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NEF-09-00104-NRC

Director
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
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Louisiana Energy Services, LLC
National Enrichment Facility
NRC Docket No. 70-3103

Subject: License Amendment Request for the National Enrichment Facility (NEF) to add sole IROFS for an unanalyzed accident involving the assay sampling rig (LAR-09-09)

Louisiana Energy Services (LES) requests an amendment to the Materials License in accordance with Title 10 Code of Federal Regulations Part 70 (10 CFR 70), Subpart E, §70.34, for the National Enrichment Facility to authorize the design modification and revision of Items Relied on for Safety (IROFS) to control chemical releases for the Assay Sampling Rig.

During an Owner Acceptance Review (OAR) in Capenhurst, England, of ET-UK Product System and associated system drawings it was discovered that the Assay Sampling Rig had not been fully analyzed in the National Enrichment Facility Integrated Safety Analysis (ISA) accident sequences. A Condition Report was initiated to track completion of the analysis process. It has been determined that IROFS are necessary to control chemical releases for the Assay Sampling Rig.

The criticality accident sequence specific to the use of the Assay Sampling Rig and its exhaust into an exhaust ventilation system is being analyzed independently and is outside the scope of this amendment request. The development of this analysis is ongoing and tracking will occur through the NRC corrective action program.

Enclosure 1 provides an affidavit whereby LES considers the information provided in this license amendment request as proprietary design sensitive information and export controlled information and requests the information be withheld from public disclosure in accordance with 10 CFR § 2.390(a)(4).

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Enclosure 2 describes the Assay Sampling Rig and identifies the new accident sequence, and new IROFS with its safety function.

Enclosure 3 provides replacement page changes to the affected NEF license basis documents.

Enclosure 4 provides a redacted version of LAR-09-09, Enclosure 2, license amendment request.

LES appreciates the efforts of the NRC staff in supporting the review and approval of this important amendment in a timely manner.

If you have any questions regarding this license amendment request, please contact Stephen Cowne, Director, Quality and Regulatory Affairs, at 575.394.5253.

Respectfully,

Gregory OD Smith
Chief Operating Officer and Chief Nuclear Officer

Enclosures:
1) Affidavit
2) Description of Proposed Design Modifications
3) Replacement Page Changes to License Basis Documents
4) Redacted Version of License Amendment Request

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Enclosure 4
(Redacted)

Description of Assay Sampling Rig, IROFS, and Accident Sequence

1.0 INTRODUCTION

1.1 Purpose

During an Owner Acceptance Review (OAR) in Capenhurst, England, of ET-UK Product System and associated system drawings it was discovered that the Assay Sampling Rig had not been fully analyzed in the National Enrichment Facility Integrated Safety Analysis (ISA) accident sequences. A Condition Report (2008-1438-CR) was initiated to track completion of the analysis process. Chemical analysis has now been completed, ISA team meetings have been held, and a design change initiated.

Approval of a new IROFSC21 identified for mitigation against a chemical sequence and inclusion of missing ISA information is requested. IROFSC21 is the same IROFS proposed in LAR-09-08 submitted previously for the Cascade Sampling and Tails Take-off vacuum pump and trap sets.

A summary of the missing information is: (1) a chemical accident sequence, (2) a criticality accident sequence, and (3) [redacted] for the Assay Sampling vacuum pump and trap set.

1.2 Scope

This License Amendment Request is to include the Assay Sampling vacuum pump and trap set missing chemical accident sequence and [redacted] into the license documents along with a request for approval of proposed new items relied on for safety (IROFS) to control the chemical sequence.

[redacted]

The [redacted] therefore, new chemical and criticality supporting documentation is required.

The criticality accident sequence specific to the use of the Assay Sampling Rig and its exhaust into an exhaust ventilation system is being analyzed independently and is outside the scope of this amendment request.

Since the development of this analysis is ongoing, but is not yet complete, commitments and "placeholders" in the License Basis Documents are proposed here to ensure completion of the rig criticality sequence and supporting documentation (see Section 3.0 below). This is consistent with the current ISA where completion of certain data or design requirements are stated to occur during the final design stage. Formal tracking will occur through the NEF corrective action program.

2.0 DESCRIPTIONS AND ANALYSIS:

2.1 Current License:

A. The Assay Sampling rig is currently described in several processes in the Integrated Safety Analysis (ISA) Summary (ISAS). Descriptions were found in Sections:
- 3.4.1.3, *Product Take-off System*;
- 3.4.1.4, *Tails Take-off System*;
- 3.4.4.2(E), *Assay Sampling System*;
- 3.4.4.3, *Design Description*;
- 3.4.5.2(F), *Assay Sampling Subsystem*;
- Table 3.4-4, *Product Take-off System Design*;
- Table 3.4-5, *Product Take-off System Codes and Standards;*
- Table 3.7-2, *Accident Sequence Descriptions;*
- Table 3.7-7, *Product System* (Safe-by-Design Components)

and in the Safety Analysis Report (SAR) in:
- SAR Table 5.1-2, *Safety Criteria for Buildings/Systems/Components*,
- SAR Section 5.2.1.3.5, *Pump free Volume Assumptions*, and
- SAR Section, 5.2.1.4, *Nuclear Criticality Safety Analyses*.

B. ISAS Section 3.4.1.3, *Product Take-off System*, and Section 3.4.1.4, *Tails Take-off System,* currently discuss each system.

C. ISAS Table 3.4-4, currently includes a description of the Assay Sampling Pump/Chemical Trap Set. [redacted]

D. ISAS Table 3.4-5, *Product Take-off System Codes and Standards,* currently includes codes and standards applicable to the Product System. The Assay Sampling system is considered part of the product system.

E. ISAS Table 3.7-2, *Accident Sequence Descriptions,* Accident Identifier: "LOSS OF SAFE-BY-DESIGN ATTRIBUTE," currently includes the Product system as requiring safe-by-design components. The Assay Sampling Rig provides a function for the Product System. The safe-by-design components for the Assay Sampling Rig are identified in Tables 3.7-6 through

3.7-21, *Product System, Criticality Assessment of Passive Safe-By-Design Components.*

F. ISAS Table 3.7-7, *Product System* (safe-by-design components) identifies safe-by-design attributes of critical components on the Assay Sampling Rig. The Assay Sampling Rig components (column A) are identified by sequence ID (column B) and critical design attributes are identified in column C for upset conditions (column D). The upset conditions analyzed for the Assay Sampling Rig are: corrosions/erosion, fire, maintenance, impact/drop/ external events (construction on site), external events (failure of above-ground liquid storage tanks); external events (seismic, tornado, external fire, local intense precipitation); more heat, more pressure, loss of confinement or leakage.

The components or support equipment to the vacuum rigs currently analyzed for loss of safe-by-design attribute for the Product System are: [redacted] The critical design attributes have been identified for all applicable HAZOP Guidewords, following the methodology described in the NEF ISA Summary.

[redacted] Taking credit for any materials in these components to absorb neutrons, and thus reduce k_{eff} would have to be justified. To avoid this, components that may potentially accumulate fissile material are modeled as being filled with optimally water moderated uranic breakdown material. Thus, any internal material other than this already modeled, worst case fissile material is conservatively ignored in any criticality calculation.

When a criticality calculation is performed, the three dimensional arrangement of fissile material is what determines k_{eff}. [redacted] in a criticality analysis, this change has no impact on criticality safety.

G. ISAS Accident Identifier: PT2-5, prohibiting hydrocarbon oils in vacuum pumps is currently identified in Table 3.7-2, *Accident Sequence Descriptions*, as applicable to the Assay Sampling Systems. IROFS30a, IROFS30b, and IROFS30c will continue as controls for the Assay Sampling rig.

H. The Safety Analysis Report (SAR) Table 5.1-2, *Safety Criteria for Buildings/Systems/Components*, identifies UF_6 pumps and their safety criteria and shows how the safe values of Table 5.1-1 are applied to the facility design to prevent a nuclear criticality event.

I. SAR Section 5.2.1.3:5, *Pump Free Volume Assumption*, identifies the types of pumps and the pump free volume assumptions.

J. Section 5.2.1.4, *Nuclear Criticality Safety Analyses*, identifies criticality analysis is required for individual systems or components and their interaction with other systems or components containing enriched Uranium.

[redacted]

2.2 Missing from License:

The following items are missing from the license basis documents. (Any corresponding license basis document page updates can be found in Attachment 3.)

A. ISAS Section 3.4.4.2(E), design description for the Assay Sampling Rig needs to be updated to reflect [redacted].

B. ISAS Section 3.4.5.2(F), design description for the Assay Sampling Rig needs to be updated [redacted]

C. ISAS Table 3.4-4, description of the [redacted]

D. ISAS Table 3.7-2, *Accident Sequence*, needs a chemical sequence added for the Assay Sampling pump and trap set. Based on consequence analysis, a new sole IROFSC21 is proposed to control this sequence. This C21 IROFS is the same IROFS proposed in LAR-09-08 submitted previously for the Cascade Sampling and Tails Take-off vacuum pump and trap sets.

E. A risk table is needed to identify the chemical sequence risk factors. A new accident sequence and risk table is proposed for addition to Table 3.7-1 for the Assay Sampling rig chemical sequence.

F. A risk table is needed to identify the criticality sequence risk factors. However, the criticality risk determination is outside the scope of this LAR (see Commitment items in Section 3 below).

G. Table 3.8-1, *Items Relied on for Safety (IROFS),* and Table 3.8-2, *Sole Items Relied on for Safety (IROFS)*require a change to add a new IROFSC21 for control of the missing chemical sequence (new sequence PT5-1).

[redacted]ISAS Table 3.7-7, *Product System* (safe-by-design components) identifies safe-by-design attributes of critical components on the Assay Sampling Rig. [redacted]

I. ISAS Table 3.7-2, *Accident Sequence*, needs development of a criticality sequence similar to EC4-2 in the ISA Summary. Analysis of this criticality sequence is outside the scope of this License Amendment (see Commitment items in Section 3 below).

The requirement to exhaust to a Safe-by-Design (SBD) GEVS will be included in ISAS Table 3.7-7 *Critical Attributes,* for the Product System in the *Criticality Assessment of Passive Safe-by-Design Components* table, and identified to be analyzed during final design. Table 3.7-7 components are addressed by Accident Sequence "LOSS OF SAFE-BY-DESIGN ATTRIBUTE" in Table 3.7-2, *Accident Sequence Descriptions*, in the ISA Summary. Inclusion here ensures the requirement to exhaust to a Safe-by-Design GEVS and establish new IROFS as required is met.

The Assay Sampling Rig will be analyzed for the missing criticality sequences and any IROFS or credited design features will be identified during final design changes occurring concurrently for the GEVS systems. This concurrent criticality sequence analysis and establishment of any associated controls is outside the scope of this License Amendment Request.

3.0 COMMITMENTS

A. The following commitments will be added to the Safety Analysis Report (SAR), Section 3.4, consistent with other commitments currently identified in the SAR. See Attachment 3 of this amendment for a description of the page changes.

   a. The commitment for the Assay Sampling Rig UF_6 process pump or pump set to exhaust to a Safe-by-Design (SBD) Gaseous Effluent Ventilation System (GEVS) will be added to Section 3.4, *Compliance Item Commitments,* of the SAR. This compliance item will include completion of the criticality analysis, accident sequence, and risk determination. The addition of a new commitment (Section 3.4.41) in this section will be consistent with the other compliance items (e.g., Section 3.4.1).

   b. ISAS Table 3.7-2, *Accident Sequence Descriptions,* Accident Identifier "LOSS OF SAFE-BY-DESIGN ATTRIBUTE." The requirement for the Assay Sampling Rig exhausting to a SBD GEVS will be added to this section. This sequence includes the Product system as requiring safe-by-design components. The Assay Sampling Rig provides a function for the Product System. The safe-by-design components for the Assay Sampling Rig are identified in the cited Tables 3.7-6 through 3.7-21; specifically, Table 3.7-7, *Product System, Criticality Assessment of Passive Safe-By-Design Components.*

   c. ISAS Table 3.7-7 *Critical Attributes,* will be updated to include the requirement for the Assay Sampling Rig to exhaust to a SBD GEVS, but will be analyzed during the final design for a SBD GEVS (see Attachment 3, page changes).

4.0 DESCRIPTION OF CHANGES

The Assay Sampling system is described in the ISA Summary in Section 3.4. For similar sampling and evacuation rigs, such as the cascade sampling rig, IROFS for chemical and criticality control have been identified in the ISA Summary (ISAS). [redacted]

The Assay Sampling Rig differs from other pump and trap sets [redacted] while using the Assay Sampling Rig in similar process operations. [redacted] There are no other major design differences.

[redacted]. Therefore, the consequences have potential to be higher for the Assay Sampling Rig than current analyses.

During a classified ISA team meeting in Capenhurst, United Kingdom (UK), the Product system was evaluated. This meeting included discussion on the Assay Sampling vacuum pump and trap set. Additionally, a follow-up meeting was held specific to the Assay Sampling set. The individual components, by process area and process parameters (e.g., type of pumps, length of piping, actual valving, etc.) were identified, the system design was evaluated, applicable controls were discussed, IROFS were identified, and in-depth system operation and inherent design protective features were all reviewed. A number of proposals were considered to adequately control process hazards. In depth discussions were held regarding adequate controls for the risk of UF_6 leakage into the workplace during Assay Sampling operations. Facility baseline design information was obtained through controlled facility drawings, specifications, calculations, and technical documents for review.

The ISA process employed is consistent with the NEF ISA methodology and with guidance in NUREG-1513 and NUREG-1520. Compliance with performance requirements of 10 CFR 70.61 is achieved. Development of the accident sequence meets the controlled risk index criteria, consistent with NUREG-1520 accident sequence evaluation criterion. This approach, as discussed in the NEF ISA Summary, Section 3.1.1, *ISA Methods,* employs a semi-quantitative risk index method for categorizing accident sequences in terms of their likelihood of occurrence and their consequences of concern.

Upon conclusion of the ISA team meetings, configuration changes were completed and this License Amendment was developed. 10 CFR 70.72c requires prior NRC approval for new accident sequences and new sole IROFS applicability. Permanent changes to the unclassified ISA will be incorporated into the NEF ISA documentation and ISA Summary upon approval of this amendment request. Any classified or design sensitive changes are updated and maintained in the classified ISA located in Capenhurst, UK. Unclassified updates to the license basis documents are attached in Enclosure 3.

This license amendment request proposes control of chemical consequences by inclusion in the ISA of a new accident sequence (PT5-1) requiring a new IROFSC21 as a flow restriction to control consequences below 10 CFR 70.61 thresholds. The IROFS design will be consistent with the consequence calculations. Any existing IROFS or SBD controls will be retained. IROFS and safe-by-design components are maintained at quality level 1.

4.1 IROFS and SBD Controls

The proposed Assay Sampling Rig IROFS are as follows:.

Table 1, *New IROFS for Assay Sampling Rig*

Accident Sequence	IROFS	Type	Safety Function	Applicability	Chemical / Criticality	Affected Area
PT5-1	C21	PEC	Flow restriction to ensure in the event of a postulated release worker consequences of inhalation of uranic material and HF are low. An orifice or pipe restriction on the suction side of the vacuum pump provides flow restriction consistent with the consequence analysis.	New IROFS	Chemical	Process Services Corridor

The existing Assay Sampling Rig IROFS are as follows:

Table 2, *Existing IROFS*

Accident Sequence	IROFS	Type	Safety Function	Chemical / Criticality	Affected Area
PT2-5	30a	AC	Limit hydrocarbon oil (moderator mass) in enriched Uranium product by controlling the type of oil used in process vacuum pumps	Criticality	Assay Sampling Systems
PT2-5	30b	AC	Limit hydrocarbon oil (moderator mass) in enriched Uranium product by verifying through test prior to addition of oil that process vacuum pump oil is not hydrocarbon oil	Criticality	Assay Sampling Systems
PT2-5	30c	AC	Limit hydrocarbon oil (moderator mass) in enriched Uranium product by verifying through test after oil addition and prior to placing vacuum pumps in the process system, that process vacuum pump oil is not hydrocarbon oil	Criticality	Assay Sampling Systems

The existing Safe-by-Design (SBD) Controls are:

Table 3, Existing SBD Controls

Accident Sequence	IROFS	Type	Safety Function	Chemical / Criticality	Affected Area
LOSS OF SAFE-BY-DESIGN	Safe-by-Design	SBD	Passive, safe-by-design, attributes of components for the Assay Sampling pump and trap set are identified in Tables 3.7-6 through 3.7-21 of the ISA Summary. The features of these components do not rely on human interface to perform the criticality safety function.	Criticality	Assay Sampling Pump and Trap Set SBD Components

New chemical analyses and supporting calculations were developed for the Assay Sampling rig chemical sequence and is located at Capenhurst in the United Kingdom (UK). Page markups from the ISA Summary are attached (Enclosure 3) and require inclusion of a new accident sequence PT5-1.

Section 5 below describes the Assay Sampling system and proposed IROFS in greater detail than is typically included in the ISA Summary.

5.0 SYSTEM DESCRIPTION

During production it is necessary to know the Uranium-235(^{235}U) concentration of the operational unit product or tails stream. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

5.1 Process Hazards

The process hazards are UF_6 releases to atmosphere and HF releases to atmosphere.

Releases to atmosphere are minimized by operating the entire process at below atmospheric pressure. Abnormal pressures are detected via pressure sensors and indicated by alarms. Appropriate actions to stop UF_6 flow, isolate process steps or shut down systems happens automatically.

Before any breaks in the process are carried out, the pipework is evacuated and nitrogen purged. The pipework is all welded construction and process valves are bellows sealed. Before discharge, all gases are treated with activated carbon and Al_2O_3 to remove any residual traces of UF_6 and HF. The filtered gases are then discharged into a GEVS for final filtration, chemical adsorption, and monitoring prior to release.

5.2 Proposed IROFS

IROFS30a, IROFS30b, and IROFS30c are existing IROFS applicable to the Assay Sampling pump and trap set and will continue to be IROFS applicable to the Assay Sampling Rig. IROFS30a, IROFS30b, and IROFS30c administratively limit hydrocarbon oil as a moderator mass in enriched Uranium product to ensure moderation control assumptions are maintained by controlling the type of oil introduced and used in process vacuum pumps.

IROFSC21 is proposed as a new IROFS providing flow restriction to ensure in the event of a postulated release worker consequences of Uranic material and HF are below regulatory threshold limits identified in 10 CFR 70.61.

5.3 Defense in Depth and Other Safety Features

IROFS as well as the following measures are used to reduce the likelihood of occurrence of an accident scenario.

Defense in depth features enable the system, as a whole, to exhibit greater tolerance to failures and provide successive levels of protection such that safety is not completely dependent upon any single element of the design, construction, maintenance, or operations of the facility.

- Hydrocarbon lubricants are not used. The product system pumps are lubricated with synthetic oil, Perfluorinated polyether (PFPE). (see IROFS30a, IROFS30b, and IROFS30c)

- All product take-off system components containing UF_6 are safe from criticality by geometry. (SBD controls)

[redacted]

Stopping the pumps provides a defense-in-depth measure to the system (i.e., without pumps running there is no forced flow.)

- [redacted] Alarms allow identification of deviations so protective actions can be taken, if necessary, before increased progression.)

[redacted]

5.4 Assay Sampling

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

6.0 PROPOSED CHANGES

Evaluation of a chemical sequence for the Assay Sampling Rig or inclusion in similar sequences was missed during the original license application. Therefore, development of a new (PT5-1) sequence is required. The PT5-1 initial failure (initiating event) is an operator error that results in incorrect sampling sequence [redacted]

This is an error that should be prevented by an interlock in the Process Control System; however, for purposes of this PT5-1 sequence, it is assumed the PCS and this interlock also fail.

[redacted] The quantities are insufficient to affect the public beyond the site fence.

[redacted]

With IROFSC21 in place, the worker consequences of inhalation of uranic material or HF are calculated as below 10 CFR 70.61 thresholds in the event of a release. The quantities are insufficient to affect the public. As a result of IROFSC21, the consequence analysis shows the consequences have been mitigated to an acceptable level and the risk is acceptable.

6.1 Basis for Change

[redacted]

[redacted]

In the uncontrolled PT5-1 accident sequence, it is assumed that the operator gets the sampling sequence wrong. [redacted]

The ISA team reviews considered a number of proposals for control of the Assay Sampling System. This included application of existing IROFS versus application of a new IROFS. The existing IROFS for similar sequences have been challenging to design where the IROFS would adequately perform its intended function. Therefore, this approach was not chosen and a new IROFSC21 was selected. [redacted] Consequence analysis has demonstrated with IROFSC21 in place, the consequences in PT5-1 have been mitigated to acceptable levels.

[redacted] Therefore, the system, in its normal operation will provide flow restriction and accident sequence PT5-1 results in the consequences below 10 CFR 70.61 thresholds.

The acceptable risk associated with PT5-1 is demonstrated in ISA Table 3.7-1, *Accident Sequence and Risk Index* (see Enclosure 3). [redacted] has been determined applicable to the Assay Sampling Rig to ensure Quality Level 1 (QL-1) control of the restriction device. [redacted] This ensures the design of the Assay Sampling Rig is safe and in compliance with 10 CFR 70.61 performance criteria. It has been demonstrated [redacted] adequately controls the risk in PT5-1.

6.2 Safety Significance

The new PT5-1 accident sequence results in low consequences to workers and members of the public with IROFSC21 [redacted] IROFSC21 has been identified as a new IROFS applicable to ISA accident sequence PT5-1. [redacted] has been demonstrated sufficient to adequately control the risks associated with accident sequence PT5-1 (see risk table, Enclosure 3). The Assay

Sampling Rig process operations, as shown by consequence analysis, complies with 10 CFR 70.61 performance criteria.

The new PT5-1, Assay Sampling Rig accident scenario complies with the controlled risk index criteria consistent with NEF ISA methodology and NUREG-1513 and complies with NUREG-1520 accident sequence evaluation criteria. This approach, as discussed in the ISA Summary, Section 3.1.1, *ISA Methods,* employs a semi-quantitative risk index method for categorizing accident sequences in terms of their likelihood of occurrence and their consequences of concern. The new passive engineered control IROFSC21 is a Quality Level-1 control with required Management Measures.

7.0 ENVIRONMENTAL CONSIDERATIONS

There are no new or additional significant environmental impacts associated with the process operations for the Assay Sampling Rig for the changes proposed in this License Amendment Request. The proposed changes do not meet the criteria specified in 10 CFR 51.60(b)(2) since they do not involve a significant expansion of the site, a significant change in the types of effluents, a significant increase in the amounts 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. The Assay Sampling Rig was identified in the original NEF license application and partially analyzed in the ISA, however, some of the analyses were incomplete. This was not discovered until recently during a design review process for the Product System (see 2008-1438-CR).

The proposed new IROFSC21 for the Assay Sampling Rig has been demonstrated as providing an adequate safety function for the postulated PT5-1 accident sequence; and, therefore, the PT5-1 sequence remains at an acceptable risk level when controlled by IROFSC21. No new Licensed materials or materials that could affect Licensed materials have been introduced. As a result, there is no increased Environmental impact and no additional environmental considerations different from the original ISA analyses for similar vacuum pump and trap sets. The Environmental Report is not affected.

8.0 SEISMIC CONSIDERATIONS

Consideration was given to the potential for adverse effects resulting from a seismic event. The ISA meeting for pump and trap sets concluded that flow-restriction (IROFSC21), either inherent or added, would not be adversely affected by a seismic event. Since in all cases the restriction is upstream of the vacuum pump, external leaks would result in low consequences. No potential faults were identified where the flow rate would increase as a result of the seismic event.

Seismic consideration for potential adverse effects resulting from a seismic event and results on the rig configuration or location or effluents/safe-by-design gaseous effluent ventilation system where the Assay Sampling rig exhausts was not considered here. It is outside the scope of this license amendment.

9 CONCLUSION

A new IROFSC21 is proposed as a Class A sole IROFS passive engineered control for a new PT5-1 sequence for the Assay Sampling vacuum pump and chemical trap set. An acceptable controlled risk has been shown for the set as demonstrated by a Risk Index of (3) (see Enclosure 3) and inclusion of IROFSC21 as a PEC flow restriction. Acceptable risk is provided in the Assay Sampling System. Implementation of a new IROFSC21 ensures the new design is safe and complies with 10 CFR 70.61 performance criteria.