[7590-01-P]

NUCLEAR REGULATORY COMMISSION

10 CFR Part 40

[NRC-2008-0421]

RIN 3150-AI40

Groundwater Protection at Uranium *In Situ* Recovery Facilities

AGENCY: Nuclear Regulatory Commission.

ACTION: Proposed rule and draft guidance; request for comment.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) proposes to amend its regulations that govern the licensing of uranium mills and the disposition of tailings and waste that arise from the extraction and milling of uranium by issuing risk-informed requirements for groundwater protection at uranium *in situ* recovery (ISR) facilities. The NRC's current regulations are focused on conventional uranium milling and do not expressly address uranium extraction by the ISR process.

DATES: Submit comments on the proposed rule and associated draft guidance by **[INSERT DATE 75 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**. Comments received after the above date will be considered if it is practical to do so, but the NRC is able to assure consideration only for comments received on or before this date.

ADDRESSES: You may submit comments by any of the following methods (unless this document describes a different method for submitting comments on a specific subject); however, the NRC encourages electronic comment submission through the Federal rulemaking website:

- **Federal rulemaking website:** Go to https://www.regulations.gov and search for Docket ID **NRC-2008-0421**. Address questions about NRC dockets to Dawn Forder; telephone: 301-415-3407; e-mail: Dawn.Forder@nrc.gov. For technical questions contact the individuals listed in the FOR FURTHER INFORMATION CONTACT section of this document.

- **E-mail comments to:** Rulemaking.Comments@nrc.gov. If you do not receive an automatic e-mail reply confirming receipt, then contact us at 301-415-1677.

- **Mail comments to:** Secretary, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, ATTN: Rulemakings and Adjudications Staff.

For additional direction on obtaining information and submitting comments, see "Obtaining Information and Submitting Comments" in the SUPPLEMENTARY INFORMATION section of this document.

FOR FURTHER INFORMATION CONTACT: Douglas Mandeville, telephone: 301-415-0724; e-mail: Douglas.Mandeville@nrc.gov; or George Tartal, telephone: 301-415-0016; e-mail: George.Tartal@nrc.gov. Both are staff of the Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

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A. Obtaining Information

Please refer to Docket ID **NRC-2008-0421** when contacting the NRC about the availability of information for this action. You may obtain publicly available information related to this action by any of the following methods:

- **Federal Rulemaking Website:** Go to https://www.regulations.gov and search for Docket ID **NRC-2008-0421**.

- **NRC's Agencywide Documents Access and Management System (ADAMS):** You may obtain publicly available documents online in the ADAMS Public Documents collection at https://www.nrc.gov/reading-rm/adams.html. To begin the search, select "Begin Web-based ADAMS Search." For problems with ADAMS, please contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to pdr.resource@nrc.gov. For the convenience of the reader, instructions about obtaining materials referenced in this document are provided in section XVIII, "Availability of Documents."

- **Attention:** The PDR, where you may examine and order copies of public documents, is currently closed. You may submit your request to the PDR via e-mail at pdr.resource@nrc.gov or call 1-800-397-4209 between 8:00 a.m. and 4:00 p.m. (EST), Monday through Friday, except Federal holidays.

B. Submitting Comments

The NRC encourages electronic comment submission through the Federal rulemaking website (https://www.regulations.gov). Please include Docket ID **NRC-2008-0421** in your comment submission.

The NRC cautions you not to include identifying or contact information that you do not want to be publicly disclosed in your comment submission. The NRC will post all

comment submissions at https://www.regulations.gov as well as enter the comment submissions into ADAMS. The NRC does not routinely edit comment submissions to remove identifying or contact information.

If you are requesting or aggregating comments from other persons for submission to the NRC, then you should inform those persons not to include identifying or contact information that they do not want to be publicly disclosed in their comment submission. Your request should state that the NRC does not routinely edit comment submissions to remove such information before making the comment submissions available to the public or entering the comment into ADAMS.

II. Background

A. Conventional Mills and ISR Facilities

The NRC licenses and regulates uranium mills under its regulations in part 40 of title 10 of the *Code of Federal Regulations* (10 CFR), "Domestic Licensing of Source Material," because these facilities possess and process uranium source material.[1] The possession and processing of source material are activities that require a license from the NRC under the Atomic Energy Act of 1954, as amended (AEA).[2] Prior to the 1990s, uranium ore was processed primarily at conventional mills. Mills using the conventional milling process receive ore in the form of rock containing uranium and grind the ore to remove and concentrate the uranium. The leftover rock from this process is a sand-like material, known as tailings, that is consolidated into tailings piles. Tailings are contaminated with chemicals used in the uranium extraction process and contain heavy

[1] The term "source material" is defined as "(1) Uranium or thorium, or any combination thereof, in any physical or chemical form or (2) ores which contain by weight one-twentieth of one percent (0.05%) or more of: (i) Uranium, (ii) thorium or (iii) any combination thereof." 10 CFR 40.4, "Definitions".
[2] 42 U.S.C. § 2011 *et seq*. AEA, § 62, 42 U.S.C. § 2092 ("Unless authorized by a general or specific license issued by the [Nuclear Regulatory] Commission … no person may transfer or receive in interstate commerce, transfer, deliver, receive possession of or title to, or import into or export from the United States any source material after removal from its place of deposit in nature…").

metals and radionuclides. Additionally, conventional milling generates a variety of liquid wastes, such as leaching fluids. These tailings and wastes, which contain radiological and nonradiological constituents, are classified as a form of byproduct material and are regulated by the NRC under the AEA.

The ISR process is another uranium milling process that was first used commercially in the United States in the late 1970s. Since the 1990s, the ISR process has become the predominant means of extracting uranium in the United States. The ISR process eliminates the steps of digging ore from the ground, transporting it to a mill, grinding it, and leaching it to dissolve the uranium. At ISR facilities, the chemical leaching occurs underground in a portion of an aquifer containing the ore body known as a production unit. A leaching solution, known as a lixiviant, containing either an alkaline solution including oxygen and/or bicarbonate or an acid solution such as sulfuric acid, is pumped to the ore body in the production unit through injection wells, thereby inducing a chemical change in the ore body that releases the uranium from the host rock. The lixiviant that carries the recovered uranium is pumped to the surface using production wells. All of the injection and production wells that are used to recover the uranium from the ore body in a production unit are located in an area known as a wellfield.

After being pumped to the surface, the lixiviant is transferred to a processing facility where an ion exchange process is used to separate the recovered uranium from the lixiviant. The recovered uranium is then processed into a solid form called "yellowcake." The lixiviant is then pumped back from the processing facility to the ore body in the production unit to continue uranium recovery. The yellowcake is ultimately used in the manufacture of fuel for nuclear reactors.

The processing facilities supporting ISR operations (e.g., ion exchange columns, precipitation and drying circuits), and wastes produced by ISR operations (e.g., hazardous constituents released in the groundwater by lixiviant injection, soil

contaminated from spills, process wastes in surface impoundments), come under the NRC's regulatory authority. To help ensure that byproduct material stays within the production unit and does not migrate from the production unit to surrounding groundwater during or after ISR operations, the NRC enforces requirements regarding the construction of wells, the design of ISR wellfields, and groundwater monitoring. The NRC also requires restoration of the production unit to ensure hazardous constituent concentrations are below NRC approved limits. The restoration process begins when lixiviant injection into the production unit permanently ceases.

The ISR process does not generate tailings but does produce waste that constitute byproduct material, which requires proper management. The NRC's current regulations for byproduct material generated by uranium milling are focused on operations at conventional mill sites and are set forth in appendix A to 10 CFR part 40, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for their Source Material Content" (appendix A). Therefore, the NRC currently regulates groundwater protection at ISR facilities using site-specific license conditions that incorporate the risk-informed and best management practices that have been shown to be successful for more than 40 years. Best management practices for groundwater protection, in the context of ISR facilities, are those practices that have been demonstrated to be the most effective and practical means to prevent, detect, and correct any leakage or migration of radiological and nonradiological contaminants to surrounding groundwater.

These risk-informed and best management practices are provided in the NRC regulatory guidance in NUREG-1569, "Standard Review Plan for In Situ Leach Uranium Extraction License Applications" (NUREG-1569), published in 2003. Many of the risk-informed practices presented in NUREG-1569 are further described in

NUREG/CR-6733, “A Baseline Risk-Informed, Performance-Based Approach for In Situ Leach Uranium Extraction Licensees” (NUREG/CR-6733), published in 2001. The principal purpose of NUREG-1569 is to ensure the quality and uniformity of the NRC staff’s review and evaluation of ISR license applications (for the initial application and any amendments thereto). The NRC also uses this guidance to inform the development of site-specific license conditions.

This proposed rule would establish regulations specific to uranium ISR facilities to protect groundwater from the radiological and nonradiological hazards associated with the generation of byproduct material. Because the ISR process currently is the predominant method used for uranium milling, the issuance of ISR-specific regulations would provide transparency and, therefore, result in the effective and efficient regulation of groundwater protection at ISR facilities. Such regulations would codify the risk-informed and best management practices for groundwater protection used by the NRC in site-specific license conditions. The NRC expects that these regulations would result in an ISR licensing process that has enhanced regulatory stability, predictability, and clarity for the preparation of license applications and the NRC staff’s review and evaluation of such applications. Additionally, these regulations would streamline the licensing process for those groundwater protection requirements now covered principally by site-specific license conditions. In this regard, by codifying those requirements currently addressed in site-specific license conditions, the NRC expects to reduce the costs associated with preparing the Safety Evaluation Report and the license itself, and reduce the number of requests for additional information during the NRC staff’s evaluation of an application. These proposed regulations would also provide a stronger basis for the NRC’s national program for Agreement State compatibility and for the

NRC's evaluation and oversight of Agreement State programs.[3] Finally, addressing groundwater protection requirements via rulemaking would provide greater transparency of the NRC's regulation of groundwater protection at ISR facilities, adapt to regulatory needs identified by stakeholders, provide opportunities for stakeholders to offer input to the changes to the ISR licensing process, and maintain the NRC's role as an effective regulator.

B. Statutory and Regulatory Background

In 1978, Congress enacted the Uranium Mill Tailings Radiation Control Act (UMTRCA)[4] to address the radiological and nonradiological hazards associated with the tailings or wastes generated in the uranium milling process, particularly with the tailings piles accumulating at conventional mill sites. The UMTRCA amended several provisions of the AEA, including the classification of these tailings or wastes as a form of byproduct material, provided that the tailings or wastes resulted from the extraction of uranium or thorium from ores processed primarily for their source material content. Such byproduct material is generally referred to as AEA section 11e.(2) byproduct material.[5] The ISR process does not generate tailings but does produce waste streams containing AEA section 11e.(2) byproduct material that require proper management.

Through its amendments to the AEA, Title II of UMTRCA established a complementary regulatory scheme over active and decommissioning uranium milling

[3] Section 274 of the AEA authorizes the NRC to relinquish or discontinue its regulatory authority over certain categories of radioactive material to a State following a duly executed agreement between the NRC and the governor of the State. 42 U.S.C. § 2021. After the agreement is entered into, the State, now an "Agreement State," must issue or adopt regulations compatible to those NRC regulations that govern the subject matter areas relinquished to the Agreement State. A State that has not entered into a Section 274 agreement is referred to as a "non-Agreement State."
[4] Public Law 95-604, 92 Stat. 3021 (1978).
[5] Section 11 of the AEA defines the term "byproduct material." 42 U.S.C. § 2014(e). The UMTRCA added AEA § 11e.(2), which established a new category of byproduct material, namely, "the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content."

facilities between the U.S. Environmental Protection Agency (EPA) and the NRC (Title II of UMTRCA applies to active sites, whereas Title I applies to named inactive uranium milling sites).[6] The UMTRCA added AEA section 275, which authorizes the EPA to issue standards of general application for the protection of the public health, safety, and the environment from radiological and nonradiological hazards associated with the processing, possession, transfer, and disposal of AEA section 11e.(2) byproduct material.[7] For nonradiological hazards, it directs the EPA to establish standards of general application consistent with the standards required under subtitle C of the Solid Waste Disposal Act, as amended (SWDA).[8] The SWDA is now commonly referred to as the Resource Conservation and Recovery Act (RCRA).[9]

The UMTRCA also added AEA section 84,[10] which requires that the NRC or the appropriate Agreement State ensure the proper management of AEA 11e.(2) byproduct material in such a manner as the NRC deems appropriate to protect the public health, safety and the environment from the material's radiological and nonradiological hazards associated with the processing and possession of such material. In doing so, the NRC must conform with the standards of general application issued by the EPA under AEA section 275b. Any general requirements established by the NRC regarding its management of AEA section 11e.(2) byproduct material must, to the maximum extent practicable, be at least comparable to requirements that are applicable to the possession, transfer, and disposal of similar hazardous material regulated by the EPA under RCRA. Under AEA section 84a.(3), the EPA would concur on whether such general requirements were in fact comparable to the RCRA requirements for similar

[6] No ISR facilities are covered by Title I; all Title I sites are inactive conventional milling sites.
[7] AEA § 275b.(1); 42 U.S.C. § 2022(b)(1).
[8] AEA § 275b.(2); 42 U.S.C. § 2022(b)(2).
[9] Subtitle C, Solid Waste Disposal Act, 42 U.S.C. §§ 6921-69399, as amended by The Resource Conservation and Recovery Act of 1976, 42 U.S.C. §§ 6901 et seq.
[10] 42 U.S.C. § 2114.

hazardous material.

The NRC or the applicable Agreement State agency is the regulatory or licensing agency for all uranium recovery facilities, including ISR facilities, and is responsible for evaluating any license application for an ISR facility or amendment to an existing license, regulating and inspecting the operation and decommissioning of the ISR facility, and enforcing the terms and conditions of the operating license.[11] In 1983, Public Law 97-415 added a new paragraph 84c. to AEA section 84 and amended AEA section 274o.[12] These amendments gave authority to the NRC and Agreement States, respectively, to establish site-specific alternatives to the specific requirements adopted and enforced by the NRC including the standards of general application promulgated by EPA under AEA section 275.

The EPA issued its initial standards of general application under UMTRCA for conventional mills, in the form of regulations, on October 7, 1983, and then amended these standards on November 15, 1993.[13] At that time, the EPA chose not to issue standards for ISR facilities, instead stating that the groundwater protection requirements at these facilities are provided by the Underground Injection Control (UIC) program of the Safe Drinking Water Act (SDWA).[14] These regulations were added as a new subpart D to the EPA's 40 CFR part 192 regulations, entitled "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings." Subpart D of 40 CFR part 192 establishes the EPA's standards of general application for uranium byproduct materials at UMTRCA Title II sites, including those standards concerning groundwater protection. The EPA addressed its statutory requirement under AEA section 275b.(2), to

[11] AEA § 275b.(2); 42 U.S.C. § 2022(b)(2) ("no permit issued by the [EPA] Administrator is required under this Act or the [Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901 et seq.] for the processing, possession, transfer, or disposal of [section 11e.(2)] byproduct material").
[12] Public Law 97-415, §§ 19-20, 96 Stat. 2067, 2078-79 (1983).
[13] 48 FR 45926 (October 7, 1983) and 58 FR 60340 (November 15, 1993).
[14] 48 FR at 45932-33.

establish standards for nonradiological hazards consistent with those in RCRA, by issuing regulations 40 CFR 192.31 through 192.33 that cross-reference specific EPA RCRA requirements for groundwater protection in 40 CFR part 264.

The regulations in 40 CFR 192.32(a)(2) directly reference the RCRA standards by stating that "uranium byproduct materials shall be managed so as to conform to the groundwater protection standard in § 264.92 of this chapter," with certain exceptions as set forth in 40 CFR 192.32(a)(2)(i)-(v).[15] The requirements in 40 CFR 264.92 specify that hazardous constituents detected in groundwater at a regulated unit must not exceed the concentration limits provided in 40 CFR 264.94 in the uppermost aquifer beyond the point of compliance. As defined in 40 CFR 264.95, the point of compliance is a set location, as determined by the regulator, where the 40 CFR 264.92 groundwater protection standards must be met and where monitoring must be conducted.

As made applicable to uranium byproduct materials by 40 CFR 192.32(a)(2), the RCRA groundwater protection standard in 40 CFR 264.92 requires compliance with 40 CFR 264.94, which in turn, allows for a licensee to meet one of three different hazardous constituent concentration limits that must not be exceeded in groundwater at the point of compliance. The first is the establishment of a background level for each hazardous constituent based upon sampling to determine the concentration or quantity of that hazardous constituent present in the groundwater prior to the commencement of ISR operations.[16] The second establishes a maximum concentration, as set forth in Table 1 of 40 CFR 264.94,[17] as the standard for certain listed hazardous constituents (e.g., arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) if the

[15] *E.g.*, 40 CFR 192(a)(2)(v) provides that "functions and responsibilities designated in Part 264 of this chapter as those of the 'Regional Administrator' with respect to 'facility permits' shall be carried out by the regulatory agency."
[16] 40 CFR 264.94(a)(1).
[17] Table 1 - Maximum Concentration of Constituents for Ground-water Protection.

background level of the constituent is below the value given in Table 1.[18] The third allows for the establishment of an alternate concentration limit (ACL) by the regulatory agency if the agency finds that the licensee cannot meet either the background level or the maximum concentration for a given hazardous constituent.[19] In this regard, the RCRA regulations state that the regulatory agency may approve an ACL for a hazardous constituent based on a finding that the constituent "will not pose a substantial present or potential hazard to human health or the environment as long as the alternate concentration limit is not exceeded."[20] Section 264.94(b)(1) includes a list of groundwater protection factors that the regulatory agency must consider in determining whether to approve or disapprove an ACL.

Other aspects of the RCRA groundwater protection standard that are made applicable to the management of uranium byproduct materials include the establishment of a detection monitoring program, as provided in 40 CFR 264.98.[21] Furthermore, the regulations in 40 CFR 192.33 require that if the hazardous constituent concentration limit for any hazardous constituent is exceeded, a corrective action program as specified in 40 CFR 264.100 shall be put into operation.[22]

The NRC initially issued regulations to implement UMTRCA in 1979 and 1980. The 1979 rule added definitions for the terms "byproduct material" and "uranium milling" to 10 CFR 40.4, "Definitions."[23] The 1979 rule defined "uranium milling" to mean "any activity that results in the production of byproduct material." The NRC's definition of "byproduct material" sets forth the UMTRCA definition of byproduct material but adds that the term includes "discrete surface wastes resulting from uranium solution extraction

[18] 40 CFR 264.94(a)(2).
[19] 40 CFR 264.94(a)(3).
[20] 40 CFR 264.94(b).
[21] 40 CFR 92.132(a)(2)(iii).
[22] 40 CFR 92.133.
[23] 44 FR 50012, 50013-14 (August 24, 1979).

processes." The definition also stated that "[u]nderground ore bodies depleted by such solution extraction operations do not constitute 'byproduct material' within this definition."[24] The definition's clause concerning the uranium solution extraction process is notable in two respects. First, it acknowledges the then relatively new use of the ISR process to extract uranium. Second, the clause shows that when the NRC first issued its UMTRCA implementing regulations, it had not yet determined that wastes in groundwater generated by the use of the ISR process constituted AEA section 11e.(2) byproduct material. The definition did not, however, explicitly exclude such wastes from the scope of "byproduct material" as it did with depleted underground ore bodies. In its 1980 final rule, the NRC further amended 10 CFR part 40 and added its primary UMTRCA implementing regulations as appendix A to 10 CFR part 40.[25] When EPA first issued its UMTRCA implementing standards in 1983, its definition of "uranium byproduct material" was essentially the same as the NRC's definition of "byproduct material" except that EPA did not include the clause concerning the discrete surface wastes resulting from uranium solution extraction processes.[26]

Following the EPA's issuance of its 40 CFR part 192, subpart D standards, the NRC made conforming amendments to appendix A to 10 CFR part 40, in 1985 and again in 1987.[27] Currently, appendix A applies those EPA RCRA groundwater protection regulations in 40 CFR part 264 that are listed in 40 CFR part 192, subpart D, but does not explicitly cross-reference them. Although the current criterion 5B requirements are focused on conventional uranium mills, the NRC has applied these requirements to ISR facilities through the use of site-specific license conditions. In this proposed rule, the

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[24] 10 CFR 40.4 (definition of "byproduct material"). The current 10 CFR 40.4 regulation is essentially unchanged from when it was added in 1979.
[25] 45 FR 65521, 65533 (October 3, 1980). The appendix A requirements are set forth in the form of "Criteria."
[26] 40 CFR 192.31(b). The EPA definition also did not reference thorium, which is included in the NRC definition.
[27] 50 FR 41852 (October 16, 1985); 52 FR 43553 (November 13, 1987).

NRC would codify the groundwater protection requirements currently imposed upon ISR facility licensees by site-specific license conditions and would establish the maximum contaminant levels (MCL) for hazardous constituents in groundwater as those set forth in the appropriate tables of the applicable EPA regulations by express cross-reference.

C. Actions Leading to Current Rulemaking

In the 1990s, the uranium recovery industry expressed concerns to the NRC over perceived dual regulation between the NRC and the EPA with respect to the protection of groundwater impacted by ISR operations. As described by the NRC staff in a 1999 paper to the Commission, SECY-99-0013,[28] the industry asserted that the NRC's regulation of groundwater at ISR facilities is duplicative of the groundwater protection programs required by the SDWA,[29] as administered by the EPA or an EPA-authorized State through the SDWA UIC program.[30] The industry further recommended that the NRC defer regulation of the groundwater at ISR facilities currently under the NRC's jurisdiction to either the EPA or the EPA-authorized State UIC program, as appropriate.[31]

In SECY-99-0013, the staff recommended that the Commission withdraw from the active regulation of groundwater at ISR facilities and that the Commission should classify only post-ion exchange wastes as AEA section 11e.(2) byproduct material. Under this option, the NRC would have taken a narrow view of the definition of AEA section 11e.(2) byproduct material in that groundwater impacted by ISR operations in the production unit would not have been considered AEA section 11e.(2) byproduct material and, therefore, that groundwater would have been regulated under the SDWA UIC program. The NRC would then have regulated only discrete surface wastes and

[28] "Recommendations on Ways to Improve the Efficiency of NRC Regulation at In Situ Leach Uranium Recovery Facilities," SECY-99-0013 (March 12, 1999).
[29] 42 U.S.C. §§ 300f *et seq*.
[30] SECY-99-0013, at 1.
[31] *Id*., at 2.

effluents resulting from the production of yellowcake occurring from processing of the uranium extraction fluids at the ISR facility.

In SRM-SECY-99-0013, the Commission disapproved the staff's recommendation and determined that any liquid waste generated during or after the uranium extraction phase of ISR site operations, and all evaporation pond sludges derived from liquid wastes, are properly classified as AEA section 11e.(2) byproduct material.[32] As such, hazardous constituents in groundwater that have been released from underground ore bodies by the ISR process are thus governed by the AEA, as amended by UMTRCA, and appendix A to 10 CFR part 40, and must be managed accordingly. The Commission further determined that the staff should make no legal distinction among the waste waters produced at different stages in a facility's life cycle and directed that this position be implemented immediately and codified in a new rule and associated regulatory guidance.[33] The Commission, however, did not foreclose revisiting the question in the future as it approved the staff continuing discussions with the EPA and appropriate States to determine the extent that the NRC can rely on the EPA's SDWA UIC program for groundwater protection, "thereby potentially minimizing NRC review of ground-water protection issues at [ISR] facilities."[34] In this regard, the Commission stated that "[i]n the interim, it is recognized that dual regulation of the groundwater at *in situ* leach facilities by NRC and EPA will continue until such time that NRC can defer to the EPA's UIC program."[35]

During this time, deferral to the EPA's UIC program appeared to be a viable option given the EPA's stated position in the preamble to its October 1983 final rule that

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[32] The Commission determination and direction to the staff was made in the form of a staff requirements memorandum (SRM), SRM-SECY-99-0013, "Staff Requirements – Recommendations on Ways to Improve the Efficiency of NRC Regulation at In Situ Leach Uranium Recovery Facilities," (July 26, 2000).
[33] SRM-SECY-99-0013.
[34] *Id.*
[35] *Id.*

issued 40 CFR part 192, subpart D. Specifically, the EPA stated that:

> Rules for protection of ground water from the underground operations of *in situ* mining are provided by the Underground Injection Control program promulgated under Sections 1421 and 1422 of the Safe Drinking Water Act. The associated regulations, 40 CFR Parts 144, 145, and 146, impose administrative and technical requirements on such operations, through either approved State programs or EPA-implemented programs. These regulations are not intended to apply to the underground ore bodies depleted by *in situ* uranium mining operations.[36]

The EPA's UIC regulations govern the installation and use of injection wells at ISR facilities. Before an ISR facility licensee may inject lixiviant through an approved injection well into an aquifer, it must obtain a UIC Class III injection well permit from either the EPA or the requisite State agency, provided that the EPA has delegated the appropriate SDWA authority to that State.[37] Additionally, if the aquifer meets the definition of an underground source of drinking water (USDW), then the EPA must first exempt that aquifer from the protections of the SDWA before the licensee may begin to inject lixiviant.[38]

As a result of SRM-SECY-99-0013, the NRC considered initiatives to eliminate or reduce the overlapping regulation of groundwater protection at operating ISR facilities by the NRC under its UMTRCA authority and the non-Agreement States of Nebraska and Wyoming under their delegated UIC authority.[39] In an October 2003 paper to the Commission, the NRC staff presented several options for reducing or eliminating this overlapping regulation.[40] The NRC staff recommended that these States be allowed to

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[36] 48 FR at 45932-33.
[37] Wells used for uranium ISR extraction are categorized as Class III wells per 40 CFR 144.6(c)(2).
[38] 40 CFR 144.7(b)(2) ("No designation of an exempted aquifer submitted as part of a UIC program shall be final until approved by the Administrator as part of a UIC program"); *see also* Office of Water, EPA memorandum, "Enhancing Coordination and Communication with States on Review and Approval of Aquifer Exemptions Requests Under SDWA," July 24, 2014, p. 1 ("EPA is responsible for the final review and approval of all aquifer exemption requests, based on the regulatory criteria in 40 CFR 146.4").
[39] Wyoming became an Agreement State in October 2018.
[40] SECY-03-0186, "Options and Recommendations for NRC Deferring Active Regulation of Ground-water Protection at In Situ Leach Uranium Extraction Facilities" (October 29, 2003).

take lead regulatory responsibility over groundwater protection at ISR facilities under their UIC regulatory authority through the development of memoranda of understanding (MOUs) with the NRC. The Commission subsequently approved this recommendation.[41]

Accordingly, between June and August 2004, the NRC conducted detailed evaluations of Nebraska's and Wyoming's EPA-authorized UIC programs. The purpose of these reviews was to compare the States' groundwater protection programs with the NRC groundwater protection program to determine if the States' groundwater protection requirements were equivalent to those of the NRC's program. The NRC planned to use a finding of equivalency between the NRC and State groundwater protection programs as the basis for entering MOUs, which would authorize these States to take lead regulatory responsibility for groundwater protection. As explained in a July 2005 paper, however, the NRC staff informed the Commission that the reviews found that the Nebraska and Wyoming groundwater protection programs were not equivalent to the NRC groundwater protection program.[42] These findings ended the MOU process with the states of Nebraska and Wyoming.

In a January 2006 memorandum to the other Commissioners, Commissioner Merrifield expressed his concerns regarding the dual regulation of groundwater protection programs at ISR facilities.[43] Commissioner Merrifield stated that the manner in which the NRC regulated ISR facility licensees was complex and unmanageable, and that the NRC should remedy this situation through notice and comment rulemaking. Commissioner Merrifield stated that the staff should focus on eliminating the dual regulation by the NRC and the EPA of groundwater protection. Specifically, the

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[41] SRM-SECY-03-0186, "Staff Requirements – Options and Recommendations for NRC Deferring Active Regulation of Ground-water Protection at In Situ Leach Uranium Extraction Facilities" (November 19, 2003).
[42] SECY-05-0123, "Status of the Development of Memoranda of Understanding with Nebraska and Wyoming, Regarding the Regulation of Groundwater Protection at their In Situ Leach Uranium Recovery Facilities," (July 8, 2005).
[43] COMJSM-06-0001, "Regulation of Groundwater Protection at *In-Situ* Leach Uranium Extraction Facilities" (January 17, 2006).

Commissioner recommended that the NRC should adopt the industry's recommendation that the NRC retain its jurisdiction over the wellfields and groundwater under its AEA authority but should defer active regulation of groundwater programs to the EPA or the EPA-authorized state through EPA's UIC permit program.

In March 2006, the Commission responded to COMJSM-06-0001 by directing the staff to initiate a rulemaking effort specifically tailored to groundwater protection programs at ISR facilities.[44] The Commission further directed that the rule focus on eliminating dual NRC/EPA regulation by deferring regulation of groundwater protection to EPA and EPA-authorized States through their SDWA UIC programs. The Commission also specified that the staff should work closely with EPA, EPA-authorized States, and other interested stakeholders in the rulemaking effort. This Commission direction authorized the staff's initial ISR-specific 10 CFR part 40 rulemaking effort.

In response to the Commission's direction, the NRC staff worked with the EPA to eliminate dual regulation of groundwater protection under UMTRCA and the SDWA UIC program. In COMSECY-07-0015, the NRC staff informed the Commission that the EPA staff raised concerns about basing groundwater protection requirements for ISR facilities on the EPA's UIC program.[45] The EPA staff stated that any NRC groundwater protection requirements should be based on the EPA's standards of general application that were issued as 40 CFR part 192, subpart D, rather than the UIC requirements. Therefore, in COMSECY-07-0015, the NRC staff recommended that the Commission approve that any NRC ISR-specific rule would rely on 40 CFR part 192, subpart D.

In the SRM to COMSECY-07-0015, the Commission approved the NRC staff's request stating, "[t]he Commission has approved resumption of the rulemaking process

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[44] SRM-COMJSM-06-0001, "Staff Requirements - Regulation of Groundwater Protection at *In-Situ* Leach Uranium Extraction Facilities" (March 24, 2006).
[45] COMSECY-07-0015, "Path Forward for Rulemaking on Groundwater Protection at In Situ Leach Uranium Extraction Facilities" (April 30, 2007).

for groundwater protection at in situ leach uranium extraction facilities to conform to 40 CFR part 192."[46] In response to the SRM, the NRC staff began a rulemaking to issue a set of ISR-specific requirements to standardize the existing NRC risk-informed and best management practices for groundwater protection at ISR facilities, reflected through site-specific license conditions, and to otherwise conform to the EPA standards of general application in 40 CFR part 192, subpart D. The rulemaking was intended to ensure more consistency and certainty in the NRC's evaluation and approval of ISR license applications and to expedite and streamline the overall ISR licensing process.

During the 2006 to 2010 timeframe, the NRC coordinated its rulemaking efforts extensively with the EPA and included EPA staff as members of the NRC rulemaking working group. However, because NRC and EPA staff could not reach resolution on certain key issues (e.g., post-restoration monitoring duration), the NRC staff's proposed rulemaking was never submitted to the Commission. The NRC decided to defer its rulemaking in 2010, after EPA staff informed the NRC that it planned to issue standards of general application for ISR facilities pursuant to its authority under section 275b. of the AEA.

In January 2015 the EPA published a proposed rule to amend 40 CFR part 192.[47] The EPA then published another proposed rule in January 2017, which superseded the January 2015 proposed rule.[48] The NRC had jurisdictional and technical concerns with the January 2015 and January 2017 proposed rules. The NRC formally submitted comments in response to EPA's January 19, 2017, proposed rule requesting public comments.[49] In its comments, the NRC highlighted the current regulatory

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[46] SRM-COMSECY-07-0015, "Staff Requirements - Path Forward for Rulemaking on Groundwater Protection at In Situ Leach Uranium Extraction Facilities" (June 8, 2007), at 1.
[47] 80 FR 4156; January 26, 2015.
[48] 82 FR 7400; January 19, 2017.
[49] ADAMS Accession No. ML17173A638.

framework's established, low-risk operational record that demonstrates no significant safety or environmental impacts arising from ISR activities since the ISR process for uranium extraction was introduced commercially in the late 1970s.

In October 2018, the EPA withdrew its January 2017 proposed rule.[50] In its withdrawal notice, the EPA concluded, based on feedback from stakeholders, that it had "serious questions concerning as to whether the [January 19, 2017,] proposed rule as written was within EPA's authority under UMTRCA."[51] The EPA also concluded that "[t]he EPA no longer believes that a national rulemaking to issue standards is necessary at this time, as the EPA believes the existing regulatory structures are sufficient to ensure the targeted protection of public health and the environment at existing ISR facilities" and that "present market circumstances suggest that the influx of new ISR applicants that was once anticipated and that was an underlying motive for the proposal is not likely to materialize."[52]

After the EPA withdrew its rulemaking, the NRC sought stakeholder perspectives to inform its decision regarding whether it should restart its deferred rulemaking. In January 2019, the NRC published a notice in the *Federal Register* (FR) requesting views from interested stakeholders.[53] The NRC received 33 comment submissions from individuals, Agreement States, Native American Tribal governments, environmental groups, and industry. Most commenters were supportive of continuing the rulemaking. The Organization of Agreement States (OAS) and the respective Agreement State regulatory agencies for Colorado, Oregon, Washington, and Wyoming supported resumption of the NRC's deferred ISR rulemaking. Most industry commenters supported a limited-scope rulemaking to better ensure the efficiency and effectiveness of

[50] 83 FR 54543; October 30, 2018.
[51] *Id.*
[52] *Id.*
[53] 84 FR 574 (January 31, 2019).

the licensing process for ISR facilities. Certain individuals and environmental groups did not support continuing the rulemaking, with their primary assertion being that such regulations could allow greater expansion of the industry and subsequently result in greater adverse environmental impacts.

In December 2019, the NRC staff provided SECY-19-0123 to the Commission to propose options on whether to proceed with the ISR rulemaking.[54] The paper provided the following alternatives: 1) no action; 2) update ISR regulatory guidance only; or 3) resume the ISR-specific proposed rule held in abeyance since 2010 with the emphasis on establishing risk-informed groundwater protection requirements that specifically address ISR operations. The staff recommended option 3. In SRM-SECY-19-0123, the Commission approved the NRC staff's recommendation to resume rulemaking "to provide risk-informed ISR-specific requirements that would provide increased consistency and transparency in licensing reviews between the NRC and Agreement States and to clarify the applicability of existing requirements to ISR activities in 10 CFR part 40, in particular the applicability of alternate concentration limits for ISR facilities."[55] In addition, the Commission directed a limited scope rulemaking, stating that given "diminished domestic ISR activity, the rulemaking should be narrowly targeted and its costs should be included in fee relief."[56]

D. July 2020 EPA-NRC Memorandum of Understanding on ISR Rulemaking

In spring 2019, the NRC began development of an MOU with the EPA to delineate the roles and responsibilities of each agency under Title II of UMTRCA for regulating uranium ISR activities. The MOU was signed by both agencies and became

[54] SECY-19-0123, "Regulatory Options for Uranium In-Situ Recovery Facilities" (December 16, 2019).
[55] SRM-SECY-19-0123, "Staff Requirements – Regulatory Options for In-Situ Recovery Facilities," (October 22, 2020).
[56] *Id.*

effective in July 2020.[57] The purpose of the MOU is to 1) provide a framework for cooperation and coordination between the NRC and the EPA for implementing each party's statutory responsibilities under AEA sections 84 and 275 with respect to regulating uranium ISR activities in a timely, efficient, and thorough manner; 2) describe the responsibilities of each party in regulating uranium ISR activities; and 3) foster opportunities for effective and efficient communication between the NRC and the EPA, including the exchange of written information, and interagency meetings.

The July 2020 MOU contains definitions for ISR activities and provisions for ISR rulemaking to enable and guide each agency in their issuance of regulations under their respective UMTRCA authorities. In Section VIII.a. of the July 2020 MOU, the EPA and the NRC affirmed that the standards of general application for groundwater protection at uranium ISR facilities are found in 40 CFR part 192, subpart D. The subpart D regulations cross-reference specific EPA RCRA groundwater protection regulations in 40 CFR part 264. Of particular importance to a future ISR rulemaking is that the July 2020 MOU confirms that the regulations in 40 CFR part 192, subpart D are the groundwater protection standards for ISR facilities. The subpart D regulations directly reference the requirements in 40 CFR 264.94 that will be applicable to hazardous constituents in groundwater at ISR facilities and include ACLs.

Furthermore, the July 2020 MOU contains several provisions to ensure that NRC and EPA align on the regulatory basis for technical requirements in any future rulemaking efforts addressing groundwater protection at ISR facilities. For example, Section VII.c. of the MOU addresses the length of the post-restoration groundwater monitoring period by providing that the corrective action framework of Subtitle C of

[57] "Memorandum of Understanding Between the U.S. Nuclear Regulatory Commission and the U.S. Environmental Protection Agency Concerning the Regulation of Uranium in situ Recovery Activities" (July 23, 2020), ADAMS Accession No. ML20218A248.

RCRA is the appropriate regulatory framework for ISR facilities, including the use of ACLs approved by the regulatory agency. Specifically, in any future rulemaking, the agencies agreed that post-restoration monitoring will incorporate the same requirements as the RCRA regulation for corrective action for aquifer contamination in 40 CFR 264.100, which in turn references 40 CFR 264.96(c). Section 264.96(c) requires monitoring of hazardous constituents at point of compliance wells to demonstrate there has been no statistically significant exceedance of the approved hazardous constituent concentration limits for three consecutive years. The proposed rule's post-restoration monitoring requirement is, therefore, comparable to the RCRA standards as required in AEA section 84a(3). Additionally, the MOU provides that should the NRC promulgate general requirements concerning the management of AEA section 11e.(2) byproduct material, the NRC would request the concurrence of the EPA, in accordance with AEA section 84a.(3), that those general requirements are at least comparable to those requirements applicable to the possession, transfer, and disposal of similar hazardous material regulated by the EPA under RCRA. Under the MOU, the NRC would submit the draft final rule setting forth such general requirements to EPA for concurrence. Finally, the MOU acknowledges the 1989 United States Court of Appeals, 10th Circuit decision that held that the concurrence of the EPA is not required for a regulatory agency to approve an ACL.[58]

E. NRC's Current Regulatory Practice for Groundwater Protection at ISR Facilities

The NRC has, to date, regulated groundwater protection at ISR facilities by using site-specific license conditions that incorporate the relevant regulations for groundwater protection found in appendix A to 10 CFR part 40 and that are otherwise informed by the

[58] *Environmental Defense Fund v. U.S. Nuclear Regulatory Commission*, 866 F.2d 1263, 1268-1269 (10th Cir. 1989).

NRC's operational experience and best management practices. This regulatory approach has been shown to successfully protect groundwater at NRC licensed ISR facilities for more than 40 years in that there have been no known significant adverse impacts to groundwater quality in surrounding aquifers.[59] Therefore, this regulatory approach provides the basis for the issuance of ISR-specific regulations for groundwater protection in this proposed rule. The NRC requires, as a standard condition of its site-specific ISR license, that a licensee demonstrate that it has all necessary permits, including the UIC aquifer exemption for the groundwater in the production unit, before it can commence ISR operations. The NRC regulations that address groundwater protection requirements for the management of uranium byproduct material are currently found in criteria 5, 7, 7A, 9, and 13 of appendix A to 10 CFR part 40. The NRC has applied the groundwater protection standards in these criteria to hazardous constituents in the production unit for groundwater protection at ISR facilities using site-specific license conditions, as informed by the applicable regulatory guidance.

The paragraph 5B(5) requirements of criterion 5 of appendix A set out the hazardous constituent concentrations that must be met at the points of compliance and include ACLs. The paragraph 5B(5) groundwater protection requirements are first referenced in paragraph 5B(1), which states that the specific concentration limits that must not be exceeded are "those limits established by the Commission as indicated in paragraph 5B(5) of this criterion."[60] As written, paragraph 5B(1) addresses the

[59] In a 2009 NRC staff paper to the Commission, the staff reported its findings on the environmental impacts resulting from the operation of the three then active ISR facilities under NRC license ("Staff Assessment of Groundwater Impacts From Previously Licensed In-Situ Uranium Recovery Facilities," July 10, 2009 (Staff Assessment Paper)). The staff stated that the NRC had "approved 11 groundwater restorations at the 3 facilities" and that over 60 percent of the constituents were restored to their pre-operational concentrations." Staff Assessment Paper at 1. The staff concluded that all constituents were "restored to levels that NRC staff found to be protective of public health and the environment." *Id*. The NRC staff confirmed this conclusion in 2017 as part of it comments on the EPA"s January 2017 proposed 40 CFR Part 192 rule ("U.S. Nuclear Regulatory Commission Staff's Comments on the U.S. Environmental Protection Agency's Proposed Rulemaking for 40 CFR Part 192, 82 FR 7400," ADAMS Accession No. ML17173A638).
[60] 10 CFR part 40, appendix A, paragraph 5B(1).

hazardous constituent concentration limits at points of compliance impacted by leakage of hazardous constituents to groundwater in the uppermost aquifer from above-surface disposal areas at conventional mills (e.g., waste impoundments) containing uranium and thorium byproduct materials. As provided in paragraph 5B(1), the hazardous constituent concentration limits in paragraph 5B(5) specifically apply to "hazardous constituents entering the groundwater from a licensed site."

Within a production unit in an ISR wellfield, there is no disposal area equivalent to a conventional mill waste impoundment. Instead, it is the altered groundwater in the production unit that is the potential source of hazardous constituents that may migrate to immediately surrounding groundwater. In 1999, the Commission determined that the groundwater that is altered in the production unit during ISR operations constitutes AEA section 11e.(2) byproduct material.[61] In April 2009, the NRC published a regulatory issues summary (RIS) to clarify that the paragraph 5B(5) requirements (of criterion 5 of appendix A) are the applicable hazardous constituent concentration limits for groundwater restoration in ISR wellfields.[62]

Therefore, for each production unit, the NRC has required the licensee to identify the known or potential hazardous constituents in the production unit that may migrate to surrounding groundwater. The regulations in paragraph 5B(2) provide three criteria the NRC uses to determine if a constituent in the groundwater in the production unit is hazardous: 1) the constituent is reasonably expected to be in or derived from the byproduct material; 2) the constituent has been detected in the groundwater; and 3) the constituent is listed in criterion 13.

For groundwater in the production unit, the NRC has required that any

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[61] SRM-SECY-99-013.

[62] RIS 2009-05, "Uranium Recovery Policy Regarding: (1) The Process for Scheduling Licensing Reviews of Applications for New Uranium Recovery Facilities and (2) The Restoration of Groundwater at Licensed Uranium In Situ Recovery Facilities," April 29, 2009.

radiological or nonradiological constituent that is reasonably expected to be in or derived from the operation of an ISR wellfield is a potential hazardous constituent of concern, and as such, constitutes AEA section 11e.(2) byproduct material. The regulations in criterion 13 provide a non-inclusive list of potential hazardous constituents of concern. Criterion 13 also provides flexibility to add constituents on a case-by-case basis. Additionally, an identified hazardous constituent may be excluded by the NRC on a site-specific basis pursuant to the regulations in paragraph 5B(3) which state,

> Even when constituents meet all three tests in paragraph 5B(2) of this criterion, the Commission may exclude a detected constituent from the set of hazardous constituents on a site specific basis if it finds that the constituent is not capable of posing a substantial present or potential hazard to human health or the environment.

In making any such determination to exclude an identified hazardous constituent under paragraph 5B(3), the NRC is required to consider the presence of any USDW and aquifers exempted by the EPA in accordance with paragraph 5B(4).

Paragraph 5B(5) defines the hazardous constituent concentration limits for management of uranium byproduct material at ISR facilities. Specifically, paragraph 5B(5) states,

> At the point of compliance, the concentration of a hazardous constituent must not exceed—
> (a) The Commission approved background concentration of that constituent in the groundwater;
> (b) The respective value given in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed; or
> (c) An alternate concentration limit established by the Commission.

For ISR facilities, the NRC has interpreted the paragraph 5B(5) hazardous constituent concentration limits to apply to the groundwater in the production unit and in the surrounding groundwater to the production unit. The surrounding groundwater is considered to be the groundwater in immediately overlying, underlying, and adjacent

aquifers[63] to the production unit.

Under criterion 7A, the NRC requires the licensee to conduct groundwater sampling at point of compliance wells in the production unit, and the immediately overlying, underlying, and adjacent aquifers to the production unit to measure the background hazardous constituent concentration levels to be used to establish the Commission approved concentration limits for hazardous constituents as defined in paragraph 5B5(a) or (b). Specifically, the licensee must provide for NRC approval the sampling data for the background concentration level of each hazardous constituent at the points of compliance. For ISR facilities, these points of compliance are wells in the production unit and in the immediately overlying, underlying, and adjacent aquifers to the production unit. The licensee must conduct the sampling of the background concentration levels at these point of compliance wells before ISR operations begin (i.e., before the licensee may inject lixiviant into the aquifer). To date, the locations of the point of compliance wells and the methods to sample and establish background hazardous constituent concentration limits in the production unit have been regulated using site-specific license conditions, as informed by risk-informed and best management practices reflected in the applicable regulatory guidance.

Furthermore, under criterion 7A, the NRC requires the licensee to conduct a monitoring program to detect migration of byproduct material from the production unit to surrounding aquifers after ISR operations begin. Specifically, the licensee must monitor the point of compliance wells previously installed (for the evaluation of hazardous constituent background concentration levels) at locations in immediately overlying, underlying, and adjacent aquifers to detect any potential migration of hazardous

[63] The proposed rule defines the *Production unit* as the part of an aquifer from which the source material is extracted by ISR operations. The immediately adjacent aquifer is the groundwater on the lateral perimeter of the production unit of the ISR wellfield, as opposed to those aquifers above (overlying) and below (underlying) the production unit.

constituents from the production unit. These point of compliance wells are sampled bi-weekly to detect excursions, which are defined as the detection of indicator constituents that may signal the movement of fluids containing byproduct material from the production unit into surrounding groundwater. These indicator constituents travel faster than the hazardous constituents in the groundwater to enable an early warning of the potential for an exceedance of the approved paragraph 5B(5)(a) or (b) hazardous constituent concentration limits.

If the bi-weekly sampling detects an excursion, the licensee must take action to eliminate the excursion (e.g., adjust wellfield injection and production flow rates) to prevent the migration of hazardous constituents to groundwater surrounding the production unit. If the monitoring shows that the approved hazardous constituent concentration limits in paragraph 5B(5)(a) or (b) at a point of compliance well in an immediately overlying, underlying, or adjacent aquifer have been exceeded because of hazardous constituents that have migrated away from the production unit in a wellfield, the NRC requires the licensee to take corrective action to restore the groundwater to the approved hazardous constituent concentration limits. Prior to taking the corrective action, the licensee must submit a corrective action program for Commission approval unless otherwise directed by the Commission.

In addition, after the licensee terminates extraction of uranium in a production unit, the NRC requires, through site-specific license conditions, the restoration of groundwater in that production unit. As part of this process, the NRC requires the licensee to submit a wellfield restoration plan, which must be approved before ISR operations in the production unit begin. Groundwater restoration of a production unit typically uses a combination of best management practices including: 1) groundwater transfer, 2) groundwater sweep, 3) reverse osmosis with permeate injection, 4) groundwater treatment with reductants, and 5) groundwater recirculation. The

restoration process generally takes several years. Monitoring of groundwater at point of compliance wells located in the production unit in the wellfield is used to measure the progress of restoration.

The goal of the restoration is to return the levels of all hazardous constituents within the production unit to the approved hazardous constituent concentration limits, which are protective of public health and safety and protective of immediately overlying, underlying, and adjacent aquifers to the production unit. In RIS 2009-05, the NRC determined that paragraph 5B(5) sets forth the applicable hazardous constituent concentration limits for groundwater restoration of the production unit. The regulations in paragraph 5B(5) specifically state that the approved concentration limits in paragraph 5B(5)(a) or (b) should be met at approved points of compliance for hazardous constituents. Paragraph 5B(6) provides that the background concentrations pose no incremental hazard and the "drinking water limits," also known as MCLs, provide an acceptable hazard.

Paragraph 5B(6), however, also provides that if meeting either paragraph 5B(5)(a) or (b) is not practically achievable for a specific hazardous constituent, the licensee may propose an ACL under paragraph 5B(5)(c). Specifically, paragraph 5(B)(6) states that the Commission may establish a site-specific ACL for a hazardous constituent as provided in paragraph 5B(5) if it finds that the proposed limit is as low as reasonably achievable, after considering practicable corrective actions, and that the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded.

Paragraph 5B(6) provides that the NRC must consider nine factors to evaluate potential adverse effects on groundwater quality and ten factors to evaluate potential adverse effects on hydraulically connected surface water quality in determining whether to approve the proposed ACL. An evaluation of these factors will allow the NRC to make

the appropriate present and potential hazard findings with respect to the proposed ACL. The licensee must provide sufficient site-specific information to enable the NRC to determine whether the proposed ACL for that hazardous constituent in the production unit presents no hazard or potential hazard to groundwater or surface water quality. The NRC's evaluation and approval or disapproval of a proposed ACL can only be addressed after the licensee has demonstrated it has taken all practical measures to restore the hazardous constituent concentration levels to the approved concentration limits in paragraph 5(B)5(a) or (b). As such, an ACL cannot be proposed by the licensee, or evaluated or approved by the NRC until the licensee terminates ISR operations in a given production unit.

Once restoration is initiated, the NRC requires the licensee to continue to implement restoration measures to the extent necessary to achieve and then to maintain compliance with the approved hazardous constituent concentration limits in the production unit. Furthermore, once restoration is completed, the NRC requires the licensee to conduct post-restoration monitoring at the applicable points of compliance wells on a quarterly basis for at least one year, after the approved hazardous constituent concentration limits are met, using a practice currently known as stability monitoring. Stability monitoring requires the licensee to measure and demonstrate that the hazardous constituent concentration levels at the point of compliance wells do not exhibit statistically significant increasing trends for at least one year (four consecutive quarters). If the stability monitoring shows no statistically significant increasing trends for a hazardous constituent at a point of compliance well for at least one year, no additional post-restoration monitoring has been required by the NRC.

After stability monitoring has been completed, the NRC requires the licensee to submit an ISR wellfield restoration report providing the groundwater stability monitoring data from the point of compliance wells in the production unit and any other information

necessary to enable the NRC to determine that the approved hazardous constituent concentration limits will not be exceeded. Once the NRC determines that the approved hazardous constituent concentration limits will not be exceeded, the NRC approves that restoration of the production unit has been completed.

In addition to the relevant criteria in appendix A that the NRC currently applies to address groundwater protection at ISR facilities, the NRC requires that an applicant meet numerous risk-informed and best management practices reflected in applicable guidance prior to licensing that are not addressed in appendix A. For example, the NRC requires that the applicant characterize the regional and local geological and hydrologic setting of the ISR site to show that the site is suitable for ISR operation (e.g., subsurface conditions will naturally prevent migration of uranium byproduct material from the production unit to surrounding groundwater). The applicant must also identify all wells that may be hydraulically connected to the production unit in the wellfield and assess if they may be impacted by ISR operations. The applicant must also describe the past, present, and future groundwater use in and near the proposed production unit. This information is used by the NRC to understand how the past water use has, and the current water use continues to, influence the groundwater flow system in the production unit and surrounding aquifers and how future water use will impact this groundwater flow system. This information is critical for the NRC to evaluate if hydraulic control by inward gradient in the production unit can be achieved and maintained to prevent the migration of contamination to surrounding groundwater.

Finally, the applicant is prohibited from installing any wells associated with radiological operations (e.g., production, injection, or monitoring well networks associated with ISR facilities) in the wellfield prior to the NRC issuing the license for an ISR facility. This prohibition results from the application of 10 CFR 40.32(e), coupled with the 10 CFR 40.4 definitions of “construction” and the “commencement of

construction." Construction includes the installation of wells associated with radiological operations and 10 CFR 40.32(e) prohibits the commencement of construction until the NRC's Director, Office of Nuclear Material Safety and Safeguards, or his or her designee, has concluded, "after weighing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives," that the proposed license should be issued.[64]

The license issued by the NRC will include license conditions based on the criteria of appendix A but made applicable to ISR facilities. In addition, the NRC will include license conditions based on risk-informed and best management practices not covered by appendix A. For example, after licensing but prior to beginning ISR operations in a wellfield, the licensee must undertake intensive site-specific geological and hydrological characterization in the wellfield to verify that the licensee can hydraulically control the byproduct material in the production unit to prevent the migration of hazardous constituents into surrounding groundwater. This characterization is accomplished by using information that is gathered during the installation of the injection, production, and monitoring wells. The installation of these wells must meet specific requirements concerning their construction, completion, and development including well logging that provides information to characterize the subsurface geology.

After installation, the licensee must conduct mechanical integrity tests on each well to ensure there are no well casing leaks that may contaminate groundwater. The licensee must also conduct formation testing in the wellfield, including pumping tests in the production unit, to demonstrate there is no hydraulic connection between the injection and production wells and the immediately overlying and underlying aquifers to

[64] 10 CFR 40.32(e) ("Commencement of construction prior to [the NRC's approval of the license] is grounds for denial of a license to possess and use source and byproduct material in the plant or facility") (alteration added).

the production unit. The licensee must also use the results of the pumping tests to demonstrate that it can achieve and maintain an inward hydraulic gradient to draw groundwater into the production unit from the immediately adjacent aquifer in order to prevent the migration of hazardous constituents into that aquifer. In addition, the licensee must demonstrate that it will conduct its operations to prevent leaks and spills to the uppermost aquifer in the wellfield.

F. Regulatory Changes Associated with this Proposed Rule

The NRC proposes to add a new criterion 14 to appendix A to 10 CFR part 40 that would establish regulations specific to uranium ISR facilities to protect groundwater from the radiological and nonradiological hazards associated with the generation of AEA section 11e.(2) byproduct material, thus codifying the risk-informed and best management practices for groundwater protection used by the NRC in site-specific license conditions. The proposed rule would also amend certain provisions of criterion 5, as appropriate. The only notable substantive change from current NRC ISR facility licensing practice would be to require at least three years of quarterly post-restoration monitoring at the points of compliance in the production unit after the licensee's groundwater restoration efforts have met the approved hazardous constituent concentration limits. This new requirement would be aligned with the applicable RCRA standards and differs from the current practice of requiring only one year of quarterly post-restoration monitoring. The response to Question I. in Section III, "Discussion," of this notice provides additional information.

Finally, this proposed rule would also add new definitions specific to ISR operations to appendix A to 10 CFR part 40 and amend the definition of *Byproduct material* in § 40.4 to add the phrase "and liquid wastes" following the phrase "discrete surface wastes" to clarify that those liquid wastes in the groundwater that result from ISR

operations are a form of AEA section 11e.(2) byproduct material. This proposed change to the definition of *Byproduct material* would reflect the Commission's 1999 decision in SRM-SECY-99-0013 that any liquid waste generated during or after the uranium extraction phase of ISR site operations, and all evaporation pond sludges derived from liquid wastes, are properly classified as AEA 11e.(2) byproduct material.

III. Discussion

A. What action is the NRC taking?

The NRC proposes to revise appendix A by adding a new section VI, "Additional Technical Criteria for In-Situ Recovery (ISR) Operations," which consists of a new criterion 14 that establishes groundwater protection requirements specific to ISR facilities. This proposed rule would also revise the preamble paragraph of criterion 5, appendix A, and paragraphs 5B(1), 5B(2), 5B(5)(b), and 5C of criterion 5, to clarify that several of the current conventional uranium milling requirements apply to ISR operations, including the use of ACLs. The proposed rule would further add a new paragraph 5(B)(1)(b) to criterion 5 that would establish the applicable groundwater protection standard for ISR facilities with an express cross-refence to paragraph 5B(5), which, in turn, sets the hazardous constituent concentration limits that must not be exceeded at the point of compliance in the groundwater. The new paragraph 5(B)(1)(b) would also provide that the Commission will establish the point of compliance and compliance period on a site-specific basis pursuant to criterion 14, and that the Commission will identify hazardous constituents, establish concentration limits, and may adjust the point of compliance, if needed.

The proposed rule would revise the current definition of *Byproduct Material* in 10 CFR 40.4 to include liquid wastes from ISR facilities that may impact groundwater.

The proposed rule would also add, in the Introduction to appendix A, new definitions for *Aquitard*, *Corrective action*, *Excursion*, *ISR facility*, *Indicator constituent*, *In situ recovery*, *Production unit*, and *Wellfield*; and revise, in the Introduction to appendix A, the current definition of *Point of compliance*.

The proposed rule would also add a preamble paragraph to section I, "Technical Criteria," of appendix A to identify the classes of applicants and licensees that would be subject to the proposed rule, if ultimately promulgated. Finally, this proposed rule would cross reference the values for the maximum concentrations for groundwater protection for all uranium mills (both conventional mills and ISR facilities) to the EPA's MCL regulations for drinking water.

B. What persons would this action affect?

This proposed rule, if adopted, would apply to an application for, and the licensing, operation, and decommissioning of, a new ISR facility, a new wellfield within a licensed ISR facility, or a new production unit within an operating wellfield of a licensed ISR facility, if the application is submitted after the effective date of this rule.

C. Why do the requirements need to be revised?

Appendix A to 10 CFR part 40 contains requirements primarily related to the operation of conventional uranium mills. These regulations were established to conform to the EPA's standards of general application in 40 CFR part 192, subpart D. The current groundwater protection requirements in appendix A to 10 CFR part 40 focus on the contamination of surrounding groundwater caused by seepage from disposal areas such as mill tailings impoundments and do not directly address groundwater protection at ISR facilities. The ISR operations do not produce any tailings, but do produce waste streams containing AEA section 11e.(2) byproduct material that require proper

management. These waste streams originate on or near the surface from pipes, evaporation ponds, and ion exchange facilities, and in the groundwater in the production unit where the injected lixiviant releases the uranium from the host rock. Since the 1990s, the ISR process has become the predominant means of extracting uranium in the United States. In the absence of specific NRC regulations applicable only to ISR facilities, the NRC has had to rely primarily on license conditions that incorporate risk-informed and best management practices to appropriately regulate ISR facilities.

In the absence of NRC regulations specific to ISR facilities, licensing reviews for each applicant and approval of other requirements for licensees may vary–depending on differences among NRC and Agreement State licensing reviewers. The proposed regulations are expected to make the licensing process and the NRC's regulatory oversight more predictable and consistent for the NRC, licensees, and the public.

D. What is the basis for proposed criterion 14?

The NRC and EPA have complementary statutory authority over the regulation of AEA section 11e.(2) byproduct material under UMTRCA. Appendix A to 10 CFR part 40 already includes many general requirements issued by the NRC to conform to the EPA standards of general application set forth in 40 CFR part 192, subpart D that the NRC has found to be applicable to ISR facilities, including the groundwater protection requirements found in criteria 5, 7, 7A, and 13. In July 2020, the EPA and the NRC entered into an MOU to address each agency's regulatory authority under UMTRCA with respect to regulating uranium ISR facilities. This MOU sets forth the resolution of several jurisdictional and technical issues and describes the coordination between the two agencies in accomplishing their respective responsibilities under UMTRCA. The July 2020 MOU confirms that the standards of general application for groundwater protection at ISR facilities are those set forth in 40 CFR part 192, subpart D.

In addition to other changes, this proposed rule would add a new section VI and criterion 14 to appendix A to 10 CFR part 40, applicable only to ISR facilities, consisting of groundwater protection requirements that conform with 40 CFR part 192, subpart D and the applicable RCRA requirements contained therein. Criterion 14 would also codify those risk-informed and best management practices that the NRC has implemented through site-specific license conditions.

E. What is proposed in the new criterion 14 and what definitions are proposed?

The NRC proposes to add a new criterion 14 to appendix A to 10 CFR part 40 that would establish regulations specific to uranium ISR facilities to protect groundwater from the radiological and nonradiological hazards associated with the generation of AEA section 11e.(2) byproduct material, thus codifying the risk-informed and best management practices for groundwater protection used by the NRC in site-specific license conditions. Together with the revised applicable requirements in criterion 5, and the existing requirements in criteria 7, 7A, 9 and 13, the criterion 14 requirements would establish a standardized groundwater protection program for the NRC regulation of ISR facilities.

The proposed requirements in criterion 14 are set out in eight specific provisions: a) site characterization and suitability demonstration; b) wellfield pre-operational requirements; c) well design and construction requirements; d) operating, monitoring, and reporting requirements; e) mechanical integrity; f) wellfield restoration; g) plugging and abandonment; and h) corrective action. The criterion 14 provisions set out technical requirements for groundwater protection that would enable the NRC staff to determine if the ISR facility can be operated to prevent, detect, and correct leakage or migration of contaminants from the production unit to surrounding groundwater.

Criterion 14(a) would require that the applicant submit specific, detailed geologic

and hydrologic site characterization information (e.g., a description of the local and regional hydrogeologic gradient and hydrostratigraphy; past, current and future groundwater use, etc.) to demonstrate the suitability of a site to undertake ISR operations in such a manner that there would be no significant impact to the groundwater. The NRC has determined that this information is needed because the production unit is a subsurface natural system, in contrast to an engineered and manufactured system where the design, operation, and behavior are understood and can be tested or simulated to predict its performance.

Criterion 14(b) would set out wellfield pre-operational requirements that must be satisfied after the issuance of the license or license amendment (in the case of a new production unit or new wellfield), but prior to the injection of lixiviant into the production unit. The licensee would be required to undertake sampling and analysis of radiological and nonradiological hazardous constituents described or otherwise identified under paragraph 14(b)(2) to determine the background hazardous constituent concentration levels in the groundwater at all point of compliance wells in the production unit in each wellfield, and in the immediately overlying, underlying, and adjacent aquifers to the production unit in each wellfield. A licensee would be required to take at least four independent samples at each point of compliance well as provided in paragraph 14(b)(3)(ii) to be consistent with the comparable RCRA regulation in 40 CFR 264.97(g)(1). These samples must be taken at a minimum of two weeks apart or at an interval approved by the NRC. The background hazardous constituent concentration levels would be used by the NRC to establish the approved hazardous constituent concentration limits in paragraph 5B(5)(a) or (b) for groundwater restoration for the production unit and for any corrective action in the aquifers immediately overlying, underlying, and adjacent to the production unit. The licensee also would be required by paragraph 14(b)(4) to select at least three indicator constituents to minimize the

likelihood of false positives for excursion detection as described in NUREG/CR 3967. The licensee also would be required to measure background concentration levels to determine the upper control limit for each indicator constituent at point of compliance wells in the aquifers immediately overlying, underlying, and adjacent to the production unit. The licensee also would be required by paragraph 14(b)(5) to provide a wellfield restoration plan demonstrating how it will meet the approved hazardous constituent concentration limits in the production unit after restoration. The NRC must approve both the background hazardous concentration levels submitted in accordance with paragraph 14(b)(3), the selection of the three indicator constituents and the determination of the upper control limit for each indicator constituent in accordance with paragraph 14(b)(4), and the wellfield restoration plan submitted in accordance with paragraph 14(b)(5), before the licensee may inject lixiviant into the production unit.

Criterion 14(c) would include requirements for injection, production, and monitoring well design and construction.

Criterion 14(d) would include requirements for ISR wellfield operation and monitoring to ensure the control of byproduct material within the wellfield so that the leakage or migration of byproduct material into surrounding groundwater would be prevented and detected so that corrective action could be taken. The licensee would be required to measure injection pressures to demonstrate that the maximum injection pressure has not been exceeded and to measure injection and production flow rates or volume to demonstrate an inward hydraulic gradient in the production unit to prevent migration of byproduct material The licensee also would be required to conduct monitoring at point of compliance wells to detect any excursion that may signal the migration of byproduct material into surrounding groundwater, to establish a program to detect leaks and spills into the uppermost aquifer, and to meet specific reporting requirements.

Criterion 14(e) would include requirements for mechanical integrity testing to ensure that any leaks caused by failures in specific well installation components (e.g., casings) are detected and corrected to prevent leakage of AEA section 11e.(2) byproduct material into surrounding groundwater.

Criterion 14(f) would include requirements for groundwater restoration in the production unit in the wellfield. The licensee would be required to meet the approved hazardous constituent concentration limits in paragraph 5B(5)(a) or (b) in the production unit after restoration is completed. If the licensee cannot practically achieve these limits, then under paragraph 5B(5)(c), the licensee may propose, and the NRC may establish, an ACL for a hazardous constituent, after a demonstration that there is no present or potential hazard to groundwater or surface water quality pursuant to paragraphs 5B(4) and 5B(6). Criterion 14 contemplates that groundwater restoration, whether to the approved hazardous constituent concentration limits set forth in paragraph 5B(5)(a) or (b) or to an approved ACL, would be conducted under a RCRA corrective action framework.[65] As such, criterion 14(f) would require at least three years of quarterly post-restoration monitoring at the points of compliance in the production unit after groundwater restoration has met the approved hazardous constituent concentration limits or to an approved ACL. Additionally, the licensee would be required to demonstrate that there has been no statistically significant exceedance of the approved hazardous constituent concentration limits or to an approved ACL for three consecutive years. The licensee would be required to submit a wellfield restoration report for NRC

[65] Section VII.c. of the July 2020 MOU entered into between the EPA and the NRC states that "[t]he corrective action framework under Subtitle C of the [Solid Waste Disposal Act], as amended, [footnote omitted] would be the appropriate model to apply for developing standards of general application concerning or relating to those aquifers in ISR wellfields that have been restored to the regulatory agency's approved groundwater protection standards or requirements, including those aquifers restored using an alternate concentration limit approved by the regulatory agency in accordance with AEA § 84c." (42 U.S.C. § 2214(c)). RCRA, 42 U.S.C. §§ 6901 *et seq.*, amended Subtitle C, Solid Waste Disposal Act, 42 U.S.C. §§ 6921-69399.

approval after these requirements are met.

Criterion 14(g) would include requirements for the licensee to submit a plugging and abandonment plan for all wells to ensure that byproduct material fluids do not leak from plugged and abandoned wells into surrounding groundwater.

Criterion 14(h) would include requirements for corrective action pursuant to criterion 5D for three specific events. Specifically, corrective action would be required for 1) a confirmed excursion that lasts more than 60 days and has demonstrated an exceedance of an approved hazardous constituent concentration limit; 2) a statistically significant exceedance of an approved hazardous constituent concentration limit at a point of compliance well in the production unit during post-restoration monitoring; or 3) for the detection of leakage into the uppermost aquifer.

With respect to definitions, the proposed rule would add definitions for the terms *Aquitard, Corrective action, Excursion, Indicator constituent, ISR facility, In situ recovery, Production unit*, and *Wellfield*. These definitions would be added to the existing list of definitions in the Introduction section of appendix A. In addition, the existing *Point of compliance* definition would be revised to add requirements specific to ISR operations. Further, the proposed rule would revise the definition of *Byproduct material* in 10 CFR 40.4 to clarify that those liquid wastes in the groundwater that result from ISR operations are a form of AEA section 11e.(2) byproduct material.

F. What revisions are proposed for paragraph 5B(5) and Table 5C?

The proposed rule would update paragraph 5B(5)(b) and remove the criterion 5C table in appendix A and replace it with cross references to specified EPA groundwater protection numerical standards. Currently, paragraph 5B(5)(b) provides a licensee the option to restore the level of a given hazardous constituent present in the groundwater so that it is at or below the maximum concentration for that constituent found in the

criterion 5C table, “Maximum Values for Groundwater Protection,” in appendix A if the value is higher than its background concentration level. The current criterion 5C table, which was added to appendix A by the NRC in its 1987 rulemaking, lists the then available MCLs from the EPA’s standards for protection of drinking water and the maximum concentrations for other selected constituents expected to be commonly found at uranium milling sites. The proposed paragraph 5B(5)(b) would reference the proposed criterion 5C, which would no longer be in a tabular format but would instead cross reference the EPA’s 40 CFR part 141 tables that contain the various hazardous constituent MCLs for drinking water and the 40 CFR 264.94 Table 1, “Maximum Concentration of Constituents for Ground-water Protection,” for those constituents not listed in the 40 CFR part 141 tables (e.g., lead and silver). The references to the criterion 5C table in the revised paragraph 5B(5)(b) and the table itself would be removed. These proposed changes would be applicable to both conventional mills and ISR facilities.

The NRC is considering these proposed changes to paragraph 5B(5)(b) and to the criterion 5C table because when the NRC added the criterion 5C table in 1987, the EPA was still in the process of developing the MCLs and the EPA has subsequently revised certain MCLs and added new constituents of concern to the standards for protection of drinking water (40 CFR part 141). By adding cross references in a revised criterion 5C to the EPA’s 40 CFR part 141 MCLs for hazardous constituents and to the EPA’s maximum concentrations in 40 CFR part 264, Table 1, appendix A should not require future revision if the EPA later revises these standards.

G. What is the role of a point of compliance well?

A point of compliance well plays an integral groundwater protection role both in the NRC’s current practice of regulating ISR facilities by site-specific license conditions

and in this proposed rule as it represents the location where the approved hazardous constituent concentration limits set forth in paragraph 5B(5) of appendix A to 10 CFR part 40 must be met. The proposed rule would continue to define the term the *Point of compliance* as a site-specific location in the uppermost aquifer where the groundwater protection standard must be met; however, the proposed rule would add, for ISR operations, that the point of compliance also includes a site-specific location below the uppermost aquifer in the production unit in the wellfield, or in aquifers adjacent to, above, or below the production unit, where the groundwater protection standard must be met.

With this revised definition, a licensee would be required to install point of compliance wells not only in the production unit but also in the immediately overlying, underlying, and adjacent aquifers to the production unit. The point of compliance wells in the production unit would be used to establish the background hazardous constituent concentration levels before lixiviant injection, and subsequent to the termination of ISR operations, would act as the points of compliance to determine if the approved background hazardous constituent limits are achieved after restoration of the production unit and for post-restoration monitoring.

The point of compliance wells in the immediately overlying, underlying, and adjacent aquifers would be used to establish the background hazardous constituent concentration levels and the indicator constituent upper control limits for excursion detection before lixiviant injection. During ISR operations, these point of compliance wells in the immediately overlying, underlying, and adjacent aquifers to the production unit would be used to detect excursions. If corrective action is required as a result of an excursion being detected, these point of compliance wells would be used to determine if the corrective action has met the approved hazardous constituent concentration limits.

The proposed rule's provisions concerning point of compliance wells at ISR facilities would be a new addition to appendix A of 10 CFR part 40 to address the

difference between conventional uranium mills and ISR facilities. As described in Section II.A. of this document, appendix A was written for the regulation of conventional mills. The uranium recovery operations of conventional mills occur above-ground, including the disposal of the tailings or wastes resulting from the processing of the uranium ore. Such tailings or wastes constitute AEA section 11e.(2) byproduct material and are required to be disposed of in surface impoundments designed to prevent the leakage of the byproduct material into either surface water or groundwater. Paragraph 5A(1) sets forth the primary groundwater protection standard for a conventional mill's surface impoundment, namely, the installation of a liner "that is designed, constructed, and installed to prevent any migration of wastes out of the impoundment to the adjacent subsurface soil, groundwater, or surface water." The regulatory assumption is that the liner will not fail. If leakage of byproduct material occurs due to a failure of the liner to contain the material, then the licensee must take corrective action, which may include the installation of one or more point of compliance wells. Point of compliance wells are, thus, not part of the design of the conventional mill or its surface impoundment, but are only installed in the event of a leakage from the impoundment that will require corrective action.

In contrast, point of compliance wells are a critical part of groundwater protection in the ISR wellfield. The point of compliance wells are required to be installed before operations to measure background hazardous constituent concentration levels in the production unit and in the immediately overlying, underlying, and adjacent aquifers. The point of compliance wells are also used during operations for excursion detection in the immediately overlying, underlying, and adjacent aquifers and for any required corrective action. Finally, after restoration of the production unit, the point of compliance wells are used to demonstrate compliance with the approved hazardous constituent concentration limits pursuant to paragraph 5B(5) and to conduct post-restoration monitoring.

H. How is an excursion defined and confirmed under the proposed rule?

The proposed rule defines the term *Excursion* to mean the detection of indicator constituents that may signal the movement of fluids containing byproduct material from the production unit into surrounding groundwater. The term *Indicator constituent* is defined to mean a parameter, such as chloride, conductivity, total alkalinity, or other conservative solute, whose value is used to detect an excursion. Indicator constituents travel at or close to the same velocity as the groundwater and are not slowed by geochemical or physical processes that impact the migration of hazardous constituents in the byproduct material (e.g., uranium, radium).[66] As such, the detection of an excursion, i.e., the presence of indicator constituents, serves as an early warning system of the movement of fluids containing byproduct material from the production unit into surrounding groundwater, so that the licensee can take action to eliminate migration of hazardous constituents into the surrounding groundwater.

In order to prevent the movement of byproduct material into surrounding groundwater, the proposed criterion 14 would require the licensee to establish a monitoring program to detect excursions, including the installation of point of compliance wells in the immediately overlying, underlying, and adjacent aquifers to the production unit that could be affected by migration of byproduct material. Under the proposed paragraph 14(d)(2)(iii), after lixiviant injection begins in the production unit, the licensee would be required to take samples to measure the three selected indicator constituents every two weeks from the point of compliance wells in the aquifers immediately overlying, underlying, and adjacent to the production unit. In accordance with proposed paragraph 14(d)(2)(iii)(A), an excursion would be deemed to have occurred if, in any

[66] NUREG/CR–3967, "An Analysis of Excursions at Selected In Situ Uranium Mines in Wyoming and Texas," July 1986.

point of compliance well, two or more excursion indicator constituents exceed their upper control limits. An adequate excursion indicator constituent is one that is found in significantly higher concentrations in the production unit during ISR operations than in the surrounding groundwater outside the production unit.

The licensee should choose excursion indicator constituents that are not significantly attenuated by geochemical or physical processes. Because a sample may result in a false positive, an excursion confirmation sample must be taken within 48 hours after the initial analysis that indicates that an excursion occurred. If that second sample does not indicate the upper control limits were exceeded, a third sample would be taken. If either the second or the third sample confirms that an excursion has occurred, the licensee would be required to take corrective action according to the requirements in paragraph 14(h)(1). If neither of the samples confirms an excursion, the point of compliance well would be removed from excursion status.

I. Are alternate concentration limits applicable to groundwater restoration at ISR wellfields?

Yes. The proposed regulations for groundwater restoration in criterion 14(f) state that after completion of ISR operations in a production unit, the licensee must restore the hazardous constituents in the production unit identified under paragraph 14(b)(2) to the constituent's approved concentration limit listed in either paragraphs 5B(5)(a) or (b) pursuant to the wellfield restoration plan described in paragraph 14(b)(5). The approved concentration limit would be either the approved background concentration for that hazardous constituent (paragraph 5B(5)(a)) or one of the values listed in criterion 5C (e.g., MCLs), if the background concentration is below these values (paragraph 5B(5)(b)).

If the licensee cannot practically achieve the approved concentration limit for a

hazardous constituent, the licensee may propose an ACL pursuant to paragraph 5B(5)(c). Paragraph 14(f) would require that the licensee submit an application for an ACL as an amendment to its license in accordance with 10 CFR 40.44. After receiving a licensee's application requesting an ACL, the NRC would publish a notice of opportunity for hearing in the *Federal Register*.

Pursuant to paragraph 14(f), the NRC will consider the factors specified in paragraphs 5B(4) and 5B(6) in its evaluation of the ACL application. Paragraph 5B(4) requires the NRC to consider the presence of any USDW and exempted aquifers. Paragraph 5B(6) states that the background concentrations pose no incremental hazard and the other values listed in criterion 5C, including the MCLs, which are drinking water limits, provide an acceptable hazard. Paragraph 5(B)(6) provides that the NRC may establish a site-specific ACL for a hazardous constituent if it finds that the proposed limit is as low as reasonably achievable, after considering practicable corrective actions, and that the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded.

Additionally, paragraph 5B(6) provides nine factors to evaluate potential adverse effects on groundwater quality and ten factors for potential adverse effects on hydraulically connected surface water quality that will be considered by the NRC for the present and potential hazard finding for a proposed ACL. An evaluation of the paragraph 5B(6) factors would enable the NRC to make the appropriate present and potential hazard findings with respect to the proposed ACL. In its license amendment application proposing the ACL, the licensee must provide sufficient site-specific information to enable the NRC to adequately address the paragraph 5B(6) factors and to determine whether the proposed ACL for that hazardous constituent in the production unit presents no hazard or potential hazard to groundwater or surface water quality. These factors are then considered by the NRC to evaluate the ACL for that hazardous

constituent in a production unit. An ACL may not be proposed or established until after ISR operations have ceased in the production unit and until the licensee has demonstrated that meeting either the approved background concentration or the MCL for the subject hazardous constituent is not practically achievable at that production unit.

Although this proposed rule would not apply to current ISR facility licensees who are not seeking to install a new wellfield within a licensed ISR facility or a new production unit within an operating wellfield of a licensed ISR facility, such current ISR facility licensees can request that the NRC approve the use of an ACL in accordance with paragraph 5B(5)(c).[67] The NRC would process such an ACL request in a similar manner to that described in the proposed rule's criterion 14(f), including the publication of a notice of opportunity for hearing in the *Federal Register*.

J. What post-restoration groundwater monitoring requirements are being proposed for ISR wellfields?

Presently, the NRC requires the licensee to conduct post-restoration monitoring at the applicable points of compliance wells on a quarterly basis for at least one year, after the approved hazardous constituent concentration limits are met, using a practice currently known as stability monitoring. This practice is required through site-specific license conditions. Post-restoration groundwater monitoring, as proposed in paragraph 14(f)(1), would occur after all activities to restore the groundwater in a wellfield have ended and all monitored hazardous constituents are at or below their approved concentration limits in paragraph 5B(5). The proposed rule post-restoration monitoring would require quarterly monitoring for three consecutive years following completion of groundwater restoration at point of compliance wells in the restored

[67] In RIS-2009-05, the NRC determined that "the requirements in Criterion 5B of Appendix A apply to restoration of groundwater at uranium ISR facilities." RIS-2009-05, at 3.

production unit to ensure that there is no statistically significant exceedance of the approved hazardous constituent concentration limits.

The proposed post-restoration monitoring requirement conforms to the 40 CFR part 192, subpart D standards for corrective action in 40 CFR 192.33 as it is comparable to the RCRA corrective action requirements in 40 CFR 264.96(c) and 40 CFR 264.100(f).[68] If any point of compliance well shows a statistically significant exceedance, the proposed rule would require the licensee to undertake corrective action pursuant to paragraph 14(h)(2). Depending on the results of the corrective action, the NRC may require the licensee to restart post-restoration monitoring after the corrective action is completed. Restoration of the production unit would be deemed complete when concentrations for all hazardous constituents remain at or below approved limits for three consecutive years.

The proposed post-restoration monitoring requirement to demonstrate there has been no statistically significant exceedance of the approved hazardous constituent concentration limits for three consecutive years is the only notable substantive change in the proposed rule when compared to current NRC licensing practice. The proposed post-restoration monitoring requirement would be applicable to each production unit in a wellfield and would ensure that the hazardous constituent concentration levels in each production unit are maintained after restoration at or below the approved hazardous constituent concentration limits.

K. Are monitoring and corrective action requirements for protecting the uppermost aquifer being proposed?

Yes. Although groundwater impacts from ISR operations are more likely to occur

[68] In section VII.c. of the July 2020 MOU, the EPA and the NRC agreed that groundwater restoration at ISR facilities will be considered under the RCRA corrective action framework.

in the aquifers immediately overlying, underlying, and adjacent to the production unit where uranium is extracted, it is important to ensure that groundwater in the uppermost aquifer is also protected from the effects of near surface and above surface ISR operations. Areas in which these operations occur include waste fluid evaporation ponds, facilities processing lixiviant, source, and byproduct material, and associated wellfield infrastructure. Experience to date shows that leakage or spills into the uppermost aquifer can occur as a result of ISR operations in each of these areas.

The proposed rule's paragraph 14(d)(4) would require each licensee to establish a program, to be approved by the NRC, to detect leaks or spills of lixiviant, source, or byproduct material into the uppermost aquifer. If the licensee detects leakage or spills of lixiviant, source, or byproduct material in the uppermost aquifer, the licensee would be required to notify the NRC under proposed paragraph 14(d)(5)(iii). Upon detection, the licensee would have to undertake corrective action following the requirements of paragraph 14(h)(3). The licensee would be required to notify the NRC of the corrective action taken and results within 60 days of detection. Corrective action would not be considered complete until the NRC confirms that the source of the leakage was eliminated and the hazardous constituent concentration levels were restored to the approved hazardous constituent concentration limits.

L. How do the EPA's underground injection control program requirements interface with the proposed new criterion 14?

Permits for underground injection wells–a broad class of wells that includes EPA UIC Class III injection wells used in ISR operations, as well as Class I and V disposal wells also commonly utilized at ISR facilities–are issued under the EPA's UIC program authority set forth in the EPA's regulations at 40 CFR parts 144 and 146. Under EPA's UIC program, the licensee must apply to the EPA to exempt the groundwater in the

production unit from the protections of the SDWA before injection in Class III wells can begin. The EPA's regulations in 40 CFR 144.3 define an *Exempted aquifer* as an aquifer or a portion thereof that meets the criteria in the definition of USDW but which has been exempted according to the procedures in 40 CFR 144.7. The criteria to determine when a USDW may be designated as an exempted aquifer by the EPA Administrator are found in 40 CFR 146.4. When the EPA Administrator approves and issues an aquifer exemption, the EPA provides an exempted aquifer boundary that includes the production unit in a wellfield and a buffer zone outside the production unit.

Several UIC requirements are similar to those currently required by the NRC in site-specific licenses and in the provisions of proposed criterion 14. The NRC proposes to use similar language from the UIC regulations for Class III injection wells, modified to be specific to ISR operations, such as mechanical integrity testing and plugging and abandonment of injection wells, and considers these proposed regulations as complementary to the EPA's UIC regulations. The NRC's licensees would still be subject to the UIC program requirements through direct regulatory oversight by the EPA or those states to which the EPA has delegated its UIC program authority. The requirements in the proposed criterion 14 would only be applied to Class III wells at ISR facilities.

The EPA's UIC program regulates injection wells, whereas the NRC intends to regulate both injection and production wells under the proposed rule. The NRC is proposing to include production wells in the rule as they may be converted to injection wells in order to modify groundwater flow paths during operations, particularly during any corrective actions. Furthermore, the UIC program does not require the UIC Class III well permittee (i.e., the NRC licensee) to restore the groundwater quality of the production unit of the exempted aquifer but instead requires them to demonstrate that the groundwater in the production unit will not contaminate any USDW surrounding the

exempted aquifer (e.g., outside the aquifer exemption boundary) before the Class III injection wells can be plugged and abandoned. In the proposed criterion 14(f), the NRC would expressly require restoration of the exempted aquifer. Another difference between the two programs is that the UIC regulations require only an initial integrity test prior to operations for uranium Class III injection wells. In this regard, the EPA premised its UIC regulations on the determination that most injection wells would have a relatively short service life.[69] Based upon the NRC's regulatory experience, injection wells at ISR facilities may need to be operational throughout the term of the ISR facility license and, as such, the proposed criterion 14(e) will require a mechanical integrity test for both injection and production wells before initial use and before reuse of wells that have been serviced with equipment or procedures that could damage the well casing, and at least once every five years thereafter. Also, the UIC regulations require routine monitoring of pressure and flows to the injection wells. The purpose for this monitoring is to ensure that the formation fracture pressure is not exceeded during operations and the integrity of the wells is maintained. In the proposed criterion 14(d), the NRC would require routine monitoring of pressure and flows to ensure that the inward gradient is maintained during both ISR operations and groundwater restoration.

Finally, criterion 14(f) would ensure protection of the USDWs when establishing an ACL for a hazardous constituent after groundwater restoration. Specifically, criterion 14(f) requires compliance with the existing paragraph 5B(4) which requires that in making any determination concerning groundwater use for establishment of an ACL for a hazardous constituent under paragraph 5B(6), the NRC must consider the presence of any USDWs and exempted aquifers.

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[69] In its June 1980 final rule promulgating 40 CFR Part 146, "Underground Injection Control Program: Criteria and Standards," the EPA stated that "the periodic demonstration of mechanical integrity will apply only to the wells with longer [useful] life, i.e., salt and geothermal wells." 45 FR 42472, 42485 (June 24, 1980).

M. What agencies participated in the development of this proposed rule?

The working group involved in the preparation of this proposed rule included NRC staff and two Agreement State representatives, one each from the respective regulatory agencies of Texas and Wyoming. The OAS approved these representatives. Early drafts of this proposed rule were provided for review and comment to all Agreement States with authority for AEA section 11e.(2) byproduct material. The NRC staff also provided the EPA with an early draft of the proposed rule and otherwise kept the EPA staff informed on the development of this proposed rule consistent with the July 2020 MOU. The EPA and Agreement States will be able to provide comments during the formal comment period for this proposed rule.

IV. Section By Section Analysis

§ 40.4 Definitions

This proposed rule would revise the first sentence of the definition of *Byproduct material*.

Appendix A to 10 CFR part 40

This proposed rule would revise the definition for *Point of compliance* and add new definitions for *Aquitard, Corrective action, Excursion, In situ recovery*, *Indicator constituent*, *ISR facility, Production unit*, and *Wellfield*.

This proposed rule would revise the introductory text of criterion 5 to list the specific criteria that apply to ISR facilities.

This proposed rule would revise paragraph 5B(1) to add two subparagraphs, (a) and (b). Paragraph 5B(1)(a) would retain the original language for the secondary

groundwater protection requirements for conventional mills currently written in 5B(1). Paragraph 5B(1)(b) would add a new technical criterion that addresses the secondary groundwater protection requirements for ISR facilities.

This proposed rule would revise paragraph 5B(2) by adding a sentence at the beginning to declare that for ISR facilities, a constituent becomes a hazardous constituent subject to paragraph 5B(5) only when the constituent meets all three of the tests in paragraph 14(b)(2). The remainder of paragraph 5B(2) would remain unchanged.

This proposed rule would revise paragraph 5B(5)(b) to require the hazardous constituent concentration to be met at a point of compliance be the most recent version of EPA's MCL for a hazardous constituent, or if the constituent has no MCL, the maximum concentration value found in Table 1 of 40 CFR part 264 per criterion 5C. However, if the background level of the hazardous constituent is above the MCL or Table 1 concentration, the licensee would only be required to meet the background level.

This proposed rule would remove the criterion 5C table and add text in its place to cross reference the EPA MCLs in 40 CFR part 141 or the maximum concentration values in Table 1 of 40 CFR part 264 for those constituents not listed.

This proposed rule would add criterion 14 as a new technical criterion under a new section, "VI. Additional Technical Criteria for In-Situ Recovery (ISR) Operations," that would provide additional regulations specific to groundwater protection at ISR facilities. The requirements in the proposed criterion 14 are set out in eight specific provisions: (a) site characterization and suitability demonstration; (b) wellfield pre-operational requirements; (c) well design and construction requirements; (d) operating, monitoring, and reporting requirements; (e) mechanical integrity; (f) wellfield restoration; (g) plugging and abandonment; and (h) corrective action.

V. Regulatory Flexibility Certification

As required by the Regulatory Flexibility Act of 1980, 5 U.S.C. 605(b), the Commission certifies that this rule, if adopted, will not have a significant economic impact on a substantial number of small entities. This proposed rule concerns groundwater protection requirements for uranium ISR facilities. A majority of the companies (six of eight) that own these facilities fall within the scope of the definition of "small entities" set forth in the Regulatory Flexibility Act or the size standards established by the NRC (10 CFR 2.810). However, as described in the regulatory analysis for this proposed rule, the proposed rule's changes are expected to be financially beneficial to industry, and would result in an insignificant impact on those companies' revenues. As a result, this proposed rule would not have a significant economic impact on a substantial number of small entities.

VI. Regulatory Analysis

The NRC has prepared a draft regulatory analysis on this proposed regulation. The analysis examines the costs and benefits of the alternatives considered by the NRC. The conclusion from the analysis is that this proposed rule and associated guidance would result in a total net overall cost of ($395,394). Of that amount, the expected benefit is $15,606 to industry; and expected costs are ($101,600) to Agreement States, ($298,400) to the NRC, and ($11,000) to the EPA for their concurrence on the final rule. The NRC requests public comment on the draft regulatory analysis. The draft regulatory analysis is available as indicated in the "Availability of Documents" section of this document. Comments on the draft regulatory analysis may be submitted to the NRC as indicated under the ADDRESSES caption of this document.

VII. Backfitting and Issue Finality

The NRC has determined that the backfitting provisions in 10 CFR 50.109, 70.76, 72.62, and 76.76 and the issue finality provisions in 10 CFR part 52 do not apply to this proposed rule. The class of licensees subject to this rulemaking are applicants for a new ISR facility license or current ISR facility licensees that submit an application for a license amendment for a new wellfield within a licensed ISR facility or a new production unit within an operating wellfield of a licensed ISR facility, the application for which is submitted after the effective date of this rule. The rulemaking would also revise the MCLs for hazardous constituents in all uranium mills (conventional or ISR) to those provided in EPA regulations under 40 CFR. This class of licensees would be regulated in accordance with 10 CFR part 40. As 10 CFR part 40 contains no backfitting provisions, and these licensees are not within the scope of an NRC regulation that contains a backfitting or issue finality provision, this proposed rule is not within the scope of the NRC's backfitting and issue finality provisions.

In addition, the one substantive change proposed by the NRC in this rulemaking is to require a three-year post-restoration monitoring period, which is based on the EPA's RCRA regulation, 40 CFR 264.96. This change satisfies AEA section 84a.(3), which provides that any NRC "general requirements" concerning the management of AEA section 11e.(2) byproduct material be at least comparable to the EPA's RCRA regulations for similar hazardous material. This proposed requirement would differ from the current NRC stability monitoring standard that is set forth in ISR facility licenses. The NRC has determined that at least one-year of stability monitoring provides reasonable assurance of adequate protection and, based upon the NRC's operational experience, is protective of groundwater. As such, the NRC does not propose to apply

this change to current ISR facility licensees who do not intend to expand their facility by adding a new wellfield or production unit.

VIII. Cumulative Effects of Regulation

The NRC is following its cumulative effects of regulation (CER) process by engaging with external stakeholders throughout this proposed rule and related regulatory activities. Opportunity for public comment is provided to the public at this proposed rule stage. The NRC is issuing the draft supplemental guidance for comment along with this proposed rule to support more informed external stakeholder feedback. Further, the NRC may hold public meetings throughout the rulemaking process. Section IV, “Specific Requests for Comments," of this document describes how the public can access the draft supplemental guidance for which the NRC seeks external stakeholder feedback.

In addition to the questions on the implementation of this proposed rule presented in the “Specific Requests for Comments” section of this document, the NRC is requesting CER feedback on the following questions:

1. In light of any current or projected CER challenges, does this proposed rule's effective date provide sufficient time to implement the new alternative proposed requirements, including changes to programs, procedures, and facilities?

2. If CER challenges currently exist or are expected, what should be done to address them? For example, if more time is required for implementation of the new alternative requirements, what period of time is sufficient?

3. Do other (NRC or other agency) regulatory actions (e.g., orders, generic communications, license amendment requests, inspection findings of a generic nature) influence the implementation of this proposed rule's requirements?

4. Are there unintended consequences? Does this proposed rule create conditions that would be contrary to this proposed rule's purpose and objectives? If so, what are the unintended consequences, and how should they be addressed?

5. Please comment on the NRC's cost and benefit estimates in the draft regulatory analysis that supports this proposed rule. The draft regulatory analysis is available as indicated under the “Availability of Documents" section of this document.

IX. Plain Writing

The Plain Writing Act of 2010 (Pub. L. 111-274) requires Federal agencies to write documents in a clear, concise, and well-organized manner. The NRC has written this document to be consistent with the Plain Writing Act as well as the Presidential Memorandum, “Plain Language in Government Writing,” published June 10, 1998 (63 FR 31885). The NRC requests comment on this document with respect to the clarity and effectiveness of the language used.

X. Environmental Assessment and Proposed Finding of No Significant Environmental Impact

The Commission has preliminarily determined under the National Environmental Policy Act of 1969, as amended, and the Commission’s regulations in subpart A of 10 CFR part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions,” that this rule, if adopted, would not be a major Federal action significantly affecting the quality of the human environment, and an environmental impact statement is not required. The basis of this determination reads as follows: The proposed amendments would codify the risk-informed and best management practices

currently reflected in site-specific license conditions for groundwater protection at ISR facilities and of themselves would have no significant impact on the environment. Other amendments are administrative in nature and would have no significant impact on the environment.

The preliminary determination of this environmental assessment is that there will be no significant effect on the quality of the human environment from this action. Public stakeholders should note, however, that comments on any aspect of this environmental assessment may be submitted to the NRC as indicated under the ADDRESSES caption in this document. The environmental assessment is available as indicated under the "Availability of Documents" section of this document.

The NRC has sent a copy of the environmental assessment and this proposed rule to every State Liaison Officer and has requested comments.

XI. Paperwork Reduction Act Statement

This proposed rule contains new or amended information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq). This proposed rule has been submitted to the Office of Management and Budget (OMB) for review and approval of the information collection requirements.

Type of submission, new or revision: Revision.

The title of the information collection: Groundwater Protection at Uranium *In Situ* Recovery Facilities.

The form number if applicable: Not applicable.

How often the collection is required: For this rulemaking, most of the information collection requirements specific to ISR facilities are currently being collected under other regulations. The only new requirement involves changes to groundwater post-

restoration. Licensees perform post-restoration activities infrequently.

Who will be required or asked to report: A licensee performing post-restoration activities.

An estimate of the number of annual responses: 0.

The estimated number of annual respondents: 0.

An estimate of the total number of hours needed annually to complete the requirement or request: 83 hours (an increase of 80 hours reporting + an increase of 0 third party disclosure hours and 3 hours recordkeeping).

Abstract: The NRC regulates uranium *In situ* recovery facilities under 10 CFR part 40, "Domestic Licensing of Source Material," because of the facilities' possession and use of source material. Appendix A to 10 CFR part 40, "Criteria Relating to the Operation of Uranium Mills and the Disposition of tailings or wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for their Source Material Content," pertains primarily to technical, financial, ownership, and long-term site surveillance issues relating to the siting, operation, decontamination, decommissioning, and reclamation of conventional uranium mills and mill tailings. Portions of appendix A to 10 CFR part 40 apply to uranium ISR facilities. The purpose of the proposed rule is to codify, in a proposed new criterion 14 in appendix A to 10 CFR part 40, a set of regulatory requirements, including information collections, specifically applicable to groundwater protection at uranium *in situ* recovery facilities.

The NRC is seeking public comment on the potential impact of the information collections contained in this proposed rule and on the following issues:

1. Is the proposed information collection necessary for the proper performance of the functions of the NRC, including whether the information will have practical utility?
2. Is the estimate of burden of the proposed information collection accurate?

3. Is there a way to enhance the quality, utility, and clarity of the information to be collected?

4. How can the burden of the proposed information collection on respondents be minimized, including the use of automated collection techniques or other forms of information technology?

A copy of the OMB clearance package is available in ADAMS under Accession No. ML21067A098. You may obtain information and comment submissions related to the OMB clearance package by searching on https://www.regulations.gov under Docket ID NRC-2008-0421.

You may submit comments on any aspect of these proposed information collection(s), including suggestions for reducing the burden and on the above issues, by the following methods:

- **Federal Rulemaking Website:** Go to https://www.regulations.gov and search for Docket ID NRC-2008-0421.

- **Mail comments to:** FOIA, Library, and Information Collections Branch T6-A10M, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by email to Infocollects.Resource@nrc.gov.

- **Submit to OMB directly:** Written comments and recommendations for the proposed information collection should be sent within 60 days of publication of this document to https://www.reginfo.gov/public/do/PRAMain. Find this particular information collection by selecting “Currently Under Review - Open for Public Comments” or by using the search function.

Comments on the information collections will be publicly available in ADAMS and on Reginfo.gov. Submit comments by **[INSERT DATE 60 DAYS AFTER PUBLICATION IN THE *FEDERAL REGISTER*]**. Comments received after this date will be considered if it is practical to do so, but the NRC is able to ensure consideration only

for comments received on or before this date.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

XII. Criminal Penalties

For the purpose of section 223 of the AEA, the NRC proposes to amend 10 CFR part 40 under one or more of sections 161b, 161i, or 161o of the AEA. Willful violations of the rule would be subject to criminal enforcement.

XIII. Coordination with NRC Agreement States

The working group involved in the preparation of this proposed rule included two representatives from the OAS. Early drafts of this proposed rule were provided to Agreement States for review. Comments from Agreement States were taken into consideration during the development of this proposed rule.

XIV. Compatibility of Agreement State Regulations

Under the “Agreement State Program Policy Statement” approved by the Commission on October 2, 2017, and published in the FR on October 18, 2017

(82 FR 48535), NRC program elements (including regulations) required for adequacy and having a particular health and safety component are those that are designated as Categories A, B, C, D, NRC, and H&S; and those required for compatibility include those regulations and other legally binding requirements designated as Compatibility Categories A, B, C, and D. Compatibility Category A are those program elements that include basic radiation protection standards and scientific terms and definitions that are necessary to understand radiation protection concepts. An Agreement State should adopt Category A program elements in an identical manner in order to provide uniformity in regulating agreement material on a nationwide basis. Compatibility Category B are those program elements that apply to activities that have direct and significant effects in multiple jurisdictions. Compatibility Category B pertains to a limited number of program elements that cross jurisdictional boundaries and should be addressed to ensure uniformity of regulation on a nationwide basis. The Agreement State program element should be essentially identical to that of NRC. Compatibility Category C are those program elements that do not meet the criteria of Category A or B, but the essential objectives of which an Agreement State should adopt to avoid conflict, duplication, gaps, or other conditions that would jeopardize an orderly pattern in regulating agreement material on a national basis. An Agreement State should adopt the essential objectives of the Category C program elements. Compatibility Category D are those program elements that do not meet any of the criteria of Category A, B, or C, above, and, thus, do not need to be adopted by Agreement States for compatibility. Compatibility Category NRC are those program elements that address areas of regulation that cannot be relinquished to the Agreement States under the AEA or provisions of title 10 of the *Code of Federal Regulations*. These program elements should not be adopted by the Agreement States. Category H&S program elements are not required for compatibility;

however, they do have particular health and safety significance. The Agreement State should adopt the essential objectives of such program elements to maintain an adequate program.

The proposed rule would be a matter of compatibility between the NRC and the Agreement States, thereby providing consistency among Agreement State and NRC requirements. The compatibility categories are designated in the following table:

Compatibility Table

Section	Change	Subject	Compatibility	
			Existing	New
Part 40 Appendix A				
40.4	Revised	Definition - Byproduct material	H&S	H&S
Appendix A	New	Definition - Aquitard	---	C
Appendix A	New	Definition - Corrective action	---	C
Appendix A	New	Definition - Excursion	---	C
Appendix A	New	Definition - In situ recovery	---	B
Appendix A	New	Definition - Indicator constituent	---	C
Appendix A	New	Definition - ISR facility	---	C
Appendix A	New	Definition - Production unit	---	B
Appendix A	New	Definition - Wellfield	---	C
Appendix A	Revised	Definition - Point of compliance	A	C
Appendix A	Revised	Criterion 5 preamble paragraph	C	C
Appendix A	Revised	Paragraph 5B(1)	C	C
Appendix A	Revised	Paragraph 5B(2)	C	C
Appendix A	Revised	Paragraph 5B(5)(b)	C	C
Appendix A	Revised	Criterion 5C	C	C
Appendix A	New	Section VI, “ADDITIONAL TECHNICAL CRITERIA FOR IN-SITU RECOVERY OPERATIONS”	---	C
Appendix A	New	Criterion 14	---	C

This rule is proposed to be classified as Compatibility Category “B” or “C” for definitions. These definitions provide information that would be essential to the common understanding beyond the plain dictionary meaning and as such, a State’s program element should essentially be identical to the NRC’s program (for Category B) or adopt the essential objectives of the program (for Category C). To be included in Category B, the NRC determined that these definitions apply to activities that cross jurisdictional

boundaries and should be addressed to ensure uniformity of regulation on a nationwide basis for regulating ISR facilities. To be included in Category C, the NRC determined that these definitions are important for an Agreement State to have in order to avoid conflict, duplication, gaps, or other conditions that would jeopardize an orderly pattern in regulating agreement material on a national basis for regulating ISR facilities.

The remainder of the proposed rule is classified as Compatibility Category “C” for those States with authority to regulate uranium milling activities and Compatibility Category “D” for those States without such authority. Those States with authority to regulate uranium milling activities should adopt the essential objectives to avoid conflicts, duplications, or gaps. The way the essential objectives are addressed need not be the same as NRC, provided the essential objectives are met. For those States that do not have authority over uranium milling activities, compatibility is not required for Category D regulations.

The NRC invites comment on the compatibility category designations in the proposed rule and suggests that commenters refer to Handbook 5.9 of Management Directive 5.9 for more information. The NRC notes that, like the rule text, the compatibility category designations can change between the proposed rule and final rule, based on comments received and Commission decisions regarding the final rule. The NRC encourages anyone interested in commenting on the compatibility category designations in any manner to do so during the comment period.

XV. Voluntary Consensus Standards

The National Technology Transfer and Advancement Act of 1995 (Pub. L. 104-113) requires that Federal agencies use technical standards that are developed or

adopted by voluntary consensus standards bodies unless the use of such a standard is inconsistent with applicable law or otherwise impractical. In this proposed rule, the NRC would clarify groundwater protection requirements for ISR facilities. This action does not constitute the establishment of a standard that contains generally applicable requirements.

XVI. Availability of Guidance

The NRC is issuing draft supplemental guidance in conjunction with this proposed rule. Current guidance is provided in NUREG-1569, "Standard Review Plan for In Situ Leach Uranium Extraction License Applications." The supplemental guidance is intended for use by applicants, licensees, Agreement States, and the NRC staff and incorporates the proposed changes into an approach and method acceptable for implementing the requirements of the regulations. It includes guidance concerning an application for, and the licensing, operation, and decommissioning of, a new ISR facility, a new wellfield within a licensed ISR facility, or a new production unit within an operating wellfield of a licensed ISR facility, the application for which is submitted after the effective date of the final rule

The draft supplemental guidance is in a markup format to the NRC's existing guidance and reflects the provisions in this proposed rule. Comments on the draft supplemental guidance may be submitted by the methods provided in Section I, "Obtaining Information and Submitting Comments," of this document. The draft supplemental guidance is available as indicated under Section XVIII, "Availability of Documents," of this document. The NRC plans to incorporate the final supplemental guidance into the next comprehensive revision of NUREG-1569.

XVII. Public Meeting

The NRC plans to conduct a public meeting to explain the changes in this proposed rule and to answer questions to facilitate the development of public comments.

The NRC will publish a notice of the location, time, and agenda of the meeting on http://www.regulations.gov and on the NRC's public meeting Web site at least 10 calendar days before the meeting. Stakeholders should monitor the NRC's public meeting Web site for information about the public meeting at: http://www.nrc.gov/public-involve/public-meetings/index.cfm.

XVIII. Availability of Documents

The documents identified in the following table are available to interested persons through one or more of the following methods, as indicated.

DOCUMENT	ADAMS ACCESSION NO. / WEB LINK / *FEDERAL REGISTER* CITATION
Final rule, "Uranium Mill Tailings Licensing," August 24, 1979.	44 FR 50012
Final rule, "Water Programs; Consolidated Permit Regulations and Technical Criteria and Standards; State Underground Injection Control Programs," June 24, 1980.	45 FR 42472
Final rule, "Uranium Mill Licensing Requirements," October 3, 1980.	45 FR 65521
Final rule, "Uranium Mill Tailings Regulations; Conforming NRC Requirements to EPA Standards," October 16, 1985.	50 FR 41852
Final rule, "Uranium Mill Tailings Regulations; Ground-Water Protection and Other Issues," November 13, 1987.	52 FR 43553
SECY-99-0013, "Recommendations on Ways to Improve the Efficiency of NRC Regulations at *In Situ* Leach Uranium Recovery Facilities," March 12, 1999.	ML12265A460

SRM-SECY-99-0013, "Staff Requirements - SECY-99-0013 - Recommendations on Ways to Improve the Efficiency of NRC Regulations at *In Situ* Leach Uranium Recovery Facilities," July 26, 2000.	ML003735651
NUREG-1569, "Standard Review Plan for In Situ Leach Uranium Extraction License Applications," June 2003.	ML032250177
NUREG/CR-6733, "A Baseline Risk-Informed, Performance-Based Approach for In Situ Leach Uranium Extraction Licensees," September 2001.	ML012840152
NUREG/CR–3967, "An Analysis of Excursions at Selected In Situ Uranium Mines in Wyoming and Texas," July 1986.	ML14224A351
NRC Regulatory Issue Summary 2009-05, "Uranium Recovery Policy Regarding: (1) The Process for Scheduling Licensing Reviews of Applications for New Uranium Recovery Facilities and (2) the Restoration of Groundwater at Licensed Uranium In Situ Recovery Facilities," April 2009.	ML083510622
SECY-03-0186, "Options and Recommendations for NRC Deferring Active Regulation of Ground-water Protection at *In Situ* Leach Uranium Extraction Facilities," October 29, 2003.	ML031210874
SRM-SECY-03-0186, "Staff Requirements - SECY-03-0186 - Options and Recommendations for NRC Deferring Active Regulation of Ground-water Protection at *In Situ* Leach Uranium Extraction Facilities," November 19, 2003.	ML033230208
SECY-05-0123, "Status of the Development of Memoranda of Understanding with Nebraska and Wyoming, Regarding the Regulation of Groundwater Protection at their *In Situ* Leach Uranium Recovery Facilities," July 8, 2005.	ML051720523
SRM-COMJSM-06-0001, "Staff Requirements- COMJSM-06-0001 - Regulation of Groundwater Protection at *In-Situ* Leach Uranium Extraction Facilities," March 23, 2006.	ML060820503
COMSECY-07-0015, "Path Forward for Rulemaking on Groundwater Protection at *In Situ* Leach Uranium Extraction Facilities," April 30, 2007.	ML070930332

SRM-COMSECY-07-0015, “Staff Requirements - COMSECY-07-0015 – Path Forward for Rulemaking on Groundwater Protection at In Situ Leach Uranium Extraction Facilities,” June 8, 2007.	ML071590310
Staff Assessment of Groundwater Impacts From Previously Licensed In-Situ Uranium Recovery Facilities, July 10, 2009	ML091770402
Proposed rule, “Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings,” January 26, 2015.	80 FR 4156
Proposed rule, “Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings,” January 29, 2017.	82 FR 7400
NRC’s Staff’s Comments on EPA’s 2017 Proposed Rulemaking for 40 CFR Part 192, “U.S. Nuclear Regulatory Commission Staff’s Comments on the U.S. Environmental Protection Agency’s Proposed Rulemaking for 40 CFR Part 192, 82 FR 7400,” July 17, 2017.	ML17173A638
Proposed rule; withdrawal, “Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings,” October 30, 2018.	83 FR 54543
“Ground Water Protection at Uranium In Situ Recovery Facilities,” Request for comment, January 31, 2019.	84 FR 574
NRC/EPA MOU, “Memorandum of Understanding Between the U.S. Nuclear Regulatory Commission and the U.S. Environmental Protection Agency Concerning the Regulation of Uranium *In Situ* Recovery Activities,” July 23, 2020.	ML20218A248
SECY-19-0123, “Regulatory Options for In-Situ Recovery Facilities,” December 16, 2019.	ML19221B516
SRM-SECY-19-0123, “Staff Requirements – SECY-19-0123, Regulatory Options for In-Situ Recovery Facilities,” October 22, 2020.	ML20296A469
SECY-2021-XXXX, “Proposed Rule: Groundwater Protection at Uranium In Situ Recovery Facilities (RIN 3150-AI40; NRC-2008-0421)”, [DATE]	ML21067A117
Draft Supplemental Guidance to NUREG-1569	ML21111A368
Draft Regulatory Analysis	ML21067A118
Draft Environmental Assessment	ML21067A128

Throughout the development of this rule, the NRC may post documents related to this rule, including public comments, on the Federal rulemaking Web site at https://www.regulations.gov under Docket ID NRC-2008-0421.

List of Subjects In 10 CFR Part 40

Criminal penalties, Exports, Government contracts, Hazardous materials transportation, Hazardous waste, Nuclear energy, Nuclear materials, Penalties, Reporting and recordkeeping requirements, Source material, Uranium, Whistleblowing.

For the reasons set out in the preamble and under the authority of the Atomic Energy Act of 1954, as amended; the Energy Reorganization Act of 1974, as amended; and 5 U.S.C. 553; the NRC is proposing to adopt the following amendments to 10 CFR part 40.

PART 40-DOMESTIC LICENSING OF SOURCE MATERIAL

1. The authority citation for part 40 continues to read as follows:

Authority: Atomic Energy Act of 1954, secs. 62, 63, 64, 65, 69, 81, 83, 84, 122, 161, 181, 182, 183, 184, 186, 187, 193, 223, 234, 274, 275 (42 U.S.C. 2092, 2093, 2094, 2095, 2099, 2111, 2113, 2114, 2152, 2201, 2231, 2232, 2233, 2234, 2236, 2237, 2243, 2273, 2282, 2021, 2022); Energy Reorganization Act of 1974, secs. 201, 202, 206, 211 (42 U.S.C. 5841, 5842, 5846, 5851); Uranium Mill Tailings Radiation Control Act of 1978, sec. 104 (42 U.S.C. 7914); 44 U.S.C. 3504 note.

2. In § 40.4, revise the definition for *Byproduct material* to read as follows:

§ 40.4 Definitions.

* * * * *

Byproduct material means the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes and liquid wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by such solution extraction operations do not constitute “byproduct material” within this definition. With the exception of “byproduct material” as defined in section 11e. of the Act, other terms defined in section 11 of the Act shall have the same meaning when used in the regulations in this part.

* * * * *

3. In appendix A to 10 CFR part 40:

a. In the *Introduction* section, add the definitions for *Aquitard*, *Corrective action*, *Excursion*, *Indicator constituent*, *In situ recovery*, *ISR facility*, *Production unit*, and *Wellfield* in alphabetical order and revise the definition for *Point of compliance*;

b. In section I. TECHNICAL CRITERIA, add an introductory paragraph;

c. Revise criterion 5 introductory text and paragraphs 5B(1), 5B(2) introductory text, and 5B(5)(b);

d. Remove Table 5C-Maximum Values for Groundwater Protection and add in its place a new paragraph 5C; and

e. Add section VI, which includes a new criterion 14.

The additions and revisions read as follows:

APPENDIX A TO PART 40 - CRITERIA RELATING TO THE OPERATION OF URANIUM MILLS AND THE DISPOSITION OF TAILINGS OR WASTES PRODUCED BY THE EXTRACTION OR CONCENTRATION OF SOURCE MATERIAL FROM ORES PROCESSED PRIMARILY FOR THEIR SOURCE MATERIAL CONTENT

* * * * *

Aquitard means a confining bed and/or formation composed of rock or sediment that retards but does not prevent the flow of water to or from an adjacent aquifer. It does not readily yield water to wells or springs, but stores groundwater.

* * * * *

Corrective action means investigation and cleanup of releases into soil, groundwater, surface water, or air from human-created facilities or sources.

* * * * *

Excursion means the detection of indicator constituents that may signal the movement of fluids containing byproduct material from the production unit into surrounding groundwater.

* * * * *

Indicator constituent means a parameter, such as chloride, conductivity, total alkalinity, or other conservative solute, whose value is used to detect an excursion.

* * * * *

In situ recovery (ISR) means the process for extracting uranium from an underground uranium ore body by injecting a leaching solution (lixiviant) into an ore body and pumping the solution to a surface facility for further processing. This definition does not include stope leaching solution mining of conventional uranium mines and similar processes.

* * * * *

ISR facility means a facility licensed to conduct ISR operations and includes wellfields and other support and ancillary infrastructure.

* * * * *

Point of compliance means a site-specific location in the uppermost aquifer where the groundwater protection standard must be met and at which monitoring must be conducted. For ISR operations, the point of compliance also includes a site-specific

location below the uppermost aquifer in the production unit in the wellfield, or in aquifers adjacent to, above, or below the production unit, where the groundwater protection standard must be met.

Production unit means the part of an aquifer from which source material is extracted by ISR operations.

* * * * *

Wellfield means the area or areas of an ISR facility – whether spaced laterally or vertically – encompassing all or a portion of a production unit from which source material is to be extracted by ISR operations, and that contains injection, production, and monitoring wells, associated infrastructure and interconnected piping as determined by the applicant or licensee and approved by the NRC.

* * * * *

I. TECHNICAL CRITERIA

Applicability to ISR facility applicants and licensees. The preamble paragraph to Criterion 5, paragraphs 5B(1)(b) and 5B(2)-(6), and Criteria 5C-5D, 7, 7A, 9, 13, and 14 apply to an application for, and the licensing, operation, and decommissioning of, a new ISR facility, a new wellfield within a licensed ISR facility, or a new production unit within an operating wellfield of a licensed ISR facility, the application for which is submitted after **[DATE 30 DAYS AFTER PUBLICATION IN THE *FEDERAL REGISTER*]**.

* * * * *

Criterion 5—For conventional mills, Criterion 5A, paragraphs 5B(1)(a) and 5B(2)-(6), and Criteria 5C-5D, 7, 7A, and 13 incorporate the basic groundwater protection standards established by the U.S. Environmental Protection Agency in 40 CFR part 192, subparts D and E, which apply during operations and prior to closure. For a new ISR facility, a new wellfield within a licensed ISR facility, or a new production unit within an operating wellfield of a licensed ISR facility, the application for which is submitted after

[DATE 30 DAYS AFTER PUBLICATION IN THE *FEDERAL REGISTER*], paragraphs 5B(1)(b) and 5B(2)-(6) of Criterion 5, and Criteria 5C, 5D, 7, 7A, 13, and 14 incorporate the basic groundwater protection standards established by the U.S. Environmental Protection Agency in 40 CFR part 192, subpart D, which apply during operations and prior to closure.

* * * * *

5B(1)

(a) For conventional mills, uranium and thorium byproduct materials must be managed to conform to the following secondary groundwater protection standard: hazardous constituents entering the groundwater from a licensed site must not exceed the specified concentration limits in the uppermost aquifer beyond the point of compliance during the compliance period. Specified concentration limits are those limits established by the Commission as indicated in paragraph 5B(5) of this criterion. The Commission will also establish the point of compliance and compliance period on a site-specific basis through license conditions and orders. The objective in selecting the point of compliance is to provide the earliest practicable warning that the impoundment is releasing hazardous constituents to the groundwater. The point of compliance must be selected to provide prompt indication of groundwater contamination on the hydraulically downgradient edge of the disposal area. The Commission will identify hazardous constituents, establish concentration limits, set the compliance period, and may adjust the point of compliance if needed to accord with developed data and site information as to the flow of groundwater or contaminants, when the detection monitoring program established under Criterion 7A indicates leakage of hazardous constituents from the disposal area.

(b) For ISR facilities, uranium and thorium byproduct materials must be managed to conform to the following groundwater protection standard: hazardous constituents

entering the groundwater from a production unit in a wellfield, at the point of compliance, must not exceed the specified concentration limits established by the Commission as indicated in paragraph 5B(5) of this criterion. The Commission will also establish the point of compliance and compliance period on a site-specific basis pursuant to Criterion 14. The Commission will identify hazardous constituents, establish concentration limits, and may adjust the point of compliance if needed to accord with developed data and site information as to the flow of groundwater or contaminants, for the detection monitoring program established under criterion 7A and the additional ISR-specific monitoring requirements established under Criterion 14 to detect migration of hazardous constituents from a production unit in a wellfield.

5B(2)--For ISR facilities, a constituent becomes a hazardous constituent subject to paragraph 5B(5) of this criterion only when the constituent meets all three of the tests in paragraph 14(b)(2) of this appendix. For conventional mills, a constituent becomes a hazardous constituent subject to paragraph 5B(5) of this criterion only when the constituent meets all three of the following tests:

* * * * *

5B(5)

* * * * *

(b) The maximum contaminant level for that constituent as set forth in Criterion 5C, provided that the background level is below the value listed; or

* * * * *

5C–Maximum Contamination Levels for Groundwater Protection. The maximum contaminant levels for hazardous constituents are provided in the tables in 40 CFR 141.61(a) and (c) and 40 CFR 141.62(b), or in 40 CFR 141.66(b), (c), and (e) or, if the constituent is not listed in the table of the aforementioned regulations, the respective value given in Table 1 in 40 CFR 264.94.

* * * * *

VI. ADDITIONAL TECHNICAL CRITERIA FOR ISR OPERATIONS

Criterion 14 –The following are the groundwater protection standards for ISR facilities.

(a) Site characterization and suitability demonstration. In accordance with 10 CFR 40.31(h) and 40.32, the NRC will approve an application for a license to operate a new ISR facility, or in accordance with 10 CFR 40.45, the NRC will approve an amendment to add a new wellfield within a licensed ISR facility or a new production unit within an operating wellfield of a licensed ISR facility, if the applicant adequately demonstrates the ability of the geologic and hydrologic units to hydraulically isolate byproduct material from any aquifers immediately overlying, underlying, and adjacent to the production unit. Specifically, the applicant must provide the following:

(1) A map showing the surface location of the proposed ISR facility and associated infrastructure, including wellfields.

(2) Maps and cross sections showing the geologic and hydrologic units across the site. Maps and cross sections shall indicate the horizontal and vertical limits of aquifers and aquitards, their thickness, their position relative to the production unit, and the magnitude and direction of groundwater movement in the production unit and any aquifers immediately overlying, underlying, and adjacent to the production unit.

(3) Characterization of the local stratigraphy of the site based on field measured data (such as that obtained from cutting and core logging reports, geophysical logs, and other methods), including local geologic cross sections and fence diagrams that describe and show stratigraphic correlations.

(4) Maps and cross sections detailing the local geologic structure of the site, and a more generalized map and cross sections illustrating the local geologic characteristics such as folds, faults, strikes, and dips.

(5) Identification of all ore bodies to be targeted in the production unit.

(6) Identification, location, and detailed discussion of geologic features such as folds, faults, and fractures; all known wells (including oil and gas wells); and all surface and subsurface mines and other infrastructure associated with such mining activities, that may have an effect on the site groundwater hydrology.

(7) Description of the local and regional hydrogeologic gradient and hydrostratigraphy. For the production unit and any aquifers immediately overlying, underlying, and adjacent to the production unit, local-scale potentiometric or water surface elevation maps of these aquifers shall also be included and be sufficient to show the groundwater flow direction.

(8) The locations, depths, screened intervals, and other pertinent information on wells and borings used to characterize the site.

(9) An assessment of the groundwater quality, including radiological and nonradiological constituents present and an assessment of the hydrologic parameters, including potentiometric heads, hydraulic gradients, and water levels in the uppermost aquifer~~s~~, the production unit, and aquifers immediately overlying, underlying, and adjacent to the production unit. These assessments must include an evaluation of any seasonal and historical variability of the groundwater quality or the hydrologic parameters. These assessments must be done at least on a quarterly basis for one year immediately before filing a license application.

(10) A description of all hydrologic parameters used to determine expected operational and restoration performance, and descriptions of pumping tests used to determine parameters such as, but not limited to, hydraulic conductivity, transmissivity, and specific storage.

(11) Information on past, current, and anticipated future water use in the local area surrounding the proposed license site, including a description of local groundwater

well locations, type of use, amounts used, and screened intervals sufficient to evaluate the potential impact from ISR operations. Such information shall further include:

(i) Data reasonably available from public records or otherwise known to the applicant or licensee about all boreholes and local wells within and near the proposed wellfield, and those wells that are potentially hydraulically connected to the proposed wellfield. The locations of these wells must be shown on maps submitted under paragraph 14(a)(1) of this criterion. The data shall, at a minimum, include a description of each borehole and well type, construction, date drilled, location, depth, and record of completion, abandonment, or plugging.

(ii) Maps showing the number and location of all existing injection wells, production wells, abandoned wells, dry holes, public water systems, and water wells in and near the license area. The maps must also show surface bodies of waters, mines (surface and subsurface), quarries and other pertinent surface features such as known or suspected faults and all residential, commercial, agricultural and industrial improvements.

(12) A geological and hydrological conceptual model of the site. Any technical basis used to develop the conceptual model shall be provided.

(b) Wellfield pre-operational requirements. Pursuant to the definition of construction in 10 CFR 40.4, no wells associated with radiological operations (e.g., production, injection, or monitoring well networks associated with ISR facilities) may be installed in the wellfield prior to the NRC issuing the license. After the issuance of the license, the licensee must submit the information required in paragraphs 14(b)(1) through 14(b)(5) of this criterion to the NRC. The NRC must approve the background hazardous constituent concentration levels and the selected indicator constituents and associated upper control limits submitted in accordance with paragraphs 14(b)(3) and 14(b)(4) of this criterion and the wellfield restoration plan submitted in accordance with

paragraph 14(b)(5) of this criterion before the licensee may inject lixiviant into any injection well in the wellfield.

(1) Wellfield characterization. The licensee must provide the following:

(i) A map showing the as-built wellfield and infrastructure, including the location of the injection, production, and point of compliance wells.

(ii) Cross sections showing the geologic and hydrologic units across the wellfield. Maps and cross sections must indicate the horizontal and vertical limits of aquifers and aquitards, their ground water elevation levels, their thickness, and their position relative to the production unit in the wellfield.

(iii) A description of all hydrologic parameters used to determine expected operational and restoration performance of the wellfield, and descriptions of aquifer pumping tests used to determine parameters such as, but not limited to, hydraulic conductivity, transmissivity, and specific storage.

(iv) A demonstration of a horizontal hydraulic connection between injection and production wells within the production unit.

(v) A demonstration of a hydraulic connection between the injection and production wells and the point compliance wells in the immediately adjacent aquifer surrounding the production unit.

(vi) A demonstration of either a lack of hydraulic connection between the injection and production wells and the immediately overlying and underlying aquifers to the production unit or a method to mitigate any existing hydraulic connection to these aquifers.

(2) Identification of hazardous constituents. Pursuant to paragraph 5B(1)(b) of this appendix, the licensee must identify those radiological and nonradiological constituents that are hazardous and are reasonably expected to be present within the production unit or that may be expected to increase in concentration as a result of ISR

operations. A radiological or nonradiological constituent becomes a hazardous constituent when the constituent meets all three of the following tests:

(i) The constituent is reasonably expected to be in or derived from the byproduct material produced from ISR operations;

(ii) The constituent has been detected in the groundwater in an aquifer in the production unit; and

(iii) The constituent is listed in Criterion 13 of this appendix.

(3) Background hazardous constituent concentration levels. For each hazardous radiological and nonradiological constituent identified, the licensee must provide and submit an analysis of groundwater samples sufficient to establish the background hazardous constituent concentration levels to the NRC for approval pursuant to paragraph 5B(5)(a) of this appendix. Radiological and nonradiological constituent groundwater samples are required to be collected and analyzed to determine the background hazardous constituent concentration levels for each new wellfield, as follows:

(i) The licensee must identify the point of compliance wells in the production unit and the aquifers immediately overlying, underlying and adjacent to the production unit. The point of compliance wells must be located in the immediately overlying, underlying, and adjacent aquifers to the production unit and at least one well, which may be a production or injection well, per acre within the production unit unless otherwise approved by the NRC. The number, location, and screen interval of the point of compliance wells in the production unit and the aquifers immediately overlying, underlying and adjacent to the production unit must be shown to be sufficient to provide a representative sample of the background hazardous constituent concentration levels. The licensee must provide the number, location, and the screen interval of the point of

compliance wells and the technical justification for their selection to the NRC for approval.

(ii) The licensee must obtain groundwater samples from all point of compliance wells in the production unit and in the aquifers immediately overlying, underlying and adjacent to the production unit. The licensee must take, at a minimum of two weeks apart or at an interval approved by the NRC, at least four independent sets of groundwater samples from each point of compliance well.

(iii) For each wellfield, the licensee must use the groundwater sampling data collected pursuant to paragraph 14(b)(3)(ii) of this criterion to determine the background hazardous constituent concentration levels in the point of compliance wells in the production unit and in the aquifers immediately overlying, underlying and adjacent to the production unit using generally accepted statistical techniques. The groundwater sampling data and the proposed background concentration levels for each hazardous constituent at the point of compliance wells in the production unit and in the aquifers immediately overlying, underlying and adjacent to the production unit, and the technical justification for their selection, must be submitted for NRC approval.

(4) Indicator constituents. In order to detect the potential migration of byproduct material into groundwater surrounding the production unit in each wellfield, the licensee must select a minimum of three indicator constituents at all point of compliance wells in the aquifers immediately overlying, underlying and adjacent to the production unit and determine the numerical upper control limit for each indicator constituent. The licensee must obtain groundwater samples and analyze the indicator constituents from each point of compliance well. The licensee must take, at a minimum of two weeks apart or at an interval approved by the NRC, at least four independent sets of groundwater samples from each point of compliance well before wellfield operations begin. The licensee must use generally accepted statistical techniques to determine the upper control limits. The

proposed indicator constituents and the upper control limits for each indicator constituent must be submitted for NRC approval.

(5) Wellfield restoration plan. A wellfield restoration plan must be submitted for NRC approval. The wellfield restoration plan will be evaluated on whether it provides reasonable assurance that the NRC-approved hazardous constituent concentration limits in paragraph 5B(5)(a) or (b) of this appendix will be met after restoration in the production unit is completed. Each wellfield restoration plan must include:

(i) An estimate of the volume of and hazardous constituent concentration levels in byproduct material that will require remediation during groundwater restoration of the production unit;

(ii) A description of the method used to estimate the pore volume and the associated horizontal and vertical flare factors in the production unit;

(iii) A description of the methods to be used for wellfield restoration and a schedule for completion;

(iv) Identification of the hazardous constituents and any other groundwater constituents to be monitored, the well locations to be used as points of compliance, and sampling frequency of those point of compliance wells;

(v) For each hazardous constituent identified pursuant to paragraph 14(b)(2) of this criterion, the restoration plan must specify a targeted hazardous constituent concentration limit, expressed in terms of a numerical limit, and include an analysis or demonstration that the wellfield can be restored to meet these limits. The hazardous constituent concentration limits must be established at points of compliance that adequately represent the production unit; and

(vi) A description of the post-restoration monitoring program pursuant to Criterion 14(f) of this appendix.

(c) Well design and construction requirements. For new injection and production wells, design and construction specifications are required to ensure byproduct material does not leak into surrounding groundwater. Schematic or other appropriate drawings of the surface and subsurface construction details of such wells are required. In cases where the information would be repetitive and the wells are of similar age, type, and construction, the applicant or licensee, upon approval by the NRC, may submit data for a representative number of wells. In addition, the licensee must meet the following requirements:

(1) Injection and production wells must be cased and cemented to prevent the migration of byproduct material into or between aquifers, although the licensee may propose alternative methods to cementing for NRC approval. The casing and cement used in the construction of each newly drilled well must be designed for the life expectancy of the well. In determining and specifying casing and cementing requirements, the following factors must be considered:

(i) Depth to the injection zone;

(ii) Injection wellhead pressure;

(iii) Hole size;

(iv) Size and grade of all casing strings, including wall thickness, diameter, nominal weight, length, joint specification, and construction material;

(v) Corrosiveness of lixiviant and byproduct material;

(vi) Lithology of injection and confining units; and

(vii) Type and grade of cement.

(2) Appropriate well logs and other tests must be conducted during the drilling and construction of new injection and production wells. The well logs and tests appropriate to each well must be determined based on the intended function, depth, construction, and other characteristics of the well, availability of similar data in the area

of the drilling site and the need for additional information that may arise from time to time as the construction of the well progresses.

(3) For each wellfield, point of compliance wells must be located in the immediately overlying, underlying, and adjacent aquifers to the production unit in accordance with paragraph 14(b)(3)(i) of this criterion and constructed using standard monitoring well installation, completion, and development methods for the purpose of detecting excursions. If the wellfield operation may be affected by subsidence or catastrophic collapse, the point of compliance wells must be located so that they will not be physically affected.

(d) Operating, monitoring, and reporting requirements. During ISR operations and wellfield restoration, the licensee must manage byproduct materials so that any hazardous constituents from a production unit that migrate into groundwater in aquifers immediately overlying, underlying, and adjacent to the production unit do not exceed the hazardous constituent concentration limits approved pursuant to paragraph 5B(1)(b) of this appendix. Operating and monitoring reports are required on a regular basis to ensure that groundwater protection is adequate.

(1) Operating requirements.

(i) Injection and production wells must be operated to withdraw fluid in excess of that injected into the wellfield sufficient to ensure inward flow of groundwater into the wellfield so as to prevent migration of byproduct material outside the production unit. An inward hydraulic gradient must be maintained into the production unit at all times until post-restoration monitoring pursuant to paragraph 14(f)(1) of this criterion is initiated.

(ii) Injection between the outermost casing protecting adjacent aquifers and the well bore is prohibited.

(iii) Injection pressure at the wellhead must be calculated to ensure that the pressure in the production unit during injection does not initiate new fractures or

propagate existing fractures. In no case will wellhead injection pressure initiate fractures in confining geologic units or cause migration of byproduct material into aquifers immediately overlying, underlying and adjacent to the production unit.

(iv) Before a wellfield begins operation, the applicant or licensee must submit an operating plan for the wellfield containing the following elements:

(A) A formation testing program to obtain minimum fracture pressure and average fluid pressure in the production unit;

(B) A well development program;

(C) An injection and production well operating plan that demonstrates an inward hydraulic gradient will be established and maintained in the production unit during operations and restoration until post-restoration monitoring commences;

(D) Contingency plans to address shut-ins or well failures so as to prevent the migration of byproduct material into aquifers immediately overlying, underlying and adjacent to the production unit;

(E) The projected average and maximum daily rate and volume of lixiviant injected and production well fluid withdrawn;

(F) The projected average and maximum wellhead injection pressure;

(G) A qualitative analysis and ranges in concentrations of all lixiviant ingredients. The applicant or licensee may request that this information be characterized as proprietary information;

(H) Specifications for pipelines, wellfield header houses, and other related wellfield infrastructure to prevent byproduct material leakage to the uppermost aquifer; and

(I) Procedures to test and inspect pipelines, wellfield header houses, and other related wellfield infrastructure to detect leaks or other conditions that could lead to byproduct material leakage to the uppermost aquifer.

(2) Wellfield operation and restoration monitoring requirements. The licensee must comply with the following operational and restoration monitoring requirements in a wellfield:

(i) Continuous monitoring of injection pressure, or daily recording of injection pressure to demonstrate the injection pressure is below the maximum value for the production unit.

(ii) Continuous monitoring of injection and production well flow rates or daily recording of injection and production well flow rates or volumes to demonstrate that an inward hydraulic gradient is maintained in the production unit.

(iii) At least every 2 weeks, a sample must be taken for the approved indicator constituents in the point of compliance wells in aquifers immediately overlying, underlying and adjacent to the production unit for excursion detection.

(A) An excursion is detected if, in any point of compliance well, two or more indicator constituents exceed their upper control limits.

(B) If an excursion is detected, a second sample must be taken within 48 hours after results of the first analyses were received. If the second sample does not indicate that upper control limits were exceeded, a third sample must be taken within 48 hours after the second set of sampling data was acquired.

(C) If the second and third samples do not indicate that upper control limits are exceeded, the excursion is not confirmed. If either the second or third sample shows that the indicator constituent(s) exceed their upper control limits, an excursion is confirmed. After an excursion is confirmed, the point of compliance well must be placed in excursion status and reported pursuant to paragraph 14(d)(5)(ii) of this criterion.

(D) If an excursion is confirmed and following the 7-day report required by paragraph 14(d)(5)(ii) of this criterion:

(i) The licensee must evaluate the cause of the excursion and take action to eliminate the excursion. An excursion in aquifers immediately overlying, underlying, and adjacent to the production unit can be deemed eliminated when all excursion indicator constituents are below their respective upper control limits for three consecutive samples for the indicator constituents until the excursion is eliminated.

(ii) The licensee must submit a written report describing the excursion event, efforts taken to eliminate the excursion, and the results within 60 days of the excursion confirmation.

(iii) If the excursion is not eliminated in 60 days, corrective action must be initiated in accordance with paragraph 14(h)(1) of this criterion.

(3) Monitoring of pressure and flow rate on all injection wells on an individual well basis by wellfield manifold monitoring. Manifold pressure and flow rate monitoring may be used for wellfield operations having more than one injection well if these wells use a common manifold. Separate monitoring systems for each injection well are not required provided the applicant or licensee demonstrates that manifold monitoring is comparable to individual well monitoring.

(4) Uppermost aquifer monitoring requirements. For all surface and near surface operations having the potential to contaminate the uppermost aquifer, the applicant must describe and the licensee must establish a program, to be approved by the NRC, to detect leaks or spills of byproduct material into the uppermost aquifer. Such a program must include commitments that any leak or spill of byproduct material will be adequately evaluated to ensure that the uppermost aquifer is not impacted. If byproduct material is confirmed to have leaked into the uppermost aquifer, the licensee must take corrective action in accordance with paragraph 14(h)(3) of this criterion.

(5) Reporting requirements. Licensees must meet the following reporting requirements:

(i) Semi-annual reports of results of the effluent monitoring required by 10 CFR 40.65 must be submitted to the NRC.

(ii) When an excursion is confirmed under paragraph 14(d)(2)(ii) of this criterion, a report must be made to the NRC within 1 business day, followed by submission of a written report to the NRC within 7 calendar days from when the excursion is confirmed; and

(iii) If surface or near surface leakage or spills of byproduct material are detected in the uppermost aquifer, a report must be made to the NRC within 1 business day, followed by submission of a written report to the NRC within 7 calendar days from when the leakage is detected in the uppermost aquifer.

(e) Mechanical integrity. Demonstration of mechanical integrity of injection and production wells is required before initial use and before reuse of wells that have been serviced with equipment or procedures that could damage the well casing, and at least once every 5 years thereafter.

(1) A well is deemed to have mechanical integrity if:

(i) There is no significant leak in the casing, tubing, or packer; and

(ii) There is no significant fluid movement into an aquifer through vertical channels adjacent to the injection well bore.

(2) One of the following methods must be used to verify the absence of significant leaks under paragraph 14(e)(1)(i) of this criterion:

(i) Following an initial pressure test, monitoring of the casing annulus pressure with sufficient frequency to be representative as approved by the NRC, while maintaining an annulus pressure different from atmospheric pressure measured at the surface; or

(ii) A pressure test with liquid or gas.

(3) Tests, other than those listed in paragraph 14(e)(2) of this criterion, may be used to demonstrate mechanical integrity with the approval of the NRC.

(f) Wellfield restoration. Following completion of uranium recovery operations in a production unit in a wellfield, the licensee must restore the hazardous constituents identified under paragraph 14(b)(2) of this criterion to the approved concentration limits listed in paragraphs 5B(5)(a) or (b) of this appendix pursuant to the wellfield restoration plan described in paragraph 14(b)(5) of this criterion. If the licensee cannot practically achieve the approved concentration limit for a hazardous constituent, the licensee may propose an alternate concentration limit pursuant to paragraph 5B(5)(c) of this appendix. In its evaluation of a proposed alternate concentration limit pursuant to paragraph 5B(5)(c) of this appendix, the NRC will consider the factors specified in paragraphs 5B(4) and 5B(6) of this appendix. An application for an alternate concentration limit shall be submitted as an amendment of a license in accordance with 10 CFR 40.44.

(1) Post-restoration monitoring.

(i) Following completion of restoration in a production unit, an NRC-approved post-restoration monitoring program must be implemented at the approved point of compliance wells in the wellfield restoration plan. The post-restoration monitoring program must include quarterly sampling at each approved point of compliance well for three years to analyze whether hazardous constituents exceed their approved concentration limits pursuant to paragraph 5B(5) of this appendix. The analysis must be performed on a well-by-well basis.

(ii) Post-restoration monitoring for each production unit is deemed complete when groundwater samples, collected quarterly from point of compliance wells, show that hazardous constituent concentration levels have remained below their approved concentration limits with no statistically significant exceedance for three consecutive years.

(iii) The licensee must notify the NRC in writing within 7 days if, during the post-restoration monitoring period, the collected samples show that concentrations of any of the monitored hazardous constituents at a point of compliance well has shown a statistically significant exceedance of its approved limit. The licensee must take corrective action in accordance with paragraph 14(h)(2) of this criterion.

(2) Wellfield restoration report. Following completion of the post-restoration monitoring program for each production unit in the wellfield, the licensee must submit a restoration report for NRC approval describing the wellfield restoration activities and results, including compliance with the NRC-approved hazardous constituent concentration limits in paragraph 5B(5) of this appendix and the post-restoration monitoring data demonstrating no statistically significant exceedance of the approved concentration limits for three consecutive years.

(g) Plugging and abandonment. The methods for abandoning wells must be determined and specified to ensure that vertical movement of fluids, including byproduct material, along the borehole is prevented.

(1) Before any injection, production, or point of compliance well is plugged and abandoned, a wellfield plugging and abandonment plan must be submitted for NRC approval.

(2) Before abandoning injection, production, or point of compliance wells, or any other well associated with any corrective action taken pursuant to paragraph 14(h) of this criterion, the wells must be plugged with cement in a manner which will not allow the movement of byproduct material either into or between aquifers. The NRC may allow injection or production wells to use other plugging materials if the NRC is satisfied that such materials will prevent movement of byproduct material into or between aquifers.

(3) The plugging and abandonment plan must demonstrate adequate protection of aquifers.

(h) Corrective action. If one of the events listed in paragraphs 14(h)(1)-(3) of this criterion occurs, the licensee must take the corresponding corrective actions listed for that event as set forth in either paragraph 14(h)(1), (2), or (3) of this criterion. In addition, the NRC may impose additional requirements for construction, operation, monitoring, or reporting as necessary to address any of these events.

(1) If an excursion is not eliminated within 60 days of confirmation:

(i) The licensee must terminate injection of lixiviant into the production unit.

(ii) The licensee must conduct sampling to determine whether any hazardous constituent has exceeded their approved concentration limits at the point of compliance well with the confirmed excursion. If any hazardous constituent has exceeded its approved concentration limits, the licensee must characterize the extent of the contamination and take corrective action to the extent necessary to achieve compliance with the approved concentration limits.

(iii) The licensee must provide an increase to the financial surety for corrective action in accordance with paragraph 9(f)(4) of this appendix.

(iv) The corrective action must continue until the hazardous constituent concentration levels meet their approved concentration limits. The licensee must then provide a report for NRC approval describing the corrective action taken, the corrective action results and monitoring data that demonstrates that the hazardous constituents meet their approved concentration limits. If NRC confirms that the corrective action is completed, the additional surety requirements resulting from the excursion may be removed.

(2) If any hazardous constituent concentration level at a point of compliance well in the restored production unit shows a statistically significant exceedance of any approved hazardous constituent concentration limits during post-restoration monitoring and following the 7-day report required by paragraph 14(f)(1)(iii) of this criterion:

(i) The licensee must take corrective action to the extent necessary to achieve compliance with the approved concentration limits for all hazardous constituents.

(ii) Once corrective action is completed such that the hazardous constituent concentration levels meet their approved concentration limits, the licensee must provide a written report for NRC approval describing the corrective action taken, the corrective action results, and monitoring data that demonstrates that the hazardous constituents meet their approved concentration limits at the point of compliance wells in the production unit.

(iii) If the NRC determines that the licensee has not provided reasonable assurance that the corrective action for the exceedance was successful, the NRC may impose additional requirements for corrective action, operation, monitoring, or reporting as necessary. In addition, the NRC may require the licensee to restart the post-restoration monitoring at the affected point of compliance wells in the restored production unit by collecting quarterly samples which demonstrate no statistically significant exceedance of the approved concentration limits for any hazardous constituent for three consecutive years.

(3) If surface or near surface leakage or spills of source, lixiviant or byproduct material are detected in the uppermost aquifer and following the 7-day report required by paragraph 14(d)(5)(iii) of this criterion:

(i) The licensee must take corrective action to the extent necessary to achieve compliance with the approved concentration limits for all hazardous constituents.

(ii) The licensee must provide a written report describing the event, corrective action taken, and the corrective action results within 60 days of detection.

(iii) Once corrective action is completed and the hazardous constituent concentration levels meet their approved concentration limits, the licensee must provide a written report for the NRC approval describing the corrective actions taken and

monitoring data that demonstrates that the hazardous constituents meet their approved concentration limits.

Dated: [Month, Day], 2021.

For the Nuclear Regulatory Commission.

Annette Vietti-Cook,
Secretary of the Commission.