



**UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
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ATLANTA, GEORGIA 30303-8931**

August 25, 2003

Department of the Army
ATTN: Brigadier General Patricia L. Nilo
Commandant
U.S. Army Chemical School
Ft. Leonard Wood, Missouri 65473-8926

SUBJECT: NRC INSPECTION REPORT NO. 01-02861-05/03-01

Dear General Nilo:

On July 5-6, 2003, the NRC completed an inspection at Ft. McClellan, Alabama. The purpose of the inspection was to determine whether decommissioning activities authorized by the license were conducted in accordance with Nuclear Regulatory Commission (NRC) requirements. At the conclusion of the inspection, the findings were discussed with members of your staff identified in the enclosed report. The enclosed report presents the results of the inspection.

The inspection was an examination of activities conducted under your license as they relate to radiation safety and compliance with the Commission's rules and regulations and with the conditions of your license. Within these areas, the inspection consisted of selective examinations of representative records, discussion with licensee and contractor personnel, and the performance of a confirmatory survey. The confirmatory survey consisted of "walkover" surveys of selected areas, performing radiation measurements.

Two documents submitted by the Army were reviewed during the inspection: "Airborne Radiological Survey - Main Post and Pelham Range, Walkover Radiological Survey at Rideout Field and Anomaly Surveys on Main Post and Pelham Range, and Groundwater Investigation - Burial Mound at Rideout Field," and "Final Radiological Status Report - Ft. McClellan - Pelham Range 'Burial Mound'," both dated October 2002. Areas requiring clarification are discussed in the enclosed Inspection Report.

In accordance with 10 CFR 2.790 of NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in NRC's Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC web site at <http://www.nrc.gov/reading-rm/ADAMS.html> (the Public Electronic Reading Room).

Should you have any questions concerning this letter or report, please contact us.

Sincerely,

/RA/

Thomas R. Decker, Chief
Materials Licensing/Inspection Branch1

Docket No. 030-17584
License No. 01-02861-05

Enclosure: NRC Inspection Report
No. 01-02861-05/03-01

cc w/encl:
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*see previous concurrence

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U.S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket No.: 030-17584

License No.: 01-02861-05

Report No.: 01-02861-05/03-01

Licensee: Department of the Army

Location: Fort McClellan, Alabama

Date: July 5-6, 2003

Inspectors: Orysia Masnyk Bailey, Health Physicist
Bryan A. Parker, Health Physicist

Accompanied By: Heather Gepford, Ph.D., CHP, Health Physicist
Karen McCallie, DNMS Division Secretary

Approved by: Thomas R. Decker, Chief
Materials Licensing and Inspection Branch 1
Division of Nuclear Materials Safety

Enclosure

EXECUTIVE SUMMARY

DEPARTMENT OF THE ARMY
FORT MCCLELLAN, ALABAMA
NRC INSPECTION REPORT NO. 01-02861-05/03-01

The purpose of this inspection was to perform a confirmatory survey of portions of the Pelham Range and to evaluate and discuss with cognizant licensee and contractor personnel the "Airborne Radiological Survey - Main Post and Pelham Range, Walkover Radiological Survey at Rideout Field and Anomaly Surveys on Main Post and Pelham Range, and Groundwater Investigation - Burial Mound at Rideout Field" and "Final Radiological Status Report - Ft. McClellan - Pelham Range 'Burial Mound'" reports, both dated October 2002.

Attachment:

List of Persons Contacted
Inspection Procedures Used

REPORT DETAILS

1. Scope

This inspection was conducted to perform a confirmatory survey and to review the following documents submitted by the licensee: "Airborne Radiological Survey - Main Post and Pelham Range, Walkover Radiological Survey at Rideout Field and Anomaly Surveys on Main Post and Pelham Range, and Groundwater Investigation - Burial Mound at Rideout Field," and "Final Radiological Status Report - Ft. McClellan - Pelham Range 'Burial Mound'," both dated October 2002.

2. Observations and Findings

The licensee has completed its remediation of a burial mound located at Rideout Field on Pelham Range. This was the last known area of residual contamination at Ft. McClellan. The results of the final status survey of the burial mound were submitted in a report entitled "Final Radiological Status Report - Ft. McClellan - Pelham Range 'Burial Mound'," dated October 2002. To ensure that the groundwater in the area was not affected, the licensee performed a groundwater investigation. To help ensure that there were no other areas of contamination at Ft. McClellan, the licensee contracted Fugro Airborne Surveys (Fugro) to perform an aerial survey, and Shaw E&I, Inc. (Shaw) (formerly the IT Corporation) to perform other surveys as needed, to provide assurance that all radiological material use areas at Ft. McClellan had been addressed. The results of these efforts were documented in a report entitled the "Airborne Radiological Survey - Main Post and Pelham Range, Walkover Radiological Survey at Rideout Field and Anomaly Surveys on Main Post and Pelham Range, and Groundwater Investigation - Burial Mound at Rideout Field."

The flyover survey utilized a sodium-iodide gamma-ray detector to measure the radioactive properties of Ft. McClellan and a global positioning system to provide navigational information. Maps were prepared to indicate Cs-137 and/or Co-60 activity, total exposure and low-energy to high-energy ratios. These delineated "anomalous" areas for ground follow up, and provided information for the differentiation between naturally occurring and man-made elevated responses.

The following summarizes the findings: "The airborne survey positively identified three Cs-137 and Co-60 sources, including one on the Main Post (Anomaly M1) and two on Pelham Range (Anomalies P1 and P2). The airborne survey also identified four other anomalies for follow up evaluation (one on the Main Post [Anomaly M-2] and three on Pelham Range [Anomalies P3 through P5]). Anomaly M1 on the Main Post was located near the community center and M2 on Iron Mountain. Anomaly M2 was selected based on historical land use. Anomalies P1 and P2 on Pelham Range were coincident with ATG's radiological waste removal location at Rideout Field. The waste removal activities were conducted concurrent with the airborne survey. The other anomalies at Pelham Range were selected based on historical land use and were near trails used to transport supplies and equipment during the same period as the radiological training." Several other areas were identified that appeared to be areas of higher radiation levels, but the contractor determined that these were "artifacts" of the survey process.

Contractors from Shaw evaluated the “anomalies” and several of the “artifacts” and performed a walkover survey of the ground surrounding the remediated burial mound. Two of the identified anomalies, P1 and P2, were found to be a radioactive waste disposal site undergoing remediation. The site contained Cs-137 and Co-60 sources that had been used in training exercises. Radiation “shine” from the uncovered waste masked the area surrounding the remediation site so that it could not be properly characterized during the airborne survey. The walkover survey was conducted using a Ludlum 2221 scaler/rate meter coupled with a Ludlum 44-10 2x2 sodium iodide detector sensitive to gamma radiation. The Ludlum system was used to identify the gamma-ray peak locations and an Exploranium GR-135 Identifier portable gamma spectrometer was used to identify the gamma-emitting radioactive materials. The burial mound itself was surveyed by the contractor, Allied Technology Group (ATG), performing the remediation. The survey results of the Burial Mound survey are documented in the “Final Radiological Status Report.” Health physicists from the Alabama Department of Public Health, Division of Radiation Control and from the Environmental Protection Agency accompanied the contractors during their evaluations. They performed surveys with a Ludlum Model 19 ion chamber and with Bicron microR meter and had findings comparable to those observed by Shaw.

Shaw selected ten anomalies or artifacts to investigate based on elevated readings during the airborne survey and historic land use. Survey points P1 through P7 and M1 and M2 were those points selected by Fugro. Points P8 through P10 were characterized as artifacts by Fugro but were further evaluated by Shaw. Each anomaly was located using the coordinates from the airborne survey. Each area was then surveyed with a Ludlum 2221/44-10 NaI detector to identify the area with the highest count rate. A portable gamma spectrometer was then used to identify the radiological contaminants at the location by placing the instrument on the ground and collecting a spectrum for 30 minutes. Spectra were also obtained from two reference or background areas.

The following was concluded concerning the investigation of the anomalies by Shaw: “Survey results were within the expected range for naturally occurring radioactive materials in soil. Anomalies identified during the course of the survey were due to variability in soil types and measurement conditions (i.e., geometry). There is no indication that radiological anomalies were present in inaccessible areas...The only nuclides identified in these spectra were naturally occurring uranium series radionuclides (Pb-214, Bi-214) and K-40. In some cases, the elevated exposure rates were attributable to visible shale outcroppings or clay soil. Surface exposure rates ranged from 8 microRoentgens per hour (uR/hr) for the reference area to 42 uR/hr at Anomaly P4.”

The Fugro portion of the report, written prior to Shaw's investigation of the anomalies, contained the following statement: "Anomaly P4 was selected because of the relatively high total exposure rate at this location and because of historical land use. There is also a coincident Co-60 high at this location. The Co-60 counts are not above what should be considered the noise range, and an analysis of the full spectrum indicates natural uranium and potassium appear to be responsible for the total exposure rate high at this location. However, further investigation may be warranted. If this should prove to be a significant source of man-made radiation, the rest of the data should be re-evaluated using this anomaly as characteristic signature."

An inspector from the Alabama Department of Public Health, Division of Radiation Control obtained a soil sample from P4 and provided the following results:

ISOTOPE	ACTIVITY (pCi/g)	Activity Uncertainty
K-40	26.9	± 06.3%
Mn-54	00.018	± 14.3%
Bi-212	39.2	± 06.2%
Pb-212	04.40	± 06.0%
Bi-214	02.00	± 03.9%
Pb-214	01.99	± 05.3%
Ra-226	02.12	± 21.5%
Th-227	00.186	± 03.2%
Ac-228	07.95	± 07.5%
Th-234	03.82	± 07.7%
U-235	00.198	± 09.3%

Two anomalies were identified on the Main Post. Sampling and gamma spectroscopy confirmed the presence of Cs-137 at M1. Initially, gamma spectroscopy indicated the presence of Cs-137 at M-2. There was concern that the apparent Cs-137 peak had been misidentified due to thermal drift of the detector. The measurement was repeated at a later date with no nuclides identified. There were no elevated count rates in the area. The report concludes that the elevated reading during the flyover survey was an artifact due to the low natural exposure rate.

The M1 location was originally part of Ft. McClellan but was deeded to the city of Anniston in 1976. Review of records during previous inspections indicated that the material buried in this location was probably from material used in the early 1950s

before a materials license was issued to the Army. An inspector from the Alabama Department of Public Health, Division of Radiation Control obtained a soil sample from approximately six inches down near the roots of a tree in the affected area in January 2002. The results indicated 2.22 picocuries per gram (pCi/gm) of Co-60 and 416 pCi/gm of Cs-137.

A letter dated August 1, 2002, from the U.S. Army Corps of Engineers (ACE) to the NRC states "Response action undertaken by the Corps at LaGarde Park property will be carried out consistent with the Comprehensive Environmental Response, Compensation, and Liability Act, (CERCLA)(42 U.S.C. 9601 et seq.) Including the permit waiver provision of CERCLA, Section 121(e)(42 U.S.C. 9621 (e))."

"Corps investigation indicated that this waste was associated with the U.S. Army Chemical School's use of the property during the 1950s. Based on this, the LaGarde Park property has been determined to be eligible for action under the Defense Environmental Restoration Program (DERP). This program authorizes the Secretary of Defense to undertake response action at formerly used defense sites (FUDS) related to contamination associated with past Department of Defense (DOD) use. The Corps is DOD's delegated execution agent for these DERP-FUDS response actions and has fenced the area to preclude public access. Additional response action will be taken to remove the contamination in accordance with CERCLA and National Contingency Plan requirements."

"The permit waiver provision of CERCLA 121(e) applies to Corps DERP-FUDS site response actions starting with commencement of a CERCLA response action and continuing through completion of the response action. In carrying out its cleanup responsibilities under DERP-FUDS, the Corps employs established health and safety standards, which are at least as stringent as U. S. Nuclear Regulatory Commission (NRC) requirements. Consequently, NRC regulation of the Corps response action is not considered necessary or appropriate."

Representatives from the Alabama Division of Radiation Control have been monitoring progress at this site and advise that USACE plans to begin remediation work at the end of August 2003. The State of Alabama plans to monitor activities through the end of the completion of remediation of this area.

The original groundwater investigation work plan called for the installation of four monitoring wells. Three of the residuum wells were installed down gradient of the burial mound and one was installed up gradient. Groundwater was not encountered in residuum at three of the wells and three additional wells were installed in the bedrock water-bearing zone, at depths up to 92 feet below ground surface at the residuum well locations. Groundwater samples were collected from the four wells with water present and analyzed for gamma-emitting radionuclides (including Co-60 and Cs-137) and Sr-90. Only two naturally occurring radionuclides were detected (Bi-214 and Pb-214). Analytical results indicate that there were no concentrations of the Cs-137, Co-60, and Sr-90 above the MDLs in these groundwater samples. Therefore, the burial mound does not appear to have radiologically impacted the groundwater at this site.

During this inspection, the inspectors went to each of the identified anomaly or artifact sites and performed a confirmatory survey using a Ludlum Model 19 microR meter and a Ludlum 3-98 outfitted with a Low Energy Gamma (LEG) probe. These were the sites evaluated by Shaw. The inspectors also performed a walkover survey of approximately 5% of the area of the burial mound "footprint." A Shaw health physicist accompanying the inspectors had a portable gamma spectrometer with him and took a spectrum at each site confirming the original information submitted in the October 2002 report. The inspectors noted the relatively higher readings at P4, which had been attributed to shale by the licensee. The inspectors asked the licensee to provide additional justification for this conclusion in light of the concerns expressed by the Fugro contractors. The results of the NRC survey are provided in the Attachment to this report.

Soil samples were obtained by an inspector from the Alabama Division of Radiation Control in August 2001 from the "clean dirt" that had passed through the conveyor belt analyzer and was mounded to be placed back into the excavated burial mound. The following results were reported.

SAMPLE #1

ISOTOPE	RESULT (pCi/g)	MDL
Cs-137	00.274 \pm .6%	00.02
Co-60	00.07 \pm 11.0%	00.06
K-40	03.74 \pm 7.8%	00.5

SAMPLE #2

ISOTOPE	RESULT (pCi/g)	MDL
Cs-137	00.273 \pm 6.7%	00.02
Co-60	00.032 \pm 16.1%	00.06
K-40	04.62 \pm 6.8%	00.5

SAMPLE #3

ISOTOPE	RESULT (pCi/g)	MDL
Cs-137	00.990 \pm 5.6%	00.02
K-40	04.21 \pm 7.1%	00.5

SAMPLE #4

ISOTOPE	RESULT (pCi/g)	MDL
Cs-137	00.336 \pm 7.4%	00.02
K-40	03.77 \pm 7.8%	00.5

NRC inspectors obtained soil samples from the bottom of the excavated Burial Mound on January 28, 2002. The following are the results of these samples for Co-60 and Cs-137.

LOCATION	RESULTS (pCi/g)	RESULTS (pCi/g)
	Co-60	Cs-137
Grid A-3	00.019 \pm 0.05	00.44 \pm 0.04
Grid A-6	00.01 \pm 0.03	-00.02 \pm 0.02
Grid A-5	00.07 \pm 0.06	00.23 \pm 0.04
Grid A-7	00.03 \pm 0.04	00.08 \pm 0.04

3. Conclusion

Further information or clarification is required concerning the flyover survey. There are no further concerns regarding the groundwater in this area or the final status survey of the burial mound. Review of the licensee's request for license termination can continue once the licensee's response is received. 10 CFR 20.1402 requires the consideration of residual radioactivity that is distinguishable from background radiation when evaluating site release for unrestricted use. 10 CFR 20.1003 defines residual radioactivity to include radioactivity from all licensed and unlicensed sources used by the licensee.

Once the USACE has completed the remediation of the LaGarde recreation area (Anomaly M1) and the NRC has received the final survey data for analysis in conjunction with the current Fort McClellan radiological data, license termination review can continue.

Clarification Required:

Much of the area surveyed was forested, with tree heights ranging from an estimated 70 to 100 feet. The licensee, in their report, described that the biomass had the effect of increasing the effective flying height by an additional 50 feet of altitude, and stated that an exposed source can be detected at heights of up to 150 feet; however, there is no discussion on the effect of burial on the sensitivity other than to mention that burial has a larger impact than flying height. The report does not provide the suspected burial depth.

A range of sensitivities based on burial depth would help to determine if the system's sensitivity was adequate for the activity of the sources at the time of the survey. The range should account for a surface deposit down through to the likely maximum burial depth. The maximum burial depth should be chosen based on the historical site assessment (HSA). Sources buried greater than 12 to 20 inches in depth would not have a high probability for detection. Please provide this information.

The system was calibrated before and after each flight. Calibration was performed using three accurately positioned hand-held sources. Details of the calibration were not provided. Please provide additional detail including information such as calibration radionuclides used with their activity and positions, tolerance for energy calibration, full-width half-max, background level, and other general gamma spectroscopy quality control (QC) parameters. The detectors were packaged in unheated enclosures that were shock-protected and were automatically stabilized with respect to the K-40 peak. This approach was valid because K-40 would appear in all survey areas and would be useful to correct the electronics for thermal drifting and thereby maintain the system within calibration. Differences in background due to moisture were accounted for by fixed-site test line flights. These tests were also used to monitor the equipment. Please provide information as to what these tests were or acceptable QC parameters. Also, discuss the impact of the environment, such as weather, on the operation of the system.

Discussion in the report indicates that radon background measurements could not be performed because there were no upward-looking detectors utilized during the survey. Radon banding was observed in the uranium window and to a lesser extent in other windows and was adjusted to base levels to match local backgrounds on a line by line basis. According to the report, this correction may cause errors in defining absolute background and concentration values, but does not affect identification of point source anomalies. Please provide additional information regarding this stripping technique, particularly a reference, to allow for validation of this conclusion.

Following the radon correction, the Cs-137, Co-60, K-40, uranium, and thorium windows were first corrected for spectral overlap with the stripping ratios modified by altitude. Based on the reversed stripping ratio for uranium into thorium, an additional adjustment factor was calculated. According to the report, after the stripping was completed, there were still contributions of K-40 in the Co-60 window and uranium (Bi-214) in the Cs-137 window. It will affect the accuracy of absolute background and ground concentration values for Cs-137 and Co-60 but there is no discussion as to how to evaluate the impact. Please provide a reference or additional detail for the applied approach.

Following the spectral overlap correction, the next correction accounted for attenuation due to air at the flying altitude. The correction reduced the data to a nominal flying altitude, the intended flying height, of 33 feet. No mention is made of any attenuation corrections for biomass. Considering the assumption that the biomass would add an effective 50 feet to the flying altitude, it would be conservative to apply the correction to any data collected at altitudes higher than the intended flying height of 33 feet. Please provide a reference or further clarification for the applied approach.

Anomaly P4 had elevated Co-60 in addition to elevated exposure rate, unlike P3 and P5 through P10, which only exhibited elevated exposure rates. The P4 ground investigation exposure rate measurement was significantly greater than other shale outcropping anomalies. In addition, the exposure rate at the surface was nearly two times the one-meter measurement, compared to the other anomalies where the exposure rates did not significantly change with distance. During the M2 anomaly ground survey, the hand-held NaI spectrometer drifted and incorrectly identified Cs-137 in the spectrum. Because of the exposure rate results and potential for misidentification, or non-identification, for the P4 anomaly, please provide additional information supporting your conclusion that the elevated readings in this area were due to the shale outcropping.

The report stated in the airborne survey documentation that if ground surveys of the lower priority anomalies identify sources, the assumptions used during the data reduction would need to be revisited. This would be especially true if additional surveys at the P4 anomaly identify a source.

EXIT MEETING SUMMARY

The inspectors discussed the inspection results with the personnel indicated below in the list of persons contacted, at the end of the inspection on July 6, 2003. The inspectors advised that there were several points that required clarification or additional information before license termination could be completed. These are discussed in the inspection report. The RSO stated that the license should be terminated without consideration of the M1 area since the property no longer belonged to the Army and the Army Corps of Engineers had taken over responsibility for remediating the area. No proprietary information was discussed.

ATTACHMENT

LIST OF PERSONS CONTACTED

State of Alabama, Division of Radiation Control:

James T. Williams, Radiation Physicist

Department of the Army, Ft. McClellan, Alabama:

Lisa Holstein, Base Relocation and Closure Coordinator (BRAC)

Lee Jaye, Environmental Engineer, BRAC

*John May, Radiation Safety Officer

Shaw E&I, Inc:

* Rick Green, Health Physicist

Ben Hodges, Senior Unexploded Ordnance Supervisor

Environmental Protection Agency:

Lloyd Generette, Environmental Scientist

*present during exit meeting.

INSPECTION PROCEDURES USED

IP 83890 Closeout Inspection and Summary

IP 87104 Decommissioning Inspection Procedure for Materials Licenses

NRC SURVEY RESULTS:

Anomaly Number	Surface Exposure Rate (cpm)	1-meter Exposure Rate (uR/hr)	Location (GPS)
P1 Burial Mound "Footprint"	300-600	5-8	Range from walkover of "footprint"
P2 Burial Mound "Footprint"	300-600	5-8	Range from walkover of "footprint"
P3	500	14	N 33.72642 W 85.49383
P4	2000	40	N 33.72482 W 85.99564
P5	600	14	N 33.72252 W 85.98685
P6	200	4	N 33.73367 W 85.99063
P7	500	7	N 33.71181 W 86.00676
P8	400	6	N 33.73104 W 85.99207
P9	450	8	N 33.73101 W 85.99189
P10	500	7	N 33.73101 W 85.99165
M2	300	5	N 33.70324 W 85.80973

Note: M1 not evaluated. Army Corps of Engineers is remediating.

INSTRUMENTS USED:

Model 19 Serial No. 131320
Calibrated: 05/03/03
(Property of EPA # 000462)

Ludlum Model 3-98 Serial No. 150727
(NRC 069361) with LEG probe
Calibrated 03/03/03