UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
245 PEACHTREE CENTER AVENUE NE, SUITE 1200
ATLANTA, GEORGIA 30303-1257

January 28, 2016

Mr. David Del Vecchio
President and Chief Operating Officer
Chicago Bridge and Iron AREVA MOX Services
Savannah River Site
P.O. Box 7097
Aiken, SC 29804-7097

SUBJECT: MIXED OXIDE FUEL FABRICATION FACILITY- NRC INSPECTION REPORT NUMBER 70-3098/2015-004

Dear Mr. Del Vecchio:

During the period from October 1 through December 31, 2015, the U. S. Nuclear Regulatory Commission (NRC) completed inspections pertaining 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 and license application 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 and license application 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, no violations or deviations were identified.
In accordance with 10 CFR 2.390 of NRC's "Rules of Practice and Procedure," a copy of this letter and its enclosure 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

Enclosure: NRC Inspection Report No. 70-3098/2015-004
w/attachment: Supplemental Information

cc w/encl: (See next page)

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 No. 70-3098/2015-004
w/attachment: Supplemental Information

cc w/encl: (See next page)

■ PUBLICLY AVAILABLE □ NON-PUBLICLY AVAILABLE □SENSITIVE ■ NON-SENSITIVE
ADAMS: ■ Yes ACCESSION NUMBER: ML16028A211 ■ SUNSI REVIEW COMPLETE ■ FORM 665 ATTACHED

OFFICE	RII: DCP	RII: DCP	RII: DCI	RII: DCI	RII:DCP	
SIGNATURE	/RA/	/RA verbal/	/RA via Email/	/RA via Email/	/RA/	
NAME	W. Gloersen	C. Huffman	D. Harmon	C. Smith	D. Seymour	
DATE	1/27/2016	1/27/2016	1/27/2016		1/28/2016	
E-MAIL COPY?	YES	YES	Yes	Yes		

OFFICIAL RECORD COPY DOCUMENT NAME:G:\CCI\DCP\CPB1\MOX FFF\Inspection\Inspection Reports\2015\2015-004\IR 2015004 final.docx

cc w/encl:
Mr. Scott Cannon, Federal Project Director
NA-262.1
P.O. Box A
Aiken, SC 29802

Ms. Joyce Connery, Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Ave., NW, Suite 700
Washington, DC 20004

Mr. Joseph Olencz, NNSA/HQ
1000 Independence Ave., SW
Washington, DC 20585

Ms. Susan Jenkins
Division of Radioactive Waste Management
Bureau of Health and Environmental Control
2600 Bull St.
Columbia, SC 29201

D. Silverman
Morgan, Lewis, and Bockius
1111 Penn. Ave., NW
Washington, DC 20004
G. Carroll
Nuclear Watch South
P.O. Box 8574
Atlanta, GA 30306

Ms. Diane Curran
Harmon, Curran, Spielburg and Eisenberg, LLP
1726 M St., NW, Suite 600
Washington, DC 20036

L. Zeller
Blue Ridge Environmental Defense League
P.O. Box 88
Glendale Springs, NC 28629

Mr. Dealis Gwyn, Licensing Manager
CB&I AREVA MOX Services
Savannah River Site
P.O. Box 7097
Aiken, SC 29804-7097

Letter to D. Del Vecchio from Deborah Seymour dated January 28, 2016.

SUBJECT: MIXED OXIDE FUEL FABRICATION FACILITY- NRC INSPECTION REPORT NO. 70-3098/2015-004

Distribution w/encl:
R. Johnson, NMSS
D. Tiktinsky, NMSS
W. Jones, RII
J. Yerokun, RII
D. Seymour, RII
R. Musser, RII
D. Ayres, RII
J. Heisserer, RII
W. Gloersen, RII
C. Huffman, RII
PUBLIC

U.S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket No.:	70-3098
Construction Authorization No.:	CAMOX-001
Report No.:	70-3098/2015-004
Applicant:	Chicago Bridge and Iron (CB&I) AREVA MOX Services
Location:	Savannah River Site Aiken, South Carolina
Inspection Dates:	October 1 – December 31, 2015
Inspectors:	C. Huffman, Senior Resident Inspector, DCP W. Gloersen, Senior Construction Project Inspector, DCP D. Harmon, Construction Inspector, DCI C. Smith, Construction Inspector, DCI
Accompanying Personnel:	W. Jones, Director, DCP R. Nease, Chief, Construction Projects Branch 2 A. Chowdhury, Staff Engineer Southwest Research Institute
Approved by:	D. Seymour, Chief Construction Projects Branch 1 Division of Construction Projects

Enclosure

EXECUTIVE SUMMARY

Chicago Bridge and Iron (CB&I) AREVA MOX Services (MOX Services)
Mixed Oxide (MOX) Fuel Fabrication Facility (MFFF)
NRC Inspection Report (IR) Number (No.) 70-3098/2015-004

The scope of the inspections encompassed a review of various MFFF activities related to Quality Level (QL)-1 (safety-related) construction for conformance to U.S. Nuclear Regulatory Commission (NRC) regulations, the Construction Authorization Request (CAR), the MOX Project Quality Assurance Plan (MPQAP), applicable sections of the license application and applicable industry standards. This inspection included, as applicable, the following inspection attributes: corrective action program, installation, test control, design control, and quality assurance program.

Routine Resident Inspections

The inspectors reviewed the applicant's construction project status meeting notes, reviewed the status of work packages maintained at various work sites, conducted daily tours of work and material storage areas, and observed installation of mechanical equipment. The inspectors verified that the licensee is identifying conditions adverse to quality and capturing them in their corrective action program. Construction activities were performed in a safe and quality-related manner. No findings of significance were identified (Section 2).

PSSC Inspections

The principle systems, structures and components (PSSCs) discussed in this inspection report included:

PSSC-021, Fire Barriers

Installation and Procedure Controls

The inspectors observed construction activities related to PSSC-021, Fire Barriers, as described in Table 5.6-1 of the MFFF CAR. The inspection attributes observed were procedure controls and installation. The associated items relied on for safety (IROFS) components were fire dampers located in the MOX Process Building (BMP). No findings of significance were identified (Section 3.a).

PSSC-036, MFFF Building Structure

Installation and Procedure Controls

The inspectors reviewed construction activities related to PSSC-036, MFFF Building Structure (including vent stack), as described in Table 5.6-1 of the MFFF CAR. The inspection attributes observed were procedures and installation. The associated IROFS component was the MFFF BMP temporary construction opening closures in Rooms C233. No findings of significance were identified (Section 3.b).

PSSC-024, Gloveboxes

Installation, Special Processes, and Procedure Controls

The inspectors observed construction activities and reviewed records related to PSSC-024, Gloveboxes, as described in Table 5.6-1 of the MFFF CAR. The inspectors observed ongoing installation and procedure control activities associated with the following gloveboxes:

- Precipitators (KCA 3000)
- Rotary Filter (KCA 7000)
- Calcinator (KCA 8000)
- Dosing Hoppers (KCB 1000)
- Sampling (KCB 2000)
- Transfer (KCB 3000)
- Fractionation (KCB 4000)
- Analysis (KCB 5000)
- Filling Cans (KCC 1000)
- Transfer (KCC 2000)

The inspection attributes observed were procedure controls, special processes and installation. The inspectors observed installation, alignment of the glovebox units, welding and procedure control activities associated with the gloveboxes. No findings of significance were identified (Section 3.c).

Programmatic Inspections

The requirements for problem identification and resolution specified in the MPQAP were implemented adequately. Measures were established to assure that conditions adverse to quality (CAQ), such as failures, malfunctions, deficiencies, deviations, defective material and equipment, nonconformances, and significant conditions adverse to quality, were promptly identified and corrected at the MFFF. The documentation and reporting of conditions adverse to quality were adequately performed in accordance with procedures and specifications. Quality Assurance records associated with these activities were properly maintained in accordance with project procedures. The inspectors also determined that MFFF had an adequate employee concerns program and provided sufficient training to their staff, that the staff were generally aware of the importance of having a strong safety conscious work environment and expressed a willingness to raise safety issues. No findings of significance were identified (Section 4.a).

Analysis of Structural Design Changes

The inspectors reviewed the adequacy of as-built Fuel Manufacturing Building (BMF) design for original design basis taking into account cumulative effects and found that the as-built BMF design is adequate because: (i) the as-built structural analysis acceptably incorporated major changes that occurred during BMF construction and followed industry accepted codes and standards and (ii) wall and slab panels, columns, and beams selected for code compliance verification represented BMF structure highest stressed components and conformed to American Concrete Institute code requirements. Based on this review, Inspector Follow up Item (IFI) 70-3098/2009-004-002, Review and Evaluate Responses from RCA-09-04, is closed (Section 5).

REPORT DETAILS

1. Summary of Facility Status

During the inspection period, the applicant (Chicago Bridge and Iron (CB&I) AREVA MOX Services (MOX Services)) continued construction activities of principle systems, structures and components (PSSCs). Construction activities continued related to closure of temporary construction openings (TCOs) related to walls in the MFFF Process Building (BMP). Other construction activities included staging of process piping and installation of supports in the Aqueous Polishing Building (BAP) and BMP, installation of process piping in the BAP, installation of ventilation system ductwork and supports in the BAP and BMP, installation of fire dampers in the BAP and BMP, and installation of various gloveboxes in the BAP and BMP. The applicant continued to receive, store, assemble, and test glove boxes and process equipment at the Process Assembly Facility (PAF).

2. Routine Resident Inspection Activities, (Inspection Procedure (IP) 88130, Construction: Resident Inspection Program for On-Site Construction Activities at the Mixed Oxide Fuel Fabrication Facility; and IP 88110, Quality Assurance: Problem Identification, Resolution, and Corrective Action)

a. Scope and Observations

The inspectors reviewed the applicant's construction weekly status meeting notes. The inspectors routinely held discussions with MOX Services design engineers, field engineers, quality control (QC) personnel, and construction personnel in order to maintain current knowledge of construction activities and any problems or concerns.

The inspectors routinely reviewed the status of work packages (WPs) maintained at various work sites. The inspectors monitored the status of WP completion to verify construction personnel obtained proper authorizations to start work, monitor progress and to ensure WPs were kept up-to-date as tasks were completed.

The inspectors routinely reviewed various corrective action documents. The review included non-conformance reports (NCRs) and condition reports (CRs). The inspectors also reviewed the closure of selected NCRs and CRs.

The inspectors routinely performed tours of the MOX Fuel Fabrication Facility (MFFF) work areas to verify that MOX Services' staging of piping, installation of ductwork, and installation of glove-boxes, installation of fire dampers met regulatory commitments and procedural requirements.

The inspectors conducted tours of material storage areas to determine if MOX Services was properly storing equipment and materials in accordance with MOX Project Quality Assurance Plan (MPQAP) storage requirements. Specifically, the inspectors assessed MOX Services compliance with Project Procedure (PP) 10-38, Storage and Control of Material.

The inspectors verified that installations of supports and glove boxes were in accordance with applicable field drawings and met the general construction notes.

The inspectors performed reviews of WPs and routine walk downs of the areas to verify adequate cleanliness. The inspectors performed routine walk downs of installed piping and tanks to ensure cleanliness control barriers were properly maintained.

b. Conclusions

The inspectors reviewed the applicant's construction project status meeting notes, reviewed the status of work packages maintained at various work sites, conducted daily tours of work and material storage areas, and observed installation of mechanical equipment. The inspectors verified that the licensee is identifying conditions adverse to quality and capturing them in their corrective action program. Construction activities were performed in a safe and quality-related manner. No findings of significance were identified.

3. PSSC Related Inspections

a. PSSC-021, Fire Barriers

(1) Attribute: Procedures (IP 55050, Nuclear Welding General Inspection Procedure)

(a) Scope and Observations

The inspectors observed construction activities related to PSSC-021, Fire Barriers, as described in Table 5.6-1 of the MFFF CAR. The inspection attributes observed were procedure controls and installation. The associated IROFS components were fire dampers located in the MOX Process Building (BMP).

Specifically, the inspectors observed the following fire dampers installed in the BMP:

HSA-DMPF 0115-13	HSA-DMPF 0184-B-01	HSA-DMPF 0150B-02
HAS-DMPF 0150-B-01	MDE-DMPF 184-B	MDE-DMPF 0150-B-02

Specifically, the inspectors verified that the stainless steel dampers were installed in accordance with the requirements set forth in DCS01-BMF-DS-PLF-A-04509, Revision 3, MOX Fuel Fabrication Facility Construction of Typical Fire Damper Penetration Details. The inspectors examined welds to determine whether welds formed a complete seal where required and that structural welds attaching flanges to the damper were adequate.

(b) Conclusion

The inspectors observed construction activities related to PSSC-021, Fire Barriers, as described in Table 5.6-1 of the MFFF CAR. The inspection attributes observed were procedure controls and installation. The associated IROFS components were fire dampers located in the MOX Process Building (BMP). No findings of significance were identified.

b. PSSC-036, MFFF Building Structure (including Vent Stack)

(1) Attribute: Design Control (IP 88130)

(a) Scope and Observations

The inspectors reviewed construction activities related to PSSC-036, MFFF Building Structure (including vent stack), as described in Table 5.6-1 of the MFFF CAR. The inspection attributes observed were procedures and installation. The associated IROFS component was the MFFF BMP temporary construction opening closure in Room C233

Specifically, the inspectors observed rebar and formwork installation associated with closure of the TCO in Room C233. The inspectors also observed the concrete after formwork removal to determine whether the concrete placements resulted in walls free of major concrete defects such as delamination, honeycombing or voiding. The inspectors reviewed construction specification DCS01-BKA-DS-SPE-B-09330-8, Placing Concrete and Reinforcing Steel for Quality Level 1, 2, 3 and 4, to determine whether concrete work was performed in accordance with the appropriate procedures.

The inspectors observed the installation of embed plates, as well as rebar and its attachment to embedded threaded couplers to determine whether they were installed in accordance with the requirements of American Concrete Institute (ACI)-349, Code Requirements for Nuclear Safety-Related Concrete Structures. Specifically, the inspectors observed the spacing of rebar, clear cover, lap length, and cleanliness of threaded connections. The inspectors also observed the use of a properly calibrated torque wrench (Serial Number CE7980) used to install the rebar.

(b) Conclusions

The inspectors reviewed construction activities related to PSSC-036, MFFF Building Structure (including vent stack), as described in Table 5.6-1 of the MFFF CAR. The inspection attributes observed were procedures and installation. The associated IROFS component was the MFFF BMP temporary construction opening closure in Room C233. No findings of significance were identified.

c. PSSC-024, Gloveboxes

(1) Attribute: Installation (IP 88130 and IP 55050 Nuclear Welding General Inspection Procedure)

(a) Scope and Observations

The inspectors observed construction activities and reviewed records related to PSSC-024, Gloveboxes, as described in Table 5.6-1 of the MFFF CAR. The inspectors observed ongoing installation and procedure control activities associated with the following gloveboxes:

- Precipitators (KCA 3000)
- Rotary Filter (KCA 7000)
- Calcinator (KCA 8000)
- Transfer (KCB 3000)
- Fractionation (KCB 4000)
- Analysis (KCB 5000)

- Dosing Hoppers (KCB 1000)
- Sampling (KCB 2000)
- Filling Cans (KCC 1000)
- Transfer (KCC 2000)

The inspection attributes observed were procedure controls, special processes and installation. The inspectors observed installation, alignment of the glovebox units, welding and procedure control activities associated with the gloveboxes. No findings of significance were identified.

The inspectors focused on the vendor weld quality of the gloveboxes and the attachment of the gloveboxes to existing embed plates in the BAP. Welds were inspected to determine whether gloveboxes were structurally sound and free from defects that would allow leakage. Welds were examined for defects such as cracks, lack of fusion, porosity and dimensional inadequacies.

The inspectors observed storage condition of the gloveboxes to determine whether adequate moisture, temperature, and cleanliness controls were implemented.

(b) Conclusions

The inspectors observed construction activities and reviewed records related to PSSC-024, Gloveboxes, as described in Table 5.6-1 of the MFFF CAR. The inspection attributes observed were procedure controls, special processes and installation. The inspectors observed installation, alignment of the glovebox units, and welding activities associated with the gloveboxes. No findings of significance were identified.

4. Programmatic Inspections

a. Quality Assurance: Problem Identification, Resolution and Corrective Actions (IP 88110)

(1) Scope and Observations

The inspection scope covered a review of quality related documents and activities related to QL-1 (safety-related) construction to verify conformance to NRC regulations, the MPQAP, and applicable industry standards. The purpose of the inspection was to evaluate programmatic implementation of the applicant's problem identification, resolution, and corrective action requirements as defined in the MPQAP.

The inspectors reviewed applicable portions of MOX Services' corrective action program (CAP) to assess its adequacy and whether it was effectively implemented. The inspectors reviewed procedures associated with problem identification and corrective actions. The inspectors reviewed several CRs and NCRs that were initiated by the applicant to verify that there was proper documentation, prioritization, and resolution of problems identified. The inspectors reviewed the classification of the condition, timeliness, and adequacy of corrective actions to verify compliance with the applicant's programs as outlined below.

(a) Procedures

The inspectors reviewed MOX Services' CAP implementing procedures to verify that changes were appropriately approved and implemented. Specifically, MOX PP3-5, Control of Nonconforming Items; and PP3-6, Corrective Action Process, were reviewed

to evaluate if the changes made to the procedures were consistent with requirements and commitments for identifying, reporting, and documenting conditions adverse to quality. During this inspection, the inspectors reviewed PP 3-6, to determine whether the applicant had a program for performing a sufficient analysis of conditions adverse to quality, and when required, the procedure instructed the applicant to perform corrective action(s) to prevent recurrence.

Additionally, the inspectors reviewed PP8-3, Evaluation and Reporting of Defects and Nonconformance (10 CFR Part 21), for identification, screening, and submittal of Part 21 reports. The inspectors reviewed this procedure to determine whether the procedure contained the appropriate provisions for screening and reporting Part 21 issues to the NRC.

The inspectors also reviewed PP3-11, Assessments; PP3-2, Trend Analysis; and PP3-25, Root Cause Analysis, to confirm that the procedures were consistent with requirements and commitments for identifying, reporting, and documenting conditions adverse to quality.

(b) Identification and Classification of Conditions Adverse to Quality (CAQ)

The inspectors reviewed a sample of closed CRs from the last 12 months to determine whether they: (1) were assigned a significance level consistent with the criteria in PP3-6; (2) had unique identifiers for tracking; and (3) adequately described the problem for which the CR was initiated. As part of MOX Services' CAP review, the inspectors reviewed PP3-6 guidelines for the management review committee (MRC) meeting. This was done to evaluate the applicant's process for the review of initiated CRs as well as the threshold for assigning significance levels to initiated CRs. The inspectors also reviewed the MRC evaluation process to determine whether the CRs had an approved corrective action plan used to preclude recurrence, as applicable and observed the MRC meeting to determine if the process was adequately implemented.

The inspectors reviewed a sample of NCRs and verified that they had unique identifiers, provided an adequate description of the nonconforming condition, and were issued for material non-conformances that were within the scope of the NCR-related deficiencies identified in PP3-5. The inspectors also verified that nonconforming conditions were appropriately assigned significance levels, evaluated, and the dispositions were approved as required.

(c) Documentation and Reporting of CAQs

The inspectors reviewed a sample of CRs from different areas to verify that the applicant implemented an adequate process for documenting and reporting conditions adverse to quality. The inspectors verified that the CRs were appropriately reviewed to determine if the extent of condition was documented, the remedial action(s) completed in a timely manner and documentary evidence was documented within the CR.

The inspectors also reviewed the management assessment reports as well as surveillances to determine whether the results were distributed to the appropriate organizations and management, corrective action were initiated as necessary, and that they met the procedural requirements.

The inspectors reviewed fifteen 10 CFR Part 21 evaluation forms and associated CRs and NCRs from the past year. The forms were evaluated to verify that potential significant conditions adverse to quality were adequately evaluated and the process was properly implemented.

(d) Follow-up, Closure, and Trending

The inspectors reviewed Quality Assurance Audit Report No. SA-15-A04 as well as the following management assessments:

- Calendar Year (CY) 15-A-QA-077, Project Assurance Activity Assessment of CR/NRC Programs
- CY15-A-QA-004, Verification of the QC receipt UNSAT Log's Compliance with PP3-28 Requirements
- CY15-A-MC-021-0, 2015 Activity Assessment Process Unit Design and Commissioning Condition Reports

The inspectors also reviewed trend analyses SQAP-040 and SQAP-041 to verify that they were done in accordance with the procedure and MPQAP and that adverse trends were correctly identified and entered into the corrective action program.

During this review, the inspectors verified that CRs were initiated as a result of audit findings representing a CAQ. In addition, the inspectors verified that CRs were initiated as a result of NRC findings identified during the last 12 months and that the CAQs were appropriately entered into the corrective action program and the adverse conditions were corrected or in the process of being corrected.

(e) Employees Concern Program (ECP)

The inspectors evaluated the applicant's Safety Conscience Work Environment (SCWE) through a review of PP 3-1, Employee Concerns Program, Revision (Rev.) 8, a review of the SCWE surveys that were conducted annually at the MFFF, and interviews that were conducted by the inspectors pertaining to SCWE at the MFFF. NRC staff verified that actions or tasks that resulted from MOX Services SCWE survey results were tracked in the MOX Services Action Tracker system. These Action Trackers documented MOX Services follow-up of SCWE issues, and, included implementation of appropriate action where necessary.

The NRC inspection included a review of MOX Services SCWE survey results from 2012 to 2015. In general, the SCWE survey results showed an improving work environment since 2012. The 2015 MOX SCWE survey results provided a yearly comparison of the overall annual results. The 2015 overall results showed improvement compared to the 2014 overall results, which likewise showed improvement compared to the 2013 overall results.

The NRC inspection also included a total of ten interviews of contractor and non-contractor (MOX Services) employees. All individuals interviewed indicated that they would be willing to raise a safety concern or report errors and that there were no conditions under which they would be hesitant to raise a safety concern or report errors. All individuals interviewed indicated that they would go to their supervisor, corrective

action program, or the ECP to raise a safety concern or report an error. Only one individual indicated that he would be hesitant to raise a safety, quality, or compliance concern to the NRC.

The inspectors also verified that MOX Services had an adequate ECP that provided sufficient training to their staff, and that the staff were generally aware of the importance of having a strong SCWE.

The inspectors verified that employees coming onto the site were required to have training on the applicant's CAP and the applicant's ECP process as part of the General Employee Training. The ECP is also included in the Consolidated Annual Training program required at the MFFF.

(2) Conclusions

The requirements for problem identification and resolution specified in the MPQAP were implemented adequately. Measures were established to assure that CAQs, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, nonconformances, and significant conditions adverse to quality, were promptly identified and corrected at the MFFF. The documentation and reporting of conditions adverse to quality were adequately performed in accordance with procedures and specifications. QA records associated with these activities were properly maintained in accordance with project procedures. The inspectors also determined that MFFF had an adequate ECP and provided sufficient training to their staff, that the staff were generally aware of the importance of having a strong SCWE and expressed a willingness to raise safety issues. No findings of significance were identified.

5. Follow-up of Previously Identified Items (IP 88110)

a. (Closed) Inspector Follow-up Item (IFI) 70-3098/2009-004-002, Review and Evaluate Responses from RCA-09-04

(1) Scope and Observations

The applicant performed Root Cause Analysis (RCA)-09-004 in response to CR 2009-0168 and specifically discussed concrete defects incurred during placement; clear cover issues that resulted in the impacting of the design "d" (effective depth) dimension; and construction discrepancies between design calculations, design drawings and vendor drawings.

Based on the root causes identified in RCA-09-004, Rev. 2, the inspectors requested the applicant provide documentation establishing the acceptability of the as-built configuration of the applicable structures at the MFFF taking into account the various non-conformances identified from a bounding perspective. The applicant informed the inspectors that MOX Services had evaluated the acceptability of the as-built configuration with documentation provided in CR 09-0399.

The applicant issued CR 09-0399, Cumulative Effect of Structural Issues on ANSYS, to conduct three dimensional structural analysis for the final MFFF as-built condition, and to assess the effect of all of the design changes made, during construction, to the structural and foundation systems of the Fuel Manufacturing Building (BMF). The purpose of this

structural analysis was evaluate the final as-built structure under all loading combinations.

The inspectors performed a review of the cumulative effects analysis and post-cumulative effects activities of the BMF performed by MOX Services. The cumulative effects analysis also included validation of the as-built BMF for original design basis by accounting for significant design changes made during the construction of the BMF.

The MOX Services analysis, design, construction, redesign, reanalysis, retrofitting, and as-built validation for original design basis of the BMF were divided into four phases for this inspection report:

- Analysis and design prior to the start of construction of the BMF.

- Reanalysis, redesign, or retrofitting of components on a case-by-case basis due to numerous intermediate changes made to the design during the construction of the BMF or due to construction non-conformances.

- As-built analysis of BMF which considered the combined impact of significant design changes that occurred during the construction of BMF or due to construction non-conformances. This phase included validation of as-built BMF for original design basis taking into account the results of cumulative effects analysis. This analysis was based on the construction drawings up to July 26, 2012, called the freeze date. This phase of activities was designated by MOX Services as the Cumulative Effects Analysis.

- Redesign, reanalysis, or retrofitting of components on a case-by-case basis due to changes made to the BMF design since the July 26, 2012 freeze date. This phase of activities was designated by MOX Services as the Post-Cumulative Effects Activities.

The four phases of activities are briefly discussed in DCS01-BMF-DS-NTF-B-01346-1, Executive Summary of BMF Cumulative Effects Structural Evaluation (hereafter called executive summary report). The scope of this inspection of facility changes included the review of the following two areas: (1) Cumulative Effects Analysis, and (2) Post-Cumulative Effects Activities. The inspectors reviewed overall aspects of these two areas and performed detailed review of selected representative items provided in the executive summary report. The activities included review of as-built analysis and redesign, retrofitting, and as-built validation for original design basis; interview of MOX Services structural and seismic engineers; review of structural modeling and analysis computer demonstration; inspection of selected retrofitted components; and interview of MOX Services design and construction engineers.

(a) Cumulative Effects Analysis

The inspectors reviewed the list of major changes of the BMF provided in the executive summary report that were incorporated into the cumulative effects analysis. These changes included significant penetrations, wall thickness and location change, gabion

wall height reduction, increase in roof thickness, geometry changes of walls and slabs near the direct oxidation process area, and incorporation of controlled low strength material (CLSM).

i) As-Built Structural Analysis

In modeling, the major design changes of the BMF occurred by the freeze date as provided in the executive summary report. Calculation DCS01-XGA-DS-CAL-B-01401-1 made a number of idealizations, simplifications, and assumptions. Penetrations that were more than approximately 10 feet by 10 feet in size were modeled discretely. The groups of smaller penetrations were conservatively modeled as one large penetration. However, the effects of isolated smaller penetrations were assumed to be insignificant for load path and distribution of load. The changes to the wall thickness and location were incorporated in the ANSYS model based on the updated construction drawings up to the freeze date.

The gabion wall changes were incorporated in the modeling through changes in the wall height and the corresponding changes of the number of tieback beams connecting the gabion wall to BMF structure and amount of rock fill between gabion wall and BMF wall. The ANSYS model incorporated changes in roof slab thickness, rock layer and cover slab. Geometry changes of walls and slabs near direct metal oxidation process area was incorporated in the cumulative effects analysis model by removal of a wall, addition of penetrations, and modification of floor loading as discussed in Design Change Request (DCR) 12-0530, DCR 12-0531, and DCR 12-0532.

Since the compressibility of CLSM was verified to be similar to engineered fill, no update was needed in previous backfill model that was composed partly of CLSM and partly of engineered fill. However, CLSM properties were conservatively used to develop soil lateral load because CLSM developed higher lateral pressure than engineered fill. Calculation DCS01-XGA-DS-CAL-B-01401-1 assumed that the modifications made to BMF since the freeze date did not have any significant effect on the structure. Engineering Change Request (ECR)-027031 provided detailed justification to demonstrate that the dynamic properties of as-built BMF did not change significantly from those of preconstruction BMF and thus input accelerations from calculation DCS01-XGA-DS-CAL-B-01069-0 were acceptable for use with the cumulative effects model.

The NRC staff finds that the list of major changes of BMF provided in the executive summary report is acceptable because it was based on the detailed information provided in various CRs, engineering change requests (ECRs), DCRs, NCRs, and NRC inspection reports. The NRC staff determined that the redesign methodology, modeling technique, and cumulative effects structural analysis of BMF were acceptable because they conformed to design and analysis codes and standards [e.g., ACI 349-97 (ACI, 1998); American Society of Civil Engineers (ASCE) 4-98, Seismic Analysis of Safety-related Nuclear Structures and Commentary, (ASCE, 2000)], and were either better or similar to those used prior to the construction of BMF.

ii) Validation of As-Built BMF Design for Original Design Basis Taking into Account Cumulative Effects

The inspectors reviewed the validation of as-built BMF design for original design basis taking into account cumulative effects as provided in the executive summary report. Based on as-built BMF configuration and available analysis results, highest stressed structural components were selected to achieve the validation goal. Column lines were selected for the north-south walls and the east-west walls. The walls were selected for the full length from one side to the other and from roof to the foundation. Additional walls and slabs which did not maintain a 10% project design margin in previous analyses were also selected. The selected walls and slabs were broken into panels which is referred to as a wall or slab portion that is bounded by intersecting walls and slabs. A total of 356 wall and slab panels representing worst case panels were selected. All columns and beams were also selected for validation.

The wall and slab panels, columns, and slabs were validated with consideration of design changes, construction non-conformances that resulted in reduced reinforcement conditions, discounting of epoxy reinforcement, alternate method for hook bar development length calculation, discounting of selected duplicating structural model elements, reinforcement ductility, construction sequence, and selected reduction of 10% design margin as discussed in the executive summary report.

Validation calculation DCS01-XGA-DS-CAL-B-01109-3 took the output of as-built structural analysis calculation DCS01-XGA-DS-CAL-B-01401-1 as input to perform evaluation of wall and slab panels, columns, and beams using Microsoft Excel Spreadsheets, including the Solver Macro, for ACI 349-97 (ACI, 1998) code compliance. This calculation qualified all the selected wall and slab panels, columns, and beams. Validation of the selected beams, columns, and wall and slab panels which were the highest stressed components with cumulative effects constituted the validation of the BMF design for original design basis.

(b) Post-Cumulative Effects Activities

The inspectors reviewed the list of changes of BMF provided in the executive summary report that were not incorporated into the cumulative effects analysis. These changes were made in the design during construction of BMF based on post freeze date construction drawing. These changes included modification of a BMP wall between the column lines for a fire door, removal of a portion of concrete wall between column lines, precast slab supports modification, fuel assembly storage area walls height extension, remediation for missing U-bars in temporary construction openings (TCOs) closures on N lines, and closure of large penetrations.

An ANSYS sub-model was created for the modified BMP wall described in ECR-023131. The analysis results were analyzed in the Solver Macro Spreadsheet and the modified wall section was found to be qualified with only localized impact. Executive summary report and ECR-009075 presented the sub-modeling and qualification of wall and slab sections in the proximity of concrete wall between column lines where concrete was removed to allow for access of a concrete rod pusher machine. This removal of concrete resulted in only local impact. The design of a modified precast slab support

was required because of the presence of numerous inadequate welds in the original design. The design and qualification of the new support was provided in a series of ECRs such as ECR-000875, ECR-025929, and ECR-026117. The support modification did not require any changes to the cumulative effects structural analysis model.

ECR-013197 provided a description of the impacted walls in the fuel assembly area to be taken out by hydro-lancing without affecting the reinforcement to accommodate the design changes pertaining to the fuel rod lengths. ECR-013197 qualified these walls whose modification had only localized impact.

At several locations of TCO U-bars could not be installed. ECR-026905 used reinforcement reduction factor to modify the interaction ratios to consider missing U-bars. This did not require any changes to the cumulative effects structural analysis model. Due to HVAC equipment modifications, two penetrations in a wall were closed as discussed and qualified in ECR-021239. This closure increased the strength, stiffness, and mass in the reinforced concrete fill but would have negligible impact on the structure.

The NRC staff finds that these post-cumulative effects activities were localized and the reanalysis, redesign, or both involved only local areas, including sub-modeling of the proximity area. The reanalysis, redesign, and retrofitting were conducted using techniques specified in codes and standards [e.g., ASCE 4-98 (ASCE, 2000)], including using standard sub-structuring technique for sub-modeling analysis of the proximity area. No changes to the cumulative effects structural analysis model were required.

(2) Conclusions

The inspectors reviewed the adequacy of as-built BMF design for original design basis taking into account cumulative effects and found that the as-built BMF design is adequate because: (i) as-built structural analysis acceptably incorporated major changes that occurred during BMF construction and followed industry accepted codes and standards [e.g., ASCE 4-98 (ASCE, 2000)] and (ii) wall and slab panels, columns, and beams selected for code compliance verification represented BMF structure highest stressed components and conformed to ACI 349-97 (ACI, 1998) code requirements. Based on this review, IFI 70-3098/2009-004-002, Review and Evaluate Responses from RCA-09-04, is closed.

6. Exit Interviews

The inspection scope and results were summarized throughout this reporting period and by the Senior Resident Inspector at an exit meeting with applicant senior management on January 7, 2016. Dissenting views were not expressed by 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.

SUPPLEMENTAL INFORMATION

1. PARTIAL LIST OF PERSONS CONTACTED

R. Alley, Engineering Assurance Manager
A. Chiaramonte, NCR Coordinator
N. Daniel - Site Superintendent 2
D. Del Vecchio, President and Chief Operating Officer
M. Gober, Vice President, Engineering
D. Gwyn, Licensing/Nuclear Safety Manager
D. Howard - Engineer III
D. Ivey, Project Assurance Manager
R. Justice, QA Programs Manager
J. Keklak, QA Manager
B. Kennedy - Engineer III
S. King, Vice President, Operations
T. Lynch - Technical Consultant
A. Olorunniwo, Civil/Structural Manager
E. Radford, Regulatory Compliance
G. Rousseau, Executive Vice President, Deputy Project Manager
T. Daud Al-Shawaf - Technical Consultant
M. Stewart - Principal Engineer
D. Yates, Licensing
L. Zahl, Regulatory Compliance

2. INSPECTION PROCEDURES (IPs) USED

IP 88110	Quality Assurance: Problem Identification, Resolution, and Corrective Action)
IP 88130	Resident Inspection Program For On-Site Construction Activities at the Mixed-Oxide Fuel Fabrication Facility
IP 55050	Nuclear Welding General Inspection Procedure

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Item Number	Status	Description
70-3098/2009-04-02	Closed	IFI: Review and Evaluate Responses from RCA-09-04 (Section 5.a).

4. LIST OF ACRONYMS USED

ACI	American Concrete Institute
ASCE	American Society of Civil Engineers
AWS	American Welding Society
BAP	Aqueous Polishing Building
BMF	Fuel Manufacturing Building
BMP	MOX Process Building
CAQ	Condition Adverse to Quality
CAR	Construction Authorization Request

CB&I	Chicago Bridge and Iron
CIB2, 3	Construction Inspection Branch 2, 3
CLSM	Controlled Low Strength Material
CPB1, 2	Construction Projects Branch 1, 2
CR	Condition Report
CY	Calendar Year
DCP	Division of Construction Projects
DCR	Design Change Request
ECP	Employee Concerns Program
ECR	Engineering Change Request
FTS	Fluid Transport System
IFI	Inspection Follow-Up Item
IP	Inspection Procedure
IR	Inspection Report
IROFS	Items Relied on for Safety
KCD	Oxalic Mother Liquors Recovery
KDB	Dissolution Unit
MFFF	MOX Fuel Fabrication Facility
MOX	Mixed Oxide
MOX Services	CB&I AREVA MOX Services
MPQAP	MOX Project Quality Assurance Plan
MRC	Management Review Committee
NCR	Non-conformance Report
No.	Number
NRC	Nuclear Regulatory Commission
NTM	Jar Storage and Handling Unit
PAF	Process Assembly Facility
PP	Project Procedure
PRE	Grinding
PSJ	Ground and Sorted Pellet Storage
PSSC(s)	Principle System(s), Structure(s), and Component(s)
QA	Quality Assurance
QC	Quality Control
QL	Quality Level
QL-1	Quality Level 1
RCA	Root Cause Analysis
RII	Region II
Rev.	Revision
SCWE	Safety Conscious Work Environment
TK	Tank
TCO	Temporary Construction Opening
WP	Work Package

5. LIST OF PSSCs REVIEWED

PSSC-021	Fire Barriers
PSSC-024	Gloveboxes
PSSC-036	MFFF Building Structure

6. RECORDS AND DOCUMENTS REVIEWED

Audits, Surveillances, and Assessments

Audit Report No. SA-15-A04
CY15-A-QA-077, Project Assurance Activity Assessment of CR / NRC Programs
CY15-A-QA-004, Verification of the QC receipt UNSAT Log's Compliance with PP3-28 Requirements
CY15-A-MC-021-0, 2015 Activity Assessment Process Unit Design and Commissioning Condition Reports

Condition Reports

10888-MOX-CR-15-298, Skew-T Fillet Welds KDB TK4000
10888-MOX-CR-15-066, Mechanical Couplers Not Installed / Inspected Per Manufacturer's Installation Instructions
10888-MOX-CR-14-344, Weld overlay of CJP Weld / No Weld Joint Design
10888-MOX-CR-14-294, Failure to Update Active Work Package Every 7 Days
10888-MOX-CR-15-112, Welds do not meet code requirements on SMCI precast embed plates
10888-MOX-CR-14-471, Verification of adequacy of extent of condition investigation
10888-MOX-CR-14-338, Improper Welding Technique
10888-MOX-CR-14-316, QL-1 storage
10888-MOX-CR-15-225, Missed Weld Symbol
10888-MOX-CR-15-057, NTM Stainless steel headed studs with cracks or bursts
10888-MOX-CR-14-340, Rod Room Stationary Oven Power Failure
10888-MOX-CR-14-320, Material Storage in Violation of PP10-37
10888-MOX-CR-15-316, Minimum Weld Size Code Requirements Not Met
10888-MOX-CR-14-376, NTM Process Unit Vendor Seal Welds Not Specifically Called Out Per AWS Requirements
10888-MOX-CR-14-317, Level B Storage Area Requirements
10888-MOX-CR-14-339, Carbon Steel Rake Placed on Top of Stainless Piping
10888-MOX-CR-14-254, Failure of Welder to Return Weld Filler Material
10888-MOX-CR-14-266, Weld Repair without WDS
10888-MOX-CR-14-281, CR not Initiated When Required
10888-MOX-CR-14-295, Nonconforming Material Not Controlled
10888-MOX-CR-14-298, Loss of Rod Oven Temperature Log Sheets
10888-MOX-CR-14-305, Bypassed Welding Hold Point
10888-MOX-CR-14-292, Use of QL-4 material in a QL-1 application.
10888-MOX-CR-14-314, Fillet Weld Termination Not Per AWS D1.6
10888-MOX-CR-14-333, QL-4 Material installed in QL-2 application
10888-MOX-CR-14-352, Missing Weld Data Sheets
10888-MOX-CR-14-377, Missing Weld Documentation
10888-MOX-CR-14-390, Inadequate Installation Practices.
10888-MOX-CR-14-403, C110 Welder violated WTS
10888-MOX-CR-14-440, Missing Weld on Seismic Link
10888-MOX-CR-14-445, MFFF Pipe & Supports Status of Completion
10888-MOX-CR-14-476, Missing Weld Docs (C121-PS-00015)
10888-MOX-CR-15-017, Incorrect Preparation and Review of Weld Data Sheets
10888-MOX-CR-15-028, Improper Documentation of Weld Inspection

10888-MOX-CR-15-139, Incorrect Weld Filler Material
10888-MOX-CR-15-160, GTAW Welding Activities
10888-MOX-CR-15-280, Loss of Traceability
10888-MOX-CR-15-350, Unsatisfactory Welding Trend
10888-MOX-CR-15-364, Welding Without Filler Material
10888-MOX-CR-14-258, NCR Issues: Configuration Management Not Maintained, QL Misidentified, Noncompliant Dispositions
10888-MOX-CR-14-261, Temporary Modifications Not Restored In Accordance With IAT Requirements
10888-MOX-CR-14-335, Pipe Bending
10888-MOX-CR-14-351, Failure to Submit PP8-6 to Licensing for Approval
10888-MOX-CR-14-407, Confirmation Required Database Discrepancies
10888-MOX-CR-14-424, Section VIII Code Data Plate Removal
10888-MOX-CR-14-474, Extent of Condition Investigation Deficiencies
10888-MOX-CR-15-027, Differing Interpretations of FTS Material Corrosion Test Requirements
10888-MOX-CR-15-203, Bypassed Hold Point
10888-MOX-CR-15-222, Hilti Anchor hold point skipped.
10888-MOX-CR-15-281, Loss of Traceability
10888-MOX-CR-15-285, Fabrication out of tolerance on Fire Damper
10888-MOX-CR-14-272, Housekeeping and Project Controls for Material Storage
10888-MOX-CR-14-323, Trend Analysis Reporting Deficiencies
10888-MOX-CR-14-358, Testing Completed Before Final Verification of NDE in Welding Documentation
10888-MOX-CR-14-372, Unapproved ECR Used as Basis of Revision
10888-MOX-CR-14-393, Deficiencies Not Entered Into Corrective Action System
10888-MOX-CR-14-433, Improper Separation of Class 1E Cable/Wire
10888-MOX-CR-14-482, Work Performed Without Specific Work Step for Craft and MOX CE Verification
10888-MOX-CR-15-016, Failure to Preserve KPC TK4000/4500 Post-Installation
10888-MOX-CR-15-031, PP11-61 (Progressive Examination) and PP11-64 (Weld Mapping and Data Sheets) Violation
10888-MOX-CR-15-055, Work Not Performed as Outlined in NCR Disposition
10888-MOX-CR-15-069, By-passed Hold Point / 14-C145-DRIP-2079-FW014-C0R0
10888-MOX-CR-15-098, OOT Gasket Groove in Seismic Links
10888-MOX-CR-15-101, CodeMan Software Malfunction
10888-MOX-CR-15-104, Cumulative Effect Calculations may Contain Superseded Information or Not Current Information.
10888-MOX-CR-15-143, Clarify CGD Acceptance Requirements
10888-MOX-CR-15-175, 325SB Welds Unacceptable
10888-MOX-CR-15-180, Additional Work Step Controls
10888-MOX-CR-15-188, Bypassed Hold Point
10888-MOX-CR-15-255, Work Performed Without Job Steps
10888-MOX-CR-15-257, C234-PS-06900 Discontinuities
10888-MOX-CR-15-300, Nonconforming Material Worked Without Authorization
10888-MOX-CR-15-301, Nonexistent Torque Table
10888-MOX-CR-15-313, Violation of Procurement Procedures
10888-MOX-CR-15-327, Noncompliant Disposition Approved by All Reviewers
10888-MOX-CR-15-353, Nonconforming Material Worked Without Disposition Authorization
10888-MOX-CR-15-004, Unaccounted-for Nonconforming Items

10888-MOX-CR-15-081, Items for Axial Load Test Not MOX QC Receipt Inspected
10888-MOX-CR-15-122, PSJ M04 Plates Welded Out in Wrong Location
10888-MOX-CR-15-187, Bypassed Hold Point
10888-MOX-CR-15-242, Damaged Duct
10888-MOX-CR-15-279, Delinquent NCR Reviews
10888-MOX-CR-15-303, Visual Pin Hole Noticed in Vendor Weld in GME GB*6300
10888-MOX-CR-15-343, Weld Altered After Final Inspection
10888-MOX-CR-14-300, Loose Parts not Found
10888-MOX-CR-14-344, Weld Overlay Of CJP Weld / No Weld Joint Design
10888-MOX-CR-14-400, Out of Cal Equipment Not Adequately Addressed in a Timely Manner
10888-MOX-CR-14-418, Incomplete Documentation of Final Attributes
10888-MOX-CR-15-056, Mismatched Support Components
10888-MOX-CR-15-130, Stud Welding
10888-MOX-CR-15-138, Room C334 Drip Tray Missing Weld Documentation
10888-MOX-CR-15-173, NTM*EJ1000F Bellows
10888-MOX-CR-15-211, Incorrect Specification Used for Procurement of Welded Threaded Studs
10888-MOX-CR-15-269, Manufacturing Instructions are not Consistently Identifiable for WPS/Mech Pen Deficiency Resulted
10888-MOX-CR-15-320, CGIE Contains Conflicting Requirements for Dimensional Verification
10888-MOX-CR-15-356, Damage to Structo-Crete
10888-MOX-CR-15-237, Unapproved Modification of QL-1 HVAC Equipment
10888-MOX-CR-14-457, Work Performed Without Work Controlling Documentation and/or Design Engineering Approval.
10888-MOX-CR-14-451, Failure to Initiate a CR
10888-MOX-CR-14-389, SA 14 A04 Audit Findings Related to Commercial Grade Dedication
10888-MOX-CR-14-396, NCRS Closed Prior to Completion of Corrective Actions
10888-MOX-CR-14-379, Inadequate Completion of CR-12-311

Design Change Requests (DCRs)

DCR 12-0530 DCR 12-0531 DCR 12-0532

Engineering Change Requests (ECRs)

ECR-023131, Rev. 0
ECR-013197, Rev. 2
ECR-000875, Rev. 5
ECR-026117, Rev. 5
ECR-027031, Rev. 0
ECR-009075, Rev. 0
ECR-026905, Rev. 0
ECR-025929, Rev. 2
ECR-021239, Rev. 3

Nonconformance Reports

10888-MOX-NCR-14-5767
10888-MOX-NCR-14-5805
10888-MOX-NCR-14-5841
10888-MOX-NCR-15-6079
10888-MOX-NCR-14-5912
10888-MOX-NCR-14-5783
10888-MOX-NCR-14-5815
10888-MOX-NCR-15-6024
10888-MOX-NCR-14-5812
10888-MOX-NCR-15-6094

10888-MOX-NCR-14-5808
10888-MOX-NCR-15-6011
10888-MOX-NCR-14-5751
10888-MOX-NCR-14-5841
10888-MOX-NCR-15-5982
10888-MOX-NCR-15-6274
10888-MOX-NCR-15-6504
10888-MOX-NCR-15-6362
10888-MOX-NCR-14-5899
10888-MOX-NCR-14-5836
10888-MOX-NCR-15-6255
10888-MOX-NCR-14-5802
10888-MOX-NCR-14-5959
10888-MOX-NCR-15-6234
10888-MOX-NCR-15-6461
10888-MOX-NCR-15-6560
10888-MOX-NCR-14-5812

Part 21 Evaluation Reports

2014 21, Part 21 Evaluation of intermediate plate welds of glovebox (KDA*GB3500) supplied by Wright Industries.
2014 29, Part 21 Evaluation of confinement welds on PML gloveboxes fabricated by Flanders
2015 11, Part 21 Evaluation of seal weld within GME*GB2000 performed by Keller Technology
2015 13, Part 21 Evaluation of SMCI welds of angle miter joints on embed plate for Active Gallery
2015 18, Part 21 Evaluation of pinhole leak in vendor weld - Precision Custom Components
2014 19, Part 21 Evaluation of pitting on pipe coming off of KCA*DMST8500 provided by Frenuc
2014 30, Part 21 Evaluation of missing welds in seismic links supplied by Hyspan
2015 02, Part 21 Evaluation of HRC QL-1 Couplers
2015 07, Part 21 Evaluation of SMCI Embed Plates - Part 21 Report Issued
2015 16, Part 21 Evaluation of fasteners supplied by Nova Machine Products
2014 24, Part 21 Evaluation of PSJ Storage Racks Supplied by Peterson
2014 34, Part 21 Evaluation of parts fabricated by Robatel for KCB*GB1000
2015 04, Part 21 Evaluation of torque wrench used by Marks Brothers (MBI) in assembly of flanges for KCD*EV5000
2015 09, Part 21 Evaluation of "out of calibration" pressure gauge used by Diversified Metal Products (DMP)
2015 15, Part 21 Evaluation for Flanders Filter Housings

Project Procedures

PP 03-01, Rev. 8, Employee Concerns Program
PP 03-02, Rev. 5, Trend Analysis
PP 03-05, Rev. 11, Control of Nonconforming Items
PP 03-06, Rev. 17, Corrective Action Process
PP 03-11, Rev. 11, Self-Assessments
PP 03-25, Rev. 4, Root Cause Analysis
PP 08-03, Rev. 6, Evaluation and Reporting of Defects and Noncompliance (10 CFR Part 21)

Technical Reports

ACI 349-97, Code Requirements for Nuclear Safety-Related Concrete Structures, 1998
ASCE 4-98, Seismic Analysis of Safety-Related Nuclear Structures and Commentary, 2000
DCSOI-XGA-DS-CAL-B-01068, Structural Analysis of the BMF Structure, Rev. 7
DCS01-XGA-DS-CAL-B-01078, BMF Interior, Exterior Walls and Columns Reinforced Concrete Design, Rev. 8
DCS01-XGA-DS-CAL-B-01401, Structural Analysis of As-Built Configuration of the BMF Structure, Rev. 1
DCS01-XGA-DS-CAL-B-01109, Cumulative Effect of BMF Concrete Structural Issue on Original ANSYS Analysis, Rev. 3
DCS01-XGA-DS-CAL-B-01064, Methodology and Assumptions for BMF Finite Element Analysis, Rev. 1
DCS01-XGA-DS-CAL-B-01112, BMF-Evaluation of Reinforced Concrete Structure for Construction Sequence, Rev. 0
DCS01-XGA-DS-CAL-B-01565, Analysis & Evaluation of MFFF Building for Beyond Design Basis, Rev. 1
DCS01-AAJ-DS-DOB-B-40103, Basis of Design for Structures, Rev. 3
DCS01-XGA-DS-CAL-B-01069, Soil-Structure Interaction Analysis of MOX Fuel Fabrication Building, Rev. 0
DCS01-XGA-DS-CAL-B-01101-1, Study for Using Controlled Low Strength Material (CLSM) Locally and Analysis Update of BMF Structure
DCS01-BMF-DS-NTF-B-01346-1, Executive Summary of BMF Cumulative Effects Structural Evaluation
Skidmore, T.E., D.N. Maxwell, and S.R. Howard, MOX Ledger Plate Weld Examination and Material Analysis (U), SNL-TR-2015-00159, Aiken, SC: Savannah River National Laboratory, June 2015
Pinc, R.l., M. D. Watkins, and J.O. Jirsa, Strength of Hooked Bar Anchorages in Beam-Column Joints, CESRL Report No. 77-3, Austin, TX: The University of Texas, November 1977
Jirsa, J.R., J.L. Marques, A Study of Hooked Bar Anchorages in Beam-Column Joints, Austin, TX: The University of Texas, July 1972
Johnson, L.A., J.O. Jirsa, The Influence of Short Embedment and Close Spacing on the Strength of Hooked Bar Anchorages, PMFSEL Report No. 81-2, Austin, TX: The University of Texas, April 1981