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REGION I

Report No. 030-04593/92-002
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Licensee: Department of the Army
Materials Technology Laboratory
405 Arsenal Street
Watertown, Massachusetts

Inspection At: 405 Arsenal Street
Watertown, Massachusetts

Inspection Conducted: November 30 and December 1 - 3, 1992

Inspectors: Mark C. Roberts — 2-3-93
Mark C. Roberts — date
Senior Health Physicist

Mark R. Bouwens — 2-3-93
Mark R. Bouwens — date
Health Physicist

for Anthony Dimitriadis — 2.3.93
Anthony Dimitriadis — date
Health Physicist

Approved by: John D. Kinneman — 2-3-93
John D. Kinneman, Chief — date
Research, Development and Decommissioning Section

Inspection Summary: Routine, unannounced safety inspection conducted November 30 and December 1-3, 1992 (Inspection No. 030-04593/92-002; 040-02253/92-002; 070-00263/92-002).

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Areas Inspected: Organization and staffing for decommissioning; training and instructions to workers; facilities and equipment; laboratory instrumentation and calibration; portable instrumentation and calibration; termination surveys/release of facilities; radiation protection procedures; remediation activities; external radiation protection; internal radiation protection; respiratory protection program; posting and labeling; effluent control and monitoring; radioactive waste disposal and transportation; mixed waste disposal; contaminated cistern in Building 313; closure of excavation adjacent to Building 312; quality assurance programs; Commonwealth of Massachusetts oversight; tour of Government Services Administration (GSA) site; tour of Filipello Park; MTL radiation protection program.

Results: No violations were identified. The inspectors reviewed the survey data for an excavation adjacent to Building 312, and based on the review, released the area for unrestricted use. The issues of analysis of cross-check samples and the duplicate analysis of a fraction of the routine samples will be reviewed during a future inspection.

DETAILS

1. Persons Contacted

*Lt. Colonel James Naughton, Commander, MTL
*Peter Cornetta, Radiation Protection Officer, Material Technology Laboratory (MTL)
*Captain Joy Howard, Alternate Radiation Protection Officer, MTL
*Michael Borisky, Health Physicist, Army Research Laboratory (ARL)
*Alex Feldman, Radiological Control and Safety Officer, Scientific Ecology Group (SEG)
*Robert Chase, Technical Monitor, MTL
*Robert Hysong, QA Evaluator, Roy F. Weston, Inc.
*Carolyn Burns, Quality Assurance Evaluator/Health Physicist (QAE/HP), Stone & Webster Engineering Company
Paul Black, Assistant Radiation Protection Officer, MTL
Laura Rodman, Base Realignment and Closure Office, MTL
Gerard Policastro, Manager Support Services, SEG
Todd Eastman, Project Coordinator, Chem-Nuclear Systems, Inc.
John Andrews, Documentation Oversight, SEG
Philip Mann, Survey Operations Coordinator, SEG
Fran Donovan, Contracting Officer's Representative, U.S. Army Corps of Engineers
Beverly Lawrence, U.S. Army Corps of Engineers
Michael Rhodes, Instrumentation Coordinator, SEG
Lee Ann Campbell, Dosimetry Specialist, SEG
Dee Anderson, Analytical Services Coordinator, SEG
Ronald E. Spencer, Assistant Radiation Training Coordinator
Gary Lewis, Radiation Training Coordinator, SEG
Jerry Rood, Radiation Engineer/Facilities HP Supervisor, SEG
Tom Maynard, Operations Foreman, SEG
Daryl Samuels, Respiratory Protection Program Coordinator, SEG
John Robinson, Consultant, The Interlink Group
Dominick Orlando, Project Monitor, NMSS, USNRC

*Denotes those present at exit interview.

2. Background

The U. S. Army Materials Technology Laboratory (MTL), located in Watertown, Massachusetts, has performed testing and research and development activities with a variety of radioactive materials since the 1940's. Although depleted uranium (DU) has been the principal radioactive material used, the facility possesses byproduct material and special nuclear material licenses in addition to its source material license. As a result of the enactment of the Base Closure and Realignment Act (Public Law 100-526), MTL has commenced actions to decommission the facility. As part of the decommissioning, licensed radioactive material possessed at the facility must be properly disposed or transferred and residual radioactive contamination must be reduced to levels that meet current Nuclear Regulatory Commission (NRC) guidance for release of facilities and

equipment for unrestricted use. Prior to closure of the facility, all decommissioning activities must be completed, including a final radiological survey, approval from the NRC to release the facilities for unrestricted use and termination of all radioactive material licenses by the NRC.

The active portion of the MTL facility covers 36.5 acres of the former Watertown Arsenal site. In 1968, the Army closed the Arsenal and sold half of its area to the City of Watertown for commercial and residential development. Of the 30 buildings and structures remaining on the MTL site, radiological surveys identified two buildings with widespread contamination (Buildings 43 and 312) and five other buildings (Buildings 39, 97, 211, 292 and 313) with limited contamination. Depleted uranium is the contaminant in each of these buildings. A research reactor built in 1957 and operated until 1970 also exists on the site. The research reactor is being decommissioned under a separate decommissioning plan.

MTL submitted a decommissioning plan to the NRC on April 23, 1992. Region I reviewed the plan and approved a portion of the plan so that decommissioning work could commence. On September 22, 1992, MTL submitted a response to the NRC's remaining questions on the decommissioning plan. On December 7, 1992, MTL sent a technical basis document to the NRC concerning depleted uranium limits in soil. These documents are being reviewed by Region I.

3. Organization and Staffing for Decommissioning

Until recently, MTL was under the U. S. Army Laboratory Command (LABCOM), which was part of the Army Materiel Command (AMC). The Army Materiel Command reports directly to the Department of the Army. A recent reorganization changed the name of LABCOM to the Army Research Laboratory (ARL). Each of the individual facilities formerly reporting to LABCOM have a new designation as an ARL facility. The Material Technology Laboratory in Watertown is now designated as ARL-WT (Army Research Laboratory - Watertown). However, for consistency with past reports, this document will continue to use the MTL designation.

Under the Base Closure and Realignment Act, the closure of the designated facilities is coordinated by a series of Base Realignment and Closure (BRAC) Offices. There is a BRAC Office at each of the facilities to be closed, as well as at each level of the Army organization above the facility, e.g. there are BRAC offices at the Department of the Army, AMC and ARL. Funding and coordination of the base closure activities is administered by each BRAC office through the Army Corps of Engineers (COE). Coordination of the decommissioning project for the MTL site is performed by the New England Division (NED) of the COE. A designated Contracting Officer's Representative (COR) from the COE manages the decommissioning contract at the site. However, since MTL is still the actual licensee, the Commander of the facility maintains overall responsibility for safety at the site and the decommissioning project.

The U. S. Army Toxic and Hazardous Materials Agency (USATHAMA), through their consultant, Roy F. Weston, Inc. (Weston), prepared the characterization study and the decommissioning plan for the MTL site. This agency continues to provide consultation to MTL and the COE for the decommissioning of the site. The COE selected Morrison-Knudsen (MK) as the decommissioning contractor. A site project manager for Morrison-Knudsen is responsible for coordinating the contractor's activities for the project including safety and radiation safety. Westinghouse Scientific Ecology Group (SEG) has been contracted by Morrison-Knudsen to provide health physics services for the project. SEG provides the health physics support for both the operational tasks (including radiation safety for job coverage, respirator fit-testing, dosimetry services and analytical support) and the termination surveys (including portable instrumentation, computer graphics, data reduction and report generation). The project manager for SEG is also the contractor's Radiological Control and Safety Officer (RC&SO). Stone & Webster Engineering Corporation provides an Independent Quality Assurance Evaluator/Health Physicist (QAE/HP) to monitor the decommissioning activities for the COE.

The health physics contractor, SEG, performs actions supporting both the reactor and the site decommissioning projects. The SEG project manager has five technical sections reporting to him: Reactor Engineering and Health Physics Support, Analytical Services, Radioactive Waste and Radiological Engineering Services, Facilities Health Physics Support and Technical Health Physics Support (Termination Surveys). The Termination Survey Group has the largest staff and includes health physics technicians for performing surveys, laborers for preparing survey grids, clerical and drafting support for the preparation of the survey packages and technical supervisors to handle computer data reduction and resolve technical issues.

The Radiation Protection Officer (RPO) of MTL and the radiation protection staff perform the routine duties necessary to meet the license conditions and regulatory requirements of the MTL licenses. In addition to these duties, the RPO and staff provide radiological oversight for the decommissioning project. The RPO has direct access to the Commanding Officer in matters of radiation safety. A separate group from Weston, reporting to the RPO, provides additional radiological oversight.

Other Commands under AMC provide support services to the MTL decommissioning project. The most significant service is provided by the Armaments, Munitions and Chemicals Command (AMCCOM). This organization is responsible for the packaging, transportation and disposal of radioactive wastes for the U. S. Army. AMCCOM has contracted Chem-Nuclear Systems, Inc. (CNSI) to perform these services. Although CNSI also operates the licensed low-level radioactive waste burial facility in Barnwell, South Carolina, not all waste is disposed at the Barnwell site. AMC also provides some additional manpower support for the project by supplying health physics technicians from the Seneca Army Depot.

No safety concerns were identified.

4. Training and Instructions to Workers

Development of the training program and the actual training of contractor employees was initiated in May 1992. Most of the decontamination laborers have had no previous experience working with radioactive material. Three types of health physics and radiation protection training lessons are given to the contractor employees: non-radiation worker training, radiation worker training, and radioactive waste program/regulatory basis. An examination is given at the end of each of the classes. A typical training lesson is four hours in duration with a class size of 15 to 20 persons. Workers must receive a minimum score of 70 percent on the examination following the training in order to begin any type of radiation work. If a worker does not pass the examination, he must attend the training class again and be re-tested. One of the inspectors examined the class training records for the period June 2, 1992 through December 2, 1992. Items examined included attendance records, sign-in sheets, dates of attendance, and test scores of individuals. All records appeared to be complete and accurate. Training records are filed both by class and by individual.

To evaluate the effectiveness of the training, the inspector interviewed a foreman of a decontamination work crew. From this discussion, the inspector determined that the training is effective and informative. The foreman indicated that the training classes helped him and the work crew separate the issues of exposure and contamination in a manner that made the crew feel more comfortable working in a radiation environment. The inspector reviewed the training records for the foreman and found all records to be in order.

In addition to the basic classes in radiation worker training, specialized classes are provided to supervisors and health physics technicians. Training for the supervisors consists of on-the-job training and review of written guidelines. Health physics technicians receive a formal training class covering the site radiation safety procedures. Training for Termination Survey Package reviewers consists of oral instruction, review of written guidelines and on-the-job training with a qualified reviewer.

No safety concerns were identified.

5. Facilities and Equipment

A series of trailers on the site provide offices, storage space and space for special facilities, such as dosimetry, analytical equipment and radiation survey instrumentation. Vacant areas in MTL buildings provide additional office space and training rooms. SEG provides or procures most of the technical equipment including analytical instruments, computers, survey equipment, respirators and some of the decontamination equipment. Other support equipment (e.g. scaffolding) is rented and special services (e.g. dosimetry and CO_2 pellet blasting) are contracted. The facilities and equipment are appropriate for the project. Specifics are discussed in the applicable sections below.

No safety concerns were identified.

6. Laboratory Instrumentation and Calibration

The SEG staff performs on site radiological analyses of operational and environmental samples to support radiation safety for the remediation tasks and provide data for termination surveys. Most of the laboratory analytical equipment is housed in a single trailer. Counting equipment includes a Canberra Genie microcomputer gamma spectroscopy system, a Packard liquid scintillation counter and a Tennelec LB5100 gas-flow proportional counter system. A portable gamma spectroscopy system is available for in situ measurements. A second LB5100 gas-flow proportional counting system is available in another building and is used primarily by the technicians performing closeout surveys. The detectors in the gamma spectroscopy systems are both high-resolution, intrinsic germanium detectors.

The counting laboratory is staffed by an analytical coordinator and two to three analysts. The coordinator attended a special training class given by Canberra on the operation of the gamma spectroscopy system and has had previous experience operating similar systems and the remainder of the analytical equipment. The inspector observed the gamma counting and analysis of a routine sample and had no questions concerning the methodology.

The intrinsic germanium detector was calibrated by the SEG staff with mixed gamma plus americium-241 reference standards, traceable to the National Institute for Standards and Technology (NIST). Each source contains nine radionuclides that emit eleven significant photons spanning the gamma energy spectrum from 0.060 MeV to 1.836 MeV. The standards were fabricated in the same geometry (a one-liter Marinelli beaker) as the samples routinely counted in the laboratory. One of the standards is a water equivalent matrix (density of 1.15), to simulate aqueous samples, and the other is a sand matrix (density of 1.40), to simulate soil and other solid samples. The reference file for the more appropriate standard is used when samples are counted and analyzed. The standards are counted daily as an operational check of the equipment. Data for two of the photon energies are plotted on a control chart. A background is counted weekly. A maintenance log is also kept for this counting system. The inspector reviewed the control charts, background counting data and the maintenance log for the time period August 19, 1992 to December 1, 1992. All records examined were complete and up-to-date.

All samples to be counted in the analytical laboratory are logged into a sample receipt log in a designated area of the trailer. Each individual sample for gamma analysis and each batch of samples for alpha or beta counting (typically smear samples) is assigned an identifying number. Soil or sludge samples are dried and weighed prior to counting to accurately report the measured concentration on the basis of dry weight. Liquid scintillation counting has been performed on very few samples, most of which have related to the reactor decommissioning. Sample results are kept as electronic data files and as hard copies. Samples for gamma analysis are typically counted for 500 seconds. For solid samples, the sensitivity for U-238 is typically around 5 picocuries/gram. The gamma emissions from the thorium-234 (Th-234) daughter of U-238 are used to identify

U-238 or compute the minimum detectable activity (MDA) if a detectable quantity of U-238 is not found in the sample. The sensitivity of the equipment for counting smears is more than sufficient to meet the current cleanup criteria of 1,000 dpm/100 cm^2 for removable beta-gamma activity. Access to the counting laboratory is controlled by a Radiation and Hazardous Work Permit (RHWP).

During the week of the inspection, the analytical laboratory received a series of cross-check samples from North American Scientific Company. These samples have been "spiked" with known quantities of radioactive material by the supplier, but the quantities and identities are not known by the laboratory. Analysis of samples of this type provide a quality control check of the laboratory's analytical capability. The samples were not scheduled to be counted and analyzed before the inspection was completed. The results obtained from this quality control check will be examined during a future inspection.

Currently, approximately ten percent of the samples that have been counted are set aside for a duplicate analysis by a second laboratory. There have been no duplicate analyses performed as of the date of the inspection. Due to the large number of samples counted to date, a large backlog of samples await duplicate analysis. For this reason, the fraction of samples set aside may be reduced. The duplicate analysis program will be reviewed during a future inspection.

No safety concerns were identified.

7. Survey Instrumentation and Calibration

SEG provides instrumentation for the termination surveys, special surveys and health physics operational support. An instrumentation specialist/coordinator and two additional instrumentation specialists ensure operability of the portable survey equipment. These individuals also prepare and calibrate instrumentation for special surveys, e.g., in situ examination of pipes and ensure operability of the personal contamination monitors (Eberline Model PCM-1B's) installed at certain health physics control points. Routine instrument calibration is typically performed by the manufacturer.

Each of the termination survey teams uses a Ludlum Model 2350 Data Logger survey instrument, equipped with a Model 43-68 100 cm^2 gas proportional detector. The detector is operated in the continuous gas-flow mode and the high voltage setting allows for counting both alpha and beta radiations. The instrumentation is mounted on a wheeled cart equipped with brackets for holding a small bottle of compressed P-10 counting gas and the flow controller. A nine-meter (30-foot) length of tygon tubing supplies the counting gas to the detector. SEG has found no problems using this length of gas supply tubing or electronic cables. The Model 2350 is also compatible with numerous other probes that are used on the site. Larger area gas proportional detectors (both 300 cm^2 and 550 cm^2) are used frequently for screening areas to determine if remediation is required. A rate meter equipped with a 15.5 cm^2 Geiger-Müller (GM)

pancake probe is used for small areas or irregular surfaces where the 100 cm^2 probe cannot be used. Ludlum Model 19 Micro R meters are used by the survey teams to measure exposure rates. There appeared to be sufficient portable survey equipment for twelve field survey teams.

The termination survey technicians perform a calibration check on the proportional detectors with a technetium-99 beta source at the beginning and end of each day. The data collected with that instrument for that day is discarded and the area resurveyed if the calibration checks show a variation greater than twenty percent between the beginning and end of the day. A change to the survey procedure is under development that will avoid the possible loss of a full day of data for an instrument. The new procedure will add a performance check with a cesium-137 source for each instrument before and after each data set is collected. The area will be resurveyed if the two performance checks show a variation of more than twenty percent.

The Model 2350 Data Logger is equipped with a microprocessor that enables the instrument to be programmed for a variety of purposes. The operating parameters of the instrument such as threshold, operating voltage, dead time, and count time are programmed into the instrument and are verified at the beginning and end of each day. The instruments have a programmed function key to take three background counts. All of the operating parameters (i.e., count time, number of measurements, etc.) for the background measurements are programmed into this function key. Another function key is used to set up the instrument for surveying. The surveyor needs only to input the location code for the area to be surveyed and the number of measurements to be taken prior to initiating the survey. The instrument can store a maximum of 250 measurements. The operator takes a series of integrated measurements in a fixed pattern using a programmed count time. An automatic time delay between each measurement allows the technician to move to the next location to take a reading. The instruments have a pause function to allow the surveyor additional time between measurements, if necessary. The instruments are equipped with an audible alarm that sounds if the number of counts obtained during a measurement is greater than the preset alarm value. After completing the survey of an area, the collected data in the instrument is downloaded directly to a microcomputer for processing.

Instruments for operational surveys include the same instrumentation as the termination surveys and additional equipment. Larger area gas proportional probes are used by the operations staff to screen areas prior to the termination survey. The operational health physics staff also use NE America Model CM-7 survey meters with a 100 cm^2 gas proportional probe for monitoring personnel and equipment exiting contamination areas.

No safety concerns were identified.

8. Termination Surveys/Release of Facilities

The termination survey procedure consists of five basic elements: a walk-down of the area by a technical supervisor (or Building Foremen); establishing the survey grid for the area; performing the contamination and radiation survey; downloading the survey data into a computer database; and reviewing the completed survey package. Information relating to each of the five elements is filed in a Termination Survey Package for each area. Each element of the termination survey program was inspected. The elements are discussed in detail below.

A Building Foreman conducts a walk-down of each area to establish the survey needs for that area prior to performing each termination survey. The area is emptied of movable objects to the extent possible. The Building Foreman reviews the area history to determine if the area is an affected or unaffected area. An area is affected if previous characterization measurements or a termination survey identified contamination. All other areas are designated as unaffected areas. All of the grids in an affected area are surveyed; only 25% of the grids in unaffected areas are surveyed.

The grid pattern typically used is a one-meter by one-meter grid for the entire floor and the walls to a height of two meters above the floor. The number of measurements taken above the two meter mark and on the ceiling is determined by the Building Foreman. The Building Foreman also identifies the locations of special structures such as drains, intake vents, and structural additions to an area (i.e., bookshelves, counters, sinks, etc.) and determines the number and type of measurements to be taken on each of these objects or structures. The determination is made by considering the size and type of structure to be surveyed. For example, a counter and sink area would have a sufficient number of direct measurements and smears to adequately survey the top of the counter, underneath the counter, and the sink. The specific locations of the measurements and smears that are taken on a special structure are determined by the health physics technician on the survey team. All surfaces and structures to be surveyed are given an identifier code that is part of the location code. Areas above false ceilings are not surveyed since these are found primarily in office areas. Contamination has not been found in offices or intake vents for the offices. The information obtained from the walk-down is recorded on the Termination Survey Package Worksheet and is filed in the Termination Survey Package.

The inspector observed a walk-down with a Building Foreman. The Building Foreman explained the procedure that he follows while conducting a walk-down and the concerns that he addresses while determining the number and type of measurements that will be taken during the survey. The decisions that were made by the Building Foreman appeared to be appropriate for the area.

The type of grid pattern to be installed is listed on the Termination Survey Package Worksheet. The grid pattern starts from the bottom left hand side of a wall and the southwest corner of a floor. Measuring tapes and levels are used to ensure that grids are established in a consistent manner. The grid pattern is marked on the walls and floor with stickers placed at each corner or tape designating the borders of each grid. Each grid square is labelled to denote the identifier code for that surface and the grid square number. The inspector observed a grid team establishing a grid pattern in one of the areas. The grid team appeared to follow the procedure described for installation of a grid.

As discussed above, an area to be surveyed is emptied to the extent possible prior to the walk-down of the area. However, some of the larger, movable objects may not be removed. In these cases, laborers working with the survey teams move obstructions that block surfaces to be surveyed. Photographs are taken of fixed structures or unusual circumstances encountered in the area to be surveyed. These photographs are filed in the Termination Survey Package as part of the Survey Unit Diagram.

The grid squares to be surveyed in an unaffected area are chosen at random using a two-dimensional matrix with 25% of its elements filled randomly. Each element on the matrix represents one grid square. The health physics technician draws the surface to be surveyed onto the matrix making sure that 25% of the elements within the drawing are filled. The matrix is filed in the Termination Survey Package.

Termination surveys are typically performed by teams of four people (two health physics technicians and two laborers). The surveys are performed utilizing the Ludlum Model 2350 survey meter and Model 43-68 gas proportional probe. The probe is held nearly at contact with the surface being monitored. The following measurements are taken for each grid square that is surveyed: five direct measurements (one at each corner and one in the center), one smear in the center of the square (or at the location of an unusually high beta-gamma measurement), and an exposure rate measurement at a distance of one meter from the center of the grid square surface. The walls are surveyed from the bottom left grid square to the top right square. The floor is surveyed from the southwest corner to the northeast corner. Partial squares, created on the perimeter of the surface to be surveyed, are surveyed with the same number of measurements as other grid squares. Although the number of measurements to be taken above the two meter mark and on the ceiling is determined by the Building Foreman, the exact location of the measurements are determined by the health physics technician. The location of the measurements on these surfaces are not marked and not necessarily able to be relocated exactly unless activity in excess of the alarm value is measured. If a grid square to be surveyed is blocked by a fixed structure, an adjacent square is surveyed.

The instruments have a programmed alarm value of 3,636 dpm/100 cm^2. This alarm value is 80% of the release limit of 4,545 dpm/100 cm^2. This release limit satisfies the current criteria of both the NRC and the Commonwealth of Massachusetts. If a measurement is greater than the alarm value, an audible alarm will sound. If the alarm sounds, the health physics technician resurveys the location. If the elevated reading is

confirmed, the location is marked and the Building Foreman is notified. If the Building Foreman determines, through additional surveys, that the area is contaminated above the release criteria, the facility health physics staff is notified so that further remediation can be performed. During the termination surveys, only three or four areas have been found where additional remediation has been required. The inspector observed a survey team at work. The procedure that the health physics technicians used and the knowledge that they demonstrated appeared appropriate for the surveys that they were conducting.

The results of the radiation survey measurements taken by the survey teams are filed in the Termination Survey Package for the area where measurements were taken. The measurements for an area are referenced by a unique ten character location code. The location code specifies the building, area, level (floor), room number, sub area number, and wall/floor/ceiling of the location where the measurement was taken.

A computer program, written by Ludlum and modified by SEG, is used to download the data from the survey instruments to a microcomputer. A written log is kept by the computer operator listing the date of the download, the location code of the information downloaded, and the name of the data file where the information is stored. Each sample point is stored in the data file by sample number, location code (ten character code), detector number, count time, counts measured, cpm/probe area, and dpm/probe area. The operating parameters for the survey instruments and the survey data are downloaded to files stored on the hard drive of the computer. Backups of the downloaded files are stored on floppy disks. These disks are stored in a fireproof vault on site. A hard copy of the data is filed as the Download Data Sheet in the Termination Survey Package.

A review of each Termination Survey Package is conducted after the termination survey is completed to assure that all of the necessary information for the specific area has been collected and filed in the package. The Termination Survey Review Checklist is used to document this review. The review includes a comparison of the survey requirements listed during the walk-down to the work actually completed. Examples of what the reviewer looks for are the appropriate survey coverage of the grids (i.e. 25% or 100%), the total number of data points, and any measurements with values above the release limit. The review of the grid coverage is documented on the Termination Survey Grid-to-Data Collection Review Summary. Comments by the reviewer are written on the Termination Survey Package Review Worksheet. The Termination Survey Review Checklist, Termination Survey Grid-to-Data Collection Review Summary, and the Termination Review Worksheet are filed in the Termination Survey Package. The reviewer reports any findings of an incomplete package or anomalous information in the package to the Survey Operations Coordinator.

The information concerning the termination survey of an area is filed in a Termination Survey Package. The items that are in the package along with a brief description of some of the information contained in each item is listed below.

i) Termination Survey Package Review Worksheet - The coversheet for the package that lists location information, the technician who completed the survey, and observations or problems that the reviewer of the package noted.

ii) Termination Survey Review Checklist - This checklist indicates which items have been filed in the package and which items in the package were reviewed.

iii) Termination Survey Grid-to-Data Collection Review Summary - The summary is used to verify compliance with the percentage of grid squares that were to be surveyed for that specific area. The summary lists the location code of the surfaces to be surveyed, the number of grids to be surveyed, the number of grids that were surveyed, and the percent of grids that were surveyed.

iv) Termination Survey Package Worksheet - The worksheet is completed during the walk-down of the area. The worksheet lists the history of the area, location code, description of the area, and instructions for the surveyor.

v) Randomly generated two-dimensional matrix with surfaces drawn by the surveyor.

vi) Survey Diagram (plan view) of area.

vii) Smear analysis from a LB5100 Low Background Counting System.

viii) Download Data Sheet - Each sample point is listed by sample number, location code (ten character code), detector number, count time, counts measured, cpm/probe area, and dpm/probe area.

ix) Survey Unit Diagram - Pictures of fixed structures and unusual circumstances that were encountered in the area to be surveyed. Some pictures reflect the area before the movable structures were removed.

The inspector reviewed nine Termination Survey Packages from five different buildings. The packages appeared to have the necessary information for the areas that they represented. The inspector visually compared two of the packages to the areas that they represented. The areas that the inspector reviewed were Building 311/area 6 (an open area) and Building 39/room 304 (a conference room). The inspector verified the following items in the packages: the location codes, the percentage of grid squares to be surveyed was correct for the area, the instructions to the surveyor were appropriate for the area, special structures were appropriately identified and surveyed, and photographs adequately represented the fixed structures and unusual circumstances for the areas.

No safety concerns were identified.

9. Radiation Protection Procedures

Procedures have been prepared and approved by SEG for the major health physics activities performed on the site. Each procedure lists the purpose, applicability, references, definitions, apparatus, precautions, limitations and the procedural steps. Worksheets or forms referenced by the procedure are included as attachments to the procedures. The procedures examined were clear and unambiguous. Workers were observed to be performing activities in accordance with applicable procedures.

No safety concerns were identified.

10. Remediation Activities

Significant remediation was observed to be in progress in Buildings 43 and 312. Remediaton of a few contaminated spots was observed in Building 311 where scabbling devices were being used to remove contaminated concrete from the floor. In Building 43, the major activity was the excavation of contaminated soil from beneath the floor, carbon dioxide (CO_2) pellet blasting on the walls and building rafters and total remediation of the DU Melt Laboratory. In Building 312, the major cleanup effort involved the DU machine shop, beryllium machine shop and the Plating Shop.

In Building 43, large processing machines for pressing, rolling and milling DU had been anchored deep into the floor. The machines had been previously removed, but contamination remained in the floor where this equipment once stood. As of the date of the inspection, excavations had reached depths of 2 to 3 meters (seven to ten feet). The work activities observed included digging and removing contaminated soil. Remediation in the DU melt area included grit blasting and the removal of contaminated drain lines from the floor. This work was not directly observable since entry required the use of an airline respirator. The CO_2 pellet blasting was primarily performed on the high bay walls of the building. Building 43 is only a one floor building; however, the walls are approximately 10 meters (40 feet) high, requiring the erection and removal of scaffolding to reach all areas. Workers were observed wearing the assigned protective clothing for the areas in which they were working. Health physics support was clearly evident. Health physics technicians were performing surveys on equipment removed from the area, surveying workers for contamination, obtaining soil samples from the excavated areas and assisting workers in removing protective clothing.

Access to Building 43 is through a control point manned by a health physics technician. To initially enter the work area, the worker or visitor must review the RHWP and sign an acknowledgement. The worker then signs an entry/exit log each time he enters or leaves the general work area. The inspectors randomly selected twelve names on the entry log and confirmed that each had signed the RHWP acknowledgement sheet. Prior to exiting local work areas, individuals must survey themselves for contamination with hand-held instruments. At the exit of the building, individuals must pass through a personnel contamination monitor (Eberline PCM-1B). A health physics technician is available to assist with the operation of the monitor.

Major remediation work in Building 312 could not be directly observed since entry to the work areas required the use of an airline respirator due to the presence of mixed radioactive and hazardous waste. Strong health physics support for entry and exit to the work area was observed at the control point.

No safety concerns were identified.

11. External Radiation Protection

SEG provides dosimetry for employees and visitors involved in the decommissioning project. A film badge and direct-reading dosimeter are issued to each individual. Extremity monitoring has not been necessary since the licensed material on site is primarily in the form of contaminated debris and measured surface exposure rates are low. The number of dosimeters issued gradually increased from four in June 1992 to over 500 in November 1992. The dosimetry specialist is supplied with radiation worker sign-off sheets to verify that a given individual has received required training. Dosimetry is not issued to a person that does not have the required training. The dosimetry supplier is Landauer, Inc., a NVLAP (National Voluntary Laboratory Accreditation Program) approved vendor.

The inspector reviewed the dosimetry records for the period June 1, 1992 through November 20, 1992. The majority of the dose equivalents reported were "M" (less than 10 millirem). The highest dose reported, 100 millirem, occurred during the month of July. All results are reviewed by the dosimetry specialist and manually transcribed on to the permanent record. As of the date of the inspection, there have been approximately fifteen reports of personnel monitoring issued to terminated employees as required by 10 CFR 19.13 and 20.408.

No safety concerns were identified.

12. Internal Radiation Protection

Air sampling is conducted in areas where decontamination operations are conducted. The locations of the air samplers are determined by the Building Foremen and audited by the Facilities Health Physics Supervisor. Sampling times vary from approximately thirty minutes to ten hours depending on the duration of the remediation work. In addition to the general area samplers, a lapel sampler is used when a group of workers conducts aggressive remediation work. The lapel sampler is placed on the individual in the group that has the greatest probability to receive an intake.

Air samplers have typical flow rates of 5 to 100 liters per minute depending on the unit. The filters from the air samplers are counted for both alpha and beta activity on a Tennelec LB5100 gas-flow proportional counter for 30 minutes. The gamma component is counted on the gamma spectroscopy system in the analytical trailer. If the activity on the filter appears greater than 25% of the Maximum Permissible Concentration (MPC), the filter is recounted approximately 30 minutes later to allow decay of any radon daughters present on the filter. The inspector reviewed selected records of air filter analyses for alpha and beta activity. The results show that all samples were less than 25% of the MPC. The air sampling data is reviewed daily by the RC&SO.

A urinalysis for uranium is conducted on each worker before he begins employment to establish a baseline for the individual and is repeated upon the termination of employment. Urine samples are analyzed for total uranium to a sensitivity one

microgram per liter. Results greater than this value are sampled again. If re-sampling is not completed, dosimetry is not issued to that individual. The inspector reviewed the results of the bioassay sampling program. All sample results were less than one microgram per liter for either the original sample or a re-sample.

The contractor, SEG, also provides for a baseline whole body count for each worker. Whole body counts are repeated at termination or annually, whichever is earlier. The whole body counting is performed by Yankee Atomic Environmental Laboratory.

Employees have access to their dosimetry records through the dosimetry specialist.

No safety concerns were identified.

13. Respiratory Protection Program

One of the inspectors reviewed the respiratory protection program required by 10 CFR 20.103. Personnel that are to be respirator qualified are medically evaluated by a local physician. Training in the use of respiratory protection and quantitative fit-testing of respirators is conducted by SEG personnel. The quantitative fit-testing is performed by trained SEG staff members using a Portacount Plus test device. This device does not use a separate challenge atmosphere in a test booth, but uses the dust particles in ambient air to measure the fit-factor for the respirator. For the quantitative fit-test, the tested individual performs a series of exercises while wearing a special test respirator. The exercises are intended to simulate actual work activities and include talking out loud, head movements and running-in-place. Typical fit-test factors achieved are grater than 2,000. Individuals who have successfully completed the medical qualification, training and quantitative fit-testing are issued a certification card and are placed on a list of authorized respiratory protection users.

The inspector observed the respiratory issue, cleaning and maintenance area. Respirators that have been used are surveyed for radioactive contamination prior to being returned to the maintenance area. Respirators are then disassembled, cleaned and disinfected, dried, reassembled, inspected and packaged in clean plastic bags. All work in this area is conducted under a standing RHWP. The supervisor provided on-the-job training to all technicians assigned to respiratory protection program operations. The inspector observed the issue of respirators to five different individuals. In order to determine if individuals are qualified respirator users, the technicians may refer to the list of authorized users or request to see the individuals certification card. The technicians may also issue respirators to authorized workers without checking the authorized list if the worker is known by sight and the technician has previously checked that the individual is on the list of authorized users. For the five individuals examined, all five had the certification card available, all were on the list of authorized respirator users and all received the proper size respirator.

For remediation activities at MTL, both filter respirators and supplied air respirators are used. Supplied air respirators were observed in use in Buildings 43 and 312. None of

the areas where respiratory protection is required are IDLH (Immediately Dangerous to Life and Health) atmospheres. Workers wearing supplied air respiratory protection work under a "buddy" system and no worker may work alone while wearing a supplied air respirator. Supplied air for the airline respirators is provided in large compressed air cylinders. In Building 43, twelve cylinders are connected together to a cascade distribution header. Individual direct connections to the distribution header supply air to the workers. A similar apparatus is reported to be in place in Building 312.

No safety concerns were identified.

14. Posting and Labeling

Required forms and signs, such as Form NRC-3 and "Caution Radioactive Materials" signs, were appropriately posted. NRC Form-3's were observed at the following four locations: on a bulletin board at the entrance to the "hard hat" area for the reactor, basement of Building 36 in the craftsmen break area, entrance to the reactor, and in front of the dosimetry trailer. The contractor stated that there were NRC Form-3's located at the entrance of Building 43 and in the first floor cafeteria in Building 36; however, these forms were not located. The licensee agreed to replace the NRC Form-3's in these areas. The inspectors concluded that sufficient NRC Form-3's were posted.

No safety concerns were identified.

15. Effluent Control and Monitoring

The buildings where intensive remediation operations are being conducted are equipped with High Efficiency Particulate Air (HEPA) filtration systems to capture airborne contaminants exhausted from the areas. Building 43 has two HEPA units each rated at 4,000 cubic feet per minute. The HEPA systems are equipped with continuous air monitors (CAM's) set to alarm if concentrations equivalent to 25% of the MPC are detected in the exhaust air. The air pumps automatically shut off and an alarm is activated when a CAM detects activity above the alarm set point. The alarm unit consists of an audible alarm and a rotating light.

The alarm systems for the CAM's are tested weekly by placing a check source near the detector on the CAM. The set points of the CAM's are checked daily along with the flow rate of the sampler tube. The sampler flow rate is checked from a flow rate monitor (rotameter) built into the sampling unit. The rotameters are calibrated with a venturi digital calibrator prior to the installation of the CAM's in the HEPA systems. The filters from the CAM's are collected weekly. These filters are analyzed for both alpha and beta activity on a gas-flow proportional counter. The gamma component is analyzed on the gamma spectroscopy system. Results of the alpha and beta activity analyses for selected samples were reviewed by the inspector and all results showed activities to be less than 25% of the MPC. The air sampling data is reviewed by the RC&SO.

Batch releases of process water are made to the sanitary sewer as necessary. Prior to discharge, the waste water is cleaned by passing it through a series of filter/demineralizers. Samples are taken and analyzed prior to the discharge. Results have been generally less than detectable for all liquid releases from the site.

No safety concerns were identified.

16. Radioactive Waste Disposal and Transportation

Low level radioactive waste generated at the site is prepared and packaged by SEG. Waste is then transferred to Chem-Nuclear Systems, Inc. (CNSI) for disposal. Title to and possession of the waste is accepted by Chem-Nuclear when the paperwork is presented. CNSI is under contract by AMCCOM for disposal of the U.S. Army's radioactive waste.

Shipping papers for the waste are prepared by CNSI. The majority of the waste is packaged and shipped in "B-25" boxes [approximately 2.8 cubic meters (100 cubic feet) in volume] which meet the requirement for strong tight packages. Most of the shipments are transferred as Radioactive Material, Low Specific Activity (LSA), n.o.s. UN2912. Shipments are consigned as exclusive use allowing the licensee to use only strong tight packages for shipment. A shipment of radioactive waste is typically comprised of six or seven B-25 packages on a flatbed truck. A subcontractor (J.B. Hunt) is used for transportation of wastes to the CNSI facility in South Carolina.

Samples of waste are collected and sent to Controls for Environmental Pollution (CEP), a contractor, in New Mexico for characterization. The analyses take four to five weeks to complete. If SEG requests that the process be expedited, it takes approximately seven days for the results, except for the strontium-90. Five hundred grams of soil or one liter of resin constitutes a sample of the waste being shipped. Waste is never transferred to Chem-Nuclear until the analytical results have been received by SEG.

The inspector observed a waste shipment being prepared for transport. The shipment was properly blocked, braced, placarded (LSA) and the shipping papers were in order.

The inspector examined 24 sets of shipping papers for the period October 16, 1992 through November 20, 1992. Records of the 24 shipments indicate that the shipments average 17,500 Kilograms (38,500) pounds and contain approximately 6 millicuries of radioactivity. There have not been any shipments which have required a Type B package, and thus no need for any certificate of compliance. There have not been any incidents during transportation which would require notification to Department of Transportation.

No safety concerns were identified.

17. Mixed Waste Disposal

Mixed waste (a mixture of hazardous wastes regulated under Subtitle C of the Resource Conservation and Recovery Act (RCRA) and radioactive wastes regulated under the Atomic Energy Act) is being generated on the Watertown Site during pipe removal, excavation, and remediation activities in Buildings 43, 311, and 312. Analysis of samples have indicated trace amounts of beryllium, mercury, arsenic, and zinc in addition to the depleted uranium. These wastes are primarily contaminated soils; however, the remediation in Building 43 will generate machinery, ventilation ducts, and building material as mixed waste.

In addition to the mixed waste soil, the licensee has approximately two hundred 210-liter (55-gallon) drums containing suspected mixed waste. Morrison/Knudsen has constructed a staging area near Building 43 where Chem-Waste Systems and SEG collect samples for analysis. SEG provides an initial gamma spectroscopy analysis. Samples of the mixed waste are subsequently sent to CEP for complete Toxicity Characteristic Leaching Procedure (TCLP) and radiological report.

No safety concerns were identified.

18. Contaminated Cistern in Building 313

Radiological surveys show uranium in the sludge at the bottom of the cistern under Building 313 as high as 49.4 pCi of total uranium per gram of sludge. The cistern, a structure 22 meters (71 feet) long by 8 meters (26 feet) wide by 4 meters (14 feet) deep, collects storm water and water from melting ice and snow. It is divided into chambers separated by partial walls with arched openings. The thirty centimeter (one foot) thick walls of the cistern are constructed of multi-layered clay brick. Some of the walls were reported to be cracked. Access to the cistern is through a hole approximately one meter by one meter (three feet by three feet) in the floor of a room in Building 313.

The cistern has several inlets, two of which come from Building 313. It is unknown where the pipes originate, although the contractor suggested that they may lead from the roof gutters for Building 313. Another inlet to the cistern comes from the storm sewer drain in the street between Buildings 43 and 313.
The sludge was originally located in a pile about 0.9 to 1.2 meters (three to four feet) high underneath one of the inlets to the cistern. The particular inlet was not identified by the contractor representative interviewed. The sludge has been partially liquified in the cistern by the contractor so that it can be pumped out and packaged for disposal. At the time of the inspection, the floor was reportedly covered with eight to thirty centimeters (three to twelve inches) of sludge. MTL plans to appropriately decontaminate this cistern.

No safety concerns were identified.

19. Closure of Excavation Adjacent to Building 312

At the request of the RC&SO of SEG, the inspection team reviewed the status of an excavation adjacent to Building 312 resulting from the removal of a contaminated pipe and soil. The pipe exited Building 312 and ran under a roadway between two of the site buildings. The excavation created a potential safety hazard for personnel and vehicle traffic. MTL representatives and their contractor (SEG) were confident that the area had been remediated to below standards for soil contained in the decommissioning plan; however, the decommissioning plan does not include criteria for surveying and sampling excavations.

One of the inspectors reviewed the results from the soil sampling and analysis performed following the remediation. All U-238 concentrations in these samples were less than the MDA of 2.7 pCi/gram. Exposure rate measurements performed in the vicinity of the excavation were indistinguishable from background. The inspector determined, based on the information provided, the excavation could be released for unrestricted use and filled with clean soil. However, since the filled area will not be accessible for confirmatory surveys, the inspector requested that three soil samples be removed from the excavation for subsequent analysis. SEG agreed to take and archive the soil samples. The inspector also requested that filling excavations (that could not or should not be left open), where remediation had been performed, be addressed in an addendum to the decommissioning plan. MTL representatives agreed to prepare this addendum.

No safety concerns were identified.

20. Quality Assurance Programs

Quality Assurance for the decommissioning activities at MTL is provided to SEG by Stone and Webster. The Quality Assurance Evaluator/Health Physicist (QAE/HP) of Stone and Webster provides daily reports to SEG entitled "Daily Reports on Contractor Compliance with Facilities Decommissioning Plan".

Roy F. Weston, Inc. also oversees the decommissioning activities at MTL. The Weston QA Evaluator provides daily reports and weekly summaries of decommissioning activities. The daily reports focus on buildings where decontamination activities are in progress and specifically focus on potential problems that may arise. The weekly reports summarize activities, problems, and meetings held during the week and planned activities for the following week.

Problems noted by the QA Evaluator are reported to the Alternate RPO of MTL and the Radiological Control and Safety Officer of SEG. If the problem consists of significant deviations from the decommissioning plan, a memorandum is written and distributed to

contractor and licensee personnel including the Alternate RPO of MTL and the Radiological Control and Safety Officer of SEG. Less significant problems are reported verbally. The QA Evaluator and the Alternate RFO follow up on reported problems to assure that they have been corrected.

Decontamination activities that are audited, as listed on the daily report checklist, are: training; notices, instructions, and reports to workers; equipment quality assurance; radiological control area; protective clothing; personnel frisking; decontamination; airborne radioactivity monitoring; chemical hazards; field site safety inspection; and respiratory protection.

No safety concerns were identified.

21. Commonwealth of Massachusetts Oversight

The Radiation Control Program in the Department of Health of the Commonwealth of Massachusetts provides oversight for this project in the area of discharges or releases of radioactive material to the environment. A consultant from The Interlink Group, contracted by the Radiation Control Program, is on site two or three days each week to perform this oversight function. This individual primarily examines data and documents relating to routine airborne emissions from the facility and batch liquid discharges made to the Charles River. A discussion with the consultant indicated that he had not found any problems in this area as of the date of the inspection.

No safety concerns were identified.

22. Tour of Government Services Administration (GSA) Site

Representatives from the NRC's Office of Nuclear Material Safety and Safeguards (NMSS), MTL, COE and ARL toured the GSA site with the inspectors. The GSA site covers an area of five hectares (twelve acres) located along the north branch of the Charles River, approximately eleven kilometers (seven miles) west of Boston, Massachusetts and 1.6 kilometers (one mile) east of MTL. The site is currently controlled by the GSA. The GSA site is on the Site Decommissioning Management Plan list.

The GSA site was used for depleted uranium operations conducted by the U.S. Army as part of the activities of the Manhattan Engineering District (MED). The area was used for packaging and storing radioactive waste, burning uranium scrap, and staging radioactive waste shipments. The site may also have been used by MTL. In 1981 the GSA site was surveyed and total uranium concentrations as high as 26,000 pCi/g were found in soil samples from the site. All buildings were reported to be free of residual radioactivity at that time.

In 1988-1989 Chem-Nuclear Systems, Inc., under contract with GSA, conducted remediation operations on the GSA site. Remediation activities were stopped when an underground petroleum storage tank and volatile organic compounds in the ground water were discovered. In October 1990, a Comprehensive Site Assessment of the GSA site was prepared by the contractor and submitted to GSA. In 1992 the COE agreed to manage remaining remediation for GSA.

In Building 235 on the GSA site there were approximately forty 210-liter (55-gallon) drums and four B-25 containers containing mud, sediment, boots, gloves and various other items associated with previous survey or decontamination operations.

The inspectors specifically examined the area of the property known as the burn pit. It appeared that there was a significant excavation of the area. A contaminated concrete pad is reportedly located at the bottom of a large hole, reportedly 3.6 meters (12 feet) deep in the original location of the burn pit. The hole is currently filled with water and is covered with a large sheet of plastic anchored on all sides.

The visible sections of perimeter fence appeared to be intact. There is also a secondary fence around the burn pit area. Both fences had locked gates.

The inspectors agreed that the COE, acting for GSA, was authorized to dispose of the 210-liter (55-gallon) drums and begin additional characterization of the burn pit and surrounding area.

No safety concerns were identified.

23. Tour of Filipello Park

The individuals who toured the GSA site also visited Filipello Park. Filipello Park is a city park covering approximately 7 hectares (17 acres) located approximately 1.6 kilometers (one mile) northeast of the MTL facility. The park was developed in the early 1980's on the former town landfill. The park currently has a parking lot, cabana, playground, and basketball courts. Adjacent to the entrance of the park is an inactive incinerator building. The property in front of the building is currently being used as the Watertown Recycling Center. The recycling effort appears to use only the property outside of the incinerator building. There does not appear to be any use of the inside of the building at this time. The property of the incinerator is fenced with a chain-link fence. The building is in very poor condition. The doors to the building appeared to be intact; however, several windows have been broken.

During a recent public meeting, citizens expressed concern that radioactive materials could have been buried in the landfill since MTL was a user of the landfill. There is no current evidence that licensed radioactive material was ever disposed at the landfill; however, MTL and the COE are examining historical information.

No safety concerns were identified.

24. MTL Radiation Protection Program

The RPO distributes TLD badges to individuals in programs dealing with materials analysis, physical metallurgy, corrosion analysis, crystallography, x-ray, surface science, plating lab, melt lab, reactor, security, uranium lab, health physics, former depleted uranium processors, and personnel who may work with contaminated equipment. The dosimetry program also duplicates the dosimetry for the MTL contract radiation workers conducting decommissioning activities. The TLD badges were issued quarterly until late in 1991 when the frequency of distribution was changed to monthly. The TLD badges are sent to the U.S. Army Radiation Dosimetry Center in Lexington, Kentucky for analysis. This facility is NVLAP approved. The dosimetry records were reviewed for the period January 12, 1992 to November 5, 1992. Very few dosimeters have indicated any measurable dose equivalent. The highest dose equivalent measured was 120 millirem shallow, and 70 millirem deep, during the first quarter of 1992.

Training for radiation workers is offered about March of each year and when a new employee is hired. Attendance sheets for the training classes are maintained. The radiation safety training outline includes the following topics: information from 10 CFR 19 and 20 and NRC Form 3; natural and man-made sources of ionizing radiation; the atom, radioactivity, and radioactive sources; alpha, beta, and neutron radiations; radiation protection principles; survey meters, personnel dosimetry, and restricted area entrance and exit procedures; radiation exposure; radioactive contamination-decontamination; biological effects of radiation; and a review of NRC Regulatory Guides 8.13 and 8.29.

The inspector reviewed the Radiation Control Committee (RCC) meeting minutes for 1992. RCC meetings have been held at least quarterly. Examples of the topics covered at the meetings include current and new research involving the use of radioisotopes, NRC inspection results, review and approval of changes in the decommissioning plan, a review of radiation worker exposure information, a review of the status of decommissioning activities, and a review of radiation work permits.

No safety concerns were identified.

25. Exit Interview

The results of the inspection were discussed with the licensee representatives identified in Section 1. The inspectors stated that the issues of the analysis of cross-check samples and the duplicate analysis of a fraction of the samples would be reviewed during a future inspection. MTL representatives confirmed they will submit an addendum to the facility decommissioning plan that addresses the closure of excavations following their remediation. This addendum will also address any other items that have not been fully covered in the current decommissioning plan.