

December 31, 2009

Dr. Woodrow Whitlow, Jr., Director
NASA Glenn Research Center at Lewis Field
21000 Brookpark Road M.S. 3-2
Cleveland, OH 44135

SUBJECT: NRC INSPECTION REPORTS 050-00030/09-001 AND
050-00185/09-001 - NASA PLUM BROOK REACTOR FACILITY

Dear Dr. Whitlow:

On December 3, 2009, the U.S. Nuclear Regulatory Commission completed inspection activities at the National Aeronautical and Space Administration (NASA) Plum Brook Reactor Facility, Sandusky, Ohio. The purpose of the inspection was to determine whether the decommissioning activities were conducted safely and in accordance with the NRC requirements. Specifically, during on-site inspections on June 22-24, August 10-12, September 21-23, and December 1-3, 2009, the inspectors evaluated decommissioning performance and conducted independent confirmatory radiation surveys and soil sampling activities assisted by personnel from the Oak Ridge Institute for Science and Education (ORISE). At the conclusion of the on-site inspection on December 3, 2009, the inspectors discussed the inspection findings with members of your staff. The results of analysis of soil samples collected during the December 1-3, 2009, inspection will be provided in a future inspection report.

This inspection consisted of an examination of decommissioning activities at the NASA Plum Brook Reactor Facility as they relate to safety and compliance with the Commission's rules and regulations. Areas examined during the inspection are identified in the enclosed report. Within these areas, the inspection consisted of a selective examination of procedures and representative records, and interviews with personnel.

Based on the results of this inspection, the NRC did not identify any violations.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC website at <http://www.nrc.gov/reading-rm/adams.html>.

W. Whitlow

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We will gladly discuss any questions you may have regarding this inspection.

Sincerely,

/RA/By George M. McCann Acting For/

Christine A. Lipa, Chief
Materials Control, ISFSI,
and Decommissioning Branch

Docket Nos.: 050-00030 and 050-00185

License Nos.: TR-3 and R-93

Enclosure:

NRC Inspection Reports 050-00030/09-001
and 050-00185/09-001

cc w/encl: Radiation Health Program Director,
 Ohio Department of Health (ODH)
 S. Helmer, ODH
 M. Rubadue, ODH
 Ohio Environmental Protection Agency,
 Division of Planning
 K. Peecook, NASA, Plum Brook Station

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**U.S. NUCLEAR REGULATORY COMMISSION
REGION III**

Docket No. 050-00030 and 050-00185

License No. TR-3 and R-93

Report Nos. 050-000030/09-001 and 050-00185/09-001

Licensee: National Aeronautics and Space Administration
(NASA)

Facility: Plum Brook Reactor Facility
Test Reactor and Mockup Reactor

Location: Sandusky, Ohio

Dates: June 22-24, 2009,
August 10-12, 2009
September 21-23, 2009, and
December 1-3, 2009

Inspectors: William G. Snell, Senior Health Physicist
Peter Lee, Health Physicist
Jeremy Tapp, Health Physicist

Approved by: Christine A. Lipa, Chief
Materials Control, ISFSI, and
Decommissioning Branch
Division of Nuclear Materials Safety

Enclosure

EXECUTIVE SUMMARY

NASA Plum Brook Reactor Facility Inspection Reports 050-00030/09-001 and 050-00185/09-001

This routine decommissioning inspection included a review of the licensee's current performance related to decommissioning activities, including radiation surveys and soil sampling. Primary activities observed involved soil excavation and sorting using the MACTEC ORION Soil Sorting System. Work areas reviewed included the Pentolite Ditch, Cold Retention Basins, Waste Handling Building, Fan House, Hot Retention Vaults, and Storm Sewer Drainage System excavations.

Research and Test Reactor Decommissioning

The licensee's MACTEC ORION Soil Sorter System being used to process excavated soil was functioning as intended. The inspectors concluded that the process was adequate to segregate soil contaminated in excess of the site Derived Concentration Guideline Levels (DCGLs).

The inspector's review of Final Status Survey (FSS) designs and results concluded the FSSs were properly designed and that the FFS results were well below the DCGLs stated in the licensee's final status survey plan.

Inspectors' observations of work in progress and of the facility determined: that work areas were adequately established to ensure worker safety; that the control of radioactive material areas and wastes were roped off and labeled appropriately; and personal protective clothing was adequate.

Inspectors' independent confirmatory surveys and soil sampling results were consistent with the licensee's FSS results. The inspectors concluded that the FSS surveys were performed appropriately and in accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) guidance. The licensee was also effectively completing decontamination and dismantlement activities along with adequate calibration of survey instruments and completion of associated documentation.

Report Details

1.0 Research and Test Reactor Decommissioning (69013)

1.1 Inspection Scope

The inspectors interviewed site personnel, performed facility and site tours, and observed decommissioning activities being performed. The inspectors evaluated the licensee's soil sorting and surveying process conducted by its' contractor, MACTEC, to assess the equipment's ability to properly sort and segregate contaminated soil.

The NRC inspectors, with assistance from Oak Ridge Institute for Science and Education (ORISE) contractor personnel, performed radiological confirmatory surveys. The inspectors surveyed the Pentolite Ditch, Cold Retention Basins, Waste Handling Building, Fan House, Hot Retention Vaults, and Storm Sewer Drainage System excavations.

The inspectors reviewed the licensee's FSS design and FSS request packages, which included the licensee's survey methodology and calibration records, and evaluated the licensee's calibration process and efficiency determination.

1.2 Observations and Findings

Due to the large volume of potentially contaminated soil requiring excavation, the licensee used a MACTEC ORION Soil Sorter System. Employing field radiological surveys, the licensee processed soil that was greater than one half the site Derived Concentration Guideline Level (DCGL). The MACTEC System was configured to sort soil exceeding the site DCGL into separate piles for offsite disposal. Soil that was less than the DCGL was set aside to receive final status surveys and be used as backfill. The licensee collected systematic samples of the sorted soil as an independent quality control check of the process.

The inspectors identified a concern regarding the ability of the System to adequately segregate soil in excess of the DCGL. In response to the inspectors concern, MACTEC reconfigured the System's software followed by a series of verification tests to ensure the system was working as intended. The licensee's subsequent test results demonstrated the MACTEC System would identify and separate soil in excess of the DCGL.

The inspectors and ORISE personnel reviewed the operating procedures and calibration process of the MACTEC System for technical soundness, along with a review of the daily operational log books and calibration documents. No additional concerns were identified with the MACTEC System.

The licensee completed remediation and final status surveys of Phase 1 of the Storm Sewer Drainage system excavations, the open land area south of the Pentolite Ditch, the ground and lower levels of the Fan House (FH), the ground level of the Waste Handling Building (WHB), the two Cold Retention Basins (CRB), the Hot Retention Area (HRA) Tank Vault, and Upper and Lower Pipe Chases.

During and following the remediation of the Pentolite Ditch and following the remediation of the CRBs, ORISE personnel conducted independent confirmatory surveys, side-by-

side surveys with licensee personnel, and collected independent soil samples. These surveys included surface scans with a 2x2 NaI detector coupled to a GPS datalogger to capture the survey results for later review. Particular attention was given to drainage areas and pipes where material may have accumulated. A total of 15 soil samples were collected from judgmental locations where elevated direct gamma readings were detected during surface scanning. During scanning of the CRBs; one elevated area of radiation was identified, which was in an area already marked for investigation by the licensee who was still conducting the FSS of the CRBs. Further investigation identified a buried piece of metal. No other elevated readings were identified in the CRBs. Only one elevated area of radiation was located in the Pentolite Ditch, and this area was below the DCGL for that location. The DCGL for Cs-137 for the CRBs was 11.55 picocuries per gram (pCi/g) and for the Pentolite Ditch was 13.34 pCi/g. For the five soil samples collected in the CRBs, the maximum sample contained 0.73 pCi/g, and for the ten samples collected in the Pentolite Ditch, the maximum sample contained 0.35 pCi/g.

The inspectors reviewed work execution package (PBRF-WEP-09-008) and final status Survey Request 164 (SR-164) for the storm drain excavations. In-process independent confirmatory surveys were performed in the north section of Survey Unit OL-1-1 to determine the adequacy and accuracy of the licensee's procedures and FSS results. The inspectors also collected three soil samples from systematical sampling locations. The inspectors reviewed the FSS design and results of the survey unit OL-1-1, to verify that residual contamination was less than the DCGL stated in the licensee's final status survey plan. The inspectors also evaluated the scan sensitivity of the licensee's survey instruments used for field measurements. The in-process confirmatory survey did not identify any radiation levels above background. Three independent soil samples were collected and sent to the NRC's contract laboratory, ORISE for analysis and no activity was found exceeding the minimum detection concentrations of 0.05 and 0.11 pCi/g for Cs-137 and Co-60, respectively.

The inspectors reviewed Survey Design 30 and SR-204 for Phase 1 of the Storm Sewer Drainage system excavations (survey unit OL-1-6) and evaluated the scan sensitivity of the survey instruments used for field measurements with respect to Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) guidance. The inspectors performed surveys in selected portions of survey unit OL-1-6 to determine the adequacy and accuracy of the licensee's procedures and FSS results. No significantly elevated areas of residual radioactivity were found. The inspectors also collected two soil samples from locations where scan measurements were slightly higher than background readings in other areas of survey unit OL-1-6. The two soil samples were sent to the NRC's contract laboratory, ORISE for analysis and results will be reported and compared to samples collected by the licensee in a future inspection report. The inspectors reviewed the FSS release record for survey unit OL-1-6 to verify that residual contamination was less than the DCGLs stated in the licensee's final status survey plan. All of the licensee's results were well below the approved DCGLs.

The inspectors reviewed Survey Design 32 and SR-179 for selected open land areas south of the Pentolite Ditch that included two large excavations the licensee plans to backfill. The inspectors performed surveys in survey units OL-3-3 and OL-3-12 and in selected portions of OL-3-4. All measurements were at or near background levels and consistent with the licensee's. Three independent confirmatory soil samples were taken,

one in each excavation and one in the north portion of survey unit OL-3-4 where readings discernable from background were found. The three soil samples were sent to ORISE for analysis and results will be reported and compared to the licensee's in a future inspection report. The inspectors reviewed the FSS release records for survey units OL-3-3, OL-3-4, OL-3-12, and OL-3-18 to verify that residual contamination was less than the DCGLs stated in the licensee's final status survey plan. All of the licensee's results were well below the approved DCGLs.

The inspectors reviewed Survey Design 31 and SR-155 for the HRA Upper and Lower Pipe Chases, which include survey units HR-1-19 through HR-1-25. These survey units consist of the floor, walls, and ceiling, which were constructed with poured reinforced concrete. The licensee determined these survey units to be MARSSIM Class 1 and a 100% scan of the surfaces was conducted along with systematic static measurements with a 100 square centimeter beta scintillator. The inspectors performed independent confirmatory scans of selected portions of these survey units with a 100 square centimeter beta scintillator with all results being consistent with the licensee's. The inspectors also performed selected independent confirmatory static measurements of the licensee's systematic and investigative locations. The inspectors compared the results to the licensee's FSS release records and all results were consistent with the licensee's and well below the DCGL stated in the licensee's FSS plan.

The inspectors reviewed Survey Design 23 and SR-105 and SR-109 for the lower and ground level floors of the Fan House, which includes survey units FH-1-1 through FH-1-4 and FH-2-1 through FH-2-4. These survey units consist of poured reinforced concrete. The licensee determined these survey units to be MARSSIM Class 1 and a 100% scan of the surfaces was conducted along with systematic static measurements. The inspectors performed independent confirmatory scans of selected portions of these survey units with a 100 square centimeter beta scintillator with all results being consistent with the licensee's. The inspectors also performed selected independent confirmatory static measurements of the licensee's systematic and investigative locations. The inspectors then compared the results to the licensee's FSS release records and all results were consistent with the licensee's and well below the DCGL stated in the licensee's FSS plan. In addition, the inspectors performed independent confirmatory surface scans of survey units FH-1-5 through FH-1-11 and FH-2-5 through FH-2-11 with all results being consistent with the licensee's and below their limit to perform additional investigative static measurements.

The inspectors reviewed Survey Design 29A and SR-183, SR-184, and SR-205 for the ground level of the WHB, which includes survey units WH-1-1 through WH-1-12. These survey units consist of the floor and walls and were constructed with poured reinforced concrete, unpainted cinder block, and mortar. The licensee determined these survey units to be MARSSIM Class 1 and a 100% scan of the surfaces was conducted along with systematic static measurements. The inspectors performed independent confirmatory scans of selected portions of these survey units with a 100 square centimeter beta scintillator with all results being consistent with the licensee's. The inspectors also performed selected independent confirmatory static measurements of the licensee's systematic and investigative locations. The inspectors then compared the results to the licensee's FSS release records and all results were consistent with the licensee's. All of the results except for one location were below the DCGL stated in the

licensee's FSS plan. The inspector's and licensee's results for location IM-2 in survey unit WH-1-3 were consistent and found to be greater than the $DCGL_w$ but less than the calculated $DCGL_{EMC}$, therefore passing the elevated measurement test and meeting MARSSIM requirements for release of that survey unit.

The inspectors also reviewed the efficiency determination process for the licensee's 100 square centimeter beta scintillator detector used on structural surfaces. The licensee performed this activity with the appropriate source type and geometry applicable to the known residual radionuclides present on the surfaces of the buildings where surveys were being performed.

1.3 Conclusions

The licensee's MACTEC ORION Soil Sorter System being used to process excavated soil was functioning as intended. The inspectors concluded that the process was adequate to segregate soil contaminated in excess of the site Derived Concentration Guideline Levels (DCGLs).

The inspector's review of Final Status Survey (FSS) designs and results concluded the FSSs were properly designed and that the FFS results were well below the DCGLs stated in the licensee's final status survey plan.

Inspectors' observations of work in progress and of the facility determined: that work areas were adequately established to ensure worker safety; that the control of radioactive material areas and wastes were roped off and labeled appropriately; and personal protective clothing was adequate.

Inspectors' independent confirmatory surveys and soil sampling results were consistent with the licensee's FSS results. The inspectors concluded that the FSS surveys were performed appropriately and in accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) guidance. The licensee was also effectively completing decontamination and dismantlement activities along with adequate calibration of survey instruments and completion of associated documentation.

2.0 **Exit Meeting Summary**

The inspectors presented the final inspection results to licensee management at the conclusion of the onsite inspection on December 3, 2009. The licensee acknowledged the findings presented.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION
PARTIAL LIST OF PERSONS CONTACTED

Licensee

K. Peecook, Program Manager
*R. Case, Assistant Program Manager
*W. Stoner, Radiation Safety Officer
*John Thomas, Project QA & Licensing Manager

*Indicates presence at the final exit meeting held on December 3, 2009.

LIST OF PROCEDURES USED

IP 69013 Research and Test Reactor Decommissioning

LIST OF ACRONYMS USED

CRB	Cold Retention Basin
DCGL	Derived Concentration Guideline Level
DNMS	Division of Nuclear Material Safety
DCGL	Derived Concentration Guideline Level
FH	Fan House
FSS	Final Status Survey
HRA	Hot Retention Area
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
NASA	National Aeronautical and Space Administration
NRC	Nuclear Regulatory Commission
ORISE	Oak Ridge Institute for Science and Education
PBRF	Plum Brook Reactor Facility
pC/g	Picocuries per gram
SR	Survey Request
WHB	Waste Handling Building

DOCUMENTS REVIEWED

Licensee documents used during the inspection were specifically identified in the Report Details, above.

Additional documents used are listed below.

Letter Report for Analytical Results for Three Soil Samples from NASA Plum Brook, Sandusky, Ohio, Oak Ridge Institute for Science and Education, July 16, 2009 (ML092020178)

Final Confirmatory Letter Report for the Cold Retention Basins, Pentolite Ditch, and Technical Evaluation Results of the MACTEC ORION Soil Sorting System at the Plum Brook Reactor Facility, Sandusky, Ohio, Oak Ridge Institute for Science and Education, December 21, 2009 (ML093630819)

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened	None
Closed	None
Discussed	None