



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

January 30, 2009

Mr. David Stinson
President and Chief Operating Officer
Shaw AREVA MOX Services
Savannah River Site
P.O. Box 7097
Aiken, SC 29804-7097

SUBJECT: MIXED OXIDE FUEL FABRICATION FACILITY- NRC INSPECTION REPORT
70-3098/2008-004 AND NOTICE OF VIOLATION

Dear Mr. Stinson:

During the period of October 1 through December 31, 2008, the US Nuclear Regulatory Commission (NRC) completed inspections of construction activities related to the construction of the Mixed Oxide Fuel Fabrication Facility. The purpose of the inspections was to determine whether activities authorized by the construction authorization were conducted safely and in accordance with NRC requirements. The enclosed inspection report documents the inspection results. At the conclusion of the inspections, the findings were discussed with those members of your staff identified in the enclosed report.

The inspections examined activities conducted under your construction authorization as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your authorization. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel.

Based on the results of these inspections, two violations of NRC requirements were identified regarding the failure to implement Section 3 of the MOX Project Quality Assurance Plan (MPQAP), Design Control; and Section 11 of the MPQAP, Test Control. The violations were evaluated in accordance with the NRC Enforcement Policy available on the NRC's Web site at www.nrc.gov. The violations are cited in the enclosed Notice of Violation (Notice) and the circumstances surrounding them are described in detail in the subject inspection report.

The NRC has concluded that information regarding the reasons for the violations, the corrective actions taken and planned to be taken to correct the violations and prevent recurrence, and the dates when full compliance will be achieved, is already adequately addressed on the docket in Inspection Report No. 70-3098/2008-004, therefore no response to this letter is required.

If you choose to respond, your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. Therefore, to the extent possible, the response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction.

In accordance with 10 CFR 2.390 of NRC's "Rules of Practice," a copy of this document and its enclosures 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>.

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

Sincerely,

/RA/

Deborah A. Seymour, Chief
Construction Projects Branch 1
Division of Construction Projects

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

Enclosures: 1. Notice of Violation
2. NRC Inspection Report 70-3098/2008-004 w/attachment

cc w/encls: (See next page)

In accordance with 10 CFR 2.390 of NRC's "Rules of Practice," a copy of this document and its enclosures 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>.

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Letter to D. Stinson from Deborah A. Seymour dated January 30, 2009.

SUBJECT: MIXED OXIDE FUEL FABRICATION FACILITY- NRC INSPECTION REPORT
70-3098/2008-004 AND NOTICE OF VIOLATION

Distribution w/encls:

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PUBLIC

NOTICE OF VIOLATION

Shaw AREVA MOX Services
Aiken, South Carolina

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

During NRC inspection activities conducted October 1 through December 31, 2008, violations of NRC requirements were identified. In accordance with the NRC Enforcement Policy, the violations are listed below:

- A. Condition 3.A of NRC Construction Authorization No. CAMOX-001, Revision 2, dated June 12, 2008, authorizes, in part, the applicant to construct a plutonium processing and mixed oxide fuel fabrication plant, known as the Mixed Oxide Fuel Fabrication Facility located at the Department of Energy's Savannah River Site, in accordance with the statements, representations, and conditions of the MOX Project Quality Assurance Plan (MPQAP) dated July 28, 2008 (Revision 6), and supplements thereto.
1. The MPQAP, Section 11, Test Control, Paragraph 11.2.5.A, requires that test reports/documents identify the person performing the test. In addition, Shaw AREVA MOX Services' (MOX Services) specification DCS01-BMF-DS-SPE-B-09210-0, Section 1.12, Laboratory Reports, states, "As a minimum, include the following information on each report:name of test technician...."
 2. The MPQAP, Section 11, Test Control, Paragraph 11.2.2.A, Performing Test, requires that testing be performed in accordance with Quality Assurance (QA) procedures and that the procedure describes how the testing is performed. In addition, the MPQAP, Section 11, Test Control, Paragraph 11.2.2.D, requires that acceptance criteria are based on specified requirements contained in the applicable design.

Contrary to the above:

1. On November 4, 2008, test records/documents did not identify the person performing the test, as required by the MPQAP, Section 11, Test Control, Paragraph 11.2.5.A, and MOX Services' specification DCS01-BMF-DS-SPE-B-09210-0, Section 1.12, Laboratory Reports, in that a Qore technician failed to document his name or initials on the concrete test data sheet. In addition, tester/data recorder identification had not been included on concrete cylinder compressive strength test records, performed and documented by Qore, for tests completed between August and November 2008.
2. On November 3, 2008, testing was not performed in accordance with a QA procedure that described how the testing was performed, as required by the MPQAP, Section 11, Test Control, Paragraph 11.2.2.A, Performing Test, in that the procedure used for ground rod testing (BPP-103, Ground Grid System Installation, Revision 4, did not clearly detail the procedural steps necessary to set up the ground rod test equipment. Also, the procedure did not provide

Enclosure 1

appropriate acceptance criteria based on specified requirements contained in the applicable design, as required by the MPQAP, Section 11, Test Control, Paragraph 11.2.2.D.

This is a Severity Level IV violation (Supplement II).

- B. Condition 3.A of NRC Construction Authorization No. CAMOX-001, Revision 2, dated June 12, 2008, authorizes, in part, the applicant to construct a plutonium processing and mixed oxide fuel fabrication plant, known as the Mixed Oxide Fuel Fabrication Facility located at the Department of Energy's Savannah River Site, in accordance with the statements, representations, and conditions of the MOX Project Quality Assurance Plan (MPQAP) dated July 28, 2008 (Revision 6), and supplements thereto.
1. MPQAP, Section 3, Design Control, Paragraph 3.2.5.E, Design Change Control, requires that, when a field change is approved other than by revision to the affected design documents, field changes shall be incorporated into affected design documents when such incorporation is appropriate.
 2. MPQAP, Section 3, Design Control, paragraph 3.2.4.E, Design Verification, requires that design verification shall be performed prior to release for construction.

Contrary to the above:

1. On November 10, 2008, the applicant failed to appropriately incorporate a field change into the affected design documents for concrete placement BSR F-104, as required by MPQAP, Section 3, Design Control, Paragraph 3.2.5.E, Design Change Control. The top steel reinforcement bars were not placed within the 135 degree stirrup hooks for beams B170, B173, B141, B142, B143, and B144 which serves to close the ties. This resulted in a steel reinforcement installation that deviated from the design drawings without including provisions to ensure that the original design was still valid.
2. On September 16, 2008, the applicant failed to perform an adequate design verification for field drawing BSR RF-05 prior to release for construction (placement on November 11, 2008), as required by MPQAP, Section 3, Design Control, paragraph 3.2.4.E, Design Verification. The applicant failed to identify that the field drawing (BSR RF-05) did not implement the design requirements from the design drawing (DCS01-BMF-DS-B-01359, Revision 4). Specifically, the beam stirrup parameters from the field drawing did not match the beam stirrup parameters specified on the design drawings.

This is a Severity Level IV violation (Supplement II).

The NRC has concluded that information regarding the reason for the violations, the corrective actions taken and planned to correct the violations and prevent recurrence and the date when full compliance was achieved is already adequately addressed on the docket in this letter and as documented in NRC Inspection Report No. 70-3098/2008-004. However, you are required to submit a written statement or explanation pursuant to 10 CFR 2.201 if the description therein does not accurately reflect your corrective actions or your position. In that case, or if you choose to respond, clearly mark your response as a "Reply to a Notice of Violation," and send it

to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555 with a copy to the Resident Inspector and the Regional Administrator, Region II, within 30 days of the date of the letter transmitting this Notice.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

Should you choose to respond, your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>, to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. If personal privacy or proprietary copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such information is necessary to provide an acceptable response, then please provide a bracketed material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

In accordance with 10 CFR 19.11, you may be required to post this Notice within two working days.

Dated at Atlanta, Georgia this 30th day of January 2009.

U.S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket No.: 70-3098

Construction
Authorization No.: CAMOX-001

Report No.: 70-3098/2008-004

Applicant: Shaw AREVA MOX Services

Location: Savannah River Site
Aiken, South Carolina

Inspection Dates: October 1 – December 31, 2008

Inspectors: M. Shannon, Senior Resident Inspector, Construction Projects Branch 1
(CPB1), Division of Construction Projects (DCP), Region II (RII)
M. Sheikh, Project Inspector, CPB, DCP, RII
A. Masters, Senior Construction Inspector, Construction Inspection
Branch 2 (CIB2), Division of Construction Inspection (DCI), RII
C. Abbott, Construction Inspector, CIB2, DCI, RII
J. Lizardi, Construction Inspector, CIB2, DCI, RII

Accompanying
Personnel: K. O'Donohue, Chief, CIB2, DCI
D. Seymour, Chief, CPB1, DCP

Approved: Deborah A. Seymour, Chief, CPB1, DCP

EXECUTIVE SUMMARY

Shaw AREVA MOX Services
Mixed Oxide Fuel Fabrication Facility (MOX FFF)
NRC Inspection Report No. 70-3098/2008-004

Routine inspections were conducted by regional specialist inspectors during November 3-6, and by the senior resident inspector from October 1-December 31, 2008. The inspections involved the observation and evaluation of the applicant's programs for facility construction of principle structures, systems, and components (PSSCs) and included quality assurance (QA) activities related to design verification and documentation control; problem identification, resolution, and corrective actions; structural steel and support activities; structural concrete activities; and geotechnical foundation activities.

The scope of the inspections encompassed a review of various MOX FFF activities related to Quality Level (QL)-1 construction for conformance to NRC regulations, the Construction Authorization Request, the MOX Project Quality Assurance Plan (MPQAP), and applicable industry standards. This included, as applicable, material procurement, fabrication and assembly, testing and inspection, and records management. The inspection also focused on Shaw AREVA MOX Services' (MOX Services) oversight of subcontractor activities. The inspectors reviewed applicable portions of MOX Services' program to assess the adequacy of the program and whether it has been effectively implemented. The inspectors reviewed procedures associated with problem identification and corrective actions to resolve previous problems with materials and components. The inspections identified the following aspects of the applicant's programs as outlined below:

Resident Inspection Program for On-Site Construction Activities (Inspection Procedure (IP) 88130), Supplier/Vendor Inspection (Construction Phase) (IP 88115)

Construction activities were performed related to PSSCs and included installations embedded plates and ground cables, heavy lifts of equipment and supplies, verification of equipment placements by surveys, welding, non-destructive testing, and receipt of materials. These construction activities were performed in a safe and quality related manner and in accordance with procedures and work packages. No findings of significance were identified. (Section 2)

Geotechnical/Foundation Activities (IP 88131)

Geotechnical backfill procedures and specifications were found to be adequate. QA records associated with these activities were properly maintained in accordance with project procedure. No findings of significance were identified. (Section 3)

Structural Concrete Activities (IP 88132), Quality Assurance: Inspection, Test Control, and Control of Measuring and Test Equipment (Pre-licensing and Construction) (IP 88109)

With the exception of a portion of the Receiving Building (BSR F-104), as detailed in Sections 4.d and 4.e of this inspection report, the inspectors noted that reinforcing bar (rebar) and embedded plates were properly installed, cleanliness was adequate, onsite pre-placement concrete testing activities were adequate, and concrete placement activities were appropriate. No findings of significance were identified. (Section 4.a)

The inspectors noted that the applicant had conducted over 1,200 concrete strength tests and that the test results met or exceeded the minimums required by the design specifications and the American Concrete Institute (ACI) code. An issue was identified for the applicant's failure to identify the tester or the data recorder, on QL-1 records, for concrete cylinder tests. This was identified as the first example of Violation (VIO) 70-3098/2008-004-001, Inadequate Test Procedures. (Section 4.b)

An issue was identified for the applicant's failure to provide a ground rod test procedure that clearly detailed the set up of test equipment and failed to provide appropriate acceptance criteria. This was identified as a second example of VIO 70-3098/2008-004-001, Inadequate Test Procedures. (Section 4.c)

The inspectors identified that the installed steel reinforcement in the floor beams of the BSR first floor slab deviated from the field drawings, design drawings, and ACI Code 349. The inspectors identified that a field change had been made to the original design without notifying the MOX Services' Design Engineering Department or initiating an engineering change request. This was identified as the first example of VIO 70-3098/2008-004-002, Inadequate Design Change. (Section 4.d)

The inspectors identified that the design drawings did not match the field drawings for BSR F-104. The inspectors identified that the applicant had not performed an adequate design verification of the field drawings prior to release for construction. This was identified as the second example of VIO 70-3-98/2008-004-002, Inadequate Design Change. (Section 4.e)

Structural Steel and Support Activities (IP 88133)

Through direct observation of structural support activities, the inspectors determined work activities were performed in accordance with MOX Services' project procedures. No findings of significance were identified. (Section 5)

Problem Identification, Resolution and Corrective Action (IP 88110)

The applicant had established a program and procedures that adequately implemented the corrective action program in accordance with the applicant's MPQAP and the requirements of 10 CFR 50, Appendix B, Criterion XVI, Corrective Action. No findings of significance were identified. (Section 6)

REPORT DETAILS

1. Summary of Facility Status

During the period, the applicant continued construction activities of principle structures, systems, and components (PSSCs) related to building construction up to ground level (Release 1). The applicant also continued Release 2 activities which included multiple inside and outside walls of the Manufacturing Building (BMP) and the Receiving Building (BSR). The Mixed Oxide Fuel Fabrication Facility (MOX FFF) project received its first two Quality Level (QL)-2 stainless steel process tanks on August 6, 2008. The tanks will be stored in the Process Assembly Building until they are installed in the MOX FFF. Other construction activities included installation of the metal roof on the Process Assembly Facility.

2. Resident Inspection Program for On-Site Construction Activities (Inspection Procedure (IP) 88130), Supplier/Vendor Inspection (Construction Phase) (IP 88115)

a. Scope and Observations

During the inspection period, the inspectors observed the following activities:

- (1) Installation of structural reinforcing steel in the BMP, the Aqueous Polishing Building (BAP), and the BSR;
- (2) Installation of embedded piping and embedded support plates in all three buildings; (3) concrete placements in walls and floors of the BMP, BAP and BSR;
- (4) Operation of the concrete batch plant;
- (5) Receipt of cement, fly ash, sand and gravel;
- (6) Concrete testing in the field (slump, air entrainment, and temperature);
- (7) Installation of building grounding cables in various base mats and walls; and
- (8) Surveys (proper positioning/location) of embedded piping and embedded plates.
- (9) Cleanliness of areas prior to concrete placement, and maintenance of cleanliness during the concrete placements;

The inspectors observed routine lifts conducted to position reinforcing steel and embedded plates; installation and removal of concrete retaining walls; and movement of equipment such as generators, pumps, temporary lighting, and toolboxes. The lifts were conducted in accordance with the applicant's procedures.

The inspectors reviewed the applicable sections of the applicant's Quality Assurance (QA) program and verified that the installations of the structural reinforcing steel, embedded plates, embedded piping, and electrical grounding of the MOX FFF structures were in accordance with QA programmatic requirements. Specifically, the inspectors verified that installations were in accordance with applicable field drawings and met the general construction notes detailed on the following drawings: (1) MOX Fuel Fabrication Facility, Concrete and Reinforcing General Notes, DCS01-01352, Revision 9 (Sheet 1 of 2); and (2) MOX Fuel Fabrication Facility, Concrete and Reinforcing General Notes and Tolerance Details, DCS-01352, Revision 6 (Sheet 2 of 2).

The inspectors routinely attended the applicant's construction plan-of-the-day meetings in order to maintain current knowledge of construction activities. The inspectors also routinely held discussions with Shaw AREVA MOX Services' (MOX Services) civil

engineers, field engineers, quality control/assurance personnel, US Concrete personnel, Titan steel workers, and Baker Construction personnel in order to maintain current knowledge of construction activities and to maintain current knowledge of any problems and concerns.

The inspectors routinely reviewed the status of work packages maintained at each work site. Inspectors monitored the status of work package completion to verify construction personnel obtained proper authorizations to start work, monitor progress and to ensure work packages were kept up-to-date as tasks were completed.

The inspectors routinely verified that adequate staffing was available for construction activities, changing weather conditions were taken into account for planned construction activities, and construction activities were conducted in a safe manner. The inspectors also observed proper communication in the work areas, observed that the work force was attentive, workers adhered to procedures, observed proper communication between supervisors and workers, noted adequate cleanliness of the construction areas, and noted that hazardous materials were properly stored and/or properly controlled when in the field.

The inspectors routinely reviewed various corrective action documents. The review included non-conformance reports (NCRs), condition reports (CRs), root causes and supplier deficiency reports (SDRs). The inspectors also reviewed the closure of selected NCRs and CRs. The inspectors concluded that the applicant was appropriately identifying conditions adverse to quality in their corrective action systems. The applicant identified these items during routine daily activities, special inspections, audits, and self assessments. The applicant routinely evaluated the significance of the adverse conditions, was completing corrective actions in a timely manner, and properly evaluated adverse conditions for applicable reporting requirements. The inspectors noted that the applicant entered issues identified during self assessments into the corrective action system.

b. Conclusions

Construction activities were performed related to PSSCs and included installations of embedded plates and ground cables, heavy lifts of equipment and supplies, verification of equipment placements by surveys, welding, non-destructive testing, and receipt of materials. These construction activities were performed in a safe and quality related manner and in accordance with procedures and work packages. No findings of significance were identified.

3. **Geotechnical/Foundation Activities (IP 88131)**

a. Scope and Observations

This portion of the inspection focused on the applicant's implementation of QL-1 backfill activities and included discussions with personnel performing backfill for QL-1 structures. The intent of the inspection was to determine if geotechnical activities were accomplished in accordance with the applicants design specifications, drawings, and procedures.

The inspectors reviewed Controlled Low Strength Material (CLSM) specifications and testing procedures to determine the technical requirements associated with the backfill activity. These inspections verified the proper installation of CLSM through the review of pre-placement and compression test records.

b. Conclusions

Geotechnical backfill procedures and specifications were found to be adequate. QA records associated with these activities were properly maintained in accordance with project procedure. No findings of significance were identified.

4. **Structural Concrete Activities (IP 88132), Quality Assurance: Inspection, Test Control, and Control of Measuring and Test Equipment (Pre-licensing and Construction) (IP 88109)**

a. Concrete Placement Activities

(1). Scope and Observations

The inspectors evaluated the adequacy of ongoing concrete activities conducted by Baker, QORE, and MOX Services. The inspection of these activities focused on reinforcing steel bar installation, formwork preparation, pre-placement testing, and placement procedures associated with QL-1 concrete construction of the MOX Fuel Fabrication Building Structure (MFFBS). Table 5.6-1 of the Construction Authorization Request specifies the MFFBS as one of the PSSCs.

The inspectors observed various activities prior to and during each major concrete placement. Prior to each placement, the inspectors randomly checked for proper placement of reinforcing steel, including proper lap splices, supports, and bar quantity. The inspectors randomly checked for proper embed plate placement by observing ongoing surveys, and verified embed plate support structures were in place; verified cleanliness of the placement area; observed placement of embedded piping, installation of piping supports, mounting of piping to supports, and installation of galvanic sleeves between piping and supports. The inspectors also observed the installation of the grounding system for the reinforcing steel including embedded grounding posts for future equipment installation. The inspectors also noted minimal movement of wall dowels (reinforcing steel) during the placement activities. During the placements, the inspectors observed proper lift heights and observed MOX Services' field engineers and Quality Control (QC) personnel performing inspections of the reinforcing steel, embed plates, embed piping, cleanliness prior to placements, and detailed observations of all placements.

During the concrete placements, inspectors observed operations at the batch plant and at the point of placement. Concrete placement and onsite testing activities were in accordance with procedural requirements. Minor difficulties observed during the placements were independently identified by on-going QC inspections and corrected by the applicant.

The inspectors observed that concrete samples were collected at the prescribed frequency and noted that the slump and air content met the acceptance criteria or were appropriately dispositioned with NCRs, and that the concrete test cylinders were

collected and temporarily stored per procedure prior to being transported to the off-site materials laboratory for curing and later testing. Batch plant operators correctly implemented procedural requirements and were in constant communication with the concrete placement crews.

The following list is a summary of the reviewed concrete placement activities:

- October 13, 2008, BMP W-116A-2, BMP Interior Wall, 116 cubic yards
- October 13, 2008, BAP W-1 and W-2 Cap, BAP Exterior Wall, 41 cubic yards
- October 14, 2008, BMP W-109 Column, BMP Column, 4 cubic yards
- October 14, 2008, BSR F-2, BSR Elevated Slab, 5 cubic yards
- October 14, 2008, BMP W-108 partial, BMP Interior Wall, 17 cubic yards
- October 14, 2008, BMP W-118A-1, BMP Interior Wall, 22 cubic yards
- October 16, 2008, BAP W7A -1, BAP Interior Wall, 97 cubic yards
- October 22, 2008, BAP W7A -2, BAP Interior Wall, 36 cubic yards
- October 23, 2008, BSR F101 A-1 and A-2, BSR Floor, 22 cubic yards
- October 23, 2008, BAP W7A -3, BAP Interior Wall, 20 cubic yards
- October 27, 2008, BSR F102A-3, BSR Interior Floor, 2 cubic yards
- October 30, 2008, BMP-W-118A2, BMP Interior Wall, 104 cubic yards
- November 5, 2008, BSR F-103A-1&2, BSR Interior Floor, 20 cubic yards
- November 11, 2008, BSR F-104, BSR Intermediate Floor, 808 cubic yards
- November 12, 2008, BMP W-118A-3, BMP Interior Wall, 52 cubic yards
- November 12, 2008, BSR F-102A-1&2, BAP Interior Floor
- November 21, 2008, BAP F-9, BAP Intermediate Floor, 27 cubic yards
- November 25, 2008, BAP F-7, BAP Intermediate Floor, 91 cubic yards
- November 25, 2008, BMP F-117-1, BMP Intermediate Floor-eastern half, 272 cubic yards
- December 3, 2008, BMP F-106C, BMP Secondary Floor, 53 cubic yards
- December 3, 2008, BMP-F-104 Pipe Vault, BMP Pipe Vault, 16 cubic yards

- December 3, 2008, BMP W-119A-1, BMP Interior Wall-eastern half, 113 cubic yards
- December 10, 2008, BMP W-107A, BMP Interior Wall, 133 cubic yards
- December 13, 2008, BMP W-119A-2, BMP Interior Wall-west half, 99 cubic yards
- December 15, 2008, BSR F-104 A1, A2 and A3, BSR Security Embeds, 15 cubic yards, drawing BMP-WR-05
- December 16, 2008, BAP W-8A, BAP Interior Wall, 289 cubic yards
- December 17, 2008, BSR F-104-A4, BSR Security Embeds, 5 cubic yards
- December 17, 2008, BAP- W-13, BAP Interior Wall, 79 cubic yards
- December 20, 2008, BAP W-9A, BAP Interior Wall, 130 cubic yards
- December 30, 2008, BMP W-106B, BMP Interior Wall, 145 cubic yards
- December 31, 2008, BAP W-8B, BAP Interior Wall, 110 cubic yards

The inspectors performed various reviews for the above placements, which included walk downs with the field engineers, walk downs with QC personnel, verification of rebar by use of field drawings, work package reviews and routinely performed walk downs of the area to verify adequate cleanliness prior to concrete placement.

Prior to concrete placement BSR F-104 on November 11, 2008, the inspectors examined beam widths, beam depths, slab thicknesses, and rebar installation. The beam depths and widths were observed to be 47.5 inches, 32 inches, and respectively. The slab thickness was observed as 24 inches. Depth dimensions were taken from the formwork top surface to the final concrete elevation or to the top surface of the embed plates. Beam widths were observed from one of the lateral formwork faces to the other. The field and design drawings required beam depths, beam widths, and slab thicknesses of 47 inches, 32 inches, and 24 inches, respectively. The deviation of 0.5 inch from the 47-inch-depth design was within the tolerances specified in American Concrete Institute (ACI) 117, Specifications for Tolerances for Concrete Construction and Materials and Commentary.

Prior and during the BSR F-104 placement, the inspectors observed formwork cleanliness and alignment, reinforcing steel installation, and in-process testing of concrete (slump, air content, density, and temperature) related to both placements. The applicant's QA staff was observed conducting testing and surveillance of concrete activities as required by the QA program.

During the inspection period, the inspectors evaluated the adequacy of ongoing structural concrete activities conducted by Baker Concrete Construction Inc., QORE, and MOX Services. This inspection focused primarily on steel reinforcement storage and handling, steel reinforcement specifications, and the concrete testing laboratory.

MOX Services' Construction Specification, DCS01-BKA-DS-SPE-B-09328-3, Section 03201, Concrete Reinforcement for Quality Level 1a (IROFS), 2, 3, and 4, Revision 3, and DSC01-BKA-DS-SPE-B-09330-4, Section 03301, Placing Concrete and Reinforcing Steel for Quality Level 1, 2, 3, and 4, Revision 4, were reviewed for adequacy. QA documentation and implementation procedures were also reviewed by the inspectors to verify whether activities being performed onsite were in accordance with internal procedures, specifications and NRC regulations.

Baker Concrete Construction project procedure (BPP)-115, Work Package Planning and Approval, Revision 3, was reviewed. Baker Concrete Construction Work Package (WP) 08-10888-C-1935-BMP-W118A-C was reviewed in preparation for inspection of the scheduled release 2 concrete placement. The WP documentation was in accordance with procedures and current with adequate information for the stage of construction of the associated construction activities and concrete placement for that section.

(2). Conclusions

With the exception of BSR F-104 (See Sections 4.d and 4.e of this inspection report for details), the inspectors noted that rebar and embedded plates were properly installed, cleanliness was adequate, concrete testing activities were adequate and concrete placement activities were appropriate. No findings of significance were identified.

b. Concrete Testing

(1). Scope and Observations

Since the start of construction activities, the inspectors have observed the field testing of the concrete prior to placement and the field preparation of the concrete compressive test cylinders. No issues have been identified concerning the field testing (slump, temperature, and air entrainment) and no significant issues have been identified concerning storage of the cylinders prior to testing. The inspectors have reviewed the "Concrete Statistical Summaries" used to trend the results of the compressive test of the concrete cylinder specimens. The inspectors noted that the results exceeded the project design minimums (3,600 pounds per square inch (psi)) and the ACI code required minimums (4,000 psi). This included 1,200 cylinder compression tests with no failures or unacceptable results for the structural concrete. There were also in excess of 1,000 test results from testing of the low strength concrete used for engineered backfill that have been acceptable. Although in previous NRC inspection reports it has been documented that concrete trucks have been rejected due to the slump test results being outside of the specified range, the compressive test samples from the rejected trucks still exceeded the ACI code minimum strength.

The inspectors observed activities at the off-site independent testing laboratory, QORE. QORE is the contracted independent testing lab that performs cylinder break tests for MOX Services. The inspectors reviewed QORE training records, testing lab certification, and equipment calibration logs. No items of concern were identified.

The inspectors observed two concrete cylinder break tests. The concrete cylinder break tests were in accordance with the American Standards of Testing and Measurement (ASTM) C 39 Standards. However, the inspectors observed during the cylinder breaks, that the tester failed to initial the concrete cylinder test record. MOX Services'

Construction Specification, DCS01-BMF-DS-SPE-B-09210-0, Section 1.12, Laboratory Reports, states, "As a minimum, include the following information on each report:name of test technician." The MPQAP, Section 11, Test Control, Paragraph 11.2.5.A, requires that the test report/documentation identifies the person performing the test. The inspectors reviewed numerous concrete cylinder test records completed between August and November 2008, and determined that the tester/data recorder identification had not been included. The failure to properly identify the individuals performing the concrete break testing was identified as a violation of the MPQAP. This issue was identified as the first example of violation (VIO) 70-3098/2008-004-001, Inadequate Test Procedures. CR-2008-0429 and SDR-QC-08-0356-01 were initiated to address this issue.

The applicant performed a detailed review of the concrete test records. Qore was subsequently able to obtain the required signatures (post dated) for the previous testing by performing reviews of payroll records (to identify personnel assigned to the test lab on specific days) and comparison of test result documentation (handwriting). At the end of the inspection period, the required signatures had been obtained and the concrete test forms were revised to include the proper signature blocks.

(2). Conclusions

The inspectors noted that the applicant had conducted over 1,200 concrete strength tests and that the test results met or exceeded the minimums required by the design specifications and the American Concrete Institute (ACI) code. An issue was identified related to the applicant's failure to identify the tester or the data recorder, on QL-1 records, for concrete cylinder tests. This was identified as the first example of Violation (VIO) 70-3098/2008-004-001, Inadequate Test Procedures.

c. Ground Rod Testing

(1). Scope and Observations

During the inspection period, the inspectors reviewed the process for installation and testing of the station ground rods. When completed, the facility will have approximately 220 ground rods. While reviewing ground rod testing procedure BPP-103, Ground Grid System Installation, Revision 4, the inspectors noted that the procedure did not provide the proper guidance for installation of the ground rod test equipment. Guidance was contained in the manufacturer's technical manual (Operating Instructions – Earth Tester). However, the technical manual did not provide clear guidance for installation of the test equipment or performance of the testing.

MOX Services' original base line soil analyses had soil resistivities of 500 to 4000 ohms. Based on these data, the inspectors noted that the acceptance criteria for ground rod resistance (25 ohms) obtained from the National Electrical Code was inappropriate for the MOX FFF site in that soil conditions at the MOX FFF site made it impossible to meet a ground rod resistance of less than 25 ohms. Although the National Electrical Code specifically requires the installation of a second ground rod when the initial ground rod resistance is greater than 25 ohms, this was not considered the appropriate resistance value for ensuring the overall facility ground resistance was acceptable. Based on the original base line soil resistivities, the applicant subsequently determined that a ground rod resistance of less than 1000 ohms would be acceptable to meet facility ground

requirements and any resistance above 1000 ohms would need further evaluation. During subsequent testing of four ground rods, all four ground rods failed to meet the new test criteria of less than 1000 ohms. Actual values ranged from 1,030 ohms to 1,670 ohms. NCRs CE-09-0567 and 0568 were initiated to evaluate this condition.

The MPQAP, Section 11, Test Control, Paragraph 11.2.2.A, Performing Test, requires that testing be performed in accordance with QA procedures and that the procedure describes how testing is performed. Section 11.2.2.D, requires that acceptance criteria is based on specified requirements contained in the applicable design. However, the applicant failed to provide a ground rod test procedure that clearly detailed the set up of the test equipment and failed to provide appropriate acceptance criteria. This issue was identified as the second example of violation (VIO) 70-3098/2008-004-001, Inadequate Test Procedures. CR-2008-0423 was initiated to address this issue. The applicant revised the procedure to include the steps necessary to install the equipment. This placed the applicant back in compliance.

(2). Conclusions

An issue was identified for failure to provide a ground rod test procedure that clearly detailed the set up of test equipment and failed to provide appropriate acceptance criteria. This was identified as a second example of VIO 70-3098/2008-004-001, Inadequate Test Procedures.

d. Improper Field Change Related to BSR Floor Beams

(1) Scope and Observations

On November 10, 2008, during a walk down at MOX FFF construction site, the inspectors identified that onsite installation of the steel reinforcement for the concrete slab system of the BSR first floor (BSR F-104) did not match the BSR RF 05 field drawing. The inspectors identified that the top steel reinforcements were not placed within the 135 degree hooks for floor beams B170, B173, B141, B 142, B143, and B144 which serves to close the ties. The field drawing requires the 135 degree hooks wrapping around the two steel bars located on the top-corners of these beams. Further, ACI Code 349, Code Requirements for Nuclear Safety-Related Concrete Structures, specifies that the shear reinforcement shall be fully anchored into interconnected elements in accordance with Section 12.13. ACI-349, Section 12.13.3 states, "Between anchored ends, each bend in the continuous portion of a simple U-stirrup or multiple U-stirrups shall enclose a longitudinal bar."

Discussions with MOX Services' personnel revealed that the field engineer had approved the longitudinal bars to be moved such that they no longer were within the 135 degree hooks, without requesting an engineering change. The inspectors noted that MOX Services' PP 9-3, Design Control, Revision 13, details the ECR process to provide an expedited means to change design documents that are approved and issued for construction, procurement, or fabrication. The inspectors informed the QC department about the as-built deficiency and QC placed a hold on the placement of floor BSR F-104. The inspectors also informed MOX Services' Design Engineering, who initiated ECR-001320 to resolve this deficiency. Subsequently additional longitudinal steel reinforcing bars were installed within the 135 degree hooks for BSR floor beams B170, B173, B141,

B142, B143, and B144. This placed the applicant back in compliance with the field design.

The MPQAP, Section 3, Design Control, Paragraph 3.2.2.5.E, requires in part, that when a field change is approved other than by revision to the design documents, field changes shall be incorporated into affected design documents when such incorporation is appropriate.

However, the applicant failed to incorporate a field change into the affected design documents. The failure to perform an ECR to incorporate a field change was identified as a violation of the applicant's MPQAP. This issue was identified as the first example of violation, VIO 70-3098/2008-004-002, Inadequate Design Change. ECR-1320 was initiated to correct the problem prior to the concrete placement. CR-2009-0002 was initiated to address this issue.

(2) Conclusion

The inspectors identified that the installed steel reinforcement in the floor beams of the BSR first floor slab deviated from the field drawings, design drawings, and ACI Code 349. The inspectors identified that a field change had been made to the original design without notification of the MOX Services' Design Engineering Department or initiation of an ECR. This issue was identified as the first example of violation VIO 70-3098/2008-004-002, Inadequate Design Change.

e. Improper Design Change Related to BSR Floor Beams

(1) Scope and Observations

Following the discovery of the missing rebar in the beams for BSR F-104, the inspectors reviewed the building beam design drawings and held discussions with the MOX Services' civil engineers. During the discussions, it was noted that the design drawings specified two different size floor beam stirrups, with the north-south beams having stirrups four inches larger than the east-west beam stirrups. The inspectors noted that if the design drawings were correct, the as-built condition of BSR F-104 was incorrect. However, Engineering concluded that the design drawing was incorrect, and that the original intent was for all of the stirrups to be the same size. A CR was initiated to capture the issue, and subsequently, concrete was placed into BSR F-104.

Following placement of BSR F-104, the inspectors continued their review and based on the design of several floor beams, concluded that the intent of the original design drawings was that there should have been two different size stirrups, based on the orientation of the beam (North-South would be four inches larger than East-West). The inspectors noted that the design drawings did not match the as-built field drawings in that the field drawing specified stirrups with the same dimensions for any orientation. The inspectors reviewed the field and design drawings of the BSR's first floor slab, and found that the field drawing BSR RF 05 depicted different typical beam details than those specified in design drawing DCS01-BMF-DS-PLF-B-01359, Revision 4.

The MPQAP, Section 3.2.4, Design Verification, paragraph 3.2.4.E, requires that design verification shall be performed prior to release for construction. During the design review/verification of the field drawings on September 16, 2008, the applicant failed to

identify that the field drawings did not implement the design requirements. The failure to perform adequate design verification for BSR F-104 was considered to be a violation. This issue was identified as the second example of VIO 70-3098/2008-004-002, Inadequate Design Change. CR 2008-0467 was issued to address this issue.

Subsequently, ECR-1414 was initiated to modify the design drawings to allow for same size stirrups disregarding orientation for the MOX FFF floor beams. The design change provided an alternative to the original design in that it allowed for use of stirrups of the same dimensions and staggered in the beams. The structural design engineers also performed additional design calculations for the changes to the floor beams and concluded that the small reductions in design margins were acceptable. These calculations were also documented in ECR-1414. The inspectors verified that the design drawing was appropriately revised, and reviewed the design calculations for the changes to the floor beams. No further issues were identified. The inspectors concluded that the changes placed the applicant back into full compliance with the design drawings.

(2) Conclusion

The inspectors identified that the design drawings did not match the field drawings for BSR F-104. The inspectors identified that the applicant had not performed an adequate design verification of the field drawings prior to release for construction. This was identified as the second example of VIO 70-3-98/2008-004-002, Inadequate Design Change.

5. **Structural Steel and Support Activities (IP 88133)**

(1) Scope and Observations

The inspectors observed structural steel and support activities conducted by MOX Services. This inspection focused on MOX Services' steel embedment plate storage and handling activities.

MOX Services' Project Procedure (PP) 11-24, Receiving and Processing Material, Revision 0, and PP 11-25, Control of QL-1 & QL-2 Material, Revision 0, were reviewed and determined to be adequate.

MOX Services' PP 11-26, Material Handling, Storage & Control, Revision 1, was reviewed in preparation for inspection of the embed plate laydown yard area. The embed plate laydown yard area was in accordance with PP 11-26. The inspectors also conducted interviews with MOX Services' staff and contractors which focused on steel embed plate receipt inspections, and steel embed plate storage, handling, and control procedures. No issues were identified.

The inspectors reviewed Engineering Change Request (ECR)-000613 which was generated by the applicant. The ECR was related to structural embed plate field bending during field handling. This ECR was reviewed to ensure allowable tolerance for bending of embed plate studs/deformed bars during field handling were not exceeded. Proper documentation and resolutions of the bent studs/deformed bars were resolved on-site.

(2). Conclusions

Through direct observation of structural support activities, the inspectors determined work activities were performed in accordance with MOX Services' project procedures. No findings of significance were identified.

6. **Problem identification, Resolution and Corrective Action (IP 88110)**

a. Scope and Observations

The inspectors reviewed MOX Services' PP 3-6, Corrective Action Process, Revision 10, to evaluate the adequacy of the process and to verify that site procedures contained provisions for identifying, reporting and documenting conditions adverse to quality. The inspectors reviewed the applicant's procedure for conducting formal root cause evaluations, PP 3-25, Root Cause Analysis, Revision 2, and PP 3-10, Stop Work Notification, Revision 3. Additionally, the inspectors reviewed PP 3-2, Trend Analysis, Revision 3, and attended two Management Review Committee meetings in order to evaluate the applicant's threshold for assigning significance levels to recently initiated CRs.

NCRs, CRs, and ECRs generated by the applicant were reviewed to verify the proper documentation and resolutions of problems identified onsite. The inspectors noted that these items were adequately documented in the Corrective Action Program. Review of MOX Services' procedures and interviews with the applicant's staff confirmed that a process exists for documenting and reporting conditions adverse to quality to appropriate levels of management responsible for the conditions, and to the organization responsible for the condition.

The inspectors determined that the applicant had established adequate procedures for the identification and resolution of conditions adverse to quality, as required by Section 16, Corrective Action, of the MPQAP.

b. Conclusions

The applicant had established a program and procedures that adequately implemented the corrective action program in accordance with the applicant's MPQAP. No findings of significance were identified.

7. **Follow-up of Previously Identified Items**

The following items were reviewed for completion of corrective actions:

VIO 70-3098/2008-01-03: Failure to meet ACI Code Requirements Section 6 (c). The corrective actions associated with this violation were reviewed and found to be appropriate to address this violation. The corrective actions included increased inspection upon receipt of rebar and stationing a QC inspector at the vendor facility. Based on this review, this violation is closed.

VIO 70-3098/2007-04-01: Three Examples of Failure to Follow Procedures. The inspectors reviewed NRC Inspection Report 70-3098/2007-04 and noted that this issue

was placed into the applicant's corrective action program as CR 07-0035. Based on observations during the remainder of the inspection period, the inspectors concluded that corrective actions were prompt and thorough. Based on this review, this violation is closed.

8. Exit Interviews

The inspection scope and results were summarized throughout this reporting period by the regional specialist inspectors on September 24, and November 6, 2008; and by the senior resident inspector on January 8, 2009. No dissenting comments were received from the applicant. Although proprietary documents and processes were reviewed during this inspection, the proprietary nature of these documents or processes was not included in this report.

1. PARTIAL LIST OF PERSONS CONTACTED

Applicant Personnel

J. Adair, Civil - Mechanical Engineering Manager
C. Allen, Engineering Manager
D. Barnett, QA Specialist
F. Blanks, QA Specialist
B. Cliatt, QA Specialist
W. Crisler, QC Manager
W. Elliott, Engineering Vice-President
A. Fadeley, Quality Control
D. Gwyn, Regulatory Affairs Manager
G. Huttleston, Site Tech Representative
D. Ivey, Lead Auditor
R. Justice, Quality Assurance (QA) Programs Engineer
D. Kehoe, QA Engineer
F. Maranda, Construction Procurement Manager
O. Mendiratta, Licensing Engineer
J. Miller, Material Manager
B. Parks, Procurement Engineering Group Manager
T. Sau, Engineer
G. Shell, QA Manager
D. Stinson, President and Chief Operating Officer
R. Whitley, Supply Quality Manager
L. Wood, Document Control Manager
S. Youngerman, Technical Services Manager

Other individuals contacted included supervisors, engineers, and inspection, measurement, and testing technicians.

2. INSPECTION PROCEDURES (IPs) USED

IP 88109	Quality Assurance: Inspection, Test Control, and Control of Measuring and Test Equipment (Pre-licensing and Construction)
IP 88110	Quality Assurance: Problem Identification, Resolution and Corrective Action
IP 88115	Supplier/Vendor Inspection (Construction Phase)
IP 88130	Resident Inspection Program for On-Site Construction Activities
IP 88131	Geotechnical/Foundation Activities
IP 88132	Structural Concrete Activities
IP 88133	Structural Steel and Support Activities

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

<u>Item Number</u>	<u>Status</u>	<u>Description</u>
70-3098/2008-04-01	Open/Closed	VIO – Inadequate Test Procedures, (Sections 4.b and 4.c)
70-3098/2008-04-02	Open/Closed	VIO – Inadequate Design Change, (Sections 4.d and 4.e)
70-3098/2008-01-03	Closed	VIO – Failure to meet ACI Code Requirements (Section 8)
70-3098/2007-04-01	Closed	VIO – Three Examples of Failure to Follow Procedures (Section 8)

4. LIST OF ACRONYMS USED

ACI	American Concrete Institute
ADAMS	Agency-Wide Document Access and Management System
ASTM	American Society of Testing and Materials
BAP	Aqueous Polishing Building
BMF	Fuel Manufacturing Building
BMP	Manufacturing Building
BPP	Baker Concrete Construction project procedure
BSR	Receiving Building
CFR	Code of Federal Regulations
CLSM	Controlled Low Strength Material
CR	Condition Report
ECR	Engineering Change Request
IP	Inspection Procedure
IROFS	Item Relied on for Safety
MFFBS	MOX Fuel Fabrication Building Structure
MOX FFF	MOX Fuel Fabrication Facility
MOX Services	Shaw AREVA MOX Services
MPQAP	MOX Project Quality Assurance Plan
NCR	Nonconformance Report
NMSS	Nuclear Materials Safety and Safeguards
PP	Project Procedure
psi	Pounds per Square Inch
PSSC	Principle Structures, Systems, and Components
QA	Quality Assurance
QC	Quality Control
QL	Quality Level
QORE	Geotechnical Engineering and Construction Materials Testing Laboratory
Rebar	Reinforcing bar
SDR	Supplier Deficiency Report
SR	Surveillance Report
WP	Work Package

5. LIST OF DOCUMENTS REVIEWED

PP 3-4, Records Management, Revision 6

PP 3-6, Corrective Action Process, Revision 10

PP3-25, Root Cause Analysis, Revision 2

PP3-10, Stop Work Notification, Revision 3

PP 3-28, Quality Control Receiving Inspection, Revision 1

PP3-2, Trend Analysis, Revision 3

PP 11-24, Receiving and Processing Material, Revision 0

PP 11-25, Control of QL-1 & QL-2 Material, Revision 0

PP 11-26, Material Handling, Storage & Control, Revision 1

PP 11-45, Bending Reinforcing Steel, Revision 0

Shaw Areva MOX Services Specification, DSC01-BKA-DS-SPE-B-09328-3, Section 03201 – Concrete Reinforcement for Quality Level 1a (IROFS), 2, 3, and 4, Revision 3

Shaw Areva MOX Services Specification, DSC01-BKA-DS-SPE-B-09330-4, Section 03301 – Placing Concrete and Reinforcing Steel For Quality Level 1, 2, 3, and 4, Revision 4

Shaw Areva MOX Services, Construction Specification DCS01-BKA-DS-SPE-B-09202-0, Division No. 1 – Concrete Supply (Off-Site), Revision 0

Shaw Areva MOX Services, Construction Specification DCS01-BMF-DS-SPE-B-09210-0, Specification Section 01415 – ITL Requirements for Construction Contract CP-20 BMF Structural Work, Revision 0

BPP 103, Ground Grid System Installation, Revision 4

BPP 107, Construction Surveying, Revision 0

BPP 111, Miscellaneous Steel Procedure, Revision 2

BPP 113, Material Management and Control, Revision 5

BPP 115, Work Package Planning and Development and Approval, Revision 3

WP 08-10888-C-1935-BMP-W118A-C

ASTM C 1077, Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation, December 15, 2007

ASTM C 39/C 39M-05, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens, November 1, 2005

Condition Report No. 08-0429, Concrete Cylinder Reports Failed to Identify Tester

Engineering Change Request No. 000613, Allowable Tolerance for Bending of Embed Plate Studs/Deformed Bars During Field Handling,

Non-Conformance Report No. QC-08-020, Bend Radius

Non-Conformance Report No. BK-08-0509, Bending of Nelson Studs on Embed Plates

Non-Conformance Report No. EN-08-0368, Reinforcing Steel in BMP Base Mat

Supplier Deficiency Report No. SR-QC-08-0356-01, the Independent Testing Lab (ITL) QORE has not been documenting the tester or data recorder on Compressive Strength Tests Reports

Operating Instructions-Earth Tester