FORT McCLELLAN

Anniston, Alabama

FINAL REPORT

DECEMBER 1996

ALLIED TECHNOLOGY GROUP

RADIOLOGICAL REMEDIATION of BUILDING 3192 HOT CELL AND GROUNDS
and BUILDING 3182 'MILITARY POLICE MUSEUM' • FORT McCLELLAN, ANNISTON, ALABAMA

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ACRONYMS

ATG	Allied Technology Group, Inc.
BOA	Basic Order Agreement
CFR	Code of Federal Regulations
cpm	counts per minute
DAC	Derived Air Concentrations
DCF	Defense Consolidation Facility
DEH	Fort McClellan Department of Environment and Housing
dpm	disintegrations per minute
HEPA	High Energy Particulate Absorbent
HSP	Health and Safety Plan
IOC	Industrial Operations Command
NIST	National Institute of Standards Technology
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
pCi	picocuries
QA	Quality Assurance
RSO	Radiation Safety Officer
RWP	Radiation Work Permit
TCLP	Toxicity Characteristic Leaching Process
TLD	Thermoluminescent Dosimeter

RADIOLOGICAL REMEDIATION of BUILDING 3192 HOT CELL AND GROUNDS and BUILDING 3182 'MILITARY POLICE MUSEUM' FORT McCLELLAN, ANNISTON, ALABAMA

1.0 INTRODUCTION

Allied Technology Group, Inc. (ATG) was contracted by Industrial Operations Command (IOC) for the decontamination of two buildings (including a Hot Cell), facility grounds, and facility structures at Fort McClellan in Anniston, Alabama.

Pre-remediation surveys were performed to characterize the site and establish radiological controls for the remediation. This work has been performed in three phases. The Basic Order Agreement (BOA) for this project was DAAA09-92-G-0003, Project Number USA-023-94, Delivery Order 0077.

1.1 Background Information

The second phase of this effort revised, expanded, and completed the scope of work that was to be performed during the first phase.

1.2 Scope of Services

The actions taken in this project consisted of:

- Remediation of the Building 3192 Hot Cell, Building 3192 and surrounding grounds to guideline limits.
- Remediation of Building 3182 (Military Police Museum) and surrounding grounds to guideline limits.

1.3 Limitations

This document and the information contained herein have been prepared solely for the use of Industrial Operations Command. Allied Technology Group's services for this project were performed in accordance with BOA DAAA09-92-G-0003, Delivery Order 0077, and with current professional standards of practice for radiological decontamination and decommissioning in the area. Allied Technology Group's investigation was limited to the vicinity of the buildings and grounds described herein and was limited to testing for Cesium (Cs137) and Cobalt (Co60). Opinions regarding the conditions of the buildings and grounds are limited to the areas described herein.

Area Release

All decisions pertaining to the future release and usage of any of the buildings or grounds discussed in this report will be the responsibility of the U.S. Army and the appropriate Federal and State regulatory agencies. Surveys conducted as part of the work discussed in this report were conducted according to current practice guidelines and bench-marked against the release criteria established by U.S. Nuclear Regulatory Commission Guide 1.86 and Title 10 Code of Federal Regulations, Part 20.

2.0 SITE INFORMATION

2.1 Geology and Hydrology

Per a Characterization Report from Chem-Nuclear Systems, Inc. dated December 16, 1985, core borings throughout the area identified varying consistencies of hardpan (a dense, hard-packed clay layer), and varying silty clay deposits to depths of three (3) feet. The presence of naturally occurring

isotopes of radium, thorium, and their associated daughter products were evident. Under the concrete apron, various areas showed saturation immediately beneath the concrete and other areas did not. Certain core holes in this area drained dry when surface water was introduced. Other core holes remained filled, or maintained water levels at varying depths.

Possibly, various fill materials were used during initial construction. This could have resulted in subsurface "lenses" underneath the concrete and asphalt. Contamination may have leached into the soils through these "lenses".

2.2 Site History

Department of Defense documents suggested that significant strontium 90 contamination existed in an area adjacent to Building 3180. This contamination dated back to 1959. In 1973, an effort was made to remove this contamination, but certain quantities remained. In 1986, Chem-Nuclear removed a leaking underground storage tank and associated piping to reduce the concentration of cobalt 60 and cesium 137. Additional remediation has been performed by Base personnel from 1985 to the present.

The Hot Cell in Building 3192 was extensively contaminated in the late 1950's or early 1960's when sources containing powdered cobalt 60 were segmented. Because of an inadequate ventilation system, this contamination migrated out of the Hot Cell into the building and the surrounding grounds.

The Military Police Museum was contaminated with cesium 137. This was due to leaking piping and sources.

2.3 Site Conditions at the Completion of the Pre-remediation Survey

Only cobalt 60 contamination was found in Building 3192. Contamination was located in and around the Hot Cell, its contents, and the shield door. Maximum contamination levels (100,000 dpm/100cm^2) were found on the crane components. Both cobalt 60 and cesium 137 were detected in the surrounding grounds. Samples from the grounds outside of the fenced area indicated that there was no migration of activity from the grounds surrounding Building 3192. Work was stopped due to lack of funding.

2.4 Site Conditions at the Termination of the Initial Remediation

During the Building 3192 remediation, fixed contamination radiation levels ranging from 100 to 130 μR/hr above background in the vicinity of the east doorway of the Military Police Museum were detected. The isotope of interest was determined to be cesium 137 inside of the museum.

2.5 Identity of Contaminants and Release Criteria

Based upon knowledge of site history, previous characterizations and surveys, and NRC correspondence, the significant radiological contaminants were known to be:

CONTAMINANT		AREA
Cesium	^{137}Cs	Building 3182 and Grounds
Cobalt	^{60}Co	Building 3192 and Grounds

On the basis of contaminants, per U.S. NRC Regulatory Guide 1.86 and 10 CFR 20, the surface contamination guideline release values for Buildings 3182 and 3192 were:

Fixed Contamination	Loose Contamination
5,000 dpm $\beta\gamma$/100cm^2	1,000 dpm $\beta\gamma$/100cm^2

Clean limits for this project are based on Nuclear Regulatory Commission Guidance in a memo from John W.N. Hickey, Chief Operations Branch, Division of Fuel Cycle, Medical, Academic and Commercial Use Safety to William E. Cline, Chief Nuclear Materials Safety and Safeguards Branch Region II on the subject of "Evaluation of Acceptability of Proposed Decommissioning Activities (for Fort McClellan, Alabama Facility) dated May 6, 1987.

Matrix	Contaminant	Clean Release Criteria
Soil	^{60}Co	8 pCi/gram above background
Soil	^{137}Cs	15 pCi/gram above background

Where more than one radionuclide is present, the sum of the radios of the individual radionuclide concentrations to their respective concentration limits shall not exceed 1.

The gamma exposure at 1 meter above the ground surface shall not exceed 10 μR/hr above background for an area of greater than 30 feet by 30 feet and shall not exceed 20 μR/hr above background for any discrete area (i.e., less than 30 feet by 30 feet).

In addition to the radiological standards established for the remediation, composite samples (soil, trash, metals, etc.) were pulled from the shipping containers and subjected to full toxicity characteristic leaching process (TCLP) testing. This was to determine if organics, solvents, heavy metals, pesticides, or herbicides were present. The waste streams had to be profiled in order to determine disposal requirements.

The paint from the Hot Cell walls was found to be contaminated with lead. The presence of asbestos in floor tiles and mastic was confirmed.

3.0 PROJECT OVERVIEW

3.1 Project Background

Pre-remediation characterization survey activities were conducted by ATG in November 1994. Major activities consisted of:

- Performing a radiological survey of the Hot Cell to determine the extent of contamination and confirm the isotopes of concern.
- Performing a radiological survey of the interior and exterior of Building 3192.
- Performing a radiological survey of the ventilation system.
- Removing excess materials which would impede job performance or cause increased background radiation levels during the characterization.
- Confirming that the valve control pit was previously remediated.
- Performing core sampling in the previously removed/remediated tank and valve control pit area.
- Preparing a list of materials to be released, or considered waste.

Building 3192 remediation work commenced in November 1995. Major activities consisted of:

- Hot Cell decontamination, including the removal of affected piping.

- Removing the ventilation system.
- Remediating the classroom.
- Characterizing and remediating the outside grounds.
- Surveying, decontaminating (as required), and releasing of miscellaneous loose classroom items.
- Surveying and sampling the east storm drain and the west sewer.

Contamination in the east doorway of the Military Police Museum (Building 3182) was also determined during this phase of the project. Project activities were stopped in late December (1995) due to a lack of funding.

ATG remobilized in June of 1996 to complete the efforts in Building 3192 and to decontaminate the Military Police Museum. Major activities consisted of:

- Regridding, surveying, and confirmation sampling of outside areas.
- Performing a Quality Assurance Survey of the outside areas.
- Decontamination and release of the Hot Cell.
- Surveying and releasing the classroom.
- Collecting five (5) additional soil samples on the east side of the building.

Building 3182 activities consisted of:

- Constructing a ventilated enclosure over the Military Police Museum rear doorway and adjacent interior surfaces.
- Gridding, surveying, and decontaminating the Military Police Museum.
- Core sampling underneath the building to ensure contamination had not leached into the foundation and/or soil.

Brokering

Final brokerage of the waste will be performed upon completion of the waste stream profile for Envirocare.

3.2 Organization and Responsibility

IOC Point of Contact	Mr. Mike Styvaert, Health Physicist
Fort McClellan Point of Contact	Mr. John May, Health Physicist
ATG Project Director	Mr. William Haney
ATG Project Manager	Mr. Frank Whitaker
ATG Project Health & Safety	Mr. Chad Becker
ATG Radiological Control Supervisor	Mr. Neal Whatley
ATG Corporate Health Physicist	Mr. Thomas O'Dou, Mr. Joel Cehn

3.3 Survey and Sampling Objectives

The purpose of the final surveys and soil samples was to demonstrate that the radiological conditions at subject areas of Fort McClellan satisfied Fort McClellan License criteria, U.S. NRC Regulatory Guide 1.86, 10 CFR 20, and NRC Memorandum "Evaluation of Acceptability of Proposed Decommissioning Activities", and, that these areas can therefore be released from licensing restrictions for future use without radiological controls. The specific objectives of the surveys and sampling were to show that:

3.3.1 Surface Activity of Buildings and Structures

Average surface activity levels of buildings and structures (total of both fixed and removable activity) are below guideline values established as acceptable by NRC and identified in Regulatory Guide 1.86.

Reasonable efforts have been made to clean up removable activity and that removable activity in any $100cm^2$ area does not exceed 20% of the average surface activity per Regulatory Guide 1.86.

3.3.2 Volume Activity of Soil and Building Materials

Average radionuclide concentrations of soil and building materials are at or below guideline values established as acceptable by the NRC. For land areas, averaging is based on a $100m^2$ (10m x 10m) grid area.

3.3.3 Exposure Rate

The gamma exposure at 1 meter above the ground surface shall not exceed 10 μR/hr above background for an area of greater than 30 feet by 30 feet and shall not exceed 20 μR/hr above background for any discrete area (i.e., less than 30 feet by 30 feet).

3.4 Instrumentation

A list of survey instrumentation and probes used during the Fort McClellan Project is provided in Table 1.

A combination of instrumentation and techniques were chosen to provide the best detection sensitivity. All instruments were calibrated on at least a six month basis, using NIST traceable standards. Operational and background checks were performed at least once per shift of instrument used. See Appendix H 'Daily Instrument Response Checks/Performance Log' for additional information.

3.5 Survey Procedures/References

Survey planning and procedures were performed in accordance with a Fort McClellan approved Detailed Work Procedure (Appendix A). This Work Plan was prepared from criteria delineated from the following references:

- U.S. Nuclear Regulatory Commission Division of Industrial and Medical Safety, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material (August 1987)".

- U.S. Army Technical Bulletin 43-0116, "Requisition, Handling, Storage, and Identification of Radioactive Material".

- NUREG/CR-2082, "Monitoring for Compliance with Decommissioning Termination Survey Criteria".
- NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination", Draft, June 1992.
- U.S. Code of Federal Regulations, Title 10, "Energy".
- U.S. Code of Federal Regulations, Title 29, "Labor".
- U.S. Code of Federal Regulations, Title 40, "Protection of the Environment".
- Allied Technology Group Health and Safety Plan, Fort McClellan.
- U.S. Nuclear Regulatory Guide 1.86.
- NRC Memorandum "Evaluation of Acceptability of Proposed Decommissioning Activities", from John W.N. Hickey, Chief Operation Branch, Division of Fuel Cycle, Medical, Academic and Commercial Use Safety to William E. Cline, Chief Nuclear Materials Safety and Safeguards Branch Region II, dated May 06, 1987.
- Fort McClellan, Delivery Order 0077.

Prior to working in and around any area at Fort McClellan, a prejob survey was performed to determine the levels of potential contamination that existed in the work area. Personnel performing the surveys were supervised by the ATG Radiological Controls Supervisor.

Results of the prejob surveys were used to assemble and issue a Radiological Work Permit (RWP) to accomplish the necessary work in specific areas. A copy of all project RWP's have been archived and stored in the project files.

A Quality Assurance survey was performed at the completion of remediation activities. Locations of elevated activity were decontaminated and re-surveyed. The Quality Assurance survey was conducted in accordance with NUREG/CR-5849. Smears and surveys were taken at the intersections of the grid lines.

Radiological Surveys of Fort McClellan areas are included as part of this report in:

Appendix J	Radiation Survey Reports
Appendix K	Air Sample Data and Analysis
Appendix L	Final Release Surveys - Tools, Equipment, Supplies, Miscellaneous Materials
Appendix M	Final Release Surveys - Classroom West Wall, North Wall, South Wall, East Wall, Trusses/Ceiling Beams, Ceiling, Floor
Appendix N	Final Release Surveys - Hot Cell Trench, Ledge, Walls, Tube Sheet, Manipulator Arms, Floor, Ceiling, Entry Way, and Exterior
Appendix O	Final Release Surveys - Building 3192 Office, Shower, Foyer and Air Conditioning Room
Appendix P	Final Release Surveys - Museum
Appendix Q	Quality Assurance Survey - FM-010

Included in each Radiological Survey Report is a detailed drawing of the survey site and identification of the survey points. Attached to each survey report is a Smear Counting Analysis Report that presents the results of field testing. Each Radiological Survey Report was subjected to Quality Control Oversight and has been "signed off" by an ATG Senior Health Physics Technician. Radiological Air Sampling Data Reports of work area activities are also included.

3.5.1 Reference Grids

Grids were established for the purpose of referencing locations of samples and measurements relative to buildings and other site features. Individual grid squares were sized one (1) meter by one (1) meter inside the buildings. Outdoor areas were gridded into one (1) foot by one (1) foot squares. The one (1) foot by one (1) foot grid was used to layout the outside ground area. This is more conservative than the ten (10) meter by ten (10) meter criteria established in CR-5849, 'Manual for Conducting Radiological Surveys in Support of License Termination'. This grid pattern was chosen to allow the systamatic use of 1 inch Nal detector (micro-R meters) in every square foot of space within the fenced area behind the Military Police Museum surrounding Building 3192, 'the Hot Cell and Classroom'.

3.5.2 Surface Scans

Ground and building surfaces were 100% direct scan surveyed in order to identify locations of residual surface and near-surface activity.

Building interior surface scans were conducted for alpha, beta, and gamma radiations. Soil surfaces were scanned for gamma radiation only.

Instrumentation for scanning is listed in Table 1. The instruments having the lowest detection sensitivity were used for scans wherever physical surface conditions and measurement locations permitted.

Scanning speeds were ½ detector width per second for beta detection instruments, and 0.5 m per second for gamma instruments.

3.5.3 Removable Surface Activity Measurements

Three (3) smears per grid were taken inside of the building.

3.5.4 Exposure Rate Measurements

A microR survey of the outside area grids was performed. Contact readings exceeding 5 μR/hr three (3) times the average background radiation levels were noted.

3.5.5 Soil Sampling

Soil was analyzed for cesium 137 and cobalt 60. Selected samples were also subject to TCLP testing.

Sub Surface

During the characterization, core samples were to be taken down to twelve (12) feet in the valve control pit area. Samples were only taken down to six (6) feet in the pit itself because of concrete in the area. Samples were separated into 3 feet, 6 feet, 9 feet, and 12 feet samples when possible.

In June 1996, four (4) "angled" soil borings were taken at the interface of the Military Police

Museum and the concrete apron on the south side of the museum. The samples were taken at depths of 1 foot, 2 feet, and 4 feet. The 4 foot sample was taken under the building foundation to determine if contamination had leached underneath the building.

Surface

Samples (about two kilograms each) of surface soil (2-6 inches) were collected. A microR survey was performed for each grid area. Particular attention was paid to areas with elevated microR readings. A minimum of four (4) samples were taken for every $100m^2$ (900 ft^2) of affected area. Samples were taken at the intersections of the three meter grid areas. A minimum of one (1) background sample was taken for every $100m^2$ (900 ft^2) of non-affected grid area. Samples were taken from grid area centers when possible. There were 112 confirmatory surface samples taken. Sample results were all below the guideline limits. There were 64 samples from affected areas and 48 from non-affected (background) areas.

3.5.6 Special Measurements and Samples

During the characterization, paint was analyzed for lead and tile was analyzed for asbestos. Sludge and water from the sewer manhole was subjected to Gamma Spectroscopy Analysis.

Ten (10) samples of lead shielding, paint, concrete, soil, rad trash, insulation, miscellaneous metals, mineral oil, tile, and mastic were subjected to Gamma Spectroscopy and TCLP analysis.

3.6 Background Level Determinations

Background exposure rates were measured with microR meters.

3.7 Sample Analysis

Smears for removable contamination were analyzed for gross alpha and gross beta activity. Soil samples were analyzed for cobalt 60 and cesium 137 by Gamma Spectroscopy.

3.8 Data Interpretation

Data conversions and evaluations were performed following the guidance in NUREG/CR-5849. Measurement data is in units of $dpm/100cm^2$ or cpm (surface activity), $\mu R/hr$ (exposure rates), and pCi/g (soil concentrations) for comparison guidelines. Values were adjusted for contributions from natural background.

Additional remediation and/or further sampling and measurements were performed where guidelines were not met.

3.9 Records

All original survey data has been archived at the ATG Oak Ridge office and will be held until such time as authorized for disposal. Soil samples remain at the laboratories that performed the analyses.

4.0 DESCRIPTION OF WORK

4.1 General

The Detailed Work Procedure, Radiological Remediation of Fort McClellan Hot Cell and Grounds (Appendix A), the Health and Safety Plan (Appendix B), and the Quality Assurance Plan (Appendix C) for Project Number USA 023-94, Delivery Order 0077 were drafted in the ATG Oak Ridge.

Tennessee office and submitted for approval. These documents were verified to be in conformance with the Basic Order Agreement (BOA) DAAA09-92-G-00037-0077. Comments were resolved and incorporated into the appropriate documents. These documents were approved by early November of 1995.

Remediation work commenced on November 6, 1995 and continued until December 21, 1995. Initial work consisted of the remediation of Building 3192, the Hot Cell and the grounds surrounding Building 3192 up to Building 3182 (Military Police Museum).

At this time, financial restraints and an expanded scope of work curtailed activities. Modification 1 was issued to include the remediation of the Military Police Museum, core drilling samples under the Museum and additional soil sampling on the east side of Building 3192. The sampling of eleven ground water wells was deleted from Modification 1.

Remediation work recommenced on June 24, 1996 and was completed on August 1, 1996. The radioactive waste generated by the remediation was sampled and the results of the samples weresent to Mountain States Analytical of Salt Lake City, Utah. The results of this sampling will allow the waste to be profiled and brokered into Envirocare, Inc. of Clive, Utah.

4.2 Site Health and Safety Plan

Field work performed by ATG was conducted in accordance with a site-specific Health and Safety Plan. This plan described the basic safety requirements for investigation, characterization, surveying, excavation, decontamination and decommissioning (D&D), sampling and analysis, and guideline limits for the release of subject building exterior areas.

The Health and Safety Plan was applicable to all ATG personnel performing work at the site. Subcontractor personnel working at the site were briefed on the contents of the Health and Safety Plan before being allowed to participate in any work activities. A reference copy of the Plan was kept on site at all times during project work activities. A copy of the site specific Health and Safety Plan is included in Appendix B.

Before excavations or digging, the Fort McClellan Department of Engineering and Housing (DEH) was contacted. Prints and records were researched to ensure that the excavation and/or digging would not disturb underground utilities, sewers, septics, or any other documented underground facility.

Any material suspected to contain asbestos was tested for asbestos content, or researched through Base Environmental Engineering. Asbestos content was confirmed in the floor tile and mastic of the Building 3192 classroom and the Military Police Museum. The floor tile of the classroom was not disturbed. The tile and mastic in the Military Police Museum was removed in accordance with the requirements of 29 CFR 1926 Section 1100.

4.3 Training

Upon arrival on the site, all personnel were briefed on the contents of the Health and Safety Plan along with the Detailed Work Plan and Quality Assurance Plan. This training was documented on the Daily Training and Safety Meeting Forms and is included in Appendix D 'Daily Training and Safety Meetings'. A Health and Safety Manager was appointed to ensure that all site activities were conducted in accordance with applicable OSHA and Allied Technology Group safety practices. This individual was also responsible for work activity oversight to ensure compliance to standard safety practices. Each morning, tailgate safety meetings were conducted to discuss general safety practices, any specific safety issues, and the scope of daily work activities.

All ATG personnel were verified to have documented current 40 Hour OSHA Hazardous Waste Operator (HAZWOPER) Training and current physicals in accordance with 29 CFR 1910.120. This

was also verified for subcontractors or other personnel who actually participated in site remediation efforts, before being allowed to commence work.

Subcontractors or other personnel who physically participated in site remediation efforts were also verified to meet these requirements before engaging in work activities.

4.4 Radiological Safety

Radiological controls consisted of, but were not limited to, contamination surveys, radiation surveys, air sample surveys, and posting boundaries of radiological work areas. Surveys of all affected materials and areas were performed to determine specific radiological conditions. All personnel on site performed work under the guidance and direction of a Radiation Work Permit (RWP).

The isotopes of concern were cobalt 60 and cesium 137. These are the only isotopes identified by NRC Correspondence on the subject of decommissioning these areas of Fort McClellan.

Airborne contamination concentration limits were set at 25% of the Derived Air Concentration (DAC) limit for the most restrictive isotope of concern on site (cobalt 60) as specified in 10 CFR 20, "Standards for Protection Against Radiation", Appendix B "Concentrations in Air and Water Above Natural Background". The DAC airborne concentration value was $9.0E^{-09}$ μCi/ml for Co^{60} and the concentration limit was set at $2.0E^{-09}$ μCi/ml.

Personnel working with or handling radioactive material provided separate entry and exit bioassay urine samples for the purpose of determining internal dose assessment of the individual. The laboratory analysis of these samples is provided in Appendix E, 'Bioassay Report'. No personnel showed any levels above the detection limits of the two isotopes of concern.

All personnel working with or handling radioactive materials were also issued TLDs (thermoluminescent dosimeters) for the purpose of determining the external dose received while conducting project activities. No substantial whole body dose was anticipated as the original characterization surveys had shown the highest dose rate to be 290 μR/hr. Cobalt 60 and cesium 137 are strong gamma emitters and thus easily detected. The dose received for this project was 0.000 person-rem. The documentation for the results of the whole body monitoring program are contained in Appendix F, 'Dosimetry Report'.

The following guideline for acceptability of activities for decommissioning are restated here, based on Nuclear Regulatory Commission guidance in a memo from John W.N. Hickey, Chief Operations Branch, Division of Fuel Cycle, Medical, Academic and Commercial Use Safety to William E. Cline, Chief Nuclear Materials Safety and Safeguards Branch Region II on the subject of "Evaluation of Acceptability of Proposed Decommissioning Activities (for Fort McClellan, Alabama, facility) dated May 06, 1987.

External Radiation

The gamma exposure at one (1) meter above the ground surface shall not exceed 10 μR/hr above background for an area of greater than 30 feet by 30 feet and shall not exceed twenty 20 μR/hr above background for any discrete area (i.e., less than 30 feet by 30 feet).

Sample Contamination Levels

Concentration criteria developed for cobalt 60 and cesium 137 for situations in which subsurface contamination may be present, such as when burials of material have been made.

Radionuclide	Concentration Limits Above Background (pCi/gm)
^{60}Co	8
^{137}Cs	15

Where more than one radionuclide is present, the sum of the ratios of the individual radionuclide concentrations to their respective concentration limits shall not exceed one (1).

All material, tools, and equipment involved in the remediation of the site were surveyed and released in accordance with the criteria of Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors".

All building and external grounds were surveyed in accordance with the guidance of Regulatory Guide 1.86, the NRC Guidance Correspondence dated 05/06/87, and the criteria of CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination".

4.5 Remedial Actions

November/December 1995

Two (2) sea-land containers were delivered by the Army Industrial Operations Command (IOC) prior to arrival of ATG personnel on site. The contents of these sea-lands consisted of 160 drums, automotive repair tools, a 2000 CFM HEPA (High Efficiency Particulate Absorbent) unit, and assorted tools and equipment. These sea-lands had been stocked by and shipped from the Defense Consolidation Facility (DCF), Barnwell, South Carolina. Radiological surveys were conducted of all tools, drums, and equipment. Some of the drums showed small amounts of internal contamination. These items were to be used in the remediation of the site.

An initial crew of seven (7) personnel arrived on site November 06, 1995 to stage the site prior to the arrival of the rest of the crew the following week. The requirements of 29 CFR 1910.120 were met by all individuals comprising the ATG crew. Training for the initial crew was conducted on the Fort McClellan Detailed Work Plan, Health and Safety Plan, and Quality Assurance Plan. TLDs were issued to the crew. Bioassay urine samples were obtained. Initial contact was made with John May, Fort McClellan Base Radiological Safety Officer (RSO) and Sgt. Kenneth Baugh. The office trailer was delivered by G.E. Modular, Montgomery, Alabama. Electricity was hooked up to the trailer and to a 2000 CFM HEPA unit by Fort McClellan Department of Environmental and Housing (DEH) electricians.

Clean up commenced in Building 3192. Any loose, unnecessary material or equipment in the building was surveyed and released from the building. The access walkway was cleaned off. Contaminated material was placed in a B-25 box left on site by Chem Nuclear Systems, Inc. during their initial 1983 through 1985 characterization and remediation. The outside grass, which was waist high, was cut back around the area. All loose material in the field outside of Building 3192 was picked up. Chairs were unbolted, surveyed and removed from the Building 3192 classroom.

A sample was obtained from the west manhole sewer to analyze gross activity. This sewer was the discharge point for the Building 3192 waste process and holding tanks and had shown contamination above the release limits in previous surveys. This sample was sent to Thermonuclear Laboratories in Albuquerque, New Mexico for analysis. The results of this sample showed activity below the guideline limits. The west sewer and surrounding soil was still removed and disposed of because of previous sample and survey results.

The General Radiation Work Permits for the site, FM-001, Pre-Job Characterization and FM-002, General Entry, were written. These RWPs allowed initial work to ≤10,000 DPM/100 cm^2 (see Appendix G 'RWP Log/Radiation Work Permit'), to begin. A general survey was performed of Building 3192, the outside grounds, the concrete apron and pad, the back of Building 3192, and the Military Police Museum exterior. Higher general area dose rates were noted in the back (south) of the museum. The walls of these buildings also showed higher dose rates. Surveys of other buildings showed that this phenomena is due to the natural thorium in the building brick and mortar. The results of these surveys are documented in Appendix J, 'Radiation and Contamination Survey Reports'.

An additional crew of thirteen (13) reported to work on Monday, November 13, 1995 for a total of twenty (20) personnel on site for this first phase of the remediation. The requirements of 29 CFR 1910.120 were met by all individuals. Training was conducted on the Fort McClellan Detailed Work Plan, Health and Safety Plan, and Quality Assurance Plan. TLDs were issued and bioassay urine samples were obtained. The ATG crew worked until Saturday, December 21, 1995 when a lack of funding caused the project to be suspended. Upon exit of these individuals, all TLDs were collected and read. Bioassay urine samples were collected for radiological analysis.

June/July 1996

An ATG crew of eighteen (18) arrived on site June 24, 1996 and worked until August 1, 1996. OSHA requirements for training and medical certification were verified in accordance with the requirements already specified. TLDs were issued and retrieved from these personnel and entry and exit bioassay urine samples were obtained and analyzed for internal radiological ingestion/inhalation.

B-25 and B-12 boxes were shipped to Fort McClellan to support the remediation effort. Eventually fifteen (15) B-25 boxes and forty-five (45) B-12 boxes would be obtained and shipped to the site. One (1) B-25 box remained from a previous Fort McClellan remediation.

This report is written for each remediation area. The events of remediation will be written in one time line although there were two phases to the work effort.

4.6 Building 3192 Hot Cell, Classroom, Office, Shower, Foyer, and Air Conditioning Room

All removable items were surveyed and released. This included drums, miscellaneous materials and trash. The manipulator arms from the Hot Cell were disassembled and released. The classroom chairs were unbolted, surveyed, and released from the area. An area outside of the classroom was surveyed and prepared as a laydown area.

Scaffolding was set up to remove the ceiling tile (non-asbestos per the Base). RWP FM-102, Overhead in Bldg. 3192, was in place during the removal of the false ceiling overhead, bracing, supports, framework, and other components of the ceiling. Lee Jaye of Fort McClellan Environmental Engineering was contacted to verify that this ceiling had been sampled (along with 200 other ceilings) and verified not to contain asbestos. The false ceiling, supports, and framework were surveyed and released.. Six hundred sections of tile were removed, surveyed (by surface scans and smears), then released.

RWP FM-103, Duct Work Removal, was created for the removal of the ductwork in the overhead. Respirators and full protective clothing were required for the initial cuts of the duct work. Negative ventilation of the system was achieved with HEPA units. Contamination was not found in the initial cuts. After several sections were cut and the absence of contamination was established, respirator requirements were dropped. All duct work above the classroom, associated supports, and framework was removed, surveyed and released.

Activities then moved into the Foyer area between the Hot Cell and the Classroom where work to remove, survey and release all ductwork continued. Finally, all ductwork and equipment such as the

Air Conditioning and Refrigeration Unit were removed, surveyed and released (with the exception of ventilation ductwork to the Hot Cell). Insulation from the duct work was disposed of as radioactive material in the staged B-25 and B-12 boxes.

The air conditioning and air handling unit was vented and contained by a local contractor, Pyramid Mechanical. The unit had little or no residual refrigerant. The unit was disassembled, surveyed, and released.

An enclosure was built on the concrete apron to stage the Hot Cell Door. This enclosure was wood framed and wrapped with heavy duty, all weather plastic for weather proofing. Railroad ties were set up to support the Hot Cell Door, an 8' x 7' x 3' solid steel and concrete structure whose overall weight is estimated at 5 tons. All accessible areas of the Hot Cell Door and the trough (the railing on which the door rides) were decontaminated prior to removing the door. A section of the Building 3192 east wall, large enough to remove the Hot Cell Door, was removed with jack hammers. The Hot Cell Door was opened as much as possible and the electrical wire was disconnected. A local crane company, Model City Erection, was contracted to pull the door outside of the building (a four wheel drive, heavy duty forklift was used). Once outside the building, a crane was used to lift the Hot Cell Door to its final resting place on the concrete apron. The weather proof enclosure was placed over the door. The door was then completed deconned, surveyed and released. The outside wall of the building was temporarily closed with weather proof material. The crane and forklift were surveyed and released from the site. The inaccessible areas of the hot cell door were remediated inside the enclosure after the hot cell door had been set. The entire area was then surveyed for release in accordance with the criteria of Regulatory Guide 1.86.

The rail trench line that the hot cell door had operated on was deconned. In order to complete the decon of this trench area part of the rails had to removed.

The vent ducting leading into the hot cell was removed and disposed of in the staged B-25/B-12 boxes. The vent ducting had contamination levels in the range of 120,000 ccpm (corrected counts per minute) on contact. The manway covers on top of the hot cell was removed and disposed of. There were two (2) hot cell rings which were made of steel and set into the concrete of the hot cell ceiling. These rings had imbedded contamination. The rings were jack hammered out of the concrete. Once the rings were jack hammered out of the concrete they were hoisted by come-a-longs and lowered into B-25 boxes for disposal.

The rings for the manipulator arms were deconned. These were located on the top part of the hot cell. The east transfer tube cover was removed and disposed of as radioactive waste. This transfer tube was deconned. The west transfer tube cover and tube were deconned, surveyed, and released in place.

The overhead trolley in the hot cell was removed. This item was disposed of as radioactive waste. The tracks for the trolley were removed and deconned or disposed of as radiaoctive waste.

The paint on the walls of the hot cell and ceiling were painted with lead paint which was impregnated with cobalt 60 contamination. Safe-T-Lead Strip made by I.P.C. (International Products Corporation) was used to remove the lead paint. This product was very successful and did not create any airborne contamination while removing the lead. All personnel were monitored and wore protective clothing in accordance with the requirements of 29CFR1926.62 'Lead'. This lead was seperated from the rest of the radioactive waste as this was 'mixed waste'. Residual contamination still existed under the lead paint in the concrete of the walls and ceiling. This contamination had to be removed by jack-hammering.

The final release survey of the building was conducted. The classroom, the office area, the shower, the foyer, the air conditioning room, and the hot cell (floor, ceiling, and walls) was gridded out in one yard (three feet) by one yard grids. This was more conservative than the one meter grids recommended by CR-5849, 'Manual for Conducting Radiological Surveys in Support of License

Termination'. The criteria as defined in CR-5849 was followed and is detailed in section 3.5 of this report. Areas were worked in parallel with other remediation activities in the building. The first area surveyed and released was the classroom and overhead, then the area between the classroom and the foyer of the building (some interference--wood partitions had to be removed in this area) and then the foyer, office, shower, entrance, air conditioning room, and finally the hot cell area. All areas surveyed in the final release surveys were below the guideline limits. Trench areas in the hot cell, foyer, air conditioning room, and shower were sampled and analyzed for activity. These samples were below the guideline limits.

The leaded glass shield windows were removed from their casing in the south wall of the hot cell. These window casings were jack-hammered out and the windows pushed out. There were three (3) seperate glass sections seperated by mineral oil between each section. The mineral oil was drained into a 55-gallon drum prior to the removal of the lead shield windows. Each window section weighed approximately 500 pounds. Leaded glass windows showed no smearable contamination but had 300 ccpm fixed contamination. This appears to be natural radioactivity from thorium. These leaded glass windows were labeled as radioactive material and turned over to the Fort McClellan Radiological Safety Officer, John May. The mineral oil and water mixture that had existed between each of the window sections was sampled and sent out for analysis.

The drain piping which ran from floor drains in the building, the old sink room, the heating and ventilation room, the hot cell, and the hot cell trench area was the next area to be remediated. This drain piping was removed by jack-hammering. The drain piping was three (3) to six (6) inches below the floor of the hot cell. The concrete in the hot cell area was high density, and thicker than the concrete in the foyer area of the building. The drains of the drain piping read 150 μR/hr. The piping itself was contaminated from 75 μr/hr. to 800 μR/hr. This piping was removed in the building and placed into B-12/B-25 boxes. This piping was removed up to the north wall. The piping outside of the building will be discussed in a seperate section. Ground water seeping into the excavation area often interfered with work in this area and caused significant delays.

The source tubes were used to store sources during the operational days of the hot cell. These tubes were steel shells, approximately six (6) to eight (8) inches in diameter set into concrete with a steel cover plate over the concrete. There were twenty (20) source tubes in a four (4) by five (5) array. The source tubes ranged from twenty-four (24)" deep to fifty (50)" deep. The source tubes were contaminated from 150 ccpm to 1500 ccpm. These tubes were deconned by mechanical agitation. A wire wheel on a drill was used to abraid the surface of the tubes to removed the contamination. Survey and release of these tubes was performed with a 2" x 2" Nal tube. The tops of the tubes were a concrete and lead cap matrix. These caps were surveyed and removed from the hot cell and placed into the steel drum containing the lead paint, due to the lead and radioactive contamination for separate disposal. The steel cap over the top of the source tube could not be decontaminated using decon solutions and wipe down. The cap was removed with a gas torch, surveyed, and placed into a radioactive shipping container. The top of the concrete block that the source tubes were imbedded in had contamination on the top of the block. The residual contamination on top of the concrete was removed by the use of a jack-hammer, scabbling, and wipe down decontamination. The concrete block and source tubes were surveyed and released in the final release survey of the hot cell.

The remaining contamination in the walls, floor, and ceiling of the hot cell (following the lead paint removal) was removed by jack-hammering, scabbling, and wipe down decontamination. Scaffolding was constructed to reach higher, inaccessible areas of the hot cell. All entrys to the hot cell were sealed during jack-hammering and negative ventilation was maintained on the hot cell. Particulate airborne activity was mitigated by water misting. A preliminary release survey of this area was performed. Several area had to be remediated (jack-hammered and scabbling)again due to imbedded contamination.

4.7 Building 3182 - Military Police Museum

During the initial characterization, radiological activity was detected in the back of the Military Police Museum. This activity seemed to be localized on the east doorway of the building. The area was sampled and a gamma spectroscopy analysis was performed which identified that the predominant isotope in this area was cesium 137. Surface scans of the door sill and area just inside of the doorway of the east area showed radiation levels as high as 130 μR/hr.

In June of 1996, four (4) angled soil borings were taken at the interface of the Military Police Museum and the concrete apron on the south side of the Museum. the samples were taken at depths of 1 foot, 2 feet, and 4 feet. The 4 foot samples were taken under the building foundation to determine if contamination had leached underneath the building. The results of these depth samples analyses did not detect any activity above the guideline limits.

Prior to performing any work, the Museum was surveyed for background contamination levels. After the work in the Museum, this sampling was repeated. No detectable increase of activity was detected in this area, confirming that the integrity of the enclosure tent had been maintained.

The affected floor area was first exposed by removing and rolling back the overlay carpeting. The area just inside the Museum adjacent to the east doorway was initially isolated from the rest of the Museum by erecting a tent enclosure. This tent enclosure was erected with plastic sheeting and guy wire. The tent enclosure was built to enclose an area of approximately 10' by 18'. The tile floor of the Museum and the mastic (glue) was sent out for analysis. The sample was analyzed by the engineering group of Fort McClellan DEH. The floor tile had no detectable asbestos but the mastic was confirmed to be 3% ACM (asbestos containing material). The area was set up and asbestos trained personnel removed the mastic and tile with a solvent in accordance with the requirements of 29CFR section 1101.

Upon removal of the tile and mastic, the area was gridded and surveyed. The anomolies in the area were predominantly adjacent to the east door and along a slight trench on the west wall of the area. Remediation of the area was performed by scabbling and jack-hammering.

Upon completion of the remediation effort, the tent and associated equipment were removed and surveyed for release in accordance with Regulatory Guide 1.86. The affected floor area and the west wall area were gridded and release surveys were performed in accordance with CR-5849.

The area behind the M.P. Museum east doorway was found by survey and sampling to contain cesium 137 contamination above the guideline limits. This area was covered in part by the concrete walkway leading to the east doorway. This concrete walkway was jackhammered, removed, surveyed, and released. The soil underneath and adjacent to this area was removed and placed into B-12 boxes. Subsequent sampling of this area showed cesium 137 levels to be below the guideline limits. This area was subsequently gridded along with the entire outside area, and surveyed to confirm guideline limits had been met.

4.8 Storm Drains and Sewers

During the initial characterization conducted in November 1994, two (2) samples were taken from the west sewer manhole. These samples were one water sample and one sludge sample. The water sample was found to contain cesium 137 in excesss of guideline limits and the sludge sample was found to have cobalt 60 contamination in excess of the guideline limits.

In November and December of 1995, during the final remediation effort, three (3) samples of the concrete, sludge, and soil were taken from the storm drain northwest of Building 3192, the storm drain west of Building 3192, and the sewer in the street of Building 3181 (downstream of the west storm drain by Building 3192). The sample results were below the guideline limits. Three (3) soil samples

were taken in the west sewer area. Sample results were below the guideline limts. One (1) soil samples was taken by the sewer outlet and found to be below guideline limits.

Although the samples taken at this time were within the guideline limits, the presence of detectable contamination in the west storm sewer, and the positive samples detected in the initial characterization effort justified the removal of this storm drain. The storm drain was then excavated by backhoe and placed into a B-25 box. A confined space entry had been planned for this area but by removing the storm drain this was not necessary. Upon the removal and disposal of the storm drain, surveys and samples of the soil and exit drain piping did not show the presence of any radioactivity above the established release criteria.

The entry piping into the storm drain was excavated and disposed of as radioactive material. The entry drain only ran approximately 10 feet toward the valve control pit and tank area. This area had been remediated previously by Chem-Nuclear personnel and by base personnel under the direction of Greg Komp, the Radiological Safety Officer at that period.

This area was then filled in with soil. The area was then gridded and surveyed and sampled for release as detailed in section 4.9, 'Outside Grounds'. Cobalt 60 and cesium 137 activity was confirmed to be below guideline limits with the rest of the outside area during the final release survey in accordance with the guidance of CR-5849.

4.9 Outside Grounds

Based on the original characterization sampling results from Chem-Nuclear Corporation performed in 1983, and subsequent resampling performed in 1994 by Allied Technology Group, soil was remediated from the southern boundary of the concrete apron, on both sides of the walkway, and on the southern side of the roadway leading into the enclosure area. (See Appendix R, 'Original Characterization Gamma Spectroscopy'). A trench of approximately 1 foot wide by 1 foot in depth was excavated from this area. Samples were taken in each grid quadrant (grid quadrants were established as 10 feet by 10 feet). All samples results were below the release limits outlined in section 2.5 of this document and are provided in Appendix T, 'Laboratory Sample Results - Soil'.

As detailed in Section 4.8 ('Storm Drains and Sewers') of this report, samples were taken of the excavated area following the removal of the west storm drain and sewer. The excavated soil from this area was sampled following the removal of the storm drain, sewer brick, and related material. Upon receipt of certified laboratory results which confirmed Co^{60} and Cs^{137} levels below the established NRC criteria limits, the area was filled back in and a grid pattern established for final release surveys.

The entire fenced-in enclosure behind Building 3182 (Military Police Museum), was gridded in a pattern of ten (10) foot by ten (10) foot squares. An alpha-numeric nomenclature was used to uniquely identify each grid square. The alpha nomenclature ran in a north to south direction while the numeric nomenclature ran in an east to west direction. A one (1) inch by one (1) inch NaI detector (micro-R meter) was placed in an array of ten instruments and each square foot of the ten (10) foot by ten (10) foot pattern within the fenced confined area was surveyed and the associated alpha-numeric location and dose rate was documented. A one meter general area survey was performed in each grid area. A quality assurance survey was performed at the intersection of each grid pattern. These quality assurance surveys are documented in Appendix Q, 'FM-010, 'Outside Area Surveys' and 'Quality Assurance Surveys'.

Four random samples were taken outside of the fenced area in the north, south, east, and west pattern. The results of these samples showed no detectable levels of Cs^{137} or Co^{60}. A minimum of four (4) samples were taken in every ten (10) meter by ten (10) meter grid pattern of the affected area in accordance with the requirements of CR-5849, 'Manual for Conducting Radiological Surveys in Support of License Termination'. Any anomalies identified in the survey (three times background) were sampled, otherwise the samples drawn were in a random patten within the grid. Three 10 foot

by 10 foot grids are approximately a 10 meter by 10 meter grid. More extensive sampling was performed around the concrete apron, on both sides of the walkway, on the south side of the roadway, in the back of the Military Police Museum, Building 3182, and around the Hot Cell and Classroom, Building 3192. Five additional samples were obtained from Chem-Nuclear which defined grids E-48-E52, E35-E39, and E22-E26 on the southwest side of the Hot Cell and Classroom, Building 3192 per the work scope to ensure the path of the plume from the Hot Cell had not contaminated this area. Any samples which exceeded the limits for Cs^{137} of 15 pCi/gram above background and for Co^{60} of 8 pCi/gram above background (as detailed in Section 2.5) were further remediated and then sampled following the remediation to ensure that the area fell within the release criteria. The outside area grid surveys and documentation are shown in Appendix Q, FM-010, 'Outside Area Surveys' and 'Quality Assurance Surveys'. The sample results are shown in Appendix S, 'Laboratory Sample Results-Storm Drain, Liquid Sample form Hot Cell Window and Appendix T, 'Laboratory Sample Results-Soil'.

4.9 Generated Waste

During the remediation of the Building 3192 Classroom and Hot Cell, Building 3182 Military Police Museum, and Outside Grounds, radioactive waste and some mixed hazardous waste was generated. This waste was placed into strong tight containers either as B-25 boxes (96 cubic feet), B-12 boxes (48 cubic feet) or 55-gallon drums (7.5 cubic feet). This radioactive waste was in the form of contaminated soil, concrete, insulation, wood, piping, lighting materials, brick, radioactive trash, HEPA filters and material, HEPA vacuum material, and miscellaneous material (electrical material, tools, etc.). The mixed hazardous material was in the form of contaminated lead. This lead was matrixed lead (lead and concrete which had formed the top of the source tubes) and lead paint removed from the hot cell walls during decontamination and remediation.

Sixteen (16) B-25 boxes, forty-five (45) B-12 boxes, and a 55-gallon drum were staged, filled, surveyed and labeled, documented, and prepared for shipment at Fort McClellan. (See Appendix V, 'B-12 and B-25 Status Log'). The volume of waste generated was approximately 3500 cubic feet and the total weight was 220,050 pounds. This waste will be resorted and prepared for shipment to Envirocare, Inc. of Utah at a later date. Following the shipment, an addendum report will be issued to supplement this report.

The mixed hazardous waste consisting of a B-25 box of contaminated lead waste will be prepared and shipped to NSSI/Sources and Services, Inc. in Houston, Tx. for processing and disposal.

5.0 SUMMARY

5.1 Laboratory Analysis Results

During the initial characterization conducted in November of 1994, a total of fifty-eight (58) samples were taken. Twenty-one (21) samples were taken in November and December of 1995. In June and July of 1996, forty-seven (47) samples were taken during the execution of the remediation. Ten (10) samples were taken to profile the waste streams. Finally, one-hundred and twenty-six (126) confirmatory and background samples were taken. All samples were analyzed for cobalt 60 and cesium 137 unless otherwise stated. Copies of the Certified Analytical Results for all samples are included in:

Appendix R	Original Characterization Gamma Spectroscopy
Appendix S	Laboratory Sample Results - Storm Drain, Liquid from Hot Cell Window
Appendix T	Laboratory Sample Results - Soil

5.1.1 Building 3192 Classroom

- November 1994: One (1) sample of paint from the classroom walls was analyzed for lead and radioactive materials. The presence of lead was confirmed on the hot cell walls and ceiling in the form of lead based paint. The scope of these work activities was to remove only the amount of lead necessary to lower the contamination levels in these areas to those levels that meet the criteria for release. The classroom floor tile and mastic was tested for asbestos. Asbestos content was between 1% and 5%. The floor tile and mastic were left in place.

- November / December 1995: No samples were taken in the classroom during this time period.

- June / July 1996: No samples were taken in the classroom during this time period.

5.1.2 Building 3192 Hot Cell Interior and Exterior

- November 1994: One (1) sample of paint from the Hot Cell walls was analyzed for lead and radioactive contamination. The presence of lead and cobalt 60 in excess of guideline limits was confirmed. This paint was removed during the remediation and will be disposed of at Nuclear Sources and Services, Inc.

- November / December 1995: One (1) sample of a mineral oil and water mixture was taken from the Hot Cell window. The presence of cobalt 60 and cesium 137 in excess of guideline limits was confirmed. The oil was drained into a 55 gallon drum and remains for brokerage.

- June / July 1996: Eight (8) soil samples were taken in various areas around the Hot Cell drain piping. Analysis results were below guideline limits for both cobalt 60 and cesium 137. Four (4) confirmatory soil samples were taken inside the Hot Cell and one (1) confirmatory soil sample was taken outside of the Hot Cell doorway. Sample results were below guideline limits.

5.1.3 Building 3192 Office, Shower, Foyer, and Air Conditioning Room

- November 1994: No samples were taken during this time period.

- November / December 1995: No samples were taken during this time period.

- June / July 1996: Five (5) soil samples were taken from areas around various building drains. Analysis results were below guideline limits for both cobalt 60 and cesium 137 for four (4) of the samples. A soil sample taken from an area surrounding the outside portion of the clean shower drain line contained cobalt 60 in excess of guideline limits. The drain line and surrounding soil was removed. Five (5) confirmatory soil samples were taken in various sections of Building 3192. Sample results were below guideline limits.

5.1.4 Building 3182 - Military Police Museum

- November 1994: No samples were taken during this time period.

- November / December 1995: No samples were taken during this time period.

- June / July 1996: Six (6) concrete samples were taken. Four (4) samples from the floor were found to contain cesium 137 in excess of guideline limits. One (1) sample of grout also contained cesium 137 in excess of guideline limits. These areas were scabbled and chiseled out. One (1) background sample was taken. The sample result was below the guideline limits.

5.1.5 Storm Drains and Sewers

- November 1994: During the initial characterization, one (1) water sample and one (1) sludge sample were pulled from the west sewer manhole. The water sample contained cesium 137 in excess of guideline limits. The sludge sample contained cobalt 60 in excess of guideline limits.

- November / December 1995: Three (3) samples of concrete, sludge, and soil were taken from the storm drain northeast of Building 3192, the storm drain west of Building 3192, and the sewer in the street near Building 3181. Sample results were below guideline limits. Three (3) soil samples were taken in the west sewer area. Sample results were below guideline limits. One (1) soil sample was taken by the sewer outlet and was found to be below guideline limits.

- Although sample results were below limits, the west sewer and surrounding soil was removed because of the initial characterization sample results, and surveys conducted during this time period.

- June / July 1996: No samples were taken during this time period.

5.1.6 Outside Grounds

- November 1994: A total of fifty-three (53) soil samples were taken to initially characterize the outside grounds. Thirty (30) core samples were taken. Core samples were taken in the tank and valve control pit area down to a depth of twelve (12) feet when possible. Two (2) of these samples were above background limits for both cobalt 60 and cesium 137. Twenty-three (23) surface samples were taken. Three (3) samples were above the guideline limit for cesium 137. Three (3) samples were above the guideline limit for cobalt 60.

- November / December 1995: A total of thirteen (13) confirmatory soil samples were taken after excavation/remediation. Twelve (12) samples were from the surface and one (1) was taken at a depth of three (3) feet. All of these samples were below guideline limits. Soil was removed from the entire perimeter of the Military Police Museum, the sidewalk between the Museum and Building 3192, and the portion of the driveway inside the fence. This particular scope of work was based on surveys, the characterization samples, and historical data from previous Chem-Nuclear activities. Soil was also removed around the piping that was excavated and removed.

- June / July 1996: A total of twenty-seven (27) samples were taken to support the execution of this portion of the project. One (1) solid sample was pulled from a drum and was below guideline limits. The remaining samples were soil. Four (4) samples were pulled from the previously excavated trench to confirm that there was no migration of contamination. These samples were below guideline limits. Another four (4) samples were taken for confirmation of background activity. These samples were also below guideline limits. Two (2) samples were taken outside of Building 3192. One (1) sample was below guideline limits and one (1) sample was over the limits for cobalt 60. This area was excavated after receipt of the sample analysis.

  Sixteen (16) soil samples were taken to support the remediation of the Military Police Museum exterior grounds. Two (2) of these samples were in excess of guideline limits for cesium 137. These areas were excavated after receipt of the sample analysis.

  One hundred and twelve (112) confirmatory soil samples were taken at the completion of remediation activities. Sample results were below guideline limits. Four (4) background samples were taken outside of the fence. Sample results were also below guideline limits.

  In addition, ten (10) composite samples from the B-25 boxes were subjected to TCLP and Gamma Spectroscopy analysis. The waste streams were comprised of oil, paint, concrete, soil,

lead, tile, mastic, insulation, and miscellaneous metals and trash. This full profile analysis was done to characterize the waste for final disposal at Envirocare.

At the request of the sample laboratory, Mountain States Analytical, the waste streams were re-sampled in November 1996. Previous samples of lead paint, mastic, tile, and the miscellaneous metal samples were of insufficient volume for a complete analysis. The re-samples were drawn with sufficient volume to successfully run the required analysis. This resampling was done to avoid problems with disposal into Envirocare.

Results of this re-sampling effort confirm the presence of methylene chloride in the lead paint and tile/mastic samples.

5.2 Survey Results

Copies of all November/December 1995 and June/July 1996 surveys are included in this report as:

Appendix J	Radiation Survey Reports
Appendix K	Air Sample Data and Analysis
Appendix L	Final Release Surveys - Tools, Equipment, Supplies, Miscellaneous Materials
Appendix M	Final Release Surveys - Classroom West Wall, North Wall, South Wall, East Wall, Trusses/Ceiling Beams, Ceiling, Floor
Appendix N	Final Release Surveys - Hot Cell Trench, Ledge, Walls, Tube Sheet, Manipulator Arms, Floor, Ceiling, Entry Way, and Exterior
Appendix O	Final Release Surveys - Building 3192 Office, Shower, Foyer and Air Conditioning Room
Appendix P	Final Release Surveys - Museum
Appendix Q	Quality Assurance Survey - FM-010

Initial characterization surveys were included in the Interim Report and not included in this Final Report. The surveys included in Appendix J, 'Radiation Survey Reports', cover a wide range of project activities.

5.2.1 Building 3192 Classroom

- November/December 1995: Five (5) surveys were to facilitate the remediation of the east wall, ceiling tile (non-asbestos), work in the overhead, and the free release of ductwork. Six (6) final release surveys were performed to release the north wall, east wall, south wall, west wall, floor, and ceiling of the classroom.

- June/July 1996: Three (3) Final Release Surveys were performed to release the trusses, upper and lower beams, and ceiling stack vent. One (1) QA Free Release Survey of the entire classroom was performed.

5.2.2 Building 3192 Hot Cell Interior and Exterior

- November/December 1995: Twelve (12) surveys were performed to facilitate remediation of the Hot Cell interior/exterior and to release the Hot Cell roof and door.

- June/July 1996: Eighteen (18) surveys were performed to facilitate remediation of the Hot Cell interior/exterior. This included pipe removal, jackhammering, scabbing, and soil sampling. Sixteen (16) Final Release Surveys were performed to release the trench, ledge, walls, tube sheet,

manipulator arms, floor, ceiling, entryway, and exterior. Four (4) QA Free Release Surveys of various Hot Cell areas were performed.

5.2.3 Building 3192 Office, Shower, Foyer, and Air Conditioning Room

- November/December 1995: Four (4) surveys were performed to facilitate release of air handling equipment.

- June/July 1996: Two (2) surveys were performed to smear drains and determine pre job conditions in the air conditioning room. Twenty-eight (28) Final Release Surveys were performed to release the office, shower, foyer, and air conditioning room.

5.2.4 Building 3192 Drain Piping Removal

- November/December 1995: No surveys were performed during this time period.

- June/July 1996: Five (5) surveys were performed to support removal of the drains and piping.

5.2.5 Building 3192 Verification Survey

- In July 1996, a verification survey of the interior of Building 3192, with the exception of the Hot Cell, was performed.

5.2.6 Building 3182 Military Police Museum

- November/December 1995: No surveys were performed during this time period. However, a 110 μR/hr hot spot on the concrete in the doorway of the museum was detected.

- June/July 1996: Thirteen (13) surveys were performed to facilitate the remediation of the Military Police Museum. One (1) Final Release Survey was performed. One (1) QA Free Release Survey of the Museum was performed at the end of the job.

5.2.7 Storm Drains and Sewers

- November/December 1995: One (1) survey of excavated piping (inside) was performed to support drain and piping removal.

- June/July 1996: No surveys were performed during this time period.

5.2.8 Outside Grounds

- November/December 1995: No surveys were performed during this time period.

- June/July 1996: Seven (7) surveys were performed to determine if radon was present in sample holes to measure soil and concrete dose rates for comparison against guideline limits, and to document soil sample locations.

5.2.9 Quality Assurance Survey - July 1996

To ensure that the outside grounds were remediated to applicable guideline limits, a Quality Assurance Survey was performed. The first part of the survey consisted of taking a surface dose reading, and a one (1) meter dose reading at 158 survey points (316 readings). These readings were taken at the intersections of every 2 grids (400 ft^2).

The next part of the Quality Assurance Survey consisted of individual grid (100 ft^2) surveys. Ten (10) microR meters were attached to a plank, background readings for each meter were recorded, and 100 surface scan readings were taken in each grid (sub-grids being 1 ft^2). Approximately 50,000 readings were taken and recorded. If an individual reading was in excess of three (3) times the established background reading. it was considered an anomaly. Six (6) anomalies were identified. Soil and/or concrete was sampled, then excavated in the area of the anomaly. This area was then resurveyed to determine if guideline limits were met. If they were not, the area was further excavated and resampled until guideline limits were met. Twelve (12) soil/concrete samples were taken as a result of the Quality Assurance Survey. One of these samples was found to contain 60.4 pCi/g of cesium 137. This area was again excavated and surveyed.

Confirmatory soil and concrete sampling overlapped the QA Survey. Confirmatory samples were drawn from area that were already dispositioned by the QA Survey.

5.2.10 Various Releases

Unconditional Release Surveys are used to free release items for unrestricted use in accordance with Regulatory Guide 1.86. Items such as tools, heavy equipment, and scaffolding are typically wiped down (if necessary) and surveyed to document that free release criteria has been met.

Additionally, items that are removed during remedial activities are free released when possible. These items may have removable activity or no activity. For example, the classroom chairs, Hot Cell manipulator arms, drop ceiling components, electrical components, and the Hot Cell Door from Building 3192 were free released.

Finally, to document that remediation efforts were successful, a Free Release Survey of affected buildings and grounds are performed to document that guideline limits have been met. This was previously discussed in this report.

Conditional Release Surveys are used to document the radiological conditions of an item that does not meet the free release guidelines. Glass blocks from the Hot Cell were not free released. Shipping containers (i.e., B-12 boxes, B-25 boxes, 55 gallon drums) are also subject to a conditional release. In this case, the conditional release documents that shipping and burial requirements for contamination and dose rates have been met. (See Section 5.2.11, Releases For Shipping and Disposal).

- November/December 1995: A total of thirteen (13) Conditional and Unconditional Release Surveys were performed during this time period.

- June/July 1996: Thirty-nine (39) Unconditional Release Surveys were performed during this time period.

5.2.11 Releases for Shipping and Disposal

- November/December 1995: A total of forty-seven (47) Conditional Release Surveys for shipping and disposal were performed. Forty-six (46) B-12 and B-25 boxes were surveyed. In addition, a 55 gallon drum of lead paint chips (removed from the Hot Cell) was surveyed.

- June/July 1996: Twelve (12) B-12 and B-25 boxes were surveyed. All of the shipping containers remain at Fort McClellan and are awaiting brokerage. Three (3) surveys from this activity are missing. These boxes will be opened, inspected, and surveyed prior to brokerage

5.2.12 Miscellaneous Surveys

- November/December 1995: Eleven (11) surveys were performed to support the project. Routine office trailer surveys, a clean storage area survey, and a Sea-Land container survey was performed.

- June/July 1996: Twenty-seven (27) surveys were performed in this time period. In addition to the aforementioned surveys, incoming equipment surveys were also performed.

5.3 Waste Brokerage

Sixteen (16) B-25 boxes, forty-five (45) B-12, and a 55 gallon drum remain at Fort McClellan and are awaiting brokerage.

6.0 RECOMMENDATIONS

Based on the surveys and sample data obtained during this project in accordance with the guidance prescribed in CR-5849, 'Manual for Conducting Radiological Surveys in Support of License Termination' and in accordance with the limits prescribed in 'Regulatory Guide 1.86' and NRC Memorandum, 'Evaluation of Acceptability of Proposed Decommissioning Activities' the following areas are recommending for release and eventual license termination:

- Building 3192, 'Hot Cell and Classroom'

- Building 3182, 'Military Police Museum'

- Outside Grounds around Bldg. 3192 including roadway, sidewalk, and concrete apron behind Bldg. 3182.

This recommendation follows the brokerage of all radioactive waste currently staged in this area.

7.0 REFERENCES

BOA DAAA09-92-G-0003, Delivery Order 0077, Project Number USA-023-94

United States Nuclear Regulatory Commission, Regulatory Guide 1.86.

Title 10 Code of Federal Regulations, Part 20.

ATG, Inc. Interim Report, Project Manager's Log, Radiological Characterization, Fort McClellan Building 3192 and Grounds, Anniston, AL.

Chem-Nuclear Systems, Inc. Characterization Report, dated December 16, 1985.

U.S. Nuclear Regulatory Commission Division of Industrial and Medical Safety, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material (August 1987)".

U.S. Army Technical Bulletin 43-0116, "Requisition, Handling, Storage, and Identification of Radioactive Material".

NUREG/CR-2082, "Monitoring for Compliance with Decommissioning Termination Survey Criteria".

NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination", Draft, June 1992.

Allied Technology Group Health and Safety Plan, Fort McClellan.

NRC Memorandum "Evaluation of Acceptability of Proposed Decommissioning Activities", from John W.N. Hickey, Chief Operation Branch, Division of Fuel Cycle, Medical, Academic and Commercial Use Safety to William E. Cline, Chief Nuclear Materials Safety and Safeguards Branch Region II, dated May 06, 1987.

Fort McClellan, Delivery Order 0077.

TABLE 1

INSTRUMENTATION FOR RADIOLOGICAL SURVEYS
FORT MCCLELLAN PROJECT

Type of Measurement/Technique	Instrumentation Detector	Meter	Background	Efficiency %	Detection Sensitivity
Surface Scans - Alpha	Ludlum Model 43-5 Ludlum Model 43-65 $ZnS(A_g)$ Detectors Ludlum 43-68 ($100cm^2$)	Ludlum Model 3 Ludlum Model 12 Ludlum Model 18 Analyzer	0-5 CPM α	~ 10-15 ~ 15	60 dpm/$100cm^2$ α 100 dpm/$100cm^2$ α
Surface Scans - Beta/Gamma	Ludlum Model 44-9 Thin Window GM Ludlum 43-68 ($100cm^2$)	Ludlum Model 3 Ludlum Model 12 Ludlum Model 177 Ludlum Model 18 Analyzer	50-100 CPM $\beta\gamma$ 300-500 CPM $\beta\gamma$	~ 10 ~ 20	10,000 dpm/$100cm^2$ $\beta\gamma$ 7,500 dpm/$100cm^2$ $\beta\gamma$
Exposure Rates	NaI Scintillation MicroR Meter Ludlum Model 19	(Same as Detector)	10-11 μR/hr γ	N/A	2 μR/hr
Gross Alpha/Beta/Gamma on Smears	$ZnS(A_g)$ Scintillation Detector Ludlum Model 43-10-1	Ludlum Model 2929 Dual Channel Scaler Ludlum Model 2200 Single Channel Analyzer	41-65 CPM $\beta\gamma$ 0.1-0.5 CPM α	~21 $\beta\gamma$ ~ 32 α	120-140 dpm/$100cm^2$ $\beta\gamma$ 10-14 dpm/$100cm^2$ α
Surface Scans - Gamma	NaI 2" x 2" Scintillation Ludlum Model 44-10	Ludlum Model 3 Ludlum Model 12 Ludlum Model 2221	8000-10000 CPMγ	N/A	12,000 CPM
Direct Measurement Static Reading (1 minute)	Ludlum Model 44-9 Thin Window GM Ludlum Model 43-5 Ludlum Model 43-65 $ZnS(A_g)$ Detectors Large Area Gas Prop. Ludlum 43-68 ($100cm^2$) Large Area Gas Prop. Ludlum 43-68 ($100cm^2$)	Ludlum Model 3 Ludlum Model 12 Ludlum Model 18 Analyzer Ludlum Model 18 Analyzer	50-100 CPM $\beta\gamma$ 0-5 CPM α 300-500 CPM $\beta\gamma$ 0-5 CPM α	~ 10 $\beta\gamma$ ~ 10-15 α ~ 20 $\beta\gamma$ ~ 15 α	4000 dpm/$100cm^2$ $\beta\gamma$ 160 dpm/$100cm^2$ α 500 dpm/$100cm^2$ $\beta\gamma$ 50 dpm/$100cm^2$ α