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MEMORANDUM TO: Andrea Kock, Director
Division of Fuel Management
Office of Nuclear Material Safety
and Safeguards

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SUBJECT: PROPOSED RECOMMENDATIONS FOR BUILDING A SMARTER FUEL CYCLE INSPECTION PROGRAM

This memorandum and enclosure present the results and recommendations from the U.S. Nuclear Regulatory Commission (NRC) fuel cycle inspection program working group (WG). On April 26, 2019, the NRC staff established a WG to conduct a holistic assessment of the fuel cycle inspection program to improve the effectiveness and efficiency of the program (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19074A139). The attached report is the culmination of thorough analyses and extensive communications between the NRC staff, members of the public, and the nuclear industry.

The report summarizes the staff's recommendations resulting from the implementation of the WG initiatives, stakeholder correspondence, and feedback from public meetings. The fuel cycle inspection program is mature. Inspection data, licensee performance reviews, and operational experience have ensured fuel cycle facilities are operated safely and securely in accordance with regulatory requirements. Stakeholder feedback generally indicated that the fuel cycle inspection program is an effective oversight program, as such, all the recommendations identified in the attached report are characterized as program enhancements. These changes are being proposed under Inspection Manual Chapter 2600, “Fuel Cycle Facility Operational Safety and Safeguards Inspection Program,” consistent with your roles and responsibilities to develop and direct the implementation of policies, programs, and procedures for inspecting fuel cycle licensees.

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Finally, the WG recommends the development of a detailed implementation plan to prioritize and incorporate the recommendations into the inspection program, inspection documentation and guidance during calendar year 2020 in order to allow for an implementation of inspection activities beginning in January 2021.

Enclosure:
Report: Proposed Recommendations
for Building a Smarter Fuel Cycle Inspection Program

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RECOMMENDATIONS FOR BUILDING A SMARTER FUEL CYCLE INSPECTION PROGRAM

PURPOSE

The purpose of this report is to present a set of recommendations to enhance the fuel cycle core inspection program for the areas of safety and safeguards as referenced in IMC 2600 and IMC 2683. The assessment excluded recommendations to inspection guidance for reactive, supplemental, and generic safety issue inspections as well as physical protection, classified material and information security. The U.S. Nuclear Regulatory Commission (NRC) staff developed these recommendations based on suggestions from both internal and external stakeholders for improving the effectiveness and efficiency of the inspection program in the areas of safety and safeguards. This report completes the activities tasked under the working group (WG) charter (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19074A139).

SUMMARY

This report summarizes the staff's recommendations resulting from the implementation of the WG initiatives, stakeholder correspondence, and feedback from public meetings. Stakeholder feedback generally indicated that the fuel cycle inspection program is an effective oversight program. As such, all the recommendations identified in this report are characterized as enhancements to the program.

As part of the WG's deliberation process, a wide range of recommendations were considered. Overall, the WG staff agreed that the proposed changes are consistent with the NRC's Principles of Good Regulation and will ensure that the fuel cycle inspection program continues to accomplish its goals. The changes proposed in this report will result in refocusing some inspection activities on areas that provide the greatest safety benefit while maintaining an effective fuel cycle oversight program. The proposed changes to the inspection program include: (1) modifications to inspection frequencies and resource estimates associated with completion of inspection procedures, (2) modifications to inspection procedures to reduce overlaps, and (3) modifications to inspection frequencies of inspection procedures for facilities with an NRC-approved corrective action program[1].

BACKGROUND

The fuel cycle oversight program applies to operating fuel cycle facilities licensed by the NRC including nuclear fuel fabrication facilities, uranium enrichment facilities, and uranium conversion facilities. The current oversight program as defined in Inspection Manual Chapter (IMC) 2600, "Fuel Cycle Facility Operational Safety and Safeguards Inspection Program," includes the following elements: (1) core inspections, including resident inspections, (2) plant specific reactive inspections, (3) plant specific supplemental inspections, (4) generic safety issue inspections, and (5) Licensee Performance Reviews (LPRs). The inspection program is designed to determine whether licensed fuel cycle facilities are operated safely and securely, in accordance with regulations, and to identify indications of declining safety or safeguards performance. The program defines the core inspection effort to be performed at each type of

[1] An approved corrective action program as defined in Regulatory Guide 3.75 "Corrective Action Programs for Fuel Cycle Facilities."

fuel cycle facility, and provides guidance for reactive, supplemental, and generic safety issue inspections.

The core inspection program is implemented through inspection procedures (IPs). The IPs identify requirements that the inspectors consider while evaluating the associated areas related to safety and safeguards. Each IP provides a resource estimate to complete the inspection requirements of that procedure. The core inspections for each type of facility are specified in Appendix B of IMC 2600.

The core inspections are grouped by functional and program areas. Functional and program areas are related to a technical discipline at the facility and may be comprised of one or more inspectable areas. The functional areas are evaluated during the LPR to identify areas needing improvement (ANIs).

The material control and accounting portion of the fuel cycle inspection program is referenced in IMC 2600 as part of the program description and included in the resource estimates specified in Appendix B of IMC 2600. Inspection Manual Chapter 2683, "Material Control and Accounting Inspection of Fuel Cycle Facilities," defines objectives for the material control and accounting inspections and includes the list of IPs.

Inspections at fuel cycle facilities are performed by qualified inspectors from Region II, with support from other technical staff as needed. In addition, resident inspectors are assigned to the facilities that possess and process strategic special nuclear material (Category I facilities) and provide an onsite NRC presence for direct observation and verification of licensees' ongoing activities. The resident inspection program is described in more detail in Appendix C of IMC 2600. The residents perform some of the core inspection functions at their assigned facilities. In addition to the inspection activities completed by the resident inspector at Category I facilities, Appendix B of IMC 2600, list inspection activities that are completed by region-based inspectors.

REVIEW APPROACH AND SCOPE

On April 26, 2019, the NRC staff established a WG to conduct a holistic assessment of the fuel cycle inspection program to improve the effectiveness and efficiency of the program (ADAMS Accession No. ML19074A139). Although incremental changes to the program have occurred, this is the first time a holistic assessment of the program has been completed. In the context of the NRC's ongoing transformation environment, the WG was tasked to look for areas of transformation and innovation in the fuel cycle licensing and oversight programs while adhering to the Principles of Good Regulation that guide the way the NRC conducts its work.

The WG consisted of staff experienced in oversight of fuel cycle facilities. The WG solicited and assessed feedback from internal and external stakeholders (including NRC staff, the public, and industry) on potential changes to the inspection program. The WG leveraged operating experience (both domestic and international), risk insights, inspection data and changes to the program because of the lessons learned from previous events in its assessment to determine whether the inspection program applied the appropriate focus on areas that provide the greatest safety benefit. The WG was also tasked to look for areas of overlap and to consider ways to make all phases of the inspection program more efficient (e.g., scheduling, preparation, inspection, enforcement, documentation). The assessment included an evaluation of inspection frequency and resource estimates.

The scope of the WG included the core inspection effort for the areas of safety and safeguards as referenced in IMC 2600 and IMC 2683. The assessment excluded recommendations to inspection guidance for reactive, supplemental, and generic safety issue inspections. In addition, physical protection, classified material and information security were not included as part of the scope. Inspection Manual Chapter 2681 "Physical Protection and Transport of Special Nuclear Material and Irradiated Fuel Inspections of Fuel Facilities," (ADAMS Accession No. ML17240A158) and associated procedures were significantly revised in 2017. The revision included consolidation and changes to inspection procedures. The changes to IMC 2681 were implemented in January 2018, and therefore, excluded from the scope of this assessment.

Stakeholder feedback was a key element for the success of this effort to ensure that program improvements were viable and met the intended goals of the inspection program. To gather a wide range of recommendations, the WG held 10 public engagements with interested stakeholders. In addition to public meeting notices, the WG reached out to local community groups, state officials, and the Union of Concerned Scientists to ensure a variety of stakeholder feedback was solicited. The WG also leveraged the use of video technology to the improve accessibility for stakeholders to participate remotely in the public meetings. References to the public engagement activities can be found in Attachment 1.

RESULTS

a. Assessment of gaps and overlaps

No gaps were identified during the assessment of the inspection procedures. However, the WG identified that the inspection area of chemical safety will benefit from additional inspection guidance regarding the scope of inspections performed under IP 88020 "Operational Safety." The assessment identified areas of overlap in inspection procedures for Maintenance and Surveillance and Waste Management. The WG's recommendations described in Section d. below address the overlaps and identifies efficiencies during implementation of the inspection program procedures.

b. Assessment of inspection technical areas

The WG evaluated the inspection technical areas that are included in IMC 2600 to develop a ranking of importance based on five qualitative criteria. The inspection technical areas considered were: (1) criticality safety, (2) plant operations and chemical safety, (3) fire safety, (4) environmental, (5) radiation protection, (6) transportation, (7) emergency preparedness, and (8) material control and accounting.

The goal of the WG was to ensure the inspection program applies the appropriate level of effort based on the safety and risk significance of each inspection area. Therefore, the eight inspection areas were ranked into three risk tiers using the following criteria: (1) risk insights based on knowledge from the integrated safety analyses accident sequences, (2) operating experience, (3) complexity of regulatory requirements, and (4) reputational risk. Each inspection area was ranked as being of high, medium or low risk ranking. A fifth criterion, engineering judgement, was used as a weighting factor assigned to each of the four criteria.

The criterion related to accident sequences assessed both the overall quantity and relative risk importance of accident sequences for each of the inspection technical areas. The criterion considered the overall number of accident sequences, the overall threshold of consequences of concern for each technical area and the overall relative number of safety controls or items relied

on for safety (IROFS). For this criterion, the inspection technical areas of criticality and chemical safety were assigned a high value, due to the WG's conclusion that these areas carry the greatest number of sequences leading to high or intermediate consequences. In addition, these two inspection technical areas carry the highest number of IROFS used to mitigate or prevent accidents of concern. Therefore, the WG leveraged its knowledge of the integrated safety analyses (ISAs) and risk insights to rank each area according to the safety significance it plays in the analyses of the facilities. The other areas were ranked according to their respective relative overall risk.

The operating experience criterion utilized data from the Fuel Cycle Annual Operating Experience Report to leverage the staff analysis of reported events at fuel cycle facilities. The 2018 Operating Experience Report (ADAMS Accession No. ML19004A407) discussed the numbers and types of events reported since 2007 and used statistical analyses to identify trends in performance areas, determine contributing factors, and evaluate the safety significance of those events. Based on the staff's analysis of the data, and as illustrated in Figure 1 of Attachment 2, the inspection technical areas with the highest average number of events per year are criticality safety and operational safety (which encompasses plant operations and chemical safety). These two areas were ranked high and the other areas were ranked according to their respective number of events.

In addition to the five qualitative criteria and as a subset to the operating experience criterion, the team qualitatively considered inspection results, international experience and lessons learned from previous events. For example, the staff completed an assessment of other inspection-related data, such as violations and the results of LPRs for the last 10 years. Violations were identified by performance area for the last 10 years as well as areas needing improvement for each of the performance areas identified in the LPRs. This assessment provided valuable information related to the history of compliance per performance area. In the area of international experience, the WG considered known international practices related to the inspection of fuel cycle facilities. For example, some international regulatory agencies, perform large team inspections at fuel cycle facilities on a yearly basis. In addition, as the WG evaluated recommendations to the inspection program, special attention was given to lessons learned from previous events. A specific example is in the area of plant modifications since this inspection area is a recent addition to the core inspection program as a result of lessons learned from recent events.

The criterion associated with regulatory requirements assessed the overall complexity of current regulatory requirements and inspection guidance for each of the inspection technical areas. Inspection technical areas with a significant number of regulatory requirements and complex inspection guidance as documented in inspection procedures were scored with a higher value. In addition to regulatory requirements, areas that relied on commitments to complex codes and standards were also scored higher. The inspection technical area of material control and accounting for example, was ranked high under this criterion given the significant complexity of regulatory and inspection guidance. Other areas were ranked according to their respective level of complexity.

The criterion for reputational risk arose from the feedback received from public stakeholders. This criterion assesses the public interest for each of the inspection technical areas based on past and current experiences. Therefore, the criterion qualitatively assesses the impact to the public's view of the effectiveness of the inspection program from identified deficiencies or events in each of the inspection areas. The WG considered interest from the public for each area based on correspondence, feedback received during public meetings and LPRs, and direct

feedback received during engagement activities as a result of this initiative. The areas of environmental, radiation protection and fire protection were ranked high due to the significant amount of public interest on these areas. Other areas were ranked according to their respective level of public interest.

A final criterion of engineering judgement was used as a weighting factor by the WG to reflect the overall importance of each of the four criteria used in the decision-making matrix. The weighting factor was based on the WG's engineering judgement and was implemented using a weighted multi-criteria decision matrix. To that end, the WG allocated a higher weighting factor to the accident sequences criterion, given its nexus to the integrated safety analysis and risk insights. Lower weighting factors were assigned taking into consideration the relative safety significance of each criteria. Therefore, the results for each of the inspection areas were multiplied by the weighting factor to obtain a final value that was later used to develop the tier ranking.

Figure 2 of Attachment 2 provides an illustration of how the criteria were ranked using the matrix approach. Using the decision-making matrix, each of the inspection technical areas were ranked into three tier levels. Figure 3 of Attachment 2 provides the results of the ranking. Tier 1 was assigned to criticality safety, plant operations, and chemical safety. Tier 2 was assigned to fire safety, emergency preparedness and radiation protection. Tier 3 was assigned to environmental and transportation. Material control and accounting was assigned to Tier 1 for Category 1 facilities, due to the higher enrichment of the material at those facilities, and to Tier 3 for the rest of the facilities.

c. Feedback from stakeholders

The WG received significant feedback during its public engagement activities from the industry, Nuclear Energy Institute (NEI), and members of the public regarding efforts to further risk inform the fuel cycle inspection program. The overall message received from the industry and NEI was that the fuel cycle inspection program is an effective oversight program, but that some areas of the program would benefit from focusing our efforts on issues of higher significance. Industry representatives and NEI also stated that the inspection program could benefit from leveraging existing information in the ISAs, recommended allocating more of the core inspection hours to the resident inspectors, and recommended adjusting inspection frequencies at facilities with an NRC approved corrective action program. Members of the public, on the other hand, expressed concerns about reduction of inspection hours because they feared that licensees would become complacent due to a reduce on-site presence. The following sections summarize the areas of more interest to stakeholders.

<u>Resident inspector program</u>

In public discussions, NEI strongly supported their recommendation to shift more region-based inspection hours into the resident inspector program, for Category I facilities. To that end, the WG completed an assessment of the current hours included in the resident inspector program. The WG concluded that the resident inspectors currently operate at full capacity because the total effort accounting for direct inspection hours, preparation and documentation activities, and indirect activities, such as enforcement and site-specific training, exceeds the agency's full-time equivalent assumption of 1500 hours. Therefore, the WG does not recommended shifting additional hours to the resident inspector program. The WG recommends an in-depth assessment of the scope of resident inspector guidance and its referenced procedures as part of the implementation phase of this initiative. The assessment should consider potential

changes to ensure the scope of the resident inspector program is focused on the areas that provide the greatest safety benefit and should also consider recommendations provided by external stakeholders. Based on this review, further adjustment of inspection activities between regional and resident inspector activities may be recommended.

Integrated Safety Analysis and its use in the inspection program

An Integrated Safety Analysis (ISA) is a key foundation of the regulatory basis of a facility and a formal regulatory requirement within 10 CFR 70 Subpart H, "Additional Requirements for Certain Licensees Authorized To Possess a Critical Mass of Special Nuclear Material." The purpose of an ISA is to ensure that both licensees and the NRC have current and adequate information on the basis for safety of fuel cycle facilities.

Significant stakeholder feedback was received recommending the WG further consider leveraging insights from licensee's ISA's to enhance the inspection program. The WG assessed this feedback and concluded that the current inspection program fully leverages the use of the ISAs for all aspects of inspections. For example, the ISA's principal safety function is to identify accidents and a set of IROFS to prevent or mitigate consequences of concern. Consistent with the agency's principles of being risk-informed regulators, inspectors leverage the ISA's to select the samples used during inspections. In addition, the inspection program further leverages the ISA by using information on management measures applied to ensure that IROFS are available and reliable to prevent or mitigate accident sequences of concern. Another example of how the ISAs are used in the inspection program is by leveraging annual updates as required by the regulation in the inspection sample used to verify that modifications to the facility do not adversely impact safety.

Industry representatives recommended that the inspection program should provide credit (i.e. reduced inspection effort) to facilities with a robust ISA and safety margin included in the ISA's. More specifically, facilities should get credit for inclusion of additional IROFS that drive down the risk profile beyond the regulatory requirements (e.g., from the licensee's definition of highly unlikely definition of -4 to a voluntary -6). This concept was not included in the staff proposal for several reasons.

First, as part of initial approval of the methodologies used in the ISAs and subsequent annual ISA summary updates, the NRC staff reviews only a subset of individual fuel cycle processes in detail. Therefore, approval of ISA methods is not an endorsement of the analyses of all processes in every respect. In addition, ISAs are living documents maintained by the licensee and the regulatory requirements allow licensees to make changes without prior NRC approval. Taking this into account, the WG concluded that relying on safety margin included in the ISAs for specific processes would require substantial additional NRC review of all processes and changes made by licensees to their ISAs.

Secondly, the concept described identifies a methodology that assesses margin for each accident sequence rather than assessing the overall facility risk profile. The WG believes that to have an indication of overall facility risk profile, a significant burden will be required to develop a tool that will allow the staff to assess changes of overall risk at the facility. Due to the level of information available to the staff, the staff would need to request significant information from licensees in order to develop a meaningful tool.

The WG concluded that the current inspection program adequately leverages risk insights as a result of the implementation of the ISAs. It should be noted that the WG utilized ISA insights in

its methodology to develop the ranking of the inspection technical areas. Therefore, given that the required level of effort to account for additional safety margin outweighs the potential efficiencies, the WG does not recommend incorporating further reductions to the inspection program based on the safety margin in ISAs.

Incorporating NRC-approved Corrective Action Programs (CAP)

The NRC received specific comments from URENCO USA (ADAMS Accession No. ML19304A103) expressing support for adjusting inspection frequencies to account for the existence of an NRC-approved CAP as defined by Regulatory Guide (RG) 3.75. NRC regulations require fuel cycle licensees to implement CAP elements for certain aspects of their licensed activities, such as the identification and implementation of corrective actions for IROFS or management measures failures, audit and assessment of findings, and incident investigation results. However, fuel facility licensees are not required to have an NRC-approved CAP. In SRM-SECY-10-0031, "Revising the Fuel Cycle Oversight Process," dated August 4, 2010 (ADAMS Accession No. ML102170054), the Commission directed the staff to consider how to best reflect in the enforcement policy that most fuel cycle licensees, while not required, have voluntarily developed CAP. The Commission also directed that the staff implement revisions to the baseline inspection program to credit licensees' effective problem identification and resolution programs. As a result, the staff developed options to include incentives to licensees with an effective CAP by providing credit in the Enforcement Policy. Section 2.3.2 of the Enforcement Policy allows the NRC to disposition NRC-identified Severity Level IV violations as Non-Cited violations after the NRC has determined that an adequate CAP has been implemented. The staff also developed inspection procedures for evaluation of licensee's CAP.

The WG considered the concept of potentially reducing resources or frequencies of inspection for certain inspection technical areas for licensees with an NRC-approved CAP. An important consideration is that under IMC 2600, licensees who have an NRC-approved CAP, currently receive an additional NRC inspection. The objective of this additional inspection is to ensure licensees are maintaining the programmatic elements of the CAP and that the CAP is implemented in accordance with procedures. Corrective action programs inspected by the NRC have verified that licensees adequately identify, correct, and address root causes of deficiencies that could lead to impacts to safety. Thus, for facilities with an NRC-approved CAP, the NRC staff has additional assurance that deficiencies will be identified and corrected prior to impacting safety. Therefore, the WG recommends a reduction in the frequency of inspection to Tier 2 and Tier 3 inspection technical areas for licensees with an NRC-approved CAP.

d. Frequency of inspections and resource estimates

Leveraging the results of the tier ranking process of inspection areas, the WG, in collaboration with subject matter experts, developed the basis for the allocation of inspection frequencies and estimated resources per area. Based on the holistic assessment, the WG concluded that the higher ranked areas benefit from a high level of inspection attention, while lower ranked areas could be given less attention without decreasing program effectiveness. Areas with a Tier 1 ranking would thus be inspected at a higher frequency and with more resources than other areas due to their higher risk level. In addition to the results of the tier ranking for each inspection area, the WG considered differences in the type and category of facilities for the development of hours per area. For example, in the area of MC&A a higher level of effort would be needed for Category I facilities because these facilities possess and process high enriched uranium. Since Category III facilities poses and process low enriched uranium, a moderate level of effort would be appropriate.

The WG recommends that Tier 1 areas should maintain a minimum of an annual inspection frequency commensurate with the risk importance of these areas. In addition, the WG recommends that Tier 2 areas should maintain a minimum of a biennial frequency commensurate with the risk importance of these areas. The WG concluded, that due to the scope of Tier 1 and Tier 2 areas, cross-disciplined inspection teams continue to be necessary for a broader level of samples. For Tier 3 areas, the WG recommends a minimum of triennial inspection frequencies, which will allow a reduction in inspection resources without impacting the goals of the inspection program.

Resource estimates for each of the inspection areas were developed using the insights from the tier ranking and insights gathered from inspectors as to the estimated hours needed to successfully complete the necessary scope of each inspection procedure. Resource estimate assumptions were also adjusted for each of the inspection procedures to allow inspectors to complete risk informed inspections by leveraging the results of the ISAs for sample selection. The WG recommends: (1) Tier 1 inspection areas be assigned a minimum of 90 hours (assumes 3 inspectors for one inspection week), (2) Tier 2 inspection areas be assigned a minimum of 60 hours (assumes 2 inspectors for one inspection week), and (3) Tier 3 inspection areas be assigned a minimum of 30 hours (assumes 1 inspector for one inspection week).

The WG recommends clarifications to the inspection guidance in IMC 2600 and inspection procedures on the expectations associated with the allowance for variance in the core inspection hours for all inspection areas needed to satisfy the goals of the inspection program. In public discussions, the WG received stakeholder feedback to incorporate flexibility in the hours delineated in each of the inspection procedures. The WG recommends a revision to IMC 2600 to include an acceptable variance of plus or minus 10 percent in the core hours. In addition, language on the acceptable variance should be included in the resources estimate section for each inspection procedure.

In the inspection areas of environmental and transportation, the WG recommends a larger variance from 30 hours up to 60 hours, due to the length of time between inspections. While each inspection procedure is allocated an estimated number of hours to complete the inspection, a variance of hours is currently included in the inspection procedure for plant modifications. Similar to the current plant modifications procedure, a variance of hours for the environmental and transportation inspection areas will be used in circumstances when it is determined that the lower end of the variance is not adequate to complete the scope of the inspection. This may occur, for example, when a licensee has made meaningful changes to their programs, or when follow-up on complex issues in these areas is needed. If during the planning stage of the inspection, it is determined that the hours allocated are not sufficient to fully implement the scope of the inspection, the inspectors would obtain branch chief approval to allocate more hours within the identified range to the inspection.

Attachment 3 provides a marked-up version of the Appendix B to IMC 2600 with the recommended hours and frequencies for each area of the core inspection program. The WG evaluated the frequency and resource estimates allocated to each inspection procedure based on the results of the risk ranking tier of each inspection area as well as based on expert elicitation on the number hours needed to satisfy the goals of the inspection program. In addition, hours were adjusted based on overlaps, shifts of hours to region-based inspections and to ensure inspections activities are performed under the most effective procedure. The following provides a description of the recommended changes.

- Adjust all inspection procedures from 32 hours of direct inspection per week to 30 hours of direct inspection per week to better align with the inspector's travel and inspection days. Implementation experience gathered from inspectors identified that on average, inspectors spent 3 hours of direct inspection upon arriving at the site on Monday and 9 hours of direct inspection each day on Tuesday, Wednesday and Thursday. Therefore, all inspection procedures will be adjusted to 30 hours of estimated direct inspection.

- Coordinate transportation inspections performed under IMC 2690 "Inspection Program for Dry Storage of Spent Reactor Fuel at Independent Spent Fuel Storage Installations and for 10 CFR Part 71 Transportation Packaging" and IP 86740 "Inspection of Transportation Activities" to ensure both inspections are performed during the same inspection week. Efficiencies can be gained by performing transportation inspection activities in tandem, both by consolidating support from the licensee to one week and by allowing inspectors to collaborate in completing the inspection scope.

- Plant Operations
    - "Resident Inspector Program"
        - The WG recommends an overall decrease due to a shift of inspection hours from the resident inspector program to other IPs completed by regional inspectors. Based on the WG assessment that the resident inspectors operate at full capacity, the WG recommends shifting hours for samples of the plant operations inspection area from the resident inspector program to region-based inspections. The basis for the change is to provide the residents with more flexibility to respond or follow up on events and other indirect inspection activities. In addition, shifting samples to region-based inspections allow inspectors from RII to bring a specialized technical focus to the areas of criticality and chemical safety which are ranked as Tier 1.

    - "Operational Safety" – Region-based
        - The WG recommends an overall increase supported by the identified need to include more inspection guidance and resources on the inspection technical area of chemical safety. In addition, the increase also reflects shift of hours from the resident inspector program for Category I facilities, shift of hours from criticality safety and the proposed incorporation of important elements of IP 88025 "Maintenance and Surveillance of Safety Controls" due to overlaps identified.
        - Facilities with an adequate CAP as defined by RG 3.75 – no changes to level of effort on this IP due to inspection areas with a Tier 1 ranking.

- Criticality Safety
    - The WG does not recommend major changes. The WG recommends a shift of hours for Category I facilities from the resident inspector procedure to the region-based procedure. As discussed above, shifting samples to region-based inspections allows inspectors from RII to bring a specialized technical focus to the area of criticality which is ranked as Tier 1.
    - Proposed hours remain static for Category III, Uranium Conversion and Gas Centrifuge facilities. For these types of facilities, the inspection hours were adjusted to 30 hours of direct inspection per inspection week.

- Facilities with an adequate CAP as defined by RG 3.75 – no changes to level of effort on this IP due to Tier 1 ranking.

- Fire Protection
  - The WG recommends an overall decrease of hours consistent with Tier 2 risk ranking. Combining important elements of scope from triennial and annual inspections into a new biennial IP 88054 will reduce overlaps and will result in efficiencies during implementation of inspection activities.
  - For Category I facilities, the WG recommend shifting of hours from the resident inspector program into a region-based procedure to provide flexibility to resident inspector program.
  - Facilities with an adequate CAP as defined by RG 3.75 – consistent with Tier 2 ranking, propose to further decrease the frequency to triennial.

- Material Control and Accounting
  - The WG recommends an overall decrease in the level of effort because insights gathered from expert elicitation concluded that efficiencies can be gained on the implementation of inspection procedures without impacting the goals of the inspection program. The recommended level of effort also aligns with the other Tier 1 ranking areas of criticality and chemical safety.
  - Category I facilities were assigned a Tier 1 ranking since these facilities possess and process strategic special nuclear material, and due to the complexity on the scope of inspection guidance and associated regulatory requirements.
  - Category III and Gas Centrifuge facilities reflect both a reduction to the frequency and level of effort that aligns with Tier 3 ranking for this area at these facilities, due to reduced complexity on the scope of inspection guidance and associated regulatory requirements as compared to Category 1 facilities.
  - The MC&A observation is now listed in the table as it was not previously listed in the table of core inspection hours. This observation has historically been part of the program.
  - Facilities with an adequate CAP as defined by RG 3.75 – no changes to the level of effort in this area due to tier ranking. In addition, due to the complexities on the scope and inspection activities for this area, such as requirements for completion of physical inventories, the WG does not recommends extending the frequency for Category III and Gas Centrifuge facilities from biennial to triennial.

- Radiation Protection
  - The WG recommends:
    - An overall decrease in the level of effort to align with the Tier 2 ranking of this inspection area.
    - Incorporate important elements of waste management into radiation protection to reduce overlaps in inspection guidance.
    - For facilities with an adequate CAP as inspected by RG 3.75 – consistent with Tier 2 ranking, further decrease the inspection frequency to triennial.

- Environmental Protection
  - The WG recommends:
    - An overall decrease on the level of effort to align with the Tier 3 ranking of this inspection area.

        - Incorporate flexibility into the procedure with a range of hours to accommodate for any necessary adjustments on inspection scope based on the length of time between inspections.
        - Facilities with an adequate CAP as inspected by RG 3.75 – consistent with Tier 3 ranking, propose to decrease the frequency from triennial to every 5 years.

- Waste Management
    - The WG recommends:
        - Incorporate risk significant elements of into radiation protection and environmental protection to reduce overlaps in the inspection guidance.
        - Delete and remove waste management from IMC 2600 Appendix B.

- Transportation
    - The WG recommends:
        - An overall decrease in the level of effort to align with the Tier 3 ranking of this inspection area.
        - Incorporate flexibility into the procedure with a range of hours to accommodate for any necessary adjustments on inspection scope based on the length of time between inspections.
        - Facilities with an adequate CAP as inspected by RG 3.75 – consistent with Tier 3 ranking, propose to decrease the frequency from triennial to every 5 years.

- Maintenance and Surveillance
    - The WG recommends incorporation of the risk significant elements of this procedure into the region-based operation safety and criticality safety due to overlaps in the area of management measures. The inspection procedures have the same elements and review management measures as part of their scope. Aspects of maintenance and surveillance that are not covered in operation safety and criticality safety will be added to these procedures to ensure all risk significant elements are maintained and inspected.
    - Delete and remove maintenance and surveillance from IMC 2600 Appendix B.

- Emergency Preparedness
    - Emergency Preparedness
        - The WG recommends:
            - An overall decrease in the level of effort to align with the Tier 2 ranking of this inspection area.
            - Facilities with an adequate CAP as inspected by RG 3.75 – consistent with Tier 2 ranking, propose to decrease the frequency from biennial to triennial.
    - Evaluation of Exercises and Drills
        - No changes.

- Plant Modifications
    - Plant Modifications (Annual)
        - The WG does not recommend changes to this IP.
        - The WG recommends that facilities with an adequate CAP as inspected by RG 3.75, be inspected every 3 years. The basis for this

recommendation is that the WG considers that facilities with a robust and NRC inspected program will apply all the elements of their CAP during the implementation of any plant modifications. Those elements are part of their licensing basis and will be inspected using a sample approach under procedure IP 88072.

- Plant Modifications (Triennial)
  - No changes to IP.
  - The two IPs are recent additions to the core inspection program. The WG recommends an assessment of the effectiveness and lessons learned upon completion of implementation across all licensed facilities to determine if further changes are needed.

- Inspection preparation and documentation
  - Actively work with licensees to include more documentation in electronic reading rooms to facilitate in-office review during preparation for inspections at the site. Electronic rooms provide efficiencies in inspector preparation by allowing inspector to review documents prior to arriving to the site and help inspectors in the sample selection of processes and controls to be inspected at the site.
  - Increase the use of technological tools (e.g., SharePoint) to provide quicker and easier access to commonly relied-on licensee documents and to provide electronic concurrences on inspection report documentation. Leveraging technological tools results in more efficient review of licensing documents and inspection report preparation and documentation.
  - Evaluate if there are changes needed to the expectations for appropriate depth and time allocated for inspection preparation and documentation as a result of the implementation of the recommendations in this report.
  - Evaluate if updates to the standardized inspection report templates could decrease the time required to document inspection results that do not result in potential compliance issues.
  - Explore expanding the use of Inspection Scheduling, Tracking and Reporting (ISTAR) to include report generation. Full implementation is dependent upon potential future Replacement Reactor Program System updates (which will require program office funding) and IP revisions.
  - Use planned IP revisions to focus on identifying items which may only be of regulatory significance to specific licensees or facility types. This is should aid the inspectors in focusing their prep time.

e. Incorporating operating experience into the program

The current inspection program framework evaluates the inspection results of the implementation of the core inspection program, temporary instructions and reactive inspections against compliance with regulatory in assessing licensee performance under IMC 2604 “Licensee Performance Review” to determine if there is a need to perform additional plant specific inspections.

The WG recognized that recently implemented programmatic tools such as the Operating Experience Program (OpE) and IMC 2650, “Fuel Cycle Inspection Assessment Program,” provide significant value to the inspection program and should be formally integrated into the current framework. The results of the analysis of trends of operating experience and the results of IMC 2650 assessments will provide information of significant value to determine, on a frequent basis, if there are changes needed to improve the effectiveness of the core inspection

program. Therefore, the WG recommends formalizing into the inspection program the process to use the results of the Operating Experience Program and IMC 2650 assessments.

f. Metrics

As previously stated, all the recommendations identified in this report are characterized as enhancements to the program. Completion of the core inspection program is currently tracked as a metric and reported in the Congressional Budget Justification. In addition, IMC 2650 "Fuel Cycle Inspection Assessment Program" has an element to verify completion of the core inspection program. Therefore, the WG does not recommend modifications to the current metrics as the metrics are considered effective in ensuring the goals of the inspection program are met.

Alternate Views Regarding Changes to IP 88045 "Effluent Control and Environmental Protection"

Some staff members have expressed the view that the proposed recommended changes to the environmental protection inspection procedure should not be implemented. In their view, the proposed Tier 3 ranking does not accurately reflect recent operating experience and potential reputational risks associated with spills and leaks. These staff members believe that the frequency and allocated hours for this inspection area should not be reduced. In addition, the staff members indicated that inspection guidance in IP 88045 needs to be enhanced to support the inspection of licensee's compliance with the regulations in 10 CFR Part 20 related to decommissioning planning. More specifically, the staff members believe that clarifications are needed to inspection guidance on 10 CFR Part 20.1406(c) and 20.1501 related to inadvertent releases. These two regulatory requirements were amended to improve decommissioning planning and reduce the likelihood that any current operating facility would become a legacy site. Since additional guidance is needed in this area, some staff members indicated that the staff should assess licensee's performance with revised guidance before making a decision about whether to reduce inspection hours in this area.

The WG was aware of and considered recent issues in the area of environmental protection during the implementation of the WG activities. In addition, the WG was aware of the need to evaluate and identify clarifications to the inspection guidance in IP 88045 related to decommission planning. However, the efforts to develop potential updates to IP 88045 were temporary placed on hold until completion of the WG holistic assessment of the inspection program. The WG agrees that as part of the revisions to inspection procedures as a result of the recommendations in this report, additional licensing and inspection guidance on compliance with the decommissioning planning rule should be developed.

The WG considered these perspectives in providing its draft recommendations. Specifically, the WG considered whether changes to the ranking of the area of environmental should be adjusted given recent events related to leaks and spills that did not rise to the level of reportable events and given the need to update guidance in this area. The WG concluded that these factors did not warrant a change to the recommended frequency of inspections in these areas. However, the WG recommends that additional licensing and inspection guidance on compliance with the decommissioning planning rule be developed and implemented. In addition, the WG recommends that, once inspection procedures are revised and implemented, an assessment of the environmental inspection area be completed consistent with IMC 2650 to verify the effectiveness of the proposed changes to inspection frequency and guidance.

List of Recommendations

- The WG recommends an in-depth assessment of the scope of resident inspector guidance and its referenced procedures as part of the implementation phase of this initiative. The assessment should consider potential changes to ensure the scope of the resident inspector program is focused on the areas that provide the greatest safety benefit and should also consider recommendations provided by external stakeholders. Based on this review, further adjustment of inspection activities between regional and resident inspector activities may be recommended.

- The WG recommends a reduction in the frequency of inspection to Tier 2 and Tier 3 inspection technical areas for licensees with an NRC-approved CAP.

- The WG recommends the following inspection frequencies and hours based on the tier ranking of each of the inspection areas.
    - Tier 1 areas – annual inspection frequency and a minimum of 90 hours.
    - Tier 2 areas – biennial inspection frequency and a minimum of 60 hours.
    - Tier 3 areas – triennial inspection frequency and a minimum of 30 hours with a range of hours to accommodate for any necessary adjustments on inspection scope based on the length of time between inspections.

- The WG recommends a revision to IMC 2600 to include an acceptable variance of plus or minus 10 percent in the core hours. In addition, language on the acceptable variance should be included in the resources estimate section for each inspection procedure.

- The WG recommends incorporation of changes described in section d. along with the marked-up version of the Appendix B to IMC 2600 with the recommended hours and frequencies for each area of the core inspection program.

- The WG recommends formalizing into the inspection program the results of the Operating Experience Program and the Fuel Cycle Inspection Assessment Program to determine, on a frequent basis, if changes to core inspection program are needed.

Public Engagement Activities

1. **March 13, 2019**, Regulatory Information Conference. Smarter Inspection Initiative introduced. Slides https://www.nrc.gov/public-involve/conference-symposia/ric/past/2019/docs/abstracts/marcanoj-w19-hv.pdf
2. **April 2, 2019,** Meeting with industry on CER- Summary of Meeting- https://www.nrc.gov/docs/ML1910/ML19106A349.pdf
3. **May 21, 2019,** Public Meeting Summary: Building a Smarter Fuel Licensing and Oversight Program. https://www.nrc.gov/docs/ML1916/ML19163A267.html
4. **June 27, 2019,** Meeting with Nuclear Energy Institute on Building a Smarter Fuel Cycle Inspection Program https://www.nrc.gov/docs/ML1918/ML19184A060.html
5. **August 8, 2019**, Meeting with NEI On Building A Smarter Fuel Cycle Inspection & Licensing Program https://www.nrc.gov/docs/ML1922/ML19227A158.html
6. **September 12th, 2019,** Public Meeting Summary - NRC's Smarter Inspection Program for Fuel Cycle Facilities https://www.nrc.gov/docs/ML1930/ML19304A112.html
7. **September 25, 2019,** Summary of Meeting to Discuss Fuel Cycle Regulatory Activities and Cumulative Effects of Regulation https://www.nrc.gov/docs/ML1927/ML19274D398.pdf
8. **October 17, 2019**, Meeting with URENCO USA On Specific Recommendations for Building A Smarter Fuel Cycle Inspection Program https://www.nrc.gov/docs/ML1930/ML19303D270.html
9. **November 15, 2019,** Meeting Summary: Building a Smarter Fuel Licensing and Oversight Program https://www.nrc.gov/docs/ML1933/ML19338C823.html
10. **March 5, 2020,** Meeting Notice: Meeting to provide an overview of the draft reports for Building a Smarter Fuel Cycle Licensing and Oversight Program https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML20052E707

Figures and Tables

Figure 1. Fuel Cycle Operating Experience – Events Per Year

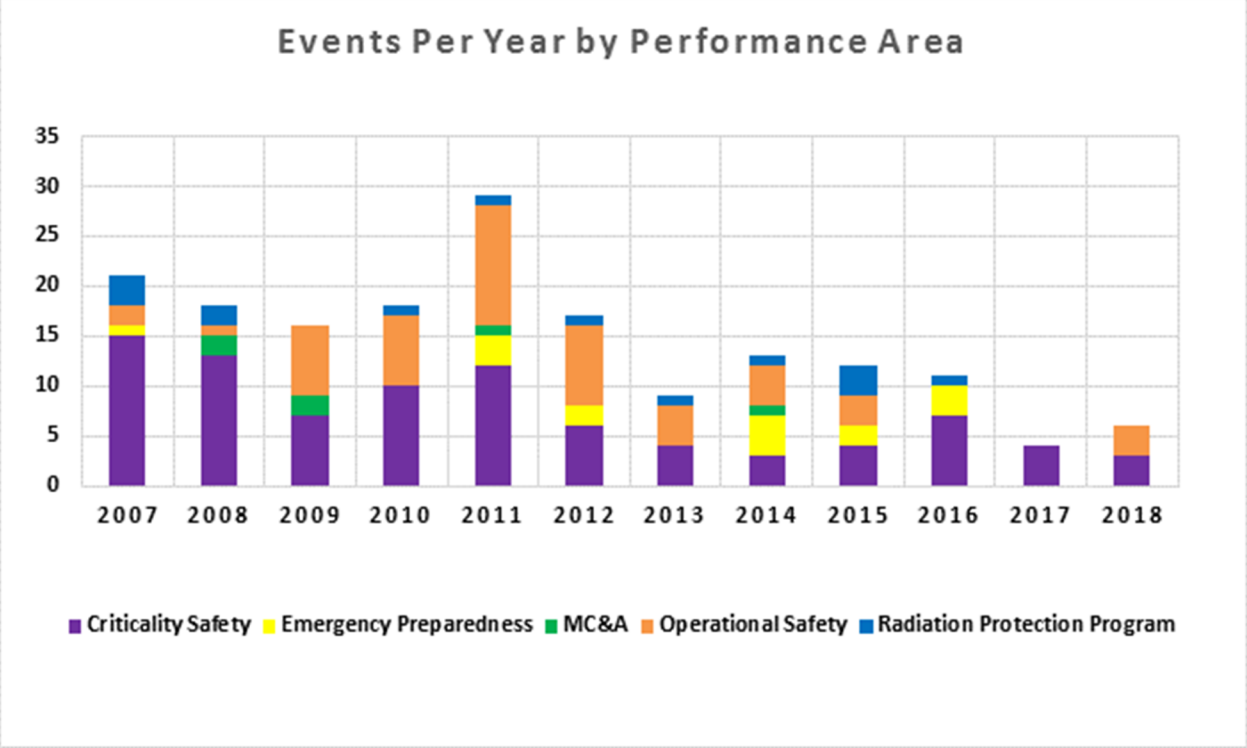

Figure 2. Example of Matrix Used to Rank Inspection Technical Areas

	Accident Sequences	Operating Experience	Regulatory Requirements	Reputational Risk
Criticality	*High*	*High*	*Medium*	*Low*
Chemistry	*High*	*High*	*Low*	*Low*
Fire	*Medium*	*Medium*	*Medium*	*High*
Environmental	*Low*	*Low*	*Low*	*High*
Radiation Protection	*Medium*	*Low*	*Low*	*High*
Transportation	*Low*	*Low*	*Medium*	*Low*
Emergency Preparedness	*Medium*	*Medium*	*Low*	*Medium*
Material Control & Accounting	*N/A*	*Medium*	*High*	*Low*

Figure 3. Tier Ranking of Inspection Technical Areas

Technical Areas (Safety)	
Criticality Safety	Tier 1
Chemical Safety	
Fire Safety	Tier 2
Emergency Preparedness	
Radiation Protection	
Transportation	Tier 3
Environmental	

Technical Areas (Safeguards)	
Material Control and Accounting	Tier 1/Tier 2*

*Category I facilities ranked Tier 1; Category III and Gas Centrifuge facilities ranked Tier 2

Tables of Proposed Recommendations to the Core Inspection Program

Proposed Recommendations to IMC 2600 Appendix B

		Category I Fuel Facility		Category III Fuel Fabrication Facility		Uranium Conversion Facility		Gas Centrifuge Facility				Laser Enrichment Facility	
Function/ Program Areas	Procedure or Procedure Suite	Inspection Frequency	Estimated Resources per IP (hrs)	Inspection Frequency	Estimated Resources per IP (hrs)	Inspection Frequency	Estimated Resources per IP (hrs)	Inspection Frequency	Estimated Resources per IP (hrs)	Approved CAP Frequency	Estimated Resources per IP (hrs)	Inspection Frequency	Estimated Resources per IP (hrs)
SAFETY OPERATIONS													
Plant Operations	88020 (OPR)	- Annual (2 per year)	- 105	Annual (2 per year)	~~60~~ 120	Annual (2 per year)	~~60~~ 90	Annual (2 per year)	~~60~~ 90	Annual (2 per year)	90	-	-
	88135+ (Resident Inspection Program)	Annual	~~797~~ 752	-	-	-	-	-	-	-	-	-	-
Criticality Safety	88015	Annual (2 per year)	~~192~~ 120	Annual (2 per year)	~~64~~ 60	-	-	Annual (2 per year)	~~64~~ 60	Annual (2 per year)	60	-	-
Fire Protection	88055 (FPB)	- Biennial	- 30	Annual Biennial	~~32~~ 60	Annual Biennial	~~32~~ 60	Annual Biennial	~~32~~ 60	Triennial	60	-	-
	~~88054 (FPT)~~	~~Triennial*~~	~~90~~	~~Triennial*~~	~~90~~	~~Triennial*~~	~~90~~	~~Triennial*~~	~~90~~	-	-	-	-

Proposed Recommendations to IMC 2600 Appendix B

		Category I Fuel Facility		Category III Fuel Fabrication Facility		Uranium Conversion Facility		Gas Centrifuge Facility		Laser Enrichment Facility	
Function/ Program Areas	Procedure or Procedure Suite	Inspection Frequency	Estimated Resources per IP (hrs)	Inspection Frequency	Estimated Resources per IP (hrs)	Inspection Frequency	Estimated Resources per IP (hrs)	Inspection Frequency	Estimated Resources per IP (hrs)	Inspection Frequency	Estimated Resources per IP (hrs)
SAFEGUARDS											
MC&A	Procedures as in IMC 2683	Annual	~~152 196~~ 120	~~Annual~~ Biennial	~~54 72~~ 60	-	-	~~Annual~~ Biennial	~~62 84~~ 60	-	-
	MC&A Observation	Triennial	30	Triennial	30	-	-	Triennial	30	-	-

Proposed Recommendations to IMC 2600 Appendix B

		Category I Fuel Facility		Category III Fuel Fabrication Facility		Uranium Conversion Facility		Gas Centrifuge Facility				Laser Enrichment Facility	
Function/ Program Areas	Procedure or Procedure Suite	Inspection Frequency	Estimated Resources per IP (hrs)	Inspection Frequency	Estimated Resources per IP (hrs)	Inspection Frequency	Estimated Resources per IP (hrs)	Inspection Frequency	Estimated Resources per IP (hrs)	Approved CAP Frequency	Estimated Resources per IP (hrs)	Inspection Frequency	Estimated Resources per IP (hrs)
RADIOLOGICAL CONTROLS													
Radiation Protection	88030 (RP)	Biennial ~~with annual subsections~~	~~64~~ 60	Biennial ~~with annual subsections~~	~~64~~ 60	Biennial ~~with annual subsections~~	~~64~~ 60	Biennial ~~with annual subsections~~	~~64~~ 60	Triennial	60	-	-
Environmental Protection	88045 (Effluent Control and Env.)	~~Annual~~ Triennial	~~32~~ 30-60	~~Annual~~ Triennial	~~32~~ 30-60	~~Annual~~ Triennial	~~32~~ 30-60	~~Annual~~ Triennial	~~32~~ 30-60	5 Years	30-60	-	-
~~Waste Management~~	~~88035 (WM)~~	~~Biennial~~	~~32~~	~~Biennial~~	~~32~~	~~Biennial~~	~~32~~	~~Biennial~~	~~32~~	-	-	-	-
Transportation	86740 (T)	~~Biennial~~ Triennial	~~32~~ 30-60	~~Biennial~~ Triennial	~~32~~ 30-60	~~Biennial~~ Triennial	~~32~~ 30-60	~~Biennial~~ Triennial	~~32~~ 30-60	5 Years	30-60	-	-
FACILITY SUPPORT													
~~Maintenance/ Surveillance~~	~~88025 (MS)~~	-	-	~~Annual~~	~~30~~	~~Annual~~	~~30~~	~~Annual~~	~~30~~			-	-
Emergency Preparedness	88050 (EP)	~~Annual~~ Biennial	~~32~~ 30	~~Annual~~ Biennial	~~32~~ 30	~~Annual~~ Biennial	~~32~~ 30	~~Annual~~ Biennial	~~32~~ 30	Biennial	30	-	-
	88051 (Exercise Observation)	Biennial	48	Biennial	48	Biennial	48	Biennial	48	Biennial	48	-	-
Plant Modifications (Annual)	88070	Annual unless 88072 is performed	~~32*~~ 30-90*	Annual unless 88072 is performed	~~32*~~ 30-90*	Annual unless 88072 is performed	~~32*~~ 30-90*	Annual unless 88072 is performed	~~32*~~ 30-90*	~~Annual unless 88072 is performed~~	~~32*~~	-	-
Plant Modifications (Triennial)	88072	Triennial	~~96*~~ 90*	Triennial	~~96*~~ 90*	Triennial	~~96*~~ 90*	Triennial	~~96*~~ 90*	Triennial	90*	-	-
Corrective Action Program	88161	-	-	-	-	-	-	-	-	Triennial	90	-	-

*Note: The actual planned inspection hours will depend on information developed from routine inspections, changes to the ISA Summary, discussions with Project Inspectors, Project Managers, and staff, etc.

Comparison of Annualized Core Inspection Hours: Current Program and Proposed Recommendations to IMC 2600 Appendix B

	Category I Fuel Facility		Category III Fuel Fabrication Facility		Uranium Conversion		Gas Centrifuge Facility			Laser Enrichment Facility	
Function Areas Core Hours	**Current Program**	**Proposal**	**Current Program**	**Proposal**	**Current Program**	**Proposal**	**Current Program**	**Proposal**	**Proposal CAP**	**Current Program**	**Proposal**
Resident Inspector	797	752									
Plant Operations	0	105	60	120	60	90	60	90	90	0	0
Criticality Safety	192	120	64	60	0	0	64	60	60	0	0
Fire Protection	30	15	51	30	51	30	51	30	20	0	0
MC&A	196	120	72	30	0	0	64	30	30	0	0
MC&A Observation	10	10	10	10	0	0	10	10	10	0	0
Security	241	241	8	8	8	8	184	184	184	136	136
Radiation Protection	32	30	32	30	32	30	32	30	20	0	0
Environmental Protection	32	10	32	10	32	10	32	10	6	0	0
Waste Management	16	0	16	0	16	0	16	0	0	0	0
Transportation	16	10	16	10	16	10	16	10	6	0	0
Maintenance/Surveillance	0	0	30	0	30	0	30	0	0	0	0
Emergency Preparedness	56	39	56	39	56	39	56	39	34	0	0
Plant Modifications	53	50	53	50	53	50	53	50	30	0	0
Corrective Action Program	0	0	0	0	0	0	40	30	30	0	0
Total Annualized Hours =	**1672**	**1502**	**500**	**397**	**354**	**267**	**708**	**573**	**520**	**136**	**136**

Notes: (1) Security inspection area was outside of the scope of this initiative. (2) Laser Enrichment Facility is illustrated for consistency with current IMC 2600 Appendix B tables, facility is currently inactive.