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

April 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 70-3098/2009-001

Dear Mr. Stinson:

During the period of January 1 through March 31, 2009, 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, the NRC has identified an apparent violation of NRC requirements that is being considered for escalated enforcement action in accordance with the NRC Enforcement Policy. The apparent violation involved failures of several aspects of the quality assurance program, including performance of quality affecting activities in accordance with approved implementing procedures, design controls, and the corrective action program. Since the NRC has not made a final determination in this matter, no Notice of Violation is being issued for the inspection findings at this time. In addition, please be advised that the number and characterization of the apparent violation described in the enclosed inspection report may change as a result of further NRC review.

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

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

Enclosure: NRC Inspection Report 70-3098/2009-001 w/attachment

cc w/encl: (See next page)

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cc w/encl: (See next page)

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OFFICE	RII: DCP	RII: DCP	RII: DCI				
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NAME	W. Gloersen	M. Shannon	J. Lizardi				
DATE	4/30/2009	4/30/2009	4/30/2009				
E-MAIL COPY?	YES	YES	YES				

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Letter to David Stinson from Deborah A. Seymour dated April 30, 2009.

SUBJECT: MIXED OXIDE FUEL FABRICATION FACILITY- NRC INSPECTION REPORT 70-3098/2009-001

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U.S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket No.:	70-3098
Construction Authorization No.:	CAMOX-001
Report No.:	70-3098/2009-001
Applicant:	Shaw AREVA MOX Services
Location:	Savannah River Site Aiken, South Carolina
Inspection Dates:	January 1 – March 31, 2009
Inspectors:	M. Shannon, Senior Resident Inspector, Construction Projects Branch 1 (CPB1), Division of Construction Projects (DCP), Region II (RII) J. Lizardi, Construction Inspector, Construction Inspection Branch 2 (CIB2), Division of Construction Inspection (DCI)
Accompanying Personnel:	J. Seat, Construction Inspector, CIB2, DCI
Approved:	Deborah A. Seymour, Chief, CPB1, DCP

Enclosure

EXECUTIVE SUMMARY

Shaw AREVA MOX Services
Mixed Oxide Fuel Fabrication Facility (MOX FFF)
NRC Inspection Report No. 70-3098/2009-001

Routine inspections were conducted by the senior resident inspector from January 1-March 31, 2009, and by regional specialists. 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 (CAR), 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 inspections 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 was 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)

Construction activities were performed related to PSSC-007, 009, 0036, and 0045 as described in Table 5.6-1 of the MFFF CAR 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. Except as noted in Sections 2.b, 4.e, 4.f, 5.b, and 5.c of this report, these construction activities were performed in a safe and quality related manner and in accordance with procedures and work packages. (Section 2.a)

The first example of an apparent violation for failure to follow the MPQAP was identified for a condition where the clearance between embedded plates and reinforcement did not meet the American Concrete Institute (ACI)-117 code requirements (PSSC-036). (Section 2.b)

Geotechnical/Foundation Activities (IP 88131)

Geotechnical backfill procedures and specifications were adequate. Quality Assurance records associated with these activities were properly maintained in accordance with project procedures. No findings of significance were identified. (Section 3)

Structural Concrete Activities (IP 88132)

Except as noted in Sections 2.b, 4.e, 4.f, 5.b, and 5.c of this report, the inspectors concluded that rebar and embedded plates were properly installed, cleanliness was adequate, concrete test activities were adequate, and concrete placement activities were appropriate (PSSC-036). (Section 4.a)

Field preparation of concrete test cylinders and temporary storage of the cylinders was acceptable. No issues were identified concerning the field testing (slump, temperature, and air entrainment). The inspectors reviewed the "Concrete Statistical Summaries" used to trend the results of the compressive test of the concrete cylinder specimens. Testing to date indicates that the concrete placed at the MOX facility met design strength requirements (PSSC-036). (Section 4.b)

Installation of ground cables and ground rods was performed in accordance with procedures and work instructions. No findings of significance were identified. (Section 4.c)

The applicant experienced a problem with voiding in various walls located in the Manufacturing Building (BMP) and the Receiving Building (BSR) (PSSC-036). Immediate corrective actions were completed and no new voiding issues were identified. At the end of the inspection period, the applicant had not started repair activities. (Section 4.d)

A second example of an apparent violation was identified for failure to follow the MPQAP for the for improper installation of vertical reinforcement in columns located in the BMP (PSSC-036). The columns were repaired prior to concrete placement. (Section 4.e)

A third example of an apparent violation was identified for failure to follow the MPQAP for installation of BMP wall reinforcement in BMP W-117 outside of allowable ACI 349 tolerances (PSSC-036). The applicant completed an analysis of the wall prior to continuation of construction of the wall into BMP W-121, and confirmed that the as-built configuration of BMP W-117 still met design requirements. (Section 4.f)

Except as noted in Sections 2.b, 4.e, 4.f, 5.b, and 5.c of this report, through direct observation of structural support activities, the inspectors determined that work activities were performed in accordance with MOX Services' project procedures. (Section 4.g)

Problem Identification, Resolution, and Corrective Action (IP 88110)
Quality Assurance: Design and Documentation Control [Pre-licensing and Construction] (IP 88107)

Except as noted in Sections 2.b, 4.e, 4.f, 5.b, and 5.c of this report, the applicant had established a program and procedures that adequately implemented the corrective action program in accordance with the applicant's MPQAP. (Section 5.a)

The fourth example of an apparent violation was identified for failure to follow the MPQAP for the design change that improperly increased allowable tolerances for placement of

reinforcement bar in the stirrups of building floor beams (PSSC-036). The engineering change request (ECR) was subsequently voided and the design drawing requirements were re-applied. (Section 5.b)

A fifth example of an apparent violation was identified for failure to follow the MPQAP for a design change that improperly removed ACI requirements for clearance between embedded plate anchors and reinforcement bar (PSSC-036). A new ECR was generated that properly justified removal of the ACI 117-90 clearance requirements. (Section 5.c)

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 started installation of Quality Level (QL)-4 and QL-1 tanks during this inspection period. Approximately 22 tanks were received, stored, and tested in the Process Assembly Building until they are installed in the MOX FFF. Other construction activities included civil foundation activities related to construction of the secure warehouse next to the MOX facility.

2. Resident Inspection Program for On-Site Construction Activities (Inspection Procedure (IP) 88130)

a. Routine Inspection Activities

(1) Scope and Observations

During the inspection period, the inspectors observed the following activities associated with PSSC-007, 009, 0036, and 0045 as described in Table 5.6-1 of the MFFF Construction Authorization Request (CAR):

(a) Installation of structural reinforcing steel in the BMP, the Aqueous Polishing Building (BAP), and the BSR;
(b) Installation of embedded piping and embedded support plates in the three buildings;
(c) Concrete placements in walls and floors of the BMP, aqueous polishing building (BAP) and BSR;
(d) Operation of the concrete batch plant;
(e) Receipt of cement, fly ash, sand and gravel;
(f) Concrete testing in the field (slump, air entrainment, and temperature);
(g) Installation of building grounding cables in various base mats and walls;
(h) Surveys (proper positioning/location) of embedded piping and embedded plates;
(i) Cleanliness of areas prior to concrete placement, and maintenance of cleanliness during the concrete placements;
(j) Lifting and installation of one QL-1 annular tank (91,000 pounds (lbs)) and three QL-4 collection tanks.

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 lift of the 91,000 lbs quality level 1 (QL-1) annular tank was the heaviest lift to date. Except as noted in Sections 2.b, 4.e, 4.f, 5.b, and 5.c of this report, the inspectors reviewed the applicable sections of MOX Project Quality Assurance Plan (MPQAP) 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 Quality Assurance (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 and 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 any problems or concerns.

The inspectors routinely reviewed the status of work packages maintained at each work site. The 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); and reviewed the closure of selected NCRs and CRs. Except as noted in Sections 2.b, 4.e, 4.f, 5.b, and 5.c of this report, the inspectors concluded that the applicant was appropriately identifying conditions adverse to quality in their corrective action system. 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, completed 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.

(2) Conclusions

Construction activities related to PSSC-007, 009, 0036, and 0045 as described in Table 5.6-1 of the MFFF CAR were performed 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. Except as noted in Sections 2.b, 4.e, 4.f, 5.b, and 5.c of this report, these construction

activities were performed in a safe and quality related manner and in accordance with procedures and work packages.

b. Improper Clearances Between Embedded Plates and Rebar Reinforcement (PSSC-036)

(1) Scope and Observations

On February 19, 2009, during placement of BMP F-201 (elevated floor), the inspectors noted that there was improper clearance between the floor rebar and a few of the embedded plates. The clearance between the rebar and one embed plate was estimated to be ¼ inch. The on-site Quality Control (QC) inspector was notified, along with engineering and QC management. However, concrete was placed on the areas before corrective actions were taken. NCR QC-09-652 was initiated to address this issue.

Approximately one week prior to the placement on February 19, the inspectors discussed with the MOX Services field engineer, that the clearance between the reinforcement and the embedded plates did not meet American Concrete Institute (ACI) code requirements and would need to be re-adjusted. The field engineer stated that this task would be accomplished just before placement. This failure is identified as the first example of Apparent Violation (APV) 70-3098/2009-01-001: Failure to Follow the MPQAP. This issue was captured in the applicant's corrective action program as NCR QC-09-652.

(2) Conclusions

The first example of an apparent violation for failure to follow the MPQAP was identified for a condition where the clearance between embedded plates and reinforcement did not meet ACI-117 code requirements (PSSC-036).

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. Backfilling activities included backfilling of fire system piping, electrical conduits and precast distribution boxes, foundation for secure warehouse, electrical vaults, piping vaults and areas adjacent to MOX facility base mats.

The inspectors reviewed controlled low strength material (CLSM) specifications and testing procedures to determine the technical requirements associated with the backfill activity. This inspection verified the proper installation of CLSM through the review of pre-placement and compression test records.

b. Conclusions

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

4. Structural Concrete Activities (IP 88132)

a. Concrete Placement Activities (PSSC-036)

(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 CAR specifies the MFFBS as one of the PSSCs (PSSC-036).

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. During the placements, the inspectors observed proper lift heights and observed MOX Services' field engineers and QC personnel performing inspections of the reinforcing steel, embed plates, embed piping, cleanliness prior to placements, and detailed observations of the 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 transport to the off-site materials laboratory (QORE) 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:

January 8, 2009, BMP W-119A-3, BMP Interior Wall, 4 cubic yards
January 8, 2009, BMP W-113, BMP Exterior Wall, 234 cubic yards
January 8, 2009, BMP W-117A, BMP Interior Wall, 103 cubic yards
January 12, 2009, BAP F-11C, BAP Intermediate Floor, 125 cubic yards
January 12, 2009, BAP F-8, BAP Intermediate Floor, 8 cubic yards
January 13, 2009, BAP W-8C, BAP Interior Wall, 130 cubic yards
January 17, 2009, BAP W-9C, BAP Interior Wall, 125 cubic yards
January 21, 2009, BMP F-109C, BMP Floor, 57 cubic yards
January 27, 2009, BAP W-7B, BAP Interior Wall, 93 cubic yards
January 27, 2009, BMP W-120-1 North, BMP Interior Floor, 94 cubic yards
January 29, 2009, BMP Pipe Vault, 29 cubic yards
February 2, 2009, BMP F-111, BMP Floor, 2 cubic yards
February 5, 2009, BAP W-10, BAP Interior Wall, 181 cubic yards
February 6, 2009, BMP F-118, BMP Exterior Wall, 307 cubic yards
February 9, 2009, BAP W-12, BAP Interior Wall, 277 cubic yards
February 12, 2009, BAP W-12.2, BAP Interior Wall, 150 cubic yards
February 13, 2009, BMP W-120-2 South, BMP Interior Wall, 51 cubic yards
February 17, 2009, BMP Electrical Vaults (Bottoms), 13 cubic yards
February 19, 2009, BMP F-201, BMP Secondary Floor, 348 cubic yards
February 20, 2009, BAP W-12.3 Line 1-1.9, BAP Interior Wall, 67 cubic yards
February 28, 2009, BAP W-11.2 Line 2.4.1-3.4, BMP Interior Wall, 121 cubic yards
March 3, 2009, BMP F-119, BMP Floor, 260 cubic yards
March 4, 2009, BMP W-122A, BMP Interior Wall, 440 cubic yards
March 4, 2009, BSR W-101, BSR Exterior Wall, 534 cubic yards
March 5, 2009, BAP W-11-4 Line 1-1.9,BAP Interior Wall, 100 cubic yards
March 5, 2009, BAP Panel 123.1 and 123.2, BAP Precast Floors, 19 cubic yards
March 11, 2009, BAP W-10.2 Line 1-1.9, BAP Interior Wall, 86 cubic yards
March 11, 2009, BAP Panel 141.1, BAP Precast Floor, 5 cubic yards
March 17, 2009, BAP Pipe Vault, 7 cubic yards
March 17, 2009, BMP W-123.A1, BMP Interior Wall, 14 cubic yards
March 18, 2009, BAP F-10, BAP Floor, 91 cubic yards
March 24, 2009, BAP W-11.3 Line 2.4-2.4.1, BAP Interior Wall, 130 cubic yards
March 26, 2009, BAP W-10.3, BAP Interior Wall, 4.5 cubic yards
March 26, 2009, BAP W-12-4, BAP Interior Wall, 4.5 cubic yards
March 26, 2009, BMP W-122, BMP Interior Wall, 100 cubic yards
March 30, 2009, BMP W-121, BMP Interior Wall, 124 cubic yards
March 30, 2009, BMP F-111, BMP Floor, 2 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.

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 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

The inspectors concluded that, except as noted in Sections 2.b, 4.e, 4.f, 5.b, and 5.c of this report, observed rebar and embedded plates were properly installed, cleanliness was adequate, concrete testing activities were adequate and concrete placement activities were appropriate (PSSC-036).

b. Concrete Testing (PSSC-036)

(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 were identified concerning the field testing (slump, temperature, and air entrainment) and no significant issues were identified concerning storage of the cylinders prior to testing. The inspectors reviewed the "Concrete Statistical Summaries" used to trend the results of the compressive test of the concrete cylinder specimens. The summaries indicated that the concrete installed at the MOX facility met the design strength requirements.

(2). Conclusions

Field preparation of concrete test cylinders and temporary storage of the cylinders was acceptable. No issues were identified concerning the field testing (slump, temperature, and air entrainment). The inspectors reviewed the "Concrete Statistical Summaries" used to trend the results of the compressive test of the concrete cylinder specimens. Testing to date indicates that the concrete placed at the MOX facility met design strength requirements (PSSC-036).

c. Station Grounding System Installation

(1) Scope and Observations

During the inspection period, the inspectors reviewed the process for installation and testing of the station ground rods. Because of previous difficulties, the ground rod testing procedure was revised. During the period, subsequent ground rod installation was successful and ground rod test values were less than 1,000 ohms. The applicant had previously revised test procedures and had given additional training to test personnel. In addition, ground cable installation in the BMP, BAP and BSR continued successfully. Ground cable cad-welding was observed and was appropriate.

(2) Conclusions

Installation of ground cables and ground rods was performed in accordance with procedures and work instructions. No findings of significance were identified.

d. Voids in BMP and BAP Walls (PSSC-036)

(1) Scope and Observations

At the beginning of this inspection period, the inspectors noted an increase in the number of NCRs initiated for voiding in BMP and BAP walls. The inspectors observed several walls with varying degrees of voiding. Some of the voiding was structural in that embedded rebar was visible. The applicant indicated that the majority of the voiding met the ACI standard for being considered non-structural. Because of the increase in voiding problems, the applicant stopped placement activities until corrective actions were completed. Corrective actions included consolidation training, enhanced procedural guidance, and development of a pre-placement checklist. The checklist included a signature block for a senior Baker supervisor confirming that necessary actions were taken to ensure a successful placement. Since the corrective actions were completed, approximately 30 placements were performed with no additional voiding issues. To date, the applicant has placed approximately 47,000 cubic yards of concrete. Of the 47,000 cubic yards, there were approximately two to four cubic yards (total in several walls) of voiding.

Because of the concerns with voiding, the NRC dispatched regional specialists to the MOX facility to follow up on repair activities. At the end of the inspection period, the applicant was still in the process of developing repair procedures, training personnel on repair techniques and purchasing repair materials.

The inspectors reviewed the concrete truck tickets for each of the placements with voiding conditions. For placement BMP W-106, the inspectors noted a larger than expected variation in the amount of plasticizer added to the trucks. The applicant concluded that variation would have provided an inconsistent and low base slump and workability of the concrete would have been an issue. The inspectors had previously noted that US Concrete had not consistently watered down the aggregate piles as recommended by Baker personnel. The inspectors concluded that this leads to errors in water content measurement and the subsequent need to increase and vary the amount

of super plasticizer in order to obtain the desired slump. However, using the plasticizer to obtain the correct slump increases the difficulty in workability, especially when the trucks have to wait for wall placements. The inspectors noted that by the end of the placement, the concrete probably did not have the desired base slump of two to four inches. The inspectors noted that concrete trucks that were tested met the required test criteria.

The contract with US Concrete ended on December 31, 2008. Since that time the aggregate piles have been consistently watered down and there have been no large variations in the use of the super plasticizer. Baker personnel indicated that workability of the concrete has improved.

(2) Conclusion

The applicant experienced a problem with voiding in various walls located in the BMP and BSR (PSSC-036). Immediate corrective actions were put into place and no new voiding issues were identified. At the end of the inspection period, the applicant had not started repair activities.

e. Improper Installation of BMP Building Column Reinforcement (PSSC-036)

(1) Scope and Observations

On February 5, 2009, during a walk down at MOX FFF construction site, the inspectors identified that the vertical reinforcement bars in columns M10A and N10 of the BMP were not properly installed. Specifically, the vertical reinforcement bars for columns M10A and N10 were not properly positioned in the corners of the stirrups and ties. This resulted in reinforcement bars that were not properly supported by ties and stirrups, which results in a reduction of the column buckling resistance. The field drawings depicted the vertical reinforcement bars location to be along the tie perimeter and one vertical bar within each tie corner. Further, the American Concrete Institute (ACI) Code 349-97 specifies in Section 7.10.5.3 that, “Ties shall be arranged such that every corner and alternate longitudinal bar shall have lateral support provided by the corner of a tie with an included angle of not more than 135 degrees…” The vertical column reinforcement for column N10 was placed up to three inches from the ties. The ACI 117-90 Section 2.2.2 specifies a reinforcement placement tolerance of up to 1 inch for that member size. Also, the vertical column reinforcement for column M10A was placed up to three inches from the ties, while the ACI 117-90 Section 2.2.2 specifies a reinforcement placement tolerance of up to 0.5 inch for that member size.

The inspectors informed the MOX design engineering staff about this deficiency, and ECR 001833 was initiated to resolve the issue. The proposed solution was to add five #11 reinforcement bars for N10, and eight #8 reinforcement bars for M10A at the specified locations. The installation of these additional bars was to stabilize the ties around the columns, and to assist the main bars in the column to resist buckling. The addition of the bars also ensured that the columns met the ACI 117 code tolerance requirements. The inspectors observed the addition of the column vertical rebar and verified that appropriate vertical reinforcement bars were placed in the stirrups and ties within the proper tolerance.

The inspectors noted that improper rebar placement in the base mats for additional columns and supports located in the three buildings will require similar repairs prior to concrete placement. The applicant has implemented an inspection activity to identify those columns and supports needing repairs and associated ECRs.

This failure is identified as the second example of APV 70-3098/2009-01-001: Failure to Follow the MPQAP. This issue was captured in the applicant's corrective action program as ECR 1833, NCR-EN-09-632 and CR-09-50.

(2) Conclusions

A second example of an apparent violation was identified for improper installation of vertical reinforcement in columns located in the BMP (PSSC-036). The columns were repaired prior to concrete placement.

f. Improper Installation of BMP Wall Reinforcement (PSSC-036)

(1) Scope and Observations

During a routine inspection on March 18, 2009, the inspectors identified that installed rebar in wall placement BMP W-117-line 2, did not meet ACI 349 code requirements for clear cover tolerance in that the actual clear cover exceeded the specified clear cover plus the ACI 349 allowable tolerance of ½ inch. The inspectors noted that ACI 349 Section 7.5.1. requires accurate placing of rebar and 7.5.2 states that, "unless otherwise specified by the Engineer, reinforcement…shall be placed within the following tolerances…+ or – ½ inch for walls less than 24 inches." MOX civil/design engineers had not specified a different tolerance. The design and field drawing specified clear cover was 2 ½ inches with ½ inch tolerance, resulting in a maximum clear cover of three inches. The rebar protruding from placement BMP W-117 had clear cover that was in excess of 4.5 inches.

Engineering was notified of the condition and CR 2009-104 was initiated to capture the deficiency. On March 30, 2009, the applicant completed ECR 2249 which was used to analyze the actual installation condition of the BMP walls in W-117 and continuation of the walls into BMP W-121 between lines 2 and 3 and between lines M and N. The analysis determined that the actual placement of the rebar in the walls still met the design requirements. Therefore, engineering was able to specify tolerances in excess of 4.5 inches making the as installed rebar in BMP W-117 and BMP W-121 acceptable to ACI 349, Section 7.5.

The inspectors noted that in several instances, wall rebar installed in the base mats of the BMP did not meet the clear cover tolerances as presently specified by ACI 349. Engineering has developed a plan to identify potential wall clear cover problems and ECRs and or actual repairs will be implemented prior to placement of any walls identified as deficient.

ACI 349, Code Requirements for Nuclear Safety Related Structures, Section 7.5.2, requires that unless specified by the engineer, reinforcement shall be placed within a tolerance of ½ inch of the specified clear cover. On March 18, 2009, the inspectors

identified that the reinforcement already installed in BMP W-117 was installed in excess of the clear cover ½ inch tolerance (4.5 inch vs. maximum of 3 inch). The failure to identify that reinforcement was installed outside of allowable ACI 349 code tolerances is identified as the third example of APV 70-3098/2009-01-001: Failure to Follow the MPQAP. This issue was captured in the applicant's corrective action program as CR-09-104.

(2) Conclusions

A third example of an apparent violation was identified for issues involving the installation of BMP wall reinforcement in BMP W-117 outside of allowable ACI 349 tolerances (PSSC-036). The applicant completed an analysis of the wall prior to continuation of the wall into BMP W-121 and confirmed that the as-built configuration of BMP W-117 still met design requirements.

g. Storage and Handling of Structural Steel Items (PSSC-036)

(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 findings of significance were identified.

(2) Conclusions

Through direct observation of structural support activities, the inspectors determined work activities were performed in accordance with MOX Services' project procedures.

5. **Problem identification, Resolution and Corrective Action (IP 88110)**
Quality Assurance: Design and Documentation Control [Pre-licensing and Construction] (IP 88107)

a. Routine Review of Corrective Action Program Documents

(1) Scope and Observations

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.

Except for as noted in Sections 2.b, 4.e, 4.f, 5.b, and 5.c of this report, 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.

(2) Conclusions

Except for as noted in Sections 2.b, 4.e, 4.f, 5.b, and 5.c of this report, the applicant had established a program and procedures that adequately implemented the corrective action program in accordance with the applicant's MPQAP.

b. Improper Change to ACI Code Requirements and Design Drawing Specifications (PSSC-036)

(1) Scope and Observations

On February 4, 2009, ECR 1784 was approved for use. It improperly referenced ACI 349, Section 7.10.5.3 to justify the revision of design drawing requirements detailed on design drawing DCS01-BMF-DS-PLF-B-01352-6. Sheet 2, which required the beam reinforcement to be placed within or equal to one bar diameter (vertical depth variance). This would require the horizontal bar placement in the beam stirrups to be within one bar diameter of the stirrup hook. The revision allowed placement of the horizontal bar to be up to four inches vertical distance from the stirrup hook. ACI 349, Section 7.10.5.3, was intended for the laterally supported horizontal rebar along the sides of the beam and it requires that they be placed no farther apart than six inches. This section of the code was not intended to address the placement of the rebar in the stirrup hooks.

The inspectors discussed this discrepancy with the engineering staff and ECR 1784 was voided on February 19, 2009. However, ECR 1784 had been implemented and had been used to justify installation of rebar in beams located in floor BMP-F-118 which was placed on February 6, 2009. NCR QC-09-0656 was initiated to identify that the installed rebar in the beams of placement BMP F-118 did not meet the design drawing specifications.

ECR 1784 was approved for use on February 4, 2009, which changed the design drawing (DCS07.01252-6) tolerance details, with an inadequate and improper justification. This failure involving the design change for placement of horizontal reinforcement bar tolerance in beam stirrups is identified as the fourth example of APV 70-3098/2009-001-01: Failure to Follow the MPQAP. This issue was captured in the applicant's corrective action program as CR-09-063.

(2) Conclusions

A fourth example of an apparent violation was identified for the design change that improperly increased allowable tolerances for placement of reinforcement bar in the stirrups of building floor beams. The ECR was subsequently voided and the design drawing requirements were re-applied.

c. Improper Change to ACI Code Requirements (PSSC-036)

(1) Scope and Observations

On February 1, 2009, the inspectors reviewed ECR 0376, which removed the ACI 117-90, Section 2.3, requirement for clearance from embed plate anchors to the reinforcement bars. The requirement specified a clearance of the greater of one inch or one bar diameter. The justification for removal of the requirement was that "This tolerance is intended for the embedded item itself and not the anchors attached thereto." The inspectors concluded that the justification was incorrect in that the code requirements did apply to the anchors. Engineering was notified of the deficiency. On February 5, 2009, ECR 1792 was approved and this ECR appropriately justified exclusion of ACI 117-90, Section 2.3, requirements for embedded plate anchors.

ECR 376 was approved for use on September 6, 2007, with an inadequate/improper justification. This failure is identified as the fifth example of APV 70-3098/2009-01-001: Failure to Follow the MPQAP. This issue was captured in the applicant's corrective action program.

(2) Conclusions

A fifth example of an apparent violation was identified for the design change that improperly removed ACI requirements for clearance between embedded plate anchors and reinforcement bar. A new ECR was generated that properly justified removal of the ACI 117-90 clearance requirements.

6. Exit Interviews

The inspection scope and results were summarized throughout this reporting period by the senior resident inspector on April 1, and April 29, 2009. No dissenting comments were received from the applicant. Although proprietary documents and processes may have been 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
R. Whitley, QC Manager
W. Elliott, Engineering Vice- President
D. Gwyn, Regulatory Affairs Manager
G. Shell, QA Manager
D. Stinson, President and Chief Operating Officer

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

2. INSPECTION PROCEDURES (IPs) USED

IP 88107	Quality Assurance: Design and Documentation Control [Pre-licensing and Construction]
IP 88110	Quality Assurance: Problem Identification, Resolution and Corrective
IP 88130	Resident Inspection Program for On-Site Construction Activities
IP 88131	Geotechnical/Foundation Activities
IP 88132	Structural Concrete Activities

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Item Number	Status	Description
70-3098/2009-01-01	Open	APV: Failure to Follow the MPQAP (Sections 2.b, 4.e, 4.f, 5.b, and 5.c)

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
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	Construction Materials Testing Laboratory
Rebar	Reinforcing bar
SDR	Supplier Deficiency Report
SR	Surveillance Report
WP	Work Package

5. LIST OF DOCUMENTS REVIEWED

PP 3-6, Corrective Action Process, Revision 10
PP3-25, Root Cause Analysis, Revision 2
PP 3-28, Quality Control Receiving Inspection, Revision 1
PP 11-24, Receiving and Processing Material, Revision 0
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-BMF-DS-SPE-B-092100, Specification Section 01415 – ITL Requirements for Construction Contract CP-20 BMF Structural Work, Revision 0
BPP 103, Ground Grid System Installation, Revision 4
111, Miscellaneous Steel Procedure, Revision 2
BPP 115, Work Package Planning and Development and Approval, Revision