 2.22 dpm per pCi

4.2.1 Survey Meter #1

Table 3
Operational Check Data for Survey Meter #1

	Background	Cs-137 STD.	Ra-226 STD.	Th-230 STD.
mR/hr	0.01 - 0.02	2.2	30	0.6
cpm	50	8,000	90,000	2,000
Efficiency	N/A	0.00364	0.0422	0.118
LLD (dpm)	N/A	9051	781	279
MDA (pCi)	N/A	4077	352	125

Conditions of the battery and response to a ^{137}Cs source were checked each time the survey meter was turned on during the day and at the end of the day. A partial listing of actual readings is reported in Table 4. Responses were also checked for ^{230}Th and ^{226}Ra sources.

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Table 4

Survey Meter #1 Operational Check Log

Type of Monitoring: Direct Radiation and Surface Activity Levels				Project: Richards Gebaur Airport	
Instrument: Ludlum Model 3 Survey Meter (SN 106312) with Pancake GM Probe Model 44-9 (SN PR105396)					
Date/Time	**Batt.**	**Bkg (cpm)**	**Cs-137 (mR/hr)**	**Th-230 (cpm)**	**Ra-226 (kcpm)**
Expected☞	OK	20 - 60	2.0		
9/9/97					
0704	OK	50	2.0	1900	90
0910	OK	40	2.0	1900	90
1148	OK	50	2.2	1900	90
1303	OK	50	2.5	1900	90
1607	OK	50	2.5	1900	90
9/10/97					
0650	OK	40	2.0	2000	80
0900	OK	50	2.0	2000	90
1200	OK	50	2.5	2000	90
1530	OK	50	2.5	2000	90
9/12/97					
1130	OK	45	2.0	2000	80
1230	OK	50	2.0	2000	90
9/15/97					
0644	OK	50	2.25	2100	90
0900	OK	50	2.0	2000	80
1300	OK	55	2.0	1800	80
1400	OK	50	2.0	1900	90

Date/Time	Batt.	Bkg (cpm)	Cs-137 (mR/hr)	Th-230 (cpm)	Ra-226 (kcpm)
Expected☞	OK	20 - 60	2.0		
9/17/97					
1230	OK	60	2.0	2000	90
1500	OK	50	2.0	2000	90
9/18/97					
1130	OK	45	2.0	2000	90

4.2.2 Survey Meter #2

Table 5

Operational Check Data for Survey Meter #2

	Background	Cs-137 STD.	Ra-226 STD.	Th-230 STD.
mR/hr	0.01 - 0.02	2.5	30	0.6
cpm	30	8,000	90,000	1,800
Efficiency	N/A	0.00362	0.0422	0.107
LLD (dpm)	N/A	7,050	605	238
MDA (pCi)	N/A	3,176	272	107

Conditions of the battery and response to a ^{137}Cs source were checked each time the survey meter was turned on during the day and at the end of the day. A partial listing of actual readings is reported in Table 6. Responses were also checked for ^{230}Th and ^{226}Ra sources.

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Table 6

Survey Meter #2 Operational Check Log

Type of Monitoring: Direct Radiation and Surface Activity Levels				**Project**: Richards Gebaur Airport	
Instrument: Ludlum Model 3 Survey Meter (SN 66839) with Pancake GM Probe Model 44-9 (SN PR063659)					
Date/Time	**Batt.**	**Bkg (cpm)**	**Cs-137 (mR/hr)**	**Th-230 (cpm)**	**Ra-226 (kcpm)**
Expected☞	OK	20 - 60	2.5		
9/9/97					
0700	OK	20	2.5	2000	100
0913	OK	30	2.5	2000	100
1149	OK	40	2.25	2000	100
1300	OK	40	2.25	2000	100
1609	OK	40	2.5	2000	90
9/10/97					
0650	OK	20	2.5	1800	80
0900	OK	20	2.5	1800	90
1200	OK	30	2.5	1900	90
1530	OK	40	2.5	1800	90
9/15/97					
0645	OK	30	2.5	1800	90
0900	OK	30	2.5	1800	90
1300	OK	30	2.5	1800	90
1400	OK	30	2.5	1800	90

4.2.3 Gamma Probe

The gamma probe measures only gamma radiation, in orders of magnitude more sensitive than the survey meter. Field calculations at other sites comparing measurements with the gamma probe to laboratory analyses have reliably demonstrated the ability to detect as low as 5 pCi/g of ^{226}Ra in soil. Each 10 kcpm above background indicates an additional 5 pCi/g.

Table 7
Operational Check Data for Gamma Probe

	Background	Cs-137 STD.	Ra-226 STD.	Th-230 STD.*
kcpm	3.00	313	800	N/A
Efficiency	N/A	0.141	0.374	N/A
LLD (dpm)	N/A	1,810	674	N/A
MDA (pCi)	N/A	815	304	N/A

Note: * Th-232 emits only alpha radiation.

Conditions of the battery and response to a ^{137}Cs source were checked each time the data logger was turned on during the day and at the end of the day. A partial listing of actual readings is reported in Table 8. Responses were also checked for a ^{226}Ra source. Since the gamma probe responds only to gamma radiation and the ^{230}Th source emits only alpha radiation, no readings of this source were taken.

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Table 8
Gamma Probe Operational Check Log

Type of Monitoring: Volume Concentration of Radioactive Materials				**PROJECT**: Richards Gebaur Airport	
Instrument: Ludlum Model 2350 Data Logger with Ludlum Model 43-10 2 x 2 inch NaI(Tl) Gamma Scintillator					
Date/Time	Batt.	Bkg (kcpm)	Cs-137 (kcpm)	Th-230 (kcpm)	Ra-226 (kcpm)
EXPECTED ☞	≥4.4 V				
9/9/97					
0735	5.5	5.23	335		801
0918	5.5	6.24	310		771
1152	5.5	6.73	315		795
1300	5.5	6.62	330		812
1612	5.5	5.65	317		805
9/10/97					
0705	5.4	8.50	314		800
0905	5.5	6.73	317		797
1205	5.5	6.53	325		799
1535	5.5	7.09	340		806
9/12/97					
1135	5.4	6.52	327		803
1230	5.4	5.47	318		795
9/15/97					
0646	5.4	6.05	309		796
0905	5.4	7.23	315		803
1305	5.4	7.40	327		814
1405	5.4	6.05	320		811

4.2.4 Alpha Probe

The alpha probe measures only alpha radiation, in orders of magnitude more sensitive than the survey meter. The alpha probe has a background count rate that is essentially zero. Since the range of alpha particles in air is only a few centimeters, the source emitting alpha radiation must be very close to the detector to be recorded. This feature makes it an excellent choice for measuring surface contamination or airborne particulates that include alpha emitting radionuclides, such as, ^{226}Ra and its daughters or progeny.

Table 9
Operational Check Data for Alpha Probe

	Background	Cs-137 STD.*	Ra-226 STD.**	Th-230 STD.
cpm	< 0.01	N/A	N/A	5,200
Efficiency	N/A	N/A	N/A	0.315
LLD (dpm)	N/A	N/A	N/A	1.480
MDA (pCi)	N/A	N/A	N/A	0.667

Note: *Cs-137 emits no alpha radiation.
** The sealed Ra-226 standard emits only gamma radiation, since alpha radiation is absorbed by the case

Conditions of the battery and response to a ^{230}Th source were checked each time the data logger was turned on during the day and at the end of the day. A partial listing of actual readings is reported in Table 10. Responses were not checked for ^{137}Cs and ^{226}Ra sources, since the sealed sources emit no alpha radiation.

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Table 10
Alpha Probe Operational Check Log

Type of Monitoring: Surface Activity Levels				**Project**: Richards Gebaur Airport	
Instrument: Ludlum Model 2350 Data Logger with Ludlum Model 43-1 Alpha Scintillation Detector					
Date/Time	**Batt.**	**Bkg (cpm)**	**Cs-137**	**Th-230 (kcpm)**	**Ra-226**
Expected ☞	≥ 4.4 V	≤ 0.1			
9/9/97					
0730	5.2	≤ 0.01		4.98	
0920	5.3	≤ 0.01		5.17	
1155	5.3	≤ 0.01		4.93	
1307	5.4	≤ 0.01		5.29	
1615	5.2	≤ 0.01		5.38	
9/10/97					
0702	5.2	≤ 0.01		5.44	
0906	5.2	≤ 0.01		5.17	
1207	5.3	≤ 0.01		5.22	
1537	5.3	≤ 0.01		5.20	
9/12/97					
1135	5.1	≤ 0.01		4.96	
1230	5.2	≤ 0.01		5.23	
9/15/97					
0647	5.2	≤ 0.01		5.20	
0900	5.2	≤ 0.01		5.25	

Date/Time	Batt.	Bkg (cpm)	Cs-137	Th-230 (kcpm)	Ra-226
Expected ☞	≥ 4.4 V	≤ 0.1			
1300	5.3	≤ 0.01		5.17	
1400	5.3	≤ 0.01		4.99	
9/17/97					
1230	5.2	≤ 0.01		5.25	
1500	5.2	≤ 0.01		5.20	

4.2.5 Multi-Channel Analyzer

The multi-channel analyzer (MCA) provides both qualitative and quantitative data. Radionuclides that emit gamma radiation do so at specific energies. The higher the energy of a gamma photon is, the "brighter" it appears in the NaI(Tl) crystal of the detector. Brighter events in the crystal are recorded in higher numbered channels in the MCA. The number of scintillations, or "flashes" of light, in the detector can be related to the number of disintegrations that are occurring in the source material. A characteristic curve is generated when the number of counts in each channel is plotted on channel number. Some radionuclides, e.g., ^{137}Cs, decay in one step to a non-radioactive isotope. The gamma photon from ^{137}Cs is monoenergetic, and the 662 keV photon is frequently used in calibrating MCAs to relate channel numbers with photon energy. Once calibrated in this way, the counts appearing in other channels can be related to specific energies. When other energy peaks appear in a spectrum, the peaks can be used to identify the radionuclides that are present in the sample.

Although the gamma photons from decay of ^{137}Cs are monoenergetic, not all of the photons interact in the same way with the NaI(Tl) crystal. A characteristic curve, such as the one shown in Figure 1. Data on the energy of the peak and the area under the curve, or Region of Interest (ROI), can be used to estimate the activity of radionuclides in the sample.

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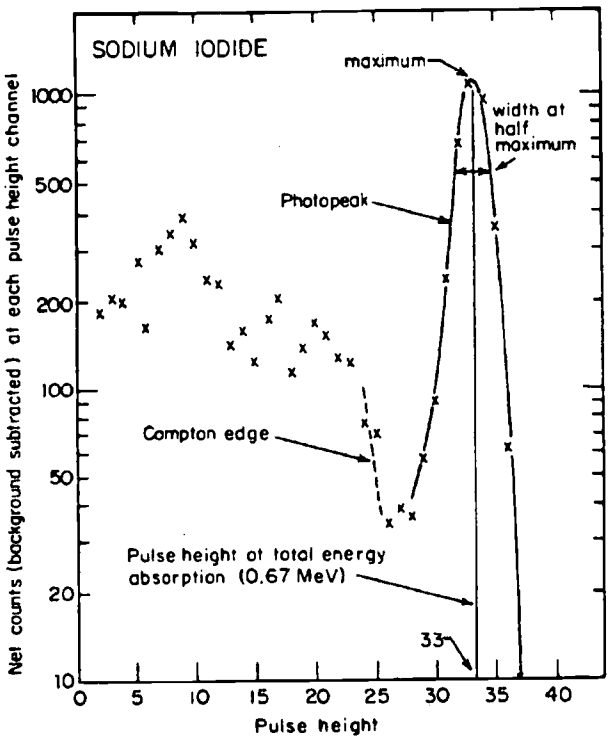
Figure 1
MCA Spectrum Showing Cesium-137 Peak at 662 keV



Some radionuclides, e.g., ^{226}Ra, decay through a series of "daughter" radionuclides, or progeny. Eventually, the series reaches a stable isotope of lead. In this decay chain, gamma photons of many different energies are emitted. The decay scheme for ^{226}Ra is illustrated in Figure 2. The principal daughters of interest for gamma spectroscopy include ^{214}Pb with energy peaks at 295 keV and 352 keV and ^{214}Bi with peaks at 609 keV. The Regions of Interest and peaks for these radionuclides are illustrated in Figure 3.

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Figure 2
Decay Scheme for Radium-226

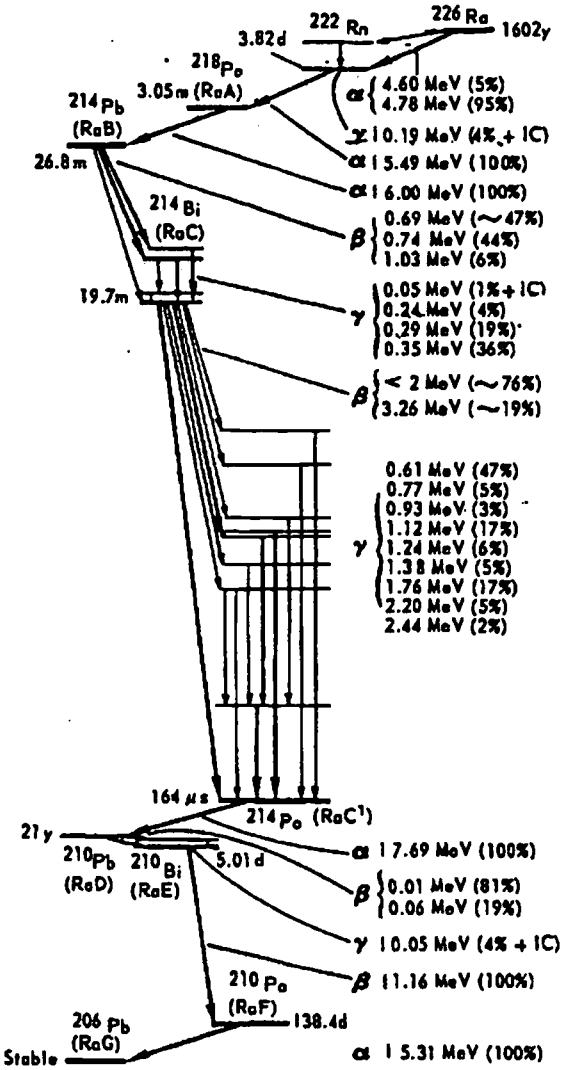

Figure 3
MCA Spectrum Showing ROI for Radium Daughters

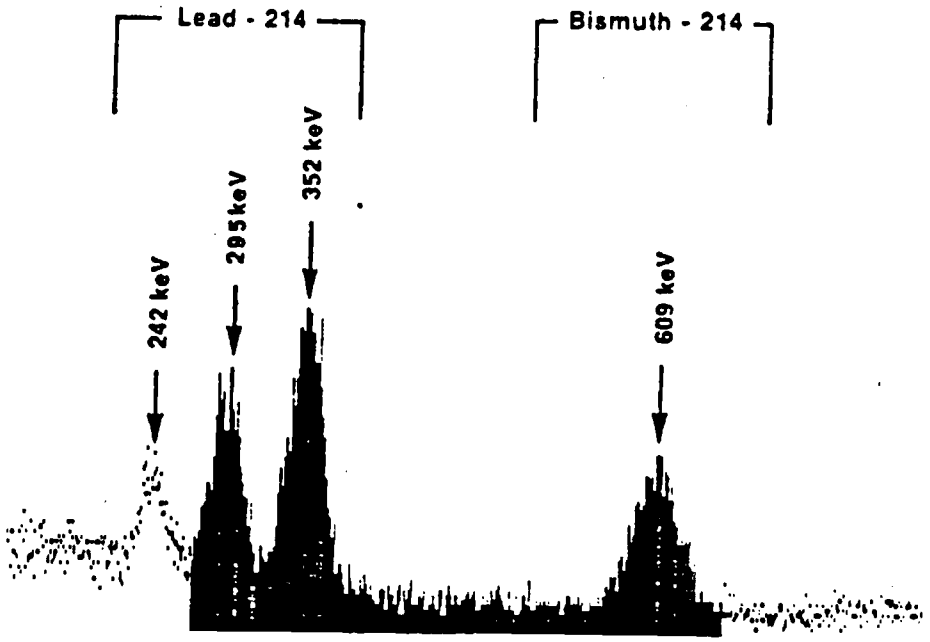

Table 11 includes field operational check data for the MCA, and Table 12 includes counts per minute in each MCA channel for background, ^{226}Ra and ^{137}Cs.

Table 11
Operational Check Data for MCA

	BKG.	Cs-137 STD.	Ra-226 STD.	Th-230 STD.*
cpm Ch 10-41, 90-120 (ROI Ra-226)	108	93,714	302,755	N/A
cpm Ch 111-146 (ROI Cs-137)	48	169,149	94,698	N/A
Efficiency	N/A	0.0762	0.142	N/A
LLD (dpm)	N/A	424	341	N/A
MDA (pCi)	N/A	191	154	N/A

Note: * Th-230 emits only alpha radiation.

Table 12
Counts per minute in Each MCA Channel for Background, Cs-137 and Ra-226

Channel No.	Background (cpm)	Cs-137 STD. (cpm)	Ra-226 STD. (cpm)
10	1	1776	5666
11	0	1765	6116
12	0	1674	6553
13	5	1648	7007
14	0	1577	7472
15	2	1615	7607
16	2	1542	7341
17	0	1547	7152
18	2	1585	6858
19	2	1539	6356
20	0	1508	5747
21	1	1542	5772
22	2	1564	5609
23	3	1490	5803
24	1	1448	6171
25	2	1471	6613
26	1	1447	7283
27	1	1479	7949
28	0	1474	8699
29	3	1473	9289
30	0	1434	9444
31	0	1513	9638
32	4	1414	9220
33	3	1316	8896

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Channel No.	Background (cpm)	Cs-137 STD. (cpm)	Ra-226 STD. (cpm)
34	0	1476	7913
35	2	1448	7119
36	0	1408	5997
37	3	1385	5164
38	2	1391	4388
39	2	1394	3684
40	5	1432	2901
41	3	1364	2578
90	5	326	1634
91	2	298	1841
92	4	343	1989
93	1	378	2257
94	3	334	2353
95	3	280	2676
96	3	247	2941
97	0	706	3159
98	2	330	3409
99	1	370	3729
100	2	350	4064
101	1	330	4267
102	4	342	4428
103	1	386	4497
104	4	393	4433
105	0	434	4362
106	0	458	4212
107	1	586	4038

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Channel No.	Background (cpm)	Cs-137 STD. (cpm)	Ra-226 STD. (cpm)
108	0	698	3715
109	2	810	3380
110	0	990	3162
111	1	1256	2804
112	2	1536	2566
113	3	1415	2288
114	1	2911	2018
115	3	2941	1758
116	2	3652	1475
117	2	4408	1474
118	0	5072	1331
119	1	6154	1280
120	2	6841	1210
121	2	7777	1132
122	1	8536	1003
123	4	9102	1068
124	1	9354	1000
125	0	9813	1028
126	0	10030	1035
127	0	9954	1053
128	3	9398	999
129	2	8934	946
130	2	8268	994
131	1	9444	991
132	3	6284	975
133	0	5540	962

Channel No.	Background (cpm)	Cs-137 STD. (cpm)	Ra-226 STD. (cpm)
134	0	4673	986
135	0	3745	974
136	4	3063	967
137	0	2421	995
138	2	1830	962
139	0	1472	1039
140	1	1060	1044
141	0	768	1000
142	0	505	1021
143	3	408	1045
144	0	210	1077
145	1	210	1038
146	1	164	1160
ROI Cs-137	48	169149	44698
ROI Ra-226	108	93714	302755

4.3 Background Determinations

Guidelines in the US Nuclear Regulatory Commission's Manual for Conducting Radiological Surveys in Support of License Termination, NUREG/CR-5849, ORAU-92/C57 were followed in designing and conducting radiological surveys to determine whether or not the site could be returned to unrestricted use. An accurate determination of background radiation levels is especially important when the use of a site has involved naturally occurring radioactive materials, e.g., ^{226}Ra. Release guidelines are typically expressed in terms of direct radiation exposure levels (mR/hr or μR/hr), surface activity levels (dpm/100 cm^2) and volume concentrations of radioactive material in soil (pCi/g). Exposure rates and surface activity were estimated with a Ludlum Model 3 Survey Meter and Model 44-9 GM pancake detector moved across surfaces at less than 1/3 the width of the detector per second. Concentrations of radionuclides were measured with a Ludlum Model 2350 Data Logger and a Ludlum Model 44-10 2 x 2 inch NaI(Tl) gamma scintillation probe with voltages set for ^{226}Ra and ^{137}Cs. Background soil samples were also collected for laboratory analysis. See section 5 for information regarding the collection of background soil samples.

Because guidelines for residual radioactivity at released sites are presented in terms of radiation levels or activity levels above normal background for the area, it is necessary to perform a background survey. Normal background radiation levels are influenced by variations in cosmic radiation levels, composition of soil, and emanation rates for ^{222}Rn from soil. The latter is further influenced by the weather. Background for a given site and time can be estimated by taking measurements and/or samples at locations in the immediate vicinity, that are unaffected by site operations. Since background levels are subtracted from gross radiation and radioactivity levels to determine the net residual activity from disposal operations, background levels must be determined with a detection sensitivity and accuracy that is at least equivalent to that data from which it will be subtracted. This is typically achieved by using the same instruments and techniques for background as those used for evaluating the final site conditions.

Radiation levels were measured along two 100 meter transects parallel to the gravel road near the LLRDC location (Figure 4). One transect ran north of the road; the second ran south of the LLRDC site. Instrument readings were taken 1 meter above the surface with Survey Meter #1 and at ground surface with the 2 x 2 inch NaI(Tl) gamma probe. The instruments were closely monitored to identify any possible points exhibiting sharply elevated readings. 20 points, one every 5 meters, were evaluated and recorded along each transet. A summary of the instrument results are presented in Table 13.

Apparent background also varies with sample geometry. Placing the gamma probe on the soil surface approximates 2 π geometry; below the surface, 4 π. Readings below ground level are higher than surface readings due primarily to the different geometrical relationship between the soil and the detector. Background radiation levels are given in Table 13.

Table 13
Background Radiation and Activity Levels

AREA	Survey Meter (mR/hr) 1 m above Surface	Gamma Probe Surface (kcpm)
North Transect	0.01 - 0.03	6.91 - 7.03
South Transect	0.01 - 0.03	6.95 - 7.40

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Figure 4
Site Plan Showing Pipe Location

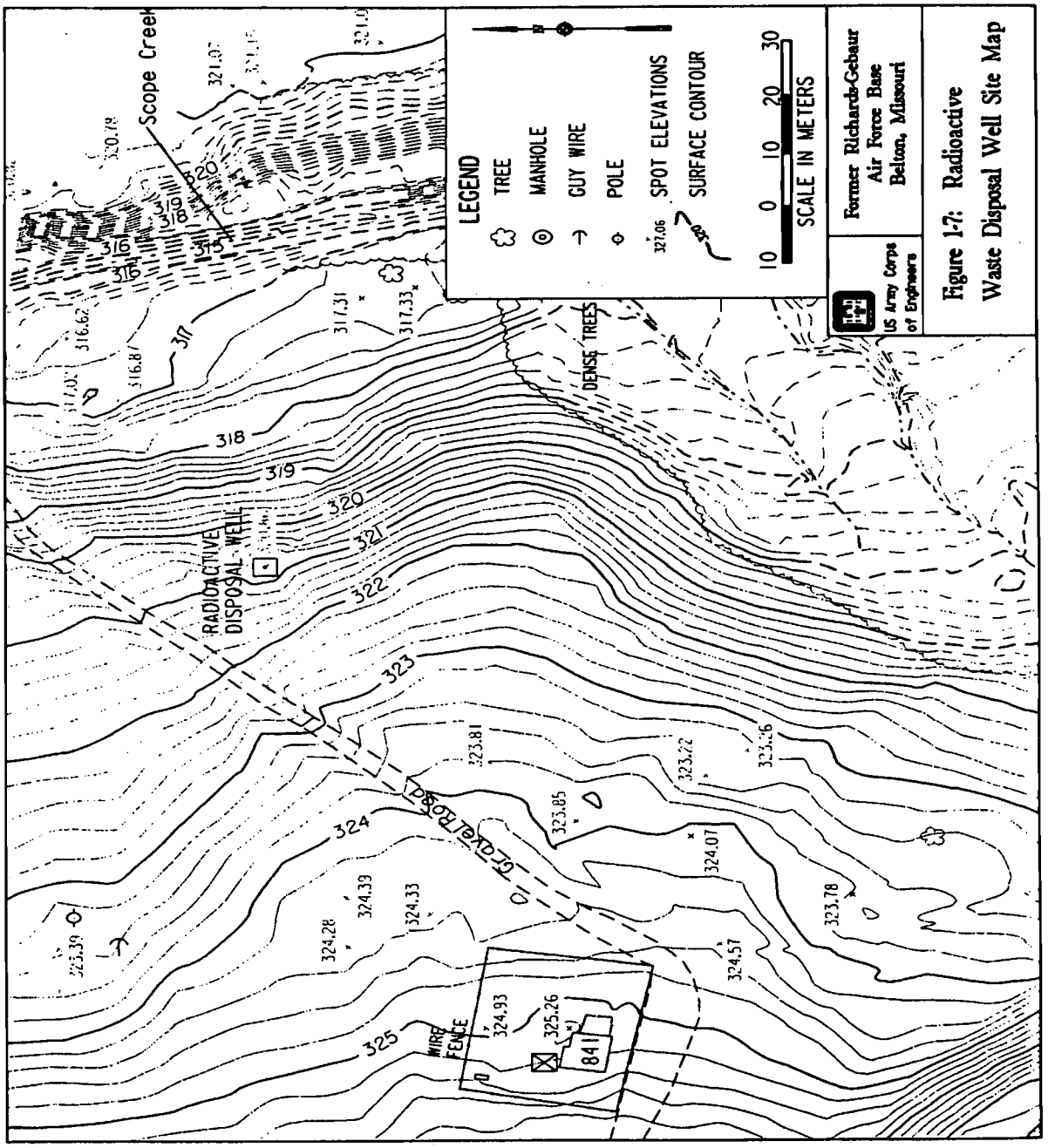

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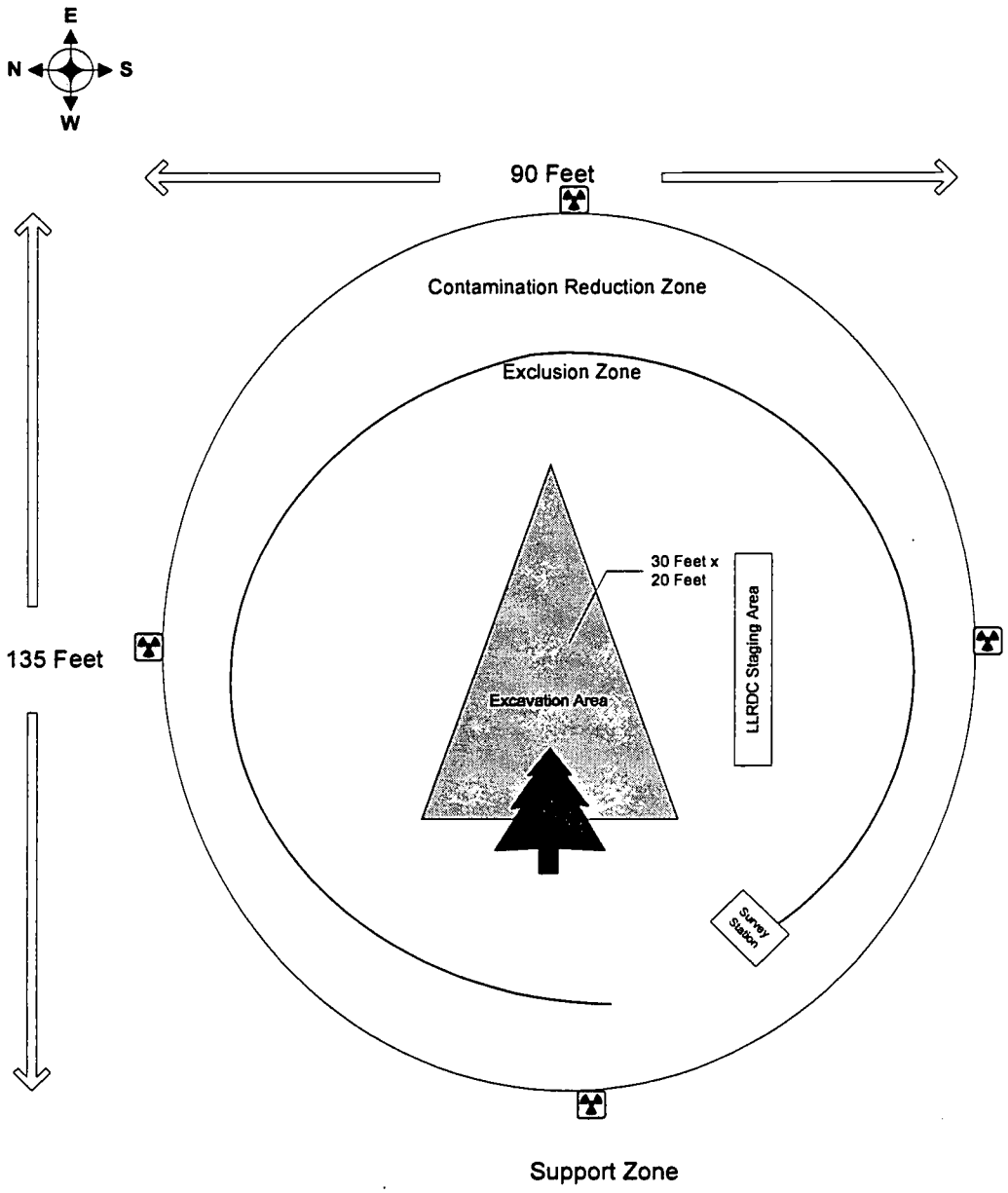
Figure 5
Site Diagram



4.4 Contamination Monitoring of Equipment, Personnel, Air and Soil

Survey Meter #1 was used to monitor equipment. Prior to entry into the Exclusion Zone (EZ) the CAT Excavator, CAT Loader, and Deere DC3 Dozer were scanned for contamination. No contamination was detected. A survey was completed following use and prior to exit from EZ as well. No contamination was detected. In addition, all tools and instrumentation used in the EZ were frisked for contamination. No contamination was detected.

All personnel were frisked for contamination prior to initial EZ entry and prior to all exits from EZ. There were no incidents of personnel contamination. This monitoring was performed with Survey Meters #1 and #2. All personnel in the exclusion zone were issued and required to wear Thermo Luminescent Dosimeters (TLD) to monitor exposure. A control TLD remained in the ECC work trailer. The TLDs were sent to Thermo Nutech Inc. for analyses. According to the analytical results, no personnel received a detectable radiation exposure. Please refer to the Nutech Report in the Attachments Section. A high volume air sampler was set up in the northeast portion of the site to monitor for airborne radioactive material. The sampler's filter paper was scanned with the alpha probe throughout the day. The results are listed in Table 14.

Table 14
High Volume Air Sampling, September 15

Time	Alpha cpm
0620	< 0.01 (start)
0820	3000
1015	2750
1120	2120 Power Off
1300	340
1600	≤ 0.01

The occurrence of counts was attributed to the buildup of naturally occurring, short half-lived progeny of ^{222}Rn rather than airborne particulate matter contaminated with ^{226}Ra. The rapid decay rate, as evidenced by the decline in count rates after the pump was inactivated, confirms this. In light of these conclusions, personnel nasal smears were not necessary.

As soil was excavated from the site, the contents of every third bucket were scanned with the gamma probe and Survey Meter #1. The high efficiency alpha scintillation probe was available for measuring alpha emitting radionuclides, but the soil was too wet for alpha radiation to be detected. No detectable levels of radiation or radioactive materials above natural background levels were evident. Had soils been found to be contaminated (i.e., twice background radiation levels), they would have been segregated from soils determined to be clean. Please refer to the Sampling and Analysis section for further data regarding soil contamination.

4.5 LLRDC Radiologic Characterization

As the excavation progressed and upon extraction and staging, the LLRDC was profiled on a foot by foot basis in an effort to determine the area of highest radioactivity. The gamma probe was used for this determination. The results of this LLRDC survey are expressed in Table #15. Once fully extracted and staged, the pipe surface was allowed to dry. The alpha probe was then utilized to locate any surface contamination. None was found.

Table 15
Profile of Activities for LLRDC Pipe

From Top (ft)	Gross kcpm	Net kcpm
Background	7.0	0.0
0	6.4	0.0
1	6.20	0.0
2	6.21	0.0
3	12.2	5.2
4	13.2	6.2
5	14.2	7.2
6	21.2	14.2
7	94.3	87.3
8	930	923
9	721	712
10	286	279

From Top (ft)	Gross kcpm	Net kcpm
11	36.0	29.0
12	14.0	7.0
13	9.75	2.75
14	8.51	1.51
15	7.17	0.17
16	7.27	0.27
17	7.58	0.58
18	9.80	2.80
19	8.02	1.02
20	9.17	2.17
21	9.02	2.02
22	8.58	1.58
23	8.02	1.02
24	7.42	0.42
25	9.08	2.08

The highest gamma radiation readings were registered at an area 8 feet from the top of the pipe. As a result, this area was chosen for Gamma Spectroscopy Analysis. This qualitative and quantitative analysis of the energy spectra was performed using a lead-shielded 3 x 3 inch NaI(Tl) probe and a portable MCA. Since the pipe was on plastic on the ground, the shielding was placed horizontally and the probe was placed perpendicular to the pipe. The instrument was calibrated using ^{226}Ra and ^{137}Cs sources. Secular equilibrium was assumed to exist for ^{226}Ra and its daughters, since the material had been buried for a number of years. Gamma radiation energies of ^{226}Ra progeny were used to indicate its presence: ^{214}Pb at 295 keV and 352 keV, and ^{214}Bi at 609 keV. The 662 keV energy peak of ^{137}Cs was used to indicate its presence. Results, given in Table 16, indicate the presence of ^{226}Ra and the absence of ^{137}Cs.

The first step in gamma spectroscopy involves a qualitative evaluation to identify the isotopes that could be present. An energy spectrum for ^{137}Cs is given in Figure 1. The Compton edge on the left side of the figure is registered with NaI(Tl) detectors in addition to the principal photopeak at 662

keV. There were no characteristics of this spectrum displayed on the spectrometer. The spectrum for ^{226}Ra is given in Figure 3 with peaks for ^{214}Pb at 295 and 352 keV and for ^{214}Bi at 609 keV. The presence of ^{226}Ra energies and the absence of ^{137}Cs energies were confirmed by placing standards near the detector after an initial spectrum was acquired for the pipe. This qualitative analysis was demonstrated to the satisfaction of the on-site USACE Health Physicist.

Clearly, if detectable ^{137}Cs was present, the 609 and 662 KeV energies would have overlapped. In such a case, the Region of Interest (ROI), or range of channel numbers, for ^{137}Cs and ^{214}Bi would have been calibrated for the efficiency of both isotopes in each ROI. This approach was deemed unnecessary, since ^{137}Cs was found not to be qualitatively present within the detection limits of the instrumentation.

Table 16
MCA Analysis of LLRDC Pipe 8 ft from Top

Channel No.	Background (cpm)	LLRDC (cpm)
10	1	5699
11	0	5746
12	0	5597
13	5	5574
14	0	5817
15	2	5991
16	2	5789
17	0	5789
18	2	5611
19	2	5670
20	0	5293
21	1	5223
22	2	5020
23	3	4867
24	1	4815
25	2	4809

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Channel No.	Background (cpm)	LLRDC (cpm)
26	1	4865
27	1	4918
28	0	4960
29	3	5118
30	0	5032
31	0	5226
32	4	5272
33	3	5153
34	0	5137
35	2	4921
36	0	4620
37	3	4378
38	2	4132
39	2	3734
40	5	3505
41	3	3160
90	5	1675
91	2	1688
92	4	1782
93	1	1887
94	3	1997
95	3	1966
96	3	2197
97	0	2187
98	2	2374
99	1	2391

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Channel No.	Background (cpm)	LLRDC (cpm)
100	2	2623
101	1	2712
102	4	2770
103	1	2813
104	4	2817
105	0	2846
106	0	2907
107	1	2824
108	0	2789
109	2	2562
110	0	2461
111	1	2314
112	2	2195
113	3	2020
114	1	1829
115	3	1710
116	2	1545
117	2	1370
118	0	1298
119	1	1198
120	2	1144
121	2	1109
122	1	1095
123	4	1018
124	1	1041
125	0	942

Channel No.	Background (cpm)	LLRDC (cpm)
126	0	918
127	0	855
128	3	973
129	2	925
130	2	932
131	1	890
132	3	907
133	0	877
134	0	896
135	0	844
136	4	854
137	0	919
138	2	888
139	0	879
140	1	883
141	0	892
142	0	895
143	3	902
144	0	906
145	1	916
146	1	894
ROI Cs-137	48	40673
ROI Ra-226	108	228332

Activities of radionuclides in the pipe were estimated by comparing the value recorded with the 2 x 2 inch NaI(Tl) probe at the same point at which the MCA analysis was performed using a

shielded 3 x 3 inch NaI(Tl) crystal, 8 feet from the top. The activity of ^{226}Ra at the 8 foot point was calculated as follows:

Gross cpm in ROI for ^{226}Ra = 228,332
Background cpm in ROI for ^{226}Ra = 108
Net cpm in ROI for ^{226}Ra = 228,224
Efficiency for ^{226}Ra (from Table 7) = 0.142
Activity of ^{226}Ra (dpm) = 228,224 / 0.142 = 1,607,211 dpm
Activity of ^{226}Ra (pCi) = 1,607,211 dpm / 2.22 dpm per pCi = 723,969 pCi

The net cpm values measured with the 2 x 2 inch NaI(Tl) gamma probe at each foot along the pipe were compared to the value at the 8 foot position (923 kcpm) from Table 15. These ratios were applied to the activity level of 723,979 pCi to estimate the activity within each 1 foot section, as indicated in Table 17. Activities were then summed for all sections.

Table 17
Activities of Ra-226 in Recovered LLRDC

From Top (ft)	Gross kcpm	Net kcpm	Net kcpm / 923 kcpm	Ra-226 pCi
Background	7.0	0.0	0	NA
0	6.4	0.0	0	0
1	6.20	0.0	0	0
2	6.21	0.0	0	0
3	12.2	5.2	0.00563	4078
4	13.2	6.2	0.00672	4863
5	14.2	7.2	0.00780	5647
6	21.2	14.2	0.0154	11,138
7	94.3	87.3	0.0946	68,477
8	930	923	1	723,979
9	721	712	0.771	558,476
10	286	279	0.302	218,841
11	36.0	29.0	0.0314	22,747

From Top (ft)	Gross kcpm	Net kcpm	Net kcpm / 923 kcpm	Ra-226 pCi
12	14.0	7.0	0.00758	5490
13	9.75	2.75	0.00298	2157
14	8.51	1.51	0.00164	1185
15	7.17	0.17	0.000184	133
16	7.27	0.27	0.000292	211
17	7.58	0.58	0.000628	454
18	9.80	2.80	0.00303	2197
19	8.02	1.02	0.00105	800
20	9.17	2.17	0.00235	1703
21	9.02	2.02	0.00219	1584
22	8.58	1.58	0.00171	1239
23	8.02	1.02	0.00105	800
24	7.42	0.42	0.000455	529
25	9.08	2.08	0.00225	1632
TOTAL				1638360

Corrections for shielding were based on the assumptions that the pipe was indeed cast iron and that the contents were mixed with concrete. The 14 inch diameter cast iron pipe had 1 inch thick walls and a 12 inch diameter core of concrete and dials. Since the entire circumference of each 1 foot section was scanned to find the highest reading, it seems reasonable to assume that the source was no further away from the probe than the center of the pipe. As a worst case for shielding calculations, the source was assumed to be in the center of the pipe and shielded by 6 inches of concrete and 1 inch of cast iron. Half-value layers for ^{226}Ra are as follows (Bernard Shleien (ed.) 1995. The Health Physics and Radiological Health Handbook. Scinta, Inc., 2421 Homestead Drive, Silver Spring, MD 20902, p. 173, Table 6.3): 6.9 cm of concrete or 2.2 cm of steel. Activities of ^{226}Ra that could emit sufficient radiation through 6 inches of concrete and 1 inch of cast iron at the levels detected can be calculated as follows:

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(1) $I = I_0 e^{-0.693 (y / x)}$

where, I = Incident, or shielded, value measured
I_0 = Internal, or unshielded, value to be calculated
x = Half-value layer thickness (cm)
y = Thickness of shield (cm)

Rearranging equation (1) gives:

(2) $I_0 = I / e^{-0.693 (y / x)}$

Since shielding is applied from both concrete and iron, these values can be substituted in equation (3) as follows:

(3) $I_0 = I / e^{-0.693 ((y1 / x1) + (y2 / x2))}$

where, y1 and x1 refers to cast iron and
y2 and x2 refers to concrete.

Substituting values gives the results in equation (4) as follows:

(4) $I_0 = 1.638\ \mu Ci / e^{-0.693 ((2.5 / 2.2) + (15.24 / 6.9))}$

$1.638\ \mu Ci / e^{-0.693 (1.1364 + 2.2087)}$
$1.638\ \mu Ci / e^{-0.693 (3.3451)}$

$1.638\ \mu Ci / 0.09846$

$I_0 = 16.637\ \mu Ci$ of ^{226}Ra

The pipe was over-packed in a steel cylinder and stabilized with sand. After the cap was welded onto the cylinder, the over-pack was scanned for direct radiation levels and wipe tested for contamination. Values as high as 0.4 mR/hr were recorded with Survey Meter #1 at the surface of the package 8 feet from one end. Wipes were tested for contamination with the alpha scintillator, and none was found.

5.0 SAMPLING AND ANALYSIS

5.1 Sampling Methodology

Samples were collected throughout the excavation activities by the QC Officer from the shovel of the excavator. Each was surveyed prior to being deposited into a plastic ziplock bag. No elevated radiation levels were observed. Sample bags were labeled according to the depth of their origin. The excavation was divided into three foot sections for sampling purposes. Six discrete samples were taken from and used to produce a composite sample representing each three foot section.

An area, not effected by site operations, was chosen to the southwest for collection of background samples. A fifteen foot hole was excavated. Ten samples were taken from this excavation profile.

When all samples were collected, each group of grab (discrete) samples were composited. Visqueen sheets were cut to provide a clean mixing area for each group. First, all 10 of the background samples were thoroughly mixed. The composited mass was divided into three portions. All three portions were treated as individual samples for the designated analyses. The results of the three background samples were averaged. Twice the average value was used as the site action level for each isotope, for comparison to the excavation sample results. Following a glove change and replacement of the visqueen, the six samples taken from depths 3 ft. to 6 ft. were mixed. A portion (greater than 100 gm) was taken of this composite mass. This procedure was repeated for each of the six remaining sample groups.

5.2 Sample Numbering

The composite samples were labeled using the following system:

RGSa-b where:

'RG' refers to Richards Gebaur
'S' refers to a soil matrix
'a-b' refers to the depth section

5.3 Sample Analysis

The following samples were sent to Dave Demorest at:

CORE Laboratories
420 West First Street
Casper, Wyoming 82601

RGS3-6	RGS15-18	RGSBKG1
RGS6-9	RGS18-21	RGSBKG2
RGS9-12	RGS21-24	RGSBKG3
RGS12-15	RGS-QC	

Sample # RGS-QC is a split of sample RGS3-6.

For quality assurance, sample RGS-QA was sent to Staff Sgt. Lawrence at:

USAF
AL/OEBA
Brooks AFB, TX 78235

This quality assurance sample is a split of sample RGS12-15.

5.4 Data Review

The samples were sent to CORE Laboratory in Casper, Wyoming for Gamma Spectroscopy for all natural and manmade isotopes, isotopic Uranium (U-238 and daughter products), isotopic Thorium (Th-232 and daughter products). CORE Laboratory was requested to perform an evaluation of all applicable quality control measures before submitting the sample results and provide this data QC evaluation with the analytical package. ECC evaluated the data according to the data review guidelines.

The following steps were followed during the data review process:

- The site action level was calculated for each isotope;
- Analytical results for each sample were studied to ensure that the correct procedure was performed;
- The laboratory test results were reviewed to ensure that the +/- error and the lower level of detection (LLD) was listed for each isotope;

- Analytical results were compare to the calculated site action level; and
- The laboratory quality control data was reviewed.

The site action levels were calculated using the results of the three background composite samples. The sample results were averaged for each isotope; twice the average was listed as the site action level as presented in Table 18. The action levels were compared to the analytical results of the excavation composite samples.

Table 18
Action Level Calculations*

Parameter / Isotope	Sample Results BKG-1	BKG-2	BKG-3	Average	Action Level
Actinium-228	1.4			1.4	2.8
Cesium-137	<0.1	<0.1	<0.1	<0.1	0.2
Cobalt-60	<0.2	<0.1	<0.2	<0.2	0.4
Lead-214	1.2	1.4		1.3	2.6
Polonium-210	1.2	0.9	1.6	1.2	2.4
Radium-226	1.6	2.7	2.2	2.2	4.4
Thorium-228	0.7	0.7	0.9	0.8	1.6
Thorium-230	0.7	0.9	1.3	1.0	2.0
Thorium-232	0.9	0.7	0.8	0.8	1.6
Uranium-234	1.0	0.8	0.9	0.9	1.8
Uranium-235	ND	0.1	ND	0.1	0.2
Uranium-238	1.1	1.1	0.9	1.0	2.0

Note: * Site Action Level for each isotope is equal to twice the average of the 3 background samples. For less than values, the less than value was used in the calculations of the average and the action level.

The Laboratory Quality Control results list the test method, method description, batch number, reporting limits, units ,and the analyst for each required parameter. The QC procedures consisted of evaluating the quality-indicator samples to determine the control of the analytical method and the useability of the data. Laboratory control samples, method blanks, method duplicates, and

matrix spikes were used to evaluate the laboratory's quality control. The percent recovery for the LCS and the MS samples were within acceptable limits according to EPA guidelines.

5.5 Sample Analytical Results

The only samples with isotope values above the calculated action limits were RGS3-6 and RGS 21-24. The thorium isotope values, ^{228}Th at 1.8 pCi/g and ^{230}Th at 2.6 pCi/g, for RGS3-6 were slightly higher (0.2 and 0.6 pCi/g, respectively) than the calculated action levels. However, since the results have a +/- error value of 0.6 and 0.8 respectively, the higher results are not considered significant.

The uranium isotope values (^{234}U at 21.1 pCi/g, ^{235}U at 1.9 pCi/g, and ^{238}U at 54.3 pCi/g) were significantly higher than their respective action levels (Table 18). Sample RGS21-24 was retested for isotopic Uranium. The additional analyses confirmed the original analytical findings and is presented in Appendix D. Reanalysis of the composite soil sample # RGS 21-24 shows isotopic ^{238}U at 56.2 pCi/g and ^{total}U at 108 pCi/g.

6.0 CONCLUSIONS

The presence of ^{226}Ra in significant quantities was confirmed in the LLRDC. The analytical analyses demonstrate that the ^{226}Ra constituent of all soil samples fell well below the MDNR-determined Action Level of 4.4 pCi/g. Therefore, it is logical to assume that no breach in the LLRDC or incident of leaking material occurred into the surrounding soils. Consequently, other potential sources for the uranium anomaly must be considered.

The soil analytical results show no increase in uranium content as the excavation depth increased from 1 ft. to 20 ft. The value for ^{238}U over this range fluctuated between 0.8 to 1.0 pCi/g. For investigation purposes, ECC recommends that USACE study the previously collected soil and bedrock samples of the site corresponding to the 21-24 ft. depth interval at the LLRDC location. This may provide some insight as to whether the uranium source is of natural origin.

The cleanup levels being considered for uranium at MO FUSRAP sites are approximately 50 pCi/g for ^{238}U and 100 pCi/g for ^{total}U. The analysis of sample # RGS 21-24 indicates that levels of isotopic ^{238}U and ^{total}U were slightly higher than the State cleanup level requirement. However, MDNR may find these Uranium levels acceptable for closure since the anomaly appears unrelated to the LLRDC.

Appendix A

Health and Safety Documents

Tailgate Safety Meeting Form

ENVIRONMENTAL CHEMICAL CORPORATION
TAILGATE SAFETY MEETING

CONDUCTED BY: Canon, Styron **DATE**: 9/15/97

SITE: Richards Gebaur (former) Airforce Base LLRDC

Project : Number: 5348 Delivery Order 16

Contract Number: DACW41-95-0023

Type of Work: Exhumation, packaging, and transportation of Low Level Radioactive Disposal Cell (LLRDC).

Identify PPE and Level of Protection: A B C D: Level D. Upgrade to Level C will take place under the direction of the RSO

Hospital/ Clinic:. Research Belton Hospital
17065 S. Highway 71

Phone: 816-348-1200

ATTENDEES: **Signature**

Ken Harris
Chris Canon
Clarence Styron
Jerry Hall
Curtis Hightower

Discussed physical, chemical, radiological, and equipment hazards for today's work and preventive measures to be taken to minimize the hazards. The goal for todays work is the successful removal, characterization and packaging of the LLRDC.

Review the safety standards from Work Plan and Site Safety and Health Plan. Great caution will be exercised when operating heavy-equipment and while working around the equipment. Care will be taken when in the vicinity of the excavation. The excavation will be properly sloped to provide a safe work environment if entrance to the 'hole' is required.

The designated PPE will be required at all times. Hearing protection will be required of equipment operators. Respiratory protection (Level C PPE) will be required if air monitoring yields positive results for airborne Ra-226 particulates. If contaminated soils are found all activities will temporarily cease while a reevaluation of PPE and work methods takes place.

Daily Quality Control Report

DAILY QUALITY CONTROL REPORT

Daily Report Number: **Date:** 9/15/97

Project Location: Richards Gebaur (former) Air Force Base

Weather: Sunny Temp. 85 Precip. None

1. Contract/Subcontractors and Area of Resposibility;

Number	Trade	HR.	Employer	Location Description of work
1	PM	10	ECC	Richards-Gebaur Airport
1	QA	10	ECC	SAME
1	RSO	10	RMW	SAME
1	OP	10	ECC	SAME
1	OP	10	ECC	SAME

2. Operation Equipment (NOT HAND TOOLS)

Equipment	Date Arrival	Safety CK	HR Used	HR Idle	HR Repair
CAT 320 Excavator	9/12/97	9/15/97	10		
913 CAT Loader	9/12/97	9/15/97	4	6	
CAT D-3 Dozer	9/12/97	9/15/97	6	4	

3. Work Performed today: Location and description of work

Arrived site 615. Completed site setup. Held tailgate safety meeting and completed equipment inspections. Pipe was anchored to front end loader and dozer. Excavation began on eastern side of pipe. Soil monitoring was performed on every third bucket of soil removed. Soil samples were retrieved from bucket and divided into three foot depth sections. Elevated meter readings discovered at first pipe joint. Area excavated to depth of 20 ft and the pipe was secured to straps and chains at top and center. Area was then benched back to allow for partial descent into excavation and to provide a space to lay pipe down. Visqueen sheeting was placed on sloped area. The pipe was lifted from vertical position and placed on sloped area. The pipe was then re-strapped and secured on both ends. A staging area was prepared on the southern end of the exclusion zone. 1015: The pipe was removed and placed on staging area for radiological analysis. No surface contamination was detected on the exterior of the pipe. Prior to backfill two more soil samples were taken from the region directly underneath where the pipe stood. These samples did not show any contamination detectable with NaI(Tl) 2x2. An area was chosen to the southwest for collection of a background composite sample. Backfill activities commenced and were

completed at 1500. All samples taken were then composited according to the depth of retrieval. The overpack pipe was prepared by welding off one end. Primary pipe was placed inside overpack pipe. Windows were cut into secondary pipe to aid with the filling of void spaces. Gamma spec characterization continued on primary pipe until 1430. Overpack of cell was completed and void space was filled to 85%. 1700: Windows in overpack cell were sealed and waste package was staged and labeled for pickup and transport on 9/17. Waste package departed site on 9/17.

End of task.

4. Control Activities Performed:

Preparatory Inspection: Machinery and area background
Initial Inspections: Site digging permit
Follow -up inspection: Personnel inspected prior to enterance and existing site.

5. Test Performed and Test Results:

High Volume Air Sampler was set up and monitored hourly for airborne alpha emitting radionuclides. No levels above background were found.

Two Ludlum Model 3 survey meters with Model 44-9 pancake detectors were field checked for proper operation and battery status. One meter was dedicated to personnel monitoring at the CRZ.

Two Ludlum Model 2350 Data Loggers were field calibrated, one with a 2x2 NaI(Tl) gamma probe and the second with an alpha probe.

One portable Multi-channel Analyzer was calibrated for Ra-226 and Cs-137.

Excavating equipment was scanned for contamination before it entered the Exclusion Zone. No contamination was detected.

Personnel were scanned for contamination before entering the Exclusion Zone and when operations ceased. No contamination was detected on any personnel.

See Closure Report for more detail on radiological characterization.

6. Material Received:

NONE

7. Submittals Reviewed

Submitted	Reference	By Whom	Actions
NONE			

8. Offsite Surveillance Activities Including Actions Taken

NONE

9. Job. Safety:

Tailgate meeting conducted and survey of personnel prior to entrance and exit of site.

10. Remarks:

Julie Peterson, USACE Health Physicist, was inside the exclusion zone and witnessed the majority of activities. Mrs. Peterson did not express any disapproval regarding ECC's field operations or methods.

11. Contractor's Verification:

On behalf of the Contractor, I certify this report is complete and correct, and materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as my be note above.

Quality Control Manager

Date 9/15/97

Personnel Contamination Survey Form

Environmental Chemical Corporation

Personnel Contamination Survey Log

Location: Richards Gebaur (former) Air Force Base
Kansas City, MO
Low Level Radioactive Disposal Cell

Date: September 15, 1997

Instrumentation: Model- Ludlum 3/ Ludlum 44-9
Serial # - 66839 / 063659

Notes: Excavation and characterization operations. No soil contamination was encountered. No contamination of any personnel or equipment occurred.

Backround: 50 cpm

Personnel	Survey Results (cpm)
Christian Canon	Bkg
Curtis Hightower	Bkg
Gerald Hall	Bkg
Ken Harris	Bkg
Clarence Styron	Bkg

Signature of QC Officer: Arth Earn

Visitors Log - Sign In Sheet

9/15/97 Visitors Log Sign-In

Name	Organization	Signature
Julie Peterson	USACE	
Thomas Shortt	COE	
Sandy Blankenship	COE	
Chuck Williams	COE	
David Linneman	COE	
DAN MITCHELL	COE	
Mitch Scherzinger	MDNR	
GUY FRAZIER	MDNR	

NRC Training Sign - In Sheet

R.M. WESTER & ASSOCIATES, INC.

215 INDACOM DRIVE • ST. PETERS, MISSOURI 63376
(314) 928-9628 • FAX 928-9857

FOR YOUR NUCLEAR REGULATORY COMMISSION RECORDS

The following signatures indicate the presence of each of the individuals successfully participating in the course **Basic Radiation Safety** presented by Dr. Clarence E. Styron, Radiation Safety Director with R. M. Wester and Associates, Inc. on September 8, 1997.

The ≥ 4-hour course covered by this seminar included regulations and other topics on the attached outline. Proficiency was demonstrated by class exercises, oral exam and a written examination.

ATTENDEES	ATTENDEES
Christian G. Canon	
Tom Shortt	
Gerald Bell	
D Hall	

CERTIFIED BY: Clarence E. Styron
Radiation Safety Director

Vehicle Condition Checklist

VEHICLE CONDITION CHECKLIST

Shipment Number: RGIRP970917 Shipment Date: 9/17/97
Carrier: West Star Industries Driver's Name: Paul Provost
Tractor: #6 Trailer Number: 90554
Trailer Type: Van, Open Top Van, Flatbed, Other: Box Van

	Inspection Checks:	SAT	UNSAT
1.	Front tire tread: at least 4/32" tread (recaps not allowed)	✓	
2.	Other tire tread: at least 3/32" tread	✓	
3.	Service brakes: good condition and properly attached	✓	
4.	Parking brake: operational and on while loading	✓	
5.	Steering mechanism: demonstrated operational	✓	
6.	Headlights and front reflectors: clean and operational	✓	
7.	Windshield wipers: demonstrated operational	✓	
8.	Rear vision mirrors (2): good condition and properly attached	✓	
9.	Horn: demonstrated operational	✓	
10.	Fire extinguishers: fully charged	✓	
11.	Trailer frame and headboard: free of visual defects	✓	
12.	Load tie-downs: adequate number for load and in good condition	✓	
13.	Brake lights: demonstrated operational	✓	
14.	Turn signals: demonstrated operational	✓	
15.	Reflectors: at proper locations on trailer	✓	
16.	Spare tire: at least 4/32" tread	✓	
Inspected By: Christina Canon Christina Canon, QC			
Driver's Signature:			

Equipment Safety Inspection Checklists

SAFETY INSPECTION CHECKLIST FOR OFF-HIGHWAY SELF- PROPELLED WORK MACHINES AND MOTOR VEHICLES

EM385-1-1 Oct. 1992

Project: Richard Gebaver AFB

Prime Contractor: ECC Contract No. DACW41-95-D-0023

Furnished and Operated By: CAT Dozier Date of Inspection: 9/25/97

Type of Equipment: Bull dozer

Make: Dozier Model No. D-3 Serial No: X65L01092X

Inspected By: JERRY HALL Title: operator Employer: ECC

Approved By: C Carver Title: QC Employer: ECC

1.	Is required roll-over protection provided (16.B.12)?	(yes)	no	n/a
	a. Plate affixed to ROPS?	(yes)	no	n/a
	b. Written certification attached to checklist?	(yes)	no	n/a
2.	Is operator protected from elements, falling or flying objects, ect. (16.B.10)?	(yes)	no	n/a
3.	Is all glass in operator's compartment safety glass (16.B.10)?	(yes)	no	n/a
4.	Backup alarms where required (16.B.01)?	(yes)	no	n/a
5.	Brakes in good condition (16.A.07)?	(yes)	no	n/a
6.	Is emergency braking system capable of automatically stopping equipment (16.A.07-d)?	yes	no	(n/a)
7.	Is a seatbelt provided for each person (16.B.08)?	(yes)	no	n/a
8.	Beds of dump trucks equipped with roll-over warning device (16.B.15)?	yes	no	(n/a)
9.	Are pulleys, belts, gears, chains, and other nip and shear points adequately guarded (16.B.03)?	(yes)	no	n/a
10.	Are fuel tanks located to prevent spills and overflows from hitting hot parts or electrical equipment (16.B.04)?	(yes)	no	n/a
11.	All lift trucks, stackers, and similar equipment have the rated capacity posted on the vehicle clearly visible to the operator (16.A.22)?	yes	no	(n/a)
12.	Is all machinery and equipment inspected daily (when in use)?	(yes)	no	n/a
13.	Is appropriate fire protection available?	(yes)	no	n/a

SAFETY INSPECTION CHECKLIST FOR OFF-HIGHWAY SELF- PROPELLED WORK MACHINES AND MOTOR VEHICLES

EM385-1-1 Oct. 1992

Project: Richard Gebaur AFB

Prime Contractor: ECC Contract No. DACW41-95-D-0023

Furnished and Operated By: CAT & Jerry Hall Date of Inspection: 9/15/97

Type of Equipment: Rubber Tired Loader

Make: CAT Model No. 914 G Serial No: 5HK53032

Inspected By: Jerry Hall Title: Operator Employer: ECC

Approved By: C. Carver Title: QC Employer: ECC

1.	Is required roll-over protection provided (16.B.12)?	(yes)	no	n/a
	a. Plate affixed to ROPS?	(yes)	no	n/a
	b. Written certification attached to checklist?	(yes)	no	n/a
2.	Is operator protected from elements, falling or flying objects, ect. (16.B.10)?	(yes)	no	n/a
3.	Is all glass in operator's compartment safety glass (16.B.10)?	(yes)	no	n/a
4.	Backup alarms where required (16.B.01)?	(yes)	no	n/a
5.	Brakes in good condition (16.A.07)?	(yes)	no	n/a
6.	Is emergency braking system capable of automatically stopping equipment (16.A.07-d)?	(yes)	no	n/a
7.	Is a seatbelt provided for each person (16.B.08)?	(yes)	no	n/a
8.	Beds of dump trucks equipped with roll-over warning device (16.B.15)?	yes	no	(n/a)
9.	Are pulleys, belts, gears, chains, and other nip and shear points adequately guarded (16.B.03)?	(yes)	no	n/a
10.	Are fuel tanks located to prevent spills and overflows from hitting hot parts or electrical equipment (16.B.04)?	(yes)	no	n/a
11.	All lift trucks, stackers, and similar equipment have the rated capacity posted on the vehicle clearly visible to the operator (16.A.22)?	yes	no	(n/a)
12.	Is all machinery and equipment inspected daily (when in use)?	(yes)	no	n/a
13.	Is appropriate fire protection available?	(yes)	no	n/a

SAFETY INSPECTION CHECKLIST FOR OFF-HIGHWAY SELF- PROPELLED WORK MACHINES AND MOTOR VEHICLES

EM385-1-1 Oct. 1992

Project: Richard "Gebaur AFB

Prime Contractor: ECC Contract No. DACW41-95-D-0023

Furnished and Operated By: Cat Date of Inspection: 9/15/97

Type of Equipment: Excavator

Make: CAT Model No. 320L Serial No: 7JK23865

Inspected By: Jerry Hall Title: operator Employer: ECC

Approved By: C. Canon Title: QC Employer: ECC

1.	Is required roll-over protection provided (16.B.12)?	(yes)	no	n/a
	a. Plate affixed to ROPS?	(yes)	no	n/a
	b. Written certification attached to checklist?	(yes)	no	n/a
2.	Is operator protected from elements, falling or flying objects, ect. (16.B.10)?	(yes)	no	n/a
3.	Is all glass in operator's compartment safety glass (16.B.10)?	(yes)	no	n/a
4.	Backup alarms where required (16.B.01)?	(yes)	no	n/a
5.	Brakes in good condition (16.A.07)?	(yes)	no	n/a
6.	Is emergency braking system capable of automatically stopping equipment (16.A.07-d)?	(yes)	no	n/a
7.	Is a seatbelt provided for each person (16.B.08)?	(yes)	no	n/a
8.	Beds of dump trucks equipped with roll-over warning device (16.B.15)?	yes	no	(n/a)
9.	Are pulleys, belts, gears, chains, and other nip and shear points adequately guarded (16.B.03)?	(yes)	no	n/a
10.	Are fuel tanks located to prevent spills and overflows from hitting hot parts or electrical equipment (16.B.04)?	(yes)	no	n/a
11.	All lift trucks, stackers, and similar equipment have the rated capacity posted on the vehicle clearly visible to the operator (16.A.22)?	(yes)	no	n/a
12.	Is all machinery and equipment inspected daily (when in use)?	(yes)	no	n/a
13.	Is appropriate fire protection available?	(yes)	no	n/a

Thermo Luminescent Dosimetry Exposure Results

Thermo NUtech
5635 Jefferson Street NE
Albuquerque, NM 87109
(505) 345-9931

NVLAP

The dosimetry processor is accredited by NVLAP of the U.S. Department of Commerce as having the competence to perform specified tests in accordance with prescribed test methods and accreditation criteria.

CURRENT TLD OCCUPATIONAL RADIATION EXPOSURE REPORT

APPROVED FOR USE IN LIEU OF NRC FORM 5

CUSTOMER NO. 09307

ROSE MARIE TAUCHE

DATE 10/02/97

DOSIMETRY SERVICES

BADGE NUMBER / BODY LOCATION	WORK FACILITY / WORK LOCATION	NAME / BIRTHDATE / AGE / GENDER	ID / ID TYPE	SERVICE[1] / FREQ.[2]	DATE ISSUED / DATE RETURNED	DOSE FOR PERIOD (mrem) NOTE[3]	DEEP	LENS	NEUTRON	SHALLOW	EXTREMITY	ACCUMULATED DOSE (mrem) FOR CALENDAR QUARTER DEEP	LENS	SHALLOW	EXTREMITY	ACCUMULATED DOSE (mrem) FOR CALENDAR YEAR DEEP	LENS	SHALLOW	EXTREMITY	PERMISSIBLE ANNUAL DEEP (rem) / ACCUMULATED LIFETIME DEEP (rem)
04000		CONTROL		T	09/01/97					13	TOTAL COUNTS									
					09/18/97															
04001		Canon, Christian ECC		T	09/01/97		0	0		0		0	0	0		0	0	0		5.0
				I	09/18/97		0			0		0	0	0		0	0	0		0.000
04002		Hall, Gerald ECC		T	09/01/97		0	0		0		0	0	0		0	0	0		5.0
				I	09/18/97		0			0		0	0	0		0	0	0		0.000
04003		Hightower, Curtis ECC		T	09/01/97		0	0		0		0	0	0		0	0	0		5.0
				I	09/18/97		0			0		0	0	0		0	0	0		0.000
04004		Harris, Ken ECC		T	09/01/97		0	0		0		0	0	0		0	0	0		5.0
				I	09/18/97		0			0		0	0	0		0	0	0		0.000
04005		Peterson, Julie USACE		T	09/01/97		0	0		0		0	0	0		0	0	0		5.0
				I	09/18/97		0			0		0	0	0		0	0	0		0.000

[1] SERVICE CODES
T - WHOLE BODY BADGE (BGX)
H - RING BADGE
J - ANKLE BADGE
K - WRIST BADGE
N - NEUTRON BADGE
A - ALBEDO BADGE

[2] FREQUENCY CODES
W - WEEKLY
B - BIWEEKLY
M - MONTHLY
P - BIMONTHLY
Q - QUARTERLY
S - SEMIANNUAL
A - ANNUAL
I - IRREGULAR

[3] NOTE CODES
C - BADGE DAMAGED
E - REPORTED BY TELEPHONE OR WIRE
F - BADGE NOT USED
G - EXPLANATION ATTACHED
X - CONTAMINATED
Z - CALCULATED CONTROL
P - PLANNED EXPOSURE

CUSTOMER
ATTENTION
ADDRESS
CITY

ENVIRON CHEMICAL CORP
FRANK MANGOLD
671 NORTH SHORE DRIVE
BENTON HARBOR MI 49022

Appendix B

Survey Instrument Calibration Certificates

X

R.M. WESTER & ASSOCIATES, INC.

215 INDACOM DRIVE • ST. PETERS, MISSOURI 63376
(314) 928-9638 • FAX 928-9857

CERTIFICATE OF CALIBRATION

CONTACT NAME: Bob Wester
CLIENT NAME: R.M. Wester & Assoc., Inc.
FACILITY ADDRESS: 215 Indacom, St. Peters, Mo. 63376
TELEPHONE: 928-9638

INSTRUMENT NAME: Ludlum
INSTRUMENT MODEL: 3
SERIAL NO.: 106312
DETECTOR TYPE: 44-9 PR 195396
METER DISPLAY: 0-2.0 mR/hr.
BATTERY CHECK: Good

INSTRUMENT DISPLAY		DISTANCE SOURCE/METER	ACTUAL EXPOSURE	RANGE OR FULL SCALE DISPLAY
mR/hr.		mm	mR/hr.	Range Multiplier
100		592	100	x100
150		500	140.3	x100
50		850	48.5	x100
10		1873	10	x10
15		1500	15.5	x10
5		2700	4.81	x10
1.0	*	2962	1.0	x1
1.5	*	2400	1.52	x1
0.5	*	3050	0.47	x1
0.1	*	1774	0.1	x0.1
0.15	*	1450	0.149	x0.1
0.05	*	2600	0.046	x0.1

(w/ plastic cap off.)

CHECK SOURCE RESPONSE IS: 2 mR/hr. (±0.1 mR/hr.) @ x10 w/ 1 µCi Cs137

(✓) CESIUM-137 CALIBRATOR (S.N. 11068) SOURCE TYPE (6810 S.N. SCS-1866) IS DIRECTLY TRACEABLE TO NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, SOURCE OUTPUT 107 mR/hr @ 60 cm - 5/2/92.

( ) INSTRUMENT CALIBRATED WITH PULSE GENERATOR (S.N. 26137) AS DETERMINED BY ACTUAL MEASUREMENT PROCEDURES. THE DETECTOR IDENTIFIED ABOVE HAS A DETECTION CAPABILITY OF 1.2 % FOR CARBON-14 (S.N. 57084807) AND 0.4 % FOR IODINE-125/129 (S.N. 13137) UTILIZING 2π GEOMETRY.

* ABSORBERS WERE USED TO ACHIEVE THESE RESULTS

CALIBRATED BY: Bill Gaukler DATE: 6-17-97 CAL. DUE DATE: 12-17-97

REVIEWED BY: [signature] DATE: 6-17-97

R.M. WESTER & ASSOCIATES, INC.

215 INDACOM DRIVE - ST. PETERS, MISSOURI 63376
(314) 928-9628 - FAX 928-9857

X

CERTIFICATE OF CALIBRATION

CONTACT NAME: Bob Wester
CLIENT NAME: R.M. Wester and Assoc. Inc.
FACILITY ADDRESS: 215 Indacom Drive, St. Peters, Mo. 63376
TELEPHONE: 928-9628

INSTRUMENT MAKE: Ludlum
INSTRUMENT MODEL: 3
SERIAL NO.: 26439
DETECTOR TYPE: 44-9 SR 063659
METER DISPLAY: 0 - 2.0 mR/hr.
BATTERY CHECK: good

INSTRUMENT RESPONSE mR/hr.		DISTANCE FROM SOURCE CENTIMETER	ACTUAL SOURCE EXPOSURE mR/hr.	RANGE OR FULL SCALE MULTIPLIER Range Multiplier
100		592	100	x100
150		465	162.3	x100
50		870	46.3	x100
10		1873	10	x10
15		1450	16.6	x10
5		2700	4.81	x10
1.0	*	2962	1.0	x1
1.5	*	2400	1.52	x1
0.5	*	3050	0.47	x1
0.1	*	1774	0.1	x0.1
0.15	*	1450	0.149	x0.1
0.05	*	2650	0.044	x0.1

CHECK SOURCE RESPONSE @: _____

(✓) CESIUM-137 CALIBRATOR (S.N. 11698) SOURCE TYPE (6010 S.N. SCS-1696) IS DIRECTLY TRACEABLE TO NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY. SOURCE OUTPUT 197 mR/hr @ 60 cm - 5/27/92.

( ) INSTRUMENT CALIBRATED WITH PULSE GENERATOR (S.N. 20137) AS DETERMINED BY ACTUAL MEASUREMENT PROCEDURES. THE DETECTOR IDENTIFIED ABOVE HAS A DETECTION CAPABILITY OF ±_____ % FOR CARBON-14 (S.N. 5208/697) AND ±_____ % FOR IODINE-125/129 (S.N. 13137) UTILIZING 2π GEOMETRY.

* ABSORBERS WERE USED TO ACHIEVE THESE RESULTS

CALIBRATED BY: Bill Faulkner DATE: 4-23-97 CAL. DUE DATE: 10-23-9

R.M. WESTER & ASSOCIATES, INC.

215 INDACOM DRIVE - ST. PETERS, MISSOURI 63376
(314) 928-9628 - FAX 928-9857

CERTIFICATE OF CALIBRATION

CONTACT NAME	Bob Wester	INSTRUMENT MAKE	Ludlum
CLIENT NAME	R.M. Wester & Assoc., Inc.	INSTRUMENT MODEL	3-50
FACILITY ADDRESS	215 Indacom	SERIAL NO.	F904-9
	St. Peters, Mo. 63376	DETECTOR TYPE	n/a
		METER DISPLAY	Digital
TELEPHONE	928-9628	BATTERY CHECK	n/a

INSTRUMENT READOUT (cpm)	DISTANCE BETWEEN DETECTOR	ACTUAL EXPOSURE	RANGE OR FULL SCALE DISPLAY
Digital	n/a	cpm	0
394 K		400,000	500 K
98.4 K		100,000	100 K
39.5 K		40,000	50 K
9.84 K		10,000	10 K
3.95 K		4,000	5 K
0.98 K		1,000	1 K
397		400	500
100		100	100

CHECK SOURCE RESPONSE IS: _____

( ) CESIUM-137 CALIBRATOR (S.N. 11088) SOURCE TYPE (6010 S.N. SCS-1006) IS DIRECTLY TRACEABLE TO NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY. SOURCE OUTPUT 107 mR/hr @ 60 cm - 5/27/92.

(✓) INSTRUMENT CALIBRATED WITH PULSE GENERATOR (S.N. 20137) AS DETERMINED BY ACTUAL MEASUREMENT PROCEDURES. THE DETECTOR IDENTIFIED ABOVE HAS A DETECTION CAPABILITY OF n/a % FOR CARBON-14 (S.N. 5200A007) AND n/a % FOR IODINE-125/129 (S.N. LX137) UTILIZING 2π GEOMETRY.

* ABSORBERS WERE USED TO ACHIEVE THESE RESULTS

CALIBRATED BY: Bill Hawkins DATE: 7-23-97 CAL. DUE DATE: 1-23-98

R.M. WESTER & ASSOCIATES, INC.

215 DEACON DRIVE • ST. PETERS, MISSOURI 63376
(314) 928-9628 • FAX 928-9857

CERTIFICATE OF CALIBRATION

CONTACT NAME	Bob Wester	INSTRUMENT MAKE	Ludlum
CLIENT NAME	R.M. Wester & Assoc. Inc	INSTRUMENT MODEL	2350
FACILITY ADDRESS	215 Deacon	SERIAL NO.	110652
	St Peters, Mo. 63376	DETECTOR TYPE	n/a
TELEPHONE	928-9628	METER DISPLAY	Digital
		BATTERY CHECK	n/a

INSTRUMENT DISPLAY (cpm)	DISTANCE BETWEEN METER	ACTUAL EXPOSURE	RANGE OR FULL SCALE DISPLAY
Digital	n/a	cpm	Digital Auto Ranging
393 Kcpm		400,000	
100 Kcpm		100,000	
39.0 Kcpm		40,000	
10.1 Kcpm		10,000	
3.83 Kcpm		4,000	
1.03 Kcpm		1,000	
393 Cpm		400	
103 Cpm		100	

CHECK SOURCE RESPONSE IS: _____

( ) CESIUM-137 CALIBRATOR (S.N. 11004) SOURCE TYPE (6810 S.N. SCS-1606) IS DIRECTLY TRACEABLE TO NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY. SOURCE OUTPUT 107 mR/hr @ 60 cm - 5/7/92.

(✓) INSTRUMENT CALIBRATED WITH PULSE GENERATOR (S.N. 20157) AS DETERMINED BY ACTUAL MEASURMENT PROCEDURES. THE DETECTOR IDENTIFIED ABOVE HAS A DETECTION CAPABILITY OF n/a % FOR CARBON-14 (S.N. S2004007) AND n/a % FOR IODINE-125/129 (S.N. 13137) UTILIZING 2π GEOMETRY.

* ABSORBERS WERE USED TO ACHIEVE THESE RESULTS

CALIBRATED BY: Bill Faulkner DATE: 6-17-97 CAL. DUE DATE: 12/17/97

Appendix C

Permits

ECC Broker Permit (#B303)

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

BROKER SITE USE PERMIT

for Commercial Low-Level Radioactive Waste Disposal Site

PERMIT NUMBER: B303 **EXPIRATION DATE:** 2/28/98

Registrant:
ENVIRONMENTAL CHEMICAL CORP
12470 W CEDAR DR
LAKEWOOD CO 80228-2002

The person or firm to whom this certificate is issued must comply with applicable federal and state regulations related to the safe management of low-level radioactive waste

Permit Does Not Imply Approval

R.M.Wester Broker Permit (#B425)

Site Use Permit (#N4375)

NARM Determination Letter

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
Airdustrial Center, Bldg. 5 • P.O. Box 47827 • Olympia, Washington 98504-7827

September 16, 1997

Chuck White
US Ecology, Inc.
1509 Johnston
Richland, Washington 99352

Dear Mr. White:

This is in response to your letter dated August 21, 1997, on behalf of the Richards-Gebaur Air Force Base (Belton, MO), requesting departmental review of its waste to determine if it qualifies as NARM.

According to your letter, the waste, generated as a result of military base decommissioning, consists of a total of 300.0 cubic feet of material and devices, is contaminated with Ra-226. The waste, consisting of 100.0 cubic feet of diffuse material (specific activity of less than 2000.0 pCi/gm) and 200.0 cubic feet of discrete items (previously encapsulated in concrete) that are essentially homogeneous with Ra-226 (specific activity of less than 10.0 nCi/gm), will be packaged in strong, tight containers in accordance with conditions of US Ecology's license, WN-I019-2. Based on our review of the material supplied us, we have determined that the waste qualifies as NARM. An application to obtain the necessary site use permit from the Washington State Department of Ecology is enclosed.

All shipments must conform to the requirements and regulations of DOT, NRC, state of Washington, as well as US Ecology, Inc.'s license, WN-I019-2. This waste must be disposed by December 31, 1996.

If you should have any questions, do not hesitate to contact me at (360) 586-9135.

Sincerely,

S. Jamil Ahmad
Radiation Health Physicist

SJA:krf

cc: Diane Hallisy, WDOE
US Ecology, Inc., Oak Ridge, TN
DOH Site Inspector, Richland, WA

Site Digging Permit

Aviation Department Excavation Permit

City of Kansas City, Missouri
Aviation Department
Engineering Division
601 Brasilia
Kansas City, Missouri 64153
Phone No. (816) 243-3030
Fax No. (816) 243-3071

Instructions:

Fill out and follow instructions for Sections A & B and return with required location map and one drawing (see Section B, 4a – 4b) to Aviation Department for Approval Signature.

Section A

KCAD Proj. No. _____ Application Date: 9-9-97

Contract No. DACA41-95-0023

Authorized Representative: _____ Phone: _____

Company Name and Address: Corps of Engineers Omaha Dist

Reason for Excavation: Removal of radioactive Disposal Well

Date of Excavation to Occur: 15 September 1997

Aviation Dept. Agent: Fred Silva Title: Util. Spec.

Approval Signature: Fred Silva Date: 09-09-1997

Permit is valid only with Aviation Department Authorized Approval Signature.

Section B

Field Verification Requirements must be met for these Utility Agencies:

1 - 1-800-DIGRITE must be contacted to locate all public utilities such as gas, telephone, electricity, water, sewer and other.

2. Federal Aviation Administration (FAA) must be contacted at 243-2790 for KCI and at [illegible]915 for the Downtown Airport.

3 Ogden-Allied Fuel must be contacted at 243-5929 for KCI Airport

4 Aviation Department, Engineering Division shall be contacted at (816) 243-3059, fax (816) 243-307 or Lakefront Management Building at 601 Brasilia, Engineering Division.

a Two drawings must be supplied to the Aviation Department, Engineering Division: an airport map showing the location of the excavation and a site drawing of the excavation. The site drawings shall include the depth and extent of the excavation.

b All excavations that are not related to Aviation Department Projects will require that sealed or dimensioned drawings be supplied to the Aviation Department

c. A minimum of three working days is required to field located Airport owned utilities.

I. Thomas O Shutt (name), acting as an authorized

Representative of Cooper & Engineers (company) do hereby certify that the utility owners identified in items 1-4 above have been contacted and the excavation will not commence until approval is received from all parties listed and all utilities in the area have been field located.

Signed: Thomas O Shutt Date: 9-9-97

Title: Construction Rep.

Comments: _____

The attached reference drawings show approximate location of all known utilities.

Public Utilities, FAA Utilities, or Ogden-Allied Fuel Lines may be shown on attached maps but their location does not represent official documentation from these agencies

The contractor is responsible for reviewing all utility information with the excavator.

The contractor is responsible for providing protection and support of existing utilities within the area of excavation.

Pavement cuts are not allowed unless approved by the Aviation Department.

All landscaping and grass areas are to be restored to original conditions.

Appendix D

Sample and Analysis Documents

Chain of Custody Forms

CHAIN OF CUSTODY

Project # | PROJECT NAME: Richards Gebaur, KC MO

SAMPLERS (Signature): Curtis Carr

Date	Time	COMP.	GRAB	SAMPLE NUMBER	CONTAINER NO.	CONTAINER SIZE (Minimum)	VOA - EPA 624	POTW Metals*	Semi - VOA EPA 625	PCB & Pest EPA 606	pH - EPA 150.0	NIOSH 3500		Remarks or Station Location:
9/15/97	1400	X		RGS 3-6	1	100gm								Gamma Spectroscopy U238 series, 232Th series
9/15/97	1400	X		RGS 6-9	1									"
9/15/97	1400	X		RGS 9-12	1									"
9/15/97	1400	X		RGS 12-15	1									"
9/15/97	1400	X		RGS 15-18	1									"
9/15/97	1400	X		RGS 18-21	1									"
9/15/97	1400	X		RGS 21-24	1									"
9/15/97	1400	X		RGS-QC	1									"
9/15/97	1400	X		RGS BKG1	1									"
9/15/97	1400	X		RGS BKG2	1									"
9/15/97	1400	X		RGS BKG3	1									"
9/16/97	1400			Field Trip Blank (Ca)	1									"

Relinquished By: (Signature)	Date:	Time:	Received by: (Signature)	Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
Curtis Carr	9/17	9:00	FEDEX Security Sealed				
Relinquished By: (Signature)	Date:	Time:	Received by: (Signature)	Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
Relinquished By: (Signature)	Date:	Time:	Received at Laboratory by: (Signature)	Date:	Time:	Remarks:	

*Per 40 CFR -136 (Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Zinc)

CHAIN OF CUSTODY

ct # | PROJECT NAME: Richards Gebaur / Whiteman AFB

PLERS (Signature): Chuck Carr

Date	Time	COMP.	GRAB	SAMPLE NUMBER	CONTAINER NO.	CONTAINER SIZE Minimum	VOA - EPA 624	POTW Metals*	Semi - VOA EPA 625	PCB & Pest EPA 606	pH - EPA 15 0.0	NIOSH 3500	Remarks or Station Location:
10/97	900	X		WAFB-QA	1	100gm							Gamma Spectroscopy
15/97	1400	X		RGS-QA	1	100gm							Gamma Spec., 238 U series, 232 Th series

*Per 40 CFR -136 (Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Zinc)

Relinquished By: (Signature) Chuck Carr	Date: 9/17	Time: 900	Received by: (Signature)	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)	Date:	Time:	Received at Laboratory by: (Signature)	Date:	Time:	Remarks:		

Sample Analysis Request Forms

ENVIRONMENTAL CHEMICAL CORPORATION

DATE: 9/16/97

SAMPLE ANALYSIS REQUEST FORM

SECTION I : COLLECTOR OR COLLECTION INFORMATION

CHECK ONE

- ☐ RUSH
- ☒ STANDARD — PROJECT BILLING REFERENCE: 5348-016
- ☐ SPECIAL (SPECIFY): _____

COLLECTOR: Christina Canon - ECC

ADDRESS: 12470 West Cedar Drive Lakewood, CO 80228

PHONE: (303) 989 - 8344 CONTACT: Same

SECTION II : SAMPLE INFORMATION

DATE COLLECTED: 9 / 15 / 97 TIME: 1400 ~~AM / PM~~

LAB ID #	COLLECTOR SAMPLE ID #	TYPE	ANALYSIS REQUESTED	FIELD NOTES
	RGS 3-6	Soil	Gamma Spec, ^{238}U series, ^{232}Th series	
	RGS 6-9	↓	↓	
	RGS 9-12			
	RGS 12-15			
	RGS 15-18			
	RGS 18-21			
	RGS 21-24			
	RGS QC			
	RGS BKG-1			
	RGS BKG-2			
	RGS BKG-3	↓	↓	
	Field Trip Blank	↓		

~~SPECIAL HANDLING AND / OR STORAGE:~~ _____

SECTION III : LABORATORY SECTION

LAB PROJECT #: _____

RECEIVED BY: _____ TITLE: _____

DATE: ____ / ____ / ____ TIME: _____ AM / PM

ENVIRONMENTAL CHEMICAL CORPORATION

DATE: 9/16/97

SAMPLE ANALYSIS REQUEST FORM

SECTION I : COLLECTOR OR COLLECTION INFORMATION

CHECK ONE

- ☐ RUSH
- ☒ STANDARD — PROJECT BILLING REFERENCE: _____
- ☐ SPECIAL (SPECIFY): _____

COLLECTOR: Christian Canon ECC

ADDRESS: 12470 West Cedar Drive Lakewood, CO 80228

PHONE: (303) 989 - 8344 CONTACT: Same

SECTION II : SAMPLE INFORMATION

DATE COLLECTED: 9 / 10 / 97 — 9 / 15 / 97 TIME: 900 — 1400 AM / PM

LAB ID #	COLLECTOR SAMPLE ID #	TYPE	ANALYSIS REQUESTED	FIELD NOTES
	WAFB QA	Soil	Gamma Spectroscopy	
	RGSQA	Soil	Gamma Spec., ^{238}U series, ^{232}Th series	

SPECIAL HANDLING AND / OR STORAGE: _____

SECTION III : LABORATORY SECTION

LAB PROJECT #: _____

RECEIVED BY: _____ TITLE: _____

DATE: / / TIME: _____ AM / PM

Representative Sample Documents

ENVIRONMENTAL CHEMICAL
CORPORATION

REPRESENTATIVE SAMPLING DOCUMENT

SAMPLE SOURCE: Richards Gebaur Airport, ~~Belton~~ MO KC,

SAMPLE DATE: 9/15/97 TIME: 1400

SAMPLING METHODOLOGY: Composite

DIAGRAM (IF APPLICABLE):

SAMPLE AMOUNT: 100 gms (minimum)

SAMPLE CONTAINER: ~~GLASS JAR WITH TEFLON LINED LID~~ Plastic Ziplock bag

SAMPLE TAG: DATE: 9/15/97 TIME: 1400

SAMPLE LOCATION: Richards-Gebaur

SAMPLE NUMBER: RGS 3-6

ANALYSIS REQUIRED: Gamma Spectroscopy, Isotopic Thorium series, Isotopic ^{238}U Serie

SAMPLER NAME (PRINT): Christian Canon

SAMPLER SIGNATURE: [signature] DATE: 9/15/97

I certify that the above sample(s) was/were taken by my direction and in my presence.

NAME (PRINT): Ken Harris TITLE: Project Manager

SIGNATURE: [signature] DATE: 9/15/97

WITNESS NAME (PRINT): _____ TITLE: _____

SIGNATURE: _____ DATE: _____

ENVIRONMENTAL CHEMICAL CORPORATION

REPRESENTATIVE SAMPLING DOCUMENT

SAMPLE SOURCE: Richards Gebaur Airport, ~~Belton~~ MO KC,

SAMPLE DATE: 9/15/97 TIME: 1400

SAMPLING METHODOLOGY: Composite

DIAGRAM (IF APPLICABLE):

SAMPLE AMOUNT: 100 gms (minimum)

SAMPLE CONTAINER: ~~GLASS JAR WITH TEFLON LINED LID~~ Plastic Ziplock bag

SAMPLE TAG: DATE: 9/15/97 TIME: 1400

SAMPLE LOCATION: Richards-Gebaur

SAMPLE NUMBER: RGS 6-9

ANALYSIS REQUIRED: Gamma Spectroscopy, Isotopic Thorium series, Isotopic ^{238}U Series

SAMPLER NAME (PRINT): Christian Canon

SAMPLER SIGNATURE: [signature] DATE: 9/15/97

I certify that the above sample(s) was/were taken by my direction and in my presence.

NAME (PRINT): Ken Harris TITLE: Project Manager

SIGNATURE: [signature] DATE: 9/15/97

WITNESS NAME (PRINT): _____ TITLE: _____

SIGNATURE: _____ DATE: _____

ENVIRONMENTAL CHEMICAL CORPORATION

REPRESENTATIVE SAMPLING DOCUMENT

SAMPLE SOURCE: Richards Gebaur Airport, ~~Belton~~ MO KC,

SAMPLE DATE: 9/15/97 TIME: 1400

SAMPLING METHODOLOGY: Composite

DIAGRAM (IF APPLICABLE):

SAMPLE AMOUNT: 100 gms (minimum)

SAMPLE CONTAINER: ~~GLASS JAR WITH TEFLON LINED LID~~ Plastic Ziplock bag

SAMPLE TAG: DATE: 9/15/97 TIME: 1400

SAMPLE LOCATION: Richards-Gebaur

SAMPLE NUMBER: RGS9-12

ANALYSIS REQUIRED: Gamma Spectroscopy, Isotopic Thorium series, Isotopic ^{238}U Series

SAMPLER NAME (PRINT): Christian Cannon

SAMPLER SIGNATURE: [signature] DATE: 9/15/97

I certify that the above sample(s) was/were taken by my direction and in my presence.

NAME (PRINT): Ken Harris TITLE: Project Manager

SIGNATURE: [signature] DATE: 9/15/97

WITNESS NAME (PRINT): _____ TITLE: _____

SIGNATURE: _____ DATE: _____

ENVIRONMENTAL CHEMICAL CORPORATION

REPRESENTATIVE SAMPLING DOCUMENT

SAMPLE SOURCE: Richards Gebaur Airport, ~~Belton~~ MO KC,

SAMPLE DATE: 9/15/97 TIME: 1400

SAMPLING METHODOLOGY: Composite

DIAGRAM (IF APPLICABLE):

SAMPLE AMOUNT: 100 gms (minimum)

SAMPLE CONTAINER: ~~GLASS JAR WITH TEFLON LINED LID~~ Plastic Ziplock bag

SAMPLE TAG: DATE: 9/15/97 TIME: 1400

SAMPLE LOCATION: Richards-Gebaur

SAMPLE NUMBER: RGS 12-15

ANALYSIS REQUIRED: Gamma Spectroscopy, Isotopic Thorium series, Isotopic ^{238}U Series

SAMPLER NAME (PRINT): Christian Canon

SAMPLER SIGNATURE: [signature] DATE: 9/15/97

I certify that the above sample(s) was/were taken by my direction and in my presence.

NAME (PRINT): Ken Harris TITLE: Project Manager

SIGNATURE: [signature] DATE: 9/15/97

WITNESS NAME (PRINT): _____ TITLE: _____

SIGNATURE: _____ DATE: _____

ENVIRONMENTAL CHEMICAL CORPORATION

REPRESENTATIVE SAMPLING DOCUMENT

MPLE SOURCE: Richards Gebaur Airport, ~~Belton~~ MO KC,

SAMPLE DATE: 9/15/97 TIME: 1400

SAMPLING METHODOLOGY: Composite

DIAGRAM (IF APPLICABLE):

SAMPLE AMOUNT: 100 gms (minimum)

SAMPLE CONTAINER: ~~GLASS JAR WITH TEFLON LINED LID~~ Plastic Ziplock bag

MPLE TAG: DATE: 9/15/97 TIME: 1400

SAMPLE LOCATION: Richards-Gebaur

SAMPLE NUMBER: RGS 15-18

ANALYSIS REQUIRED: Gamma Spectroscopy, Isotopic Thorium series, Isotopic ^{238}U Series

SAMPLER NAME (PRINT): ~~Christian~~ Canon

SAMPLER SIGNATURE: [signature] DATE: 9/15/97

I certify that the above sample(s) was/were taken by my direction and in my presence.

NAME (PRINT): Ken Harris TITLE: Project Manager

SIGNATURE: [signature] DATE: 9/15/97

WITNESS NAME (PRINT): _____ TITLE: _____

SIGNATURE: _____ DATE: _____

ENVIRONMENTAL CHEMICAL CORPORATION

REPRESENTATIVE SAMPLING DOCUMENT

SAMPLE SOURCE: Richards Gebaur Airport, ~~Belton~~ MO KC,

SAMPLE DATE: 9/15/97 TIME: 1400

SAMPLING METHODOLOGY: Composite

DIAGRAM (IF APPLICABLE):

SAMPLE AMOUNT: 100 gms (minimum)

SAMPLE CONTAINER: ~~GLASS JAR WITH TEFLON LINED LID~~ Plastic Ziplock bag

SAMPLE TAG: DATE: 9/15/97 TIME: 1400

SAMPLE LOCATION: Richards-Gebaur

SAMPLE NUMBER: RGS 18-21

ANALYSIS REQUIRED: Gamma Spectroscopy, Isotopic Thorium series, Isotopic ^{238}U Series

SAMPLER NAME (PRINT): Christian Canon

SAMPLER SIGNATURE: [signature] DATE: 9/15/97

I certify that the above sample(s) was/were taken by my direction and in my presence.

NAME (PRINT): Ken Harris TITLE: Project Manager

SIGNATURE: [signature] DATE: 9/15/97

WITNESS NAME (PRINT): _____ TITLE: _____

SIGNATURE: _____ DATE: _____

ENVIRONMENTAL CHEMICAL
CORPORATION

REPRESENTATIVE SAMPLING DOCUMENT

SAMPLE SOURCE: Richards Gebaur Airport, ~~Belton~~ MO KC,

SAMPLE DATE: 9/15/97 TIME: 1400

SAMPLING METHODOLOGY: Composite

DIAGRAM (IF APPLICABLE):

SAMPLE AMOUNT: 100 gms (minimum)

SAMPLE CONTAINER: ~~GLASS JAR WITH TEFLON LINED LID~~ Plastic Ziplock bag

SAMPLE TAG: DATE: 9/15/97 TIME: 1400

SAMPLE LOCATION: Richards-Gebaur

SAMPLE NUMBER: RGS21-24

ANALYSIS REQUIRED: Gamma Spectroscopy, Isotopic Thorium series, Isotopic ^{238}U Serie

SAMPLER NAME (PRINT): Christian Qanon

SAMPLER SIGNATURE: [signature] DATE: 9/15/97

I certify that the above sample(s) was/were taken by my direction and in my presence.

NAME (PRINT): Ken Harris TITLE: Project Manager

SIGNATURE: [signature] DATE: 9/15/97

WITNESS NAME (PRINT): _____ TITLE: _____

SIGNATURE: _____ DATE: _____

ENVIRONMENTAL CHEMICAL CORPORATION

REPRESENTATIVE SAMPLING DOCUMENT

SAMPLE SOURCE: Richards Gebaur Airport, ~~Belton~~ MO KC,

SAMPLE DATE: 9/15/97 TIME: 1400

SAMPLING METHODOLOGY: Composite

DIAGRAM (IF APPLICABLE):

SAMPLE AMOUNT: 100 gms (minimum)

SAMPLE CONTAINER: ~~GLASS JAR WITH TEFLON LINED LID~~ Plastic Ziplock bag

SAMPLE TAG: DATE: 9/15/97 TIME: 1400

SAMPLE LOCATION: Richards-Gebaur

SAMPLE NUMBER: RGSQC

ANALYSIS REQUIRED: Gamma Spectroscopy, Isotopic Thorium series, Isotopic ^{238}U Serie

SAMPLER NAME (PRINT): Christian Cannon

SAMPLER SIGNATURE: [signature] DATE: 9/15/97

I certify that the above sample(s) was/were taken by my direction and in my presence.

NAME (PRINT): Ken Harris TITLE: Project Manager

SIGNATURE: [signature] DATE: 9/15/97

WITNESS NAME (PRINT): _____ TITLE: _____

SIGNATURE: _____ DATE: _____

ENVIRONMENTAL CHEMICAL CORPORATION

REPRESENTATIVE SAMPLING DOCUMENT

SAMPLE SOURCE: Richards Gebaur Airport, ~~Belton~~ MO KC,

SAMPLE DATE: 9/15/97 TIME: 1400

SAMPLING METHODOLOGY: Composite

DIAGRAM (IF APPLICABLE):

SAMPLE AMOUNT: 100 gms (minimum)

SAMPLE CONTAINER: ~~GLASS JAR WITH TEFLON LINED LID~~ Plastic Ziplock bag

SAMPLE TAG: DATE: 9/15/97 TIME: 1400

SAMPLE LOCATION: Richards-Gebaur

SAMPLE NUMBER: RGSBKG-1

ANALYSIS REQUIRED: Gamma Spectroscopy, Isotopic Thorium series, Isotopic ^{238}U Series

SAMPLER NAME (PRINT): Christian Cannon

SAMPLER SIGNATURE: [signature] DATE: 9/15/97

I certify that the above sample(s) was/were taken by my direction and in my presence.

NAME (PRINT): Ken Harris TITLE: Project Manager

SIGNATURE: [signature] DATE: 9/15/97

WITNESS NAME (PRINT): _____ TITLE: _____

SIGNATURE: _____ DATE: _____

ENVIRONMENTAL CHEMICAL
CORPORATION

REPRESENTATIVE SAMPLING DOCUMENT

SAMPLE SOURCE: Richards Gebaur Airport, ~~Belton~~ MO KC,

SAMPLE DATE: 9/15/97 TIME: 1400

SAMPLING METHODOLOGY: Composite

DIAGRAM (IF APPLICABLE):

SAMPLE AMOUNT: 100 gms (minimum)

SAMPLE CONTAINER: ~~GLASS JAR WITH TEFLON LINED LID~~ Plastic Ziplock bag

SAMPLE TAG: DATE: 9/15/97 TIME: 1400

SAMPLE LOCATION: Richards-Gebaur

SAMPLE NUMBER: RGS BK62

ANALYSIS REQUIRED: Gamma Spectroscopy, Isotopic Thorium series, Isotopic ^{238}U Series

SAMPLER NAME (PRINT): Christian Canon

SAMPLER SIGNATURE: [signature] DATE: 9/15/97

I certify that the above sample(s) was/were taken by my direction and in my presence.

NAME (PRINT): Ken Harris TITLE: Project Manager

SIGNATURE: [signature] DATE: 9/15/97

WITNESS NAME (PRINT): _____ TITLE: _____

SIGNATURE: _____ DATE: _____

ENVIRONMENTAL CHEMICAL
CORPORATION

REPRESENTATIVE SAMPLING DOCUMENT

SAMPLE SOURCE: Richards Gebaur Airport, ~~Belton~~ MO KC,

SAMPLE DATE: 9/15/97 TIME: 1400

SAMPLING METHODOLOGY: Composite

DIAGRAM (IF APPLICABLE):

SAMPLE AMOUNT: 100 gms (minimum)

SAMPLE CONTAINER: ~~GLASS JAR WITH TEFLON LINED LID~~ Plastic Ziplock bag

SAMPLE TAG: DATE: 9/15/97 TIME: 1400

SAMPLE LOCATION: Richards-Gebaur

SAMPLE NUMBER: RGSBKG-3

ANALYSIS REQUIRED: Gamma Spectroscopy, Isotopic Thorium series, Isotopic ^{238}U Series

SAMPLER NAME (PRINT): Christian Cannon

SAMPLER SIGNATURE: [signature] DATE: 9/15/97

I certify that the above sample(s) was/were taken by my direction and in my presence.

NAME (PRINT): Ken Harris TITLE: Project Manager

SIGNATURE: [signature] DATE: 9/15/97

WITNESS NAME (PRINT): _____ TITLE: _____

SIGNATURE: _____ DATE: _____

CORE Labs Analytical Results

CORE LAB

CORE LABORATORIES

ANALYTICAL REPORT

JOB NUMBER: 975707

Prepared For:

Environmental Chemical Corporation
12470 West Cedar Drive
Lakewood, CO 80228

Attention: Christian Canon

Date: 10/27/97

Rondalynn S. Mull

Signature

10-27-97

Date

Name: Rondalynn S. Mull

Title: Laboratory Manager

420 West First Street
Casper, WY 82601

PHONE: 307-235-5741
FAX: 307-266-1676

CORE LAB

CORE LABORATORIES

SAMPLE INFORMATION
Date: 10/27/97

Job Number.: 975707
Customer ..: Environmental Chemical Corporation
Attn.....: Christian Canon

Project Number.....: 96000091
Customer Project ID....: RICHARDS GEBAUR KCMO
Project Description....: general

Laboratory Sample ID	Customer Sample ID	Sample Matrix	Date Sampled	Time Sampled	Date Received	Time Received
975707-1	yGS 3-6	Soil	09/15/97	14:00	09/18/97	09:40
975707-2	RGS 6-9	Soil	09/15/97	14:00	09/18/97	09:40
975707-3	RGS 9-12	Soil	09/15/97	14:00	09/18/97	09:40
975707-4	RGS 12-15	Soil	09/15/97	14:00	09/18/97	09:40
975707-5	RGS 15-18	Soil	09/15/97	14:00	09/18/97	09:40
975707-6	RGS 18-21	Soil	09/15/97	14:00	09/18/97	09:40
975707-7	RGS 21-24	Soil	09/15/97	14:00	09/18/97	09:40
975707-8	RGS QC	Soil	09/15/97	14:00	09/18/97	09:40
975707-9	RGS BKG1	Soil	09/15/97	14:00	09/18/97	09:40
975707-10	RGS BKG2	Soil	09/15/97	14:00	09/18/97	09:40
75707-11	RGS BKG3	Soil	09/15/97	14:00	09/18/97	09:40

CORE LAB

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: yGS 3-6
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-1
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 901.1	Actinium-228, Solid	2.1		pCi/g	10/20/97	nrf
EPA 901.1	Actinium-228, Error +/-, Solid	0.5		pCi/g	10/20/97	nrf
EPA 901.1	Cesium-137, Activity, Solid	<0.1		pCi/g	10/20/97	nrf
EPA 901.1	Cobalt-60, Solid	<0.2		pCi/g	10/20/97	nrf
EPA 901.1	Lead-214, Solid	1.3		pCi/g	10/20/97	nrf
EPA 901.1	Lead-214, Error +/-, Solid	0.2		pCi/g	10/20/97	nrf
	Polonium-210, Solid	1.1		pCi/g	10/03/97	nrf
	Polonium-210, Error +/-, Solid	0.6		pCi/g	10/03/97	nrf
	Polonium-210, LLD, Solid	0.7		pCi/g	10/03/97	nrf
EPA 901.1	Radium-226, Activity, Solid	2.0		pCi/g	10/20/97	nrf
EPA 901.1	Radium-226, Error +/-, Solid	0.4		pCi/g	10/20/97	nrf
mod. HASL 300	Thorium-228, Solid	1.8		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, Error +/-, Solid	0.6		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, LLD, Solid	0.4		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Solid	2.6		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Error +/-, Solid	0.8		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Solid	1.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Error +/-, Solid	0.5		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Solid	1.2		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Solid	0.1		pCi/g	10/06/97	nrf
[illegible] HASL 300	Uranium-235, Error +/-, Solid	0.1		pCi/g	10/06/97	nrf

CORE LAB

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: yGS 3-6
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-1
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
mod. HASL 300	Uranium-235, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, Solid	0.8		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, Error +/-, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, LLD, Solid	0.1		pCi/g	10/06/97	nrf

CORE LAB

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS 6-9
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-2
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 901.1	Cesium-137, Activity, Solid	<0.1		pCi/g	10/20/97	nrf
EPA 901.1	Cobalt-60, Solid	<0.2		pCi/g	10/20/97	nrf
EPA 901.1	Lead-214, Solid	1.7		pCi/g	10/20/97	nrf
EPA 901.1	Lead-214, Error +/-, Solid	0.3		pCi/g	10/20/97	nrf
	Polonium-210, Solid	1.4		pCi/g	10/03/97	nrf
	Polonium-210, Error +/-, Solid	0.7		pCi/g	10/03/97	nrf
	Polonium-210, LLD, Solid	0.5		pCi/g	10/03/97	nrf
EPA 901.1	Radium-226, Activity, Solid	2.2		pCi/g	10/20/97	nrf
. 901.1	Radium-226, Error +/-, Solid	0.4		pCi/g	10/20/97	nrf
mod. HASL 300	Thorium-228, Solid	1.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, Error +/-, Solid	0.5		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, LLD, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Solid	1.8		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Error +/-, Solid	0.5		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Solid	1.5		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Error +/-, Solid	0.5		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Solid	1.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Solid	ND		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Error +/-, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, Solid	1.0		pCi/g	10/06/97	nrf

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS 6-9
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-2
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
mod. HASL 300	Uranium-238, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, LLD, Solid	0.2		pCi/g	10/06/97	nrf

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS 9-12
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-3
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 901.1	Cesium-137, Activity, Solid	<0.1		pCi/g	10/20/97	nrf
EPA 901.1	Cobalt-60, Solid	<0.1		pCi/g	10/20/97	nrf
EPA 901.1	Lead-214, Solid	1.2		pCi/g	10/20/97	nrf
EPA 901.1	Lead-214, Error +/-, Solid	0.3		pCi/g	10/20/97	nrf
	Polonium-210, Solid	1.0		pCi/g	10/03/97	nrf
	Polonium-210, Error +/-, Solid	0.6		pCi/g	10/03/97	nrf
	Polonium-210, LLD, Solid	0.7		pCi/g	10/03/97	nrf
EPA 901.1	Radium-226, Activity, Solid	1.5		pCi/g	10/20/97	nrf
901.1	Radium-226, Error +/-, Solid	0.4		pCi/g	10/20/97	nrf
mod. HASL 300	Thorium-228, Solid	0.9		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Solid	0.9		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Solid	0.8		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Solid	0.6		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Error +/-, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Solid	ND		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Error +/-, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, Solid	0.9		pCi/g	10/06/97	nrf

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS 9-12
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-3
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
mod. HASL 300	Uranium-238, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, LLD, Solid	0.2		pCi/g	10/06/97	nrf

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CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS 12-15
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-4
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 901.1	Cesium-137, Activity, Solid	<0.1		pCi/g	10/20/97	nrf
EPA 901.1	Cobalt-60, Solid	<0.1		pCi/g	10/20/97	nrf
EPA 901.1	Lead-214, Solid	1.6		pCi/g	10/20/97	nrf
EPA 901.1	Lead-214, Error +/-, Solid	0.3		pCi/g	10/20/97	nrf
	Polonium-210, Solid	1.1		pCi/g	10/03/97	nrf
	Polonium-210, Error +/-, Solid	0.5		pCi/g	10/03/97	nrf
	Polonium-210, LLD, Solid	0.4		pCi/g	10/03/97	nrf
EPA 901.1	Radium-226, Activity, Solid	1.5		pCi/g	10/20/97	nrf
901.1	Radium-226, Error +/-, Solid	0.4		pCi/g	10/20/97	nrf
mod. HASL 300	Thorium-228, Solid	1.0		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, Error +/-, Solid	0.4		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Solid	1.5		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Error +/-, Solid	0.5		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Solid	1.4		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Error +/-, Solid	0.4		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Solid	0.8		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Error +/-, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Solid	ND		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Error +/-, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, Solid	1.0		pCi/g	10/06/97	nrf

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS 12-15
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-4
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
mod. HASL 300	Uranium-238, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, LLD, Solid	0.1		pCi/g	10/06/97	nrf

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CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS 15-18
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-5
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 901.1	Cesium-137, Activity, Solid	<0.1		pCi/g	10/20/97	nrf
EPA 901.1	Cobalt-60, Solid	<0.2		pCi/g	10/20/97	nrf
EPA 901.1	Lead-214, Solid	1.7		pCi/g	10/20/97	nrf
EPA 901.1	Lead-214, Error +/-, Solid	0.3		pCi/g	10/20/97	nrf
	Polonium-210, Solid	0.9		pCi/g	10/03/97	nrf
	Polonium-210, Error +/-, Solid	0.5		pCi/g	10/03/97	nrf
	Polonium-210, LLD, Solid	0.4		pCi/g	10/03/97	nrf
[illegible]A 901.1	Radium-226, Activity, Solid	2.0		pCi/g	10/20/97	nrf
901.1	Radium-226, Error +/-, Solid	0.5		pCi/g	10/20/97	nrf
mod. HASL 300	Thorium-228, Solid	0.6		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, Error +/-, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Solid	0.7		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Solid	0.7		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Solid	0.9		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Error +/-, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, LLD, Solid	0.1		pCi/g	10/06/97	nrf
[illegible] HASL 300	Uranium-238, Solid	0.8		pCi/g	10/06/97	nrf

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS 15-18
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-5
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
mod. HASL 300	Uranium-238, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, LLD, Solid	0.1		pCi/g	10/06/97	nrf

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS 18-21
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-6
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 901.1	Cesium-137, Activity, Solid	<0.1		pCi/g	10/21/97	nrf
EPA 901.1	Cobalt-60, Solid	<0.1		pCi/g	10/21/97	nrf
EPA 901.1	Lead-214, Solid	1.5		pCi/g	10/21/97	nrf
EPA 901.1	Lead-214, Error +/-, Solid	0.2		pCi/g	10/21/97	nrf
	Polonium-210, Solid	0.7		pCi/g	10/03/97	nrf
	Polonium-210, Error +/-, Solid	0.5		pCi/g	10/03/97	nrf
	Polonium-210, LLD, Solid	0.8		pCi/g	10/03/97	nrf
EPA 901.1	Radium-226, Activity, Solid	1.6		pCi/g	10/21/97	nrf
901.1	Radium-226, Error +/-, Solid	0.3		pCi/g	10/21/97	nrf
mod. HASL 300	Thorium-228, Solid	0.9		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Solid	1.7		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Error +/-, Solid	0.5		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Solid	0.5		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Error +/-, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Solid	1.0		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Solid	ND		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Error +/-, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, Solid	1.0		pCi/g	10/06/97	nrf

CORE LAB

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS 18-21
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-6
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
mod. HASL 300	Uranium-238, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, LLD, Solid	0.1		pCi/g	10/06/97	nrf

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707 Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS 21-24
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-7
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 901.1	Cesium-137, Activity, Solid	<0.1		pCi/g	10/21/97	nrf
EPA 901.1	Cobalt-60, Solid	<0.1		pCi/g	10/21/97	nrf
EPA 901.1	Lead-214, Solid	1.2		pCi/g	10/21/97	nrf
EPA 901.1	Lead-214, Error +/-, Solid	0.3		pCi/g	10/21/97	nrf
	Polonium-210, Solid	1.6		pCi/g	10/03/97	nrf
	Polonium-210, Error +/-, Solid	0.9		pCi/g	10/03/97	nrf
	Polonium-210, LLD, Solid	0.8		pCi/g	10/03/97	nrf
EPA 901.1	Radium-226, Activity, Solid	1.9		pCi/g	10/21/97	nrf
901.1	Radium-226, Error +/-, Solid	0.3		pCi/g	10/21/97	nrf
mod. HASL 300	Thorium-228, Solid	1.0		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Solid	1.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Error +/-, Solid	0.4		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Solid	1.0		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Solid	21.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Error +/-, Solid	3.8		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, LLD, Solid	0.4		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Solid	1.9		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Error +/-, Solid	0.6		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, Solid	54.3		pCi/g	10/06/97	nrf

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS 21-24
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-7
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
mod. HASL 300	Uranium-238, Error +/-, Solid	9.2		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, LLD, Solid	0.3		pCi/g	10/06/97	nrf

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CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS QC
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-8
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 901.1	Actinium-228, Solid	2.0		pCi/g	10/21/97	nrf
EPA 901.1	Actinium-228, Error +/-, Solid	0.6		pCi/g	10/21/97	nrf
EPA 901.1	Cesium-137, Activity, Solid	<0.3		pCi/g	10/21/97	nrf
EPA 901.1	Cobalt-60, Solid	<0.1		pCi/g	10/21/97	nrf
EPA 901.1	Lead-214, Solid	2.1		pCi/g	10/21/97	nrf
EPA 901.1	Lead-214, Error +/-, Solid	0.4		pCi/g	10/21/97	nrf
	Polonium-210, Solid	1.2		pCi/g	10/03/97	nrf
	Polonium-210, Error +/-, Solid	0.5		pCi/g	10/03/97	nrf
	Polonium-210, LLD, Solid	0.4		pCi/g	10/03/97	nrf
EPA 901.1	Radium-226, Activity, Solid	2.3		pCi/g	10/21/97	nrf
EPA 901.1	Radium-226, Error +/-, Solid	0.4		pCi/g	10/21/97	nrf
mod. HASL 300	Thorium-228, Solid	1.1		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Solid	1.2		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Error +/-, Solid	0.4		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Solid	1.0		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Solid	0.8		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Solid	ND		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Error +/-, Solid	0.1		pCi/g	10/06/97	nrf

CORE LAB

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS QC
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-8
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
mod. HASL 300	Uranium-235, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, Solid	1.0		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, LLD, Solid	0.3		pCi/g	10/06/97	nrf

CORE LAB

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS BKG1
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-9
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 901.1	Actinium-228, Solid	1.4		pCi/g	10/21/97	nrf
EPA 901.1	Actinium-228, Error +/-, Solid	0.4		pCi/g	10/21/97	nrf
EPA 901.1	Cesium-137, Activity, Solid	<0.1		pCi/g	10/21/97	nrf
EPA 901.1	Cobalt-60, Solid	<0.2		pCi/g	10/21/97	nrf
EPA 901.1	Lead-214, Solid	1.2		pCi/g	10/21/97	nrf
EPA 901.1	Lead-214, Error +/-, Solid	0.3		pCi/g	10/21/97	nrf
	Polonium-210, Solid	1.2		pCi/g	10/03/97	nrf
	Polonium-210, Error +/-, Solid	0.5		pCi/g	10/03/97	nrf
	Polonium-210, LLD, Solid	0.4		pCi/g	10/03/97	nrf
EPA 901.1	Radium-226, Activity, Solid	1.6		pCi/g	10/21/97	nrf
EPA 901.1	Radium-226, Error +/-, Solid	0.4		pCi/g	10/21/97	nrf
mod. HASL 300	Thorium-228, Solid	0.7		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, Error +/-, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Solid	0.7		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Error +/-, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Solid	0.9		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Solid	1.0		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Solid	ND		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Error +/-, Solid	0.1		pCi/g	10/06/97	nrf

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS BKG1
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-9
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
mod. HASL 300	Uranium-235, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, Solid	1.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, LLD, Solid	0.1		pCi/g	10/06/97	nrf

CORE LAB

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS BKG2
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-10
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 901.1	Cesium-137, Activity, Solid	<0.1		pCi/g	10/21/97	nrf
EPA 901.1	Cobalt-60, Solid	<0.1		pCi/g	10/21/97	nrf
EPA 901.1	Lead-214, Solid	1.4		pCi/g	10/21/97	nrf
EPA 901.1	Lead-214, Error +/-, Solid	0.3		pCi/g	10/21/97	nrf
	Polonium-210, Solid	0.9		pCi/g	10/03/97	nrf
	Polonium-210, Error +/-, Solid	0.6		pCi/g	10/03/97	nrf
	Polonium-210, LLD, Solid	0.8		pCi/g	10/03/97	nrf
EPA 901.1	Radium-226, Activity, Solid	2.7		pCi/g	10/21/97	nrf
901.1	Radium-226, Error +/-, Solid	0.6		pCi/g	10/21/97	nrf
mod. HASL 300	Thorium-228, Solid	0.7		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, Error +/-, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Solid	0.9		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Solid	0.7		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Error +/-, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Solid	0.8		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Error +/-, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, Solid	1.1		pCi/g	10/06/97	nrf

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS BKG2
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-10
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
mod. HASL 300	Uranium-238, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, LLD, Solid	0.1		pCi/g	10/06/97	nrf

CORE LAB

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS BKG3
Date Sampled......: 09/15/97
Time Sampled......: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-11
Date Received.......: 09/18/97
Time Received.......: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 901.1	Cesium-137, Activity, Solid	<0.1		pCi/g	10/21/97	nrf
EPA 901.1	Cobalt-60, Solid	<0.2		pCi/g	10/21/97	nrf
	Polonium-210, Solid	1.6		pCi/g	10/03/97	nrf
	Polonium-210, Error +/-, Solid	0.7		pCi/g	10/03/97	nrf
	Polonium-210, LLD, Solid	0.6		pCi/g	10/03/97	nrf
EPA 901.1	Radium-226, Activity, Solid	2.2		pCi/g	10/21/97	nrf
EPA 901.1	Radium-226, Error +/-, Solid	0.4		pCi/g	10/21/97	nrf
mod. HASL 300	Thorium-228, Solid	0.9		pCi/g	10/06/97	nrf
[illegible]ASL 300	Thorium-228, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Solid	1.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Error +/-, Solid	0.4		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Solid	0.8		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Solid	0.9		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Solid	ND		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Error +/-, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, Solid	0.9		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, LLD, Solid	0.1		pCi/g	10/06/97	nrf

CORE LAB

CORE LABORATORIES

QUALITY CONTROL RESULTS

Job Number: 975707 Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Test Method........:
Method Description.: Polonium 210
Parameter..........: Polonium-210
Batch.............: 5207
Reporting Limit...: 0.4
Units.............: pCi/L
Analyst...: nrf

QC	Lab ID	Reagent	QC Result	QC Result	True Value	Orig. Value	Calc. Result	Units	Date/Time
MD	975707-2		0.9			1.4	0.5	ABS Diff.	10/03/97 0856
MS	975707-3	975707MSPO	11.8		10.2	1.0	105.9	% REC	10/03/97 0856
MB		MB1P00925	ND						10/03/97 0856
LCS		ST1P00925	10.4		10.2		102.0	% REC	10/03/97 0856

Test Method........: mod. HASL 300
Method Description.: Isotopic Thorium
Parameter..........: Thorium-228
Batch.............: 5342
Reporting Limit...: 0.1
Units.............: pCi/L
Analyst...: nrf

QC	Lab ID	Reagent	QC Result	QC Result	True Value	Orig. Value	Calc. Result	Units	Date/Time
MD	975707-2		1.3			1.3	0.0	RPD	10/06/97 1714
MB		MBAT0930	ND						10/06/97 1714

Test Method........: mod. HASL 300
Method Description.: Isotopic Thorium
Parameter..........: Thorium-230
Batch.............: 5342
Reporting Limit...: 0.1
Units.............: pCi/L
Analyst...: nrf

QC	Lab ID	Reagent	QC Result	QC Result	True Value	Orig. Value	Calc. Result	Units	Date/Time
MD	975707-2		2.1			1.8	15.4	RPD	10/06/97 1714
MB		MBAT0930	0.2						10/06/97 1714

Test Method........: mod. HASL 300
Method Description.: Isotopic Thorium
Parameter..........: Thorium-232
Batch.............: 5342
Reporting Limit...: 0.1
Units.............: pCi/L
Analyst...: nrf

QC	Lab ID	Reagent	QC Result	QC Result	True Value	Orig. Value	Calc. Result	Units	Date/Time
MD	975707-2		1.6			1.5	6.5	RPD	10/06/97 1714
MS	975707-3	975707MSTH	6.3		3.5	0.8	157.1	% REC	10/06/97 1714
MB		MBAT0930	ND						10/06/97 1714
LCS		STAT0930	2.6		3.5		74.3	% REC	10/06/97 1714

Test Method........: EPA 901.1
Method Description.: Gamma Scan (HPGe gamma)
Parameter..........: Cesium-137, Activity
Batch.............: 5417
Reporting Limit...: 0.1
Units.............: pCi/L
Analyst...: nrf

QC	Lab ID	Reagent	QC Result	QC Result	True Value	Orig. Value	Calc. Result	Units	Date/Time
MD	975707-3		<0.1			<0.1	0.0	RPD	10/20/97 1642
LCS		LCSGEM1021	106000		101000		105.0	% REC	10/21/97 1501
LCS		LCSGEM1020	106000		101000		105.0	% REC	10/21/97 1730

CORE LAB

CORE LABORATORIES

QUALITY CONTROL RESULTS

Job Number: 975707 Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Test Method........: EPA 901.1 Batch.............: 5417 Analyst...: nrf
Method Description.: Gamma Scan (HPGe gamma) Reporting Limit...: 0.1
Parameter..........: Cobalt-60 Units.............: pCi/L

QC	Lab ID	Reagent	QC Result	QC Result	True Value	Orig. Value	Calc. Result	Units	Date/Time
MD	975707-3		<0.1			<0.1	0.0	RPD	10/20/97 1642
LCS		LCSGEM1021	127000		123000		103.3	% REC	10/21/97 1501
LCS		LCSGEM1020	125000		123000		101.6	% REC	10/21/97 1730

Test Method........: EPA 901.1 Batch.............: 5417 Analyst...: nrf
Method Description.: Gamma Scan (HPGe gamma) Reporting Limit...: 0.1
Parameter..........: Lead-214 Units.............: pCi/L

QC	Lab ID	Reagent	QC Result	QC Result	True Value	Orig. Value	Calc. Result	Units	Date/Time
MD	975707-3		1.6			1.2	28.6	RPD	10/20/97 1642

Test Method........: EPA 901.1 Batch.............: 5417 Analyst...: nrf
Method Description.: Gamma Scan (HPGe gamma) Reporting Limit...: 0.1
Parameter..........: Radium-226, Activity Units.............: pCi/L

QC	Lab ID	Reagent	QC Result	QC Result	True Value	Orig. Value	Calc. Result	Units	Date/Time
MD	975707-3		1.7			1.5	12.5	RPD	10/20/97 1642

Test Method........: mod. HASL 300 Batch.............: 5418 Analyst...: nrf
Method Description.: Isotopic Uranium Reporting Limit...: 0.1
Parameter..........: Uranium-234 Units.............: pCi/L

QC	Lab ID	Reagent	QC Result	QC Result	True Value	Orig. Value	Calc. Result	Units	Date/Time
MS	975707-2	975707MSU	6.0		5.4	1.1	90.7	% REC	10/06/97 0928
MD	975707-3		0.9			0.6	40.0	RPD	10/06/97 0928
MB		MBAU0930	ND						10/06/97 0928
LCS		STAU0930	4.8		5.4		88.9	% REC	10/06/97 0928

Test Method........: mod. HASL 300 Batch.............: 5418 Analyst...: nrf
Method Description.: Isotopic Uranium Reporting Limit...: 0.1
Parameter..........: Uranium-235 Units.............: pCi/L

QC	Lab ID	Reagent	QC Result	QC Result	True Value	Orig. Value	Calc. Result	Units	Date/Time
MD	975707-3		ND			ND	0	ABS Diff.	10/06/97 0928
MB		MBAU0930	ND						10/06/97 0928

Test Method........: mod. HASL 300 Batch.............: 5418 Analyst...: nrf
Method Description.: Isotopic Uranium Reporting Limit...: 0.1
Parameter..........: Uranium-238 Units.............: pCi/L

QC	Lab ID	Reagent	QC Result	QC Result	True Value	Orig. Value	Calc. Result	Units	Date/Time
MS	975707-2	975707MSU	4.6		5.0	1.0	72.0	% REC	10/06/97 0928
MD	975707-3		0.8			0.9	11.8	RPD	10/06/97 0928

CORE LAB

CORE LABORATORIES

QUALITY CONTROL RESULTS

Job Number: 975707

Date: 10/27/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Test Method.....: mod. HASL 300
Method Description.: Isotopic Uranium
Parameter.....: Uranium-238

Batch.....: 5418
Reporting Limit...: 0.1
Units.....: pCi/L

Analyst...: nrf

QC	Lab ID	Reagent	QC Result	QC Result	True Value	Orig. Value	Calc. Result	Units	Date/Time
MB		MBAU0930	ND						10/06/97 0928
LCS		STAU0930	4.6		5.0		92.0	% REC	10/06/97 0928

Brooks AFB QA Analytical Results

Human Systems Center
Detachment 1
Radioanalytical Branch

SAMPLE ANALYSIS RESULTS REPORTED ON 18-NOV-1997

OERA ID: 19700770
Customer Address Code: R00203Z
509 MEDICAL GROUP/SGPB
702 8TH STREET
WHITEMAN AFB MO, 65305-5282

IDENTIFICATION:
Base Sample # CS9700942
Workplace or Site ID: 203 WHITEMAN AFB
DATE COLLECTED: 15-SEP-97 RECEIVED: 22-SEP-97 COMPLETED: 17-OCT-97
Sample Volume Received: 695 GRAM(S)

EPA CODE N/A CESIUM 134	<	4.0E-02			Picocuries / Gram
EPA CODE N/A CESIUM 137	<	5.0E-02			Picocuries / Gram
EPA CODE N/A COBALT 60	<	4.0E-02			Picocuries / Gram
EPA CODE N/A POTASSIUM 40		9.4E+00	+/-	1.3E+00	Picocuries / Gram
EPA CODE N/A RADIUM 226	<	7.0E-01			Picocuries / Gram
EPA CODE N/A THORIUM 228	<	1.5E+00			Picocuries / Gram
EPA CODE N/A THORIUM 232		1.4E+00	+/-	1.2E+00	Picocuries / Gram
EPA CODE N/A URANIUM 234		1.0E+00	+/-	3.9E-01	Picocuries / Gram
EPA CODE N/A URANIUM 235	<	1.5E-01			Picocuries / Gram
EPA CODE N/A URANIUM 238		8.5E-01	+/-	3.9E-01	Picocuries / Gram

COMMENTS:

RGS-QA

RESULTS ACCURATE TO 2 SIGNIFICANT FIGURES.
UNCERTAINTY AT 95% CONFIDENCE LEVEL.

If you have any questions concerning the information provided above, please contact OERA at DSN 240-2061 or commercially at (210) 536-2061.

Mr. Amon J. Clay, GS-13
Chief, Radioanalytical Branch

Analytical Excellence Through Aggressive, Comprehensive Quality Management

Additional Analyses for Sample #RGS21-24

CORELAB

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707 Date: 12/03/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS 21-24
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-7
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 908.1	Uranium (U), Solid	108	0.7	pCi/g	11/25/97	nrf
EPA 901.1	Cesium-137, Activity, Solid	<0.1		pCi/g	10/21/97	nrf
EPA 901.1	Cobalt-60, Solid	<0.1		pCi/g	10/21/97	nrf
EPA 901.1	Lead-214, Solid	1.2		pCi/g	10/21/97	nrf
EPA 901.1	Lead-214, Error +/-, Solid	0.3		pCi/g	10/21/97	nrf
	Polonium-210, Solid	1.6		pCi/g	10/03/97	nrf
	Polonium-210, Error +/-, Solid	0.9		pCi/g	10/03/97	nrf
	Polonium-210, LLD, Solid	0.8		pCi/g	10/03/97	nrf
EPA 901.1	Radium-226, Activity, Solid	1.9		pCi/g	10/21/97	nrf
EPA 901.1	Radium-226, Error +/-, Solid	0.3		pCi/g	10/21/97	nrf
mod. HASL 300	Thorium-228, Solid	1.0		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-228, LLD, Solid	0.2		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Solid	1.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, Error +/-, Solid	0.4		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-230, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Solid	1.0		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, Error +/-, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Thorium-232, LLD, Solid	0.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Solid	21.1		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, Error +/-, Solid	3.8		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-234, LLD, Solid	0.4		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Solid	1.9		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, Error +/-, Solid	0.6		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-235, LLD, Solid	0.2		pCi/g	10/06/97	nrf

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 975707 Date: 12/03/97

CUSTOMER: Environmental Chemical Corporation PROJECT: RICHARDS GEBAUR KCMO ATTN: Christian Canon

Customer Sample ID: RGS 21-24
Date Sampled.....: 09/15/97
Time Sampled.....: 14:00
Sample Matrix.....: Soil

Laboratory Sample ID: 975707-7
Date Received.....: 09/18/97
Time Received.....: 09:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
mod. HASL 300	Uranium-238, Solid	54.3		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, Error +/-, Solid	9.2		pCi/g	10/06/97	nrf
mod. HASL 300	Uranium-238, LLD, Solid	0.3		pCi/g	10/06/97	nrf
mod. HASL 300	Isotopic Uranium, Reanalysis					
	Uranium-238, Solid	56.2		pCi/g	11/23/97	dmf
	Uranium-238, Error +/-, Solid	9.7		pCi/g	11/23/97	dmf
	Uranium-238, LLD, Solid	0.2		pCi/g	11/23/97	dmf
	Uranium-235, Solid	2.1		pCi/g	11/23/97	dmf
	Uranium-235, Error +/-, Solid	0.6		pCi/g	11/23/97	dmf
	Uranium-235, LLD, Solid	0.2		pCi/g	11/23/97	dmf
	Uranium-234, Solid	23.1		pCi/g	11/23/97	dmf
	Uranium-234, Error +/-, Solid	4.2		pCi/g	11/23/97	dmf
	Uranium-234, LLD, Solid	0.2		pCi/g	11/23/97	dmf

Appendix E

Transportation and Disposal Documents

Bill of Lading for Transport for Temporary Storage

CONTAINS HAZARDOUS MATERIALS

STRAIGHT BILL OF LADING

ORIGINAL - NOT NEGOTIABLE

Shipper's No. RGIRP-970917

Carrier's No. ~~09-17-97~~

CARRIER: West Star Industries, Inc. SCAC

Date 09-17-97

TO: Consignee R.M. Wester and Associates, Inc
Street 215 Indacom Dr.
Destination St. Peters, MO Zip 63376

FROM: Shipper US Army Corp Engineers
Street 601 E 12th
Origin Kansas City MO Zip 64106

Route:

Vehicle Number 6

U.S. DOT Hazmat Reg. No

No. Shipping Units	HM	Kind of Packages, Description of Articles (IF HAZARDOUS MATERIALS - PROPER SHIPPING NAME)	HAZARD CLASS	I.D. Number	Packing Group	WEIGHT (subject to correction)	RATE	LABELS REQUIRED (or exemption)
1		Radioactive material, excepted package - limited quantity of material, outer pipe contains inner pipe filled with dirt and concrete containing 0.616 MBq (0.0166 mCi) of Ra-226 Surface reading 0.0004 mSv/hr (0.4 mR/hr) Container RGIRP-9709XX-01 Emergency Contact: 314-928-9628	7	UN 2910		2041 kg		exempt by 49 CFR 173.421

Remit C.O.D. to:
Address:
City: State: Zip:

COD Amt: $

C. O. D. FEE:
Prepaid ☐
Collect ☐ $

NOTE - Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property. The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding $ Per

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:
The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.
(Signature of Consignor)

FREIGHT CHARGES
☐ PREPAID ☐ COLLEC

Where the applicable tariff provisions specify a limitation of the carrier's liability NMFC Item 172), if there is no release or value declaration by the shipper, and the shipper does not declare a value or release the carrier's liability, that liability shall be limited to the extent provided by NMFC Item 172. California intrastate shipments must comply with NMFC Item 173.

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

Per

PLACARDS REQUIRED: None

PLACARDS SUPPLIED ☐ YES ☐ NO - FURNISHED BY CARRIER

DRIVERS SIGNATURE:

SHIPPER: US Army Corp Engineers
PER: Andrew J. Weinhold
DATE: 9/16/97

CARRIER: R WESTER
PER: Paul Arnold
DATE: 9-17-97

EMERGENCY RESPONSE TELEPHONE NUMBER: (314) 928 9628

Monitored at all times the Hazardous Material is in transportation including storage incidental to transportation (172.604).

CONTAINS HAZARDOUS MATERIALS

DEPARTMENT OF THE ARMY
KANSAS CITY DISTRICT, CORPS OF ENGINEERS
700 FEDERAL BUILDING
KANSAS CITY, MISSOURI 64106-2896

REPLY TO
ATTENTION OF:

September 17, 1997

To RM Wester & Associates:

Please store this shipment (RGIRP-970917) at your facility pending completion of the USACE permit for burial at the US Ecology site in Richland, WA.

Sincerely,

Chuck Williams
USACE

Manifest for Transport for Temporary Storage

NARM

~~LOW LEVEL RADIOACTIVE WASTE~~ SHIPMENT CERTIFICATION FOR THE FEDERAL GOVERNMENT AS A GENERATOR/PACKAGER, AND ITS BROKERS AND CARRIERS

The following certification, completed as applicable, is made to the State of Washington:

Certification is hereby made to the State of Washington that Radiation Shipment Record No. RGIRP 970917 * NARM of ~~low-level radioactive waste~~ has be inspected in accordance with requirements of the Governor of Washington's Executive Order dated November 19, 1979, prior to its shipme Further certification is made that the inspection has revealed no items of non-compliance with all applicable laws, rules and regulations

As determined under the provisions of the Federal Tort Claims Act (28 USC § 2671-2680), the undersigned shall be liable for and hold harmless State of Washington from any and all claims, suits, losses, damages or expenses on account of injuries to any and all persons whomsoever and and all property damage, arising or growing out of or in any manner connected with any activities performed under this order

Except for any violation of applicable existing state or federal statute or regulation respecting packaging and shipment, inspection and acceptar of any item or container or material covered by this certification by the State of Washington or a duly authorized contractor shall release the pa who executed this certificate from any and all requirement of indemnification from injury or loss

SECTION A:
FOR THE GENERATOR/PACKAGER: US Army Corps Engineers (Company Name)

PERMIT NUMBER: 1.53m3

VOLUME OF WASTE IN THIS SHIPMENT: 1.53 m3

DATE: 9/17/97 BY: Construction Rep. GS-9

TITLE: Construction Rep. GS-9 USACE

Certification is hereby made to the State of Washington that Radiation Shipment Record No. _____ * N.A.R.M of ~~low-level radioactive waste~~ has b inspected in accordance with requirements of the Governor of Washington's Executive Order dated November 19, 1979, prior to its shipm Further certification is made that the inspection have revealed no items of non-compliance with all applicable laws, rules and regulations

The undersigned shall indemnify and hold harmless the State of Washington, in an amount not to exceed $1,000,000.00 per individual who ma injured, provided that indemnification shall not exceed $5,000,000.00 in total, for each occurrence, from any and all claims, suits, losses, dam injury and expenses to any person whomsoever or to property arising or growing out of or in any manner connected with the activities perfor under this order

Except for any violation of applicable existing state or federal statute or regulation respecting packaging and shipment, inspection and accepta of any item, or container or material covered by this certification by the State of Washington or a duly authorized contractor shall release the p who executed this certificate from any and all requirement of indemnification from injury or loss.

SECTION B:
FOR THE BROKER: ECC (Environmental Chemical) (Company Name)

PERMIT NUMBER: B303

VOLUME OF WASTE IN THIS SHIPMENT: 1.53m3

DATE: 9/17/97 BY: Christian Canon

TITLE: QC Officer

SECTION C:
FOR THE CARRIER: West Star (Company Name)

VOLUME OF WASTE IN THIS SHIPMENT: 1.53 m3

DATE: 9/17/97 BY: Paul C Frost

TITLE: Driver

DSHS 6048-31-C
DSHS 13-426B

* NARM - Naturally Occurring and Accelerator Produced Radioactive Material

SNW GOV-030

APPROVED BY OMB: NO. 3150-0164 EXPIRES: 3/31/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 1.17 HOURS. THIS UNIFORM MANIFEST IS REQUIRED BY NRC TO MEET REPORTING REQUIREMENTS OF FEDERAL AND STATE AGENCIES FOR THE SAME TRANSPORTATION AND DISPOSAL OF LOW-LEVEL WASTE. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0164), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

NRC FORM 540 (3-95) — U. S. NUCLEAR REGULATORY COMMISSION

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

SHIPPING PAPER

1. EMERGENCY TELEPHONE NUMBER (Include Area Code): (314) 928-9628 / (303) 9898344
ORGANIZATION: RM Wester & Associates/ECC - Chris Canon

2. IS THIS AN "EXCLUSIVE USE" SHIPMENT? ☐ YES ☒ NO

3. TOTAL NUMBER OF PACKAGES IDENTIFIED ON THIS MANIFEST ==> 1

4. DOES EPA REGULATED WASTE REQUIRING A MANIFEST ACCOMPANY THIS SHIPMENT? ☐ YES ☒ NO
If "Yes," provide Manifest Number ==>
EPA MANIFEST NUMBER

5. SHIPPER – NAME AND FACILITY
US Army Corps of Engineers
601 E, 12th St.
Kansas City, MO 64106-2896
USER PERMIT NUMBER
SHIPMENT NUMBER: R61RP970917
CONTACT: Chuck Williams
TELEPHONE NUMBER (Include Area Code): 783-8161 [illegible] 3891

6. CARRIER – Name and Address
West Star Industries, Inc
247 Indacom Dr.
St. Peters, MO 63376
CONTACT: Robert Wester
SIGNATURE – Authorized carrier acknowledging waste receipt: Paul C [illegible]

SHIPPER I.D. NUMBER
☐ COLLECTOR ☐ PROCESSOR
GENERATOR TYPE (Specify): X G
EPA I.D. NUMBER: MOD981723257
SHIPPING DATE: 09/17/97
TELEPHONE NUMBER (Include Area Code): 3147289720
DATE: 9-17-97

7. NRC FORM 540 AND 540A — PAGE 1 OF 1 PAGE(S)
NRC FORM 541 AND 541A — 1 PAGE(S)
NRC FORM 542 AND 542A — 1 PAGE(S)
ADDITIONAL INFORMATION — 1 PAGE(S)

8. CONSIGNEE – Name and Facility Address
RM Wester and Assoc. Inc
215 Indacom Dr.
St. Peters, MO 63376
SIGNATURE – Authorized consignee acknowledging waste receipt

8. MANIFEST NUMBER (Use this number on all continuation pages): R61RP-970917
CONTACT: Robert Wester
TELEPHONE NUMBER (Include Area Code): 314 928-9625
DATE: 0

10. CERTIFICATION

This is to certify that the herein-named materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation. This also certifies that the materials are classified, packaged, marked, and labeled and are in proper condition for transportation and disposal as described in accordance with the requirements of 10 CFR Parts 20 and 61, or equivalent state regulations.

AUTHORIZED SIGNATURE: [signature] TITLE: Const Rep 459 USACOE DATE: 9/17/97

11. U.S. DEPARTMENT OF TRANSPORTATION DESCRIPTION (Including proper shipping name, hazard class, UN ID number, and any additional information)	12. DOT LABEL "RADIOACTIVE"	13. TRANSPORT INDEX	14. PHYSICAL AND CHEMICAL FORM	15. INDIVIDUAL RADIONUCLIDES			16. TOTAL PACKAGE ACTIVITY IN SI UNITS	17. LSA/SCO CLASS	18. TOTAL WEIGHT OR VOLUME (Use appropriate units)	19. IDENTIFICATION NUMBER OF PACKAGE
Radioactive Material, excepted package-limited Quantity of Material, 7, UN2910, Outer pipe contains sand and inner pipe. Inner pipe contains dials and concrete	NA	NA	Solid, oxides	Ra-226			0.616 MBq (0.0166 mCi)	NA	1.53 m³ (54.1 ft³)	R61RP-970917-01

FOR CONSIGNEE USE ONLY

NRC FORM 540 (3-95)

EXPIRES: 3/31/98

SAFE TRANSPORTATION AND DISPOSAL OF LOW-LEVEL WASTE. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0166), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

NRC FORM 541 (11-96)

U.S. NUCLEAR REGULATORY COMMISSION

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION

Additional Nuclear Regulatory Commission (NRC) Requirements for Control, Transfer and Disposal of Radioactive Waste

1. MANIFEST TOTALS							2. MANIFEST NUMBER	
NUMBER OF PACKAGES/ DISPOSAL CONTAINERS	NET WEIGHT VOLUME (m^3)	NET WEIGHT (kg)	SPECIAL NUCLEAR MATERIAL (grams) U-233	U-235	Pu	TOTAL	[redacted] 917	
1	1.53	2041	NP	NP	NP	NP	3. PAGE 1 OF 1 PAGE(S)	
ACTIVITY (MBq) ALL NUCLIDES	TRITIUM	C-14	Tc-99	I-129	SOURCE (kg)		4. SHIPPER NAME	
0.616 MBq; 0.0166 mCi	NP	NP	NP	NP	NP		US Army Corps Engineers	
							SHIPPER ID NUMBER NA	

DISPOSAL CONTAINER DESCRIPTION

WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER

5. CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(S)	6. CONTAINER DESCRIPTION (See Note 1)	7. VOLUME (m^3)	8. WASTE AND CONTAINER WEIGHT (kg)	9. SURFACE RADIATION LEVEL X (μSv/hr) (mSv/hr)	10. SURFACE CONTAMINATION MBq/100 cm^2 ALPHA	BETA-GAMMA	PHYSICAL DESCRIPTION 11. WASTE DESCRIPTOR (See Note 2)	12. APPROXIMATE WASTE VOLUME(S) IN CONTAINER	13. SORBENT SOLIDIFICATION, STABILIZATION, MEDIA (See Note 3)	14. CHEMICAL DESCRIPTION CHEMICAL FORM/ CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	15. RADIOLOGICAL DESCRIPTION INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL; OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT		16. WASTE CLASSIFICATION AS-Class A Stable AU-Class A Unstable B-Class B C-Class C
RGIRP9709-01	4	1.53	2041	.004	1.67E-8 MBq/100 cm^2	3.34E-8 MBq/hr/100 cm^2	33	0.556 m^3	91	Ra-226 painted dials/Aircraft gauges	NP	Ra-226 0.616 MBq (0.0166 mCi)		AS
					1dpm/100 cm^2	2dpm/100 cm^2								

NOTE 1: Container Description Codes. For containers/ waste requiring disposal in approved structural overpacks, the numerical code must be followed by "-OP."

1. Wooden Box or Crate
2. Metal Box
3. Plastic Drum or Pail
4. Metal Drum or Pail
5. Metal Tank or Liner
6. Concrete Tank or Liner
7. Polyethylene Tank or Liner
8. Fiberglass Tank or Liner
9. Demineralizer
10. Gas Cylinder
11. Bulk, Unpackaged Waste
12. Unpackaged Components
13. High Integrity Container
19. Other. Describe in Item 6, or additional page

Note 2: Waste Descriptor Codes. (Choose up to three which predominate by volume.)

20. Charcoal
21. Incinerator Ash
22. Soil
23. Gas
24. Oil
25. Aqueous Liquid
26. Filter Media
27. Mechanical Filter
28. EPA or State Hazardous
29. Demolition Rubble
30. Cation Ion-exchange Media
31. Anion Ion-exchange Media
32. Mixed Bed Ion-exchange Media
33. Contaminated Equipment
34. Organic Liquid (except oil)
35. Glassware or Labware
36. Sealed Source/Device
37. Paint or Plating
38. Evaporator Bottoms/Sludges/Concentrates
39. CompactibleTrash
40. Noncompactible Trash
41. Animal Carcass
42. Biological Material (except animal carcass)
43. Activated Material
59. Other. Describe in Item 11, or additional page

Note 3: For solidification media that meet disposal site structural stability requirements, the numerical code must be followed by "-S." For all solidification media, the vendor (manufacturer) and brand name must also be identified in Item 13. Code 100=NONE REQUIRED.

Sorption

60. Speedi Dri
61. Celatom
62. Floor Dry/ Superdri
63. Hi Dri
64. Safe T Sorb
65. Safe N Dri
66. Floorz
67. Floorz X
68. Sorbi A Sorb
69. Other. Describe in Item 13, or additional page

Solidification

70. Chemsil 30
71. Chemsil 50
72. Dicapsel HP200
73. Dicapsel HP500
74. Petroset
75. Petroset II
76. Aquaset
77. Aquaset II
80. Cement
81. Concrete (encapsulation)
82. Bitumen
83. Vinyl Chloride
84. Vinyl Ester Styrene
89. Other. Describe in Item 13, or additional page
100. None Required

NRC FORM 541 (11-96)

CONSIGNEE ORIGINAL COPY

NRC FORM 542 (3-95) U.S. NUCLEAR REGULATORY COMMISSION

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

MANIFEST INDEX AND REGIONAL COMPACT TABULATION

List all original "PROCESSED WASTE" generators (if any) before "COLLECTED WASTE" generators.

1. WASTE COLLECTOR/PROCESSOR

NAME: Envirocare

IDENTIFICATION NUMBER:

SHIPPING DATE:

SHIPPER USE ONLY

2. MANIFEST NUMBER: RGIRP-[illegible]0917

3. PAGE 1 OF 1 PAGE(S)

4. GENERATOR IDENTIFICATION NUMBER	5. GENERATOR NAME, PERMIT NUMBER (IF APPLICABLE), AND TELEPHONE NUMBER	6. GENERATOR FACILITY ADDRESS	7. PREPROCESSED WASTE (OR MATERIAL) VOLUME (m^3)	8. MANIFEST NUMBER(S) UNDER WHICH WASTE (OR MATERIAL) RECEIVED AND DATE OF RECEIPT	9. WASTE CODE P = PROCESSED C = COLLECTED	10. ORIGINATING COMPACT REGION OR STATE	11. AS PROCESSED/COLLECTED TOTAL A. SOURCE MATERIAL (Kg)	B. SNM (g)	C. ACTIVITY (MBq)	D. VOLUME (m^3)
USEPA #: NA US Ecology #:	US Army Corp Engineers 816 983 3891 US Ecology Cust:	601 E 12th St Kansas City MO 64106	0.556	NA	C	MW LLRWC	∅	∅	0.616 (0.0166 mCi)	1.53

TOTALS OF ALL PAGES (NRC FORMS 542 AND 542A)

NRC FORM 542 (3-95)

CONSIGNEE ORIGINAL COPY

Bill of Lading for Transportation for Disposal

Manifest for Transport for Disposal

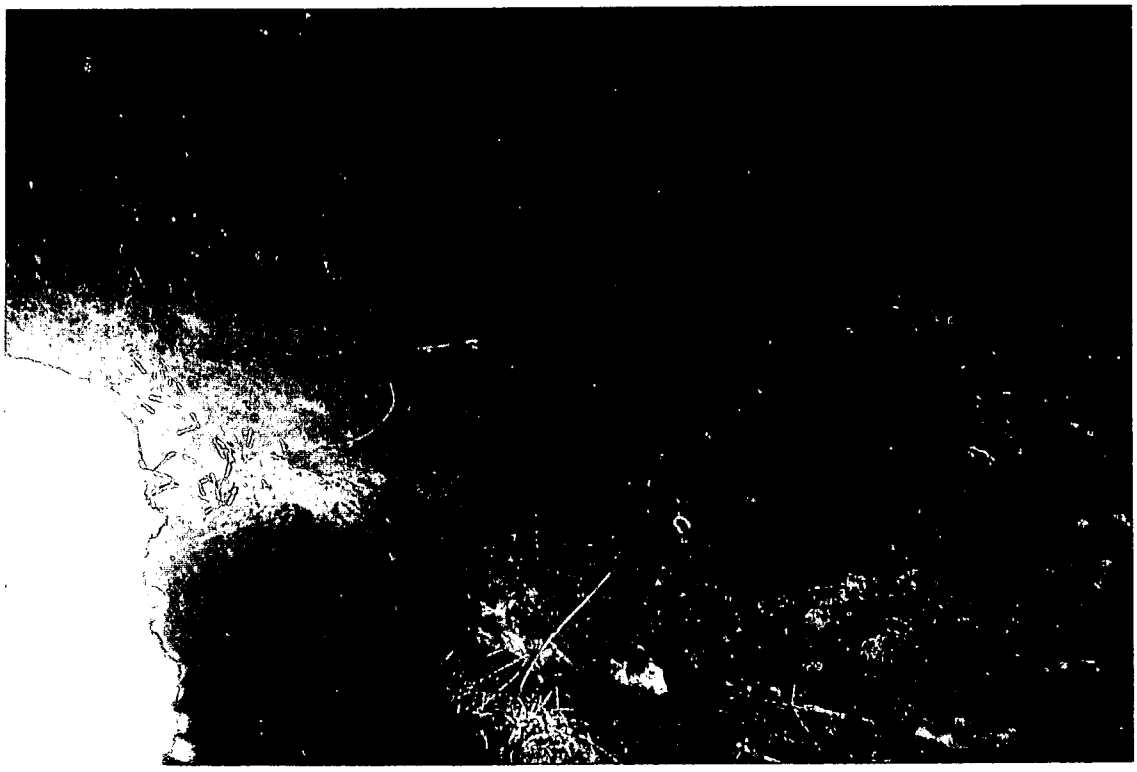
Certificate of Disposal

Appendix F

Photographic Record

Environmental Chemical Corporation
1240 Bayshore Highway
Burlingame, California 94010
November 19 ,1997

Photograph #1: LLRDC at start of excavation.



Photograph #2: LLRDC at start of excavation.

Environmental Chemical Corporation
1240 Bayshore Highway
Burlingame, California 94010
November 19 ,1997

Photograph #3: LLRDC anchored to dozer. Radiation survey activities.

Photograph #4: RSO surveys soil in vicinity of LLRDC.

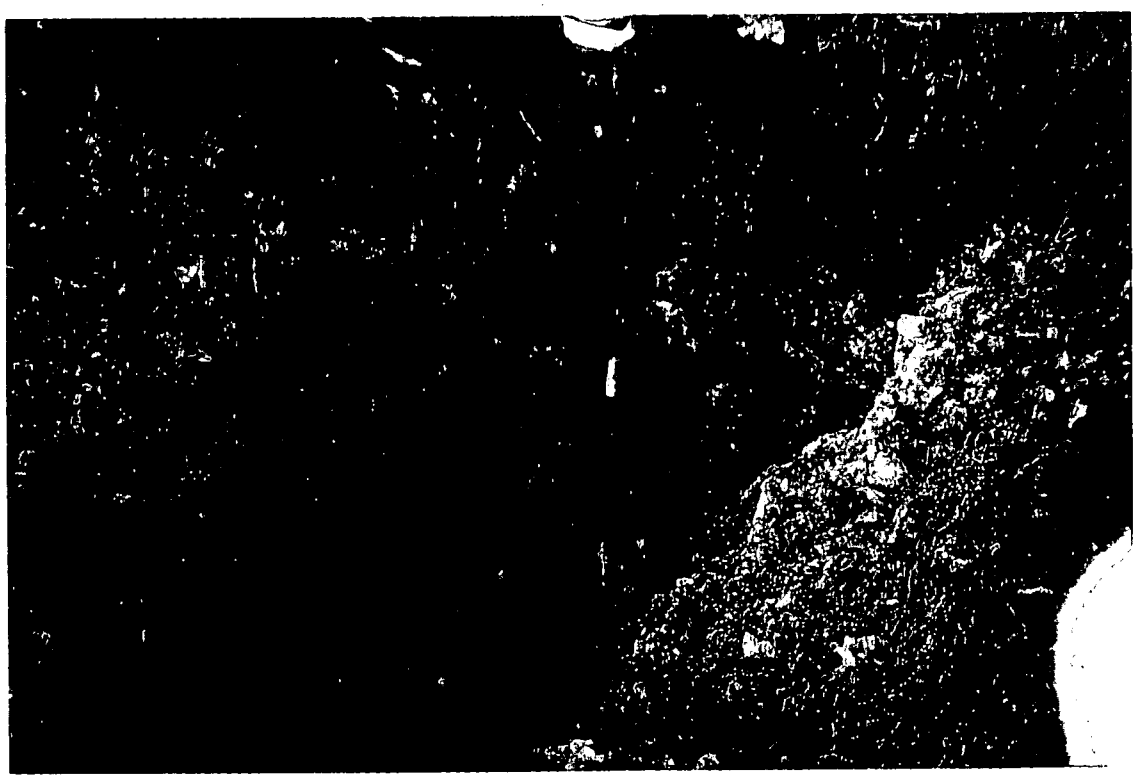
Environmental Chemical Corporation
1240 Bayshore Highway
Burlingame, California 94010
November 19 ,1997

Photograph #5: Soil sampling and surveying activities.

Photograph #6: LLRDC as excavation proceeded.

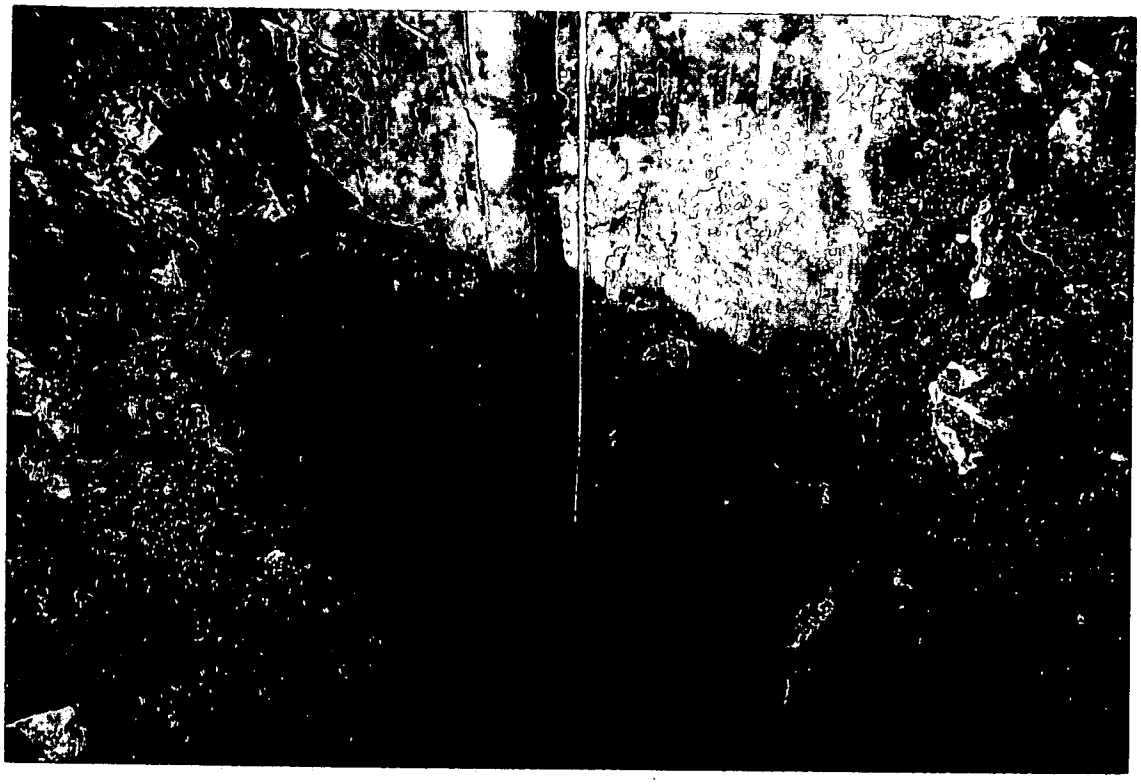
Environmental Chemical Corporation
1240 Bayshore Highway
Burlingame, California 94010
November 19 ,1997

Photograph #7: LLRDC now also anchored to front end load. LLRDC surveying activities. As excavation got deeper surveying was performed without entering 'hole'.

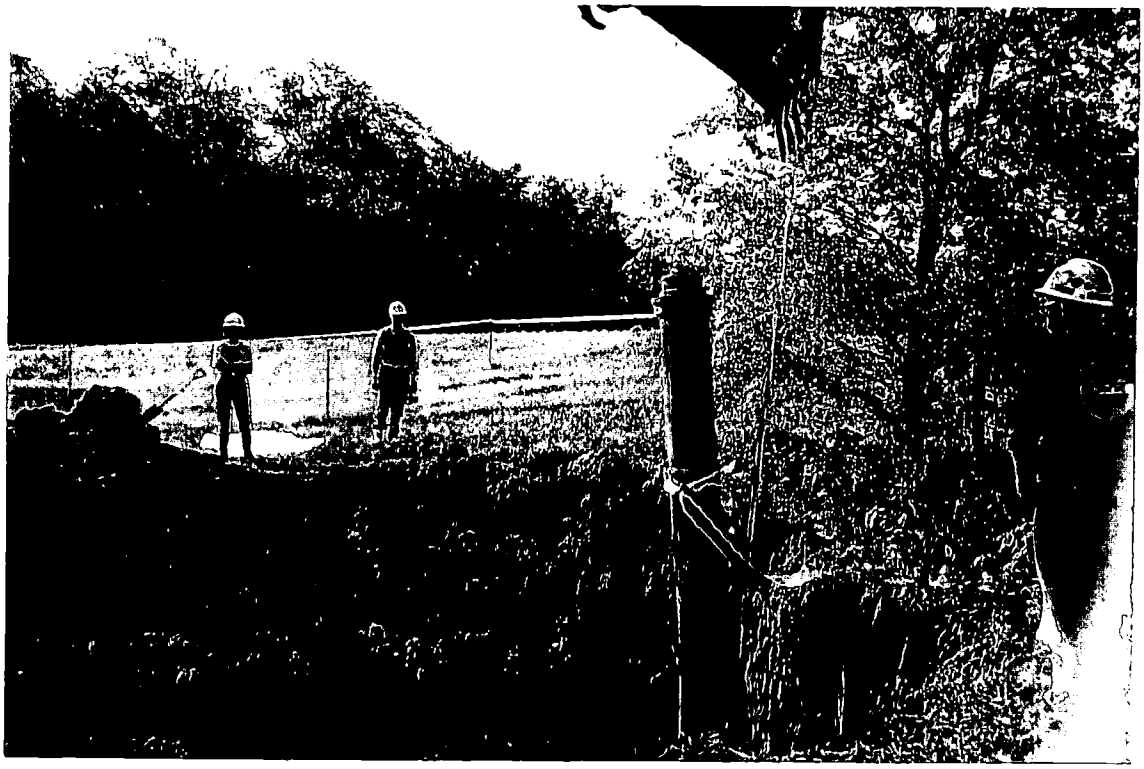


Photograph #8: LLRDC surveying activities.

Environmental Chemical Corporation
1240 Bayshore Highway
Burlingame, California 94010
November 19 ,1997

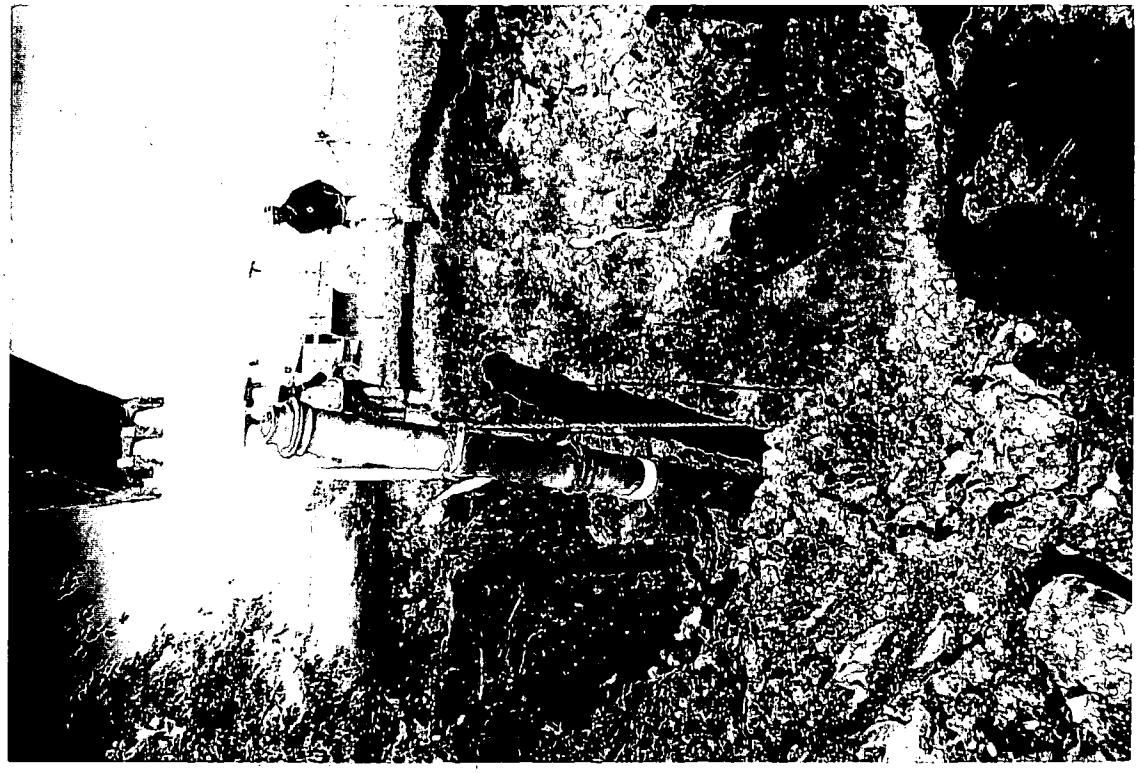


Photograph #9: Taking length measurement of LLRDC.



Photograph #10: LLRDC during extraction from the excavation.

Environmental Chemical Corporation
1240 Bayshore Highway
Burlingame, California 94010
November 19 ,1997



Photograph #11: LLRDC during extraction from excavation.

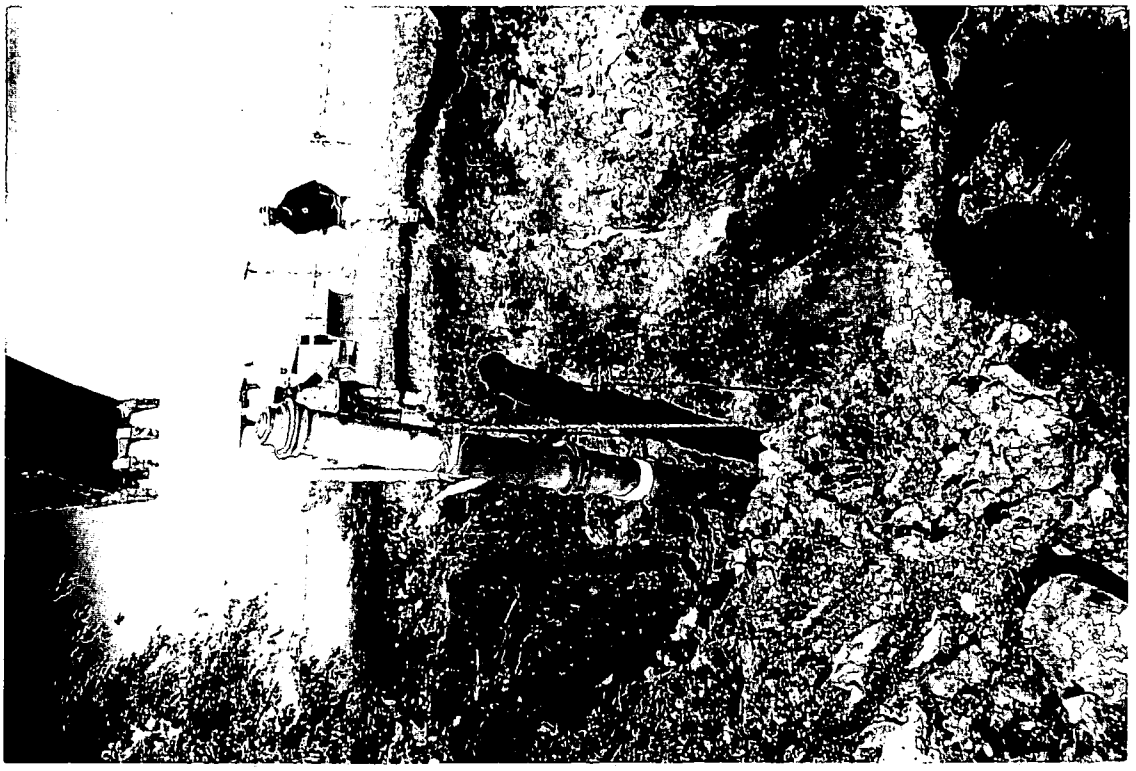
Photograph #12: LLRDC is staged on sloped area to re-strap for complete extraction.

Environmental Chemical Corporation
1240 Bayshore Highway
Burlingame, California 94010
November 19 ,1997

Photograph #9: Taking length measurement of LLRDC.

Photograph #10: LLRDC during extraction from the excavation.

Environmental Chemical Corporation
1240 Bayshore Highway
Burlingame, California 94010
November 19 ,1997



Photograph #11: LLRDC during extraction from excavation.

Photograph #12: LLRDC is staged on sloped area to re-strap for complete extraction.

Environmental Chemical Corporation
1240 Bayshore Highway
Burlingame, California 94010
November 19 ,1997

Photograph #15: Filling of void spaces in waste package.

Photograph #16: Filling of void spaces in waste package. Welding operations.

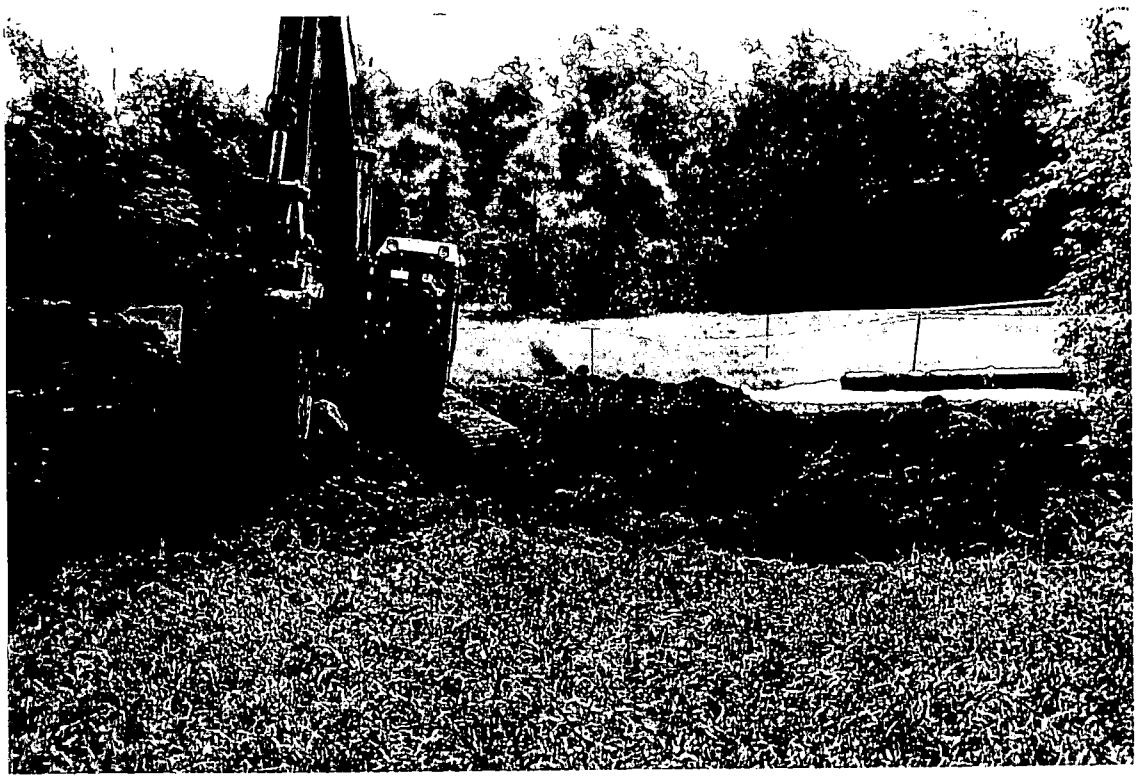
Environmental Chemical Corporation
1240 Bayshore Highway
Burlingame, California 94010
November 19 ,1997

Photograph #13: LLRDC staged on visqueen. LLRDC surveying activities.

Photograph #14: LLRDC in secondary pipe. LLRDC surveying activities.

Environmental Chemical Corporation
1240 Bayshore Highway
Burlingame, California 94010
November 19 ,1997

Photograph #17: Waste package filled to minimum 85% capacity.



Photograph #18: Backfill operations.