Recommendations on Pre-Licensing Site Construction Requirements for In Situ Uranium Recovery Facilities Pursuant to 10 CFR § 40.32(e)

A White Paper Presented to the United States Nuclear Regulatory Commission by:

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I. INTRODUCTION

With the re-emergence of the nuclear power industry, all stages of the commercial nuclear fuel cycle are experiencing a resurgence; but a resurgence that may be threatened by global economic issues. As a result, there is a need for prompt, efficient licensing actions for new domestic sources of uranium production that avoid financially burdensome delays to the extent reasonably practicable. As a result, uranium recovery companies have sought regulatory approval from agencies such as the United States Nuclear Regulatory Commission (NRC) and its Agreement States for new uranium recovery project sites, the vast majority of which will be uranium recovery using the in situ recovery (ISR) technique. As the most environmentally protective and technologically efficient form of uranium recovery, the ISR technique has become the predominant form of uranium recovery in the United States.

Traditionally, ISR projects are developed in a "phased" manner involving a variety of project-specific steps, including pre-licensing exploration and site development and post-licensing site construction, production, and ultimately final site decommissioning and decontamination (D&D) including groundwater restoration. At the completion of the developmental stages, ISR project sites typically have two types of facilities: (1) subsurface facilities in the form of wellfields sequentially developed over an identified underground uranium ore body and (2) surface facilities including, but not limited to, a central processing facility with ion-exchange columns, yellowcake drying and packaging circuits, and storage pads and various other structures and infrastructure including offices, laboratories, storage warehouses, roads and power lines. The development of the subsurface and surface facilities at ISR project sites can be regulated by a number of overlapping regulatory regimes depending on the geographic location of the proposed site (State in which it is located) and the ownership status of the land (lands supervised by Bureau of Land Management (BLM), United States Forest Service (USFS), States, Native American Tribes, private entities, etc.) on which ISR operations are to occur.

Currently, the development of ISR project sites licensed by NRC is governed, in part, by 10 CFR § 40.32(e), a regulation put into place in 1980 by NRC as part of the uranium recovery regulations promulgated in response to the enactment of the Uranium

Mill Tailings Radiation Control Act of 1978 (UMTRCA) and its definition of 11e.(2) byproduct material, as well as the 1980 Generic Environmental Impact Statement on Uranium Milling (NUREG-0706) and public comments received on the draft version. This regulation was promulgated to address the need for environmental review of potential significant and long-lasting environmental impacts from construction activities at conventional uranium mills and the potential "irrevocable and irretrievable" commitments associated with the uranium mill tailings disposal facilities, including their eventual transfer to the United States Department of Energy (DOE) or the resident State for mandatory long-term surveillance and monitoring in perpetuity as a general licensee of NRC. Consistent with Congressional intent in enacting UMTRCA to protect public health and safety from the potential impacts of *uranium and thorium mill tailings* and the facilities at which such tailings are managed and stored, NUREG-0706's scope, analyses and conclusions, and the administrative record associated with the promulgation of 40.32(e), it is apparent that NRC intended to apply Part 40.32(e)'s pre-licensing site construction requirements *only* to conventional uranium mills with attendant 11e.(2) byproduct material disposal facilities and not to ISR facilities. As the newly released Draft GEIS for ISR Facilities entitled *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (NUREG-1910) demonstrates, the potential impacts associated with the construction of ISR facilities are short-term and minimal, at worst and, at best, essentially non-existent. Thus, given the fact that ISR facilities pose little potential threat of significant and long-lasting environmental impacts and no "irrevocable and irretrievable" resource commitments, 10 CFR § 40.32(e) should be applied to ISR facilities using a "three-tiered" model framework similar to that employed by NRC Staff for power reactor sites when determining whether pre-licensing site construction activities at such sites should be permitted.

Further, given the emerging need for short and long-term domestic uranium production and the low risk associated with ISR operations, NRC should use its "discretion" to allow for flexibility for pre-licensing site construction decisions since the ability to advance quickly to active uranium recovery operations after a license is granted will result in savings of millions of dollars of financial resources and will encourage of financial investment in such domestic uranium production. In addition, the ISR operators that are parties to this White Paper emphasize that a "flexible" risk-informed NRC policy on pre-licensing site construction activities merely provides such operators with the "option" of engaging in such activities based on their internal assessment of whether site-specific circumstances dictate that such activities make good sense.

II. PRE-LICENSING SITE CONSTRUCTION UNDER 10 CFR § 40.32(e) AND PROPOSALS FOR IMPLEMENTATION OF "FLEXIBLE" GUIDANCE FOR SUCH PRE-LICENSING SITE CONSTRUCTION AT ISR SITES

A. Atomic Energy Act of 1954 and Uranium Mill Tailings Radiation Control Act of 1978: An Attempt to Regulate the Long-Term Management and Disposal of Uranium Mill Tailings

The origins of 10 CFR § 40.32(e) and its pre-licensing site construction limitations must be examined in the context of UMTRCA, as it amended the AEA. Congress enacted UMTRCA in 1978 with the specific intent of remedying NRC's perceived lack of statutory/regulatory authority to regulate *uranium mill tailings* and other uranium recovery wastes after the cessation of active uranium milling operations under its then-existing authorities contained in the AEA. The legislative history of UMTRCA reveals that, prior to its passage, NRC believed it was without statutory/regulatory authority to regulate uranium mill tailings *per se* and, thus, could not control the safe management and final disposal of mill tailings at such uranium milling facilities. As stated by the House Interior and Insular Affairs Committee:

> "Without the authorities included in H.R. 13650 [the bill would eventually be enacted as UMTRCA], *the conditions addressed by the remedial program [to clean up abandoned mill tailings sites] would be left without remedy, and the authority of the Commission to establish uniform rational standards for waste disposal from uranium mills would not be clear*."[1]

Further, it was Congress' intent not only to grant NRC express statutory/regulatory authority over the short-term potential impacts of uranium mill tailings, but also over the long-term *management* of such tailings. On this issue and as stated in Section 2 of UMTRCA, Congress sought to establish:

> "a program to regulate mill tailings during uranium or thorium ore processing at active mill operations *and after termination of such operations in order to stabilize and control such tailings in a safe and environmentally sound manner and to minimize or eliminate radiation health hazards to the public*."

This statement is further endorsed by former NRC Chairman Joseph Hendrie in his testimony before Congress:

> ""The NRC believes that long-term release from tailings piles may pose a radiation health hazard if the piles are not effectively stabilized to minimize radon releases and prevent unauthorized use of the tailings."

[1] H.R. Rep. No. 95-1480, 95th Cong., 2nd Sess. 12 (1978) (emphasis added).

In order to create a comprehensive statutory program that accomplished both goals of UMTRCA, Congress created a new class of AEA materials in Section 201 of UMTRCA, 11e.(2) byproduct material, which is defined as:

> "the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content."[2]

By creating this new definition, Congress intended that NRC exercise exclusive day-to-day federal oversight[3] of all aspects (radiological and *non*-radiological) of 11e.(2) byproduct material in the form of licensed uranium mill tailings.[4] In addition, in Section 202 of UMTRCA, Congress prescribed a specific framework for the long-term management and disposal of 11e.(2) byproduct material. The central feature of this statutory framework is the requirement that, prior to termination of any NRC license for 11e.(2) byproduct material facilities, title to all byproduct material and the land used for its disposal must be transferred to a mandatory long-term custodian (i.e., the United States Department of Energy (DOE) or the resident State) for long-term surveillance and monitoring as a general licensee of NRC in perpetuity, unless NRC determines that transfer is not necessary or desirable to protect public health and safety and the environment.[5] As a result of the enactment of UMTRCA, Congress set the stage for development of a comprehensive, federal NRC-implemented regulatory program to address all aspects of the safe and effective short and long-term management, disposal, and isolation of *uranium mill tailings at every licensed uranium mill site*.[6]

B. Preparation of NUREG-0706 on Uranium Milling

After the enactment of UMTRCA in 1978, NRC embarked on a multi-faceted developmental approach to the promulgation of regulations for the safe and effective management, disposal, and isolation of uranium mill tailings. First, as part of a general effort to assess the potential impacts of conventional uranium milling, including mill tailings management, to create amendments to 10 CFR Part 40, and to create uranium milling-specific Criteria in Appendix A, in 1976, NRC began the development of a GEIS

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[2] 42 U.S.C. § 2014(e)(2).

[3] While the United States Environmental Protection Agency (EPA) was delegated the authority to promulgate *generally applicable [environmental] standards* regarding 11e.(2) byproduct material, with which NRC was required to conform, NRC was granted primary and exclusive authority to implement and enforce such standards.

[4] In 2000, the Commission determined that *non*-Agreement States *could not* exercise "concurrent" jurisdiction with NRC over 11e.(2) byproduct material by regulating the *non*-radiological aspects of such material. *See* United States Nuclear Regulatory Commission, Staff Requirements Memorandum, SECY-99-277.

[5] 42 U.S.C. § 2113(b).

[6] In addition, Section 274 of the AEA authorizes States to enter into agreements with the Commission to allow NRC to discontinue its regulatory authority over certain AEA materials and activities and to allow States to assume such authority so long as the State-based regulatory program for such materials and activities is *compatible* with NRC's regulatory program.

that would assess, on a programmatic basis, the potential impacts to public health and safety and the environment from *conventional uranium milling facilities*. On June 3, 1976, NRC issued a notice of intent to prepare a GEIS on conventional uranium milling. In April of 1979, a draft version of what would eventually become NUREG-0706 (NUREG-0511) was published for public comment with the final version of NUREG-0706 being issued in October of 1980. NUREG-0706 was created for the purpose of "assess[ing] the potential environmental impacts of uranium milling operations, in a programmatic context, including the management of uranium mill tailings…."[7] More specifically, NRC stated that one of the purposes of NUREG-0706 was to "assess the nature and extent of the environmental impacts of conventional uranium milling in the United States…on both short and long-term bases…."[8] In the context of NUREG-0706, the term "conventional uranium milling" was defined to mean:

> "the milling of ore mined primarily for the recovery of uranium. It involves the processes of crushing, grinding, and leaching of the ore, followed by chemical separation and concentration of uranium."[9]

Given the number of existing conventional uranium milling facilities in the United States at the time and the projected potential for tens of new such facilities to be constructed by 2050, NRC focused the scope and analysis in NUREG-0706 solely on conventional uranium milling processes and the facilities at which such processes are conducted.

In order to set forth the programmatic scope of its analyses and conclusions, NRC utilized a "model mill" approach to present a "base case" from which a wide range of assessments of potential radiological and *non*-radiological impacts could be performed including land use, water resources, air quality, and public and occupational radiological dose. This "model mill" approach included the creation of a "model region" "to form a basis for analyzing potential environmental impacts…and alternative control measures….[at which] [t]he model mill…is postulated to be situated…."[10] Both the "model mill" and the "model region" were designed to encompass existing and potential future *conventional* uranium milling facilities using traditional crushing and grinding milling techniques and producing large quantities of uranium mill tailings.

After setting forth the programmatic scope of NUREG-0706 through the use of a "model mill" and "model region" approach, NRC further clarified which forms of "conventional" uranium recovery would be assessed in its analyses and which forms of uranium recovery were considered to be "unconventional." As stated by NRC in NUREG-0706, "unconventional" uranium recovery methods "include solution mining (also known as in situ mining), uranium recovery from mine water, copper dump leach liquor, or wet process phosphoric acid effluents."[11] With specific respect to ISR processes, NRC states "[i]n situ leaching (solution mining) of uranium is a viable

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[7] NUREG-0706 at 2.
[8] *Id.*
[9] *Id.* at 3.
[10] *Id.* at 4-1.
[11] *Id.* at 3-4.

uranium production method that will likely reduce the total conventional milling capacity needed in the future by a significant amount."[12] NRC also states that, in contrast to conventional uranium milling, "[n]o conventional ore mining, transporting, or grinding operations are needed prior to chemical processing to recover the uranium. *Although some solid wastes (primarily calcium salts comobilized with the uranium complex) are generated, large quantities of mill tailings are not produced.*"[13] This method of uranium production, like the others named in NUREG-0706, was excluded from analysis with NRC stating that "[t]hese processes are described to a *limited extent for completeness*."[14] Thus, the scope of NUREG-0706 and its in-depth technical and environmental analyses and conclusions were limited strictly to conventional uranium milling facilities.

C. Administrative Rulemaking Docket for 10 CFR § 40.32(e)

While NUREG-0706 was being finalized, NRC sought to develop amendments to 10 CFR Parts 40 and 150 (for Agreement States) to reflect the Congressional mandates set forth in UMTRCA for the management of uranium mill tailings. On August 24, 1979, NRC published both effective and proposed rules in the Federal Register "to implement the requirements of UMTRCA and the conclusions reached in the draft GEIS on uranium milling."[15] More specifically, as stated in the Final Rule for these amendments:

> "The amendments to Part 40 and 150 take into account the conclusions reached in a final generic environmental impact statement on uranium milling [NUREG-0706] and the requirements mandated in the Uranium Mill Tailings Radiation Control Act of 1978, as amended, public comments received on a draft generic environmental impact statement on uranium milling, and public comments received on proposed rules published in the Federal Register."[16]

The need for these regulations was described in the Final Rule's response to comments:

> "A number of commenters took the position that there is no great sense of urgency for regulations on uranium mill tailings management and mill operations. However, each year new mills are proposed and many millions of tons of tailings are generated at existing mills. As new mills are constructed and more tailings are generated, the options for dealing with tailings disposal become fewer. It is critically important that the siting and design criteria of the regulations be implemented for new facilities so that mistakes of the past are not repeated."[17]

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[12] NUREG-0706 at 3-8.
[13] *Id.* at 3-9.
[14] *Id.* at 3 (emphasis added). NRC also states on this issue: "They have not been evaluated in depth, since at the time the scope of this document was formulated; they were expected to produce relatively small quantities of uranium."
[15] 45 Fed. Reg. 65521 (October 3, 1980).
[16] *Id.*
[17] *Id.*

This Final Rule promulgated and finalized a number of UMTRCA-specific regulations, including what the Commission referred to as "siting and design criteria" for newly proposed conventional uranium milling facilities.[18] One of these regulations was a newly proposed 10 CFR § 40.32(e) that dealt directly with the extent to which a proposed conventional uranium mill project site could be developed and constructed pursuant to these "siting and design criteria" prior to the issuance of a uranium milling license. This new Part 40.32(e) imposed a requirement on the Director of NRC's then-named Office of Nuclear Material Safety and Safeguards (NMSS) (now Office of Federal and State Materials and Environmental Management Programs) to make "a positive finding on an applicant's proposed plans as meeting the requirements and objectives in Appendix A *prior to commencement of construction of a mill which produces byproduct material*."[19] As a result, the new Part 40.32(e) states:

> "In the case of an application for a license for a uranium enrichment facility, or for a license to possess and use source and byproduct material for uranium milling, production of uranium hexafluoride, or for the conduct of any other activity which the Commission determines will significantly affect the quality of the environment, the Director, Office of Federal and State Materials and Environmental Management Programs or his designee, before commencement of construction of the plant or facility in which the activity will be conducted, on the basis of information filed and evaluations made pursuant to subpart A of part 51 of this chapter, has concluded, after weighing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives, that the action called for is the issuance of the proposed license, with any appropriate conditions to protect environmental values."[20]

Based on this requirement, the Commission concluded in the regulation that "[c]ommencement of construction prior to this conclusion is grounds for denial of a license to possess and use of source and byproduct material in the plant or facility."[21] Therefore, "the denial of applications for licenses where construction is started before the appropriate environmental appraisals are completed and documented" is required.[22]

However, it is crystal-clear from NRC's accompanying explanatory language that this requirement is to be imposed only on a conventional "mill which produces byproduct material" as tailings, where it states:

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[18] *Id.*
[19] 45 Fed. Reg. at 65521.
[20] 10 CFR § 40.32(e). This rule's current language incorporates amendments and administrative revisions added in 1984, 1992, and 2008; however, the substance of the regulation has not changed since its finalization in 1980.
[21] *Id.*
[22] 45 Fed. Reg. at 65521.

> "Construction activities are likely to result in significant and long lasting environmental impacts, the propriety of which cannot be ascertained until these environmental appraisals are completed and documented."[23]

Moreover, NRC adds that:

> "The Commission also notes in this regard that milling results in the production of large quantities of byproduct material as tailings each year. When construction of a mill begins, *including its tailings disposal area*, irrevocable commitments are made regarding tailings disposal."[24]

Finally, NRC concludes that:

> "Given that each mill tailings pile constitutes a low-level waste burial site containing long lived radioactive materials, the Commission believes that prudence requires that specific methods of tailings disposal, mill decontamination, site reclamation, surety arrangements, and arrangements to allow for transfer of site and tailings ownership be worked out and approved before a license is granted."[25]

NRC's description of "milling" in the context of the Final Rule is entirely consistent with NUREG-0706 and the Congressional mandate articulated in UMTRCA. The primary goal of UMTRCA is the safe management and disposal of *uranium mill tailings*, including short-term management in accordance with EPA and NRC regulatory requirements and long-term management in accordance with Section 83's requirements for transfer of all 11e.(2) byproduct material to a mandatory long-term custodian for perpetual long-term surveillance and monitoring.[26]

This description of "milling" is, however, entirely inconsistent with the generic construction parameters for ISR facilities for a number of reasons. First, as stated above by NRC in NUREG-0706 and discussed in NRC's recently released NUREG-1910, ISR facilities do not generate large quantities of uranium mill tailings and do not require *any* tailings disposal areas for the operation of the facility or the closure of the site after cessation of operations and groundwater restoration. Initially, with respect to 11e.(2) byproduct material management, 10 CFR Part 40, Appendix A, Criterion 2 requires the disposal of such materials at licensed 11e.(2) disposal facilities, including existing conventional uranium milling facilities. Liquid wastes classified as 11e.(2) byproduct

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[23] *Id.*
[24] *Id.*
[25] *Id.*
[26] It is important to note that NRC likened the potential "irrevocable and/or irretrievable commitments" associated with conventional uranium milling facilities to those presented by facilities "in which source materials are possessed and used for the production of uranium hexafluoride and commercial waste disposal by land burial" and amended Part 40.32(e) to include such facilities. Once again, these facilities present potential significant impacts that are more similar to *conventional uranium milling facilities* and not at all similar to ISR facilities.

material at such facilities can be disposed of using a Class I UIC deep-disposal well, if available, or by the use of evaporation ponds for liquid disposal with the resulting 11e.(2) sediment ultimately transported to a licensed 11e.(2) disposal facility for disposal. In either case, ISR facilities do not require tailings management facilities with potentially significant environmental impacts that could be considered an "irrevocable and irretrievable resource commitment" in the form of a "low-level waste burial site" as contemplated by NRC when promulgating the current Part 40.32(e) requirements.

With respect to the threat of significant long-lasting environmental impacts and "irrevocable and irretrievable resource commitments," title transfer requirements for 11e.(2) byproduct material under Section 83 of the AEA do not apply to ISR facilities.[27] Conventional uranium milling facilities typically require tailings management facilities that are conservatively designed surface impoundments with liner and leachate collection and detection systems to ensure that no leakage of 11e.(2) byproduct material occurs and that require a licensee to disturb large portions (i.e., 40-80 acres) of a proposed site. Further, these impoundments also serve as the future repository for other materials at the site including, but not limited to, the mill itself, windblown tailings, and other discrete 11e.(2) surface wastes. However, while conventional uranium milling facilities are specifically designed to control and manage these materials and for eventual transfer to a mandatory long-term custodian, ISR facilities are released for *unrestricted use* after completion of operations, site D&D, including groundwater restoration and, therefore, do not contain any residual radioactive materials.[28] Thus, since ISR facilities do not require the tailings management and disposal facilities required by conventional uranium milling facilities for operations and post-operational long-term control of 11e.(2) byproduct material on-site, NRC's promulgation of Part 40.32(e) was not intended to apply to ISR facilities.

The potential impacts associated with construction activities at ISR sites already have been assessed in the Draft ISR GEIS and have been found to pose "low" levels of potential impacts. For example, the Draft ISR GEIS states with respect to land use impacts:

> "Ecological, historical, and cultural resources could be affected, but would be protected by careful planning and surveying to help identify resources and avoid or mitigate impacts. For all land use impacts except ecological, historical and cultural resources, the potential impacts would be SMALL."[29]

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[27] *See* 10 CFR Part 40.4 (depleted underground ore bodies resulting from ISR operations are not considered 11e.(2) byproduct material).

[28] In addition, the aquifer in the recovery zone at an ISR site must be an "exempted" aquifer under EPA regulations which mandates that such aquifer cannot now nor ever in the future serve as a source of public drinking water. Thus, so long as the recovery zone aquifer is restored in accordance with applicable regulatory requirements, then such aquifer will also be returned to its status prior to ISR operations.

[29] NUREG-1910 at xxxviii. It is important to note that the National Mining Association's comments on NUREG-1910 stated that ecological, historical, and cultural resource impacts

In addition, along with these minimal potential impacts, the construction of surface and subsurface facilities at ISR sites are largely, if not completely, standardized and pose the same potential impacts at every ISR site. As a result, the programmatic assessment of the construction of these facilities should be viable for all proposed pre-licensing site construction activities. Additionally, the amount of land area that potentially could be disturbed as a result of pre-licensing site construction activities generally is much less than the ten (10) percent of a proposed site which NRC Staff notes is the amount of a proposed site that would be disturbed as a result of *all* ISR operations, *including wellfields*.[30] As a matter of fact, the construction of an ISR project's surface facilities generally results in a disturbance of a minimal portion of the total site area. Thus, the potential for significant or long-term impacts from pre-licensing site construction at ISR facilities is negligible. Indeed, there are no potential AEA radiological impacts from such pre-licensing construction activities as no licensed material is possessed or used at the site prior to issuance of an NRC license.

Further, NRC also considered financial assurance arrangements,[31] including the availability of funds for long-term surveillance and monitoring after transfer of the site to the mandatory long-term custodian, when promulgating Part 40.32(e). In addition to the lack of a need for funds for title to transfer at ISR sites, the largest portion of financial assurance associated with ISR facilities is groundwater restoration. However, groundwater restoration is not necessary until an ISR operator commences and then completes active uranium recovery operations in a given wellfield pursuant to an NRC license and has no relationship to pre-licensing site construction of ISR surface or subsurface facilities, including wellfields. As a result, ISR sites do not represent the same types of potential impacts related to financial assurance as those contemplated for conventional uranium milling facilities by NRC in the Part 40.32(e) rulemaking. Thus, the issue of financial assurance for ISR facilities does not implicate the same potential risks considered by NRC in the Part 40.32(e) rulemaking.

Finally, in many cases, ISR operators may have additional financial assurance in place to address any pre-licensing site construction, since they may require additional permits from other regulatory entities such as States, BLM, and USFS. These regulatory entities frequently require some form of environmental review such as an environmental assessment (EA) and a financial assurance mechanism for a variety of structures and facilities such as office buildings, roads, storage warehouses, and wells. For example, the Wyoming Department of Environmental Quality (WDEQ) currently requires ISR operators to obtain a State Permit to Mine, which is accompanied by a financial assurance requirement for all activities on lands in the State, including the drilling of wells.[32] BLM

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should not be analyzed in the land use impact section of its analysis. However, in either scenario, land use impacts were found to be "SMALL."

[30] *See* NUREG-1910 at xl.

[31] *See* 10 CFR Part 40, Appendix A, Criteria 9 & 10.

[32] As a practical matter, NRC has no authority over wellfields prior to the injection of lixiviant pursuant to an AEA uranium recovery license; prior to beginning active uranium recovery

has a similar financial assurance requirement pursuant to its regulations for obtaining an approved Plan of Operations for ISR site activities on BLM lands.[33]

D. NRC Staff Should Implement Pre-Licensing Site Construction Guidance Similar to the Requirements in 10 CFR § 50.10 and the Limited Work Authorization Program for Nuclear Power Reactors

Given that Part 40.32(e) was never intended to apply to pre-licensing site construction at ISR sites, NRC can use its discretion to conclude that, pursuant to a risk-informed, "flexible" approach to such construction activities, denial of a license for such activities will not be *required*. By implementing a risk-informed, "flexible" approach, NRC Staff will be acting in accord with the Commission's policy on risk-informed, performance-based licensing. Based on its institutional experience, NRC has determined that its regulatory regime includes a range of licensed activities which pose differing levels of potential risk and, therefore, that it should analyze such activities and their potential impacts in conjunction with their relative levels of risk. Using this "risk-informed" approach, NRC evaluated a wide range of challenges to the safety aspects of various licensed activities, including prioritizing potential risks based on operating history and industry experience, engineering judgment and consideration of relative levels of uncertainty in safety and environmental analyses for specific activities. As stated by NRC, "[w]here appropriate, a risk-informed regulatory approach can also be used to reduce unnecessary conservatism in deterministic approaches, or can be used to identify areas with insufficient conservatism and provide the bases for additional requirements or regulatory actions." *See* United States Nuclear Regulatory Commission, SECY-98-144, *White Paper on Risk-Informed and Performance-Based Regulation* (June 22, 1998).

Based on an evaluation of its regulatory program, NRC determined that "risk-informed" regulation is an approach under which risk insights, engineering analysis and judgment, and performance history are used, to (1) focus attention on the most important activities, (2) establish objective criteria based upon risk insights for evaluating performance, (3) develop measurable or calculable parameters for monitoring system and licensee performance, and (4) focus on the results as the primary basis of regulatory decision-making."[34]

Currently, NRC regulations for nuclear power reactors offer a good example of a risk-informed, "flexible" framework for evaluating pre-licensing site construction at ISR facilities. NRC's requirements for nuclear power reactors currently offer license applicants the opportunity to obtain a limited work authorization (LWA) permit to engage in certain activities at proposed reactor sites prior to obtaining an NRC license. Based on this program, NRC prescribes a three-tiered approach to the development of a power

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operations, all ISR site wells (injection, production, monitoring) are nothing more than water wells with a State (or other agency) bond in place to assure that such wells are reclaimed.

[33] *See* 43 CFR § 3809 *et seq.*

[34] *See* United States Nuclear Regulatory Commission, SECY-98-144, *White Paper on Risk-Informed and Performance-Based Regulation* (June 22, 1998).

reactor site. This White Paper suggests that a risk-informed approach based on the administrative framework offered by the current limited work authorization guidance (LWA Guidance) offered by NRC for power reactor sites as modified to reflect the relatively low risk levels associated with ISR facilities as compared with those from conventional uranium mill tailings facilities with 11e.(2) byproduct material impoundments makes good common sense.

Limited Work Authorization Program for Power Reactors

Tier 1 (Pre-LWA Permit Construction): 10 CFR § 50.10 and the current *Interim Staff Guidance on Limited Work Authorization* (LWA Guidance) permits certain site development activities without the need for an LWA permit or any other NRC licensing mechanisms (i.e., early site permit (ESP), combined operating license (COL) or construction permit). More specifically, Part 50.10(a)(1) specifically prohibits the conduct of "construction" activities prior to the issuance of a permit such as an LWA; however, the following activities are permitted under "Tier 1" as not meeting the Part 50.10(a)(1) definition of "construction:" (1) site preparation for construction, (2) clearing of site land for structures, (3) drainage and erosion control installation, (4) erection of fences and site control measures, (5) *erection of support buildings and service facilities*, and (6) development of site infrastructure such as *paved roads*, water systems, and electrical and transmission lines.[35]

With specific respect to erection of support structures, however, NRC's current definition of "construction" includes:

> "installation of the foundation, including soil compaction, the installation of permanent drainage systems and geofabric; the placement of backfill, concrete (e.g., mudmats) or other materials which will not be removed before placement of the foundation of a structure."[36]

A significant question arises since the term "construction" includes the laying of foundations, which would be required for any support buildings and facilities as well as paved roads, which require foundations and soil compaction. Thus, it is unclear whether this term includes foundations that may be required for certain support structures such as offices or storage sheds versus those for the actual power reactor containment structure portion of the reactor site. Since it is likely that an ISR operator will seek to use the same office and storage sheds structures when operations commence, foundations for such structures likely will be required. As a result, the LWA guidance raises another issue when it states that "the term *permanent* in this context includes anything that will exist in its *final, in-place plant location after fuel load*." This appears to indicate that only the structures associated with the power reactor containment structures and facilities would

[35] *See* 10 CFR § 50.10(a)(2).
[36] *See* LWA Guidance at 3.

be implicated within the scope of the term "permanent" rather than a broader application to the full suite of power reactor site support structures and facilities.

With respect to agency authorization of such activities, the LWA guidance states:

> "Under the revised LWA rule, the impacts of construction activities need to be addressed because they are the activities being authorized. Therefore, the impacts of preconstruction and construction activities need to be separated so the impacts of the construction activities can be appropriately addressed."[37]

This appears to indicate that an applicant for an LWA would be required to provide information in its application regarding the separate impacts of preconstruction activities. Currently, any impacts caused from preconstruction activities do not require "redress" under an LWA "site redress plan." However, given the site-specific nature of such impacts, the potential for significant impacts from site preconstruction will vary depending on the issues.

Tier 2 (LWA Authorized Construction): 10 CFR § 50.10(c) and the current LWA Guidance allows the conduct of certain site development activities after obtaining NRC Staff authorization through an LWA permit. These activities include subsurface preparation, placement of concrete and installation of foundations, and in-place assembly, erection, fabrication and testing of certain forms. These activities merely require an LWA permit and *do not* require the issuance of an NRC license. In order to obtain an LWA permit, an applicant must obtain NRC approval of an LWA request[38] along with demonstrating that its application complies with relevant environmental[39] and safety analysis report[40] guidelines for power reactor sites and a "site redress plan" that includes provisions to "redress" activities authorized under an LWA that must be implemented within 180 days of withdrawal by the applicant or denial by NRC of an operating license application.[41] This "site redress plan" is designed to "address activities that were authorized under the LWA, such as the placement of piles and installation of foundations"[42] and requires that the site where authorized LWA activities occur can be returned to "an environmentally stable and aesthetically acceptable condition."[43] In essence, the "site redress plan" requirement is in place to assure that there are adequate assurances available that a proposed site can be returned to pre-construction conditions.

Tier 3 (NRC-Licensed Construction): As stated in the LWA Guidance, all reactor site development activities that cannot be conducted prior to the issuance of an

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[37] *See* LWA Guidance at 5.
[38] *See* 10 CFR § 50.10(d).
[39] *See* 10 CFR § 51.49.
[40] *See* 10 CFR §§ 52.17 or 52.79.
[41] *See* LWA Guidance at 12-13.
[42] *See* LWA Guidance at 13.
[43] *Id.*

LWA permit or pursuant to such a permit are prohibited prior to the issuance of an NRC license.

This three-tiered approach can be easily translated over to ISR project sites in a risk-informed, "flexible" manner to assure that the appropriate level of scrutiny is applied to site-specific requirements at such sites. Given the low level of potential impacts associated with ISR facilities as compared with operations at other nuclear fuel cycle facilities, a risk-informed approach to pre-licensing site construction for ISR facilities modeled on the LWA Guidance conceptual model makes good common sense. Exhibit C to the White Paper articulates this approach, but the following summary is provided for completeness:

In Situ Uranium Recovery Operations

While the LWA Guidance and its three-tiered approach provide a useful framework for formulating an approach for ISR pre-licensing site construction, current NRC regulations for power reactor sites and the LWA Guidance address a licensed activity that results in significantly greater construction impacts at the site and that carries far more potential risks than ISR operations. ISR operations typically are regarded as the lowest risk component of the nuclear fuel cycle, as well as the lowest risk form of mineral recovery in the United States. This is reflected by the fact that ISR preconstruction and construction activities, with the exception of wellfield construction, typically only affect minimal portions of a proposed site. As a result of this, the potential impacts from land use or potential radiological impacts, if any, are likely to be minimal. Further, as a general proposition and as stated in NUREG-1910, since the surface facilities associated with ISR operations are substantially similar, if not identical, the potential environmental impacts associated with construction of such facilities, for the most part, already have been assessed in a variety of industry and agency documents including, but not limited to: (1) NUREG-1910; (2) NUREG-1508 entitled *Final Environmental Impact Statement to Construct and Operate the Crownpoint Uranium Solution Mining Project*; and (3) NMA's Generic Environmental Report on ISR Facilities submitted as part of the scoping process for NUREG-1910.[44] Thus, a review of the potential environmental impacts associated with ISR pre-licensing (or preconstruction) activities should, if required at all, be minimal. Therefore, NRC's approach to pre-licensing site construction at ISR facilities should utilize the LWA "three-tiered" framework to classify which site construction activities may and may not be conducted without NRC authorization; however, NRC should account for the low level of potential impacts associated with ISR operations, including the fact that ISR sites will be released

[44] As stated by NRC in the LWA Guidance, "[t]he environmental impacts of preconstruction and construction activities have already been evaluated together in the final EISs for three ESPs and in the draft EIS for one ESP application currently under review. The Commission's guidance to the NRC staff indicates that issues that have already been evaluated and resolved in an ESP review should not be re-examined in the COL review unless new and significant information is found." *See* LWA Guidance at 13-14. This approach of avoiding redundant environmental reviews mirrors exactly the approach taken by NRC Staff in preparing NUREG-1910 for ISR facilities.

for *unrestricted use* when operations and site D&D are completed, when determining which activities are permissible. In an effort to assist NRC in developing this approach and following the framework of the LWA approach, the following summaries offer a "three-tiered" approach for pre-licensing site construction at ISR sites:

Tier 1 (Pre-Licensing Site Construction Activities Without Staff Authorization): In conformance with the 10 CFR Part 50 approach to nuclear power reactors, NRC Staff can conclude that ISR operators can engage in pre-licensing site construction activities that are similar to those allowed at power reactor sites. These activities would permit ISR operators to construct vitals aspects of their site infrastructure such as installation of power lines, installation of access roads, and construction of storage warehouses and other facilities that are necessary for construction of the central processing facility. In addition, similar to the "Tier 1" activities authorized for power reactor sites, ISR operators would be permitted to engage in these pre-licensing site construction activities without the need for express NRC Staff authorization. However, construction of office buildings, warehouses or even a central processing facility will require a concrete slab or foundation; but, the size and scope of the construction of such facilities as compared to power reactor construction activities is negligible. Thus, NRC should allow pre-licensing construction of such facilities because their potential environmental impacts will be limited in scope and can easily be redressed in the event an NRC license is not issued.

Tier 2 (Pre-Licensing Site Construction Activities Pursuant to NRC Staff Authorization): "Tier 2" activities for ISR project sites would include site construction activities similar to those authorized for power reactor sites. Such activities include, but are not limited to, construction of the central processing facility, drilling of wells for first uranium recovery wellfield, and installation of piping and other infrastructure for uranium recovery operations. Given that "Tier 2" activities would result in site facilities that are of a more extensive nature, it would be appropriate that some form of financial assurance be required to ensure that such facilities can be effectively removed from the site and the land which was disturbed can be reclaimed properly. In the event that the operator continues to be solvent, NRC Staff can impose appropriate requirements on the applicant to commence removal of structures and reclamation of disturbed land within 180 days in a manner similar to that of a "site redress plan," as prescribed in the LWA guidance. In the event that the operator is not able to perform such removal and reclamation, a financial assurance mechanism can be put in place to ensure that such activities are conducted by an independent contractor pursuant to 10 CFR Part 40, Appendix A, Criterion 9. Authorization from NRC Staff for the conduct of "Tier 2" activities would be required prior to the commencement of such activities.

As stated above, however, many ISR operators currently have proposed project sites located on State or BLM lands with their proposed projects requiring additional permits such as a "Permit to Mine" or a "Plan of Operation" to conduct most, if not all, "Tier 2" activities. As a general matter, these types of permits typically require some form of environmental review, such as an EA, and a financial assurance mechanism. More specifically, for example, the State of Wyoming requires financial assurance for

each well that is drilled on-site to ensure that well reclamation is properly completed. Based on the availability of these types of mitigation safeguards at any given site, NRC can and should avail itself of the protections provided by these regulatory entities and authorize "Tier 2" activities contingent on submission of appropriate documentation to NRC Staff prior to commencement of such activities.

Tier 3 (Post-Licensing Construction Activities Pursuant to an NRC License): As stated above with respect to "Tier 3" LWA activities, any site construction activity classified as a "Tier 3" activity would require completion of NRC's technical and environmental reviews of a site-specific application and issuance of a uranium recovery license for the proposed site. An example of a "Tier 3" activity would be construction of an evaporation pond for process bleed or restoration fluids.

By utilizing an approach to pre-licensing site construction that mirrors the framework in the LWA guidance and by using a more risk-informed approach that takes into account the benign nature of ISR operations as compared to nuclear power reactor sites but that still provides adequate assurance that any pre-licensing construction impacts can and will be substantially mitigated or, indeed, entirely eliminated, NRC can assure more cost-effective development of licensed ISR project sites. The ISR operators that are parties to this White Paper recognize that any "Tier 1" or "Tier 2" activities undertaken prior to the issuance of an NRC license are undertaken "at their own risk" until such license is issued. In other words, if no NRC license is ultimately issued, then the ISR operator will have to mitigate or eliminate any impacts per agreements with the landowner(s), NRC or other relevant federal and/or State agencies. Further, the adoption of this approach will not pose any administrative hearing issues as it serves as NRC's agency interpretation of existing regulations (10 CFR § 40.32(e)) which was promulgated in 1980 and, pursuant to 10 CFR Part 2, existing regulations are not subject to challenge in NRC administrative hearings.

III. CONCLUSION

The ability to engage in pre-licensing site construction activities prior to the issuance of an NRC license is a critical element of an ISR operator's critical path for creating sources of domestic uranium production. It is imperative to the development of domestic uranium production that NRC develop a flexible, risk-informed approach to pre-licensing site construction so that domestic ISR operators can move through the licensing process expeditiously and proceed to production cost-effectively. By espousing the approach articulated in this White Paper, we are confident that this can be accomplished.