



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW, SUITE 23T85
ATLANTA, GEORGIA 30303-8931

June 4, 2009

David Stinson, President
Shaw AREVA MOX Service
Savannah River Site
P.O. Box 7097
Aiken, SC 29804

SUBJECT: MIXED OXIDE FUEL FABRICATION FACILITY - NRC REACTIVE INSPECTION
REPORT NO. 70-3098/2009-006

Dear Mr. Stinson:

This letter refers to the reactive team inspection conducted by the U.S. Nuclear Regulatory Commission (NRC) on February 2-5 and April 20, 28, 29, 2009, at the Savannah River Site (SRS), Mixed-Oxide Fuel Fabrication Facility (MOX) in Aiken, South Carolina. The purpose of the inspection was to determine whether the identification and corrective actions implemented by MOX services staff associated with concrete voiding issues (sometimes referred to as honeycombing) were properly dispositioned. The inspection included a review of the timeline related to the identification of the issue, Quality Assurance (QA) records related to the mixing and placement of concrete material, methods used to consolidate concrete during placement, your repair procedure and implementation, interviews with personnel, and direct observations of repairs and nondestructive testing (NDT) activities.

These areas were examined using inspection procedures identified in the report to ensure Quality Level (QL-1) components can perform their intended designed safety function in compliance with your Construction Authorization Request (CAR).

Based on the results of this inspection, no violations or deviations were identified. Within the areas assessed during this inspection, the NRC concluded that MOX adequately repaired structures, systems and components (SSC) related to previously mentioned concrete voiding issues. This conclusion was discussed with you during the exit meeting on April 29, 2009.

In accordance with 10 CFR 2.390 of NRC's "Rules of Practice," this document may be accessed through the NRC's public electronic reading room, Agency-Wide Document Access and Management System (ADAMS) on the Internet at <http://www.nrc.gov/reading-rm/adams.html>

D. Stinson

2

Should you have any questions concerning this letter, please contact us.

Sincerely,

/RA/

Kathleen O'Donohue, Chief
Construction Inspection Branch 2
Division of Construction Inspection

Docket No. 70-3098
Construction Authorization No. CAMOX-001

Enclosure: NRC Inspection Report 70-3098/2009-006 w/attachment

cc w/encl: (See next page)

D. Stinson

2

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cc w/encl: (See next page)

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ADAMS: Yes ACCESSION NUMBER: ML 091550287 SUNSI REVIEW COMPLETE

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SIGNATURE	KOD	Via email					
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DATE	06/04/2009	05/30/2009	05/29/2009	05/29/2009	05/29/2009	06/04/2009	
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3

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4

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Letter to David Stinson from Kathleen O'Donohue dated June 4, 2009

SUBJECT: MIXED OXIDE FUEL FABRICATION FACILITY - NRC INSPECTION REPORT
NO. 70-3098/2009-006

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

Docket: 70-3098

Construction
Authorization No: CAMOX-001

Report: 70-3098/2009-006

Certificate Holder: Shaw AREVA MOX Services

Location: Savannah River Site
Aiken, South Carolina

Inspection Dates: February 2-5, 2009 (Phase 1)
April 20, 28, 29, 2009 (Phase 2)

Inspectors: R. Jackson, Senior Construction Inspector, Construction Inspection
Branch 2 (CIB2), Division of Construction Inspection (DCI),
Region II (RII)
J. Lizardi, Construction Inspector, CIB2, DCI, RII

Accompanying
Personnel: B. Davis, Construction Inspector, CIB2, DCI, RII
J. Seat, Construction Inspector, CIB2, DCI, RII
E. Heher, Construction Inspector, CIB2, DCI, RII

Approved: Kathleen O'Donohue, Chief
Construction Inspection Branch 2
Division of Construction Inspection

Enclosure

EXECUTIVE SUMMARY

Shaw AREVA MOX Services
Mixed Oxide Fuel Fabrication Facility
NRC Inspection Report No. 70-3098/2009-006

This report is a summary of the reactive team inspection conducted by the U.S. Nuclear Regulatory Commission (NRC) from February 2-5 to April 20, 28, 29, 2009, at the Savannah River Site (SRS), Mixed-Oxide Fuel Fabrication Facility (MOX) in Aiken, South Carolina. The inspection was lead by the Region II Division of Construction Inspection (DCI) staff. The results of the reactive inspection are contained in the detailed section of this report. The inspection was conducted through a review of selected records, procedures, interviews with personnel, and direct observation of equipment testing and work activities in the following areas: the timeline related to the identification of the issue, records related to the mixing and placement of concrete material, methods used to consolidate concrete during placement, the repair procedure and its implementation, interviews with personnel; and observations of in-progress repairs and nondestructive testing (NDT) activities.

Quality Assurance: Problem Identification, Resolution, and Corrective Action

The applicant adequately identified and implemented the corrective action process to address concrete voiding issues as required by the MOX Project Quality Assurance Program (QAP) for nonconforming components. Corrective actions associated with this issue were developed and adequately implemented in a timely manner. MOX Services staff implemented procedures to repair and verify structural adequacy of components as required by provisions of the root cause investigation conducted. Measures were also taken to prevent this issue from reoccurring. No findings of significance were identified.

Structural Concrete Activities

Structural concrete construction activities associated with repairs were performed in accordance with the project procedures and specifications drafted as a result of corrective actions. MOX services conducted NDT to verify structural components had no additional internal voids. The NDT also confirmed void repairs were adequately filled, sealed, and bonded. A sample of the testing and repairs were directly observed by the inspectors to verify implementation. The inspection verified the adequacy of the applicant's work related to structural concrete void repairs. No findings of significance were identified.

Attachment:

1. Persons Contacted
2. Inspection Procedures
3. List of Items, Opened, Closed and Discussed
4. List of Acronyms Used
5. List of Documents Reviewed

Enclosure

REPORT DETAILS

1. Summary of Site Activities

The on-site inspection activities by the Nuclear Regulatory Commission (NRC) were divided into three separated weeks. Site activities during the first week included exploratory demolition of honeycombed surfaces in the Processing Building (BMP) and Aqueous Polishing Building (BAP). During the second and third weeks of inspections, the MOX staff began surface preparation and repairs. Nondestructive testing (NDT) contractors conducted testing of walls to evaluate soundness of concrete and adequacy of repairs.

2. Quality Assurance: Problem Identification, Resolution, and Corrective Action (Inspection Procedure (IP) 88110)

a. Scope and Observations

The inspectors reviewed corrective action documentation related to concrete voids identified by MOX staff to verify the applicant entered this issue into its corrective action process as required by the Quality Assurance Program (QAP). The inspectors also reviewed procedures pertaining to nonconforming items, problem identification and resolution, corrective action and root cause analysis. Specifically, the inspectors performed the following:

- Evaluation that the corrective action program contained appropriate provisions to ensure that the condition adverse to quality (concrete voiding issue) was promptly identified and corrected.
- Evaluation that a thorough and complete extent of condition was conducted by the applicant.
- Evaluation of the formal root cause of the issue and that the associated corrective actions to prevent recurrence were adequate and properly documented.

Problem Identification and Resolution

On February 2-5, 2009, the inspectors reviewed MOX procedure PP 3-5, Control of Nonconforming Items, Revision 4, and PP 3-6, Corrective Action Process, Revision 10, to verify procedure adequacy and implementation related to voiding of concrete. The inspectors also reviewed the applicant's procedures for conducting a formal root cause analysis, PP 3-10, Root Cause Analysis, Revision 0.

The inspectors reviewed several nonconformance reports (NCR) initiated to address the concrete voiding that occurred in three separate placements. Interviews with personnel involved were also conducted to determine the sequence of events and to verify this issue was addressed in a timely manner. Condition report (CR) No. 20090007 was initiated by MOX to determine the root cause and to develop corrective actions to resolve and prevent recurrence of this issue. Engineering Change Request (ECR) 01931, related to the revision for concrete repair requirements was also initiated.

The revision provided descriptive repair requirements to better define expected conditions and appropriate repair methods. Due to the significance level assigned to CR No. 20090007, a formal root cause analysis was required per MOX Procedure PP 3-6, Corrective Action Process, Revision 10. Root Cause Analysis (RCA) -09-001 was initiated by the MOX Management Review Committee (MRC) and reviewed by the inspectors to evaluate the root cause and preventative action identified in the report. The final root causes and preventative actions, as identified by applicant, are listed below:

Root Causes

1. Lack of execution of placement procedure of concrete
 - Lack of planning and preparation of the concrete placements
 - Congestion of reinforcement
2. Lack of proficiency of concrete vibrator operators
3. Inconsistent workability of concrete mixtures

Preventative Actions

1. Develop written plans for the flow of concrete and pre-job vibrator planning of walls
2. Develop a vibrator operator proficiency plan
3. Develop guidelines to ensure consistent batching for adequate workability for the duration of concrete placement
4. Establish point of testing slump requirements at the end of the hose

b. Conclusions

The applicant adequately identified and implemented the corrective action process to address concrete voiding issues as required by the MOX Project QAP for nonconforming components. Corrective actions associated with this issue were developed and implemented in a timely manner. MOX Services staff implemented procedures to repair and verify the structural adequacy of components as required by the provisions of root cause investigation conducted. Measures were also initiated to prevent this issue from reoccurring. No findings of significance were identified in this area of inspection.

3. **Structural Concrete Activities (IP 88132)**

a. Scope and Observations

Inspectors performed observations of reinforced concrete walls in the MOX BMP and BAP to assess the severity and extent of voiding and honeycombing defects previously identified and documented by the applicant. Design drawings were reviewed to determine rebar configurations and congestion in the location of voids. The majority of the defects occurred under or around embedded items and blockouts, in corners and other areas of congestion, as well as areas where insufficient access was provided to place or consolidate (vibrate) the concrete. The voids ranged from severe surface honeycombing to deep voiding with exposed reinforcing steel. Several work packages related to the concrete voiding were reviewed to determine the timeline of events and in-process inspection results. In-process concrete testing results were also reviewed to determine the consistency of the mix during these placements.

The applicant acquired the services of a concrete contractor company to aid in assessing the extent and severity of condition. The contractors developed the concrete repair and NDT procedures. They made several improvements to the concrete mix design to improve workability. The inspectors held technical discussions with contractor personnel to determine the adequacy of repair methods selected. The contractor provided significant input into the documented repair procedure which was reviewed by the inspection team. This procedure clearly categorizes the severity and Quality Level (QL) of the concrete defect to be repaired. It also established specific repair material to be used. The compatibility of the repair material was discussed and determined to be adequate. The Commercial Grade Item Evaluation for Set 45 HW Repair Mortar DCS01-DKA-DC-CGD-M-65865-1, Revision 0, was reviewed and found to provide adequate acceptance criteria and methods for repair material qualification. This document required each lot of grout material be tested for compressive strength requirements. A sample of results for this test was reviewed by the inspection staff and found to be within specification. The inspectors performed field observations of the QL-1 repairs of Area No. 8 contained in work package 08-100888-C-1609-BAP-W8-C. The inspectors observed repair activities which included surface preparation, formwork erection, grout material mixture, and placement to verify the implementation of the revised repair procedure. The repair area observed was located on the wall along gridline C adjacent to room C150. The inspectors verified repairs were conducted in accordance with procedures and specifications.

The contractor was also responsible for conducting NDT to verify the adequacy of areas repaired and to confirm no additional internal voids exist in placements where external voids were identified. The NDT methods employed were MIRA Tomography and Impulse Response. The inspectors evaluated Procedure CTL-NDT-MOX-0001, NDT of Concrete Walls, Wall Repairs and Embedment Plates, Revision 0, to verify the proper application of testing methods. The inspectors observed the performance of MIRA Tomography on the wall located on gridline E between gridlines 3.9 and 4.8 at elevation 0'-0" of the BAP. The inspectors observed the performance of Impulse Response Testing on the west side of the wall on gridline "V" between gridlines 2 and 3 at elevation -17'-6" of the BMP. These tests were observed to verify the proper surface grid layout and preparation, and that the appropriate equipment and apparatus were used as required by procedure. The results of both tests were also evaluated by the inspectors and discussed with contractor staff to confirm the adequate interpretation of data collected.

b. Conclusions

Structural concrete construction activities associated with the repairs observed were performed in accordance with the project procedures and specifications drafted as a result of corrective actions. MOX services conducted NDT to verify structural components have no additional internal voids. The NDT also confirmed void repairs were adequately filled, sealed, and bonded. A sample of testing and repairs were directly observed by inspectors to verify implementation. The inspection concluded that the applicant's work related to structural concrete void repairs was adequate. No findings of significance were identified in this area of inspection.

4. Exit Meeting

The inspection scope and results were summarized on April 29, 2009, with MOX management. Although proprietary documents and processes were reviewed during this inspection, the proprietary nature of these documents or processes was not included in this report. The applicant acknowledged the observations and findings during the exit meetings noted above. No dissenting comments were received from the applicant.

1. **PERSONS CONTACTED**

Shaw/Areva MOX Services:

J. Adair, Civil Engineering Manager
C. Allen, Engineering Manager
M. Baker, Structural Engineer
W. Elliott, Engineering Vice-President
D. Gwyn, Regulatory Affairs Manager
R. Justice, Quality Assurance (QA) Programs Engineer
D. Kehoe, QA Engineer
O. Mendiratta, Licensing Engineer
M. Peters, Batch Plant Manager
D. Pike, Construction
R. Rutherford, Construction
T. Sau, Engineering Manager I
G. Shell, QA Manager
D. Stinson, President and Chief Operating Officer
K. Trice, Projects
J. Vaughn, Engineering
R. Whitley, Quality Control (QC) Manager
F. Willis, Licensing Engineer

Qore, Inc.:

G. Spencer, Field Lead Supervisor

Baker:

B. Belding, Project Manager
J. Jones, General Superintendent
K. Jones, Pump Truck Operator
D. Moore, Concrete Manager
T. Paulin, Concrete Manager
T. Pierce, QA/QC Manager
L. Troendle, Project Executive

Specifications

DCS01-BKA-DS-CGD-M-65865-1, Commercial Grade Item Evaluation For Set 45 HW Repair Mortar, Quality Level 1, IROFS
DCS01-BKA-DS-SPE-B-09330-4, Placing Concrete and Reinforcing Steel For Quality Level 1, 2, 3 And 4, Quality Level 1, IROFS
DCS01-WWJ-DS-SPE-B-09335-0, Grouts For Quality Level 1a, 2, 3, and 4 Work, Quality Level 1a, IROFS

Condition Reports

20090007 - Concrete Voiding
20080382 - Inconsistent Slump
20090032 – Unapproved Repair Work
20080177 – Unapproved Repair Work
20080209 – Unapproved Repair Work
20090038 – Reporting of Nonconforming Conditions

Non-Conformance Reports

QC-09-0586 - Concrete Shall Be Thoroughly Worked Around Reinforcement
BK-08-0449-S - Non Consolidated Concrete and Exposed Reinforcement
QC-09-0577-S - Contractor Shall Be Responsible For Finishing Concrete
QC-09-0576-S - Concrete Shall Be Thoroughly Worked Around Reinforcement

Engineering Change Requests

000376 - Tolerance for Embedded Item to Reinforcement
001931 - Update Concrete Repair Requirements

Root Cause Analysis Reports

RCA-09-001 - Defects in Concrete Wall Construction Between September and December 2008

Drawings

DCS01-BMF-DS-PLF-B-01363, Revision 3
DCS01-BMF-DS-PLF-B-02360, Revision 4
DCS01-BMF-DS-PLF-B-01432, Revision 2

Work Packages

08-10888-C-1935-BMP-W106B-C, W106B Interior Wall, BMP, Installation of forms, rebar, embedded items and concrete; QL-1
08-10888-C-1935-BMP-W107A-C, W107A-C BMP Interior Walls, BMP, Installation of forms, rebar, embedded items, and concrete; QL-1
08-10888-C-1609-BAP-W8-C, Interior Walls, BAP, Installation of forms, embedded items, rebar, and concrete; QL-1