Institute of Technology
West Virginia University
Office of the Dean
Division of Student Services

'04 NOV -8 P12 :56

October 28, 2004

Q-5

David J. Collins, Health Physicist
Nuclear Materials Safety Branch 4
Division of Nuclear Materials Safety, Region I
475 Allendale Road
King of Prussia, PA 19406-1415

Dear Mr. Collins:

I would like to request that our Materials License (SNM-1990, Docket #070-03071, Ref. #SNM-608) be amended in the following manner, as we have decommissioned the site at 105 Engineering Classroom Building:

1. Remove **Item 6B** (Natural Uranium) from the license
2. Remove **Item 9B** (Authorized Use) from the license
3. Remove **Item 10B** (Conditions) from the license
4. Change **Item 12** to read: "Licensed material shall be used by, or under the supervision of George T. Carlson, Ph.D. or Keith R. Honey, Ph.D.
5. Modify **Item 14 A.** to read "The source in **Item 6A** shall be…." Whereby removing **Item 6B.**

These changes will insure that our material license is fully accurate in light of the decommissioning of 105 Engineering Classroom Building. Thank you for your attention to this matter.

Sincerely,

Michael L. Neese

CC: Dr. Galan Janeksela
Nasser Razmianfar
Dr. Keith Honey

135989

NMSS/RGNI MATERIALS-002

405 Fayette Pike • Box 48, Old Main • Montgomery, WV 25136-2436 • Telephone (304) 442-3158 • FAX (304) 442-3464

FINAL STATUS SURVEY (FSS)

for

WVU Institute of Technology

405 Fayette Pike
Montgomery, WV 25136-2436

Prepared by: Gregory M. Howett

ECOLOGY SERVICES, INC.

10220 OLD COLUMBIA ROAD
COLUMBIA, MD 21046

Rev	Originator	Reviewer	Quality Assurance
1	Gregory Howett	T. Osborne, CHP	R. Rilee
Signature	Gregory M Howett	[illegible]	[illegible]
Date	9-24-04	9-24-04	9/24/04

Final Site Decommissioning Survey for

WVU Institute of Technology
405 Fayette Pike
Montgomery, WV 25136

1.0 Site Specific Information

WVU Institute of Technology is authorized by the U.S. Nuclear Regulatory Commission with Radioactive Materials License number SNM-1990 (expiration May 31, 1996) to possess Plutonium sealed neutron sources and natural Uranium canned in cylindrical containers at their facility in Montgomery, WV. The facility is located at 405 Fayette Pike in Montgomery. The area of concern for a final status survey is room 105 in the Engineering Classroom building, within the control of Radiation Safety. Ecology Services, Inc. was contracted to perform a final status survey in support of license termination. This area is scheduled for non radioactive use by another University department. The area of concern was surveyed on August 12, 2004 to document the current radiological conditions for free release.

2.0 Purpose and Scope

This document describes the plan, methods and results of the final status survey of the licensed location. The survey did not include environmental samples exterior to the building (i.e., soil, or vegetation) since it was beyond the scope requested and is further unwarranted by the results found.

3.0 Organization and Responsibilities

A team composed of qualified personnel from Ecology Services, Inc. performed the survey. The organizational chart is shown in figure 1.

Ecology Services' laboratory personnel performed analytical services for gross alpha levels on smears using approved standard operating procedures. The QA Supervisor monitors this program.

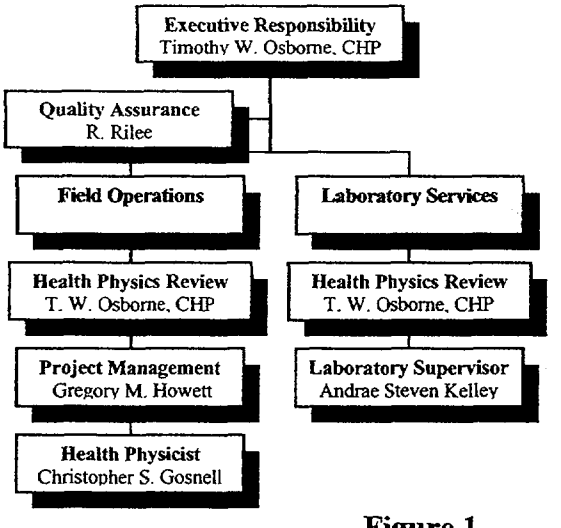

Figure 1

4.0 Radionuclide of Concern

Based upon the facility license limitations and generator information the following potential contaminants existed:

Table 1. Potential Containments

Nuclide	*Form*
Natural Uranium	Canned in cylindrical containers

4.1 Determination of Survey Objectives and Residual Radioactivity Limits

Release criterion to which the survey findings will be compared, are those specified by the NRC in their Radiological Criteria for License Termination. (10 CFR §20 Subpart E) Specifically:

> The site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a total effective dose equivalent (TEDE) to an average member of the critical group that does not exceed 25 mrem per year, and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA).

This release criterion will be translated into Derived Concentration Guideline Levels (DCGLs) for the identified potential contaminants using the DandD software program (version 2.1.0) and the Building Occupancy Scenario (using default parameters). As a conservative measure, DCGLs were calculated for a TEDE of 15 mrem rather than 25 mrem. It should be understood that the DCGLs could be exceeded by a factor of 1.66 and still remain in compliance with the NRC's release criteria. Details of the survey planning and design calculations are contained in **Enclosure 1**. Table 2 summarizes the derived concentration guideline levels for this survey.

Table 2. Derived Concentration Guideline Levels based on 15 mrem (*DandD V2.1.0*)

Radionuclide	*DCGLs (dpm/100 cm^2)*
^{238}U+C	150

The objective of the survey was to demonstrate that all survey units satisfy the release criteria. This will be accomplished by showing the results of all test methods are below the DCGLs.

5.0 Site Description

The licensed facility is a masonry construction building. The interior is a mixture of classrooms and office space. The area of concern consists of 1 distinct room with tile, concrete and steel flooring and walls constructed of plaster/drywall.

5.1 Site Conditions at Time of Final Survey

The room was empty of all radioactive material during the survey. On April 17, 2003 WVU Institute of Technology contracted Ecology Services, Inc to perform a characterization survey; survey results indicated fixed and removable ^{238}U+C contamination on the floor. The levels of ^{238}U+C contamination exceeded the limits for release of facilities as defined by the NRC in their Radiological Criteria for License Termination (10 CFR § 20 Subpart E). Ecology Services, Inc. was contracted to remove contamination to ensure that all areas identified satisfy the release criterion. Any waste produced by decontamination was removed prior to the final status survey.

6.0 Survey Design

Survey planning and procedures were in accordance with the NRC NUREG 1575 "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM), Draft Regulatory Guide DG-4006, "Demonstrating Compliance with the Radiological Criteria for License Termination", U.S. NRC, August 1998., and NUREG - 1757, Consolidated NMSS Decommissioning Guidance, Decommissioning Process for Materials Licensees, Vol. 1&2, September, 2002.

This FSS is designed for Group 1 & 2 facilities. These are facilities that may have residual radiological contamination present in building surfaces and soils. However, the licensees are able to demonstrate that their facilities meet the provisions of 10 CFR 20.1402 ("Radiological Criteria for Unrestricted Use") by applying the screening approach dose analysis. (NUREG 1757, Chapter 6) Additionally, licensees in Group 2 typically possess historical records of material receipt, use, and disposal, such that quantifying past radiological material possession and use may be developed with a high degree of confidence. Furthermore, these licensees have radiological survey records that characterize the residual radiological contamination levels present within the facilities and at their sites. That is, they are able to demonstrate residual radiological contamination levels without more sophisticated survey procedures (greater than those used for operational surveys) or dose modeling. These licensees do not need to use site-specific parameters or establish site-specific DCGLs in order to demonstrate acceptability for release of their sites.

The licensee has verifies that all of the following site conditions exist:

1. Building Surface Contamination
   - The contamination on building surfaces (e.g., walls, floors, ceilings) is superficial and non-volumetric (e.g., < 10 mm (0.4 in)).
   - Contamination on surfaces is mostly fixed (not loose), with the fraction of loose contamination not to exceed 10 percent of the total surface activity.
   - The screening criteria will not be applied to surfaces such as buried structures (e.g., drainage or sewer pipes) or mobile equipment within the building; such structures and buried surfaces will be treated on a case-by-case basis.
2. Surface Soil Contamination

- The initial residual radioactivity (after decommissioning) is contained in the top layer of the surface soil (e.g., approximately 15 cm (6 in)).
- The unsaturated zone and the ground water are initially free of contamination.
- The vertical saturated hydraulic conductivity at the specific site is greater than the infiltration rate.

Room 105 of the Engineering Classroom building was designated as a survey unit. The determinations of numbers of data point and surface scan criteria are described in **Enclosure 1**. The survey design requires 14 data points in each survey unit. The MDC_{scan} requirements for instrumentation are given in **table 5 in Enclosure 1**. The MDC_{scan} and MDC_{static} sensitivities for the instruments selected are given in tables 7 and 8 of **Enclosure 1**. The instrumentation sensitivities used in the survey satisfy the requirements. In fulfillment of the statement of work a 1 m^2 grid was applied to the floor and wipe samples were taken at the following frequencies: 1 wipe per m^2 on the floor.

ALARA (As Low As Reasonably Achievable) Considerations

In order to terminate a license, a licensee must demonstrate that the release criteria have been met and must demonstrate whether it is feasible to further reduce the levels of residual radioactivity to levels below those necessary to meet the release criteria (i.e. to levels that are "as low as reasonably achievable" (ALARA). However, explicit analyses do not have to be done for areas where no residual radioactivity distinguishable from background has been found. If residual radioactivity cannot be detected, it may be assumed that it has been reduced to levels that are ALARA [NRC Draft Reg Guide 4006, Sec 3.]

The procedures for ALARA analyses are shown in **Enclosure 1 tab A.**

6.1 Area Classification

Impacted Areas: Impacted areas were identified by using knowledge of past site operations together with site characterization surveys. In the Final Status Survey (FSS), radiation surveys do not need to be conducted in non-impacted areas.

- *Impacted areas* are areas that may have residual radioactivity from the licensed activities.
- *Non-impacted areas* are areas without residual radioactivity from licensed activities.

Area Classification: Impacted areas were classified into one of the three classes, listed below, based on levels of residual radioactivity.

- **Class 1 Areas** are impacted areas that, prior to remediation, are expected to have concentrations of residual radioactivity that exceed the DCGL. (DCGL is defined in Section 2.2 of MARSSIM);
- **Class 2 Areas** are impacted areas that, prior to remediation, are not likely to have concentrations of residual radioactivity that exceed the DCGL;
- **Class 3 Areas** are impacted areas that have a low probability of containing residual radioactivity.

Surveys conducted during operations or during characterization at the start of decommissioning are the basis for classifying areas. If the available information was not sufficient to designate an area as a particular class, the area was classified as Class 1. Areas that are considered to be on the borderline between classes received the more restrictive classification. As stated previously the Survey Planning and Design was designed after a Final Status survey for Group 1 & 2 facilities.

6.2 Reference Grids

Grids were established for the purpose of referencing locations of samples and measurements, relative to buildings and other site features. The grid intervals were based on the potential for residual contamination in the various facility locations. Grids were applied to all class I area floor surfaces at 1m intervals. Grids were not applied to Class 2 and 3 areas. Sample locations are indicated on the area maps provided in **Enclosure 2**.

6.2.1 Selection of Reference (Background) Areas

Background reference areas are not needed when radionuclide-specific measurements will be used to measure concentrations of a radionuclide that is not present in background. Background reference areas are needed for the MARSSIM method if (a) the residual radioactivity contains a radionuclide that occurs in background, or (b) the sample measurements to be made are not radionuclide-specific.

Reference areas for wipe samples were not selected since the radionuclides of concern were not constituents of background. Further, it is assumed that all removable radioactivity in the survey unit is caused by licensed operations and none is from background. Instrument background measurements for fixed contamination surveys and scans were taken in other surrounding rooms and hallways of similar construction with no history of radioactive materials use.

6.3 Meter Scan Requirements

Scanning of surfaces to identify locations of residual surface and near surface activity was performed according to the following schedule:

- Class 1 Area Surfaces – 100% of surface
- Class 2 Areas Surfaces– 50% of available surface

Building interior surface scans were conducted for beta/gamma radiation as applicable. Instrumentation for scanning is listed in **Enclosure 1**. The instruments having the lowest detection sensitivity were used for the scans wherever physical surface conditions and measurement locations permitted. Scanning speeds were, at a maximum, one half (1/2) detector width per second. Audible features on the instrumentation were used to identify locations having elevated count rates. If identified, these locations were noted for further investigation.

Static measurements were taken with the instrument indicated in **Enclosure 1**. Measurements were taken of floor surfaces using the scaler function of the instruments for a count time of 1 minute. Static measurements were uniformly spaced according to the following pattern:

- Class 1 & 2 Area Surfaces - 14 measurements per survey unit.

An exposure rate measurement was taken 1m above the floor-surface in the Class 1 Area, using an internal GM type instrument (Ludlum Model 5 mR meter) calibrated for ^{137}Cs.

6.3.1 Instrumentation

Enclosure 3 lists the instrumentation used for the survey activities, along with the parameters and detection sensitivities for the instrumentation and the survey technique. Instruments were calibrated a minimum of once every six (6) months, using National Institute of Standards Technologies (NIST) traceable standards. Calibration for the specific alpha energies expected to be present at the site was performed post survey in "as found" condition. Operational and background checks were performed at least once during each shift of operational use.

6.4 Surface Activity Measurements

6.4.1 Sample Collection and Analysis Procedures

The procedure used for taking wipe samples is outlined below:

A grid of $1m^2$ was applied to the class I floor, 1 wipe sample was taken for each grid cell. The pattern for sampling was as follows:

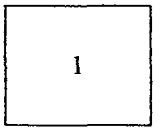

Figure 2
Pattern for Wipe Samples

The actual preprinted number of the smear filter paper was recorded on the map in the location the smear was taken. Grid cells were labeled on maps using the coordinate system as shown in **Figure 3**.

Each grid cell was surveyed beginning at A1 then moving across the row (A1, B1, and C1). Upon completion of the first row the next row (A2) was surveyed. The same pattern describe above was continued.

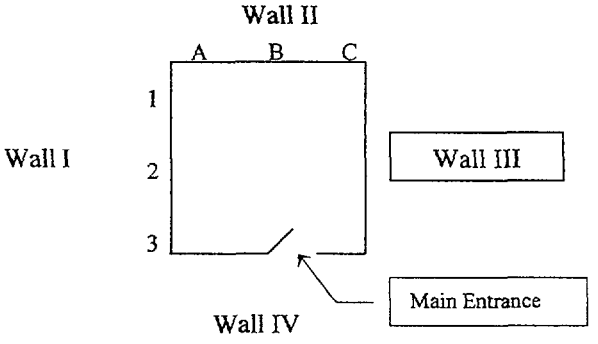

Figure 3
Grid Cell Survey Sequence

Walls were surveyed from left to right. One sample was taken per square meter on lower surfaces (with in 1 meter from the floor).

6.4.2 Sample Analysis

Wipe samples for removable contamination were analyzed for gross alpha activity after the survey.

6.4.3 Records

All samples and original survey data have been archived at Ecology Services, Inc. main office and will be held for three years or as requested by WVU Institute of Technology.

7.0 Data Interpretation

Data conversions and evaluations were performed, following the guidance in *NUREG/CR-5849*. Measurement data was converted to units of DPM/100 cm^2 (surface activity) and μR/hr (exposure rate). Average values for survey units were determined and compared with guideline levels.

8.0 Survey Findings and Results

Enclosure 2 contains individual map and schematic drawing for the survey unit. The map identifies the date and survey actions, equipment used as well as the results of sample analysis. All surfaces scanned were found to be less than the MDC_{scan} and MDC_{static} required. **Enclosure 2** contains the tables of survey smear results. All results were less than the stated DCGLs. Additional remediation and/or further sampling and measurement was not necessary, since the data met the specified level of confidence and was below the DCGLs.

9.0 Summary

On August 12, 2004 the Final Status Survey of the area of concern was performed. Surface scan and surface activity measurements were all shown to be less than DCGLs. Results of the survey demonstrate the site meets the limits for release of the facility for unrestricted use.

Gregory M. Howett
Project Manager

Enclosures:

1 – Survey Planning & Design

2 – Area Diagram and Sample Analysis Results

WVU Institute of Technology

Montgomery, WV
Engineering Classroom Building, Room 105

FINAL STATUS SURVEY PLANNING AND DESIGN

A Problem Statement:

1. The WVU Institute of Technology (the "facility") has terminated activities with licensed materials and must be released for unrestricted use in accordance with the NRC's license termination rules.

2. A final status survey is planned to determine whether or not all the survey units identified satisfy the release criterion.

B Release Criterion

1. The release criterion, against which the survey findings will be applied, will be those specified by the NRC in their Radiological Criteria for License Termination. (10 CFR §20 Subpart E) Specifically:

   > The site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that does not exceed 25 mrem per year, and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA).

2. This release criterion will be translated into Derived Concentration Guideline Levels (DCGLs) for the identified potential contaminants using the DandD software program (version 1.0) and the Building Occupancy Scenario (using default parameters). (See Table 4 below)

C Study Boundaries

The final status survey is restricted to the interior of room 105 of the Engineering Classroom Building on the WVU Institute of Technology campus in Montgomery, WV.

D Decision Rule

1. The parameter of interest in determining whether the survey results satisfy the release criteria will be the Derived Concentration Guideline Levels (DCGLs)

2. Survey Units will be evaluated using four methods, each being used to determine fixed or removable contamination levels which will be evaluated against the DCGLs.

TABLE 1 - EVALUATION METHODS

EVALUATION METHOD	PARAMETER IDENTIFIED
Scanning Surveys.	Fixed and Removable Contamination
Static Measurements at selected points.	Fixed and Removable Contamination Exposure Rates
Wipe sample measurements.	Removable Contamination
Additional wipe sample tests and static measurements (judgmental)	Removable Contamination

E Statistical Tests for Wipe Samples

1. The nonparametric statistical test used in this survey is designed to determine whether or not the level of residual activity uniformly distributed throughout each survey unit exceeds the DCGLs.

2. For the purpose of the statistical evaluation of data, the null hypothesis (H_0) will be adopted, i.e. the survey unit exceeds the release criterion. This requires significant evidence that the residual radioactivity in the survey unit is less than the release criterion to reject the null hypothesis (and pass the survey unit) In this case, a Type I decision error occurs when the null hypothesis is rejected when it is true, and is referred to as a false positive error; denoted by alpha (α). A Type II decision error occurs when the null hypothesis is accepted when it is false. This is referred to as a false negative error; denoted by beta (β).

TABLE 2 - DECISION ERRORS [MARSSIM APP D]			
H_0: THE RESIDUAL ACTIVITY IN THE SURVEY UNIT EXCEEDS THE RELEASE CRITERION			
		DECISION	
		Reject H_0 (Meets Release Criteria)	Accept H_0 (Exceeds Release Criterion)
TRUE CONDITION OF SURVEY UNIT	Meets Release Criterion	(No decision error)	Incorrectly Fail to Release Survey Unit (Type II)
	Exceeds Release Criterion	Incorrectly Release Survey Unit (Type I)	(No decision error)

3. Since the radionuclides of interest are either not present or are not present in any significant amount in background, the Sign Test will be used to evaluate data. The acceptable probabilities of Type I decision errors (α) and Type II decision errors (β) will be as follows:

TABLE 3 - ACCEPTABLE PROBABILITIES	
Decision Error	Acceptable Probabilities
Type I error (α)	.05
Type II error (β)	.05

4. Determination of the Number of Samples Required:

a. Definition of Terms

1) DCGL - Derived Concentration Guideline Level

2) LBGR - Lower Bound of the Grey Region

3) Δ (Shift) - (DCGL - LBGR)

4) σ_s - Standard Deviation

5) Δ/σ_s - relative shift

6) Sign p - The estimated probability that a random measurement from the survey unit will be less than the DCGL when the survey unit median is actually at the LBGR

7) $Z_{1-\alpha}$ & $Z_{1-\beta}$ Decision Error Percentiles (Table 5.2, MARSSIM)

8) N - Number of data points for the Sign Test

$$N = \frac{(Z_{1-a} + Z_{1-b})^2}{4(SignP - 0.5)^2}$$

b. The following table shows the calculations used to determine the number of samples required for each survey unit. [MARSSIM Sec 5.5.2.3]

TABLE 4 - DETERMINATION OF REQUIRED SAMPLE POPULATION

	Parameter								
Radio-nuclide	DCGL for 15 mrem (dpm/100 cm^2)	LBGR (dpm)	σ_s (dpm)	Δ/σ_s	Sign p	$Z_{1-\alpha}$	$Z_{1-\beta}$	N	N+20%
^{238}U+C	150	1.5	0.6	13	1.000	1.645	1.645	11	14
Source	Calculated (DandD v2.1.0)	ESI lab	ESI lab	Calculated	Table 5.4, MARSSIM	Table 5.2, MARSSIM	Table 5.2, MARSSIM	Calculated	Calculated

c. From the above data, it is clear that the default number of samples, 14 or more, is required for statistically valid results from each survey unit.

5. Areas of Elevated Activity

a. Assuming a Class I survey unit does not exceed 100 m^2,[DG4006, Table 2.1] and the number of measurements required for statistical tests is 14, and that a square grid pattern is used, then the distance between sample locations is given by:

$$L = \sqrt{\frac{A}{N}} = \sqrt{\frac{100}{14}} = 2.67m$$

b. Then the area for elevated measurements not found would be:

$$A_{EMC} = L^2 = 7.14m^2$$

c. The "area factor" is the magnitude by which the concentration within a small area of elevated activity can exceed the DCGL while maintaining compliance with the release criteria.

d. For Class I survey units of the type evaluated here, the number of samples may be driven more by the need to detect small areas of elevated activity than by the requirements of the statistical tests. Since a given concentration of residual radioactivity spread over a smaller area will, in general, result in a smaller dose or risk, the $DCGL_{EMC}$ used for the elevated measurement comparison is usually larger than the DCGL used for the statistical test.

1) For those radionuclides that deliver dose or risk primarily via internal pathways (e.g. ^{3}H, ^{14}C, ^{35}S, etc.), dose or risk is approximately proportional to inventory, so the difference in the DCGLs is approximately proportional to the areas. [MARSSIM Appendix D] therefore:

$$area \quad factor = \frac{36m^2}{L^2} = 5.04$$

2) For radionuclides that deliver dose or risk via external exposure (e.g. ^{22}Na), the relationship between $DCGL_{EMC}$ and DCGL is a function of the dose or risk modeling pathways. These are estimated here by computing the ratio of dose or risk per unit

concentration generated by RESRAD-BUILD 2.37 for areas of 36 m^2 and 7.14 m^2, otherwise using default values. The results produced an *area factor* = 2.72.

e. Since

$$Scan \quad MDC \quad (required) = DCGL \times (Area \quad Factor)$$

Then Scan MDC (required) can be calculated as shown below:

TABLE 5 - REQUIRED MDCSCAN			
Radionuclide	DCGL (dpm/100 cm^2) for 15 mrem TEDE	Area Factor	Scan MDC (required) dpm/100 cm^2
^{238}U+C	150	2.72	406.5

6. Calculation of Instrument MDCscan

a. The actual MDCscan for the instrumentation selected has been calculated for the limiting radionuclides potentially present as shown below. The method used was that identified in MARSSIM [MARSSIM Sec 6.7.2.1] using the following common parameters:

TABLE 6 - MDCSCAN COMMON PARAMETERS		
PARAMETER	ASSIGNED VALUE	DESCRIPTION
d'	1.38	Detectability value (95% false negatives and 60% false positives)
s	2	Observation Interval (1/2 probe width per second)
p	0.5	Efficiency of Surveyor
e_s	0.8	Surface Efficiency

TABLE 7 - INSTRUMENT MDCSCAN							
INSTRUMENT MAKE/MODEL	DETECTOR	ACTIVE AREA	BACKGROUND (CPM)	MDCR (NET CPM)	RADIO-NUCLIDE	EFFICIENCY (4π)	MDCSCAN dpm/100cm^2
Ludlum Model 12	43-1	83	9	22.7	^{238}U+C	28%	**172**

b. This analysis shows that all instruments selected for scanning meet or exceed the required MDC scanning sensitivity requirements given in table 5, when adjusted for a TEDE of 25 mrem.

7. Calculation of MDC_{static}

a. The actual MDC_{static} for the instrumentation selected has been calculated for the limiting radionuclides potentially present as shown below. The calculations were made with the RadCalcLE software program, version 1.0, 1999, using the MARSSIM method.

TABLE 8 - INSTRUMENT MDC_{STATIC}							
INSTRUMENT MAKE/MODEL	DETECTOR	ACTIVE AREA	BACKGROUND (CPM)	LD (NET CPM)	RADIO-NUCLIDE	EFFICIENCY (4π)	MDCSTATIC dpm/100cm^2
Ludlum Model 12	43-1	83	9	33.18	^{238}U+C	28%	**142.8**

b. The results show that all instruments selected for static measurements meet or exceed the required MDC sensitivity requirements given in table 5.

8. Scanning Coverage Fractions and Investigation Levels

- Scanning is performed to locate small areas of elevated concentrations of residual radioactivity to determine whether they meet the radiological criteria for license termination. Scanning was performed in each survey unit to detect areas of elevated concentrations. Scanning coverage fractions and scanning investigation levels for buildings and land areas are shown in Table 9. (This table is based on MARSSIM Roadmap Tables 2 and 5.8.)

Table 9 – Scanning Coverage Fractions and Investigation Levels

Class	Scanning Coverage Fraction	Scanning Investigation Levels
1	100 percent	> $DCGL_{EMC}$
2	10 to 100 percent for soil and for floors and lower walls of buildings. 10 to 50 percent for upper walls and ceilings of buildings. Systematic and Judgemental	> $DCGL_{EMC}$ or > MDC_{scan} if MDC_{scan} is greater than $DCGL_w$
3	Judgemental	> $DCGL_{EMC}$ or > MDC_{scan} if MDC_{scan} is greater than $DCGL_w$

- Systematic scans are those conducted according to a preset pattern. Judgmental scans are those conducted to include areas with a greater potential for residual radioactivity. In Class 2 areas, a 10 percent scanning coverage would be appropriate when there is high confidence that all locations would be below the $DCGL_W$. Coverage of 25 percent to 50 percent would be appropriate when there may be locations with concentrations near the $DCGL_W$. Coverage of 100 percent would be appropriate if there is any concern that the area should have had a Class 1 classification rather than a Class 2 classification. In Class 3 areas, scanning coverage is usually less than 10 percent. If any location exceeds the scanning investigation level, scanning coverage in the vicinity of that location should be increased to delineate the elevated area.

9. Evaluation of Survey Results

- All survey units should be evaluated to determine whether the average concentration in the survey unit as a whole is below the $DCGL_W$. If the radionuclide is not present in background and the measurement technique is radionuclide-specific so that comparison with a reference area is not necessary, a one-sample test, the Sign test, should be used.

- When the residual radioactivity contains a radionuclide present in the environment or when the measurements are not radionuclide-specific, the survey unit should be compared to a reference area. When the survey unit will be compared to a reference area, a two-sample test, the Wilcox Rank Sum (WRS) test, should be used.

10. ALARA Calculations

a. See Tab A.

11. References:

a. NUREG 1575, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, December 1997.

b. Draft Regulatory Guide DG-4006, *Demonstrating Compliance with the Radiological Criteria for License Termination*, U.S. NRC, August 1998.

c. Decontamination and Decommissioning (DandD) software, U.S. NRC, Version 1.00, Build 1.00.02

d. Resrad-Build software, U.S. DOE, Version 2.37, April 1998

e. RadCalcLE, Ludlum Measurements Edition, Version 1.0, ©1999, RSA Publications

Tab A to Enclosure 1

Residual Activity Levels that are ALARA

from NRC Draft Regulatory Guide DG-4006

$$\frac{Conc}{DCGL_w} = \frac{Cost}{2000 \times P_D \times 0.025 \times F \times A} \times \frac{r+\lambda}{1-e^{-(r+\lambda)N}}$$

Calculations made for:

DU contamination over an area of "A" m^2 for a cost of "$Cost_T$"
with an effectiveness of "F" in a building scenario.

$Cost_T$	P_D	F	A	r	λ	N	Conc/DCGLw =
$ 375.00	**0.09**	**0.8**	**7.14**	**0.07**	**1.55E-10**	**70**	**1.0**

$Cost_T$	Cost for remediation efforts, including transport & disposal of wastes
P_D	Population density (buildings: 0.09 person/m^2)
F	Amount of residual activity removed
A	Size of area (in m^2)
r	Monetary discount rate (0.07/yr for buildings)
λ	Decay constant for radionuclide (y^{-1})
N	Number of years of exposure (Buildings: 70)

Conc — The concentration level at or above which it will be cost effective to perform remediation.

Conc/DCGLw = — The concentration in units of DCGLw
If less than 1, ALARA remediation is usually necessary
if greater than 1, ALARA remediation is usually not required

Note: In this case, if washing/removal of surface contamination was to cost more than $375.00, then the removal activities need not be performed and the results would be ALARA. However, if elevated areas were decontaminated, the results would be ALARA regardless of the effectiveness.
(NRC Draft Reg Guide 4006, 1998, Sec 3.1)

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COLUMBIA, MD 21046
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RADIATION SAFETY SURVEY

COMPANY NAME: **WVU Institute of Technology**	BUILDING: **Engineering Classroom Building**
RADIATION SAFETY OFFICER: **MR. STEVE ROOT**	ROOM NO.: **105**

SURVEYOR: HOWETT, GOSNELL, DANIELS

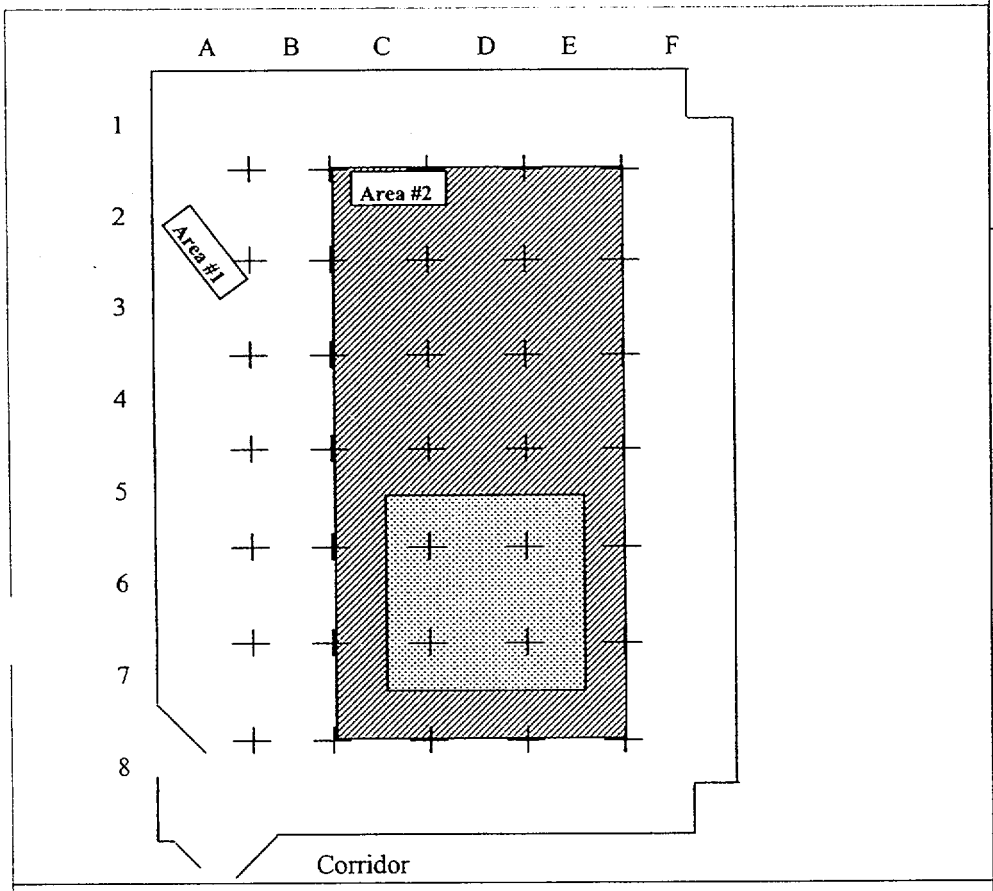
SURVEY DATE: **8/12/04**

INSTRUMENT MODEL; SN; CALIBRATION DATE; BACKGROUND READING.

Ludlum-12 w/ 43-1; 86123; background = 9.0 cpm

Ludlum-5; 118176; background = 15 µR/hr

AREA DIAGRAM:



SAMPLE ID	ACTION/WIPE SEQUENCE
Floor wipes A1-F8	**1-48**
Wall I	**49-56**
Wall II	**57-62**
Wall III	**63-70**
Wall IV	**71-76**

STATIC MEASUREMENTS WITH 43-1 PROBE:

GRID AREA	GCPM	DPM/100CM^2
B1	**24**	**65**
D1	**13**	**17**
F1	**8**	**<MDA**
A2	**22**	***56***
C2	**12**	***13***
E2	**5**	***<MDA***
B3	**13**	**17**
D3	**10**	**4**
F3	**15**	***26***
A4	**15**	***26***
C4	**29**	**86**
E4	**13**	**17**
B5	**14**	**22**
D5	**24**	**65**
F5	**11**	**9**
A6	**13**	**17**
C6	**13**	**17**
E6	**32**	**99**
B7	**11**	**9**
D7	**25**	**69**
F7	**16**	**30**
A8	**18**	**39**
C8	**13**	**17**
E8	**20**	**47**
Area #1	**13**	***17***
Area #2	**6**	***<MDA***

SUMMARY OF RESULTS:
All wipe sample results were less than the instrument L_D except as noted below. (The instrument L_D is less than 2200 dpm /100 cm^2)

Wipe location/ #	dpm/ 100 cm^2

COMMENTS:
Raised surf
Concrete

Original data is available for review upon request at ESI, Columbia, MD. 800-932-7299.

ECOLOGY SERVICES, INC.

REPORT OF SAMPLE ANALYSIS

Rev 1.3

For:	WVU Tech Decommission of Lab
Job:	Wipes
Sample Type:	Gross Alpha

Date:	1-Sep-04
By:	SAK
Sample Date:	10-Aug-04
Counting Parameters:	Gross Alpha

Equipment Description:
Counter: Gas Proportional
Detector: EIC FP-2 GFPC

Input Background Data:

Background Cts	Ct Time (m)	Background CPM	% Error
4	5	0.80	98.00%

Input Efficiency Data:

Isotope	Gross Counts	Time (m)	DPM	Efficiency (2 Pi)	% Error
PU-239	24631	5	1.16E+04	42.64%	4.00%

MDA Calculation:

MDA (CPM)	MDA (DPM)	MDA (uCi)
2	6	2.603E-06

Sample Data: Note: A zero reading for DPM or pCi/gm values indicates only that the sample activity was less than the MDA.

Sequence Number	Sample ID	Gross Counts	Ct Time (m)	CF	Decay Factor	DPM/Sample	Error at 95% C.L.
1	Floor Wipe # 1	6	5	1	0.97	< MDA	N/A
2	Wipe# 2	20	5	1	0.97	8	48.44%
3	Wipe# 3	4	5	1	0.97	< MDA	N/A
4	Wipe# 4	6	5	1	0.97	< MDA	N/A
5	Wipe# 5	23	5	1	0.97	9	44.74%
6	Wipe# 6	5	5	1	0.97	< MDA	N/A
7	Wipe# 7	5	5	1	0.97	< MDA	N/A
8	Wipe# 8	23	5	1	0.97	9	44.74%
9	Wipe# 9	3	5	1	0.97	< MDA	N/A
10	Wipe# 10	3	5	1	0.97	< MDA	N/A
11	Wipe# 11	17	5	1	0.97	6	53.22%
12	Wipe# 12	4	5	1	0.97	< MDA	N/A
13	Wipe# 13	6	5	1	0.97	< MDA	N/A
14	Wipe# 14	19	5	1	0.97	7	49.89%
15	Wipe# 15	1	5	1	0.97	< MDA	N/A
16	Wipe# 16	3	5	1	0.97	< MDA	N/A
17	Wipe# 17	12	5	1	0.97	< MDA	N/A
18	Wipe# 18	3	5	1	0.97	< MDA	N/A
19	Wipe# 19	2	5	1	0.97	< MDA	N/A
20	Wipe# 20	17	5	1	0.97	6	53.22%
21	Wipe# 21	5	5	1	0.97	< MDA	N/A
22	Wipe# 22	6	5	1	0.97	< MDA	N/A
23	Wipe# 23	12	5	1	0.97	< MDA	N/A
24	Wipe# 24	2	5	1	0.97	< MDA	N/A
25	Wipe# 25	4	5	1	0.97	< MDA	N/A
26	Wipe# 26	13	5	1	0.97	< MDA	N/A
27	Wipe# 27	1	5	1	0.97	< MDA	N/A
28	Wipe# 28	3	5	1	0.97	< MDA	N/A
29	Wipe# 29	10	5	1	0.97	< MDA	N/A
30	Wipe# 30	5	5	1	0.97	< MDA	N/A
31	Wipe# 31	5	5	1	0.97	< MDA	N/A
32	Wipe# 32	13	5	1	0.97	< MDA	N/A
33	Wipe# 33	2	5	1	0.97	< MDA	N/A
34	Wipe# 34	2	5	1	0.97	< MDA	N/A
35	Wipe# 35	9	5	1	0.97	< MDA	N/A
36	Wipe# 36	2	5	1	0.97	< MDA	N/A
37	Wipe# 37	3	5	1	0.97	< MDA	N/A
38	Wipe# 38	22	5	1	0.97	8	45.88%
39	Wipe# 39	1	5	1	0.97	< MDA	N/A
40	Wipe# 40	20	5	1	0.97	8	48.44%
	"Missed Activity"	6	1	1	0.97	6	

$$MDA(dpm) = \frac{4.65\sqrt{R_b/T_b} + 3}{T_s \cdot Efficiency}$$

Health Physicist

ECOLOGY SERVICES, INC.

REPORT OF SAMPLE ANALYSIS

Rev 1.3

For:	WVU Tech Decommission of Lab
Job:	Wipes
Sample Type:	Gross Alpha

Date:	1-Sep-04
By:	SAK
Sample Date:	10-Aug-04
Counting Parameters:	Gross Alpha

Equipment Description:
Counter: Gas Proportional
Detector: EIC FP-2 GFPC

Input Background Data:

Background Cts	Ct Time (m)	Background CPM	% Error
4	5	0.80	98.00%

Input Efficiency Data:

Isotope	Gross Counts	Time (m)	DPM	Efficiency (2 Pi)	% Error
PU-239	24631	5	1.16E+04	42.64%	4.00%

MDA Calculation:

MDA (CPM)	MDA (DPM)	MDA (uCi)
2	6	2.603E-06

Sample Data: Note: A zero reading for DPM or pCi/gm values indicates only that the sample activity was less than the MDA.

Sequence Number	Sample ID	Gross Counts	Ct Time (m)	CF	Decay Factor	DPM/Sample	Error at 95% C.L.
41	Floor Wipe # 41	6	5	1	0.97	< MDA	N/A
42	Wipe# 42	3	5	1	0.97	< MDA	N/A
43	Wipe# 43	16	5	1	0.97	< MDA	N/A
44	Wipe# 44	3	5	1	0.97	< MDA	N/A
45	Wipe# 45	1	5	1	0.97	< MDA	N/A
46	Wipe# 46	2	5	1	0.97	< MDA	N/A
47	Wipe# 47	5	5	1	0.97	< MDA	N/A
48	Wipe# 48	23	5	1	0.97	9	44.74%
49	Wall I Wipe# 49	3	5	1	0.97	< MDA	N/A
50	Wipe# 50	2	5	1	0.97	< MDA	N/A
51	Wipe# 51	7	5	1	0.97	< MDA	N/A
52	Wipe# 52	3	5	1	0.97	< MDA	N/A
53	Wipe# 53	7	5	1	0.97	< MDA	N/A
54	Wipe# 54	11	5	1	0.97	< MDA	N/A
55	Wipe# 55	1	5	1	0.97	< MDA	N/A
56	Wipe# 56	4	5	1	0.97	< MDA	N/A
57	Wall II Wipe# 57	18	5	1	0.97	7	51.47%
58	Wipe# 58	3	5	1	0.97	< MDA	N/A
59	Wipe# 59	16	5	1	0.97	< MDA	N/A
60	Wipe# 60	5	5	1	0.97	< MDA	N/A
61	Wipe# 61	2	5	1	0.97	< MDA	N/A
62	Wipe# 62	17	5	1	0.97	6	53.22%
63	Wall III Wipe # 63	3	5	1	0.97	< MDA	N/A
64	Wipe# 64	1	5	1	0.97	< MDA	N/A
65	Wipe# 65	20	5	1	0.97	8	48.44%
66	Wipe# 66	2	5	1	0.97	< MDA	N/A
67	Wipe# 67	9	5	1	0.97	< MDA	N/A
68	Wipe# 68	12	5	1	0.97	< MDA	N/A
69	Wipe# 69	4	5	1	0.97	< MDA	N/A
70	Wipe# 70	6	5	1	0.97	< MDA	N/A
71	Wall IV Wipe# 71	3	5	1	0.97	< MDA	N/A
72	Wipe# 72	4	5	1	0.97	< MDA	N/A
73	Wipe# 73	8	5	1	0.97	< MDA	N/A
74	Wipe# 74	2	5	1	0.97	< MDA	N/A
75	Wipe# 75	7	5	1	0.97	< MDA	N/A
76	Wipe# 76	5	5	1	0.97	< MDA	N/A
	"Missed Activity"	6	1	1	0.97	6	

$$MDA(dpm) = \frac{4.65\sqrt{R_b/T_b} + 3}{T_b \cdot Efficiency}$$

Health Physicist

This is to acknowledge the receipt of your letter/application dated

10/28/2004, and to inform you that the initial processing which includes an administrative review has been performed.

AMEND. SNM-1990

☑ There were no administrative omissions. Your application was assigned to a technical reviewer. Please note that the technical review may identify additional omissions or require additional information.

☐ Please provide to this office within 30 days of your receipt of this card

_____.

A copy of your action has been forwarded to our License Fee & Accounts Receivable Branch, who will contact you separately if there is a fee issue involved.

Your action has been assigned **Mail Control Number** 135989.
When calling to inquire about this action, please refer to this control number.
You may call us on (610) 337-5398, or 337-5260.

NRC FORM 532 (RI)
(6-96)

Sincerely,
Licensing Assistance Team Leader

BETWEEN:

License Fee Management Branch, ARM
and
Regional Licensing Sections

(FOR LFMS USE)
INFORMATION FROM LTS

Program Code: 22120
Status Code: 0
Fee Category: EX 1D
Exp. Date: 20130228
Fee Comments: 170.11(A)(4)
Decom Fin Assur Reqd: N

LICENSE FEE TRANSMITTAL

A. REGION I

1. APPLICATION ATTACHED
   Applicant/Licensee: WEST VIRGINIA INST. OF TECHNOLOGY
   Received Date: 20041108
   Docket No: 7003071
   Control No.: 135989
   License No.: SNM-1990
   Action Type: Amendment

2. FEE ATTACHED
   Amount: _____
   Check No.: _____

3. COMMENTS

Signed M. A. Perkins
Date 11/16/2004

B. LICENSE FEE MANAGEMENT BRANCH (Check when milestone 03 is entered /__/)

1. Fee Category and Amount: _____

2. Correct Fee Paid. Application may be processed for:
   Amendment _____
   Renewal _____
   License _____

3. OTHER _____
   _____

Signed _____
Date _____