TVA

Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

Br. 3

January 27, 2015

10 CFR 30.36

REC'D RG1 02 02 '15 AM10:12

Licensing Assistance Team
Division of Nuclear Materials Safety
U. S. Nuclear Regulatory Commission, Region I
2100 Renaissance Blvd., Suite 100
King of Prussia, Pennsylvania 19406-2713

Tennessee Valley Authority
Materials License Number 41-08165-19
Docket Number 030-38667

Subject: By-Product Materials License Number 41-08165-19 for TVA's Mixed Waste Storage Facility – Request to Terminate NRC Materials License

References:

1. Letter from TVA to NRC, "By-Product Materials License Number 41-08165-19 for TVA's Mixed Waste Storage Facility – Cessation of Principal Activities," dated August 29, 2014.

2. Letter from NRC to TVA, "Tennessee Valley Authority, Acceptance of Notification of Forthcoming Cessation of Activities at a Site, Control No. 583639" dated April 22, 2014.

3. Letter from TVA to NRC, "By-Product Materials License Number 41-08165-19 for TVA's Mixed Waste Storage Facility – Cessation of Principal Activities" dated April 3, 2014.

As discussed in the referenced letters, the TVA's Mixed Waste Storage Facility (MWSF) ceased principal activities as scheduled on June 30, 2014. The last disposal shipment of mixed hazardous waste from the facility was on June 12, 2013, and no additional mixed hazardous waste was received at the site after that date. Decommissioning activities were begun after June 30, 2014 and a Final Status Survey was completed during the week of December 1, 2014. Based on the results of that survey, TVA has concluded that the level of residual radioactivity that is distinguishable from background radiation within the two buildings where the mixed hazardous waste was stored, Mixed Waste Storage Building I (MWSB-1) and Mixed Waste Storage Building II (MWSB-2) is well below levels that could result in a Total Effective Does Equivalent (TEDE) to an average member of the critical group that exceeds 25 mrem and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA).

585991

NMSS/RGN1 MATERIALS-002

A Certificate of Disposition of Materials, NRC Form 314 is included in Enclosure 1. The Final Status Survey Report that demonstrates the facility is suitable for unrestricted release as required in 10 CFR 20.1402 is included in Enclosure 2. TVA requests that this license be terminated as soon as possible in order that other site decommissioning activities that are not related to NRC regulated activities may be completed in an expeditious manner. TVA appreciates your consideration of this request for an expedited review.

If you have any questions regarding this information, please contact Lee Miller at (423) 751-3197.

Respectfully,

J. W. Shea
Vice-President, Nuclear Licensing

Enclosures:

1. NRC Form 314, Certificate of Disposition of Materials
2. Mixed Waste Storage Facility Final Status Survey Report

Enclosure 1

NRC FORM 314

CERTIFICATE OF DISPOSITION OF MATERIALS

NRC FORM 314
(02-2014)
10 CFR 30.36(j)(1);
40.42(j)(1); 70.38(j)(1);
and 72.54(k)(5)(1)(1)

U.S. NUCLEAR REGULATORY COMMISSION

CERTIFICATE OF DISPOSITION OF MATERIALS

APPROVED BY OMB: NO. 3150-0028 **EXPIRES: 02/28/2017**

Estimated burden per response to comply with this mandatory collection request: 30 minutes. This submittal is used by NRC as part of the basis for its determination that the facility is released for unrestricted use. Send comments regarding burden estimate to the FOIA, Privacy, and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0028), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE NAME AND ADDRESS

Tennessee Valley Authority
Vice President, Nuclear Licensing
LP 3D-C
1101 Market Street, Chattanooga, Tennessee 37402-2801

LICENSE NUMBER
41-08165-19 (01-25284-01)

DOCKET NUMBER
030-38667 (030-33440)

LICENSE EXPIRATION DATE
08/31/2020

A. LICENSE STATUS (Check the appropriate box)

☐ This license has expired. ☑ This license has not yet expired; please terminate it.

B. DISPOSAL OF RADIOACTIVE MATERIAL

(Check the appropriate boxes and complete as necessary. If additional space is needed, provide attachments)

The licensee, or any individual executing this certificate on behalf of the licensee, certifies that:

☐ 1. No radioactive materials have ever been procured or possessed by the licensee under this license.

☑ 2. All activities authorized by this license have ceased, and all radioactive materials procured and/or possessed by the licensee under this license number cited above have been disposed of in the following manner.

- ☐ a. Transfer of radioactive materials to the licensee listed below:
- ☑ b. Disposal of radioactive materials:
  - ☐ 1. Directly by the licensee:
  - ☐ 2. By licensed disposal site:
  - ☐ 3. By waste contractor:

    Energy Solutions, Oak Ridge, TN received remaining mixed waste stored at facility June 13, 2013.
- ☑ c. All radioactive materials have been removed such that any remaining residual radioactivity is within the limits of 10 CFR Part 20, Subpart E, and is ALARA.

C. SURVEYS PERFORMED AND REPORTED

☑ 1. A radiation survey was conducted by the licensee. The survey confirms:

- ☑ a. the absence of licensed radioactive materials
- ☑ b. that any remaining residual radioactivity is within the limits of 10 CFR 20, Subpart E, and is ALARA.

☑ 2. A copy of the radiation survey results:

- ☑ a. is attached; or ☐ b. is not attached (Provide explanation); or ☐ c. was forwarded to NRC on: ________ Date

☐ 3. A radiation survey is not required as only sealed sources were ever possessed under this license, and

- ☐ a. The results of the latest leak test are attached; and/or ☐ b. No leaking sources have ever been identified.

The person to be contacted regarding the information provided on this form:

NAME	TITLE	TELEPHONE *(Include Area Code)*	E-MAIL ADDRESS
Lee R. Miller	Senior Licensing Manager	(423) 751-3197	lrmiller@tva.gov

Mail all future correspondence regarding this license to:

Tennessee Valley Authority, Vice President, Nuclear Licensing, LP 3D-C, 1101 Market Street, Chattanooga, TN 37402-2801

C. CERTIFYING OFFICIAL

I CERTIFY UNDER PENALTY OF PERJURY THAT THE FOREGOING IS TRUE AND CORRECT

PRINTED NAME AND TITLE	SIGNATURE	DATE
J. W. Shea, Vice President, Nuclear Licensing		1/25/2015

WARNING: FALSE STATEMENTS IN THIS CERTIFICATE MAY BE SUBJECT TO CIVIL AND/OR CRIMINAL PENALTIES. NRC REGULATIONS REQUIRE THAT SUBMISSIONS TO THE NRC BE COMPLETE AND ACCURATE IN ALL MATERIAL RESPECT. 18 U.S.C. SECTION 1001 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

Enclosure 2

MIXED WASTE STORAGE FACILITY

FINAL STATUS SURVEY REPORT

SITE DECOMMISSIONING AND NRC LICENSE TERMINATION

FINAL STATUS SURVEY REPORT

TENNESSEE VALLEY AUTHORITY

HAZARDOUS WASTE STORAGE FACILITY

MIXED WASTE STORAGE FACILITY

MIXED WASTE STORAGE BUILDINGS I AND II

NRC MATERIALS LICENSE NO. 41-08165-19

Reviewed By: James B. Colagross Date: 1-15-15
James B. Colagross
Radiation Safety Officer

Approved By: William H. Cronin Date: 1-15-15
William Cronin
General Manager,
Inspection, Testing, Monitoring,
and Analysis

Executive Summary

On February 28, 1995, the Nuclear Regulatory Commission issued Materials License No. 01-25284-01 to the Tennessee Valley Authority (TVA) for the possession and storage only of mixed fission/activation products as low level mixed waste (40 CFR 261) which was received from TVA facilities. On October 8, 2013, NRC terminated Materials License No. 01-25284-01 with the subsequent issuance of Materials License No. 41-08165-19, which authorized the same uses and locations of use as the terminated license. The low level mixed waste was stored at TVA's Mixed Waste Storage Facility (MWSF), part of TVA's Hazardous Waste Storage Facility, on TVA Reservation in Muscle Shoals, Alabama in two Mixed Waste Storage Buildings, identified as Mixed Waste Storage Building I (MWSB-1) and Mixed Waste Storage Building II (MWSB-2).

The mixed waste was received from TVA nuclear sites in sealed storage containers and stored prior to being transferred for final processing and disposal. The waste was packaged in a form ready for transport and disposal when it arrived at this facility. Handling procedures and radiation protection program procedures and practices were implemented to prevent the creation of residual radioactive contamination at the MWSF. None of the containers stored within the storage facilities leaked their contents. Over the life of the license, MWSB-1 and MWSB-2 were maintained as radiologically clean buildings, free from any contamination as evidenced by radiological surveys.

The MWSF received 112 containers of mixed hazardous waste during the operating life of the facility. The last remaining eleven drums of mixed hazardous waste which were in storage at the MWSF were shipped to a disposal site on June 12, 2013. The MWSF did not receive any additional mixed hazardous waste after that date. TVA ceased principal activities at the MWSF on June 30, 2014 and informed the NRC in a letter dated August 29, 2014.

As part of the site decommissioning and to support the license termination, a Final Status Survey (FSS) to determine the radiological conditions within MWSB-1 and MWSB-2 was performed during the week of December 1, 2014. The purpose of the FSS was to demonstrate that MWSB-1 and MWSB-2 met the radiological criteria for unrestricted use as described in 10 CFR 20.1402. As stated in 10 CFR 20.1402, a 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, including that from groundwater sources of drinking water, and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA).

The FSS was designed as described in the NRC's "Consolidated Decommissioning Guidance: *Decommissioning Process for Materials Licensees*", NUREG-1757. The MWSBs met the criteria described in NUREG-1757, Vol. 1, Chapter 7, "Decommissioning Groups", Section 7.4, "Group 2: Unrestricted Release Using Screening Criteria; No Decommissioning Plan Required." The FSS design was based on NUREG-1757, Vol. 2, Rev. 1, Appendix B, "Simple Approaches for Conducting Final Radiological Surveys," method B.2, "Alternative Simplified Method."

Based on the results of the Final Status Survey, TVA concluded that the level of residual radioactivity that is distinguishable from background radiation within MWSB-1 and MWSB-2 is well below levels that could result in a Total Effective Does Equivalent (TEDE) to an average member of the critical group that exceeds 25 mrem and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA).

CONTENTS

Sections

Figures

Attachments

1.0 License History

On February 28, 1995, the Nuclear Regulatory Commission issued Materials License 01-25284-01 to the Tennessee Valley Authority (TVA) for the possession and storage only of mixed fission/activation products as low level mixed waste (40 CFR 261) which was received from TVA facilities. The initial license did allow TVA personnel to open the mixed waste containers for visual inspection purposes as determined necessary by the Radiation Safety Officer, but did not authorize the processing or sorting of the mixed waste. The license was amended several times in subsequent amendments for reasons such as changes in personnel, organization changes, and licensed activity changes. In response to TVA's November, 19, 1999 license amendment application, the NRC issued Materials License Amendment No. 04, which authorized TVA to sort mixed waste as needed and described in the application. The license was also amended in 2012 to broaden the chemical constituents that could be included in the low level mixed waste and the authorized use was changed to possession and storage only of mixed waste fission/activation products as low level radioactive waste and chemically hazardous constituents. The authority to sort the low level mixed waste was removed from the authorized use since the need to sort the waste described in the November 19, 1999, amendment application no longer existed.

On October 8, 2013, NRC terminated Materials License 01-25284-01 with the subsequent issuance of Materials License 41-08165-19, which authorized the same uses and locations of use as the terminated license. In a letter dated April 3, 2014, TVA notified the NRC of the decision to permanently cease principal activities at the Mixed Waste Storage Facility (MWSF), which is a part of TVA's Hazardous Waste Storage Facility (HWSF). The proposed site closure schedule provided that mixed waste receipts at the MWSF would cease by June 30, 2014, and all mixed waste would be removed from the site by the end of September 2014. The MWSF did not receive any additional mixed waste after June 12, 2013, and ceased principal activities on June 30, 2014. TVA informed NRC of this in a letter dated August 29, 2014.

Radioactive Materials Authorized By NRC Materials License

Radioisotope	**Chemical or Physical Form**	**Total Activity Authorized**
A. Any byproduct material with atomic numbers 1 through 83	A. Any	A. 3 curies
B. Uranium 233	B. Any	B. 1 gram (9.5 millicuries)
C. Uranium 235	C. Any	C. 100 grams (210 microcuries)
D. Plutonium 238	D. Any	D. 0.006 gram (100 microcuries)
E. Plutonium 239	E. Any	E. 1 gram (61 millicuries)
F. Americium 241	F. Any	F. 0.1 millicurie
G. Curium 242	G. Any	G. 0.1 millicurie
H. Curium 243	H. Any	H. 0.1 millicurie
I. Curium 244	I. Any	I. 0.1 millicurie
J. Radium 226	J. Any	J. 0.1 millicurie
K. Thorium 232	K. Any	K. 0.1 millicurie
L. Neptunium 237	L. Any	L. 0.1 millicurie
M. Plutonium 240	M. Any	M. 0.1 millicurie
N. Plutonium 241	N. Any	N. 0.1 millicurie

2.0 Facility Description

The low level mixed waste was stored at TVA's MWSF, a part of the HWSF, on TVA Reservation in Muscle Shoals, Alabama. Figure 1 provides a depiction of the Mixed Waste Storage Facility and the location of the Mixed Waste Storage Buildings where the mixed waste was stored.

There were two Mixed Waste Storage Buildings, identified as MWSB-1 and MWSB-2. Both MWSBs are modular buildings that were specifically designed and built by Safety Storage Inc. to store hazardous materials. MWSB-1 provided approximately 181.5 square feet of storage area. MWSB-2 provided approximately 185.6 square feet of storage area. Neither building contained any material such as benches, cabinets, hoods, glove boxes, etc. Both buildings were situated on individual concrete pads. Figures 2 and 3 provide an overview of MWSB-1 and MWSB-2, respectively. As noted on Figure 1, the location labeled "MSWB-3" is a concrete pad which was established for future expansion, if a third building was needed.

The outside dimensions of the storage buildings are provided in the following table.

Building	Width (ft)	Length (ft)	Height (ft)
MWSB I	8.25	22.0	8.7
MWSB II	8.25	22.5	8.7

The MWSBs are Factory Mutual (FM) approved relocatable hazardous materials storage units. They were prefabricated and transported to the site. They are Underwriters Laboratory (UL) classified and constructed from UL-approved materials. Each MWSB is constructed from 10 gauge, corrosion protected steel sheet welded to 10 gauge, corrosion protected, formed steel studs. The roof/ceiling is constructed of noncombustible, 12 gauge, corrosion protected sheet continuously welded to 10 gauge, corrosion protected, formed steel purlins on 30-inch centers. The roof is sloped for rain water runoff. No mechanical fasteners penetrate the exterior walls or roof. No lightweight exterior steel skins, plywood, or rubber membranes are used in the wall or roof construction.

The MWSBs were designed to comply with national and regional codes that reflect the requirements of the Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), the National Fire Protection Association (NFPS), the Uniform Fire Code (UFC), the Standard Building and Fire Protection Codes, and the National Electrical Code (NEC).

The ventilation system was an explosion-proof, electro-mechanical system designed for maximum safety and regulatory compliance. The air exchange rate exceeded six changes per hour. It would automatically shut down in the event of a fire. The air intake was within twelve inches of the floor to minimize the accumulation of heavier-than-air hazardous vapors. The system exhaust was located near the exterior roof-line to maximize hazardous vapor dispersion.

Groundwater protection for the MWSBs was provided by integral, built-in sumps below the 55-gallon drums. They provided a volume of up to 30 percent of the cumulative volume of all of the drums. The sump was constructed of heavy gauge steel that was welded and corrosion protected. The sump was covered with a steel floor grating of rectangular design with cross bars welded at right angles to bearing bars. Metal sump covers were corrosion protected. Non-metallic sump covers could have been used if needed. If a drum leaked and radioactive material were found in a sump, then the material would be placed in a drum, the leaking drum

placed in an overpack, and the sump and grating would be decontaminated or disposed of properly. None of the drums or other storage containers stored at the MWSF were damaged or showed signs of leaking or of serious deterioration. Radiation surveys performed upon receipt of mixed waste containers, while mixed waste containers were in storage, and when mixed waste containers were shipped to permanent disposal facilities indicated that none of the mixed waste containers leaked their contents and no radioactive material was ever detected in the sump, on the grating, or any other surfaces within the MWSBs.

3.0 Conduct of Licensed Activities

The mixed waste was received from TVA nuclear sites in sealed storage containers and stored prior to being transferred for final processing and disposal. The waste was packaged in a form ready for transport and disposal when it arrived at this facility. The contents of each drum were clearly labeled in accordance with NRC regulations.

Mixed waste is governed by both NRC and EPA. The low-level radioactive waste was classified based on 10 CFR 61.55 regulations. The hazardous waste determination was performed based on Code of Federal Regulations (CFR) Title 40, Chapter I – Environmental Protection Agency, Subchapter I – Solid Wastes and Subchapter R – Toxic Substances Control Act.

The mixed wastes that were held at TVA's nuclear sites and may have been shipped to the MWSF were Class A low-level radioactive wastes mixed with hazardous wastes. The mixed wastes included, but may not have been limited to:

1. Solid, characteristic waste (based on lead content), paint stripper, paint chips, and paint chips mixed with rags.

2. Liquid, characteristic waste (based on lead content); waste oil.

3. Liquid, flammable (ignitable); waste paint, paint thinner, waste oil, flammable liquid, Varsol, oil/water mixture, diesel fuel, waste liquid, alcohol, and scintillation fluid in glass vials.

4. Liquid, corrosive; citric acid and phosphoric acid.

5. Liquid, listed waste, grease, and spent halogenated degreasing.

6. Polychlorinated biphenyls (PCBs).

TVA nuclear site that shipped the mixed waste to the MWSF considered the chemical compatibility of waste containers and their contents. Drums were selected to not react with their contents. MWSF personnel paid attention to the chemical characteristics of the contents of different drums that were placed near each other. They were sorted by hazard class. Containers of acids and flammable liquids were placed in separate MWSBs.

The drums in this facility were not stacked higher than two drums. Placement and stacking of the drums was done in such a manner as to ensure the stability of the drums and to prevent damage or deformation of the drums. MWSB-2 was routinely used to store the drums of mixed hazardous waste. MWSB-1 was used to store 40 drums of mixed hazardous waste that was contaminated with cesium 137 (Cs-137). MWSF records indicate that no other radionuclides were stored in MWSB-1.

The MWSF received 112 containers of mixed hazardous waste during the operating life of the facility. The last remaining eleven drums of mixed hazardous waste which were in storage at the MWSF were shipped to a disposal site on June 12, 2013. The MWSF did not receive any additional mixed hazardous waste after that date. A table that includes the date of receipt and disposal for the 112 containers that were received and shipped for disposal is in Attachment 1. A copy of the Uniform Hazardous Waste Manifest for the last shipment is in Attachment 2.

4.0 Minimization of Residual Contamination

Handling procedures and radiation protection program procedures and practices were implemented to prevent the creation of residual radioactive contamination at the MWSF. None of the containers stored within the storage facilities ever leaked their contents. Over the life of the license, MWSB-1 and MWSB-2 have been maintained as radiologically clean buildings, free from any contamination as evidenced by radiological surveys.

When containers arrived at the site, radiation safety technicians surveyed the containers for radiation dose rates and removable contamination. Once these surveys were completed, the containers were transported directly to one of the MWSBs. When all of the containers were placed within the MWSB, the radiation safety technician performed a radiation dose survey inside the MWSB.

Radiation safety technicians performed quarterly radiation surveys of the MWSBs when mixed wastes were stored within each building. The technicians performed dose rate measurements, obtained removable contamination smears to assess levels of removable alpha and beta/gamma removable contamination, and assessed the levels of airborne radioactivity. If the stored wastes in a MWSB were shipped for disposal and the building had been empty for a period of time, the technicians performed a survey to confirm that there was no residual contamination in the buildings.

When containers of mixed waste were removed from the MWSBs for shipment to the waste disposal facility, the radiation safety technicians surveyed the containers for radiation dose rates and levels of removable contamination.

Throughout the operational history of the MWSF, the radiation safety technicians did not identify any radiation dose rates or levels of removable contamination on mixed waste storage containers or on MWSB floors and walls that were above regulatory or procedurally established action limits. No leaks or spills of the mixed hazardous waste from the storage containers were ever identified or otherwise known to have occurred. No residual contamination was ever detected within the MWSBs.

On two occasions during the operating life of the facility, TVA personnel opened some mixed waste containers to segregate the materials contained within or to sample the contents of the containers. On the first occasion, which occurred on March 3 and 4, 2000, thirteen 55-gallon drums and three 5-gallon buckets of mixed waste were opened so that contained hard items could be segregated from the shred-able items. TVA personnel established a Contamination Work Zone with a posted Radiation Area and Contamination Area for the conduct of this task in the Hazardous Waste Storage Facility (HWSF) Receiving and Workup area. A plastic tent, which included a plastic floor, was set-up within the posted Contamination Work Zone. A Radiation Work Permit was developed to ensure the task was safely completed. Radiation safety technicians surveyed personnel as they exited the Contamination Work Zone, assessed the level of airborne contamination during the conduct of the task, and surveyed the mixed waste containers for radiation dose rates and levels of removable contamination. When the

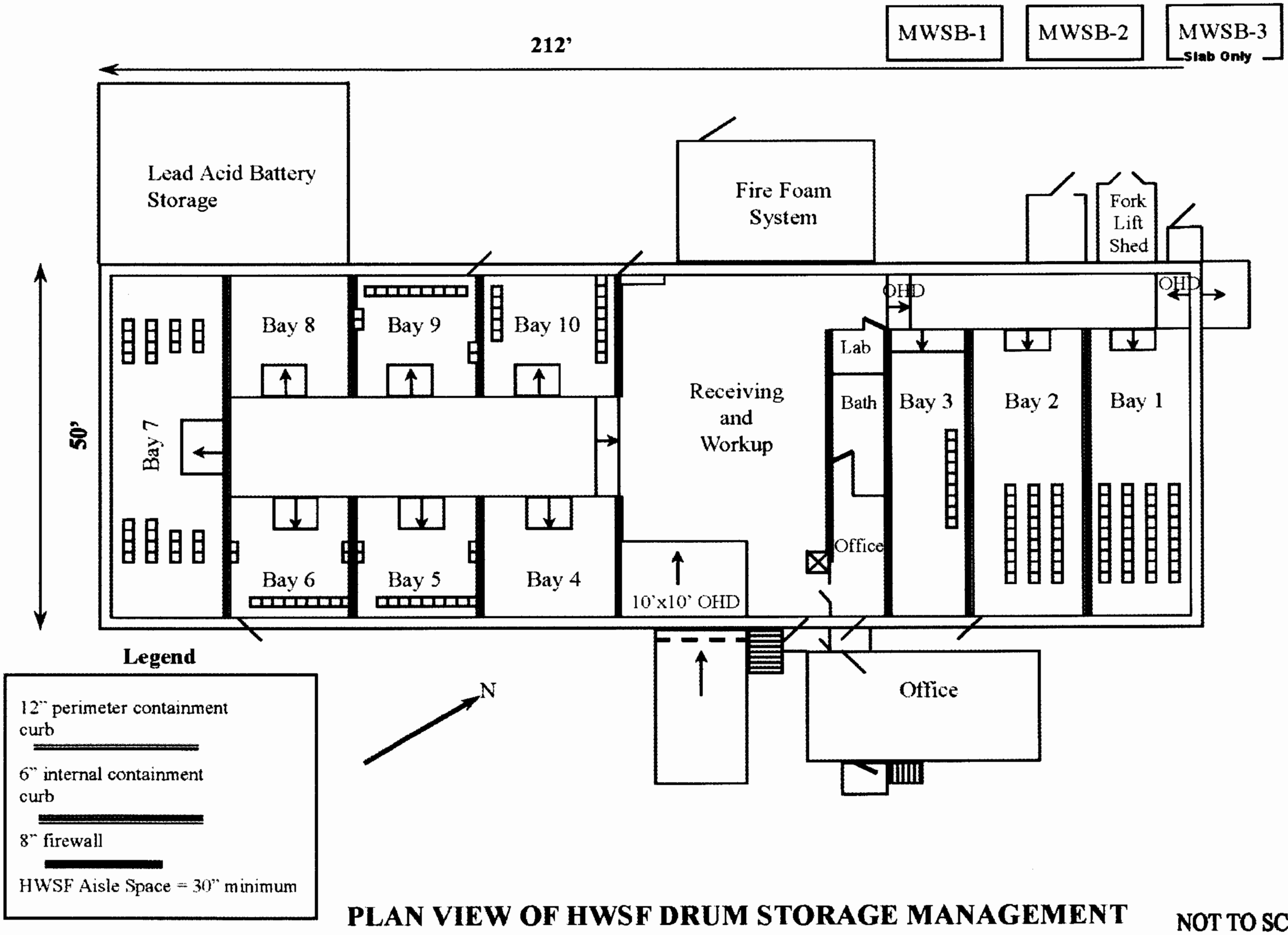
task was completed, the materials used during the performance of the task were surveyed and disposed of as radioactive waste as needed, and the area within the HWSF was surveyed to confirm there was no residual fixed or removable contamination in the area where the task was performed. The record of this activity dated March 4, 2000, including survey records, are a part of the decommissioning records maintained for the MWSF NRC license and the license Radiation Safety Officer maintains a copy of these records for review.

The second occasion when TVA personnel opened some mixed waste containers was on June 6, 2000. This task involved six drums and one 5-gallon container. The containers were opened, sampled, and resealed within the MWSB where they were stored. A Radiation Work Permit was developed to ensure the task was safely completed. A radiation safety technician performed surveys for dose rates and assessed levels of airborne contamination during the performance of the task. When the task was completed the drums were surveyed for external dose rates and removable contamination before they were shipped for disposal. The radiation safety technician also surveyed the area within the MWSB where the task was performed for area dose rates and removable contamination. The results of the surveys indicated that no radioactive material was released during the conduct of the task and no residual contamination was detected after the task was completed. The record of this activity dated June 14, 2000, including survey records, are a part of the decommissioning records maintained for the MWSF NRC license and the license Radiation Safety Officer maintains a copy of these records for review.

5.0 Final Status Survey

A Final Status Survey to determine the radiological conditions within MWSB-1 and MWSB-2 was performed during the week of December 1, 2014. A description of the Final Status Survey and the results of the survey are included in Attachment 3. Based on the results of the Final Status Survey, TVA concluded that the level of residual radioactivity that is distinguishable from background radiation within MWSB-1 and MWSB-2 is well below levels that could result in a Total Effective Does Equivalent (TEDE) to an average member of the critical group that exceeds 25 mrem and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA).

Figure 1

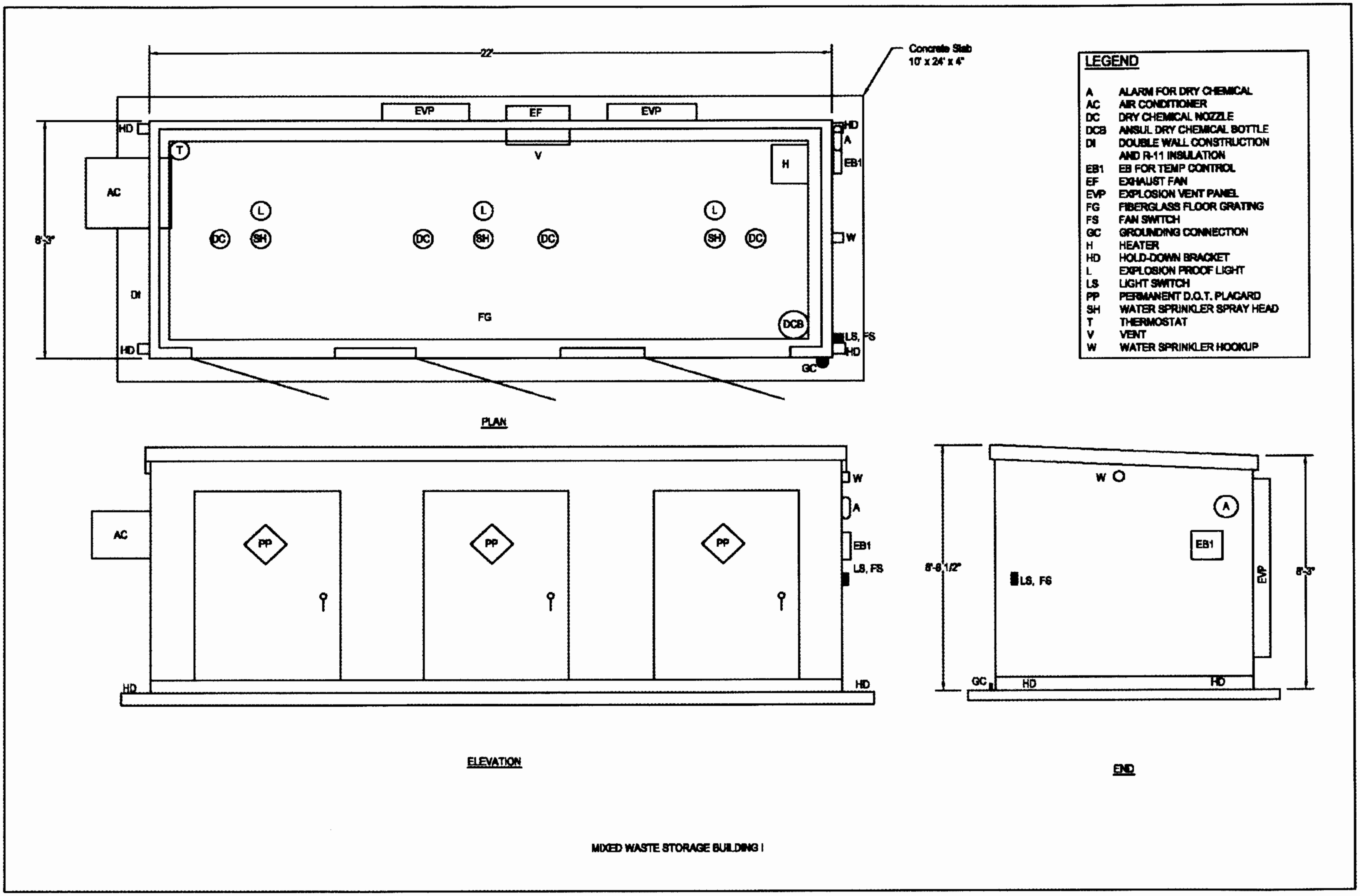


PLAN VIEW OF HWSF DRUM STORAGE MANAGEMENT

NOT TO SCALE

(r-3/2012)

Figure 2

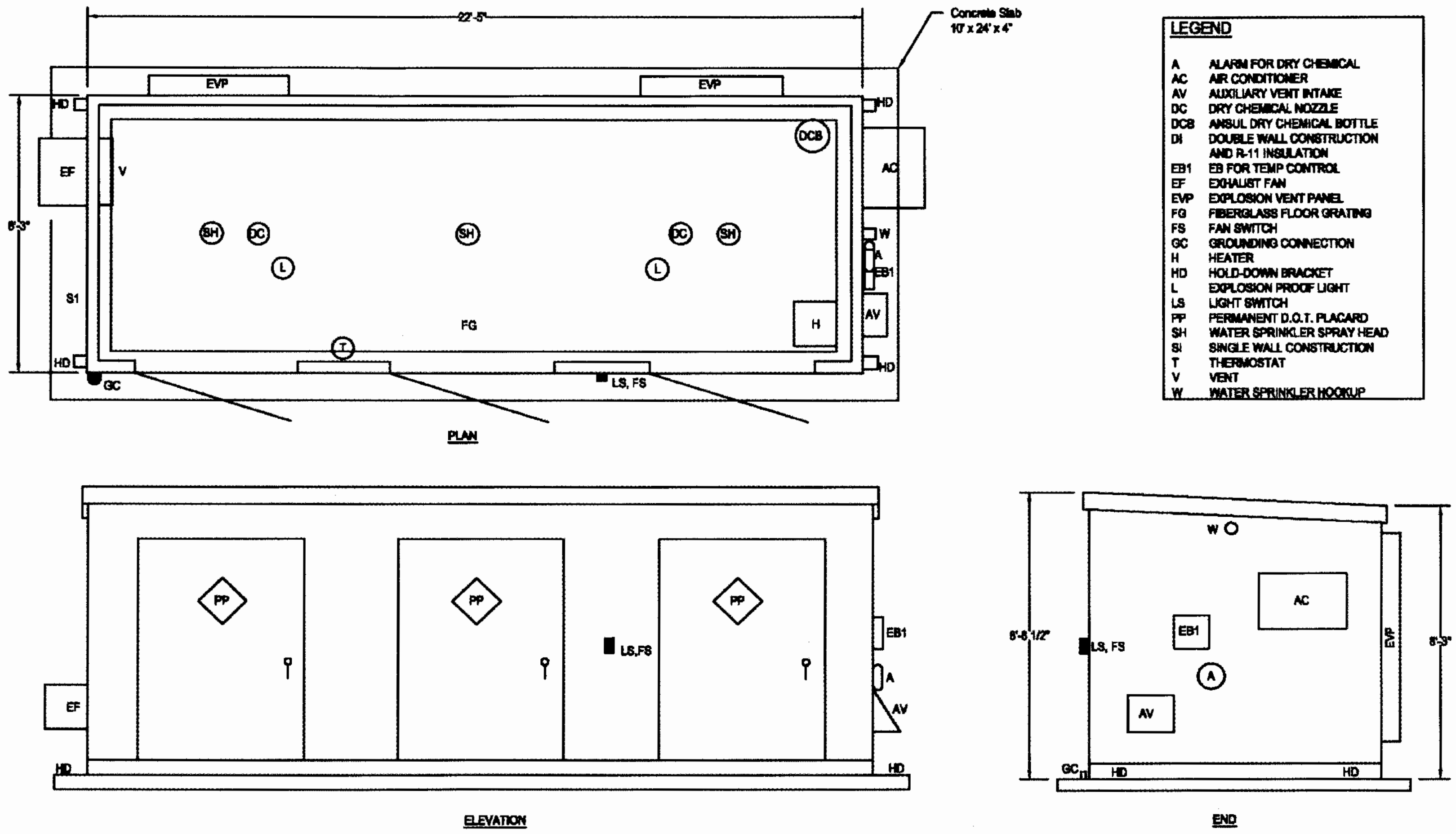


LEGEND

A	ALARM FOR DRY CHEMICAL
AC	AIR CONDITIONER
DC	DRY CHEMICAL NOZZLE
DCB	ANSUL DRY CHEMICAL BOTTLE
DI	DOUBLE WALL CONSTRUCTION AND R-11 INSULATION
EB1	EB FOR TEMP CONTROL
EF	EXHAUST FAN
EVP	EXPLOSION VENT PANEL
FG	FIBERGLASS FLOOR GRATING
FS	FAN SWITCH
GC	GROUNDING CONNECTION
H	HEATER
HD	HOLD-DOWN BRACKET
L	EXPLOSION PROOF LIGHT
LS	LIGHT SWITCH
PP	PERMANENT D.O.T. PLACARD
SH	WATER SPRINKLER SPRAY HEAD
T	THERMOSTAT
V	VENT
W	WATER SPRINKLER HOOKUP

MIXED WASTE STORAGE BUILDING I

Figure 3



MIXED WASTE STORAGE BUILDING II

Attachment 1

Mixed Waste Storage Facility

Mixed Waste Package Receipt and Shipment History

Mixed Waste Storage Facility
Package Receipt and Shipments History

DRUM NUMBERS (PACKAGES)	DATE RECEIVED DATE SHIPPED (PACKAGES)	OUTGOING MANIFEST NUMBER
972294, 972303, 972296, 972297, 972298, 972299, 972293, 972295, 972302, 972301, 972300	10/29/1997 (11) 10/16/2000 (11)	0825-01-0001
980424	2/27/1998 (1) 10/16/2000 (1)	0825-01-0001
981444, 981445	8/10/1998 (2) 1/28/2008 (2)	0825-04-0001
982657	11/13/1998(1) 1/28/2008(1)	0825-03-0001
983036, 983035	12/21/1998 (2) 10/16/2000 (2)	0825-01-0001
991419, 991418	6/17/1999 (2) 10/16/2000 (2)	0825-01-0001
994269	3/4/2000 (1) 10/16/2000 (1)	0825-02-0001
994706 (placed in 994269)	6/27/2000 (1) 10/16/2000 (1)	0825-02-0001
994767	6/28/2000 (1) 10/16/2000 (1)	0825-01-0001
1001494	4/16/2002 (1) 1/28/2008 (1)	0825-02-0002
1004278, 1004276, 1004277	1/27/2003 (3) 1/28/2008 (3)	0825-02-0002
1005224	5/9/2003 (1) 1/28/2008 (1)	0825-02-0002
1005665, 1005664	6/17/2003 (2) 1/28/2008 (2)	0825-02-0002
1022668	10/18/2007(1) 1/28/2008(1)	0825-03-0001
1022766, 1022767, 1022768	10/26/2007(3) 11/16/2007(3)	T074683
1023167, 1023201, 1023200, 1023185, 1023199, 1023156, 1023209, 1023208, 1023207, 1023206, 1023205, 1023204, 1023203, 1023202, 1023198, 1023197, 1023196, 1023195, 1023194, 1023193, 1023192, 1023191, 1023190, 1023189, 1023188, 1023187, 1023186, 1023184, 1023183, 1023182, 1023181, 1023180, 1023179, 1023178, 1023177, 1023176, 1023175, 1023174, 1023173, 1023172, 1023171, 1023170, 1023169, 1023168, 1023166, 1023165, 1023164, 1023163, 1023162, 1023161, 1023160, 1023159, 1023158, 1023157, 1023155, 1023154, 1023153, 1023152, 1023151, 1023150	12/4/2007 (60) 12/13/2007 (60)	002785862JJK
1044499, 1044498	7/31/2012 (2) 4/25/2013 (2)	TVA-April-2013
1045163, 1045164, 1045166, 1045162, 1045186, 1045165	10/1/2012 (6) 4/25/2013 (6)	TVA-April-2013

DRUM NUMBERS (PACKAGES)	DATE RECEIVED DATE SHIPPED (PACKAGES)	OUTGOING MANIFEST NUMBER
1046082	12/13/2012 (1) 6/12/2013 (1)	2764-01
1046864, 1046865, 1046866, 1046867, 1046868, 1046869, 1046863, 1046860, 1046861, 1046862	2/22/2013 (10) 6/12/2013 (10)	2764-01
TOTAL **Received** **Shipped**	 112 112	

MANIFEST NUMBER	CONSIGNEE
0825-01-0001	Envirocare of Utah, Inc. Clive, UT
0825-02-0001	Envirocare of Utah, Inc. Clive, UT
0825-02-0002	EnergySolutions Clive, UT
0825-03-0001	EnergySolutions Clive, UT
0825-04-0001	EnergySolutions Clive, UT
T074683	EnergySolutions Oak Ridge, TN
002785862JJK	Diversified Scientific Services, Inc. Kingston, TN
TVA-April-2013	Perma-Fix of Florida Gainesville, FL
2764-01	EnergySolutions Oak Ridge, TN

Attachment 2

Mixed Waste Storage Facility

Final Uniform Hazardous Waste Manifest

June 12, 2013

Published by J. J. KELLER & ASSOCIATES, INC., Neenah, WI • USA • (800) 327-6868 • www.jjkeller.com • Printed in the United States 167-BLS-C 6 10495

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number AL2640090005	2. Page 1 of 1	3. Emergency Response Phone 865-220-1555	4. Manifest Tracking Number 002226727 JJK

5. Generator's Name and Mailing Address:
TVA Power Services Center
PO#1010 PSC IE-M
Muscle Shoals, AL 35662

Generator's Phone: 256-314-2872

Generator's Site Address (if different than mailing address):
283 Materials Drive
Muscle Shoals, AL 35661

6. Transporter 1 Company Name: Hitman Transport Services
U.S. EPA ID Number: TNR000034686

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address:
Energy Solutions
1560 Bear Creek Road
Oak Ridge TN 37830

Facility's Phone: 865-220-1526

U.S. EPA ID Number: TND982157570

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
X	1. UN2910 Waste Radioactive Material, excepted package - limited quantity of material, 7, RQ (D008)	11	DM	1240	P	D008
	2.					
	3.					
	4.					

14. Special Handling Instructions and Additional Information
ERG#161
TVA
PO#550903 RLS#2005997
Contract#69885
*See attached NFC manifest of additional information.

15. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Stacey S. McCluskey
Signature:
Month 6 Day 12 Year 13

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Chris Denton
Signature: Chris Denton
Month 06 Day 12 Year 13

Transporter 2 Printed/Typed Name:
Signature:
Month Day Year

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator)
U.S. EPA ID Number

Facility's Phone:

18c. Signature of Alternate Facility (or Generator)
Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1. H141	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name: Ron Mitchell
Signature:
Month 06 Day 13 Year 13

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO DESTINATION STATE (IF REQUIRED)

GENERATOR
INT'L
TRANSPORTER
DESIGNATED FACILITY

[illegible]

FORM 540 Energy Solutions / Bear Creek Operations

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

SHIPPING PAPER

1. EMERGENCY TELEPHONE NUMBER (Include Area Code) [illegible]	5. SHIPPER - NAME AND FACILITY TVA Power Service Center C/O EnergySolutions 250 Materials Drive, PO Box 1010 Muscle Shoals, AL 35662	SHIPMENT ID NUMBER T132323 X COLLECTOR PROCESSOR GENERATOR TYPE (Specify)	7. FORM 540 AND 540A PAGE 1 OF 2 PAGE(S) FORM 541 AND 541A 6 PAGE(S) FORM 542 AND 542A 1 PAGE(S) ADDITIONAL INFORMATION 3 PAGE(S)
ORGANIZATION EnergySolutions / [illegible] Attn: Emergency Duty Officer	[illegible] PERMIT NUMBER T-TN012-L13 SHIPMENT NUMBER T132323	TELEPHONE NUMBER (Include Area Code) [illegible]	8. MANIFEST NUMBER (Use this number on all continuation pages) [illegible]
2. IS THIS AN "EXCLUSIVE USE" SHIPMENT? [ ] YES [X] NO	CONTACT Stacey McCloskey	EPA I.D. NUMBER [illegible]	9. CONSIGNEE - Name and Facility Address Energy Solutions / Bear Creek Operations Operated by EnergySolutions [illegible] Bear Creek Road Oak Ridge, TN [illegible]
3. TOTAL NUMBER OF PACKAGES IDENTIFIED ON THIS MANIFEST 11	6. CARRIER - Name and Address [illegible] Transport Services [illegible] Bear Creek Road Oak Ridge, TN [illegible] Truck #: [illegible] Trailer #: [illegible]	SHIPPING DATE [illegible]	CONTACT Fred [illegible] TELEPHONE NUMBER (Include Area Code) (865) [illegible]
4. DOES EPA REGULATED WASTE REQUIRING A MANIFEST ACCOMPANY THIS SHIPMENT? [X] YES [ ] NO If "Yes", provide Manifest Number EPA MANIFEST NUMBER [illegible] JJK	CONTACT Karen Kirby	TELEPHONE NUMBER (Include Area Code) [illegible]	SIGNATURE - Authorized consignee acknowledging waste receipt DATE 6/13/13
	SIGNATURE - Authorized carrier acknowledging waste receipt	DATE 6/12/13	10. CERTIFICATION W2264 T1323[illegible] [illegible] AUTHORIZED SIGNATURE TITLE Baker/Driver DATE 6/12/13

11. U.S. DEPARTMENT OF TRANSPORTATION DESCRIPTION (including proper shipping name, hazard class, UN ID number, and any additional information)	12. DOT LABEL "RADIOACTIVE"	13. TRANSPORT INDEX	14. PHYSICAL AND CHEMICAL FORM	15. INDIVIDUAL RADIONUCLIDES	16. TOTAL PACKAGE ACTIVITY MBq	mCi	17. LSA/SCO CLASS	18. TOTAL WEIGHT OR VOLUME (Use appropriate units)	19. IDENTIFICATION NUMBER OF PACKAGE
UN2910, WASTE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, 7; RQ (D008) DAW; EPA OR STATE HARAZDOUS; LEAD; PAINT OR PLATING 1 - METAL DRUM	NA	NA	SOLID/METAL OXIDES	C-14 ; CE-144 ; CO-58 ; CO-60 ; CS-137 ; FE-55 ; MN-54 ; NB-95 ; NI-63 ; ZN-65	[illegible]	(7.7527E-02)	NA	7.50 ft³ 170.00 lb	[illegible] (121097 ([illegible]))
UN2910, WASTE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, 7; RQ (D008) DAW; EPA OR STATE HARAZDOUS; LEAD; PAINT OR PLATING 1 - METAL DRUM	NA	NA	SOLID/METAL OXIDES	C-14 ; CE-144 ; CO-58 ; CO-60 ; CS-137 ; FE-55 ; MN-54 ; NB-95 ; NI-63 ; ZN-65	3.0118E+00	(8.1394E-02)	NA	7.50 ft³ 225.00 lb	13-000836 ([illegible] ([illegible]))
UN2910, WASTE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, 7; RQ (D008) DAW; EPA OR STATE HARAZDOUS; LEAD; PAINT OR PLATING 1 - METAL DRUM	NA	NA	SOLID/METAL OXIDES	C-14 ; CE-144 ; CO-58 ; CO-60 ; CS-137 ; FE-55 ; MN-54 ; NB-95 ; NI-63 ; ZN-65	[illegible]	(7.8279E-02)	NA	7.50 ft³ 150.00 lb	13-000837 (121080 ([illegible]))
UN2910, WASTE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, 7; RQ (D008) DAW; EPA OR STATE HARAZDOUS; LEAD; PAINT OR PLATING 1 - METAL DRUM	NA	NA	SOLID/METAL OXIDES	C-14 ; CE-144 ; CO-58 ; CO-60 ; CS-137 ; FE-55 ; MN-54 ; NB-95 ; NI-63 ; ZN-65	2.7642E+00	(7.4707E-02)	NA	7.50 ft³ 120.00 lb	13-000838 (121097 ([illegible]))
UN2910, WASTE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, 7; RQ (D008) DAW; EPA OR STATE HARAZDOUS; LEAD; PAINT OR PLATING 1 - METAL DRUM	NA	NA	SOLID/METAL OXIDES	C-14 ; CE-144 ; CO-58 ; CO-60 ; CS-137 ; FE-55 ; MN-54 ; NB-95 ; NI-63 ; ZN-65	[illegible]	([illegible])	NA	7.50 ft³ 200.00 lb	13-000839 ([illegible] ([illegible]))

FOR CONSIGNEE USE ONLY

Tennessee "License For Delivery" No. ____________

South Carolina Transport Permit No. ____________

US Ecology Generator No. ____________

US Ecology Permit No. ____________

20. Generator Certification Statement

[illegible]

Stacey S. McCloskey 6/12/13

Print Name Signature Date

Form 540 ([illegible])

Modified Date: [illegible]

Reviewed 6/12/13
B Harwell

Estimated burden per response to comply with this information collection request: 45 minutes. This uniform manifest is required by NRC to meet reporting requirements of Federal and State Agencies for the safe transportation and disposal of low-level waste. Send comments regarding burden estimate to the Records and FOIA/Privacy Services Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0164), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

FORM 541A

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST
SHIPPING PAPER (CONTINUATION)

Energy Solutions / Bear Creek Operations

8. MANIFEST NUMBER (Use this number on all continuation pages)
2764-01

PAGE 2 OF 2 PAGE(S)

11. U.S. DEPARTMENT OF TRANSPORTATION DESCRIPTION (Including proper shipping name, hazard class, UN ID number, and any additional information)	12. DOT LABEL "RADIOACTIVE"	13. TRANSPORT INDEX	14. PHYSICAL AND CHEMICAL FORM	15. INDIVIDUAL RADIONUCLIDES	16. TOTAL PACKAGE ACTIVITY MBq	mCi	17. LSA/SCO CLASS	18. TOTAL WEIGHT OR VOLUME (Use appropriate units)	19. IDENTIFICATION NUMBER OF PACKAGE
UN2910, WASTE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, 7; RQ (D008) DAW; EPA OR STATE HARAZDOUS; LEAD; PAINT OR PLATING 1 - METAL DRUM	NA	NA	SOLID/METAL OXIDES	C-14 ; CE-144 ; CO-58 ; CO-60 ; CS-137 ; FE-55 ; MN-54 ; NB-95 ; NI-63 ; ZN-65	5.7861E+00	(1.5638E-01)	NA	7.50 ft³ 180.00 lb	13-000040 (121306 (1048861))
UN2910, WASTE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, 7; RQ (D008) DAW; EPA OR STATE HARAZDOUS; LEAD; PAINT OR PLATING 1 - METAL DRUM	NA	NA	SOLID/METAL OXIDES	C-14 ; CE-144 ; CO-58 ; CO-60 ; CS-137 ; FE-55 ; MN-54 ; NB-95 ; NI-63 ; ZN-65	2.7383E+00	(7.4008E-02)	NA	7.50 ft³ 145.00 lb	13-000041 (121354 (1048889))
UN2910, WASTE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, 7; RQ (D008) DAW; EPA OR STATE HARAZDOUS; LEAD; PAINT OR PLATING 1 - METAL DRUM	NA	NA	SOLID/METAL OXIDES	C-14 ; CE-144 ; CO-58 ; CO-60 ; CS-137 ; FE-55 ; MN-54 ; NB-95 ; NI-63 ; ZN-65	2.7280E+00	(7.3731E-02)	NA	7.50 ft³ 130.00 lb	13-000042 (121474 (1048837))
UN2910, WASTE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, 7; RQ (D008) DAW; EPA OR STATE HARAZDOUS; LEAD; PAINT OR PLATING 1 - METAL DRUM	NA	NA	SOLID/METAL OXIDES	CE-144 ; CO-57 ; CO-58 ; CO-60 ; CR-51 ; CS-137 ; FE-55 ; FE-59 ; MN-54 ; NB-95 ; NI-63 ; ZN-65 ; ZR-95	5.6058E+01	(1.5151E+00)	NA	7.50 ft³ 180.00 lb	13-000043 (07-0033 (1048082))
UN2910, WASTE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, 7; RQ (D008) DAW; EPA OR STATE HARAZDOUS; LEAD; PAINT OR PLATING 1 - METAL DRUM	NA	NA	SOLID/METAL OXIDES	C-14 ; CE-144 ; CO-58 ; CO-60 ; CS-137 ; FE-55 ; MN-54 ; NB-95 ; NI-63 ; ZN-65	2.8220E+00	(7.6270E-02)	NA	7.50 ft³ 150.00 lb	13-000044 (121272 (1048555))
UN2910, WASTE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, 7; RQ (D008) DAW; EPA OR STATE HARAZDOUS; LEAD; PAINT OR PLATING 1 - METAL DRUM	NA	NA	SOLID/METAL OXIDES	C-14 ; CE-144 ; CO-58 ; CO-60 ; CS-137 ; FE-55 ; MN-54 ; NB-95 ; NI-63 ; ZN-65	2.9462E+00	(7.9627E-02)	NA	7.50 ft³ 200.00 lb	13-000045 (121016 (1048853))

(10-99)

Modified Date: 06/03/2013 13 [illegible]

EnergySolutions

Thursday, June 13, 2013

Jim Colagross
TVA Environmental Research Center/AL
P.O. Box 1010 Research Reactor
Western Area Radiological Lab
Muscle Shoals, AL 35662-1010

Dear Mr. Colagross:

The attached signed shipping manifest copies are your notice of receipt of the radioactive waste materials shipment specified on the manifest number below.

Manifest Number	Date Received
2764-2764-01	06/13/2013

Thank you for your business.

Sincerely,

Tammy P. Hall

Shipping and Receiving

[redacted]

cc: Manifest File
Shipping and Receiving file

Attachment 3

Final Status Survey

Final Status Survey

Contents

Attachments

1.0 Survey Design

The purpose of the Final Status Survey (FSS) was to demonstrate that the Mixed Waste Storage Facility buildings, Mixed Waste Storage Building 1 and Mixed Waste Storage Building 2 (MWSB-1 and MWSB-2), which were used to store mixed hazardous wastes at the Tennessee Valley Authority's Hazardous Waste Storage Facility in Muscle Shoals, AL as authorized by NRC Materials License 01-25284-01 and subsequently 41-08165-19, meet the radiological criteria for unrestricted use as described in 10 CFR 20.1402. As stated in 10 CFR 20.1402, a 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, including that from groundwater sources of drinking water, and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA).

The FSS was designed as described in the NRC's NUREG-1757, "Consolidated Decommissioning Guidance," "Decommissioning Process for Materials Licensees." Based on the licensed activities and operation history for the Mixed Waste Storage Facility, TVA determined that the MWSBs met the criteria described in NUREG-1757, Vol. 1, Chapter 7, "Decommissioning Groups", Section 7.4, "Group 2: Unrestricted Release Using Screening Criteria; No Decommissioning Plan Required." The licensee actions necessary for Group 2 decommissioning are described in Section 9.2 of Chapter 9, "Group 2 Decommissioning" in NUREG-1757, Vol. 1. As noted in NUREG-1757, Vol. 2, Rev. 1, Chapter 4,"Facility Radiation Surveys", Section 4.4, "Final Status Survey Design", Appendix B of this volume contains guidance on alternative methods of FSS for simple situations.

As stated in NUREG-1757, Vol. 2, Rev. 1, Appendix B, "Simple Approaches for Conducting Final Radiological Surveys," a large number of licensees may use a simplified method to demonstrate regulatory compliance for decommissioning, avoiding complex final status surveys. For Decommissioning Groups 1–3, licensees may use the simplified FSS method described in Appendix B of MARSSIM or the alternative protocol described in this volume. TVA determined that the Mixed Waste Storage Facility met the prerequisite conditions described in method B.2, "Alternative Simplified Method" and designed and conducted the FSS as further described in this method. This method is described below:

B.2 Alternative Simplified Method

This alternative method may be used by Decommissioning Groups 1–3 and is applicable only for surfaces of building structures and for surface soils. The following conditions are prerequisite to the use of this method:

- Use of screening DCGLs (including DandD code using default distributions).
- No complex or special surveys are included (e.g., volumetric building structure residual radioactivity, duct work, embedded piping, ground water residual radioactivity, subsurface soil residual radioactivity, buried conduit, sewer pipes, or prior onsite disposals).
- Not to be applied to land areas where soil has been previously remediated.
- Removable residual radioactivity for building surfaces must comply with the screening $DCGL_W$ basis of 10 % removable or adjusted per Screening Table (see Appendix H of this volume).
- MDC between 10 to 50 % of the $DCGL_W$ for scans, static or direct measurements, and sampling and analysis (using NUREG–1507 guidance).

If the above conditions are met, then the following simplified method may be used to design and conduct the FSS for each survey unit.

- Size is limited to 2000 m^2 for land areas and 100 m^2 for structures.
- Scanning and sampling to be performed:
  — 100 % scan and
  — 30 samples.
- Hot spot criteria is three times the $DCGL_W$, applied to any sampling location.
- A quality control program to ensure results are accurate and sources of uncertainty are identified and controlled.
- The average concentration for the survey unit is compared to the $DCGL_W$.
- Statistical tests may be the Student's *t* test, Sign test, or Wilcoxon Rank Sum test, with $\alpha = 0.05$ (no statistics are needed if all measurements are less than the $DCGL_W$).

The final status survey report (FSSR) should provide a complete and unambiguous record of the radiological status of the site and should stand on its own with minimal information incorporated by reference.

2.0 Determination of DCGLs

Derived Concentration Guideline Levels (DCGLs) are radionuclide-specific concentration limits used by the licensee during decommissioning to achieve the regulatory dose standard that permits the release of the property and termination of the license. The DCGL applicable to the average concentration over a survey unit is called the $DCGL_W$. The DCGL applicable to limited areas of elevated concentrations within a survey unit is called the $DCGL_{EMC}$. For the Alternative Simplified Method, the $DCGL_{EMC}$ is equal to three times the $DCGL_W$, applied to any sampling location.

The $DCGL_W$ is the concentration of a radionuclide which, if distributed uniformly across a survey unit, would result in an estimated dose equal to the applicable dose limit. The $DCGL_{EMC}$ is the concentration of a radionuclide which, if distributed uniformly across a smaller limited area within a survey unit, would result in an estimated dose equal to the applicable dose limit.

The waste shipment manifests were reviewed to identify the radionuclides that were received, stored, and shipped from the Mixed Waste Storage Facility. The DCGL for each radionuclide was determined by use of the NRC screening values which are listed in Table B.1 of Appendix B, NUREG-1757, Vol. 1, Rev. 2, "Consolidated Decommissioning Guidance: *Decommissioning Process for Materials Licensees*" or calculation using the DandD code and its default distributions as described in the Alternative Simplified Method. A list of the radionuclides and the assigned DCGLw for each is in Attachment FSS-1.

The DandD results for the calculation of the DCGLw for beta and gamma emitters that are not included in the NRC screening values list are in Attachment FSS-2. The most restrictive DCGLw for the beta/gamma emitting radionuclides listed in Attachment FSS-1 is 7100 dpm/100 cm^2 for cobalt 60 (Co-60). This was selected as the DCGLw for the beta/gamma emitting radionuclides. The DCGLw for each of the low energy beta emitting radionuclides is from the NRC Screening Values (e.g., Tritium (H-3), 120000000 dpm/100 cm^2).

The DCGL for the alpha emitting radionuclides was calculated using the sum of fractions approach. The DandD code was used to determine the DCGL for each individual alpha emitting radionuclide. The DandD code calculation summary sheets for the alpha emitting radionuclides

are in Attachment FSS-3. In order to apply the sum of fractions, the radionuclides and their respective activity for each waste shipment manifest were determined and the results are listed in Attachment FSS-4. The fraction of the total alpha emitting radionuclide activity was calculated for each individual alpha emitting radionuclide. This fraction and the DCGL of each individual alpha emitting radionuclide were used to calculate the DCGL for the alpha emitting radionuclides using the sum of fractions approach.

Sum of Fraction Approach to Determine Gross Activity DCGL:

$$\text{Gross Activity DCGL} = \frac{1}{\left[\dfrac{f_1}{\text{DCGL}_1} + \dfrac{f_2}{\text{DCGL}_2} + \ldots \dfrac{f_n}{\text{DCGL}_n}\right]}$$

Where:

f = relative fraction of the total activity contributed by the radionuclide

DCGL_1, DCGL_2, ... = DCGL (dpm/100 cm^2) for each radionuclide present

Gross Alpha DCGL (dpm/100 cm^2):

$$\frac{1}{\left[\begin{array}{l} \underset{\text{U-235}}{0.2442/85} + \underset{\text{Pu-238}}{0.0164/26} + \underset{\text{Pu-239}}{0.0043/24} + \underset{\text{Pu-240}}{0.0043/24} + \underset{\text{Pu-241}}{0.07045/1225} + \underset{\text{Am-241}}{0.0173/23} + \underset{\text{Cm-242}}{0.001/1050} \\ + \underset{\text{Cm-243}}{0.0041/34} + \underset{\text{Cm-244}}{0.0036/43} \end{array}\right]}$$

$$\frac{1}{\left[\underset{\text{U-235}}{2.87\text{E-}4} + \underset{\text{Pu-238}}{6.31\text{E-}4} + \underset{\text{Pu-239}}{1.79\text{E-}4} + \underset{\text{Pu-240}}{1.79\text{E-}4} + \underset{\text{Pu-241}}{5.75\text{E-}4} + \underset{\text{Am-241}}{7.52\text{E-}4} + \underset{\text{Cm-242}}{9.52\text{E-}7} + \underset{\text{Cm-243}}{1.21\text{E-}4} + \underset{\text{Cm-244}}{8.37\text{E-}5}\right]}$$

$$1/5.39\text{E-}3 = 185 \text{ dpm}/100 \text{ cm}^2$$

Once the initial DCGLw of 7100 dpm/100 cm^2 for beta/gamma emitters and 185 dpm/100 cm^2 for alpha emitters was calculated, additional conditions and factors associated with MWSB-1 and MWSB-2 and the detectability of the radionuclides were reviewed to determine if the selected DCGLw should be amended. The beta/gamma emitter with the greatest total activity stored at the MWSF was iron 55 (Fe-55) which is difficult to detect with routine field survey instruments. The "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM), NUREG-1575, Rev. 1 provides a method of assessing the concentration of multiple contaminants through the use of surrogate measurements. As described in Chapter 4, "Preliminary Survey Considerations," Section 4.3.2, "DCGLs and the Use of Surrogate Measurements," if the ratio of the amount of one contaminant to another is known, then that contaminant can be measured and the level of the second contaminant can be determined based upon the ratio of the two. For survey purposes, the DCGL of the first contaminant is modified based upon the ratio and the DCGLs of the two contaminants.

Based upon a review of the waste manifests, Co-60 could be selected as a surrogate for Fe-55. The ratio of Fe-55 to Co-60 for the six waste manifests that included Fe-55 as one of the radionuclides ranged from 0.53 to 7.4 with an average of 1.75 and a standard deviation of 2.77. The 7.4 ratio was uncharacteristic as the range of the ratios when excluding the 7.4 was 0.53 to 0.8 with an average of 0.62 and a standard deviation of 0.12. Although the surrogate ratio of 7.4 for the one waste manifest was significantly different than the other five, to be conservative, the 7.4 ratio was selected for calculating the modified Co-60 DCGL. The modified DCGL was calculated using the formula on page 4-5 of MARSSIM:

$$\mathrm{DCGL_{Co}, mod} = \mathrm{DCGL_{Co}} \times \frac{\mathrm{DCGL_{Fe}}}{[(\mathrm{Fe/Co\ Ratio}) \times \mathrm{DCGL_{Co}}] + \mathrm{DCGL_{Fe}}}$$

$$\mathrm{DCGL_{Co}, mod} = 7100\ \mathrm{dpm/100\ cm^2} \times \frac{4500000\ \mathrm{dpm/100\ cm^2}}{[7.4 \times 7100\ \mathrm{dpm/100\ cm^2}] + 4500000\ \mathrm{dpm/100\ cm^2}}$$

$$\mathrm{DCGL_{Co}, mod} = 7018\ (\text{round to } 7000)\ \mathrm{dpm/100\ cm^2}$$

Due to the difficulty in detecting the alpha emitting radionuclides with a Minimum Detectable Concentration (MDC) between 10 to 50% of the DCGLw for scans (Gross alpha DCGLw of 185 dpm/100 cm^2 versus alpha survey instrument MDC of 383 dpm/100 cm^2), a conservative approach was taken to bound the dose that could result from the storage of alpha emitting radionuclides in the MWSB-2 (no alpha emitting radionuclides were stored in MWSB-1). The DandD code was used to calculate the dose to an individual if all the alpha emitting radionuclides that had been received and stored in the MWSB-2 were evenly distributed across the floor surface. The concentration of each alpha emitting radionuclide in dpm/100 cm^2 of the floor surface was calculated and the DandD dose for this concentration was determined. The results of this assessment are provided in Attachment FSS-5. The total dose ascertained by this method was 12.33 mrem/year. To be conservative, the beta/gamma DCGLw for MWSB-2 was adjusted to 3500 dpm/100 cm^2 (12.4 mrem/yr for Co-60) so that the bounded total dose from alpha and beta/gamma emitting radionuclides would be less than 25 mrem/year.

Based upon the above discussion, the following DCGLs were established for MWSB-1 and MWSB-2:

DCGLw/DCGL$_{EMC}$
(dpm/100 cm^2)

Radionuclide	MWSB-1	MWSB-2
Alpha emitting	185/555^	185/555
Beta/Gamma emitting	7000/21000#	3500/10500
H-3	Not Applicable	120000000*
C-14	Not Applicable	3700000*
Ni-63	Not Applicable	1800000*

^ - Storage records indicate no alpha emitting radionuclides stored in MWSB-1
# - 7000 limit set even though only Cs-137 (28000) stored in MWSB-1
* - Assessed as removable contamination with a limit of 10% of DCGLw

3.0 Survey Design Parameters

The following information on the dimensions and associated areas of MWSB-1 and MWSB-2 was used in the planning of the FSS. The grate floor, sump floor, and the four walls up to a height of 2 meters were marked in 1 meter square grids to identify survey grids. Drawings of the gridded survey areas are included in Attachment FSS-6.

Surveyed Facility Dimensions
(meters)

	Width	Length	Height
MWSB-1	2.515	6.701	2.652
MWSB-2	2.515	6.858	2.652

Surveyed Surface Area
(square meters)

	Ceiling	Walls	Grate Floor	Sump Floor	Total
MWSB-1	16.85	48.88	16.85	16.85	99.43
MWSB-2	17.25	49.71	17.25	17.25	101.46

The level of residual alpha and beta/gamma emitting radionuclide contamination was assessed by the performance of scans and static (fixed point) surveys with alpha and beta detecting instruments, gamma dose rates were measured using a microR meter, and levels of removable contamination for alpha, beta, and low energy beta emitting radionuclides was determined by analyzing removable contamination samples (100 cm^2 smears). While performing alpha scans, the surveyor passed the detector over the surveyed surface at a distance of approximately 0.6 cm at a rate of approximately 2.2 cm/sec. The surveyor listened to the audible detection signal (counts) and paused and more slowly resurveyed any area when the audible counts indicated a greater than background count at a slower rate. The detection of greater than 2 cpm during this second, slower pass would require additional investigation. When performing alpha static measurements near the center of the designated survey grids, the detector (100 cm^2) was placed against the surface and a 5 minute count was obtained. A static count above 30 counts (6 cpm) required further investigation and assessment.

When performing beta scans, the surveyor passed the detector over the surveyed surface at a distance of approximately 0.6 cm at a rate of approximately 5.08 cm/sec. The surveyor listened to the audible detection signal (counts) and paused and more slowly resurveyed any area when the counts exceeded the investigation level of 150 cpm. When performing beta static measurements near the center of the designated survey grids, the detector (100 cm^2) was placed against the surface and a 1 minute count was obtained. A static count above 250 cpm required further investigation and assessment.

Radiation dose rates were measured with a microR meter held one meter above the floor in the center of each designated survey grid. Further assessment and investigation would be required if the measured dose rates were more than twice the background dose rates. Removable contamination smears were obtained near the center of each designated survey grid for alpha, beta, and low energy beta emitting radionuclides. Additional assessment and investigation would be required if the level of removable contamination was greater than 5% of the DCGLw for the applicable radionuclide (alpha, beta/gamma, or low energy beta).

The survey designs for MWSB-1 and MWSB-2 are summarized below:

MWSB-1

Scans (Investigation Level: alpha – 2 cpm; beta – 150 cpm)

Raised floor grate, sump floor, lower and upper wall grids (six areas)

- 100% scan for beta
- 10% scan (2 per area) for alpha and any survey grid > beta investigation level

Upper wall above 2 meters, ceiling and bottom side of floor grids: 100% beta scan

Static Measurements (Investigation Level: alpha – 6 cpm; beta – 250 cpm)

Raised floor grate, sump floor, lower and upper wall grids (six areas)

- obtain a beta static measurement near the center of each grid as follows:

        - 50% of raised floor grate and sump floor (at least 20 grids total)
        - 25% of lower wall grids (at least 5 grids total)
        - 25% of upper wall grids (at least 5 grids total)

    - obtain an alpha static measurement near the center of each grid selected for alpha measurement (12 grids) (although storage records indicated alpha emitting radionuclides were not stored in MWSB-1, some alpha measurements were obtained to confirm and comparison to MWSB-2 alpha results)

    - obtain a beta and alpha static measurement at each point where beta or alpha scan detected level exceeded investigation level

Contamination Smears

Alpha/beta smear: obtain a 100 cm^2 smear near the center of each survey grid where an alpha or beta static measurement was obtained (at least 30 smears).

Low energy beta smear (liquid scintillation analysis): obtain a 100 cm^2 smear near the center of each survey grid in which an alpha or beta static measurement was obtained (at least 30 smears).

Dose Rate Measurements

Obtain a dose rate measurement with a microR meter at a distance of one meter above the center of each grate and sump floor grid (at least 40 measurements).

MWSB-2

Scans (Investigation Level: alpha – 2 cpm; beta – 150 cpm)

Raised floor grate, sump floor, lower and upper wall grids (six areas)

- 100% scan for beta
- 100% scan for alpha

Upper wall above 2 meters, ceiling and bottom of floor grids: 100% beta scan

Static Measurements (Investigation Level: alpha – 6 cpm; beta – 250 cpm)

Raised floor grate, sump floor, lower and upper wall grids (six areas)

- obtain a beta and alpha static measurement near the center of each grid as follows:
    - 50% of raised floor grate and sump floor (at least 20 grids total)
    - 25% of lower wall grids (at least 5 grids total)
    - 25% of upper wall grids (at least 5 grids total)

- obtain a beta and alpha static measurement at each point where beta or alpha scan detected level exceeded investigation level

Contamination Smears

Alpha/beta smear: obtain a 100 cm^2 smear near the center of each survey grid where an alpha or beta static measurement was obtained (at least 30 smears).

Low energy beta smear (liquid scintillation analysis): obtain a 100 cm^2 smear near the center of each survey grid in which an alpha or beta static measurement was obtained (at least 30 smears).

Dose Rate Measurements

Obtain a dose rate measurement with a microR meter at a distance of one meter above the center of each grate and sump floor grid (at least 40 measurements).

Drawings of MWSB-1 and MWSB-2 that illustrate the locations where static measurements and contamination smears were obtained are in Attachment FSS-7.

4.0 Survey Quality Control

The FSS plan included quality control related activities and tasks to ensure the FSS results were accurate and sources of uncertainty were identified and controlled.

Surveyor Training and Experience

Three individuals performed the surveys during the FSS. One was the Radiation Safety Officer (RSO) for the MWSF NRC license, one was the Radiation Safety Technician that assists the RSO in the performance of radiation safety tasks on the MWSF NRC license and other TVA materials licenses, and the third was a former NRC materials branch chief and senior Health Physicist (HP). All three individuals had many hours of training in the conduct of radiation surveys and years of experience performing radiation surveys, and were provided written and verbal instruction in the FSS plan and conduct of the FSS.

Surveyor FSS Performance Observations

The FSS was completed over the course of three days. Survey preparation activities and tasks were performed on the first day including survey instrument preparation and review of the FSS plan and tasks required to conduct the FSS. The actual survey of the MWSF was completed in the following two days. During the conduct of the survey, the former NRC HP performed the duties of the quality control assessor. At least two times each day, he observed the surveyors performing surveys to ensure their performance was in accordance with the FSS plan. Activities and tasks he observed and assessed included, but were not limited to, the performance of survey instrument checks, correct selection of survey instrument for survey purpose, correct survey speed for scans and detector distance from surveyed surface, correct response to audio indicators, correct response when detected radiation may have been at or above investigation levels, correct count time for static measurements, proper documentation of survey results, and the collection of removable contamination smears to ensure they were obtained at the appropriate location, were of the appropriate area, and were taken with the appropriate smear material. At the end of each day of survey, the quality control assessor also

reviewed the survey documentation and confirmed the days accomplishments were completed as described in the FSS plan.

During the course of the two day survey, the surveyor's performance was observed and assessed on six occasions. No deficiencies were observed in the surveyor's performance of the FSS activities and tasks.

Survey Instrumentation

A list of the instruments used for the FSS is provided in the following table:

Instrument Model No.	Instrument Serial No.	Detector Model No.	Detector Serial No.	Calibration Date	Application
Ludlum Model 12	TVA 951374	Ludlum 43-92PS	PR257409	10/31/14	Alpha static & scan
Ludlum Model 12	TVA 951391 (Meter No. 1)	Ludlum 44-142	PR312382	11/15/14	Beta static & scan
Ludlum Model 12	TVA 951392 (Meter No. 2)	Ludlum 44-142	PR312395	11/26/14	Beta static & scan
Ludlum Model 19	TVA 860951	NaI Internal	N/A	11/17/14	Gamma dose rate
Tennelec LB 5100 #129	2080-M	N/A	N/A	Each day of use	Measure sample alpha & beta radioactivity
Packard Tri-Carb 2550 #284	401924		N/A	Each day of use	Measure sample low energy beta radioactivity

Instrument Calibration

The field survey instruments and laboratory instruments used to count contamination smears were calibrated in accordance with TVA calibration procedures that were developed, described, and reviewed by the NRC in TVA materials license applications and which have been reviewed and assessed during NRC inspections. TVA maintains records of these calibrations as required by NRC license requirements and regulations and these records are available for review during NRC inspections. National Institute of Standards (NIST) and/or National Bureau of Standards (NBS) traceable calibration sources were used to calibrate these instruments and the source certificates are available for review during NRC inspections.

The efficiency of the beta detecting survey instruments was determined using an electroplated Technetium 99 beta source (Serial No. 557/82). The efficiency of the alpha detecting survey instrument was determined using an electroplated Plutonium 239 alpha source (Serial No. 8350).

Survey Instrument Daily Checks

Prior to use for the survey, ten background counts and ten check source counts were obtained for each survey instrument to support an assessment of each instruments performance during the conduct of the survey. While in use during the survey, the instruments performance was assessed every few hours by obtaining a background count and check source count. The results were assessed to determine if they differed from the average background count and check source count obtained prior to the start of the survey. If the results exceeded +/- two standard deviations, another count was obtained. If this result exceeded +/- two standard deviations, the instruments operating condition was assessed (e.g., batteries, connections, detector, etc.) to determine if there was an apparent cause for the out of specification results. If no apparent cause was identified the instrument was retested. If the result exceeded +/- two standard deviations, the instrument would be returned to the calibration facility for assessment and repair as needed. During the conduct of the survey, the beta detecting instrument TVA 951392 was a few counts below the two standard deviation specification on two occasions, but a second count result was within the two standard deviation specification. There was also one occasion when both the background and check source count were well above the two standard deviation specification. The effort to determine the cause discovered that the Cs-137 check source used for the microR meter was too close to the instrument when the counts were obtained. There was also one occasion when the check source count for the alpha detecting instrument TVA 951374 was four counts above the two standard deviation specification. This occurred at the end of the survey and the instrument was not needed for additional surveys. The result was within two standard deviations of the check source counts obtained in the field during the conduct of the survey. The records of the survey instrument daily checks are in Attachment FSS-8.

Survey Instrument Minimum Detectable Concentration (MDC)

The MDC is the minimum amount of radioactivity that may be detected by a given survey instrument and measurement procedure. For the purposes of this FSS, the MDC is the minimum activity concentration on a surface that an instrument is expected to detect (i.e., activity expected to be detected with 95% confidence). The methods and formulas used to calculate the MDC for the survey instruments used for the FSS were based on the following references:

NUREG-1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions," June 1998

NUREG-1757, Volume 2, Rev.1, "Consolidated Decommissioning Guidance – Characterization, Survey, and Determination of Radiological Criteria," September 2006

NUREG-1575, Rev. 1, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," August 2000

ISO 7503-1, "International Standard, Evaluation of surface contamination – Part 1: Beta-emitters (maximum beta energy greater than 0.15 MeV) and alpha-emitters," 1988

In order to determine an instruments adequacy for the FSS, the scan and static measurement MDC for the alpha and beta emissions detecting survey instruments was

initially calculated using factor values such as detection efficiency and background counts per minute based on information provided by the instrument and detector manufacturer. The instrument was considered adequate if the calculation confirmed the instrument and detector combination would detect the specified radiation at or below the specified minimum detectable concentration (MDC between 10 to 50 % of the $DCGL_W$ for scans, static or direct measurements, and sampling and analysis (using NUREG-1507 guidance)).

The actual values for these factors, such as the instrument and detector combination detection efficiency based upon its calibration and the background counts per minute based upon average background count rates measured in the field, were used to calculate the instruments MDC. Other factors used in the MDC calculations were default values based upon the references listed above. These factors included:

Surveyor efficiency	p = 0.5 (NUREG-1507, Section 6.7.2)
Surface efficiency	Ɛs = 0.5 for maximum beta energies > 0. MeV Ɛs = 0.25 for maximum beta energies between 0.15 and 0.4 and alpha emitters (NUREG-1507, Section 5.3.2)(ISO 7503-1)
Decision error	d' = 1.38 (Table 6-5, NUREG-1575; 95% correct detection rate and 60% false positive rate at the first scan stage) (NUREG-1507, Section 6.8.1)

One other factor, the source efficiency (Sε), which represents the radionuclide emission detectability, was determined to be 1 for the beta emissions and 0.295 for the alpha emissions. The alpha emissions value for Sε was set at 0.295 because Pu-241 represented 70.45% of the total activity of the alpha emitting radionuclides stored at the MWSF and is very difficult to detect with field instruments.

Due to an alpha detecting instruments low background, instead of calculating the instruments MDC for scans, NUREG-1575 (MARSSIM) recommends determining the probability that the detection of a single count will give a surveyor sufficient cause to stop and investigate further (i.e., pause over the surveyed surface for a longer period of time to determine if single count represented the presence of alpha emitting contamination). As described in Appendix J of NUREG-1575 (MARSSIM), for alpha survey instrumentation with a background around one to three counts per minute, a single count will give a surveyor sufficient cause to stop and investigate further. Assuming this to be true, the probability of detecting given levels of alpha emitting radionuclides can be calculated by use of Poisson summation statistics. The MARSSIM formula (J-5) was used to assess the probability that a single count was sufficient to cause a surveyor to stop and investigate while using the alpha detecting survey instrument.

The formulas and factors used to calculate the scan MDC (MDCscan), the static measurement MDC (MDCstatic), and the probability of detection and surveyor investigation for the alpha instrument are provided in Attachment FSS-9. A summary of the calculated MDCs and probabilities is provided in the table below:

Instrument	MDC Scan dpm/100 cm2	MDC Static dpm/100 cm2	Probability to Investigate	DCGLw dpm/100 cm2	DCGL$_{EMC}$ dpm/100 cm2
TVA 951374 (alpha)	383	93	0.86 (DCGLw) 0.99 (DCGL$_{EMC}$)	185	555
TVA 951391 Meter 1 (beta)	1431	532	N/A	7000 (MWSB-1) 3500 (MWSB-2)	21000 (MWSB-1) 10500 (MWSB-2)
TVA 951392 Meter 2 (beta)	1598	572	N/A	7000 (MWSB-1) 3500 (MWSB-2)	21000 (MWSB-1) 10500 (MWSB-2)

As shown above, detecting alpha emissions while performing scan surveys at the prescribed MDC of between 10 to 50% of the DCGLw with the selected instrument was not likely. As previously described, due to the difficulty in detecting the alpha emitting radionuclides with a Minimum Detectable Concentration (MDC) between 10 to 50% of the DCGLw for scans, a conservative approach was taken to bound the dose that could result from the storage of alpha emitting radionuclides in the MWSB-2 (no alpha emitting radionuclides were stored in MWSB-1). The DandD code was used to calculate the dose to an individual if all the alpha emitting radionuclides that had been received and stored in the MWSB-2 were evenly distributed across the floor surface. The concentration of each alpha emitting radionuclide in dpm/100 cm^2 of the floor surface was calculated and the DandD dose for this concentration was determined. The results of this assessment are provided in Attachment FSS-5. The total dose ascertained by this method was 12.33 mrem/year. To be conservative, the beta/gamma DCGLw for MWSB-2 was adjusted to 3500 dpm/100 cm^2 (12.4 mrem/yr for Co-60) so that the bounded total dose from alpha and beta/gamma emitting radionuclides would be less than 25 mrem/year.

Laboratory Smear Sample Counting Instrumentation Lower Limit of Detection (LLD).

The LLD for the instruments used to analyze the removable contamination smear samples is provided in the table below:

Instrument	H-3 LLD dpm	C-14 LLD dpm	Ni-63 LLD dpm	Alpha LLD dpm	Beta LLD dpm
Packard Tri-Carb 2550	6.6	8.5	9.1		
Tennelec LB 5100				10.5	12.4

5.0 FSS Results

The survey results for MWSB-1 and MWSB-2 as well as the results of the contamination smear analyses are in Attachment FSS-10. Based upon a review of the results, the scans, static measurements, and removable contamination smears did not identify any areas of contamination that exceeded the DCGLw or DCGL_{EMC} established for the beta/gamma or alpha emitting radionuclides. None of the initial scan results were confirmed to indicate results that exceeded the investigation limit, none of the static measurements exceeded the $\text{MDC}_{\text{STATIC}}$ established for each survey instrument, and none of the contamination smear results exceeded the LLD of the laboratory analytical instrument. The gamma dose rate measurements were at or near background levels.

The survey results are summarized in the tables below:

Area Surveyed	**Beta Results (static: dpm/100 cm^2)**			**Alpha Results (static: dpm/100 cm^2)**			**Gamma Results**
MWSB-1	Scan cpm	Static Max	Static Avg	Scan cpm	Static Max	Static Avg	Gross Avg uR/hr
Wall Grids Beta Scanned: 40 Beta Static: 11 Alpha Scanned: 8 Alpha Static: 8	≤120	353	103	≤2	18	3	
Grate Floor Beta Scanned: 21 Beta Static: 10 Alpha Scanned: 2 Alpha Static: 2 Gamma: 21	≤120	353	105	≤2	29	15	4.5
Sump Floor Beta Scanned: 21 Beta Static: 10 Alpha Scanned: 2 Alpha Static: 2 Gamma: 21	≤120	59	13	≤2	0	0	4.3
Wall above 2m Beta Scans	≤120						
Ceiling Beta Scans	≤120						
Bottom side of floor grates Beta Scans	≤120						

Removable Contamination Smear Analysis					
MWSB-1	Alpha	Beta	H-3	C-14	Ni-63
Alpha/Beta 31 Smears	<LLD	<LLD			
Low Energy Beta 31 Smears			<LLD	<LLD	<LLD

Area Surveyed	**Beta Results (static: dpm/100 cm^2)**			**Alpha Results (static: dpm/100 cm^2)**			**Gamma Results**
MWSB-2	Scan cpm	Static Max	Static Avg	Scan cpm	Static Max	Static Avg	Gross Avg uR/hr
Wall Grids Beta Scanned: 40 Beta Static: 11 Alpha Scanned: 40 Alpha Static: 11	≤120	312	161	≤3	29	8	
Grate Floor Beta Scanned: 21 Beta Static: 10 Alpha Scanned: 21 Alpha Static: 10 Gamma: 21	≤120	312	101	≤2	47	14	5.3
Sump Floor Beta Scanned: 21 Beta Static: 10 Alpha Scanned: 21 Alpha Static: 10 Gamma: 21	≤120	279	78	≤2	0	0	4.9
Wall above 2m Beta Scans	≤120						
Ceiling Beta Scans	≤120						
Bottom side of floor grates Beta Scans	≤120						

Removable Contamination Smear Analysis

MWSB-2	Alpha	Beta	H-3	C-14	Ni-63
Alpha/Beta 31 Smears	<LLD	<LLD			
Low Energy Beta 31 Smears			<LLD	<LLD	<LLD

FSS Investigation Levels, DCGLw and DCGL_{EMC}

MWSB-1 and MWSB-2

Scans (Investigation Level: alpha – 2 cpm (88 dpm); beta – 150 cpm (2200 dpm))

Static Measurements (Investigation Level: alpha – 6 cpm (176 dpm); beta – 250 cpm (3700 dpm))

DCGLw/DCGL_{EMC}
(dpm/100 cm^2)

Radionuclide	MWSB-1	MWSB-2
Alpha emitting	185/555^	185/555
Beta/Gamma emitting	7000/21000#	3500/10500
H-3	Not Applicable	120000000*
C-14	Not Applicable	3700000*
Ni-63	Not Applicable	1800000*

^ - Storage records indicate no alpha emitting radionuclides stored in MWSB-1
# - 7000 limit set even though only Cs-137 (28000) stored in MWSB-1
* - Assessed as removable contamination with a limit of 10% of DCGLw

6.0 FSS Conclusions

Compliance with Alternative Simplified Method Approach

TVA determined that the Mixed Waste Storage Facility met the prerequisite conditions described in method B.2, "Alternative Simplified Method" and designed and conducted the FSS as further described in this method. This alternative method may be used by Decommissioning Groups 1–3 and is applicable only for surfaces of building structures and for surface soils. The following conditions are prerequisite to the use of this method:

Based on the licensed activities and operation history for the Mixed Waste Storage Facility, TVA determined that the MWSBs met the criteria described in NUREG-1757, Vol. 1, Chapter 7, "Decommissioning Groups", Section 7.4, "Group 2: Unrestricted Release Using Screening Criteria; No Decommissioning Plan Required."

- Use of screening DCGLs (including DandD code using default distributions).

Screening DCGLs or DandD code using default distributions were used to establish DCGLS.

- No complex or special surveys are included (e.g., volumetric building structure residual radioactivity, duct work, embedded piping, ground water residual radioactivity, subsurface soil residual radioactivity, buried conduit, sewer pipes, or prior onsite disposals).

  No complex or special conditions existed on the site therefore no complex or special surveys were included.

- Not to be applied to land areas where soil has been previously remediated.

  No land areas were involved in the decommissioning and therefore the final status survey did not apply to any land areas.

- Removable residual radioactivity for building surfaces must comply with the screening $DCGL_W$ basis of 10 % removable or adjusted per Screening Table (see Appendix H of this volume).

  Removable residual radioactivity for building surfaces complied with the screening DCGLw basis of 10% removable (no removable residual radioactivity identified).

- MDC between 10 to 50 % of the $DCGL_W$ for scans, static or direct measurements, and sampling and analysis (using NUREG–1507 guidance).

  With the exception of alpha scans, the MDC was between 10 to 50% of the DCGLw for scans, static or direct measurements, and sampling and analysis (using NUREG-1507 guidance). A conservative assessment which calculated the dose per year using DandD code with default distributions under the condition that all the alpha emitting radionuclides stored at the MWSF during the operating life of the facility were evenly spread on the floor of the storage building determined that the Total Effective Dose Equivalent (TEDE) to an average member of the critical group does not exceed 25 mrem per year (12.33 mrem per year). The DCGLw for the beta/gamma emitting radionuclides was adjusted so that the TEDE from the beta/gamma emitting radionuclides would not exceed 12.5 mrem per year. This conservative approach provided an adequate level of assurance that the DCGLw for the alpha emitting radionuclides was met as would have been possible had the alpha scan MDC been between 10 to 50% of the DCGLw.

  If the above conditions are met, then the following simplified method may be used to design and conduct the FSS for each survey unit.

- Size is limited to 2000 m^2 for land areas and 100 m^2 for structures.

  No land areas were involved. Structures were limited to 100 m^2.

- Scanning and sampling to be performed:
  - — 100 % scan and
  - — 30 samples.

  100% of interior surfaces were scanned and 31 samples were obtained to measure alpha and beta static radiation emissions, levels of alpha and beta residual removable contamination, and levels of low level beta residual removable contamination.

- Hot spot criteria is three times the $DCGL_W$, applied to any sampling location.

  Established hot spot criteria were three times the DCGLw.

- A quality control program to ensure results are accurate and sources of uncertainty are identified and controlled.

  A quality control program was implemented to ensure results were accurate and sources of uncertainty were identified and controlled.

- The average concentration for the survey unit is compared to the $DCGL_W$.

  The average concentration for the survey unit was compared to the DCGLw and was well below this value for alpha, beta, and gamma emitting radionuclides.

- Statistical tests may be the Student's *t* test, Sign test, or Wilcoxon Rank Sum test, with $\alpha = 0.05$ (no statistics are needed if all measurements are less than the $DCGL_W$).

  No statistics were needed because all measurements were less than the DCGLw.

The final status survey report (FSSR) should provide a complete and unambiguous record of the radiological status of the site and should stand on its own with minimal information incorporated by reference.

The FSSR provides a complete and unambiguous record of the radiological status of the site and stands on its own with minimal information incorporated by reference.

Compliance with 10 CFR Part 20.1402

As stated in 10 CFR 20.1402, a 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, including that from groundwater sources of drinking water, and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA).

Based on the MWSF site operating history, records of disposal, and the results of the FSS, TVA has concluded the residual radioactivity at the MWSF that is distinguishable from background radiation will not result in a Total Effective Dose Equivalent (TEDE) to an average member of the critical group that exceeds 25 mrem per year, including that from groundwater sources of drinking water, and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA).

Attachment FSS-1

Derived Concentration Guideline Limits (DCGLw)

For

Radionuclides Received and Stored at the Mixed Waste Storage Facility

Radionuclides Received and Stored at Mixed Waste Storage Facility
Derived Concentration Guideline Limits (DCGLw)

Radionuclide (half-life)*	Major Radiations and Energies (MeV)*	NRC Screening Value (dpm/100 cm2)	DandD Screening Value (dpm/100 cm2)
H-3 (12.262 y)	β- 0.018 max β- 0.005 avg	120000000	
C-14 (5730 y)	β- 0.158 max β- 0.049 avg	3700000	
F-18 (109.7 m)	β + 0.635 max γ 0.511 (194%)		Not Applicable Short Half-Life
Cr-51 (27.8 d)	e^- 0.315 γ 0.320 (9%)		500000
Mn-54 (303 d)	e- 0.829 γ 0.835 (100%)	32000	
Fe-55 (2.6 y)	γ 0.23 (0.004%) Bremsstrahlung	4500000	
Co-57 (270 d)	γ 0.014 (9%), γ 0.122 (87%), γ 0.136 (11%), γ 0.692 (0.14%)		200000
Co-58 (71.3 d)	β+ 0.474 max γ 0.511 (30%), γ 0.810 (99%), γ 0.865 (1.4%), 1.67 (0.6%)		65000
Fe-59 (45.6 d)	β- 1.156 max β- 0.116 avg γ 0.192 (2.8%) γ 1.095 (56%) γ 1.292 (44%)		85000
Co-60 (5.263 y)	β- 1.478 max β- 0.069 avg γ 1.173 (100%) γ 1.332 (100%)	7100	
Ni-63 (92 y)	β- 0.066 max β- 0.017 avg		1800000
Zn-65 (245 d)	β+ 0.327 max e- 1.106 γ 0.511 (3.4%) γ 1.115 (49%)		45000
Sr-90 (27.7 y)	β- 0.544 max β- 0.200 avg (Y-90) β- 2.245 max β- 0.931 avg	8700	
Nb-95 (35 d)	β- 0.930 max β- 0.046 avg γ 0.765 (100%)		150000
Zr-95 (65.5 d)	β- 1.13 max β- 0.115 avg		45000

Radionuclide (half-life)*	Major Radiations and Energies (MeV)*	NRC Screening Value (dpm/100 cm2)	DandD Screening Value (dpm/100 cm2)
Nb-97 (72 m)	β- 1.27 max β- 0.464 avg 0.665 (98%)		Not Applicable Short Half-Life
Tc-99 (2.12E5 y)	β- 0.295 max β- 0.085 avg	1300000	
Ag-110m (255 d)	β- 0.530 max β- 0.070 avg γ 0.658 (96%) γ 0.885 (71%)		10000
Sb-125 (2.71 y)	β- 0.612 max β- 0.084 avg γ 0.6, 0.25, 0.41,		40000
I-129 (1.7E7 y)	β- 0.150 max β- 0.040 avg	35000	
Cs-134 (2.05 y)	β- 1.453 max β- 0.152 avg		12000
Cs-137 (30 y)	β- 1.167 max β- 0.195 avg γ 0.662 (85%)	28000	
Ce-144 (284 d)	β- 0.320 max β- 0.081 avg		35000
U-235 (7.1E8 y)	α 4.366 (18%) α 4.396 (57%) α 4.415 (4%)		85
Pu-238 (86.4 y)	α 5.456 (28%) α 5.499 (72%)		26
Pu-239 (24,390 y)	α 5.105 (12%) α 5.143 (15%) α 5.156 (73%)		24
Pu-240 (6580 y)	α 5.123 (24%) α 5.168 (76%)		24
Pu-241 (13.2 y)	α 4.896 (0.002%) β- 0.021 max β- 0.005 avg		1225
Am-241 (458 y)	α 5.443 (13%) α 5.486 (86%)		23
Cm-242 (162.5 d)	α 6.071(26%) α 6.115 (74%)		1050
Cm-243 (32 y)	α 5.742 (12%) α 5.786 (73%) α 5.994 (6%) α 6.061 (6%)		34
Cm-244 (17.6 y)	α 5.806 (77%)		43

* Information on radiological characteristics obtained from Health Physics Handbooks (see references page E2-134)

Attachment FSS-2

DandD Screening Values for Beta/Gamma Emitters That Are Not Included in NRC Screening Values

DandD Version: 2.1.0
Run Date/Time: 12/15/2014 4:00:55 PM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution	
51Cr	UNLIMITED	CONSTANT(dpm/100 cm**2)	
Justification for concentration: DCGL determination for 25 mrem/yr dose		Value	5.00E+05

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 calculated TEDE values are < 2.41E+00 mrem/year .
The 95 % Confidence Interval for the 0.9 quantile value of TEDE is 2.41E+00 to 2.42E+00 mrem/year

DandD Version: 2.1.0
Run Date/Time: 12/15/2014 4:04:43 PM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
57Co	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: DCGL determination for 25 mrem/yr		Value 2.00E+05

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 2.37E+01 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 2.34E+01 **to** 2.40E+01 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 12/15/2014 4:06:35 PM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
58Co	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: DCGL determination for 25 mrem/yr dose		Value 6.50E+04

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 2.40E+01 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 2.40E+01 **to** 2.41E+01 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 12/15/2014 4:08:30 PM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution	
59Fe	UNLIMITED	CONSTANT(dpm/100 cm**2)	
Justification for concentration: DCGL determination for 25 mrem/yr dose		Value	8.50E+04

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 **calculated TEDE values are** < 2.41E+01 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 2.40E+01 **to** 2.41E+01 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 12/15/2014 4:10:29 PM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
63Ni	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: DCGL determination for 25 mrem/yr dose		Value 1.60E+06

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 2.20E+01 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 1.97E+01 **to** 2.49E+01 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 12/15/2014 4:12:06 PM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
65Zn	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: DCGL determination for 25 mrem/yr dose		Value 4.50E+04

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 2.34E+01 **mrem/year .**

DandD Version: 2.1.0
Run Date/Time: 12/15/2014 4:14:00 PM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	**Area of Contamination (m^2)**	**Distribution**
95Nb	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: DCGL determination for 25 mrem/yr dose		Value 1.50E+05

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 calculated TEDE values are < 2.22E+01 mrem/year .
The 95 % Confidence Interval for the 0.9 quantile value of TEDE is 2.22E+01 to 2.22E+01 mrem/year

DandD Version: 2.1.0
Run Date/Time: 12/15/2014 4:15:32 PM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution	
95Zr	UNLIMITED	CONSTANT(dpm/100 cm**2)	
Justification for concentration: DCGL determination for 25 mrem/yr dose		Value	4.50E+04

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 **calculated TEDE values are** < 2.35E+01 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 2.35E+01 **to** 2.36E+01 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 12/15/2014 4:17:10 PM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
110mAg	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: DCGL determination for 25 mrem/yr dose		Value 1.00E+04

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 calculated TEDE values are < 2.45E+01 mrem/year .
The 95 % Confidence Interval for the 0.9 quantile value of TEDE is 2.44E+01 to 2.47E+01 mrem/year

DandD Version: 2.1.0
Run Date/Time: 12/15/2014 4:18:43 PM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution	
125Sb	UNLIMITED	CONSTANT(dpm/100 cm**2)	
Justification for concentration: DCGL determination for 25 mrem/yr dose		Value	4.00E+04

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 **calculated TEDE values are** < 2.26E+01 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 2.25E+01 **to** 2.27E+01 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 12/15/2014 4:20:02 PM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
134Cs	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: DCGL determination for 25 mrem/yr dose		Value 1.20E+04

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 2.35E+01 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 2.34E+01 **to** 2.37E+01 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 12/15/2014 4:21:32 PM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution	
144Ce	UNLIMITED	CONSTANT(dpm/100 cm**2)	
Justification for concentration: DCGL determination for 25 mrem/yr dose		Value	3.50E+04

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 2.05E+01 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 1.86E+01 **to** 2.31E+01 **mrem/year**

Attachment FSS-3

DandD Code Calculations for Alpha Emitting Radionuclides

DandD Building Occupancy Scenario

DandD Version: 2.1.0
Run Date/Time: 10/6/2014 9:55:45 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
235U	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Determine DCGL screening criteria		Value 8.50E+01

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results: 90.00% of the 100 calculated TEDE values are < 2.19E+01 mrem/year .The 95 % Confidence Interval for the 0.9 quantile value of TEDE is 1.95E+01 to 2.49E+01 mrem/year

DandD Version: 2.1.0
Run Date/Time: 10/6/2014 10:03:02 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
238Pu	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Determine DCGL screening criteria.		Value 2.60E+01

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 2.13E+01 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 1.90E+01 **to** 2.43E+01 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 10/6/2014 10:06:59 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
239Pu	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Determine DCGL screening criteria.		Value 2.40E+01

Site Specific Parameters:

General Parameters:
None

Correlation Coefficients:
None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 2.16E+01 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 1.93E+01 **to** 2.46E+01 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 10/6/2014 10:09:27 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
240Pu	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Determine DCGL screening criteria.		Value 2.40E+01

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 calculated TEDE values are < 2.16E+01 mrem/year .
The 95 % Confidence Interval for the 0.9 quantile value of TEDE is 1.93E+01 to 2.46E+01 mrem/year

DandD Version: 2.1.0
Run Date/Time: 10/6/2014 10:11:31 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
241Pu	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Determine DCGL screening criteria.		Value 1.23E+03

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 2.16E+01 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 1.93E+01 **to** 2.46E+01 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 10/6/2014 10:13:47 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
241Am	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Determine DCGL screening criteria.		Value 2.30E+01

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 calculated TEDE values are < 2.14E+01 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 1.91E+01 **to** 2.44E+01 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 10/6/2014 10:16:14 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
242Cm	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Determine DCGL screening criteria.		Value 1.05E+03

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 2.15E+01 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 1.91E+01 **to** 2.44E+01 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 10/6/2014 10:18:06 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
243Cm	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Determine DCGL screening criteria.		Value 3.40E+01

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 **calculated TEDE values are <** 2.16E+01 **mrem/year .**
The 95 **% Confidence Interval for the** 0.9 **quantile value of TEDE is** 1.93E+01 **to** 2.46E+01 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 10/6/2014 10:20:19 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution	
244Cm	UNLIMITED	CONSTANT(dpm/100 cm**2)	
Justification for concentration: Determine DCGL screening criteria.		Value	4.30E+01

Site Specific Parameters:

General Parameters:
None

Correlation Coefficients:
None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 2.19E+01 **mrem/year .**
The 95 **% Confidence Interval for the** 0.9 **quantile value of TEDE is** 1.96E+01 **to** 2.50E+01 **mrem/year**

Attachment FSS-4

Radionuclide Activity Possessed and Shipped by Manifest Number

Radionuclide Activity Possessed and Shipped by Manifest Number
(mCi)

Radionuclide	0825-01-0001	0825-02-0001	T074683	0825-02-0002	TVA-April-2013	0825-03-0001	0825-04-0001	002785862 JJK	2764-01	TOTAL
	Beta/Gamma Emitters									
H-3				2.79E-04		1.14E-04	2.29E-06			3.95E-04
C-14	5.27E-06			3.02E-05		3.84E-05	1.63E-06		7.49E-02	7.5E-02
F-18					2.02E-07					2.02E-07
Cr-51	4.09E-01	4.75E-03		6.31E-04		2.68E-03			1.83E-02	4.35E-01
Mn-54	4.43E-01	5.09E-03		3.64E-04	7.29E-07	1.17E-02			1.46E-01	6.06E-01
Fe-55	9.80E-01	1.10E-02		3.27E-03		8.65E-02	3.74E-02		1.65	2.77
Co-57				1.15E-05		5.63E-07			1.72E-04	1.84E-04
Co-58	5.70E-02	6.61E-04		6.95E-04		1.64E-04			5.70E-02	9.9E-02
Fe-59				3.15E-05		1.32E-06			8.2E-03	8.1E-03
Co-60	1.80E+00	2.05E-02	8.06E-04	6.18E-04	5.45E-06	1.08E-01	5.39E-02		2.23E-01	2.21
Ni-63	3.25E-04	2.36E-08		9.56E-04		2.20E-03	2.32E-03		1.13E-01	1.19E-1
Zn-65	3.66E-01	4.19E-03		1.71E-05	1.04E-06	9.70E-03			4.57E-02	4.26E-01
Sr-90	4.67E-05	1.04E-09		4.06E-06			3.94E-06			5.47E-05
Nb-95				9.52E-06		3.44E-05			1.34E-02	1.34E-02
Zr-95				5.92E-06		2.67E-05			2.18E-03	2.21E-03
Nb-97					2.51E-07					2.51E-07
Tc-99				1.95E-05		2.54E-05	4.14E-06			4.9E-05
Ag-110m	2.79E-01	3.19E-03		3.51E-05	4.70E-07	1.10E-02				2.93E-01
Sn-113				3.71E-06		1.49E-06				5.2E-06
Sb-124						4.06E-07				4.06E-07

Radionuclide	0825-01-0001	0825-02-0001	T074683	0825-02-0002	TVA-April-2013	0825-03-0001	0825-04-0001	002785862 JJK	2764-01	TOTAL
Sb-125				1.69E-04		5.01E-06				1.74E-04
I-129				1.11E-05		1.40E-05	1.36E-06			2.65E-05
Cs-134	1.15E-02	2.93E-07		1.77E-04	2.93E-06	9.05E-03				2.07E-02
Cs-137	5.22E-02	3.28E-04	1.69E-03	8.03E-04	6.99E-04	2.23E-02	1.28E-03	2.54E-02	8.07E-03	1.13E-01
Ce-144	5.00E-09	4.98E-12		1.01E-06		9.30E-07	5.43E-07		4.0E-03	4.0E-03
(Total Beta/Gamma)										(7.1953)
Alpha Emitters										
U-235				2.00E-05						2.0E-05
Pu-238	3.11E-10	3.11E-13		1.30E-06			3.92E-08			1.34E-06
Pu-239				3.51E-07						3.51E-07
Pu-240				3.51E-07						3.51E-07
Pu-241	2.98E-05	6.45E-10		2.79E-05						5.77E-05
Am-241				1.42E-06						1.42E-06
Cm-242	7.75E-08	1.68E-12		1.89E-09						7.9E-08
Cm-243	3.46E-10	3.46E-13		2.94E-07			4.36E-08			3.38E-07
Cm-244	3.60E-13	2.36E-16		2.94E-07						2.94E-07
(Total Alpha)										(8.19E-05)
Alpha, Beta, and Gamma Emitter Totals Per Shipment										
TOTAL	4.4	4.97E-02	2.5E-03	8.2E-03	7.1E-04	2.64E-01	9.49E-02	2.54E-02	2.37	**7.1954**
										(7.2)

Radionuclide	TOTAL	Percent of TOTAL Activity	Percent Beta/Gamma Total	Percent Alpha Total
Beta/Gamma Emitters				
H-3	3.95E-04	0.0055	0.0055	
C-14	7.5E-02	1.04	1.04	
F-18	2.02E-07	0.0000028	0.0000028	
Cr-51	4.35E-01	6.03	6.03	
Mn-54	6.06E-01	8.4	8.4	
Fe-55	2.77	38.49	38.49	
Co-57	1.84E-04	0.0026	0.0026	
Co-58	9.9E-02	1.37	1.37	
Fe-59	8.1E-03	0.11	0.11	
Co-60	2.21	30.71	30.71	
Ni-63	1.19E-01	1.65	1.65	
Zn-65	4.26E-01	5.9	5.9	
Sr-90	5.47E-05	0.000076	0.000076	
Nb-95	1.34E-02	0.19	0.19	
Zr-95	2.21E-03	0.03	0.03	
Nb-97	2.51E-07	0.0000035	0.0000035	
Tc-99	4.9E-05	0.00068	0.00068	
Ag-110m	2.93E-01	4.06	4.06	
Sn-113	5.2E-06	0.000072	0.000072	
Sb-124	4.06E-07	0.0000056	0.0000056	
Sb-125	1.74E-04	0.0024	0.0024	
I-129	2.65E-05	0.00037	0.00037	

Radionuclide	TOTAL	Percent of TOTAL Activity	Percent Beta/Gamma Total	Percent Alpha Total
Cs-134	2.07E-02	0.29	0.29	
Cs-137	1.13E-01	1.57	1.57	
Ce-144	4.0E-03	0.06	0.06	
Total Beta/Gamma	7.1953	100	100	
Alpha Emitters				
U-235	2.0E-05	0.00028		24.42
Pu-238	1.34E-06	0.000019		1.64
Pu-239	3.51E-07	0.0000049		0.43
Pu-240	3.51E-07	0.0000049		0.43
Pu-241	5.77E-05	0.00080		70.45
Am-241	1.42E-06	0.00002		1.73
Cm-242	7.9E-08	0.0000011		0.1
Cm-243	3.38E-07	0.0000047		0.41
Cm-244	2.94E-07	0.000004		0.36
Total Alpha	8.19E-05	0.001		99.97
TOTAL	7.1954			
	(7.2)			

FSS-5

DandD Dose Calculation Results

Theoretical Condition

Distribution of Entire Inventory of Alpha Emitting Radionuclides Evenly Across Storage Building Floor

DandD Dose Calculation Results for Theoretical Condition

Entire Inventory of Alpha Emitting Radionuclides Evenly Distributed On Floor Surface

Mixed Waste Storage Building 2

Radionuclide	Activity (mCi)	Disintegrations per minute (dpm)	Number of 100 cm^2 Areas	dpm/100cm^2	DandD Dose (mrem/year)
U-235	2.0E-5*	4.44E4	1724	25.75	6.62
Pu-238	1.34E-6	2.97E3	1724	1.72	1.41
Pu-239	3.51E-7	7.79E2	1724	0.45	0.41
Pu-240	3.51E-7	7.79E2	1724	0.45	0.41
Pu-241	5.77E-5	1.28E5	1724	74.2	1.31
Am-241	1.42E-6	3.15E3	1724	1.83	1.70
Cm-242	7.9E-8	1.75E2	1724	0.10	0.002
Cm-243	3.38E-7	7.5E2	1724	0.44	0.28
Cm-244	2.94E-7	6.53E2	1724	0.38	0.19
TOTAL					12.33

* - E denotes exponent, 2.0E-5 = 2.0×10^{-5} and 4.44E4 = 4.44×10^{4}

Dose Based on Activity of Possessed Alpha Emitters
DandD Building Occupancy Scenario

DandD Version: 2.1.0
Run Date/Time: 10/7/2014 9:27:07 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution	
235U	UNLIMITED	CONSTANT(dpm/100 cm**2)	
Justification for concentration: Dose based on activity possessed.		Value	2.58E+01

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 6.62E+00 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 5.90E+00 **to** 7.54E+00 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 10/7/2014 9:31:21 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
238Pu	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Dose based on activity possessed.		Value 1.72E+00

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 1.41E+00 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 1.26E+00 **to** 1.60E+00 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 10/7/2014 9:35:03 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
239Pu	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Dose based on activity possessed.		Value 4.50E-01

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 calculated TEDE values are < 4.05E-01 mrem/year .
The 95 % Confidence Interval for the 0.9 quantile value of TEDE is 3.61E-01 to 4.61E-01 mrem/year

DandD Version: 2.1.0
Run Date/Time: 10/7/2014 9:36:55 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
240Pu	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Dose based on activity possessed.		Value 4.50E-01

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 4.05E-01 **mrem/year .**
The 95 **% Confidence Interval for the** 0.9 **quantile value of TEDE is** 3.61E-01 **to** 4.61E-01 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 10/22/2014 5:28:08 PM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
241Pu	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.		Value 7.42E+01

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are <** 1.31E+00 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 1.17E+00 **to** 1.49E+00 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 10/7/2014 9:39:40 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
241Am	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Dose based on activity possessed.		Value 1.83E+00

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 1.70E+00 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 1.52E+00 **to** 1.94E+00 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 10/7/2014 9:42:04 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
242Cm	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Dose based on activity possessed.		Value 1.00E-01

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 calculated TEDE values are < 2.04E-03 mrem/year .
The 95 % Confidence Interval for the 0.9 quantile value of TEDE is 1.82E-03 to 2.33E-03 mrem/year

DandD Version: 2.1.0
Run Date/Time: 10/7/2014 9:43:34 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
243Cm	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Dose based on activity possessed.		Value 4.40E-01

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 2.80E-01 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 2.50E-01 **to** 3.19E-01 **mrem/year**

DandD Version: 2.1.0
Run Date/Time: 10/7/2014 9:44:50 AM
Site Name: TVA Mixed Waste Storage Facility
Description: Using DandD to identify DCGL screening criteria for radionuclides that are not included in NRC screening values table.
FileName:C:\Users\Henson\Documents\D&D Runs\TVA MWF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution	
244Cm	UNLIMITED	CONSTANT(dpm/100 cm**2)	
Justification for concentration: Dose based on activity possessed.		Value	3.80E-01

Site Specific Parameters:

General Parameters:

None

Correlation Coefficients:

None

Summary Results:

90.00% **of the** 100 **calculated TEDE values are** < 1.94E-01 **mrem/year .**
The 95 % Confidence Interval for the 0.9 **quantile value of TEDE is** 1.73E-01 **to** 2.21E-01 **mrem/year**

Attachment FSS-6

Gridded Mixed Waste Storage Building Drawings

Mixed Waste Storage Building 1

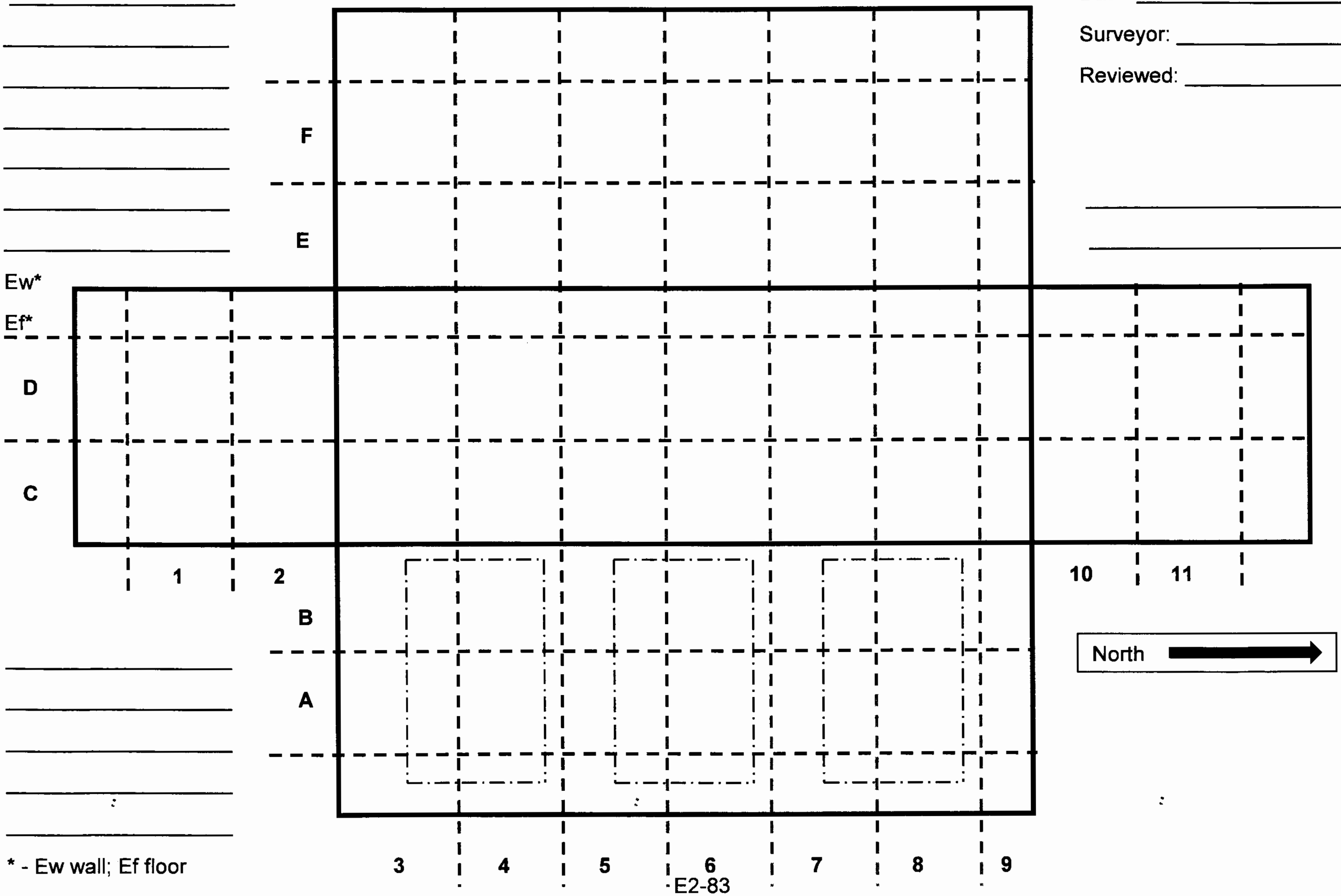
Mixed Waste Storage Building 2

Mixed Waste Storage Building 1

Date: ____________________

Surveyor: ____________________

Reviewed: ____________________



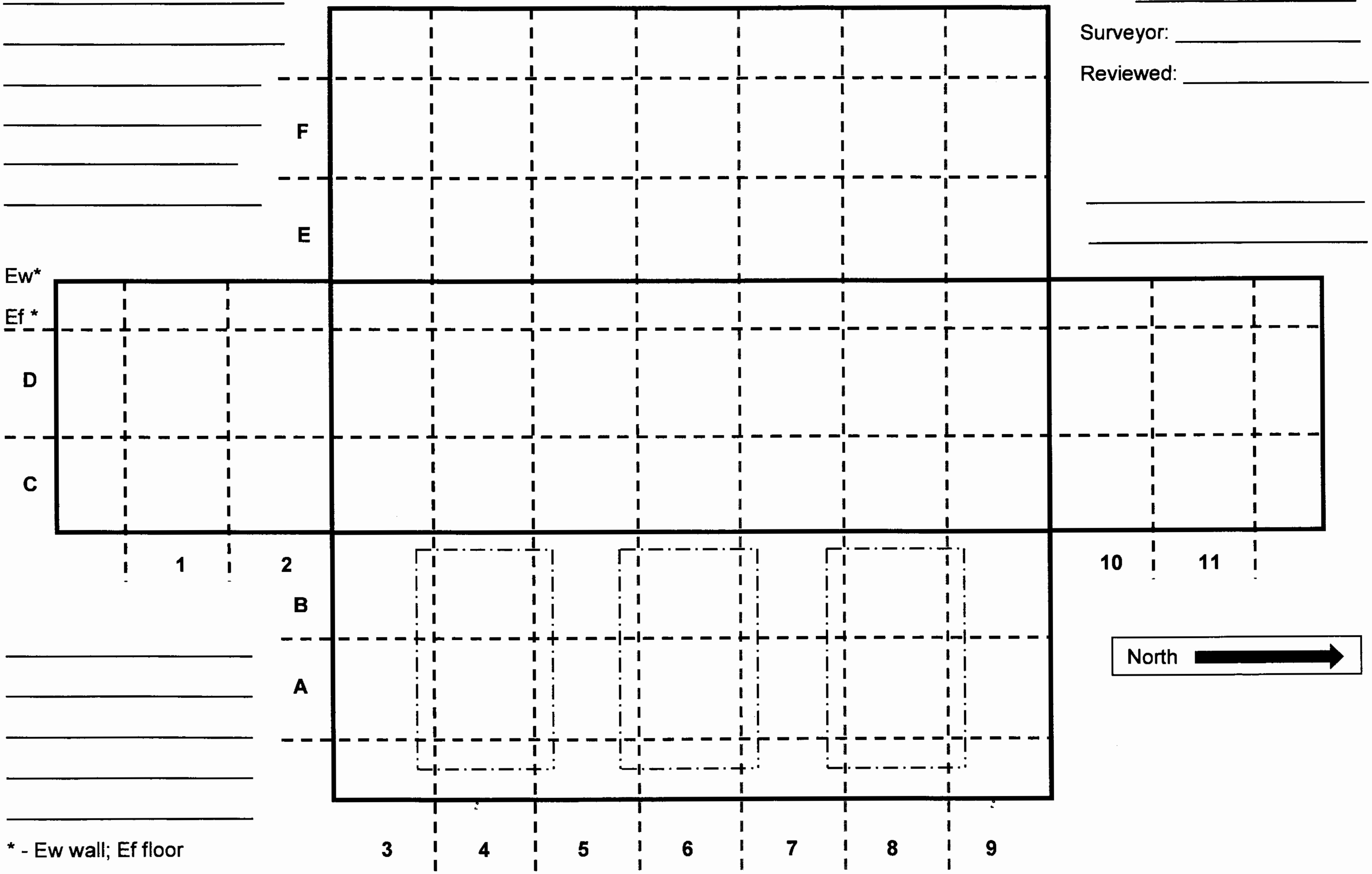
* - Ew wall; Ef floor

Mixed Waste Storage Building 2

Date: ____________________

Surveyor: ________________

Reviewed: ________________



* - Ew wall; Ef floor

Attachment FSS-7

FSS Survey and Sample Locations

MWSB-1 and MWSB-2

Mixed Waste Storage Building 1

a – alpha static count

b – beta static count

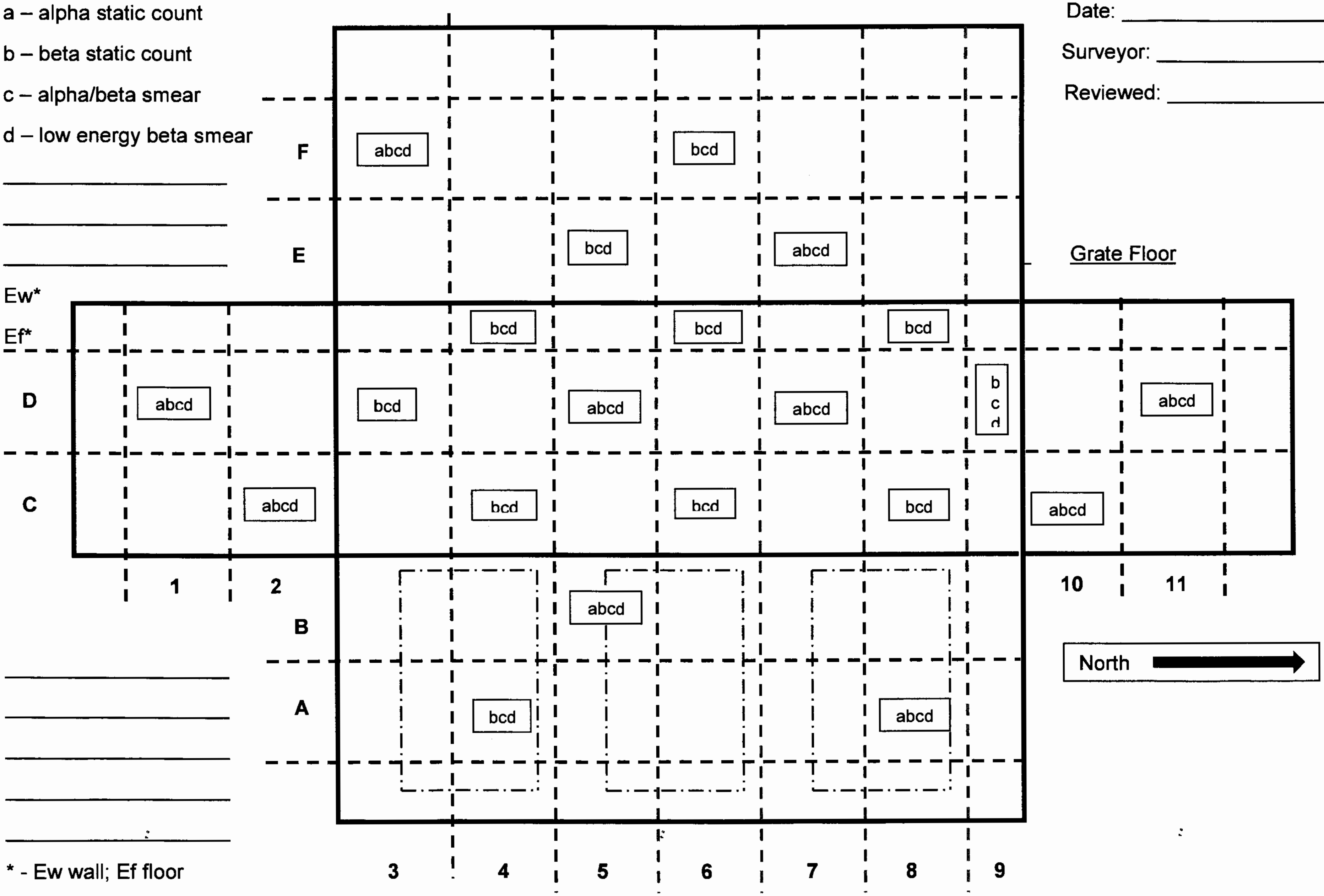
c – alpha/beta smear

d – low energy beta smear

Date: ____________________

Surveyor: _________________

Reviewed: ________________



* - Ew wall; Ef floor

Mixed Waste Storage Building 1

a – alpha static count

b – beta static count

c – alpha/beta smear

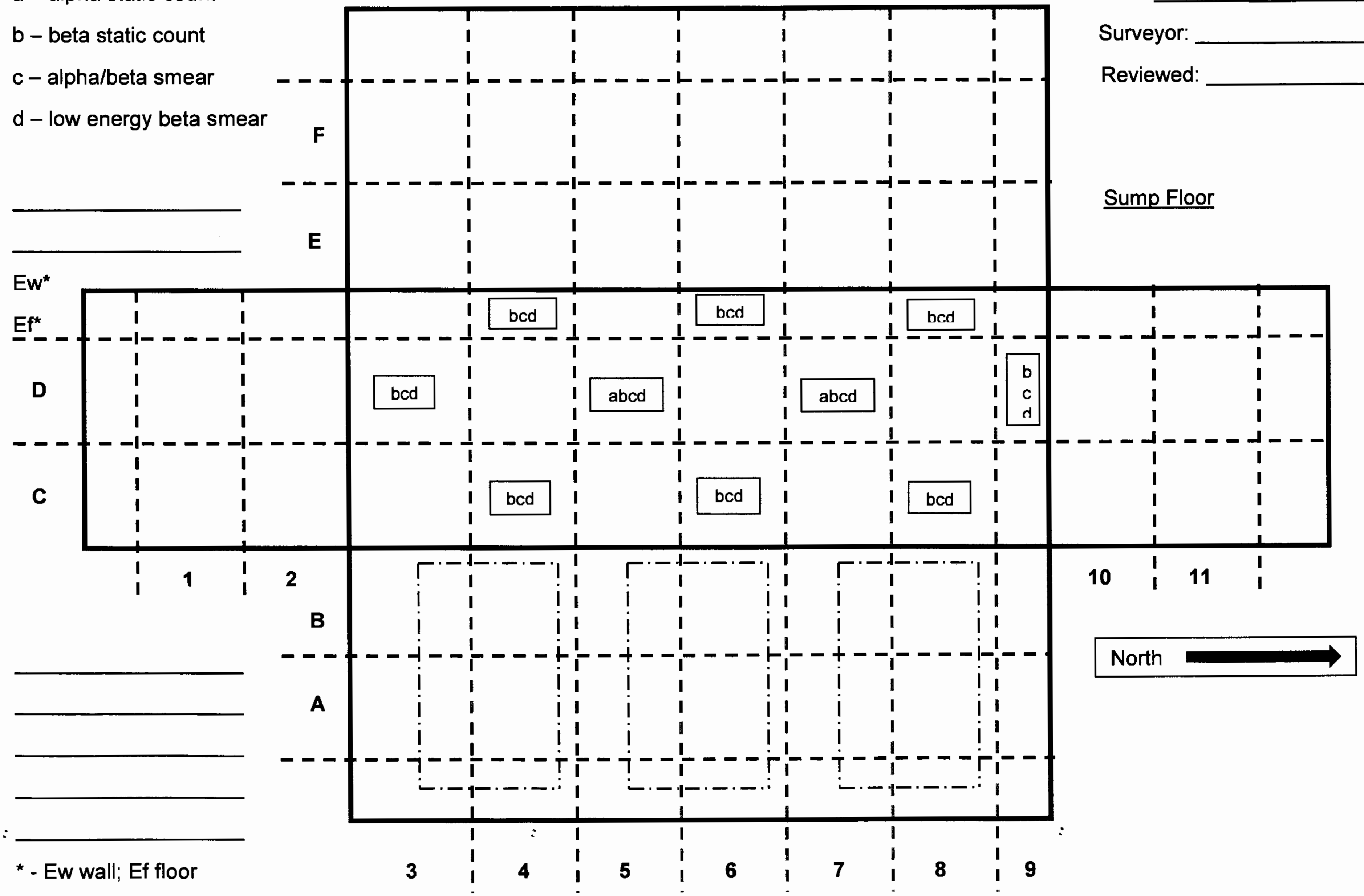
d – low energy beta smear

Date: ____________________

Surveyor: ________________

Reviewed: ________________

Sump Floor



____

____

____

____

____

____

____

* - Ew wall; Ef floor

Mixed Waste Storage Building 2

a – alpha static count

b – beta static count

c – alpha/beta smear

d – low energy beta smear

____

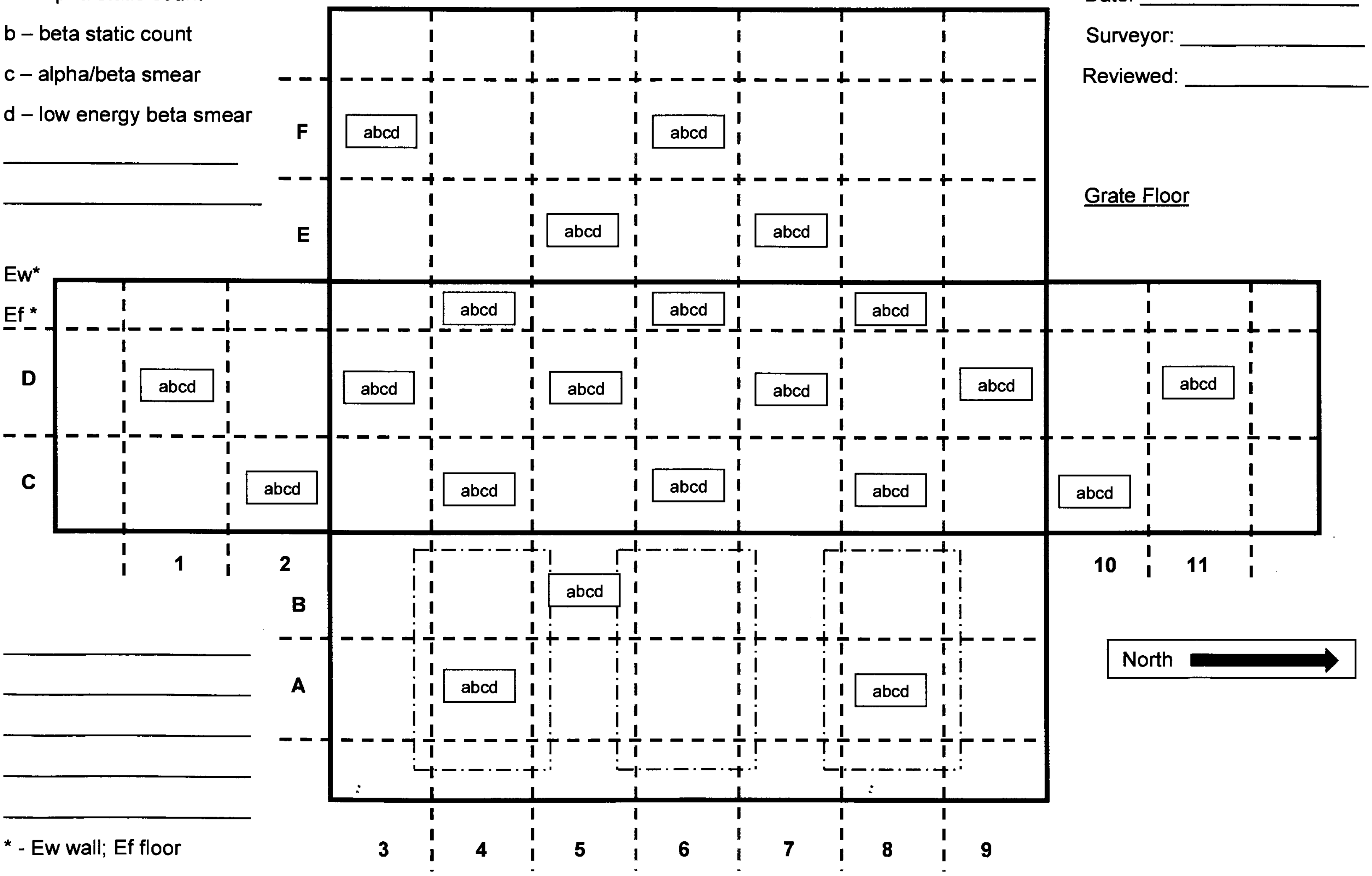
____

Date: ____________________

Surveyor: ________________

Reviewed: ________________

Grate Floor



____

____

____

____

____

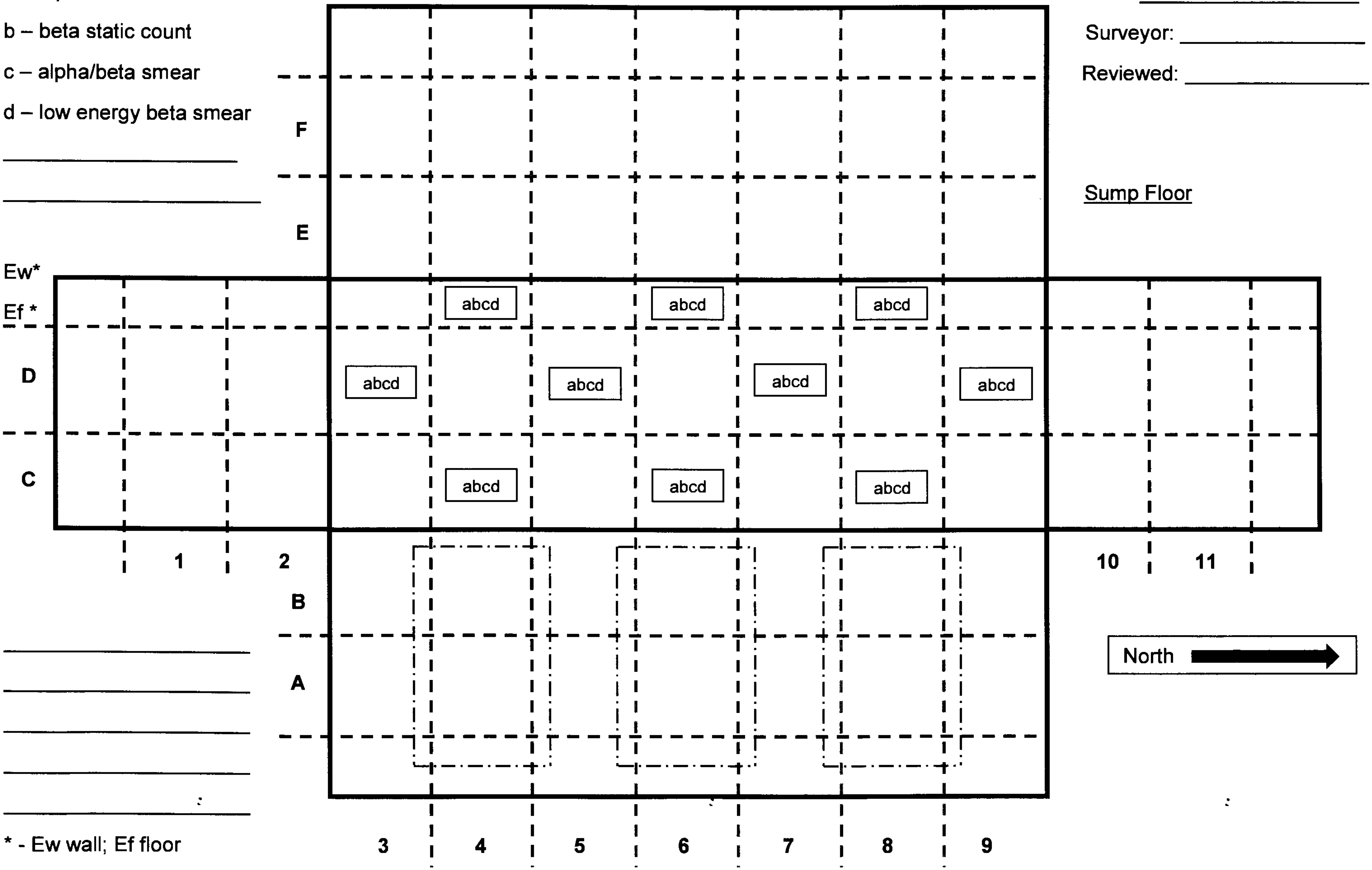
* - Ew wall; Ef floor

Mixed Waste Storage Building 2

a – alpha static count
b – beta static count
c – alpha/beta smear
d – low energy beta smear
____
____

Date: __________________
Surveyor: ________________
Reviewed: ________________

Sump Floor



____
____
____
____
____

* - Ew wall; Ef floor

Attachment FSS-8

Survey Instrument Daily Checks

Survey Instrument Daily Check
Alpha/Beta Instruments

Instrument Model No.	Instrument Serial No.	Detector Model No.	Detector Serial No.	Calibration Date
Ludlum Model 12	TVA 951374	Ludlum Model 43-92PS	PR257409	10/31/14 Due 1/31/15

Quality Control Assessment

Date: 12/2/14 **Check Source:** Pu239 (#8349)

Background Count Time: 2 m **Check Source Count Time:** 2 m

Performed By: Jay Henson

Background (cpm)	Check Source (cpm)	Background (cpm)	Check Source (cpm)
1.5	2252	1	2260
0	2230	1.5	2343
1.5	2298	0	2278
2.5	2244	0.5	2339
0.5	2303	0	2378
Average		0.9	2293
Standard Deviation		0.84 1σ 0.06 – 1.74 2σ 0 – 2.58	48.68 1σ 2246-2342 2σ 2198-2390

Daily checks should be within +/- two standard deviations. If results exceed +/- two standard deviations, obtain another count. If this result exceeds +/- two standard deviations, check instrument (e.g., batteries, connections, detector, etc.). Retest. If result exceeds +/- two standard deviations, return instrument to calibration facility for assessment.

Daily Quality Control Checks

Instrument S/N: TVA 951374 **Detector S/N: PR257409**

Date/Time	Battery	Background (cpm)	Check Source (cpm)	Results Acceptable
12/2/14 1:07 pm	OK	0.5	2315	(x) Y ( ) N
12/2/14 4:34 pm	OK	2	2314	(x) Y ( ) N
				( ) Y ( ) N
12/3/14 7:17 am	OK	2.5	2313	(x) Y ( ) N
12/3/14 10:35 am	OK	1.0	2353	(x) Y ( ) N
12/3/14 12:49 pm	OK	1.0	2324	(x) Y ( ) N
12/3/14 2:59 pm	OK	1.0	2394*	(x) Y ( ) N
*End of Survey				( ) Y ( ) N
	AVG	1.33	2335	( ) Y ( ) N
	STD DEV	0.75	32.4	( ) Y ( ) N
				( ) Y ( ) N
10 m background counts				( ) Y ( ) N
15/1.5 cpm				( ) Y ( ) N
14/1.4 cpm				( ) Y ( ) N
29/2.9 cpm				( ) Y ( ) N
22/2.2 cpm				( ) Y ( ) N
22/2.2 cpm				( ) Y ( ) N
43/4.3 cpm				( ) Y ( ) N
16/1.6 cpm				( ) Y ( ) N
18/1.8 cpm				( ) Y ( ) N
25/2.5 cpm				( ) Y ( ) N
AVG: 22.7/2.3 cpm				( ) Y ( ) N
STD DEV 9.1/0.91 cpm				( ) Y ( ) N
Without 43/4.3 cpm				( ) Y ( ) N
AVG: 20/2.0 cpm				( ) Y ( ) N
STD DEV: 5.3/0.53 cpm				( ) Y ( ) N

Survey Instrument Daily Check
Alpha/Beta Instruments

Instrument Model No.	Instrument Serial No.	Detector Model No.	Detector Serial No.	Calibration Date
Ludlum Model 12	TVA 951391 (Meter 1)	Ludlum Model 44-142	PR312382	11/15/14 Due 5/25/15

Quality Control Assessment

Date: 12/2/14 **Check Source:** Beta Source (Lu-176) SN 0875

Background Count Time: 1 m **Check Source Count Time:** 1 m

Performed By: Jay Henson

Background (cpm)	Check Source (cpm)	Background (cpm)	Check Source (cpm)
40	301	52	324
70	347	56	342
60	299	54	296
70	323	57	283
50	327	65	329
Average		57.4	317
Standard Deviation		9.32 1σ 48 – 67 2σ 39 – 76	21.2 1σ 296 - 338 2σ 275 - 359

Daily checks should be within +/- two standard deviations. If results exceed +/- two standard deviations, obtain another count. If this result exceeds +/- two standard deviations, check instrument (e.g., batteries, connections, detector, etc.). Retest. If result exceeds +/- two standard deviations, return instrument to calibration facility for assessment.

Daily Quality Control Checks

Instrument S/N: TVA 951391 Detector S/N: PR312382

Date/Time	Battery	Background (cpm)	Check Source (cpm)	Results Acceptable
12/2/14 11:05 am	OK	47	288	(x) Y ( ) N
12/2/14 11:30 am	OK	52	313	(x) Y ( ) N
12/2/14 1:13 pm	OK	59	300	(x) Y ( ) N
12/2/14 4:33 pm	OK	54	310	(x) Y ( ) N
				( ) Y ( ) N
12/3/14 7:16 am	OK	40	290	(x) Y ( ) N
12/3/14 10:17 am	OK	53	317	(x) Y ( ) N
12/3/14 1:58 pm	OK	41	290	(x) Y ( ) N
12/3/14 2:59 pm	OK	50	289	(x) Y ( ) N
End of Survey				( ) Y ( ) N
	AVG	49.5	300	( ) Y ( ) N
	STD DEV	6.5	12.1	( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N

Survey Instrument Daily Check
Alpha/Beta Instruments

Instrument Model No.	Instrument Serial No.	Detector Model No.	Detector Serial No.	Calibration Date
Ludlum Model 12	TVA 951392 (Meter 2)	Ludlum Model 44-142	PR312395	11/26/14 Due 5/26/15

Quality Control Assessment

Date: 12/2/14 **Check Source:** Beta Source (Lu-176) SN 0875

Background Count Time: 1 m **Check Source Count Time:** 1 m

Performed By: Jay Henson

Background (cpm)	Check Source (cpm)	Background (cpm)	Check Source (cpm)
80	412	97	410
118	402	93	432
81	381	95	398
87	426	113	411
110	442	117	365
Average		99	408
Standard Deviation		14.5 1σ 85 – 114 2σ 70 – 128	23 1σ 385 - 431 2σ 362 - 454

Daily checks should be within +/- two standard deviations. If results exceed +/- two standard deviations, obtain another count. If this result exceeds +/- two standard deviations, check instrument (e.g., batteries, connections, detector, etc.). Retest. If result exceeds +/- two standard deviations, return instrument to calibration facility for assessment.

Daily Quality Control Checks

Instrument S/N: TVA 951392 **Detector S/N:** PR312395

Date/Time	Battery	Background (cpm)	Check Source (cpm)	Results Acceptable
12/2/14 11:07 am	OK	72	384	(x) Y ( ) N
12/2/14 1:17 pm	OK	119	467	( ) Y (x) N*
12/2/14 1:22 pm	OK	66 (93)	397	(x) Y ( ) N
12/2/14 4:34 pm	OK	79	377	(x) Y ( ) N
				( ) Y ( ) N
12/3/14 7:15 am	OK	89	379	(x) Y ( ) N
12/3/14 10:32 am	OK	69 (77)	391	(x) Y ( ) N
12/3/14 12:52 pm	OK	79	383	(x) Y ( ) N
12/3/14 2:59 pm	OK	79	409	(x) Y ( ) N
End of Survey				( ) Y ( ) N
	AVG	76 (78)+	300	( ) Y ( ) N
	STD DEV	7.8 (8.7)+	12.1	( ) Y ( ) N
				( ) Y ( ) N
*Cs-137 check source too close to meter				( ) Y ( ) N
+Includes all data in calculation except *				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N

Survey Instrument Daily Check
Gamma Instruments

Instrument Model No.	Instrument Serial No.	Detector Model No.	Detector Serial No.	Calibration Date
Ludlum Model 19	TVA 860951	NaI Internal	N/A	11/17/14 Due: 5/17/15

Quality Control Assessment

Date: 12/2/14 **Check Source:** Cs-137 Cs-7A#1

Background Count Time: 1 m between observations
Check Source Count Time: 1 m between observations

Performed By: Jay Henson

Background (uR/hr)	Check Source (uR/hr)	Background (uR/hr)	Check Source (uR/hr)
4.5	900	5.0	800
4.5	900	4.5	800
5.0	950	5.0	800
6.0	900	4.0	820
5.0	800	4.0	900
Average		4.75	857
Standard Deviation		0.6 1σ 4.15 – 5.35 2σ 3.55 – 5.95	58 1σ 799 – 915 2σ 741 - 973

Daily checks should be within +/- two standard deviations. If results exceed +/- two standard deviations, obtain another count. If this result exceeds +/- two standard deviations, check instrument (e.g., batteries, connections, detector, etc.). Retest. If result exceeds +/- two standard deviations, return instrument to calibration facility for assessment.

Daily Quality Control Checks

Instrument S/N: TVA 860951 **Detector S/N:** N/A

Date/Time	Battery	Background (uR/hr)	Check Source (uR/hr)	Results Acceptable Initials
12/2/14 1:28 pm	OK	4.5	850	(x) Y ( ) N
12/2/14 4:30 pm	OK	5.0	900	(x) Y ( ) N
				( ) Y ( ) N
12/3/14 7:30 am	OK	5.0	825	(x) Y ( ) N
12/3/14 10:30 am	OK	5.0	900	(x) Y ( ) N
12/3/14 12:55 pm	OK	5.0	850	(x) Y ( ) N
12/3/14 2:59 pm	OK	5.0	900	(x) Y ( ) N
End of Survey				( ) Y ( ) N
	AVG	4.9	870	( ) Y ( ) N
	STD DEV	0.2	33	( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N
				( ) Y ( ) N

Attachment FSS-9

Survey Instrument Minimum Detectable Concentration Calculations

Static and Scan MDC Worksheet

Alpha Instruments

Instrument Model No.	Instrument Serial No.	Detector Model No.	Detector Serial No.	Calibration Date
Ludlum Model 12	**TVA 951374**	**Ludlum 43-92PS**	**PR257409**	**10/31/14 Due: 1/31/15**

Static MDC Calculation

MDC_{STATIC} when background and sample are counted for different time intervals (NUREG-1507, Formula (3-11), page 3-6).

$$MDC_{STATIC} = \frac{3 + 3.29 \times \sqrt{R_B \times T_{S+B} \times (1 + T_{S+B}/T_B)}}{K \times T_{S+B} \times A/100\ cm^2}$$

Where:

R_B = Background counting rate (counts per minute)

T_{S+B} = Sample counting time (minutes)

T_B = Background counting time (minutes)

K = Total Efficiency = $\mathcal{E}i \times \mathcal{E}s \times S\varepsilon$

$\mathcal{E}i$ = instrument efficiency (**2π**); $\mathcal{E}s$ = surface efficiency;
$S\varepsilon$ = source efficiency (radionuclide detectability)

A = Area of detector (cm^2)

Factor	Factor Value	Comments
R_B	2 cpm	
T_{S+B}	5 m	
T_B	10 m	
K	0.034	
$\mathcal{E}i$	0.456	2π
$\mathcal{E}s$	0.25	Alpha surface detection efficiency
$S\varepsilon$	0.295	Detectable percentage of alpha emissions
A	100 cm^2	
MDC_{STATIC}	93 dpm/100 cm^2	

Scan MDC Calculation

$$\mathrm{MDC_{SCAN}} = \frac{\mathrm{MDCR}}{\sqrt{p} \times \varepsilon i \times \varepsilon s \times S\varepsilon \times A/100\ \mathrm{cm}^2}$$

NUREG-1757, Vol. 2, Rev. 1
Appendix E, (E-2), page E-6

Minimum Detectable Count Rate (MDCR)

$$\mathrm{MDCR} = d' \times \sqrt{b_i} \times (60/i) = s_i \times (60/i)$$

$$\mathrm{MDC_{SCAN}} = \frac{d' \times \sqrt{b_i} \times (60/i)}{\sqrt{p} \times \varepsilon i \times \varepsilon s \times S\varepsilon \times A/100\ \mathrm{cm}^2}$$

Where:

d' = Decision error taken from Table 6-5 of NUREG-1575 (MARSSIM)
(true positive proportion: 0.95; false positive proportion: 0.60)

b_i = Background count per observation (R_B in cps x i)

i = Observation counting interval (detector width divided by scan speed)

s_i = minimum detectable number of net source counts in the observation interval

p = Surveyor efficiency

εi = Instrument efficiency (2π)

εs = Surface efficiency

$S\varepsilon$ = Source efficiency (radionuclide detectability)

A = Area of detector (cm^2)

Factor	Factor Value	Factor	Factor Value
d'	1.38	p	0.5
b_i	0.09	εi	0.456
i	2.73 s	εs	0.25
Scan Speed	2.2 cm/s	$S\varepsilon$	0.295
Detector Width	6 cm	A	100 cm^2
MDCR	9.1 cpm	$\mathrm{MDC_{SCAN}}$	383 dpm/100 cm^2

Alpha Detection Probability
(theoretical analysis based on ideal detection conditions)

Probability that a single count is sufficient to cause a surveyor to stop and investigate further when performing alpha scan survey NUREG-1575, Rev. 1, (MARSSIM) Appendix J (J-5):

$$P(n \geq 1) = 1 - P(n = 0) = 1 - e^{-A}$$

For $A = GEd/60v$ and $G = C \times A_D/100$

Where:

$P(n \geq 1)$ = probability of getting 1 or more counts during the time interval t

$P(n = 0)$ = probability of not getting any counts during the time interval t

G = Source activity

E = Detector efficiency (4π)

d = Width of the detector in the direction of scan (cm)

V = Scan speed (cm/s)

C = contamination guideline (dpm/100 cm^2)

A_D = Area of detector (cm^2)

For DCGLw

Factor	Factor Value	Factor	Factor Value
G	185 dpm	V	2.2 cm/s
E	0.231	C	185 dpm/100 cm^2
d	6 cm	A_D	100 cm^2
		$P(n \geq 1)$	0.86

For $DCGL_{EMC}$

Factor	Factor Value	Factor	Factor Value
G	555	V	2.2 cm/s
E	0.231	C	555 dpm/100 cm^2
d	6 cm	A_D	100 cm^2
		$P(n \geq 1)$	0.997

Static and Scan MDC Worksheet
Beta Instruments

Instrument Model No.	Instrument Serial No.	Detector Model No.	Detector Serial No.	Calibration Date
Ludlum Model 12	TVA 951391 (Meter 1)	Ludlum Model 44-142	PR312382	11/15/14 Due 5/25/15

Static MDC Calculation

$\text{MDC}_{\text{STATIC}}$ when background and sample counted for same time interval (NUREG-1507, Formula (3-10), page 3-5).

$$\text{MDC}_{\text{STATIC}} = \frac{3 + 4.65 \times \sqrt{R_B}}{\mathcal{E}i \times \mathcal{E}s \times S\varepsilon \times A/100\ \text{cm}^2}$$

Where:

R_B = Background counting rate (counts per minute)

$\mathcal{E}i$ = Instrument efficiency (2π)

$\mathcal{E}s$ = Surface efficiency

$S\varepsilon$ = Source efficiency (radionuclide detectability)

A = Area of detector (cm^2)

Factor	Factor Value	Comments
R_B	50 cpm	
$\mathcal{E}i$	0.135	2π
$\mathcal{E}s$	0.5	Beta surface detection efficiency
$S\varepsilon$	1	Detectable percentage of beta emissions
A	100 cm^2	
$\text{MDC}_{\text{STATIC}}$	532 dpm/100 cm^2	

Scan MDC Calculation

NUREG-1757, Vol. 2, Rev. 1
Appendix E, (E-2), page E-6

$$\mathrm{MDC_{SCAN}} = \frac{\mathrm{MDCR}}{\sqrt{p} \times \mathcal{E}i \times \mathcal{E}s \times S\varepsilon \times A/100\ \mathrm{cm}^2}$$

Minimum Detectable Count Rate (MDCR)

$$\mathrm{MDCR} = d' \times \sqrt{b_i} \times (60/i) = s_i \times (60/i)$$

$$\mathrm{MDC_{SCAN}} = \frac{d' \times \sqrt{b_i} \times (60/i)}{\sqrt{p} \times \mathcal{E}i \times \mathcal{E}s \times S\varepsilon \times A/100\ \mathrm{cm}^2}$$

Where:

d' = Decision error taken from Table 6-5 of NUREG-1575 (MARSSIM) (true positive proportion: 0.95; false positive proportion: 0.60)

b_i = Background count per observation

i = Observation counting interval (scan speed divided by the detector width)

s_i = minimum detectable number of net source counts in the observation interval

p = Surveyor efficiency

$\mathcal{E}i$ = Instrument efficiency (2π)

$\mathcal{E}s$ = Surface efficiency

$S\varepsilon$ = Source efficiency (radionuclide detectability)

A = Area of detector (cm^2)

Factor	Factor Value	Factor	Factor Value
d'	1.38	p	0.5
b_i	0.98	$\mathcal{E}i$	0.135
i	1.18 s	$\mathcal{E}s$	0.5
Scan Speed	5.08 cm/s	$S\varepsilon$	1
Detector Width	6 cm	A	100 cm^2
MDCR	69.5 cpm	$\mathrm{MDC_{SCAN}}$	1431 dpm/100 cm^2

Static and Scan MDC Worksheet
Beta Instruments

Instrument Model No.	Instrument Serial No.	Detector Model No.	Detector Serial No.	Calibration Date
Ludlum Model 12	TVA 951392 (Meter 2)	Ludlum Model 44-142	PR312395	11/26/14 Due 5/25/15

Static MDC Calculation

MDC_{STATIC} when background and sample counted for same time interval

$$MDC_{STATIC} = \frac{3 + 4.65 \times \sqrt{R_B}}{\varepsilon i \times \varepsilon s \times S\varepsilon \times A/100\ cm^2}$$

Where:

R_B = Background counting rate (counts per minute)

εi = Instrument efficiency (2π)

εs = Surface efficiency

$S\varepsilon$ = Source efficiency (radionuclide detectability)

A = Area of detector (cm^2)

Factor	Factor Value	Comments
R_B	78 cpm	
εi	0.154	2π
εs	0.5	Beta surface detection efficiency
$S\varepsilon$	1	Detectable percentage of beta emissions
A	100 cm^2	
MDC_{STATIC}	572 dpm/100 cm^2	

Scan MDC Calculation

$$\text{MDC}_{\text{SCAN}} = \frac{\text{MDCR}}{\sqrt{p} \times \varepsilon i \times \varepsilon s \times S\varepsilon \times A/100\ \text{cm}^2}$$

Minimum Detectable Count Rate (MDCR)

$$\text{MDCR} = d' \times \sqrt{b_i} \times (60/i) = s_i \times (60/i)$$

$$\text{MDC}_{\text{SCAN}} = \frac{d' \times \sqrt{b_i} \times (60/i)}{\sqrt{p} \times \varepsilon i \times \varepsilon s \times S\varepsilon \times A/100\ \text{cm}^2}$$

Where:

d' = Decision error taken from Table 6-5 of NUREG-1575 (MARSSIM)
(true positive proportion: 0.95; false positive proportion: 0.60)

b_i = Background count per observation

i = Observation counting interval (scan speed divided by the detector width)

s_i = minimum detectable number of net source counts in the observation interval

p = Surveyor efficiency

εi = Instrument efficiency (2π)

εs = Surface efficiency

$S\varepsilon$ = Source efficiency (radionuclide detectability)

A = Area of detector (cm^2)

Factor	Factor Value	Factor	Factor Value
d'	1.38	p	0.5
b_i	1.53 c	εi	0.154
i	1.18 s	εs	0.5
Scan Speed	5.08 cm/s	$S\varepsilon$	1
Detector Width	6 cm	A	100 cm^2
MDCR	87 cpm	MDC_{SCAN}	1598 dpm/100 cm^2

Attachment FSS-10

Survey Results

Final Status Survey Data
Mixed Waste Storage Building 1

Location MWSB-1	Beta Scan (cpm)	Beta Static Counts Per 100 cm2 Meter 1: TVA 951391 D_E: 0.068 Meter 2: TVA 951392 D_E: 0.077					Alpha Scan (cpm)	Alpha Static Counts per 100 cm2 Meter: TVA 951374 D_E: 0.034				Gamma Measurements Meter: TVA 860951		
w – wall f - floor		Meter No.	Gross cpm	Bkg cpm	Net cpm	dpm		Gross cpm	Bkg cpm	Net cpm	dpm	Gross uR/hr	Bkg uR/hr	Net uR/hr
East Wall														
A3	≤120													
A4	≤120	1	57	50	7	103								
A5	≤120													
A6	≤120													
A7	≤120													
A8	≤120	1	50	50	0	0	≤2	1.2	2	0	0			
A9	≤120													
B3	≤120													
B4	≤120													
B5	≤120	1	52	50	2	29	≤2	1.6	2	0	0			
B6	≤120													
B7	≤120													
B8	≤120													
B9	≤120													
South Wall														
C1	≤120													
C2	≤120	1	52	50	2	29	≤2	1.8	2	0	0			
D1	≤120	1	70	50	20	294	≤2	1.6	2	0	0			
D2	≤120													
E1w	≤120													
E2w	≤120													

Location MWSB-1	Beta Scan (cpm)	Beta Static Counts Per 100 cm2 Meter 1: TVA 951391 D_E: 0.068 Meter 2: TVA 951392 D_E: 0.077					Alpha Scan (cpm)	Alpha Static Counts per 100 cm2 Meter: TVA 951374 D_E: 0.034				Gamma Measurements Meter: TVA 860951		
w – wall f - floor		Meter No.	Gross cpm	Bkg cpm	Net cpm	dpm		Gross cpm	Bkg cpm	Net cpm	dpm	Gross uR/hr	Bkg uR/hr	Net uR/hr
West Wall														
E3	≤120													
E4	≤120													
E5	≤120	1	67	50	17	250								
E6	≤120													
E7	≤120	1	50	50	0	0	≤2	1	2	0	0			
E8	≤120													
E9	≤120													
F3	≤120	1	69	50	19	279	≤2	2.2	2	0.2	6			
F4	≤120													
F5	≤120													
F6	≤120	1	60	50	10	147								
F7	≤120													
F8	≤120													
F9	≤120													
North Wall														
C10	≤120	1	54	50	4	59	≤2	1	2	0	0			
C11	≤120													
D10	≤120													
D11	≤120	1	74	50	24	353	≤2	2.6	2	0.6	18			
E10w	≤120													
E11w	≤120													

Location MWSB-1	Beta Scan (cpm)	Beta Static Counts Per 100 cm2 Meter 1: TVA 951391 D_E: 0.068 Meter 2: TVA 951392 D_E: 0.077					Alpha Scan (cpm)	Alpha Static Counts per 100 cm2 Meter: TVA 951374 D_E: 0.034				Gamma Measurements Meter: TVA 860951		
w – wall f - floor		Meter No.	Gross cpm	Bkg cpm	Net cpm	dpm		Gross cpm	Bkg cpm	Net cpm	dpm	Gross uR/hr	Bkg uR/hr	Net uR/hr
Grate Floor														
C3	≤120											4.5	4.9	0
C4	≤120	1	62	50	12	177						5	4.9	0.1
C5	≤120											4.5	4.9	0
C6	≤120	1	52	50	2	29						4	4.9	0
C7	≤120											4.5	4.9	0
C8	≤120	1	61	50	11	162						4.5	4.9	0
C9	≤120											4.5	4.9	0
D3	≤120	1	59	50	9	132						4.5	4.9	0
D4	≤120											5	4.9	0.1
D5	≤120	1	52	50	2	29	≤2	0.4	2	0	0	4	4.9	0
D6	≤120											4	4.9	0
D7	≤120	1	47	50	0	0	≤2	3	2	1	29	4.5	4.9	0
D8	≤120											4.5	4.9	0
D9	≤120	1	48	50	0	0						4.5	4.9	0
E3f	≤120											5	4.9	0.1
E4f	≤120	1	74	50	24	353						4.5	4.9	0
E5f	≤120											5	4.9	0.1
E6f	≤120	1	49	50	0	0						4	4.9	0
E7f	≤120											4.5	4.9	0
E8f	≤120	1	62	50	12	177						4.5	4.9	0
E9f	≤120											4	4.9	0

Location MWSB-1	Beta Scan (cpm)	Beta Static Counts Per 100 cm2 Meter 1: TVA 951391 D_E: 0.068 Meter 2: TVA 951392 D_E: 0.077					Alpha Scan (cpm)	Alpha Static Counts per 100 cm2 Meter: TVA 951374 D_E: 0.034				Gamma Measurements Meter: TVA 860951		
w – wall f - floor		Meter No.	Gross cpm	Bkg cpm	Net cpm	dpm		Gross cpm	Bkg cpm	Net cpm	dpm	Gross uR/hr	Bkg uR/hr	Net uR/hr
Sump floor														
C3	≤120											4.5	4.9	0
C4	≤120	1	41	50	0	0						4.5	4.9	0
C5	≤120											5	4.9	0.1
C6	≤120	1	41	50	0	0						4	4.9	0
C7	≤120											4	4.9	0
C8	≤120	1	42	50	0	0						4.5	4.9	0
C9	≤120											4	4.9	0
D3	≤120	1	54	50	4	59						4.5	4.9	0
D4	≤120											4.5	4.9	0
D5	≤120	1	47	50	0	0	≤2	1.2	2.3	0	0	4.5	4.9	0
D6	≤120											4	4.9	0
D7	≤120	1	52	50	2	29	≤2	1.4	2.3	0	0	4	4.9	0
D8	≤120											4.5	4.9	0
D9	≤120	1	52	50	2	29						4.5	4.9	0
E3f	≤120											4	4.9	0
E4f	≤120	1	51	50	1	15						4.5	4.9	0
E5f	≤120											5	4.9	0.1
E6f	≤120	1	43	50	0	0						4	4.9	0
E7f	≤120											4	4.9	0
E8f	≤120	1	38	50	0	0						4	4.9	0
E9f	≤120											4	4.9	0

Location MWSB-1	Beta Scan (cpm)	Beta Static Counts Per 100 cm2 Meter 1: TVA 951391 D_E: 0.068 Meter 2: TVA 951392 D_E: 0.077					Alpha Scan (cpm)	Alpha Static Counts per 100 cm2 Meter: TVA 951374 D_E: 0.034				Gamma Measurements Meter: TVA 860951		
w – wall f - floor		Meter No.	Gross cpm	Bkg cpm	Net cpm	dpm		Gross cpm	Bkg cpm	Net cpm	dpm	Gross uR/hr	Bkg uR/hr	Net uR/hr
Walls above 2 meters	All ≤120													
Ceiling	All ≤120													
Bottom side of grate floor	All ≤120													

Final Status Survey Data
Mixed Waste Storage Building 2

Location MWSB-2	Beta Scan (cpm)	Beta Static Counts Per 100 cm2 Meter 1: TVA 951391 D_E: 0.068 Meter 2: TVA 951392 D_E: 0.077					Alpha Scan (cpm)	Alpha Static Counts per 100 cm2 Meter: TVA 951374 D_E: 0.034				Gamma Measurements Meter: TVA 860951		
w – wall f - floor		Meter No.	Gross cpm	Bkg cpm	Net cpm	dpm		Gross cpm	Bkg cpm	Net cpm	dpm	Gross uR/hr	Bkg uR/hr	Net uR/hr
East Wall														
A3	≤120						≤ 2							
A4	≤120	1	60	50	10	147	≤ 2	3	2	1	29			
A5	≤120						≤ 2							
A6	≤120						≤ 2							
A7	≤120						≤ 2							
A8	≤120	2	81	78	3	39	≤ 2	1.2	2	0	0			
A9	≤120						≤ 2							
B3	≤120						≤ 2							
B4	≤120						≤ 2							
B5	≤120	1	60	50	10	147	≤ 2	1.8	2	0	0			
B6	≤120						≤ 2							
B7	≤120						≤ 2							
B8	≤120						≤ 2							
B9	≤120						≤ 2							
South Wall														
C1	≤120						≤ 2							
C2	≤120	2	75	78	0	0	≤ 2	0.8	2	0	0			
D1	≤120	1	70	50	20	294	≤ 2	2.4	2	0.4	12			
D2	≤120						≤ 2							
E1w	≤120						≤ 2							
E2w	≤120						≤ 2							

Location MWSB-2	Beta Scan (cpm)	Beta Static Counts Per 100 cm2 Meter 1: TVA 951391 D_E: 0.068 Meter 2: TVA 951392 D_E: 0.077					Alpha Scan (cpm)	Alpha Static Counts per 100 cm2 Meter: TVA 951374 D_E: 0.034				Gamma Measurements Meter: TVA 860951		
w – wall f - floor		Meter No.	Gross cpm	Bkg cpm	Net cpm	dpm		Gross cpm	Bkg cpm	Net cpm	dpm	Gross uR/hr	Bkg uR/hr	Net uR/hr
West Wall														
E3	≤120						≤ 2							
E4	≤120						≤ 2							
E5	≤120	2	90	78	12	156	≤ 2	2.6	2	0.6	18			
E6	≤120						≤ 2							
E7	≤120	2	102	78	24	312	≤ 2	1.2	2	0	0			
E8	≤120						≤ 2							
E9	≤120						≤ 2							
F3	≤120	2	86	78	8	104	≤ 3	1.8	2	0	0			
F4	≤120						≤ 2							
F5	≤120						≤ 2							
F6	≤120	2	96	78	18	234	≤ 2	1.6	2	0	0			
F7	≤120						≤ 3							
F8	≤120						≤ 2							
F9	≤120						≤ 3							
North Wall														
C10	≤120	1	55	50	5	74	≤ 2	0.6	2	0	0			
C11	≤120						≤ 2							
D10	≤120						≤ 2							
D11	≤120	1	68	50	18	265	≤ 2	3	2	1	29			
E10w	≤120						≤ 2							
E11w	≤120						≤ 2							

Location MWSB-2	Beta Scan (cpm)	Beta Static Counts Per 100 cm2 Meter 1: TVA 951391 D_E: 0.068 Meter 2: TVA 951392 D_E: 0.077					Alpha Scan (cpm)	Alpha Static Counts per 100 cm2 Meter: TVA 951374 D_E: 0.034				Gamma Measurements Meter: TVA 860951		
w – wall f - floor		Meter No.	Gross cpm	Bkg cpm	Net cpm	dpm		Gross cpm	Bkg cpm	Net cpm	dpm	Gross uR/hr	Bkg uR/hr	Net uR/hr
Grate Floor														
C3	≤120						≤ 2					5.5	4.9	0.6
C4	≤120	1	56	50	0	0	≤ 2	2.2	2	0.2	6	5.5	4.9	0.6
C5	≤120						≤ 2					5	4.9	0.1
C6	≤120	2	98	78	20	260	≤ 2	2.4	2	0.4	12	5	4.9	0.1
C7	≤120						≤ 2					5	4.9	0.1
C8	≤120	1	50	50	0	0	≤ 2	3	2	1	29	5.5	4.9	0.6
C9	≤120						≤ 2					5	4.9	0.1
D3	≤120	1	54	50	4	59	≤ 2	1.6	2	0	0	5	4.9	0.1
D4	≤120						≤ 2					5	4.9	0.1
D5	≤120	2	88	78	10	130	≤ 2	3.6	2	1.6	47	5	4.9	0.1
D6	≤120						≤ 2					5.5	4.9	0.6
D7	≤120	1	59	50	9	132	≤ 2	2.8	2	0.8	24	5.5	4.9	0.6
D8	≤120						≤ 2					5.5	4.9	0.6
D9	≤120	2	79	78	1	13	≤ 2	3	2	1	29	4.5	4.9	0
E3f	≤120						≤ 2					5	4.9	0.1
E4f	≤120	2	102	78	24	312	≤ 2	2	2	0	0	5	4.9	0.1
E5f	≤120						≤ 2					5.5	4.9	0.6
E6f	≤120	1	44	50	0	0	≤ 2	1.4	2	0	0	5.5	4.9	0.6
E7f	≤120						≤ 2					6	4.9	1.1
E8f	≤120	2	94	78	16	208	≤ 2	2.2	2	0.2	6	5	4.9	0.1
E9f	≤120						≤ 2					6	4.9	1.1

Location MWSB-2	Beta Scan (cpm)	Beta Static Counts Per 100 cm2 Meter 1: TVA 951391 D_E: 0.068 Meter 2: TVA 951392 D_E: 0.077					Alpha Scan (cpm)	Alpha Static Counts per 100 cm2 Meter: TVA 951374 D_E: 0.034				Gamma Measurements Meter: TVA 860951		
w – wall f - floor		Meter No.	Gross cpm	Bkg cpm	Net cpm	dpm		Gross cpm	Bkg cpm	Net cpm	dpm	Gross uR/hr	Bkg uR/hr	Net uR/hr
Sump floor														
C3	≤120						≤ 2					4.5	4.9	0
C4	≤120	1	56	50	6	88	≤ 2	0.6	2	0	0	4.5	4.9	0
C5	≤120						≤ 2					5	4.9	0.1
C6	≤120	1	51	50	1	15	≤ 2	0.8	2	0	0	4	4.9	0
C7	≤120						≤ 2					5	4.9	0.1
C8	≤120	1	57	50	7	103	≤ 2	1.4	2	0	0	5	4.9	0.1
C9	≤120						≤ 2					4.5	4.9	0
D3	≤120	1	54	50	4	59	≤ 2	0.6	2	0	0	5	4.9	0.1
D4	≤120						≤ 2					4.5	4.9	0
D5	≤120	1	50	50	0	0	≤ 2	0.8	2	0	0	5	4.9	0.1
D6	≤120						≤ 2					4.5	4.9	0
D7	≤120	1	44	50	0	0	≤ 2	1	2	0	0	5	4.9	0.1
D8	≤120						≤ 2					5.5	4.9	0.6
D9	≤120	1	69	50	19	279	≤ 2	0.6	2	0	0	5	4.9	0.1
E3f	≤120						≤ 2					5	4.9	0.1
E4f	≤120	1	48	50	0	0	≤ 2	1	2	0	0	4.5	4.9	0
E5f	≤120						≤ 2					5	4.9	0.1
E6f	≤120	1	66	50	16	235	≤ 2	0.6	2	0	0	4.5	4.9	0
E7f	≤120						≤ 2					5.5	4.9	0.6
E8f	≤120	1	48	50	0	0	≤ 2	1.4	2	0	0	5.5	4.9	0.6
E9f	≤120						≤ 2					5	4.9	0.1

Location MWSB-2	Beta Scan (cpm)	Beta Static Counts Per 100 cm2 Meter 1: TVA 951391 D_E: 0.068 Meter 2: TVA 951392 D_E: 0.077					Alpha Scan (cpm)	Alpha Static Counts per 100 cm2 Meter: TVA 951374 D_E: 0.034				Gamma Measurements Meter: TVA 860951		
w – wall f - floor		Meter No.	Gross cpm	Bkg cpm	Net cpm	dpm		Gross cpm	Bkg cpm	Net cpm	dpm	Gross uR/hr	Bkg uR/hr	Net uR/hr
Walls above 2 meters	All ≤120													
Ceiling	All ≤120													
Bottom side of grate floor	All ≤120													

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 11 DEC 14

Isotope	Inst. No.	Eff. (%)	Bkg (cpm)	LLD (dpm)
63Ni:	284	0.4412	6.79	9.1

LLD = 2.71+4.66*SQRT[Bkg(CPM)*ctime(min)]
ctime(min) * counting efficiency

Sampling Information

Survey No.	RS 14-280
Survey Date:	12/3/2014
Submitted By:	W. Cain
Analysis:	Count for Ni-63
Location:	MWSF #1

Smear Number	Sampling Location	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
1	MWSF #1 Location A4		5.65				
2	MWSF #1 Location A8		5.61				
3	MWSF #1 Location B5		5.98				
4	MWSF #1 Location C2		4.34				
5	MWSF #1 Location C4		5.32				
6	MWSF #1 Location C6		5.10				
7	MWSF #1 Location C8		2 5.87	wms 12/11/14			
8	MWSF #1 Location C10		5.39				
9	MWSF #1 Location D1		2.84				
10	MWSF #1 Location D3		5.40				
11	MWSF #1 Location D5		6.84				
12	MWSF #1 Location D7		5.28				
13	MWSF #1 Location D9		5.76				
14	MWSF #1 Location D11		4.49				
15	MWSF #1 Location E4f		6.26				
16	MWSF #1 Location E5		5.46				

SMEARS < LLD

Counted by DL

Calculated by DL

Checked by WM Salter

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 11DEC14

Isotope	Inst. No.	Eff. (%)	Bkg (cpm)	LLD (dpm)
63Ni	284	0.4212	6.79	9.1

LLD = 2.71+4.66*SQRT(bkg(CPM)*ctime(min))
ctime(min) * counting efficiency

Sampling Information

Survey No.	RS 14-280
Survey Date:	12/3/2014
Submitted By:	W. Cain
Analysis:	Count for Ni-63
Location:	MWSF #1

Smear Number	Sampling Location	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
17	MWSF #1 Location E6f		6.89				
18	MWSF #1 Location E7		5.20				
19	MWSF #1 Location E8f		6.53				
20	MWSF #1 Location F3		4.44				
21	MWSF #1 Location F6		6.21				
22	MWSF #1 Location C4S		5.38				
23	MWSF #1 Location C6S		5.13				
24	MWSF #1 Location C8S		4.54				
25	MWSF #1 Location D3S		5.43				
26	MWSF #1 Location D5S		4.76				
27	MWSF #1 Location D7S		5.19				
28	MWSF #1 Location D9S		4.18				
29	MWSF #1 Location E4fS		5.51				
30	MWSF #1 Location E6fS		5.06				
31	MWSF #1 Location E8fS		5.81				

SMEARS < LLD

Counted by DL

Checked by WMSalter

Calculated by DL

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 12/11/14

Isotope	Inst. No.	Eff. (%)	Bkg (cpm)	LLD (dpm)
3H	884	0.3977	5.20	~~7.8~~ 8.5 WMS 12/11/14

LLD = 2.71+4.66*SQRT(bkg(CPM)*ctime(min))
ctime(min) * counting efficiency

Sampling Information

Survey No.	RS 14-280
Survey Date:	12/3/2014
Submitted By:	W. Cain
Analysis:	Count for H-3
Location:	MWSF #1

Smear Number	Sampling Location	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
1	MWSF #1 Location A4		4.40				
2	MWSF #1 Location A8		5.20				
3	MWSF #1 Location B5		5.50				
4	MWSF #1 Location C2		5.60				
5	MWSF #1 Location C4		5.10				
6	MWSF #1 Location C6		5.60				
7	MWSF #1 Location C8		6.10				
8	MWSF #1 Location C10		5.00				
9	MWSF #1 Location D1		5.70				
10	MWSF #1 Location D3		5.20				
11	MWSF #1 Location D5		5.10				
12	MWSF #1 Location D7		4.70				
13	MWSF #1 Location D9		4.90				
14	MWSF #1 Location D11		5.60				
15	MWSF #1 Location E4f		6.20				
16	MWSF #1 Location E5		6.50				

SMEARS < LLD

Counted by

Calculated by

Checked by WMSalter

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 11DEC14

Isotope	Inst. No.	Eff. (%)	Bkg (cpm)	LLD (dpm)
3H	284	0.3977	5.20	8.5

Sampling Information

Survey No. RS 14-280
Survey Date: 12/3/2014
Submitted By: W. Cain
Analysis: Count for H-3
Location: MWSF #1

LLD = 2.71+4.66*SQRT[bkg(CPM)*ctime(min)]
ctime(min) * counting efficiency

Smear Number	Sampling Location	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
17	MWSF #1 Location E6f		4.80				
18	MWSF #1 Location E7		5.50				
19	MWSF #1 Location E8f		5.00				
20	MWSF #1 Location F3		7.20				
21	MWSF #1 Location F6		6.60				
22	MWSF #1 Location C4S		6.80				
23	MWSF #1 Location C6S		5.00				
24	MWSF #1 Location C8S		4.80				
25	MWSF #1 Location D3S		4.40				
26	MWSF #1 Location D5S		5.00				
27	MWSF #1 Location D7S		6.80				
28	MWSF #1 Location D9S		5.80				
29	MWSF #1 Location E4fS		5.90				
30	MWSF #1 Location E6fS		4.80				
31	MWSF #1 Location E8fS		6.20				

SMEARS < LLD

Counted by DL

Calculated by DL

Checked by WmSalter

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 16 DEC 14

Isotope	Inst. No.	Eff. (%)	Bkg (cpm)	LLD (dpm)
^{14}C	284	0.4456	8.08	~~9.4~~ 6.6 DL 12/16/14

LLD = 2.71+4.66*SQRT[bkg(CPM)*ctime(min)]
ctime(min) * counting efficiency

Sampling Information

Survey No.	RS 14-280
Survey Date:	12/3/2014
Submitted By:	W. Cain
Analysis:	Count for C-14
Location:	MWSF #1

Smear Number	Sampling Location	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
1	MWSF #1 Location A4		7.85				
2	MWSF #1 Location A8		6.79				
3	MWSF #1 Location B5		6.17				
4	MWSF #1 Location C2		7.47				
5	MWSF #1 Location C4		6.14				
6	MWSF #1 Location C6		6.45				
7	MWSF #1 Location C8		7.62				
8	MWSF #1 Location C10		6.54				
9	MWSF #1 Location D1		6.86				
10	MWSF #1 Location D3		7.82				
11	MWSF #1 Location D5		7.35				
12	MWSF #1 Location D7		6.24				
13	MWSF #1 Location D9		7.45				
14	MWSF #1 Location D11		7.10				
15	MWSF #1 Location E4f		6.58				
16	MWSF #1 Location E5		6.49				

Smears <LLD

Counted by DL

Calculated by DL

Checked by WM Salter

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 16DEC14

Isotope	Inst. No.	Eff. (%)	Bkg (cpm)	LLD (dpm)
^{14}C	254	0.44%	8.08	6.6

LLD = $\frac{2.71+4.66*SQRT[bkg(CPM)*ctime(min)]}{ctime(min) * counting\ efficiency}$

Sampling Information

Survey No. RS 14-280
Survey Date: 12/3/2014
Submitted By: W. Cain
Analysis: Count for C-14
Location: MWSF #1

Smear Number	Sampling Location	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
17	MWSF #1 Location E6f		7.37				
18	MWSF #1 Location E7		7.14				
19	MWSF #1 Location E8f		6.48				
20	MWSF #1 Location F3		6.38				
21	MWSF #1 Location F6		7.16				
22	MWSF #1 Location C4S		7.60				
23	MWSF #1 Location C6S		8.03				
24	MWSF #1 Location C8S		7.01				
25	MWSF #1 Location D3S		6.38				
26	MWSF #1 Location D5S		7.26				
27	MWSF #1 Location D7S		6.63				
28	MWSF #1 Location D9S		7.08				
29	MWSF #1 Location E4fS		7.99				
30	MWSF #1 Location E6fS		7.66				
31	MWSF #1 Location E8fS		7.43				

SMEARS [illegible]

Counted by DL

Calculated by DL

Checked by WmSalter

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted 12-4-14 .

Analysis Type	Inst. No.	Eff.	Bkg (cpm)	LLD (dpm)
β	129	0.3921	1.14	12.4
α	129	0.2521 13 12-18-14 SAM	0.15	10.5

LLD = 2.71+4.66*SQRT[bkg(CPM)*ctime(min)]
ctime(min) * counting efficiency

Any counts less than or equal to the limits stated below result in activity (DPM) below the LLD for this instrument:

****DEEP PLANCHET GEOMETRY****

Instrument	Beta Limit	Alpha Limit
129	11	5
223	11	5
224	9	5
2 Min Count	Units: counts/2 minutes	

Sampling Information
Survey No. RS 14-280
Name W. Cain
Date 12/3/2014

MWSF #1
Beta / Alpha Smears

Smear Number	Sampling Location	Analysis	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
1	MWSF #1	β	~~25~~ 5					
	Location A4	α	1					
2	MWSF #1	β	6					
	Location A8	α	2					
3	MWSF #1	β	6					
	Location B5	α	0					
4	MWSF #1	β	4					
	Location C2	α	0					
5	MWSF #1	β	4					
	Location C4	α	2					
6	MWSF #1	β	3					
	Location C6	α	2					
7	MWSF #1	β	3					
	Location C8	α	0					
8	MWSF #1	β	5					
	Location C10	α	1					
9	MWSF #1	β	5					
	Location D1	α	0					
10	MWSF #1	β	7					
	Location D3	α	1					
11	MWSF #1	β	4					
	Location D5	α	0					
12	MWSF #1	β	7					
	Location D7	α	2					
13	MWSF #1	β	5					
	Location D9	α	0					
14	MWSF #1	β	7					
	Location D11	α	0					
15	MWSF #1	β	6					
	Location E4f	α	0					
16	MWSF #1	β	2					
	Location E5	α	0					
17	MWSF #1	β	1					
	Location E6f	α	0					
18	MWSF #1	β	1					
	Location E7	α	1					
19	MWSF #1	β	1					
	Location E8f	α	0					
20	MWSF #1	β	3					
	Location F3	α	2					

Counted by SM / DR
Calculated by SM / DR

Checked by WM Salter
Reviewed by James E Coley

(Mark X or NA for type of survey)

	Routine	X	Important for Decommising

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted 12-4-14

Analysis Type	Inst. No.	Eff.	Bkg (cpm)	LLD (dpm)
β	129	0.3921	1.14	12.4
α	129	0.2531 13 12-10-14 SAm	0.15	10.5

LLD = 2.71+4.66*SQRT[bkg(CPM)*ctime(min)]
ctime(min) * counting efficiency

Any counts less than or equal to the limits stated below result in activity (DPM) below the LLD for this instrument:

****DEEP PLANCHET GEOMETRY****

Instrument	Beta Limit	Alpha Limit
129	11	5
223	11	5
224	9	5
2 Min Count	Units: counts/2 minutes	

Sampling Information
Survey No. RS 14-280
Name W. Cain
Date 12/3/2014

MWSF #1
Beta / Alpha Smears

Smear Number	Sampling Location	Analysis	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
21	MWSF #1 Location F6	β	6					
		α	0					
22	MWSF #1 Location C4S	β	6	SMEARS				
		α	1					
23	MWSF #1 Location C6S	β	5					
		α	1					
24	MWSF #1 Location C8S	β	6					
		α	1					
25	MWSF #1 Location D3S	β	3			< LLD		
		α	0					
26	MWSF #1 Location D5S	β	1					
		α	0					
27	MWSF #1 Location D7S	β	2					
		α	1					
28	MWSF #1 Location D9S	β	2					
		α	1					
29	MWSF #1 Location E4fS	β	5					
		α	1					
30	MWSF #1 Location E6fS	β	4					
		α	0					
31	MWSF #1 Location E8fS	β	6					
		α	0					
		β						
		α						
		β						
		α						
		β						
		α		N				
		β			A			
		α						
		β						
		α						
		β						
		α						
		β						
		α						
		β						
		α						
		β						
		α						

Counted by SM/DR
Calculated by SM/DR

Checked by WMSalter
Reviewed by James [illegible]

(Mark X or NA for type of survey)

	Routine	X	Important for Decommising

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 12DEC14

Isotope	Inst. No.	Eff. (%)	Bkg (cpm)	LLD (dpm)
^{63}Ni	284	0.4212	6.79	9.1

LLD = 2.71+4.66*SQRT(bkg(CPM)*ctime(min))
ctime(min) * counting efficiency

Sampling Information

Survey No.	RS 14-279
Survey Date:	12/2/2014
Submitted By:	W. Cain
Analysis:	Count for Ni-63
Location:	MWSF #2

Smear Number	Sampling Location	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
1	MWSF #2 Location A4		7.64				
2	MWSF #2 Location A8		4.53				
3	MWSF #2 Location B5		6.21				
4	MWSF #2 Location C2		5.21				
5	MWSF #2 Location C4		5.09				
6	MWSF #2 Location C6		5.29				
7	MWSF #2 Location C8		4.44				
8	MWSF #2 Location C10		5.55				
9	MWSF #2 Location D1		4.60				
10	MWSF #2 Location D3		4.66				
11	MWSF #2 Location D5		4.65				
12	MWSF #2 Location D7		5.05				
13	MWSF #2 Location D9		4.61				
14	MWSF #2 Location D11		4.95				
15	MWSF #2 Location E4f		3.96				
16	MWSF #2 Location E5		6.43				

SMEARS < LLD

Counted by DL

Checked by WMoeller

Calculated by DL

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 12Dec14

Isotope	Inst. No.	Eff. (%)	Bkg (cpm)	LLD (dpm)
^{63}Ni	284	0.422	6.75	9.1

LLD = 2.71+4.66*SQRT[bkg(CPM)*ctime(min)]
ctime(min) * counting efficiency

Sampling Information

Survey No.	RS 14-279
Survey Date:	12/2/2014
Submitted By:	W. Cain
Analysis:	Count for Ni-63
Location:	MWSF #2

Smear Number	Sampling Location	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
17	MWSF #2 Location E6f		5.07				
18	MWSF #2 Location E7		6.22				
19	MWSF #2 Location E8f		4.97				
20	MWSF #2 Location F3		4.22				
21	MWSF #2 Location F6		5.78				
22	MWSF #2 Location C4S		4.50				
23	MWSF #2 Location C6S		5.91				
24	MWSF #2 Location C8S		5.40				
25	MWSF #2 Location D3S		6.61				
26	MWSF #2 Location D5S		3.88				
27	MWSF #2 Location D7S		5.22				
28	MWSF #2 Location D9S		5.70				
29	MWSF #2 Location E4fS		5.14				
30	MWSF #2 Location E6fS		4.31				
31	MWSF #2 Location E8fS		5.22				

SMEARS < LLD

Counted by

Calculated by

Checked by WMSalter

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 10 DEC 14

Isotope	Inst. No.	Eff. (%)	Bkg (cpm)	LLD (dpm)
3H	284	4.39%	5.20	8.5

LLD = 2.71+4.66*SQRT[bkg(CPM)*ctime(min)]
ctime(min) * counting efficiency

Sampling Information

Survey No.	RS 14-279
Survey Date:	12/2/2014
Submitted By:	W. Cain
Analysis:	Count for H-3
Location:	MWSF #2

Smear Number	Sampling Location	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
1	MWSF #2 Location A4	-	4.80				
2	MWSF #2 Location A8	-	5.80				
3	MWSF #2 Location B5	-	5.70				
4	MWSF #2 Location C2	-	4.20				
5	MWSF #2 Location C4	-	5.80				
6	MWSF #2 Location C6	-	4.90				
7	MWSF #2 Location C8	-	4.70				
8	MWSF #2 Location C10	-	4.80				
9	MWSF #2 Location D1	-	6.10				
10	MWSF #2 Location D3	-	5.30				
11	MWSF #2 Location D5	-	5.30				
12	MWSF #2 Location D7	-	7.00				
13	MWSF #2 Location D9	-	3.90				
14	MWSF #2 Location D11	-	4.40				
15	MWSF #2 Location E4f	-	7.00				
16	MWSF #2 Location E5	-	3.90				

SMEARS < LLD

Counted by ____________________

Checked by WMSadler

Calculated by ____________________

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 10 DEC 14

Isotope	Inst. No.	Eff. (%)	Bkg (cpm)	LLD (dpm)
3H	284	0.3976	5.2	8.5

LLD = 2.71+4.66*SQRT(bkg(CPM)*ctime(min))
ctime(min) * counting efficiency

Sampling Information

Survey No.	RS 14-279
Survey Date:	12/2/2014
Submitted By:	W. Cain
Analysis:	Count for H-3
Location:	MWSF #2

Smear Number	Sampling Location	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
17	MWSF #2 Location E6f		4.00				
18	MWSF #2 Location E7		6.40				
19	MWSF #2 Location E8f		5.80				
20	MWSF #2 Location F3		4.80				
21	MWSF #2 Location F6		5.00				
22	MWSF #2 Location C4S		5.70				
23	MWSF #2 Location C6S		5.00				
24	MWSF #2 Location C8S		5.00				
25	MWSF #2 Location D3S	[illegible]	~~6.30~~ 5.30				
26	MWSF #2 Location D5S	[illegible]	~~5.90~~ 6.30				
27	MWSF #2 Location D7S		5.90				
28	MWSF #2 Location D9S		5.20				
29	MWSF #2 Location E4fS		4.80				
30	MWSF #2 Location E6fS		6.30				
31	MWSF #2 Location E8fS		4.80				

SMEARS < LLD

Counted by DR

Calculated by DR

Checked by WMSalter

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 16DEC14

Isotope	Inst. No.	Eff. (%)	Bkg (cpm)	LLD (dpm)
				[illegible]
^{14}C	284	0.446	8.08	~~9.4~~ 6.6

Sampling Information

Survey No. RS 14-279

Survey Date: 12/2/2014

Submitted By: W. Cain

Analysis: Count for C-14

Location: MWSF #2

LLD = 2.71+4.66*SQRT(bkg(CPM)*ctime(min)) / ctime(min) * counting efficiency

Smear Number	Sampling Location	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
1	MWSF #2 Location A4		7.43				
2	MWSF #2 Location A8		7.24				
3	MWSF #2 Location B5		6.91				
4	MWSF #2 Location C2		6.21				
5	MWSF #2 Location C4		7.14				
6	MWSF #2 Location C6		6.31				
7	MWSF #2 Location C8		8.49				
8	MWSF #2 Location C10		6.48				
9	MWSF #2 Location D1		6.13				
10	MWSF #2 Location D3		6.07				
11	MWSF #2 Location D5		6.64				
12	MWSF #2 Location D7		6.15				
13	MWSF #2 Location D9		7.33				
14	MWSF #2 Location D11		7.61				
15	MWSF #2 Location E4f		5.93				
16	MWSF #2 Location E5		6.50				

SMEARS < LLD

Counted by DL

Calculated by DL

Checked by Wm Salter

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted: 16DEC14

Isotope	Inst. No.	Eff. (%)	Bkg (cpm)	LLD (dpm)
14C	284	0.0456	8.05	6.6

LLD = 2.71+4.66*SQRT[bkg(CPM)*ctime(min)]

ctime(min) * counting efficiency

Sampling Information

Survey No.	RS 14-279
Survey Date:	12/2/2014
Submitted By:	W. Cain
Analysis:	Count for C-14
Location:	MWSF #2

Smear Number	Sampling Location	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
17	MWSF #2 Location E6f		6.84				
18	MWSF #2 Location E7		6.32				
19	MWSF #2 Location E8f		6.94				
20	MWSF #2 Location F3		7.88				
21	MWSF #2 Location F6		7.56				
22	MWSF #2 Location C4S		7.66				
23	MWSF #2 Location C6S		8.24				
24	MWSF #2 Location C8S		7.49	wms 10/19/14			
25	MWSF #2 Location D3S		7.04				
26	MWSF #2 Location D5S		7.19				
27	MWSF #2 Location D7S		7.84				
28	MWSF #2 Location D9S		7.12				
29	MWSF #2 Location E4fS		7.47				
30	MWSF #2 Location E6fS		7.37				
31	MWSF #2 Location E8fS		7.54				

[illegible]

Counted by DL

Calculated by DL

Checked by WMSadler

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted 12-4-14

Analysis Type	Inst. No.	Eff.	Bkg (cpm)	LLD (dpm)
β	129	0.3921	1.14	12.4
α	129	~~0.2531~~ 0.2513 12-10-14 SAm	.15	10.5

LLD = 2.71+4.66*SQRT[bkg(CPM)*ctime(min)] / ctime(min) * counting efficiency

Any counts less than or equal to the limits stated below result in activity (DPM) below the LLD for this instrument:

****DEEP PLANCHET GEOMETRY****

Instrument	Beta Limit	Alpha Limit
129	11	5
223	11	5
224	9	5
2 Min Count	Units: counts/2 minutes	

Sampling Information

Survey No. RS 14-279

Name W. Cain

Date 12/2/2014

MWSF #2

Beta / Alpha Smears

Smear Number	Sampling Location	Analysis	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
1	MWSF #2	β	7					
	Location A4	α	1					
2	MWSF #2	β	3					
	Location A8	α	1					
3	MWSF #2	β	5					
	Location B5	α	0					
4	MWSF #2	β	5					
	Location C2	α	2					
5	MWSF #2	β	4					
	Location C4	α	2					
6	MWSF #2	β	1					
	Location C6	α	0					
7	MWSF #2	β	4					
	Location C8	α	1					
8	MWSF #2	β	2					
	Location C10	α	0					
9	MWSF #2	β	3					
	Location D1	α	0					
10	MWSF #2	β	2					
	Location D3	α	0					
11	MWSF #2	β	4					
	Location D5	α	1					
12	MWSF #2	β	2					
	Location D7	α	0					
13	MWSF #2	β	2					
	Location D9	α	0					
14	MWSF #2	β	6					
	Location D11	α	0					
15	MWSF #2	β	4					
	Location E4f	α	1					
16	MWSF #2	β	4					
	Location E5	α	1					
17	MWSF #2	β	2					
	Location E6f	α	2					
18	MWSF #2	β	2					
	Location E7	α	1					
19	MWSF #2	β	3					
	Location E8f	α	0					
20	MWSF #2	β	4					
	Location F3	α	0					

SM 12-4-14 < LLD

Counted by SM / DL

Calculated by SM/DL

Checked by WM Salter

Reviewed by James B. [illegible]

(Mark X or NA for type of survey)

	Routine	X	Important for Decommising

RADIOACTIVITY COUNTING RECORD SHEET FOR SMEARS

Date Counted 12-4-14 .

Analysis Type	Inst. No.	Eff.	Bkg (cpm)	LLD (dpm)
β	129	0.3921	1.14	12.4
α	129	0.2531	13.15	10.5

12-10-14 SAM

LLD = 2.71+4.66*SQRT[bkg(CPM)*ctime(min)] / ctime(min) * counting efficiency

Any counts less than or equal to the limits stated below result in activity (DPM) below the LLD for this instrument:

****DEEP PLANCHET GEOMETRY****

Instrument	Beta Limit	Alpha Limit
129	11	5
223	11	5
224	9	5
2 Min Count	Units: counts/2 minutes	

Sampling Information

Survey No. RS 14-279

Name W. Cain

Date 12/2/2014

MWSF #2

Beta / Alpha Smears

Smear Number	Sampling Location	Analysis	Total Counts	Total CPM	BKG CPM	Net CPM	Counter Efficiency	DPM
21	MWSF #2	β	6					
	Location F6	α	1					
22	MWSF #2	β	2					
	Location C4S	α	0					
23	MWSF #2	β	5					
	Location C6S	α	0					
24	MWSF #2	β	5					
	Location C8S	α	0					
25	MWSF #2	β	3					
	Location D3S	α	1					
26	MWSF #2	β	3					
	Location D5S	α	0					
27	MWSF #2	β	2					
	Location D7S	α	1					
28	MWSF #2	β	3					
	Location D9S	α	0					
29	MWSF #2	β	2					
	Location E4fS	α	0					
30	MWSF #2	β	3					
	Location E6fS	α	1					
31	MWSF #2	β	4					
	Location E8fS	α	3					
		β						
		α						
		β						
		α						
		β						
		α						
		β	N					
		α		A				
		β						
		α						
		β						
		α						
		β						
		α						
		β						
		α						
		β						
		α						

Smears < LLD

Counted by SM / PR

Calculated by SM / PR

Checked by WM Salder

Reviewed by James B. [illegible]

(Mark X or NA for type of survey)

	Routine	X	Important for Decommising

REFERENCES

NUREG-1507, “Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions,” June 1998

NUREG-1575, Rev. 1, “Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM),” August 2000

NUREG-1757, Vol 1, Rev. 2, “Consolidated Decommissioning Guidance – Decommissioning Process for Materials Licensees,” September 2006

NUREG-1757, Vol 2, Rev.1, “Consolidated Decommissioning Guidance – Characterization, Survey, and Determination of Radiological Criteria,” September 2006

ISO 7503-1, “International Standard, Evaluation of surface contamination – Part 1: Beta-emitters (maximum beta energy greater than 0,15 MeV) and alpha-emitters,” 1988

“Radiological Health Handbook,” U.S. Department of Health, Education, and Welfare, Public Health Service, Revised Edition, January 1970

“The Health Physics and Radiological Health Handbook,” Nucleon Lectern Associates, September 1986

Acronyms and Abbreviations

bkg	background
cpm	counts per minute
CFR	Code of Federal Regulations
DCGL	Derived Concentration Guideline Limit
DCGLw	Average DCGL over a survey area that is allowed
$DCGL_{EMC}$	Limited area DCGL that results in maximum allowable dose
D_E	product of the instrument efficiency, surface efficiency, and detectability of radioactive emissions (i.e., low energy or low percent of total emissions) that represents overall survey instrument efficiency
dpm	disintegrations per minute
E	denotes exponent, 2.0E-5 = 2.0×10^{-5} and 4.44E4 = 4.44×10^{4}
EPA	Environmental Protection Agency
FSS	Final Status Survey
ft	feet
HWSF	Hazardous Waste Storage Facility
LLD	Lower Limit of Detection
m	meter
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
MDC_{SCAN}	Instrument MDC when used during scanning surveys
MDC_{STATIC}	Instrument MDC when used to obtain static measurement
mrem	millirem
MWSB	Mixed Waste Storage Building
MWSF	Mixed Waste Storage Facility
NRC	Nuclear Regulatory Commission

Acronyms and Abbreviations
(continued)

S/N	serial number
TEDE	Total Effective Dose Equivalent
TVA	Tennessee Valley Authority
α	alpha
β	beta
γ	gamma
σ	Standard Deviation
u	micro

earthsmart
FedEx carbon-neutral
envelope shipping

ORIGIN ID:CHAA 14237512450
CHATTMAIL
TVA
1101 MARKET ST, LPBA-C

CHATTANOOGA, TN 37402
UNITED STATES US

SHIP DATE: 30JAN15
ACTWGT: 2.0 LB
CAD: 103031039/WSXI2500
DIMS: 12x10x1 IN

BILL SENDER

TO **KATHY MODES**
LICENSING ASST. TEAM DIV. NUCLEAR M
2100 RENAISSANCE BLVD
SUITE 100
KING OF PRUSSIA PA 19406
(610) 337-5251
INV: 1.6
PO: 103447
REF: 103447:1.6
DEPT:

FedEx
Express
E

J151015011401uv

MON - 02 FEB 10:30A
PRIORITY OVERNIGHT

TRK# 0201 **7727 7437 1170**

TN KPDA

19406
PA-US **PHL**

Joe Shea x2638
LP 3 D-C 0002JQC

TVA
Tennessee Valley Authority
1101 Market Street, Chattanooga, Tennessee 37402-2801

Attn: Kathy Modes
Licensing Assistance Team
Division of Nuclear Materials Safety
2100 Renaissance Blvd., Suite 100
King of Prussia, Pennsylvania 19406-2713

Envelope

ST 14
RT 329
2
10:30
F
1170
02.02

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

1/27/15, and to inform you that the initial processing which includes an administrative review has been performed.

Termination (41-08165-19)

☒ 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** 585991.
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