



**University at Buffalo**  
*The State University of New York*

Environment, Health & Safety Services

March 31, 2014

**Docket 50-57**  
**License R-77**

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, D.C. 20555

Dear Sir or Madam:

Enclosed please find a copy of the 2013 Annual Facility Technical Report for the Buffalo Materials Research Center (BMRC) at the State University of New York at Buffalo. This report is submitted pursuant to Facility Technical Specification Requirement 15.1.

If you have any questions or wish further information, please contact me at (716) 829-3301.

Sincerely,

David R. Vasbinder  
Director, Buffalo Materials Research Center

Cc: Ted Smith, U.S.N.R.C. Project Manager  
Judith Joustra, U.S.N.R.C. Region 1  
Kevin Thompson, Reactor Decommissioning Safety Committee Chair  
Joseph Raab, EH&S Director  
Laura Hubbard, Vice President for Finance and Administration  
Jeff Slawson, BMRC Radiation Safety Officer  
Mark Adams, BMRC Operations Manager

FSME20  
FSME

**STATE UNIVERSITY OF NEW YORK AT BUFFALO**

**BUFFALO MATERIALS RESEARCH CENTER**

# **ANNUAL TECHNICAL** **REPORT**

License R-77

Docket 50-57

Calendar Year 2013

Submitted by:

David R. Vasbinder  
Director

March 31, 2014

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## **1. INTRODUCTION**

This report is submitted to the United States Nuclear Regulatory Commission (NRC) pursuant to section 15.1 of Appendix A, of the Technical Specifications (License R-77) for the Buffalo Materials Research Center (BMRC) located at the State University of New York at Buffalo. It summarizes changes to the facility, major maintenance activities, surveillance tests and inspections, radiation surveys, and radioactive effluents for the 2013 calendar year. All required surveillance was completed.

## **2. MAJOR MAINTENANCE**

There were no maintenance activities performed in the BMRC during 2013 that would qualify as Major Maintenance. Only routine maintenance activities were undertaken within the BMRC.

## **3. 10CFR 50.59 CHANGES**

There were no 50.59 reviews performed during the 2013 calendar year.

## **4. DECOMMISSIONING ACTIVITIES**

In 2013, the University continued working on facility decommissioning with the Decommissioning Project Design Consultant, ENERCON and the Decommissioning Contractor LVI Services.

Decommissioning activities undertaken in 2013 included:

- Continued work on Interference removal (asbestos and lead abatement).
- Reactor Tank Internals and higher activity components were removed from the reactor tank.
- Wire saw cutting and removal of the concrete biological shield.
- Demineralizer systems were removed.
- The underground tank farm was excavated and the tanks were removed and placed inside the building in July.
- Packaging and shipment of all of these waste materials.
- The 10,000 gallon above ground waste water holding tank was removed in September.
- Building release surveys were performed in September.
- N.R.C. arranged for ORISE confirmation building survey on site in October.

## **5. RADIOACTIVE EFFLUENTS**

#### **4.1 Controlled Discharges to the Sanitary Sewer**

There were eleven controlled discharge to the sanitary sewer system in 2013. The total volume of water released was 51,955 gallons, containing a total of 4.21 millicuries of radioactivity. The first seven of these releases were from the 10,000 gallon above ground waste storage tank (referred to as 10K Tank). The 10K Tank was removed in September as part of Decommissioning. The last four releases were from temporary water holding tanks installed for this purpose. Tables 1 through 11 contain the discharge information specific to the releases including comparisons to the monthly average concentration in 10 CFR Part 20, Appendix B, Table 3 "Releases to Sewers" and the sum of the fractions.

#### **4.2 Airborne Releases**

No airborne radioactive releases, other than natural background resulting from radon and its daughter products, occurred during 2013.

### **5. ENVIRONMENTAL RADIOLOGICAL SURVEYS**

#### **5.1 Routine Surveys**

The direct radiation levels outside the BMRC reactor building are routinely monitored adjacent to the "truck door" access area and on the roof of the liquid waste holding tank vault.

Global Dosimetry Solutions dosimeters were used to monitor integrated radiation levels in six exterior areas around the facility and four locations within the building itself. These dosimeters are replaced with a new badge every month and the previous month's badge is sent to the dosimetry vendor for processing. The vendor is NVLAP certified. The minimum photon sensitivity for the dosimeters is 5 mrem.

Table 12 lists the cumulative annual summary of the environmental radiation dose equivalent from the environmental badges located around the facility. The maximum cumulative annual deep dose equivalent reading was 85 mRem on the dosimeter (# 2118) located outside the building by the truck door.

Table 13 lists cumulative annual summary of the radiation dose equivalent from the area dosimetry badges located within the building. The maximum cumulative annual deep dose equivalent reading was 201 mRem on the dosimeter (# 335) located by the truck door area.

### **6. RADIATION EXPOSURES**

#### **6.1 External Dosimetry**

External dosimetry records were maintained for a total of five BMRC staff members, ten employees of the Decommissioning Project Design Consultant, thirty five members of contractor staff, and other

authorized facility entrants. Film dosimeters provide x-ray, beta, and gamma exposure monitoring. Thermoluminescent dosimeter (TLD) rings are used to measure extremity dose for selected personnel. Also, a TLD for neutron detection is available when necessary. All dosimeters are processed by Global Dosimetry Solutions, a NVLAP certified vendor. These dosimeters are replaced on a bi-monthly basis. The film dosimeters have a minimum sensitivity of 10 mrem for both beta and photon radiation.

During 2013, the maximum deep dose received was 89 mRem and the maximum extremity dose received was 265 mRem. Both exposures were to members of the Decommissioning Contractor staff.

University Police Department officers perform routine security tours around the building. The patrol officers wear a University Police dosimeter pack when they enter the building. These dosimeters did not record any dose equivalent during 2013.

Four visitor dosimeter packs are also available. These dosimeters are issued to visitors who may need to enter into areas requiring exposure monitoring. None of these visitor dosimeters recorded any measurable dose equivalent in 2013.

Tables 14 and 15 provide summaries of personnel whole body and extremity dose for 2013.

## **7. RADIATION AND CONTAMINATION SURVEYS**

### **7.1 Exit Monitoring**

Exit monitoring is required as part of each egress from the reactor containment building and other radioactive materials areas within the BMRC. These surveys occasionally detect radioactive contamination, allowing rapid correction of contamination problems.

### **7.2 Routine Surveys**

The BMRC staff performs monthly radiation and contamination surveys of the BMRC building. In calendar year 2013, no contamination was detected above action levels during these surveys. Surveys are also performed after work involving the manipulation of potentially contaminated materials and as part of any work involving a Radiation Work Permit.

## **8. MISCELLANEOUS**

- Decommissioning activities continued in 2013 with work proceeding under the approved Decommissioning Plan.
- The Reactor Decommissioning Safety Committee convened three times during calendar year 2013. This meets the annual requirement in Facility Technical Specifications for a minimum of two committee meetings.
- The University held Informational Sessions on what to expect regarding the Decommissioning Process for occupants of neighboring buildings.





**University at Buffalo**  
**Buffalo Materials Research Center**

**Table 1 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-01  
 From: 10K Tank  
 Month: January

Volume Released: 4700 gal.  
 1.79 E+07 ml

Date of Release: 1/25/2013

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
Unidentified Beta	3.53 E-07	2E-08	5.5 E-09	2.7 E+01

TOTAL 3.53 E-07  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 27.28 %

Total of Activity Released: 6.31  $\mu\text{Ci}$

Year to Date Activity Released: 6.31  $\mu\text{Ci}$

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**Buffalo Materials Research Center**

**Table 2 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-02  
 From: 10K Tank  
 Month: February

Volume Released: 9300 gal.  
 3.53 E+07 ml

Date of Release: 2/1/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	3.80 E-05	1E-02	1.2E-06	1.2E-02
Co-60	2.97E-07	3E-05	9.1E-09	3.0E-02
Ag-108m	1.81E-06	9E-05	5.5E-08	6.2E-02
Unidentified Beta	6.83 E-08	2E-08	1.5 E-09	7.4 E+00

TOTAL 4.04 E-05  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 38.33 %

Total of Activity Released: 1426.36  $\mu\text{Ci}$

Year to Date Activity Released: 1432.67  $\mu\text{Ci}$

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**Table 3 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-03  
 From: 10K Tank  
 Month: February

Volume Released: 8000 gal.  
 3.04 E+07 ml  
 Date of Release: 2/11/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	4.10E-05	1E-02	1.1E-06	1.1E-02
Co-60	1.70E-07	3E-05	4.5E-09	1.5E-02
Ag-108m	9.40E-07	9E-05	2.5E-08	2.7E-02
Unidentified Beta	4.15E-07	2E-08	1.5 E-09	7.4 E+00

TOTAL 4.25 E-05  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 54.58 %

Total of Activity Released: 1292.75  $\mu\text{Ci}$

Year to Date Activity Released: 2725.42  $\mu\text{Ci}$

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**Table 4 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-04  
 From: 10K Tank  
 Month: March

Volume Released: 6400 gal.  
 2.43 E+07 ml

Date of Release: 3/28/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	1.65E-05	1E-02	3.5E-07	3.5E-03
Sr-90	1.45E-06	5E-06	3.1E-08	6.1E-01
Y-90	1.45E-06	7E-05	3.1E-08	4.4E-02
Ag-108m	2.50E-07	9E-05	5.3E-09	5.8E-03

TOTAL 1.97 E-05  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 0.66 %

Total of Activity Released: 477.89  $\mu\text{Ci}$

Year to Date Activity Released: 3203.30  $\mu\text{Ci}$

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**Table 5 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-05  
 From: 10K Tank  
 Month: April

Volume Released: 9400 gal.  
 3.57 E+07 ml

Date of Release: 4/12/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	7.7E-06	1E-02	2.4E-07	2.4E-03
Sr-90	3.77E-06	5E-06	1.2E-07	2.3E+00
Y-90	3.77E-06	7E-05	1.2E-07	1.7E-01
Co-60	1.54E-07	3E-05	4.8E-09	1.6E-02
Ag-108m	1.07E-06	9E-05	3.3E-08	3.7E-02
Cs-137	2.90 E-08	1E-05	9.0E-10	9.0 E-03

TOTAL 1.65 E-05  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 2.56 %

Total of Activity Released: 589.13  $\mu\text{Ci}$

Year to Date Activity Released: 3792.43  $\mu\text{Ci}$

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**Table 6 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-06  
 From: 10K Tank  
 Month: June

Volume Released: 4500 gal.  
 1.71 E+07 ml

Date of Release: 6/26/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	8.30E-06	1E-02	1.2E-07	1.2E-03
Co-60	7.30E-08	3E-05	1.1E-9	3.6E-03
Unidentified Beta	1.27 E-06	2E-08	1.9 E-08	9.4 E+01

TOTAL 9.64 E-06  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 93.87 %

Total of Activity Released: 164.88  $\mu\text{Ci}$

Year to Date Activity Released: 3957.31  $\mu\text{Ci}$

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**Table 7 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-07  
 From: 10K Tank  
 Month: August

Volume Released: 7700 gal.  
 2.93 E+07 ml  
 Date of Release: 8/21/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
Sr-90	3.81E-07	5E-06	9.6E-09	1.9E-01
Y-90	3.81E-07	7E-05	9.6E-09	1.4E-02
Unidentified Beta	7.49 E-07	2E-08	1.9 E-08	9.5 E+01

TOTAL 6.83 E-08  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 95.02 %

Total of Activity Released: 44.21  $\mu\text{Ci}$

Year to Date Activity Released: 4001.53  $\mu\text{Ci}$

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**Table 8 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-08  
 From: Hold tank  
 Month: September

Volume Released: 750 gal.  
 2.85 E+06 ml  
 Date of Release: 9/20/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	5.80-06	1E-02	1.4E-08	1.4E-04
Co-60	1.30E-07	3E-05	1.1E-03	1.1E-03
Ag-108m	8.1E-07	9E-05	2.0E-09	2.2E-03
Unidentified Beta	1.43 E-06	2E-08	3.5 E-09	1.8E+01

TOTAL 8.17 E-06  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 17.60 %

Total of Activity Released: 23.28  $\mu\text{Ci}$

Year to Date Activity Released: 4024.80  $\mu\text{Ci}$



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**Table 9 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-09  
 From: Hold Tank  
 Month: September

Volume Released: 470 gal.  
 1.79 E+06 ml  
 Date of Release: 9/20/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	1.00E-05	1E-02	1.5E-08	1.5E-04
Co-60	8.70E-07	3E-05	1.3E-09	4.5E-03
Ag-108m	8.70E-06	9E-05	1.3E-08	1.5E-02
Unidentified Beta	2.47 E-06	2E-08	3.8 E-09	1.9 E+01

TOTAL 2.20 E-05  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 19.14 %

Total of Activity Released: 39.37  $\mu\text{Ci}$

Year to Date Activity Released: 4064.18  $\mu\text{Ci}$

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**Table 10 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-10  
 From: Hold Tank  
 Month: September

Volume Released: 575 gal.  
 2.19 E+06 ml  
 Date of Release: 9/26/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	3.40E-05	1E-02	6.4E-08	6.4E-04
Co-60	1.90E-06	3E-05	3.6E-09	1.2E-02
Ag-108m	2.10E-05	9E-05	4.0E-08	4.4E-02
Unidentified Beta	4.29 E-06	2E-08	8.1 E-09	4.1 E+01

TOTAL 6.12 E-05  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 40.56 %

Total of Activity Released: 133.69  $\mu\text{Ci}$

Year to Date Activity Released: 4197.87  $\mu\text{Ci}$

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**Table 11 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-11  
 From: Hold Tank  
 Month: October

Volume Released: 6600 gal.  
 2.51 E+07 ml  
 Date of Release: 6/21/12

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
Co-60	1.6E-06	1E -02	8.4E-10	2.8 E-03
Ag-108m	1.9E-05	9E-05	1.0E-08	1.1E-02
Unidentified Beta	3.47 E-06	2E-08	1.8 E-09	9.1 E+00

TOTAL 2.41 E-05  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 9.14 %

Total of Activity Released: 14.63  $\mu\text{Ci}$

Year to Date Activity Released: 4212.50  $\mu\text{Ci}$

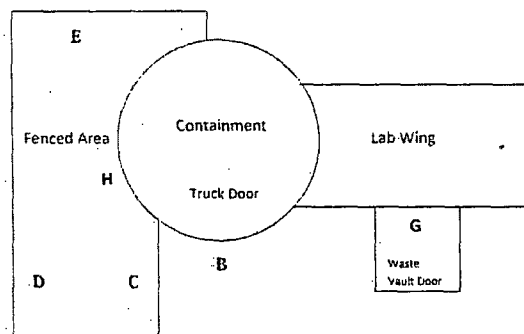
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**Table 12 -- 2013 Cumulative Summary of Environmental  
Radiation Dose Equivalent (mrem)**

Monthly Monitoring Period	B 2118 Truck Door Outside	C 2120 Fence 1	D 2121 Fence 2	E 2122 Fence 3	G 2116 Waste Vault	H Containment Wall	Control Average
January	0	0	0	0	3	0	18
February	0	0	0	0	1	0	10
March	0	0	0	0	1	0	15
April	0	0	0	0	0	0	14
May	0	0	0	0	0	0	14
June	0	0	0	0	5	0	15
July	0	0	0	0	0	0	14
August	45	27	1	0	2	0	12
September	40	5	1	1	3	1	14
October	0	0	0	0	1	0	14
November	0	0	0	0	2	0	15
December	0	0	0	0	1	0	17
Total	85	32	2	1	19	1	

Exposure reported (mR/month) is subtracted from control average.



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**Table 13 -- 2013 Cumulative Summary of BMRC Area Dosimeter Results**

Monthly Monitoring Period	335 Truck Door	1624 Bridge	357 Building Air Area	356 Stack Gas Area	Control Average
January	0	3	0	0	18
February	0	5	0	0	16
March	0	3	0	0	16
April	0	2	0	0	13
May	0	3	0	1	13
June	0	2	0	0	13
July	4	0	0	1	12
August <sup>1</sup>	86	31	25	0 <sup>2</sup>	17
September <sup>1</sup>	70	4	0	N/A	15
October	11	4	0	N/A	16
November	13	4	0	N/A	16
December	19	5	0	N/A	14
Total	201	66	25	2	

Exposure reported (mR/month) is subtracted from control average.

Note 1 : Legacy waste clean out conducted during July to September. Waste containers temporarily staged for shipment resulted in increases dose at some monitoring locations.

Note 2 : Stack System out of service. Location no longer monitored.

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**Table 14 -- 2013 Whole Body Deep Dose Equivalent Summary**

Deep Dose Equivalent (rem)	BMRC Staff	University Police	Visitor	Fuel Handler Dosimeter	Consultant Staff	Contractor Staff
None Measurable	5	1	4	1	8	25
0.001 to < 0.050	0	0	0	0	2	8
> 0.050	0	0	0	0	0	2

Deep Dose Equivalent (rem)	BMRC Staff	University Police	Visitor	Fuel Handler Dosimeter	Consultant Staff	Contractor Staff
None Measurable	5	1	4	1	3	10

**Table 15 -- 2011 Extremity Shallow Dose Equivalent Summary**

Extremity Shallow Dose (rem)	BMRC Staff	Consultant Staff	Contractor Staff
None Measurable	4	4	31
0.001 to < 0.100	1	4	2
> 0.100 to < 0.200	0	1	1
> 0.200	0	1	1

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**BUFFALO MATERIALS RESEARCH CENTER**

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Submitted by:

David R. Vasbinder  
Director

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## **1. INTRODUCTION**

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## **2. MAJOR MAINTENANCE**

There were no maintenance activities performed in the BMRC during 2013 that would qualify as Major Maintenance. Only routine maintenance activities were undertaken within the BMRC.

## **3. 10CFR 50.59 CHANGES**

There were no 50.59 reviews performed during the 2013 calendar year.

## **4. DECOMMISSIONING ACTIVITIES**

In 2013, the University continued working on facility decommissioning with the Decommissioning Project Design Consultant, ENERCON and the Decommissioning Contractor LVI Services.

Decommissioning activities undertaken in 2013 included:

- Continued work on Interference removal (asbestos and lead abatement).
- Reactor Tank Internals and higher activity components were removed from the reactor tank.
- Wire saw cutting and removal of the concrete biological shield.
- Demineralizer systems were removed.
- The underground tank farm was excavated and the tanks were removed and placed inside the building in July.
- Packaging and shipment of all of these waste materials.
- The 10,000 gallon above ground waste water holding tank was removed in September.
- Building release surveys were performed in September.
- N.R.C. arranged for ORISE confirmation building survey on site in October.

## **5. RADIOACTIVE EFFLUENTS**

#### **4.1 Controlled Discharges to the Sanitary Sewer**

There were eleven controlled discharge to the sanitary sewer system in 2013. The total volume of water released was 51,955 gallons, containing a total of 4.21 millicuries of radioactivity. The first seven of these releases were from the 10,000 gallon above ground waste storage tank (referred to as 10K Tank). The 10K Tank was removed in September as part of Decommissioning. The last four releases were from temporary water holding tanks installed for this purpose. Tables 1 through 11 contain the discharge information specific to the releases including comparisons to the monthly average concentration in 10 CFR Part 20, Appendix B, Table 3 "Releases to Sewers" and the sum of the fractions.

#### **4.2 Airborne Releases**

No airborne radioactive releases, other than natural background resulting from radon and its daughter products, occurred during 2013.

### **5. ENVIRONMENTAL RADIOLOGICAL SURVEYS**

#### **5.1 Routine Surveys**

The direct radiation levels outside the BMRC reactor building are routinely monitored adjacent to the "truck door" access area and on the roof of the liquid waste holding tank vault.

Global Dosimetry Solutions dosimeters were used to monitor integrated radiation levels in six exterior areas around the facility and four locations within the building itself. These dosimeters are replaced with a new badge every month and the previous month's badge is sent to the dosimetry vendor for processing. The vendor is NVLAP certified. The minimum photon sensitivity for the dosimeters is 5 mrem.

Table 12 lists the cumulative annual summary of the environmental radiation dose equivalent from the environmental badges located around the facility. The maximum cumulative annual deep dose equivalent reading was 85 mRem on the dosimeter (# 2118) located outside the building by the truck door.

Table 13 lists cumulative annual summary of the radiation dose equivalent from the area dosimetry badges located within the building. The maximum cumulative annual deep dose equivalent reading was 201 mRem on the dosimeter (# 335) located by the truck door area.

### **6. RADIATION EXPOSURES**

#### **6.1 External Dosimetry**

External dosimetry records were maintained for a total of five BMRC staff members, ten employees of the Decommissioning Project Design Consultant, thirty five members of contractor staff, and other

authorized facility entrants. Film dosimeters provide x-ray, beta, and gamma exposure monitoring. Thermoluminescent dosimeter (TLD) rings are used to measure extremity dose for selected personnel. Also, a TLD for neutron detection is available when necessary. All dosimeters are processed by Global Dosimetry Solutions, a NVLAP certified vendor. These dosimeters are replaced on a bi-monthly basis. The film dosimeters have a minimum sensitivity of 10 mrem for both beta and photon radiation.

During 2013, the maximum deep dose received was 89 mRem and the maximum extremity dose received was 265 mRem. Both exposures were to members of the Decommissioning Contractor staff.

University Police Department officers perform routine security tours around the building. The patrol officers wear a University Police dosimeter pack when they enter the building. These dosimeters did not record any dose equivalent during 2013.

Four visitor dosimeter packs are also available. These dosimeters are issued to visitors who may need to enter into areas requiring exposure monitoring. None of these visitor dosimeters recorded any measurable dose equivalent in 2013.

Tables 14 and 15 provide summaries of personnel whole body and extremity dose for 2013.

## **7. RADIATION AND CONTAMINATION SURVEYS**

### **7.1 Exit Monitoring**

Exit monitoring is required as part of each egress from the reactor containment building and other radioactive materials areas within the BMRC. These surveys occasionally detect radioactive contamination, allowing rapid correction of contamination problems.

### **7.2 Routine Surveys**

The BMRC staff performs monthly radiation and contamination surveys of the BMRC building. In calendar year 2013, no contamination was detected above action levels during these surveys. Surveys are also performed after work involving the manipulation of potentially contaminated materials and as part of any work involving a Radiation Work Permit.

## **8. MISCELLANEOUS**

- Decommissioning activities continued in 2013 with work proceeding under the approved Decommissioning Plan.
- The Reactor Decommissioning Safety Committee convened three times during calendar year 2013. This meets the annual requirement in Facility Technical Specifications for a minimum of two committee meetings.
- The University held Informational Sessions on what to expect regarding the Decommissioning Process for occupants of neighboring buildings.



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**Table 1 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-01  
 From: 10K Tank  
 Month: January

Volume Released: 4700 gal.  
 1.79 E+07 ml

Date of Release: 1/25/2013

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
Unidentified Beta	3.53 E-07	2E-08	5.5 E-09	2.7 E+01

TOTAL 3.53 E-07  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 27.28 %

Total of Activity Released: 6.31  $\mu\text{Ci}$

Year to Date Activity Released: 6.31  $\mu\text{Ci}$

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**Table 2 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-02  
 From: 10K Tank  
 Month: February

Volume Released: 9300 gal.  
 3.53 E+07 ml

Date of Release: 2/1/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	3.80 E-05	1E-02	1.2E-06	1.2E-02
Co-60	2.97E-07	3E-05	9.1E-09	3.0E-02
Ag-108m	1.81E-06	9E-05	5.5E-08	6.2E-02
Unidentified Beta	6.83 E-08	2E-08	1.5 E-09	7.4 E+00

TOTAL 4.04 E-05  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 38.33 %

Total of Activity Released: 1426.36  $\mu\text{Ci}$

Year to Date Activity Released: 1432.67  $\mu\text{Ci}$

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**Table 3 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-03  
 From: 10K Tank  
 Month: February

Volume Released: 8000 gal.  
 3.04 E+07 ml

Date of Release: 2/11/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	4.10E-05	1E-02	1.1E-06	1.1E-02
Co-60	1.70E-07	3E-05	4.5E-09	1.5E-02
Ag-108m	9.40E-07	9E-05	2.5E-08	2.7E-02
Unidentified Beta	4.15E-07	2E-08	1.5 E-09	7.4 E+00

TOTAL 4.25 E-05  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 54.58 %

Total of Activity Released: 1292.75  $\mu\text{Ci}$

Year to Date Activity Released: 2725.42.  $\mu\text{Ci}$



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**Table 4 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-04  
 From: 10K Tank  
 Month: March

Volume Released: 6400 gal.  
 2.43 E+07 ml  
 Date of Release: 3/28/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	1.65E-05	1E-02	3.5E-07	3.5E-03
Sr-90	1.45E-06	5E-06	3.1E-08	6.1E-01
Y-90	1.45E-06	7E-05	3.1E-08	4.4E-02
Ag-108m	2.50E-07	9E-05	5.3E-09	5.8E-03

TOTAL 1.97 E-05  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 0.66 %

Total of Activity Released: 477.89  $\mu\text{Ci}$

Year to Date Activity Released: 3203.30  $\mu\text{Ci}$

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**Table 5 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-05  
 From: 10K Tank  
 Month: April

Volume Released: 9400 gal.  
 3.57 E+07 ml  
 Date of Release: 4/12/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	7.7E-06	1E-02	2.4E-07	2.4E-03
Sr-90	3.77E-06	5E-06	1.2E-07	2.3E+00
Y-90	3.77E-06	7E-05	1.2E-07	1.7E-01
Co-60	1.54E-07	3E-05	4.8E-09	1.6E-02
Ag-108m	1.07E-06	9E-05	3.3E-08	3.7E-02
Cs-137	2.90 E-08	1E-05	9.0E-10	9.0 E-03

TOTAL 1.65 E-05  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 2.56 %

Total of Activity Released: 589.13  $\mu\text{Ci}$

Year to Date Activity Released: 3792.43  $\mu\text{Ci}$

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**Table 6 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-06  
 From: 10K Tank  
 Month: June

Volume Released: 4500 gal.  
 1.71 E+07 ml  
 Date of Release: 6/26/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	8.30E-06	1E-02	1.2E-07	1.2E-03
Co-60	7.30E-08	3E-05	1.1E-9	3.6E-03
Unidentified Beta	1.27 E-06	2E-08	1.9 E-08	9.4 E+01

TOTAL 9.64 E-06  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 93.87 %

Total of Activity Released: 164.88  $\mu\text{Ci}$

Year to Date Activity Released: 3957.31  $\mu\text{Ci}$

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**Table 7 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-07  
 From: 10K Tank  
 Month: August

Volume Released: 7700 gal.  
 2.93 E+07 ml

Date of Release: 8/21/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
Sr-90	3.81E-07	5E-06	9.6E-09	1.9E-01
Y-90	3.81E-07	7E-05	9.6E-09	1.4E-02
Unidentified Beta	7.49 E-07	2E-08	1.9 E-08	9.5 E+01

TOTAL 6.83 E-08  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 95.02 %

Total of Activity Released: 44.21  $\mu\text{Ci}$

Year to Date Activity Released: 4001.53  $\mu\text{Ci}$

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**Table 8 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-08  
 From: Hold tank  
 Month: September

Volume Released: 750 gal.  
 2.85 E+06 ml

Date of Release: 9/20/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	5.80-06	1E-02	1.4E-08	1.4E-04
Co-60	1.30E-07	3E-05	1.1E-03	1.1E-03
Ag-108m	8.1E-07	9E-05	2.0E-09	2.2E-03
Unidentified Beta	1.43 E-06	2E-08	3.5 E-09	1.8E+01

TOTAL 8.17 E-06  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 17.60 %

Total of Activity Released: 23.28  $\mu\text{Ci}$

Year to Date Activity Released: 4024.80  $\mu\text{Ci}$

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**Table 9 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-09  
 From: Hold Tank  
 Month: September

Volume Released: 470 gal.  
 1.79 E+06 ml  
 Date of Release: 9/20/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	1.00E-05	1E-02	1.5E-08	1.5E-04
Co-60	8.70E-07	3E-05	1.3E-09	4.5E-03
Ag-108m	8.70E-06	9E-05	1.3E-08	1.5E-02
Unidentified Beta	2.47 E-06	2E-08	3.8 E-09	1.9 E+01

TOTAL 2.20 E-05  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 19.14 %

Total of Activity Released: 39.37  $\mu\text{Ci}$

Year to Date Activity Released: 4064.18  $\mu\text{Ci}$

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**Table 10 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-10  
 From: Hold Tank  
 Month: September

Volume Released: 575 gal.  
 2.19 E+06 ml

Date of Release: 9/26/13

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
H-3	3.40E-05	1E-02	6.4E-08	6.4E-04
Co-60	1.90E-06	3E-05	3.6E-09	1.2E-02
Ag-108m	2.10E-05	9E-05	4.0E-08	4.4E-02
Unidentified Beta	4.29 E-06	2E-08	8.1 E-09	4.1 E+01

TOTAL 6.12 E-05  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 40.56 %

Total of Activity Released: 133.69  $\mu\text{Ci}$

Year to Date Activity Released: 4197.87  $\mu\text{Ci}$

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**Table 11 -- Waste Tank Release to Sanitary Sewer**

Release Number: 2013-11  
 From: Hold Tank  
 Month: October

Volume Released: 6600 gal.  
 2.51 E+07 ml

Date of Release: 6/21/12

Nuclide	Tank ( $\mu\text{Ci/ml}$ )	Monthly Limit ( $\mu\text{Ci/ml}$ )	Release ( $\mu\text{Ci/ml}$ )	Percent of Monthly Limit
Co-60	1.6E-06	1E -02	8.4E-10	2.8 E-03
Ag-108m	1.9E-05	9E-05	1.0E-08	1.1E-02
Unidentified Beta	3.47 E-06	2E-08	1.8 E-09	9.1 E+00

TOTAL 2.41 E-05  $\mu\text{Ci/ml}$   
 CONCENTRATION

Total of Limit Released: 9.14 %

Total of Activity Released: 14.63  $\mu\text{Ci}$

Year to Date Activity Released: 4212.50  $\mu\text{Ci}$



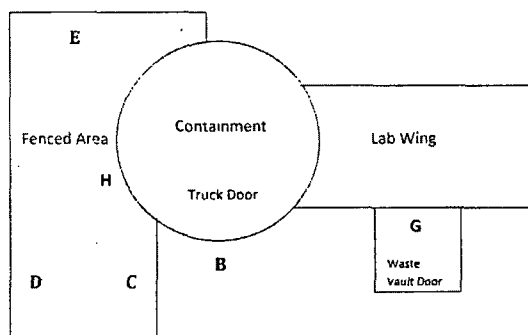
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**Table 12 -- 2013 Cumulative Summary of Environmental  
Radiation Dose Equivalent (mrem)**

Monthly Monitoring Period	B 2118 Truck Door Outside	C 2120 Fence 1	D 2121 Fence 2	E 2122 Fence 3	G 2116 Waste Vault	H Containment Wall	Control Average
January	0	0	0	0	3	0	18
February	0	0	0	0	1	0	10
March	0	0	0	0	1	0	15
April	0	0	0	0	0	0	14
May	0	0	0	0	0	0	14
June	0	0	0	0	5	0	15
July	0	0	0	0	0	0	14
August	45	27	1	0	2	0	12
September	40	5	1	1	3	1	14
October	0	0	0	0	1	0	14
November	0	0	0	0	2	0	15
December	0	0	0	0	1	0	17
Total	85	32	2	1	19	1	

Exposure reported (mR/month) is subtracted from control average.



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**Table 13 -- 2013 Cumulative Summary of BMRC Area Dosimeter Results**

Monthly Monitoring Period	335 Truck Door	1624 Bridge	357 Building Air Area	356 Stack Gas Area	Control Average
January	0	3	0	0	18
February	0	5	0	0	16
March	0	3	0	0	16
April	0	2	0	0	13
May	0	3	0	1	13
June	0	2	0	0	13
July	4	0	0	1	12
August <sup>1</sup>	86	31	25	0 <sup>2</sup>	17
September <sup>1</sup>	70	4	0	N/A	15
October	11	4	0	N/A	16
November	13	4	0	N/A	16
December	19	5	0	N/A	14
Total	201	66	25	2	

Exposure reported (mR/month) is subtracted from control average.

Note 1 : Legacy waste clean out conducted during July to September. Waste containers temporarily staged for shipment resulted in increases dose at some monitoring locations.

Note 2 : Stack System out of service. Location no longer monitored.

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**Table 14 -- 2013 Whole Body Deep Dose Equivalent Summary**

Deep Dose Equivalent (rem)	BMRC Staff	University Police	Visitor	Fuel Handler Dosimeter	Consultant Staff	Contractor Staff
None Measurable	5	1	4	1	8	25
0.001 to < 0.050	0	0	0	0	2	8
> 0.050	0	0	0	0	0	2

Deep Dose Equivalent (rem)	BMRC Staff	University Police	Visitor	Fuel Handler Dosimeter	Consultant Staff	Contractor Staff
None Measurable	5	1	4	1	3	10

**Table 15 -- 2011 Extremity Shallow Dose Equivalent Summary**

Extremity Shallow Dose (rem)	BMRC Staff	Consultant Staff	Contractor Staff
None Measurable	4	4	31
0.001 to < 0.100	1	4	2
> 0.100 to < 0.200	0	1	1
> 0.200	0	1	1