



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

September 11, 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  
70-3098/2009-010 AND NOTICE OF VIOLATION

Dear Mr. Stinson:

During the period of August 6 through 12, 2009, the U.S. Nuclear Regulatory Commission (NRC) completed an in office inspection of inspections of construction activities related to the construction of the Mixed Oxide Fuel Fabrication Facility (MFFF) conducted between January 1 and June 30, 2009. The results of the inspections were previously documented in Inspection Reports (IRs) 70-3098/2009-001 and 70-3098/2009-002. These IRs are available at the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>, at Accession Numbers ML091200733 and ML092110728, respectively.

The purpose of the in office inspection was to determine whether activities authorized by the construction authorization were conducted safely and in compliance with the Commission's rules and regulations and with the conditions of your authorization. The enclosed inspection report documents the results of our review. At the conclusion of the in office inspection, the findings were discussed with those members of your staff identified in the enclosed report.

This inspection included a review of Apparent Violation (AV) 70-3098/2009-001-001, and Unresolved Item (URI) 70-3098/2009-002-001, identified in NRC Inspection Reports 70-3098/2009-001 and 70-3098/2009-002, respectively. Based on the results of our review, three violations of NRC requirements were identified involving the failure to identify, evaluate, correct, and document conditions adverse to quality; failure to perform quality-affecting activities in accordance with approved implementing drawings and specifications, and failure to provide adequate documented justification for a change to a final design. The violations were evaluated in accordance with the NRC Enforcement Policy available on the NRC's Web site at <http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>. 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 specific violations identified in the Notice do not represent a programmatic breakdown of the related quality assurance programs. The related issues were subsequently corrected or analyzed as technically acceptable and were not significant deficiencies. However, the NRC is concerned that the measures in place to preclude these types of issues were inadequate. The proper implementation of the MFFF Project Quality Assurance Plan is of vital importance in

ensuring the facility is constructed in accordance with NRC requirements and the approved design. Please contact Ms. Deborah Seymour to schedule a management meeting to discuss your analyses of extent of condition, root causes, and corrective and preventive actions, implemented or planned, for the construction issues identified in the enclosed Notice.

You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. For your consideration, NRC Information Notice 96-28, "SUGGESTED GUIDANCE RELATING TO DEVELOPMENT AND IMPLEMENTATION OF CORRECTIVE ACTION," is available at the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>, at Accession Number ML092450179. The NRC will use your response, in part, to determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

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

Enclosures: 1. Notice of Violation  
2. NRC Inspection Report 70-3098/2009-010  
w/attachment

cc w/encl: (See next page)

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**/RA/**

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

Docket No. 70-3098  
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 w/attachment

cc w/encl: (See next page)

PUBLICLY AVAILABLE       NON-PUBLICLY AVAILABLE       SENSITIVE       NON-SENSITIVE  
 ADAMS:  Yes      ACCESSION NUMBER: ML092540121       SUNSI REVIEW COMPLETE

OFFICE	RII:DCP	RII:DCP	RII:DCP	RII:DCI	RII:EICS		
SIGNATURE	WBG	Via Email	Via Phone	Review Only	Via Email		
NAME	W Gloersen	M Shannon	R Croteau	C. Ogle	C. Evans		
DATE	9/11/2009	9/3/2009	9/11/2009	N/A	9/4/2009		
E-MAIL COPY?	YES      NO	YES      NO	YES      NO	YES      NO	YES      NO		

D. Stinson

3

cc w/encl:

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Letter to David Stinson from Deborah A. Seymour dated September 11, 2009.

SUBJECT: MIXED OXIDE FUEL FABRICATION FACILITY- NRC INSPECTION REPORT  
70-3098/2009-010 AND NOTICE OF VIOLATION

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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 Nuclear Regulatory Commission (NRC) inspection activities conducted January 1 through June 30, 2009, 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 (CA) 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 (MFFF) located at the Department of Energy's Savannah River Site, in accordance with the statements, representations, and conditions of the MFFF Project Quality Assurance Plan (MPQAP) dated March 26, 2002, and supplements thereto (MPQAP, Revision 6, Change 1, dated July 28, 2008).

MPQAP, Revision 6, Change 1, Section 5, Instruction, Procedures, and Drawings, Section 5.1, requires that quality-affecting activities are prescribed by and performed in accordance with documented, approved quality assurance (QA) procedures and other approved implementing documents (drawings, specifications, etc.) appropriate to the MFFF Project work scope.

Project Procedure (PP) 3-6, Corrective Action Process, Section 3.3.1 requires, in part, that adverse conditions shall be promptly identified, evaluated and corrected. PP 3-6, Section 3.5.1 further requires that MFFF personnel shall promptly identify and document problems, including adverse conditions.

Contrary to the above, the applicant failed to promptly identify, evaluate, correct, and document conditions adverse to quality, as required by PP 3-6, Corrective Action Process, as noted in the following examples:

1. On February 19, 2009, the applicant failed to promptly identify, evaluate, correct and document conditions adverse to quality when a BMP F-201 (elevated floor) placement was performed. This placement had improper clearance between two embed plates and reinforcing bar (rebar). The clearance on one embed plate to the reinforcement was estimated to be less than  $\frac{1}{4}$  inch. Shaw AREVA MOX Services (MOX Services) was aware several days before the placement that the reinforcement did not meet the American Concrete Institute (ACI) 119-90, Section 2.3, code requirements. However; the condition was not evaluated, documented and corrected prior to the placement on February 19.
2. On April 21, 2009, the applicant failed to promptly document conditions adverse to quality in that the rebar in placement BMP F-126 did not meet ACI 349-97, Sub-section 7.6.1 code requirements for clear spacing between parallel bars in a layer of rebar. Specifically, as of June 22, 2009, MOX Services had failed to document the deficiency in their corrective action program.

This is a Severity Level IV violation (Supplement II)

- B. Condition 3.A of NRC CA 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 MFFF, located at the Department of Energy's Savannah River Site, in accordance with the statements, representations, and conditions of the MPQAP dated March 26, 2002, and supplements thereto (MPQAP, Revision 6, Change 1, dated July 28, 2008).

Condition 3.C of the CA authorizes MOX Services to construct the facility in accordance with the design bases of the Principal Structures, Systems, and Components (PSSCs) described in the Construction Authorization Request (CAR) dated October 31, 2002.

MPQAP, Revision 6, Change 1, Section 5, Instruction, Procedures, and Drawings, Section 5.1, requires that quality-affecting activities are prescribed by and performed in accordance with documented, approved QA procedures and other approved implementing documents (drawings, specifications, etc.) appropriate to the MFFF Project work scope.

MFFF CAR, Section 11.1.7.3, specifies the codes and standards applied to the MFFF for Seismic Category 1 (SC-I) structures and includes ACI 349-97, Code Requirements for Nuclear Safety-Related Concrete Structures and Commentary.

Construction Specification Section 03301, Placing Concrete and Reinforcing Steel for Quality Level 1, 2, 3, and 4, Quality Level 1 (IROFS), DCS01-BKA-DS-SPE-B-09330-4, dated August 14, 2008, Section 1.4, specifies the use of ACI 349-97, Code Requirements for Nuclear Safety Related Concrete Structures, and ACI 117-90, Standard Specifications for Tolerances for Concrete Construction and Materials.

ACI 349-97, Section 7.5, Placing Reinforcement, Sub-section 7.5.2, requires that unless otherwise specified by the engineer, reinforcement shall be placed within the tolerances specified in 7.5.2.1. Sub-section 7.5.2.1 specifies a tolerance for "d" of  $\pm\frac{3}{8}$  inch for "d" less than or equal to 8 inches,  $\pm\frac{1}{2}$  inch for a "d" that is greater than 8 inches up to 24 inches, and  $\pm 1$  inch for "d" greater than 24 inches.

ACI 349-97, Section 7.6, Spacing Limits for Reinforcement, Sub-section 7.6.1, requires the minimum clear spacing between parallel bars in a layer shall be not less than 1 inch.

ACI 117-90, Section 2.2.2, specifies placement tolerance for reinforcement shall not be greater than 1 inch for members greater than 2 feet and not greater than  $\frac{1}{2}$  inch for members greater than 12 inches and less than 2 feet. Design drawing, DCS01-BMF-DS-PLF-01352 SH2, Revision 6, Detail 1, provides the detail to implement this requirement.

Contrary to the above, on or before April 22, 2009, the applicant failed to perform quality-affecting activities in accordance with approved implementing drawings and specifications appropriate to the MFFF Project work scope, as required by the MPQAP, Revision 6, Change 1, Section 5, as noted in the following examples:

1. Section 2.2.2. Specifically, the vertical reinforcement for column N10 was placed up to 3 inches from the column ties (required to be less than 1 inch) and the vertical reinforcement for column M10A was placed up to 3 inches from the column ties

(required to be less than ½ inch). The vertical rebar were not installed in accordance with Detail 1 of Design Drawing DCS01-BMF-DS-PLF-01352 SH2, Revision 6.

2. On March 18, 2009, the applicant failed to ensure that rebar was installed, for wall placement BMP W-117-line 2, within the tolerances specified in ACI 349-97, Section 7.5.2. Specifically, the vertical and horizontal reinforcement was designed to provide 2.5 inches  $\pm$  ½ inch of clear cover, while the actual clear cover provided was 4.5 inches.
3. On April 22, 2009, the applicant failed to ensure that the minimum clear spacing of the reinforcement in elevated floor placement BMP F-126 was not less than 1 inch, as required by ACI 349-97, Section 7.6, Spacing Limits for Reinforcement, Sub-section 7.6.1. Specifically, ten or more pieces of rebar in this placement had less than 1 inch clearance between the parallel bars, and some had no clearance between the parallel bars.

This is a Severity Level IV violation (Supplement II)

- C. Condition 3.A of NRC CA 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 MFFF located at the Department of Energy's Savannah River Site, in accordance with the statements, representations, and conditions of the MPQAP, dated March 26, 2002, and supplements thereto (MPQAP, Revision 6, Change 1, dated July 28, 2008).

MPQAP, Revision 6, Change 1, Section 3, Design Change Control, Paragraph 3.2.5.A, requires that changes to final designs shall have documented justification for use and are subject to the same design control measures and reviews as those applied to the original design.

Contrary to the above, on February 4, 2009, the applicant failed to provide an adequate documented justification for use of changes to final designs, as required by the MPQAP, Revision 6, Change 1, Section 3, Design Change Control, in that Engineering Change Request (ECR) 1784 was approved for use without an adequate documented justification. This ECR inappropriately changed DD DCS01-BMF-DS-PLF-B-01354-6, Sheet 2, rebar tolerance details for the location of horizontal rebar in the stirrups of beams

This is a Severity Level IV violation (Supplement II)

Pursuant to the provisions of 10 CFR 2.201, Shaw AREVA MOX Services is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Regional Administrator, Region II, and a copy to the NRC Resident Inspector at the Mixed Oxide Fuel Fabrication Facility construction project, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation" and should include: (1) the reason for the violations, or, if contested, the basis for disputing the violations, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved. Your response may reference or include previously docketed correspondence if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an Order or Demand for Information may be issued as to why the license should not be modified, suspended, or



revoked, or why such other actions as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response to the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001.

Because your response will be made available electronically for public inspection in the NRC Public Document Room (PDR), or from the NRC's document system (ADAMS), which is accessible from the NRC web site at <http://www.nrc.fob/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 information is necessary to provide an acceptable response, then please provide a bracketed 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 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.

Dated in Atlanta, Georgia this 11th day of September 2009.

**U.S. NUCLEAR REGULATORY COMMISSION**

**REGION II**

Docket No.: 70-3098

Construction  
Authorization No.: CAMOX-001

Report No.: 70-3098/2009-010

Applicant: Shaw AREVA MOX Services

Location: Savannah River Site  
Aiken, South Carolina

Inspection  
Dates: August 6 through 12, 2009

Inspectors: M. Shannon, Senior Resident Inspector, Construction Projects Branch 1  
(CPB1), Division of Construction Projects (DCP), Region II (RII)  
W. Gloersen, Senior Fuel Facility Project Inspector, CPB1, DCP, RII

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

## EXECUTIVE SUMMARY

Shaw AREVA MOX Services (MOX Services)  
Mixed Oxide Fuel Fabrication Facility (MFFF)  
NRC Inspection Report No. 70-3098/2009-010

An in office inspection of previously identified issues was conducted by regional staff from August 6 through 12, 2009. The in office inspection examined the results of inspections conducted between January 1 and June 30, 2009, and involved the evaluation of the applicant's programs for facility construction of principal structures, systems, and components (PSSCs).

The purpose of the in office inspection was to disposition the apparent violation (AV) identified in NRC Inspection Report 70-3098/2009-001 (AV 70-3098/2009-001-001) and the unresolved item (URI) in NRC Inspection Report 70-3098/2009-002 (URI 70-3098/2009-002-001). The results of the in office inspection is summarized below:

### **Resident Inspection Program for On-Site Construction Activities at the Mixed Oxide Fuel Fabrication Facility (Inspection Procedure (IP) 88130)**

- Two examples of a violation were identified for failure to promptly identify, evaluate, correct and document conditions adverse to quality:
  - The clearance between embed plates and reinforcing steel did not meet American Concrete Institute (ACI)-117 code requirements and was not evaluated, documented, or corrected prior to concrete placement on February 19, 2009. MOX Services was aware several days before the placement that the installed steel did not meet ACI code requirements (PSSC-036, the MFFF Building Structure) (Section 2. a.).
  - On April 21, 2009, the applicant failed to promptly document conditions adverse to quality in that the reinforcing bar (rebar) in placement BMP F-126 did not meet ACI 349-97, Sub-section 2.6.1, code requirements for clear spacing between parallel bars in a layer of rebar. As of June 22, 2009, MOX Services had failed to document the deficiency in their corrective action program (PSSC-036) (Section 2. b.).
- Three examples of a violation for failure to perform quality affecting activities in accordance with approved implementing drawings and specifications appropriate to the MFFF Project work scope were identified:
  - On February 5, 2009, the applicant failed to ensure that the vertical reinforcement in two columns were placed in each corner within the tolerances specified in ACI 117-90, Section 2.2.2. Specifically, the vertical reinforcement for column N10 was placed up to 3 inches from the column ties (required to be less than 1 inch) and the vertical reinforcement for column M10A was placed up to 3 inches from the column ties (required to be less than ½ inch). The vertical rebar were not installed in accordance with Detail 1 of Design Drawing DCS01-BMF-DS-PLF-01352 SH2, Revision 6. The columns were repaired prior to concrete placement (PSSC-036) (Section 2. c.).
  - On March 18, 2009, the applicant failed to ensure that rebar was installed, for wall placement BMP W-117-line 2, within the tolerances specified in ACI 349-97, Section

- 7.5.2. Specifically, vertical and horizontal reinforcement was designed to provide 2.5 inches  $\pm\frac{1}{2}$  inch of clear cover, while the actual clear cover provided was 4.5 inches. 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 strength requirements (Section 2.d.).
- On April 22, 2009, the applicant failed to ensure that the minimum clear spacing of the reinforcement in elevated floor placement BMP F-126 was not less than 1 inch, as required by ACI 349-97, Section 7.6, Spacing Limits for Reinforcement. Specifically, ten pieces of rebar in this placement had less than 1 inch clearance between the parallel bars, and some had no clearance between the parallel bars (PSSC-036) (Section 2.e.).
- A violation was identified for a failure of the applicant to provide an adequate documented justification for use of changes to final designs, as required by the MPQAP, Revision 6, Change 1, Section 3, Design Change Control. On February 4, 2009, Engineering Change Request (ECR) 1784 was approved for use without an adequate documented justification. This ECR inappropriately changed DD DCS01-BMF-DS-PLF-B-01354-6, Sheet 2, rebar tolerance details for the location of horizontal rebar in the stirrups of beams (PSSC-036) (Section 2.f.).

## REPORT DETAILS

### 1. Summary of Facility Status

During the period, the applicant continued construction activities of principal structures systems, and components (PSSCs) related to building construction at grade and below (Release 1). The applicant also continued Release 2 activities which included multiple inside and outside walls of the Manufacturing Building (BMP) and the Shipping and Receiving Building (BSR). Other construction activities included civil foundation activities related to construction of the secure warehouse next to the Mixed Oxide Fuel Fabrication Facility (MFFF).

### 2. Resident Inspection Program for On-Site Construction Activities at the Mixed Oxide Fuel Fabrication Facility (Inspection Procedure (IP) 88130)

#### a. Improper Clearances Between Embed Plates and Reinforcing Bar (Rebar) (PSSC-036, the MFFF Building Structure)

##### (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 reinforcing bar (rebar) and two of the embed plates. The clearance between the rebar and one embed plate was estimated to be ¼ inch. The ACI code required a clearance greater than one bar diameter or 1 inch (American Concrete Institute (ACI) 117-90, Section 2.3). During the placement, the on-site Quality Control (QC) inspector was notified of the deficiency. However, concrete was placed on the areas before corrective actions were taken. Nonconformance Report (NCR) QC-09-652 was initiated to address this issue.

Approximately one week prior to the placement on February 19, 2009, the inspectors discussed, with the MOX Services field engineer, that the clearance between the reinforcement and the embed plates did not appear to meet ACI code requirements and questioned the need for re-adjustment. The field engineer stated that this task would be accomplished before placement. However, the adverse condition was not resolved prior to concrete placement.

Project Procedure (PP) 3-6, Corrective Action Process, Section 3.3.1 requires, in part, that adverse conditions shall be promptly identified, evaluated, and corrected. PP 3-6, Section 3.5.1 further requires that MFFF personnel shall promptly identify and document problems, including adverse conditions. The failure to promptly identify, evaluate, correct, and document a condition adverse to quality is identified as the first example of Violation (VIO) 70-3098/2009-010-001: Failure to Promptly Identify, Evaluate, Correct, and Document Conditions Adverse to Quality. This issue was captured in the applicant's corrective action program (CAP) as NCR QC-09-652. This item was identified as an example of Apparent Violation (AV) 70-3098/2009-001-001 in Inspection Report (IR) No. 70-3098/2009-001. This AV is administratively closed in this inspection report.

(2) Conclusions

The first example of VIO 70-3098/2009-010-001: Failure to Promptly Identify, Evaluate, Correct, and Document Conditions Adverse to Quality, as required by PP 3-6, Corrective Action Process, was identified for a condition that did not meet ACI code tolerances. Specifically, the clearance between embed plates and reinforcement did not meet ACI-117-90 code requirements and was not repaired prior to concrete placement on February 19, 2009 (PSSC-036).

b. Failure of Civil Engineering Personnel to Promptly Identify and Document an Adverse Condition(1) Scope and Observations

On April 21, 2009, the inspectors identified that rebar placement at the interface of the floor beam and floor structural rebar (placement BMP F-126) was congested and had very little clearance between the various pieces of rebar. ACI 349-97, Section 7.6.1, requires that the clear spacing between parallel bars in a layer be at least one bar diameter but not less than 1 inch. This non-conformance was assigned to civil engineering personnel for resolution. As of June 22, 2009, the inspectors noted that civil engineering had failed to document the deficiency in the CAP.

MOX Services' personnel failed to document the failure to meet ACI 349-97, Section 7.6.1, code requirements during the period of April 21 to June 22, 2009. PP 3-6, Corrective Action Process, Section 3.5.1 requires that MFFF personnel shall promptly identify and document problems, including adverse conditions. The failure to document a condition adverse to quality is identified as the second example of VIO 70-3098/2009-010-001: Failure to Promptly Identify, Evaluate, Correct, and Document Conditions Adverse to Quality. This item was identified as an unresolved item (URI) 70-3098/2009-002-001 in IR 70-3098/2009-002. This URI is administratively closed in this inspection report.

(2) Conclusions

The second example of VIO 70-3098/2009-010-001: Failure to Promptly Identify, Evaluate, Correct, and Document Conditions Adverse to Quality, as required by PP 3-6, Corrective Action Process, was identified for failure to document in the CAP that ACI 349-97, Section 7.6.1 requirements for clear spacing between parallel bars were not met (PSSC-036).

c. Improper Installation of BMP Building Column Reinforcement (PSSC-036)(1) Scope and Observations

On February 5, 2009, during a walk down at MFFF construction site, the inspectors identified that the vertical rebar in columns M10A and N10 of the BMP were not properly installed. Specifically, the vertical rebar for columns M10A and N10 were not properly positioned in the corners of the ties. This resulted in rebar that were not properly supported by ties, which results in a reduction of the column buckling resistance. The field drawings depicted the vertical rebar location to be next to the tie perimeter and one vertical bar placed at each tie corner. Further, the 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 columns N10 and M10A were placed up to 3 inches from the ties. ACI 117-90 Section 2.2.2 specifies a reinforcement placement tolerance of 1 inch for members larger than 2 feet and ½ inch for members between 12 inches and 2 feet.

The inspectors informed the MFFF design engineering staff about this deficiency, and Engineering Change Request (ECR) 001833 was initiated to resolve the issue. The proposed solution was to add five #11 bars for N10, and eight #8 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 rebar were placed in the ties within the proper tolerance.

This failure to meet ACI 394 and ACI 117 Code requirements was identified as the first example of a violation of the MPQAP, Revision 6, Change 1, Section 5, Instruction, Procedures, and Drawings, and is identified as VIO 70-3098/2009-010-002: Failure to Perform Quality Affecting Activities in Accordance with Approved Implementing Drawings and Specifications. This issue was captured in the applicant's CAP as ECR 1833, NCR-EN-09-632, and Condition Report (CR)-09-50. This item was identified as an example of AV 70-3098/2009-001-001 in IR No. 70-3098/2009-001. This AV is administratively closed in this inspection report.

The inspectors noted that improper rebar placement in the base mats for additional columns and supports located in the aqueous polishing building, the BMP, and the BSR will require similar repairs prior to concrete placement. The applicant implemented an inspection activity to identify those columns and supports needing repairs and to generate the associated ECRs. The analyses and justification for deviation from ACI 349 and ACI 117 code requirements were provided to the NRC prior to the close of this inspection period and will be reviewed by technical staff.

(2) Conclusions

The first example of VIO 70-3098/2009-010-002: Failure to Perform Quality Affecting Activities in Accordance with Approved Implementing Drawings and Specifications was identified for the improper installation of vertical reinforcement in columns located in the BMP outside of ACI 349 and ACI 117 code tolerances (PSSC-036). The columns were repaired prior to concrete placement.

d. 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 Section 7.5.2 states that, "unless otherwise specified by the engineer, reinforcement...shall be placed within the following tolerances...±½ inch for walls less than or equal to 24 inches." MFFF civil/design engineers had not specified a different tolerance. The design and field drawings

specified a clear cover of 2.5 inches. Accounting for the allowable ½ inch tolerance provided in the ACI code, this would result in a maximum clear cover of 3 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 strength 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.

ACI 349, Code Requirements for Nuclear Safety Related Structures, Section 7.5.2, requires that unless specified by the engineer, for this member size 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 inches versus a maximum of 3 inches). The failure to install wall rebar within ACI 349-97, Section 7.5.2 code tolerances is identified as the second example of VIO 70-3098/2009-010-002: Failure to Perform Quality Affecting Activities in Accordance with Approved Implementing Drawings and Specifications. This issue was captured in the applicant's CAP as CR-2009-104. This item was identified as an example of AV 70-3098/2009-001-001 in IR No. 70-3098/2009-001. This AV is administratively closed in this inspection report.

The inspectors noted multiple instances in which wall rebar installed in the base mats of the BMP did not meet the clear cover tolerances as presently specified by ACI 349. Engineering developed a plan to identify potential wall clear cover problems. The plan indicated that ECRs and or actual repairs will be implemented prior to placement of any walls identified as deficient. Detailed analyses and justification for deviation from ACI 349-97 code requirements was completed and provided to the NRC inspector prior to the close of this inspection period. The analyses will be reviewed by NRC technical staff.

(2) Conclusions

The second example of VIO 70-3098/2009-010-002: Failure to Perform Quality Affecting Activities in Accordance with Approved Implementing Drawings and Specifications was identified for installation of BMP wall reinforcement in BMP W-117 outside of allowable ACI 349 and ACI 117 code 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 strength requirements.

e. Improper Clearances Between Parallel Reinforcement Bars (PSSC-036)

(1) Scope and Observations

On April 22, 2009, prior to placement of BMP F-126 (BMP elevated floor), the inspectors noted that the rebar placement at the interface of the floor beam and the floor structural rebar was congested, in that there was very little clearance between the various pieces of parallel rebar. ACI 349-97, Section 7.6.1, requires that the clear spacing between



parallel bars in a layer be at least one bar diameter but not less than 1 inch. The inspectors discussed this issue with the applicant.

The inspectors noted additional improper rebar placement (clearances of parallel bars) in the base mats and walls in all the three buildings. These conditions will require justification for deviation from ACI 349-97, Section 7.6.1 code requirements. The applicant was in the process of completing the analyses and justification for the deviation from the code at the end of this inspection period.

On April 22, 2009, the inspectors identified that BMP F-126 did not have code required clear spacing between parallel layers of rebar. The failure to meet ACI 349-97, Section 7.6.1 code requirements for clear spacing between parallel rebar was identified as the third example of VIO 70-3098/2009-010-002: Failure to Perform Quality Affecting Activities in Accordance with Approved Implementing Drawings and Specifications. This issue was captured in the applicant's CAP as CR-2009-0244.

The inspectors noted that the applicant had performed evaluations and bounding analyses regarding ACI 349-Section 7.6.1 issues related to individual placements. The analyses appear to be acceptable in resolving this issue. Further review will be conducted by the NRC in this area when the final bounding analysis is submitted. The failure to identify that reinforcement was installed contrary to ACI 349-97 code requirements was identified as URI 70-3098/2009-002-001 in IR 70-3098/2009-002. This URI is administratively closed in this inspection report.

(2) Conclusions

The third example of VIO 70-3098/2009-010-002: Failure to Perform Quality Affecting Activities in Accordance with Approved Implementing Drawings and Specifications was identified for installation of elevated floor rebar in BMP F-126 outside ACI 349 clear spacing requirements (PSSC-036).

f. 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. This ECR improperly referenced ACI 349-97, 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 of the design drawing required the beam reinforcement to be placed within or equal to one bar diameter (vertical depth variance). Specifically, this drawing required the horizontal bar placement in the beam stirrups to be within one bar diameter of the stirrup corner. ECR 1784 allowed placement of the horizontal bar to be up to 4 inches vertical distance from the stirrup corner. The referenced ACI code, ACI 349, Section 7.10.5.3, was intended for the laterally supported horizontal rebar along the sides of the beam and requires that the laterally supported horizontal rebar be placed no farther 6 inches apart. This section of the code was not intended to address the placement of the rebar in the stirrup corners.

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 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.

When ECR 1784 was approved for use on February 4, 2009, it changed the design drawing (DCS07.01252-6) tolerance details with an inadequate and improper justification. The deviation from ACI code requirements and failure to provide adequate documented justification for use of changes to final designs, involving the design change for placement of horizontal rebar tolerance in beam stirrups was identified as VIO 70-3098/2009-010-003: Failure to Provide Adequate Documented Justification for Changes to a Final Design. This issue was captured in the applicant's CAP as CR-2009-063. This item was identified as AV 70-3098/2009-01-001 in IR No. 70-3098/2009-001. Based on the information available, this AV is administratively closed in this inspection report.

(2) Conclusions

A violation was identified for an inadequate documented justification for changes to a final design involving a deviation from ACI 349-97 requirements related to the tolerances provided for location of horizontal rebar in the stirrups of beams (PSSC-036).

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

a. Scope and Observations

The following previously documented issue was reviewed for disposition.

A fifth example of AV 70-3098/2009-001-001: Improper Change to ACI Code Requirements was identified in IR 70-3098/2009-001. This issue was related to the improper justification provided on ECR 0376. ECR 1792 was subsequently approved and appropriately justified exclusion of ACI 117-90, Section 2.3 requirements. Since the issue was considered to be a low significance documentation error, the AV was considered to be a minor violation and is now considered to be closed.

b. Conclusions

A minor violation related to the improper justification provided in an engineering change request was discussed.

**4. Exit Interview**

The inspection scope and results were summarized on August 12, 2009, with Mr. D. Stinson and other members of his staff as indicated in the attachment. Although proprietary documents and processes were occasionally reviewed during this inspection, the proprietary nature of these documents or processes was not included in this report. No dissenting comments were received from the licensee.

**1. PARTIAL LIST OF PERSONS CONTACTED**

J. Adair, Civil - Applicant Personnel

Mechanical Engineering Manager

- C. Allen, Engineering Manager
- W. Elliott, Engineering Vice- President
- D. Gwyn, Regulatory Affairs Manager
- G. Shell, Quality Assurance Manager
- D. Stinson, President and Chief Operating Officer
- R. Whitley, Quality Control Manager

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

**2. INSPECTION PROCEDURES (IPs) USED**

IP 88130      Resident Inspection Program for On-Site Construction Activities

**3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED**

<u>Item Number</u>	<u>Status</u>	<u>Description</u>
70-3098/2009-001-001	Closed	AV: Failure to Follow the MPQAP (Five Examples) (Sections 2.a, 2.c, 2.d, 2.f, and 3.a)
70-3098/2009-002-001	Closed	URI: Failure to Identify and Document an Adverse Condition (Failure to Meet ACI 349-97 Code Requirements for Clear Spacing Between Parallel Rebar) (Two Examples) (Sections 2.b and 2.e)
70-3098/2009-010-001	Open	VIO: Failure to Identify, Evaluate, Correct, and Document Conditions Adverse to Quality (Two Examples) (Sections 2.a and 2.b)
70-3098/2009-010-002	Open	VIO: Failure to Perform Quality Affecting Activities in Accordance with Approved Implementing Drawings and Specifications (Three Examples) (Sections 2.c, 2.d, and 2.e)
70-3098/2009-010-003	Open	VIO: Failure to Provide Adequate Documented Justification for Changes to a Final Design (Section 2.f)

#### 4. **LIST OF ACRONYMS USED**

ACI	American Concrete Institute
ADAMS	Agency-Wide Document Access and Management System
AV	Apparent Violation
BMF	Fuel Manufacturing Building
BMP	Manufacturing Building
BSR	Receiving Building
CA	Construction Authorization
CAP	Corrective Action Program
CAR	Construction Authorization Request
CFR	Code of Federal Regulations
CPB1	Construction Projects Branch 1
CR	Condition Report
DCP	Division of Construction Projects
ECR	Engineering Change Request
IP	Inspection Procedure
IR	Inspection Report
IROFS	Item Relied On For Safety
MFFF	MOX Fuel Fabrication Facility
MPQAP	MFFF Project Quality Assurance Plan
NCR	Nonconformance Report
NRC	Nuclear Regulatory Commission
NMSS	Nuclear Materials Safety and Safeguards
PP	Project Procedure
PSSC	Principal Structures, Systems, and Components
QA	Quality Assurance
QC	Quality Control
RII	Region II
Rebar	Reinforcing bar
VIO	Violation
URI	Unresolved Item