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AUG 03 2011

LES-11-00100-NRC

Attn: Document Control Desk
Office of Nuclear Safety and Safeguards
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

Louisiana Energy Services, LLC
NRC Docket No. 70-3103

Subject: Request for Exception to License Condition 10.f of Materials License SNM-2010

Reference:
1. NRC Inspection Report No. 70-3103/2011-010 and Notice of Violation, dated June 22, 2011
2. LES-11-00101-NRC, Reply to Notice of Violation 70-3103/2011-010, dated August 3, 2011

On the basis of the Ref. 1 Notice of Violation (Enclosure 1); in support of the Ref. 2 Reply; and consistent with related discussions held with the NRC Headquarters and Region II Staff, URENCO USA (UUSA) herewith requests a one-time exception to the requirements of License Condition 10.f of Materials License SNM-2010 (see Enclosure 2). This exception request specifically addresses Examples 1 and 3 of Violation A of the Ref. 1 Notice, the bases for which are Sections 21 and 21.8, respectively, of the UUSA Quality Assurance Program Description (QAPD).

Should there be any questions regarding this submittal, please contact Perry Robinson, VP Regulatory Affairs, at 575.394.6598.

Respectfully,

David E. Sexton
Chief Nuclear Officer and Vice President of Operations

Enclosure: Request for Exception to License Condition 10.f of Materials License SNM-2010

IE07

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ENCLOSURE 1

REPLY TO NOTICE OF VIOLATION (NOTICE) 70-3103/2011-010

Restatement of Violation:

During a Nuclear Regulatory Commission (NRC) inspection conducted from April 25 through May 25, 2011, a violation of NRC requirements was identified.

In accordance with the NRC Enforcement Policy, the violation is listed below:

A. Special Nuclear Material (SNM) License No. 2010 requires, in part, that the licensee shall conduct authorized activities at the Louisiana Enrichment Services, L.L.C. (LES) National Enrichment Facility (NEF) in accordance with statements, representations, and conditions in the approved Quality Assurance Program Description (QAPD), dated January 6, 2011, and supplements thereto.

Section 21.15, Nonconforming Items, of the QAPD states, in part, that "Controls for the Nonconforming Items for the QL-1G Program shall be in accordance with the requirements of Section 15 of the QAPD."

Section 15, Nonconforming Items, of the QAPD states, in part, that a process shall be developed to document, provide notification, evaluate, review and approve nonconforming items. The review shall also include determining the need for additional corrective actions. The disposition, such as "use-as-is," "reject," "repair," or "rework," of nonconforming items shall be identified and documented. The technical justification for the acceptability of a nonconforming item that has been dispositioned "repair" or "use-as-is" shall be documented.

LES procedure EG-3-2100-09, Rev. 5, Identification, Disposition, and Resolution of Nonconforming Items, states, in part, in paragraph 5.1.2 d. 1) Dispositions of "repair" or "use-as-is" require technical justification for the acceptability of the nonconforming item to be documented and shall be subject to design control measures commensurate with those applied to the original design.

Contrary to the above, before May 25, 2011, the licensee failed to provide an adequate technical justification to support the "use-as-is" disposition of NCR 2009-0889. Specifically, the licensee failed to resolve the differences between the Quality Level (QL) -1 G requirements and the QL-3 as-installed condition of the Cylinder Receipt and Dispatch Building (CRDB) foundation/footing system which required the Nonconformance Report (NCR) to be generated. The acceptability of the CRBD foundation/footing system was not adequately verified, as evidenced by the following examples:

1. LES NEF failed to adequately demonstrate that Quality Control (QC) inspections performed by Field Engineers (FE) met the applicable QL-1G requirements for QC inspections credited in the technical evaluation for NCR 2009-0889. Section 21 of the QAPD states, in part, that construction activities shall be performed in accordance with documented work instructions. QC Hold Points shall be identified for inspection of critical elements. Such inspections will be subject to the full requirements applied to

QC Hold Points under the QA Level 1 Program. Specifically, the technical justification for NCR 2009-0889 credited QC inspections that were not shown to be performed by personnel that were qualified and independent of the work activities as required by Section 21 of the QAPD.

2. LES NEF failed to adequately implement procedures associated with Section 21.15 of the QAPD. For dispositions of use-as-is, procedure EG-3-2-2100-09, Rev. 5, requires a technical justification for the acceptability of a nonconforming item to be documented and shall be subject to design control measures commensurate with those applied to the original design. The technical justification for NCR 2009-0889 did not evaluate all failure modes and assumptions associated with the CRDB foundation/footing system. For example, the technical justification provided in NCR 2009-0889 did not adequately evaluate the following failure modes/mechanisms or document the assumptions as to why the failure modes/mechanisms were not considered:

    a) Anchor Bolts
        1. Steel failure due to insufficient thread engagement between nuts and rods
    b) Reinforcing Bar
        1. Failure due to insufficient development or bond

3. LES NEF failed to adequately demonstrate that traceability of the anchor bolts and reinforcing steel within the CRDB foundation/footing system was maintained to prevent the use of defective or incorrect items. Section 21.8, Identification and Control of Materials, Parts and Components, of the QAPD, states in part, that when required by specifications or codes and standards, identification of material or equipment with traceability to the corresponding mill test reports, certifications and other required documentation is maintained throughout fabrication, erection, and installation. Section 21.8 also states, in part, that verification of correct identification of materials shall be required to prevent the use of incorrect or defective items. Specifically, the technical justification provided in NCR 2009-0889 failed to demonstrate that material identification was maintained to the point of installation for the anchor bolts and reinforcing steel used within the CRDB foundation/footing system and that the correct material was verified prior to installation to prevent the use of incorrect or defective items.

This is a Severity Level IV Violation (Enforcement Policy 6.5.d)

ENCLOSURE 2

Request for Exception to License Condition 10.f of Materials License SNM-2010 (Addresses Violation A, Examples 1 and 3 of NOV 70-3103/2011-010)

1 Introduction

1.1 Purpose

This submittal proposes a one-time exception to License Condition 10.f for the Cylinder Receipt and Dispatch Building (CRDB) superstructure foundation/footers (CRDB foundation). NRC Inspection Report No. 70-3103/2011-01 and associated Notice of Violation (NOV) documented a failure "to resolve the differences between the Quality Level 1 Graded (QL-1G) requirements and the QL-3 as-installed condition of the CRDB superstructure foundation/footing system." This exception request is required to restore compliance to the license and resolve the NOV. The exception is limited to Quality Assurance Plan Description (QAPD) Chapter 21 for QL-1G requirements for aspects of the procurement and construction of the CRDB superstructure foundation/footers only.

This exception is required to establish QL-1G criteria for the CRDB superstructure foundation/footing system to allow IROFS27e operability for the CRDB superstructure.

This exception request does not apply to the IROFS27c CRDB concrete bunker foundation/footers, which were procured and constructed to the requirements of the QAPD QL-1 program and are structurally independent of the CRDB superstructure (steel building) foundation/footers.

1.2 Background

The CRDB foundation is a reinforced concrete foundation with concrete saw-tooth footings that supports the CRDB superstructure (steel building). The CRDB superstructure cannot collapse during natural phenomena events (seismic, tornado, high wind, roof snow load, roof ponding and site flooding) to ensure a chemical release does not exceed the 10 CFR 70.61 performance requirements [Item Relied On For Safety (IROFS) 27e]. This is implemented by designing the building structure to withstand the

effects of these events, consistent with the assumptions in the consequence calculations. The CRDB foundation is an integral subsystem to the IROFS27e passive engineered control. The primary function of this structure is to inspect, house, and weigh UF_6 transport (48Y and 30B) cylinders.

License Amendment Request (LAR) 08-07 (NEF-08-00095-NRC) proposed changing the SBM-1001 structure to QL-2 because the structure was not essential to IROFS, yet could affect IROFS. A similar LAR was planned, which would propose applying QL-2 requirements to the CRDB superstructure. The CRDB foundation was constructed with LES (or LES representatives) performing independent field inspections throughout the construction activities to verify that the critical attributes of design were installed as designed and specified. QL-3 reinforcing steel (rebar), concrete, and anchor bolts were installed with additional QL-2 attributes and inspection activities as defined by the design documents.

Based on NRC requests for additional information (RAI) of the SBM-1001 LAR, a revised LAR-08-07 (NEF-08-00269-NRC) was submitted and approved by the NRC, which created the QL-1G program and new IROFS27e for the SBM-1001 structure. The planned QL-2 LAR for the CRDB was never submitted. Instead, LAR 09-07 (NEF-09-00059-NRC) was submitted and approved by the NRC, which proposed changing the applicable IROFS for the CRDB superstructure from IROFS27c to IROFS27e requiring a QL-1G quality level.

Some activities prescribed by the QL-1G program must be conducted during the procurement or construction process and require documentation that is not required by the QL-2 or QL-3 programs. The CRDB foundation procurement and construction is complete. Contrary to QL-1G program requirements:

- Traceability of anchor bolts, reinforcing steel and mechanical couplers within the CRDB foundation was not fully maintained, and

- Quality control inspections were not performed by trained and qualified Quality Control personnel independent of the work activities; however, inspections were performed by engineering personnel.

2 Technical Analysis

2.1 Proposed Change

This submittal proposes a one-time exception to License Condition 10.f for a specific component of the CRDB superstructure, the foundation. The one-time exception applies to select QL-1G requirements for material traceability and Quality Control (QC) inspections as delineated in NRC Inspection Report No. 70-3103/2011-010. As a result, specific one-time exceptions are required for the following LES QAPD Chapter 21 sections:

Material Traceability Requirements	QC Inspection Requirements
QAPD Section 21.7	QAPD Section 21.4*
QAPD Section 21.8	QAPD Section 21.5*
QAPD Section 21.13	QAPD Section 21.10
QAPD Section 21.17	QAPD Section 21.18

* - also includes elements for material traceability

Material Traceability

2.1.1 One-Time Exception from QAPD Section 21.7

> Requirement: *Control of Purchased Material, Equipment and Services: LES Engineering shall define critical elements applicable to the components and material furnished for the IROFS27e structures.*

This requirement was not satisfied during construction of the CRDB foundation since design requirements were invoked after the completion of CRDB foundation installation. Critical elements applicable to the components and material furnished for the IROFS27e structures are identified in detail in Nonconformance Report (NCR) 2009-0889.

2.1.2 One-Time Exception from QAPD Section 21.8

> Requirement: *Identification and Control of Purchased Materials, Parts and Components: The requirements for IROFS27e structures will include provisions for segregated and controlled laydown areas for the IROFS27e structural elements and bolting utilized to connect the structural elements. Storage requirements shall be in accordance with suppliers requirements for QL-1G components.*

The construction contractor followed Section 4.06 of the CRDB Project Quality Assurance Plan (PQAP) for components installed in the CRDB foundation. However, these requirements were not as stringent as those required under a QL-1G program as defined in Section 21.8 of the QAPD. The anchor bolts/nuts were of a size which was unique to the CRDB, which provides additional assurance that the only bolts/nuts installed in the CRDB foundation had to be procured specifically for the CRDB. While these bolts/nuts were not segregated/stored as QL-1G items, they were stored and controlled as QL-2 items in designated lay-down areas.

There were no specific identification requirements enumerated for the reinforcing steel. The post-storage condition of the installed reinforcing steel was verified to be acceptable prior to every concrete placement. The reinforcing steel was fabricated and shipped from a reinforcing steel supplier using shop drawings which were unique for the CRDB. Therefore, there is a low probability that any reinforcing steel was used from any source other than what is documented in NCR 2009-0889.

2.1.3 One-Time Exception from QAPD Section 21.13

> Requirement: *Handling, Storage and Shipping: Handling, storage, cleaning, packaging, shipping and preservation of items are controlled in accordance with requirements of engineering or work control documents, shipping instructions or other specified documents, as applicable, to prevent damage or loss and to minimize deterioration.*

The construction contractor followed Section 4.06 of the CRDB PQAP for components installed in the CRDB foundation. The PQAP did address requirements for concrete

placement as a QL-3 activity, and addressed the anchor bolts as a QL-2 component, which were subject to additional segregation and storage requirements. However, there were no specific requirements enumerated for the reinforcing steel. The post-storage condition of the installed reinforcing steel was verified to be acceptable prior to every concrete placement as documented NCR 2009-0889. Therefore, there is a high probability that the reinforcing steel was not damaged or deteriorated.

2.1.4 One-Time Exception from QAPD Section 21.17

> *Quality Assurance Records: Requirements for the identification, generation and control of Quality Assurance Records for the QL-1G Program shall be in accordance with the requirements of Section 17 of the QAPD.*
>
> *Applicable LES design specifications, procurement documents, test procedures, operational procedures or other documents and procedures shall specify the records to be generated, supplied or maintained.*

The QL-1G requirements for QA records were not followed, since these requirements were invoked after CRDB foundation construction had been completed. Procurement documents were retained but were not always generated in accordance with QL-1G requirements. Contract documents were not created to address these requirements, specifically for material traceability and identification. However, documentation was provided which satisfied the QL-2 requirements, and records were submitted to the LES Document Control System for retention for design and work activities. All design documents (drawings and specifications) were controlled to QL-1G requirements.

QC Inspections

2.1.5 One-Time Exception from QAPD Section 21.4

> Requirement: *Procurement Document Control: LES procurement documents issued for QL-1G items or services shall include the following provisions.*

Provisions for establishing witness/inspection hold points beyond which work cannot proceed by the supplier without LES QA Manager authorization. The Procurement Director may also establish hold points including work that cannot proceed without authorization by the Procurement Director.

The provisions of this Item were not satisfied during construction to meet the QL-1G requirements, since those requirements were not invoked for procurement. However, a review of the material and processes for the installed components has determined that no procurement hold points would have been required.

2.1.6 One-Time Exception from QAPD Section 21.5

Requirement: *Instructions, Procedures and Drawings: Instructions and procedures, developed in support of QL-1G implementation for IROFS27e shall be of a type appropriate to the circumstances. These documents shall include or reference appropriate quantitative or qualitative acceptance criteria for determining that prescribed activities have been satisfactory accomplished.*

Procedures were used for verification of proper component configuration prior to concrete placement, during placement, and during curing. The critical elements for satisfying IROFS 27e were not specifically identified within these procedures, this is addressed below in Section 2.2 and in NCR 2009-0889 for reinforcing steel, anchor bolts and concrete through the application of commercial grade dedication methods.

2.1.7 One-Time Exception from QAPD Section 21.10

Requirement: *Inspection: Critical elements of the IROFS27e structures that warrant inspection during construction and installation activities shall be documented in the implementing work plans as QC Hold Points requiring verification by trained and qualified Quality Control personnel (or approved designee). The inspections performed to verify critical elements for QL-1G IROFS27e Structures are treated as QA Level 1 inspection hold points.*

This criterion was not fully satisfied during construction to meet the QL-1G requirements, since non-quality control personnel performed these inspections. The primary requirements which were not explicitly satisfied involved the utilization of qualified quality control personnel for inspections associated with elements of the CRDB foundation. Inspections were performed and documented to verify critical elements by qualified LES field and construction engineers (or LES representatives), as documented in NCR 2009-0889. The personnel performing inspections were qualified field or construction engineering personnel and they were organizationally independent from the construction contractor performing the work. As required by ASME NQA-1 Basic Requirement 10, they neither performed the work being inspected nor directly supervised those who performed the work. Since the critical attributes during construction were primarily dimensional verifications that did not require highly specialized training, it is reasonable to accept the technical adequacy and independence of the inspections which were completed as documented on the work plans that were used for installation.

2.1.8 One-Time Exception from QAPD Section 21.18

> *Requirement: Audits: LES shall be responsible for the auditing requirements of Contractor(s) performing work on IROFS27e structure(s).*

The construction contractor agreed to support audits done by LES during the preliminary phases of CRDB foundation installation per Rev 0 of the CRDB PQAP. LES procedures were used to conduct QL-2/QL-3 audits and assessments. In addition, verifications were performed as part of applying the additional methods described in NCR 2009-0889. Additional verifications provide reasonable assurance of the adequacy of purchased materials, equipment and services regardless of the quantity and scope of any actual audits.

2.2 Technical Basis for Change

2.2.1 Method

Non-Conformance Report (NCR) 2009-0889 Rev 0 documents the engineering evaluation of the CRDB foundation. NCR 2009-0889 has been revised as a result of findings in NRC Inspection Report No. 70-3103/2011-010. The engineering evaluation was prepared per the LES NCR Procedure (EG-3-2100-09, Identification, Disposition, and Resolution of Nonconforming Items) and defines the methods used to examine the existing material and placement records and identify any additional measures necessary to qualify or grade these materials and installation to the requirements of the QL-1G program. Applicable commercial grade dedication methods were utilized to demonstrate reasonable assurance that the installed materials and installation processes result in a structurally sound CRDB foundation. An evaluation of each element of the QL-1G requirements from the QAPD was done to identify and address any gaps between the processes that were in-place and the QL-1G requirements.

The QL-1G program is a graded quality program in accordance with QAPD Section 21 that focuses on those areas of design, procurement, fabrication, construction, inspection, and testing of a given structure that are considered essential to its safety function(s). Implementation of the QL-1G program requires that specific attributes of design, materials, processes and quality program controls considered critical to specific systems, structures and components (SSCs) be identified and verified. Per the QAPD Section 21 critical attributes are determined from the QL-1 design analyses. Elements of the building structure and the associated attributes credited in the analyses for ensuring structural integrity of the building shall be specifically listed by the QL-1 design agency. Critical attributes are those attributes or features of the SSC design that are considered essential to the SSC's achieving its design basis function(s).

QL-1 design calculation ARC-711 was reviewed to identify critical attributes in order to comply with QL-1G requirements to provide reasonable assurance that the IROFS27e safety function will be fulfilled. The QAPD was reviewed to assess the differences between the QL-1G and QL-2/3 requirements.

The evaluation utilized applicable critical characteristic verification methods of a commercial grade dedication process, since this is the process which would have been used if the installation had been originally performed as a QL-1G installation.

The NCR evaluation provides a listing and evaluation of the design limit states required by the CRDB concrete design codes of record, ACI 318 & 349. These limit states are dependent on specific design variables and proper installation. In the evaluation, each design variable is enumerated as it correlates to the design limit state; subsequently all of the critical variables are aggregated and summarized as design variables that are relied upon for the performance of the system.

Each design variable is associated with a critical attribute for verification. The effect of a component failure in a particular mode is evaluated from a foundation and structure perspective and considered due to its importance in functional performance.

The NCR evaluation provides a verification plan that is broken into three sections based on the verifications required for anchorage, reinforcing steel, and concrete. ACI design limits address the performance from a broader perspective; for example, anchor performance is based on a combination of adequate performance of steel and concrete, along with proper dimensional placement. The NCR evaluation is organized by limit state, and is separated into anchor limit states (covered in ACI 318 Appendix D or ACI 349 Appendix B), and concrete and reinforcement limit states, which are covered in the main body of ACI 318 and ACI 349.

2.2.2 Scope

The items covered by the NCR 2009-0889 engineering evaluation included:

1. The anchor bolts and nuts utilized in the reinforced concrete foundations that support the CRDB superstructure are credited with fulfilling the IROFS27e functionality. The anchor bolts are specified in design calculation ARC-711.

2. The reinforcing steel bar (rebar) utilized in the reinforced concrete foundations that support the CRDB superstructure is credited with fulfilling the IROFS27e functionality. The rebar is specified in design calculation ARC-711.

3. The concrete utilized in the reinforced concrete foundations that support the CRDB superstructure is credited with fulfilling the IROFS27e functionality. The CRDB floor slab on grade concrete and re-bar for the CRDB superstructure is a QL-3 component and provides structural support (hold down weight) but due to its QL-3 status is not credited in the design analysis. This is a very conservative analytical assumption. The concrete design requirement is specified in design calculation ARC-711.

2.2.3 Evaluation

General Results

The NCR evaluation verified the technical adequacy of the CRDB foundation to ensure the CRDB superstructure will not collapse during any design basis external event. The detailed bases for this determination are provided in NCR 2009-0889. The installation of the CRDB foundation was done in a controlled manner, in accordance with properly prepared procedures and design documents. The material properties of the installed components have been adequately verified through reviews of available documentation and additional material testing on a statistically significant sampling basis for all accessible components. Sufficient design margin and additional long term monitoring requirements exist to provide reasonable assurance that the CRDB foundation will fulfill its IROFS27e safety function.

The NCR evaluation process has been used to demonstrate that the installed components of the CRDB foundation will fulfill their IROFS27e safety function. Although the components do not literally meet all of the quality requirements as defined in QAPD Chapter 21, the foundation is acceptable for use as a Basic Component per License Condition 28.

Discussion of Results From Anchor Bolt Verification Plan

Anchor bolt test coupons were removed from the installed anchor bolts in accordance with the anchor bolt verification plan (NCR 2009-0889). The test coupons were checked by a QL-1 testing lab to verify adequate thread dimensions and rod cross sectional area. Procurement and installation records were reviewed to verify the correct size and length anchor bolts were installed per design requirements.

The deviation in supplier documentation and associated installation traceability is technically acceptable, based upon the fact that all of the 49 test coupons for each size grouping of the anchor bolts were found to have hardness and/or tensile strength values which are substantially above the minimum required values. All of the tested nuts passed proof loading tests per ASTM F606-10a, which also demonstrated adequate thread dimensions for these nuts. Design margin considerations and additional testing that was done to validate the adequacy of the installed rods and bolts demonstrate a high degree of assurance to prevent the use of incorrect or defective items.

Discussion of Yield/Tensile Strength Results From Anchor Bolt Test Data

Yield test data for one of the 1.75 inch diameter anchor bolt test coupons in the sample set was at 55.6 ksi, with the acceptance criteria at greater than 58 ksi per ASTM A449. The tensile strength for this test coupon was at 105.1 ksi, with the acceptance criteria at greater than 90 ksi. Tensile strength is the primary indicator to be used for acceptance. Therefore, the one low yield strength value is not indicative of a testing failure per EPRI guidelines, and additional sampling/testing is not required.

The most critical components of the CRDB foundation are the anchor bolts, which were designed and analyzed in the analysis of record assuming steel with only 36 ksi yield strength. The actual test results provided in the NCR evaluation show all primary structural 1.75 inch diameter anchor bolt coupons demonstrated average yield strengths in excess of 77 ksi. This represents an as-built margin of 213% for these critical connections in addition to the code prescribed safety factors used in the analysis. The actual test results for the 1.25 inch diameter anchor bolts coupons demonstrated average yield strengths in excess of 116 ksi, which represents an as-built margin of 322% for these connections. The actual test results for the 1.00 inch diameter anchor bolts show all of these structural anchor bolt coupons demonstrated average yield strengths in excess of 115 ksi. This represents an as-built margin of 319% for these connections.

Design margin considerations and the additional testing which was done to validate the adequacy of the installed anchor bolts and nuts demonstrates a high degree of assurance to prevent the use of incorrect or defective items. Material testing was conducted in accordance with statistically valid sampling methods, and the resulting

design margin for these components provides assurance that the installed components will fully satisfy their IROFS27e requirements to prevent collapse of the CRDB.

Discussion of Hardness Results From Anchor Bolt Test Data

For all of the 1.75 and 1.00 inch diameter anchor bolts tested, hardness values were all acceptable per ASTM A449. (Brinnell hardness {HRB} of 183-235.) Hardness testing for the 1.25 inch diameter anchor bolts identified 13 of the 49 test coupons with hardness values slightly greater than the acceptance criteria of 30 points Rockwell C (HRC). Tensile values were available for all but one of these test coupons, due to insufficient coupon length. The tensile test results for 12 of these 13 test coupons were acceptable. The one test coupon that did not have tensile test results exhibited a HRC value slightly above 30, with acceptance criteria of HRC 30 for ASTM A449 anchor bolts. Hardness testing was performed primarily to provide a direct correlation for the tested materials between hardness and tensile strength, because some of the test coupons [1.25 inch (4), 1.00 inch diameter (13)] were not long enough to obtain tensile strength values directly.

Additional reviews have been performed to determine the effect of higher than desired hardness values per the ASTM A449 standard. These reviews determined the higher than desired hardness to be acceptable per NCR 2009-0889.

Discussion of Dimensional Verification Results for Anchor Bolts

Dimensional verifications per ASTM A449 identified some anchor bolt test coupons which were outside the proscribed dimensional limits. [Coupons for 1.75 inch (3), 1.25 inch diameter (6), 1.00 inch diameter (2).] However, these dimensional variations were in the 3rd significant digit, at the 0.001 inch value, and are insignificant based upon successful tensile test results and tensile area test results. These results are acceptable because the tensile area test results were all acceptable per ASTM E8-08. (Tensile area is a function of bolt diameter, and these slight variations in diameter did not significantly reduce the tensile area.) Additional verification of dimensional acceptance is provided by the fact that all of these anchor bolts had their nuts installed without any installation issues, demonstrating additional reasonable assurance for the adequacy of the dimensional characteristics of these components.

Discussion of Proof Load Testing Results for Anchor Bolt Nuts

Proof load testing and dimensional verification of the sample population of heavy hex nuts demonstrated their full compliance with design requirements. Anchor bolt nut test data is contained in NCR evaluation Attachment 1B, Anchor Bolt Material Testing Verification Results. These testing results, combined with the additional considerations discussed in this section, provide reasonable assurance that these components will perform their IROFS27e safety function to satisfy all design basis requirements.

Discussion of Results From Reinforcing Steel Verification Plan

The reinforcing steel verification plan and review results of all CRDB foundation work plans to verify proper reinforcing steel installation is included as part of NCR 2009-0889. The review identified one work plan where no signatures were present on the pre-placement inspection documentation. However, there was a "SAT" noted on the Critical Items Checklist, which demonstrates verification was performed/documented using this form. The results of this review verified reasonable assurance exists for documentation regarding proper reinforcing steel placement.

Some CRDB foundation reinforcing steel test coupons were retained. Contract/design documents did not require retention of test coupons for all heat lots. A review of the supplier documentation revealed there were 55 unique heat lots associated with the reinforcing steel used in the CRDB foundation, and 49 heat lots for the primary structural steel. Six heat lots were for #3 bars, which were used only for tie bars. These were not credited in the design analysis, and are not included in the sampling population. Test coupons were available for 14 heat lots for reinforcing steel larger than #3 bars.

Because the reinforcing steel was not installed sequentially upon arrival, the heat lot distribution is reasonably homogeneous throughout the CRDB foundation. Discreet installation traceability was not required by contract/design documents for reinforcing steel placement for any given location in the CRDB foundation. Using the same sampling method that would have been performed under a commercial grade dedication approach, an inspection plan was developed on a statistically significant sampling basis. This plan required sampling 10 test coupons for a group of 49 heat lots. However, all 14 primary structural reinforcing steel test coupons were tested. All 14 primary structural

reinforcing steel test coupons demonstrated yield strength above the design requirement of 60 ksi. The supplier material test reports, although they are not Certified Material Test Reports, provide additional assurance for the acceptability of the reinforcing steel, because all material test reports demonstrated yield strength above the 60 ksi acceptance criteria per ASTM A615. The supplier material test reports and the additional testing that was done to validate the supplier test reports demonstrates a high degree of assurance to prevent the use of incorrect or defective items.

The deviations in supplier documentation (QL-3 actual vs. QL-1G required) and associated installation traceability is acceptable, based upon the fact that all of the reinforcing steel test coupons were found to have tensile and yield strength values which are above the minimum required values. These testing results, combined with the additional considerations discussed within this section, provide reasonable assurance that the reinforcing steel will perform its IROFS27e safety function to satisfy all design basis requirements.

Discussion of Results From Concrete Verification Plan

The Concrete Verification Plan and the results of a review of the differences between QL-1 and QL-3 concrete evolutions are included as part of NCR 2009-0889. The results of the review verified reasonable assurance exists for documentation regarding the adequacy of concrete cylinder compressive strength testing results. The results of a review of all CRDB foundation work plans to verify adequate documentation exists for verification of proper concrete placement under the QL-3 requirements. NCR 2009-0889 contains a number of documentation reviews regarding the adequacy of the concrete placement work plan documents. Although some required signatures were missing for a few attributes, alternate verification signatures were provided for most of these activities. These missing signatures/data are a result of work plan adherence inconsistencies, documented in several CR's during the time period of these construction activities. The overall level of detail and quality of documentation provides reasonable assurance for the adequacy of concrete placement activities.

Although the concrete was installed as a QL-3 component, the results of the reviews provide reasonable assurance that the installed concrete will perform its IROFS27e safety function to satisfy all design basis requirements.

Design Margin Considerations For CRDB Superstructure Foundation/Footing System

Review of UUSA Failure Modes and Effects Analysis (FEMA) Report, FEMA 355F, "State of the Art Report on Performance Prediction and Evaluation of Steel Moment-Frame Buildings", 2000, Discussion of Findings

A review of FEMA Report 355F was conducted to determine the likelihood of CRDB collapse as a result of an extreme loading condition, including design basis earthquake (DBE) or extreme wind events. This review determined that none of the Ordinary Moment Frame commercially designed structures with single stories collapsed during the extreme events studied in this report, including the North Ridge Earthquake in California on January 17th, 1994. While many connections showed degradation and failure of some connection elements, none of these structures suffered a complete collapse. This finding is consistent with design analysis for the CRDB Steel and Foundation System, since each QL-1 analysis of record document (ARC-711 for Foundation/Footing System, and SGH-090846-CA-01) utilizes the design margins prescribed by LES QL-1G Specification LES-S-S-00002. This specification invokes standard commercial ASCE-7-02 requirements and extreme load case combinations from ANSI/AISC N690.

From the FEMA:

> *"Steel moment-frame buildings are designed to resist earthquake ground shaking based on the assumption that they are capable of extensive yielding and plastic deformation, without loss of strength. The intended plastic deformation consists of plastic rotations developing within the beams, at their connections to the columns, and is theoretically capable of resulting in benign dissipation of the earthquake energy delivered to the building. Damage is expected to consist of moderate yielding and localized buckling of the steel elements, not brittle fractures. Based on this presumed behavior, building codes permit steel moment-frame buildings to be designed with a fraction of the strength that would be required to respond to design level earthquake ground shaking in an elastic manner. Steel moment-frame buildings are anticipated to develop*

their ductility through the development of yielding in beam-column assemblies at the beam-column connections. This yielding may take the form of plastic hinging in the beams (or, less desirably, in the columns), plastic shear deformation in the column panel zones, or through a combination of these mechanisms. Although no steel buildings collapsed during the Northridge earthquake, many experienced fractured connections for ground motion levels considerably smaller than the design event."

No substantial foundation or footing system damage was discussed in this report, since the vast majority of the damage was manifest in the steel structure/connections. Because the CRDB foundation and associated connections were not specifically identified as weak links in the design of ordinary moment frame steel structures, it is reasonable to assume this portion of the overall structure will adequately resist design basis loading events under standard commercial construction practices without collapse. Further, the CRDB superstructure has been designed, procured and fabricated as a QL-1G structure to applicable extreme load conditions and combinations, and as such, is not part of this exception request.

Review of CRDB superstructure foundation/footing system analysis of record, Calculation ARC-711, Rev 4, "Cylinder Receipt and Dispatch Building (CRDB) Foundation and Footing Design"

The demand to capacity ratios (DCRs) of the fundamental critical characteristics have been reviewed to verify adequate margin exists above the minimum design requirements for the applicable attributes of the CRDB foundation. Specifically, the most critical components of the CRDB foundation are the anchor bolts, which were designed and analyzed assuming steel with only 36 ksi yield strength. The actual test results provided in NCR Attachment 1B show all primary structural anchor bolt coupons demonstrated average yield strengths in excess of 77 ksi (1.75 inch bolts), 116 ksi (1.25 inch bolts) and 115 ksi (1.00 inch bolts). This represents an as-built margin of 213%, 322%, and 319%, respectively, in addition to the code prescribed safety factors used in the analysis. Therefore, it is reasonable to assume that the anchor bolts, one of the most critical components of the CRDB foundation, will fully satisfy the IROFS27e safety function to preclude any contribution to a potential collapse of the CRDB.

Concrete design assumed a value of 4,000 psi for f'_c (compressive strength of concrete) and 60 ksi Yield Strength for Reinforcement Steel. A review of the analysis of record confirmed all (DCRs) are acceptable, and many parameters have DCRs of 0.5 or better, which provides additional margin for any as-built potential material deficiencies.

Review of CRDB foundation nonconformance reports (NCRs), and comparison to Analysis of Record, Calculation ARC-711, Rev 4, "Cylinder Receipt and Dispatch Building (CRDB) Foundation and Footing Design"

All NCRs which were written for the CRDB foundation have been reviewed to ensure none of them affected the IROFS27e safety function for this system. All NCRs were reviewed by the QL-1 design agency of record, and the aggregate impact of these NCRs does not reduce the overall design capacity of the CRBD foundation.

QAPD Comparison For QL-1G and QL-2 Requirements

Refer to NCR 2009-0889, Attachment 5 for a detailed evaluation of the differences between the LAR-09-07 QL-1G requirements, and the requirements which were in-place during CRDB foundation installation activities. Based on the evaluation provided on Attachment 5 of the NCR evaluation, it is reasonable to accept these differences based upon the results of the additional testing requirements described on Attachments 1-3 of the NCR evaluation, and the overall results described in the NCR evaluation.

Long Term Administrative Monitoring of the CRDB Superstructure Foundation/Footing System

A review of the "Administrative / Other Functions" of NEF-BD-27E, Design Features of SBM and CRDB Structures, identifies the multiple additional administrative actions which are in place to provide assurance that the component elements of the CRDB Structure will remain fully capable of satisfying the IROFS27e safety function for the licensed duration of the facility.

As detailed in NCR 2009-0889, planned and preventive maintenance is performed by a qualified inspector in accordance with approved LES procedures for all IROFS27e buildings. Inspections are consistent with industrial standards and are performed prior to

start-up, two years after startup, and at least every 5 years thereafter. In addition, inspections are performed following an external event that has the potential to affect IROFS27e. The rigor of inspections (visual and/or destructive) is determined by a qualified structural engineer and/or building inspector on an as needed basis. The scope of the inspection includes exposed/accessible surfaces of structural concrete and steel elements.

Defects identified during the inspection would be noted in the inspection report. Any defects that could pose an adverse affect on the strength of the concrete and steel components are also documented on a condition report and further evaluated to determine if:

- IROFS27e remains operable, and any
- Additional inspection, tests, or repairs are needed and an appropriate time for completion of such additional inspection, tests, or repairs.

The administrative program requirements described above provide additional assurance that if there are any long term degradation mechanisms, which could affect the capability of the CRDB foundation to meet IROFS27e safety requirements, they would be indentified in a timely manner. Degradation of CRDB foundation components hidden from normal visual inspection techniques would be manifest through the steel superstructure and would be detectable prior to the onset of any substantial degradation.

2.3 Conclusions

UUSA has completed a very detailed and comprehensive engineering evaluation (NCR 2009-0889), which demonstrates that the design, testing, material controls, installation inspections, post-installation inspections, and documentation reviews, provide reasonable assurance that the CRDB foundation is structurally adequate, with acceptable design margin, to fulfill the IROFS27e safety function. The NCR evaluation, along with approval of this one-time exception, allows the installed components to be accepted as a "Basic Component" as defined by License Condition 28.

3 Safety Significance Determination

This request is for a one-time exception to License Condition 10.f for specific QAPD sections addressing material traceability and QC inspections for QL-1G anchor bolts and reinforcing steel for the CRDB superstructure foundation/footers. The foundation for the CRDB superstructure must fulfill the requirements of the IROFS27e safety function "for seismic, tornado, high wind, roof snow load, roof ponding and site flooding due to local intense precipitation, to ensure a chemical release does not exceed the 10 CFR 70.61 performance requirements."

The Technical Analysis (provided in Section 2) and the supporting engineering evaluation (NCR 2009-0889) demonstrate that the CRDB foundation was designed, procured, and constructed adequately to support the CRDB superstructure during IROFS27e design basis external events.

NCR 2009-0889 Rev 0 was revised to incorporate findings from NRC Inspection Report No. 70-3103/2011-010 and includes a more detailed failure modes and effects analysis (FMEA). This NCR provides the basis of reasonable assurance that the CRDB foundation is structurally adequate to provide perform its IROFS27e safety function, and accepts the as-built design as "use-as-is". The QC inspection and material traceability requirements of the QAPD for QL-1G items cannot be fully met; therefore, this one-time exception is being submitted to allow for the QL-1G qualification of the CRDB foundation based on the technical analysis performed and control and inspection requirements established and followed.

There is reasonable assurance that the CRDB foundation provides adequate structural margin of safety to withstand the stresses applied during the design basis accidents associated with IROFS27e despite the specific QL-1G requirements omitted during procurement and construction.

4 Environmental Considerations

There are no significant environmental impacts associated with the changes proposed in this exception request. The proposed change does not meet the criteria specified in 10 CFR 51.60 (b)(2) since it does not involve a significant expansion of the site, a significant change in the types of effluents, a significant increase in individual or cumulative occupational radiation exposure, or a significant increase in the potential for or consequences from radiological accidents. Consequently, a separate supplement to the Environmental Report is not being submitted.