

## ENVIRONMENTAL PROTECTION AGENCY

### 40 CFR Part 192

[EPA-HQ-OAR-2012-0788; FRL-9958-12-OAR]

RIN 2060-AP43

### Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings

**AGENCY:** Environmental Protection Agency (EPA).

**ACTION:** Proposed rule.

**SUMMARY:** The U.S. Environmental Protection Agency (EPA) is proposing new health and environmental protection standards under the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978. The standards proposed in this action would be applicable to byproduct materials produced by uranium in-situ recovery (ISR) and would be implemented by the U.S. Nuclear Regulatory Commission (NRC) and NRC Agreement States. The EPA initially proposed new health and environmental protection standards for ISR facilities on January 26, 2015; however, the EPA has decided to re-propose the rule and seek additional public to comment on changes to the original proposal, including changes in the regulatory framework and approach, based on public comment and new information received from stakeholders.

The first standards for uranium recovery were issued by the EPA in 1983 when conventional mining and milling were the predominant methods of uranium extraction, and were last amended in 1995. Since the early 1990s, ISR has mostly replaced conventional milling. This proposed rule would strengthen the existing regulations for uranium recovery by adopting new standards addressing groundwater hazards specific to ISR facilities. As with the original proposal, the primary focus of this proposal is groundwater protection, restoration and long-term stability.

The most significant changes from the original proposal include: Removing the default 30-year long-term monitoring provision and shifting to a Resource Conservation and Recovery Act (RCRA) Subtitle C corrective action framework as a model rather than a RCRA Subtitle C landfill framework; adding specific criteria and procedures for approving termination of long-term stability monitoring; deleting gross alpha particle activity from proposed Table 1 to subpart F of 40 CFR part 192, and

allowing more flexibility for the NRC or Agreement States to determine on a site-specific basis the constituents for which concentration based standards are set. The EPA has also sought to clarify how these standards under UMTRCA complement, and do not overlap with, the requirements of the Safe Drinking Water Act (SDWA).

This action also proposes amendments to certain provisions of the existing rule to address a ruling of the Tenth Circuit Court of Appeals, to update a cross-reference to another environmental standard and to correct certain technical and typographical errors. The proposed rule has been informed by input from the NRC, the U.S. Department of Energy (DOE), states, tribes, industry, environmental groups and other stakeholders, and would promote public health and protect groundwater by reducing the potential for groundwater contamination after production has ceased, and in aquifers adjacent to ISR facilities during uranium recovery.

**DATES:** Comments must be received on or before July 18, 2017.

**ADDRESSES:** Submit your comments, identified by Docket ID No. EPA-HQ-OAR-2012-0788, by one of the following methods:

- *www.regulations.gov:* Follow the on-line instructions for submitting comments.
- *Email:* [a-and-r-docket@epa.gov](mailto:a-and-r-docket@epa.gov).
- *Fax:* (202) 566-9744.
- *Mail:* Air and Radiation Docket, Environmental Protection Agency, Mailcode: 2822T, 1200 Pennsylvania Ave. NW., Washington, DC 20460.
- *Hand Delivery:* EPA West Building, Room 3334, 1301 Constitution Ave. NW., Washington, DC 20004. Such deliveries are only accepted during the Docket's normal hours of operation; special arrangements should be made for deliveries of boxed information.

**Instructions:** Direct your comments to Docket ID No. EPA-HQ-OAR-2012-0788. The EPA's policy is that all comments received will be included in the public docket without change and may be made available online at *www.regulations.gov*, including any personal information provided, unless the comment includes information claimed to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Do not submit information that you consider to be CBI or otherwise protected through *www.regulations.gov* or *email*. The *www.regulations.gov* Web site is an "anonymous access" system, which means the EPA will not know

your identity or contact information unless you provide it in the body of your comment. If you send an email comment directly to the EPA without going through *www.regulations.gov*, your email address will be automatically captured and included as part of the comment that is placed in the public docket and made available on the Internet. If you submit an electronic comment, the EPA recommends that you include your name and other contact information in the body of your comment and with any disk or CD-ROM you submit. If the EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, the EPA may not be able to consider your comment. Electronic files should avoid the use of special characters, any form of encryption, and be free of any defects or viruses. For additional information about the EPA's public docket visit the EPA Docket Center homepage at <http://www.epa.gov/epahome/dockets.htm>.

**Docket:** All documents in the docket are listed in the *www.regulations.gov* index. Although listed in the index, some information is not publicly available, e.g., CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, will be publicly available only in hard copy. Publicly available docket materials are available either electronically in *www.regulations.gov* or in hard copy at the Office of Air and Radiation Docket, EPA/DC, EPA West, Room 3334, 1301 Constitution Ave. NW., Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566-1744, and the telephone number for the Air and Radiation Docket is (202) 566-1742.

**FOR FURTHER INFORMATION CONTACT:** Ingrid Rosencrantz, Office of Radiation and Indoor Air, Radiation Protection Division, Mailcode 6608T, U.S. Environmental Protection Agency, 1200 Pennsylvania Ave. NW., Washington, DC 20460; telephone number: (202) 343-9286; fax number: (202) 343-2304; email address: [Rosencrantz.ingrid@epa.gov](mailto:Rosencrantz.ingrid@epa.gov).

#### SUPPLEMENTARY INFORMATION:

##### A. Does this action apply to me?

The regulated categories and entities potentially affected by the proposed standards include:

Category	NAICS code <sup>1</sup>	Examples of regulated entities
Industry: Uranium Ores Mining and/or Beneficiating.	212291	Facilities that extract or concentrate uranium from any ore processed primarily for its source material content.
Leaching of Uranium, Radium or Vanadium Ores.	212291	Facilities that extract or concentrate uranium from any ore processed primarily for its source material content.

<sup>1</sup> North American Industry Classification System.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be affected by this proposed action.

### B. What should I consider as I prepare my comments to EPA?

**Submitting CBI.** Do not submit CBI information to the EPA through [www.regulations.gov](http://www.regulations.gov) or email. Clearly mark the part or all of the information that you claim to be CBI. For CBI information contained on a disk or CD ROM that you mail to the EPA, mark the outside of the disk or CD ROM as CBI and then identify electronically within the disk or CD ROM the specific information that is claimed as CBI. In addition to one complete version of the comment that includes information claimed as CBI, a copy of the comment that does not contain the information claimed as CBI must be submitted for inclusion in the public docket. Information marked as CBI will not be disclosed except in accordance with procedures set forth in 40 CFR part 2.

**Tips for preparing your comments.** When submitting comments, remember to:

- Identify the rulemaking by docket number and other identifying information (subject heading, **Federal Register** date and page number).
- Follow directions—The agency may ask you to respond to specific questions or organize comments by referencing a Code of Federal Regulations (CFR) part or section number.
- Explain why you agree or disagree, suggest alternatives, and substitute language for your requested changes.
- Describe any assumptions and provide any technical information and/or data that you used.
- If you estimate potential costs or burdens, explain how you arrived at your estimate in sufficient detail to allow for it to be reproduced.
- Provide specific examples to illustrate your concerns, and suggest alternatives.
- Explain your views as clearly as possible, avoiding the use of profanity or personal threats.
- Submit your comments by the comment period deadline.

### C. When would a public hearing occur?

If anyone contacts the EPA requesting to speak at a public hearing concerning this proposed rule by February 21, 2017, the EPA will hold a public hearing. If you are interested in attending a public hearing, contact Mr. Anthony Nesky at (202) 343-9597. If a public hearing is held, the Agency will announce the date, time and venue on the EPA Web site at <http://www.epa.gov/radiation/tenorm/40CFR192.html>.

### D. What documents are referenced in today's proposal?

The EPA refers to a number of documents that provide supporting information for the Agency's proposed uranium and thorium mill tailings standards. All documents relied upon by the EPA in regulatory decision making may be found in the EPA docket (EPA-HQ-OAR-2012-0788) accessible via <http://www.regulations.gov/>. Other documents (e.g., statutes, regulations, and proposed rules) are readily available from public sources. The EPA documents listed below are referenced most frequently in today's proposal.

EPA 402/D-14-001, "Considerations Related to Post Closure Monitoring of Uranium In-Situ Leach/In-Situ Recovery (ISL/ISR) Sites," EPA, 2014.

EPA 402/R-14-003, "Economic Analysis: Proposed Revisions to the Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings Rule (40 CFR part 192)," EPA, 2016.

EPA 530/R-09-007, "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities—Unified Guidance," EPA, 2009.

### E. Preamble Abbreviations

The following abbreviations are used in this preamble:

ACL Alternate concentration limit  
 AEA Atomic Energy Act  
 BID Background information document  
 CFR Code of Federal Regulations  
 COOs Civilian owners and operators  
 DOE Department of Energy  
 EPA U.S. Environmental Protection Agency  
 FR Federal Register  
 ISR In-situ recovery, also known as in-situ leaching (ISL)  
 MCL Maximum contaminant level  
 NRC U.S. Nuclear Regulatory Commission

NUREG U.S. Nuclear Regulatory Commission Guides  
 OMB Office of Management and Budget  
 RAC Radiation Advisory Committee  
 RCRA Resource Conservation and Recovery Act  
 RFA Regulatory Flexibility Act  
 SAB Science Advisory Board  
 SDWA Safe Drinking Water Act  
 UCL Upper control limit  
 UIC Underground injection control  
 U.S. United States  
 UMRA Unfunded Mandates Reform Act of 1995  
 UMTRCA Uranium Mill Tailings Radiation Control Act of 1978  
 U.S.C. United States Code  
 USDW Underground source of drinking water

### F. Organization of This Document

The information presented in this preamble is organized as follows:

- I. Executive Summary
  - A. Background
  - B. Purpose of the Regulatory Action
  - C. Summary of the Major Provisions
  - D. Summary of the Costs and Benefits
  - E. Statutory Authority for This Action
- II. Summary of the Proposed Rule
  - A. Proposed Standards for Uranium ISR Operations
  - B. Amendments to 40 CFR Part 192, Subparts C and D
- III. Summary of Changes Made to the Original Proposal and Rationale for Those Changes
  - A. Incorporation of the Initial and Long-Term Stability Standards in Proposed 40 CFR 192.52
  - B. Groundwater Protection Standards
  - C. Preoperational Monitoring Requirements
  - D. Exempted Aquifers
  - E. Excursions
  - F. Initial and Long-Term Stability
  - G. Corrective Action Program
  - H. Costs and Economic Impacts
  - I. Other Miscellaneous Changes
- IV. Responses to Other Significant Comments That Did Not Result in Changes to the Original Proposal
  - A. Authority To Set and Enforce Standards
  - B. Need for New Standards for Uranium ISR Facilities
  - C. Applicability
  - D. The 95 Percent Confidence Level
- V. Summary of Environmental, Cost and Economic Impacts
  - A. Environmental Impacts of the Proposed Rule on Groundwater Quality
  - B. Incremental Costs of Complying With the Proposed Rule
  - C. Economic Impacts of the Proposed Rule on the Market for Uranium and the Uranium Industry

- D. Benefits of the Proposed Rule
- VI. Statutory and Executive Order Reviews
  - A. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review
  - B. Paperwork Reduction Act
  - C. Regulatory Flexibility Act
  - D. Unfunded Mandates Reform Act
  - E. Executive Order 13132: Federalism
  - F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments
  - G. Executive Order 13045: Protection of Children From Environmental Health and Safety Risks
  - H. Executive Order 13211: Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution or Use
  - I. National Technology Transfer Advancement Act
  - J. Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

## I. Executive Summary

### A. Background

ISR is a method by which uranium is leached from underground ore bodies by the introduction of a solvent solution, called a lixiviant, through injection wells drilled into the ore zone. The process does not require excavation to extract the ore body from the ground or conventional milling to extract the uranium from the mined ore. After the lixiviant is injected underground, it passes through the ore zone and mobilizes the uranium. The uranium-bearing solution is then pumped to the surface via extraction wells, and the solution is processed to extract the uranium. During uranium production, the fluids injected to mobilize uranium change the chemistry of the aquifer from its original state, thereby mobilizing uranium and many other minerals and metals. Groundwater from the ISR production zone can migrate from the production zone and contaminate nearby groundwater with arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, nitrate, molybdenum, radium and uranium and other constituents. The standards proposed in this action would minimize the risk of undetected groundwater degradation and constituent migration during and after ISR operations have ceased.

The EPA initially proposed new health and environmental protection standards for ISR facilities on January 26, 2015 (hereinafter “original proposal”), with the intention of finalizing the new standards in 2016.<sup>1</sup> During the public comment period, the

Agency received over 5,380 public comment letters from a wide range of stakeholders, with comments covering more than 80 different topics. In addition, during interagency review, more than 15 groups of stakeholders met with Office of Management and Budget (OMB) to voice comments on the original proposal. Commenters were particularly concerned about the default 30-year long-term monitoring requirement, felt that the optional method by which a licensee could request permission to cease long-term stability monitoring lacked sufficient specificity and believed the number of constituents required to be monitored was unreasonably burdensome. Several commenters thought the economic analysis underestimated the compliance costs and identified several additional categories of costs related to the long-term monitoring requirements they felt had been omitted from the analysis or were not representative of the actual costs incurred. Other commenters felt that several additional types of benefits should be included in the benefits analysis. After consulting with the NRC and other agencies and collecting additional information from industry, including participation in stakeholder meetings during interagency review with OMB, the EPA decided to make several changes to the original proposal and solicit additional public comment rather than finalize the rule with the changes. These changes are described in detail in section III of this preamble. The most significant changes include removing the default 30-year long-term monitoring provision and shifting to more of a RCRA Subtitle C corrective action framework as a model rather than a RCRA Subtitle C landfill framework, adding specific criteria and procedures for approving termination of long-term stability monitoring, deleting gross alpha particle activity from proposed Table 1 to subpart F, and allowing more flexibility for the NRC and Agreement States (hereinafter “regulatory agency”) to determine on a site-specific basis the constituents for which concentration-based standards are set. The EPA has also sought to clarify how these standards under UMTRCA complement, and do not overlap with, the requirements of the SDWA. In addition to these more significant changes, the EPA has also made minor changes to the original proposal, such as moving the initial and long-term monitoring standards to the proposed § 192.52 and moving the requirements for alternate concentration limits (ACLs) to a separate section (*see* proposed § 192.54). In addition to making changes to the

rule text, the EPA also re-calculated the incremental compliance costs to incorporate estimated non-monitoring costs (*e.g.*, licensing, leasing fees, continued surety, maintenance) and incorporated additional cost information provided by industry. The EPA re-evaluated the economic and energy impacts to both address the concerns raised by commenters and to incorporate the changes the Agency made to the standards since the original proposal was published. The revised costs and economic analysis for this proposal are discussed in section V of this preamble. While the majority of the changes to the original proposal are relatively minor, the EPA decided it was appropriate to re-propose the rule due to the high level of public interest in this rulemaking. This action provides the public an opportunity to review and provide comment on the changes made to the original proposal and allows the EPA to consider and make any additional changes based on those comments before finalizing the rule. The EPA is requesting comment on all aspects of this proposed action. Because this is a re-proposal, and the EPA wishes to consider comments in context, please re-submit any relevant comments that may have been submitted on the original proposal.

Several commenters also voiced concerns about information and data collection, including review of Agreement State regulatory programs that address ISRs. Although the EPA requested and collected data and information as outlined in section IV.B of this preamble, the Agency understands stakeholders concerns and are inviting stakeholders to submit additional data and analyses to further clarify the ISR process, including any additional monitoring results and analyses. The EPA will be collecting additional information on state regulatory programs, as recommended by several states.

### B. Purpose of the Regulatory Action

The EPA is proposing to add new health and environmental protection standards to regulations promulgated under UMTRCA. The proposed standards would regulate byproduct materials produced by ISR, including both surface and groundwater standards, with a primary focus on groundwater protection, restoration and stability. By explicitly addressing the most significant environmental and public health hazards presented by ISR activities, these proposed standards would address the shift toward ISR as the dominant form of uranium recovery that has occurred since the standards for

<sup>1</sup> See 80 FR 4156, January 26, 2015.

uranium and thorium mill tailings were promulgated in 1983.

This rule would provide the necessary framework for consistent and sustainable protection of groundwater at ISR sites that will continue to have beneficial uses even if the aquifer has been exempted from protection under the SDWA.

Groundwater is a scarce resource that is under increasing pressure, particularly in the arid West where groundwater has multiple uses, including for livestock production, crop irrigation, wildlife support, and human consumption. As groundwater resources are depleted, it becomes even more important to preserve those resources for future uses. Stakeholders in these areas are already finding a need to use groundwater that is of lower quality than desired.<sup>2</sup> Groundwater that contains mineral resources, such as uranium, is not necessarily of such poor quality that it cannot be used for these purposes. By altering the chemical composition of groundwater, ISR creates reasons to be concerned about impacts to groundwater, which may be used for human drinking water, as well as for other purposes, such as livestock watering, crop irrigation and wildlife support.

While an aquifer or portions of an aquifer may have been exempted from the protections of the SDWA, the aquifer may be needed in the future for human drinking water or other purposes. The standards proposed in this action do not require licensees to improve groundwater quality, only to provide confidence that: (1) In the area mined, the applicable constituent concentration standards (set at either background or health-based levels, whichever is higher), are met and remain stable; and (2) that uranium recovery operations will not endanger adjacent aquifers. EPA requests comment on whether groundwater, once it meets the constituent concentration standards, could or would potentially be used for drinking water or other purposes.

UMTRCA directs the EPA to establish standards of general application, while the NRC is vested with implementing the EPA's standards under its licensing and enforcement authority. The EPA has previously promulgated general standards under UMTRCA for surface disposal of mill tailings from

conventional uranium mining and milling, but ISR has become the dominant form of uranium extraction since the 1990s. In 2006, an NRC commissioner observed that ISR-specific rules were needed to provide a national approach to bring predictability to the industry and state regulators. This view was not predicated on specific documented instances of groundwater contamination outside of the ISR production zone. The scope and level of protection of the SDWA differs from the UMTRCA. The purpose of the SDWA UIC program is to prevent endangerment of underground sources of drinking water. In determining whether an aquifer may be exempted from the protection of the SDWA, the EPA does not consider its use for purposes other than human drinking water (e.g. agriculture and other uses).

As the highlighted portions of the SDWA regulations below show, there is no requirement to demonstrate poor water quality prior to issuing an aquifer exemption if the aquifer is or could be mineral producing. Under the SDWA's UIC regulations, aquifer exemptions are used to allow for mineral recovery in aquifers that would otherwise be protected as sources of drinking water when certain criteria are met. In the SDWA regulations, § 146.4 provides that: "An aquifer or a portion thereof which meets the criteria for an "underground source of drinking water" in § 146.3 may be determined under § 144.7 of this chapter to be an "exempted aquifer" for Class I–V wells if it meets the criteria in paragraphs (a) through (c) of this section. Class VI wells must meet the criteria under paragraph (d) of this section: (a) It does not currently serve as a source of drinking water; and (b) It cannot now and will not in the future serve as a source of drinking water because: (1) It is mineral, hydrocarbon or geothermal energy producing, or can be demonstrated by a permit applicant as part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible; or (2) It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical; or (3) It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or (4) It is located over a Class III well mining area subject to subsidence or catastrophic collapse; or (5) The total dissolved solids content of the ground water is more than 3,000

and less than 10,000 mg/l and it is not reasonably expected to supply a public water system . . . ."

In addition, although a portion of an aquifer may be exempted from the protections of the SDWA, there are no federal requirements preventing recovery and use of the water within exempted aquifers (including where ISR operations were previously conducted) for private drinking water supply, public water supply, or other uses.

UMTRCA provides authority that can be used to protect aquifers during and after uranium recovery operations, regardless of whether the aquifer meets the definition of an underground source of drinking water (USDW) as defined in the EPA's UIC regulations or is exempted from the protections of the SDWA because it meets the existing regulatory criteria for exemption. UMTRCA directs the Administrator to promulgate "standards of general application for the protection of public health, safety, and the environment from radiological and non-radiological hazards associated with the processing, and possession, transfer, and disposal of byproduct material".<sup>3</sup> The statute further provides that "[i]n establishing such standards, the Administrator shall consider the risk to the public health, safety, and the environment, the economic costs of applying such standards, and such other factors as the administrator determines to be appropriate".<sup>4</sup>

In areas being mined for uranium, the SDWA does not require operators or regulators to collect the level of data needed to definitively confirm or disprove drinking water contamination or contamination of water for other purposes that may also impact humans, such as livestock watering and crop irrigation. Additionally, data that the EPA's UIC Program have received and evaluated at or near at least one ISR facility are consistent with an excursion beyond the boundary of the exempt aquifer (i.e., leading to elevated uranium levels outside the ISR facility area).

The proposed 40 CFR part 192, subpart F would afford protections that do not currently exist under federal UIC regulations and would be complementary to existing regulations (e.g., UIC regulations) at uranium ISR facilities. For example, these new provisions proposed under the authority of UMTRCA would address corrective action, broad baseline development, monitoring well placement and aquifer restoration. The proposed provisions would also provide assurance that once

<sup>2</sup> Application for Amendment of USNRC Source Materials License SUA-1601, Ross ISR Project, Kendrick Expansion Area, Crook County, Wyoming Docket #40-9091, 2015, pp. 3-100; USGS National Brackish Groundwater Information Sheet 2013; Advanced Treatment for Groundwater, Treating Low Quality Groundwater for Municipal Use, Water Engineering and Management, Nov. 2001.

<sup>3</sup> See 42 U.S.C. 2022(b)(1).

<sup>4</sup> *Ibid.*

a facility decommissions a site, the water will meet the applicable constituent concentration standards in 40 CFR 192.52(c)(1) and will remain stable over time.

The proposed 40 CFR part 192, subpart F also would ensure that industry maintains responsibility for protection of public health and the environment at uranium ISR facilities during and after uranium recovery operations.

Since ISR alters the chemical composition of groundwater, it creates reasons to be concerned about risk to public health, safety and the environment from radiological and non-radiological hazards associated with the processing and disposal of byproduct material. Industry commenters and others say that there is no need for this rule because the EPA has not identified an instance in which an ISR operation has contaminated a source of drinking water. First, the Agency notes that this proposal addresses groundwater protection at ISR facilities both in and around the production zone and in surrounding aquifers. Focusing on the area of surrounding or adjacent aquifers, the EPA acknowledges that the Agency does not have sufficient information to document a specific instance of contamination of a public source of drinking water caused by an ISR. The Agency remains concerned, however, that the available data may not be capturing some instances of contamination that this proposed rule seeks to prevent. In other words, the Agency remains concerned that the lack of data does not demonstrate that no contamination is occurring, as industry commenters assert, but instead merely demonstrates the lack of data available to be able to make such a determination, especially where there has been limited post-restoration monitoring. The monitoring requirements in this proposal address the issue of lack of data.

As explained in this preamble, in documents supporting this proposal, and as included in the docket for this proposal, there is ample evidence of excursions occurring as the result of ISR facilities. For example, data that the EPA's UIC Program have received and evaluated at or near at least one ISR facility are consistent with an excursion beyond the boundary of the exempt aquifer, leading to elevated uranium levels outside the ISR facility. In addition, there is data in the proposal's Background Information Document (BID) describing numerous excursions from several ISR facilities. Moreover, data in attachment 5 of the BID shows that several ISR facilities have not met

background or health-based levels after restoration of the production zone. This data, when considered with the understanding that groundwater flow is often extremely slow, raises concerns that there has been insufficient monitoring conducted by these ISR facilities to identify the actual contamination that may be occurring or may occur in the future beyond the production zone and in sources of drinking water. The EPA solicits comment on industry's assertion that in no case have any excursions from ISR facilities resulted in contamination in aquifers being used as public sources of drinking water or for other uses. In addition, the EPA also requests comment on the kinds of data that would be needed to clearly link ISR operations with off-site contamination or that would support claims that there is no contamination of concern.

The EPA notes that several NRC-regulated ISR facilities are continuing to work toward restoring groundwater, with restoration and monitoring being conducted for as long as 10 years after ceasing production. The Agency understands that restoration does not always meet original background levels as evidenced by the number of restoration goals exceeding background or the levels proposed in Table 1 to subpart F. Additionally, the NRC acknowledges that efficiency could be gained by codifying its longstanding effective regulatory regime into regulations specific to ISR facilities. Historically, restoration and monitoring at ISR facilities are typically conducted for only a short period, and a longer period would provide more confidence to demonstrate that restoration of the affected groundwater is complete and that long-term stability is established with confidence before license termination. The initial and long-term stability monitoring and corrective action program included in this proposal would ensure that both of these requirements are met before ISR facilities can be decommissioned.

At ISR facilities, the groundwater is directly impacted by the injection of lixiviant into the aquifer, which alters the geochemistry of the ore-bearing formation and increases the concentration of radionuclides and other metals in the water. Restoration activities attempt to restore the water quality for specific constituents to the applicable constituent concentration standards inside the production zone. Although subpart D to 40 CFR part 192 (hereinafter "subpart D") addresses contamination of aquifers, it explicitly addresses only contamination resulting from releases from uranium mill tailings

impoundments used to store uranium byproduct material (e.g., conventional tailings impoundments, evaporation or holding ponds). Under the proposed subpart F, the licensee is required to restore groundwater in the production zone and surrounding aquifers to the applicable constituent concentration standards, to the extent possible, and to show some level of stability in the production zone prior to terminating the license. Because ISR changes the geochemistry of the groundwater, more rigorous stability-based standards together with corrective action programs are necessary to ensure that the production zone is restored and the applicable constituent concentration standards will continue to be met in the future.

As described in the preamble to the 2015 proposal, the EPA solicited technical advice on key issues related to groundwater protection at ISR sites from the Radiation Advisory Committee (RAC) of the Agency's Science Advisory Board (SAB) (80 FR 156). The final report of the SAB/RAC, along with the EPA's response, can be found at: <https://yosemite.epa.gov/sab/sabproduct.nsf/c91996cd39a82f648525742400690127/0314cef928df63cc8525775200482fa3!OpenDocument&TableRow=2.4#2>.

The SAB/RAC further considered this issue in 2015, and the Agency provided a detailed cross-walk to the 2015 proposed rule to show how the RAC's advice had been addressed. The SAB determined that no further action was needed on its part. See [https://yosemite.epa.gov/sab/sabproduct.nsf/02ad90b136fc21ef85256eba00436459/8DA59AB1BE0EA14B85257E660071F2EF/\\$File/EPA-SAB-15-009+unsigned.pdf](https://yosemite.epa.gov/sab/sabproduct.nsf/02ad90b136fc21ef85256eba00436459/8DA59AB1BE0EA14B85257E660071F2EF/$File/EPA-SAB-15-009+unsigned.pdf). In general, the BID addresses topics specifically addressed by the RAC as follows:

The EPA has evaluated available data for all phases of ISR activities to address the SAB recommendations. Section 5 of the BID analyzes data and examines specific case studies for baseline and restoration, with particular attention given to establishment of baseline at the Dewey-Burdock site in South Dakota (Attachment A). Sections 6 and 7.8 and Attachment F provide extensive analysis of post-restoration monitoring at the Crow Butte, Christensen, Highland, and Irigaray ISR sites, including regression analysis and statistical testing, and cumulative complementary distribution functions (CCDF). Results are presented by analyte, mine unit, and well.

Section 6 addresses in detail SAB recommendations related to influences on groundwater chemistry and their effects on time frames for stability

monitoring, in particular fate and transport processes (speciation, including a case study of the Crow Butte facility, and solubility) and natural attenuation processes (adsorption, presence of secondary minerals, and biological mechanisms).

This action also proposes amendments to certain provisions in the current rule, located at 40 CFR part 192. Specifically, this action addresses a ruling of the Tenth Circuit Court of Appeals, updates a cross-reference to another environmental standard and corrects other technical and typographical errors.

### C. Summary of the Major Provisions

The proposed rule includes a new subpart, subpart F, within 40 CFR part 192, which sets standards to protect groundwater at uranium ISR operations. Specifically, subpart F would set standards of general application to protect groundwater beyond the production zone during ISR operational and restoration phases and to ensure, once the wellfield is restored, that the restoration is complete and stable. The proposed rule includes three types of groundwater protection standards: (1) Constituent concentration standards, (2) initial stability standards, and (3) long-term stability standards. The proposed rule also includes monitoring requirements to establish statistically valid background water quality levels, excursion monitoring (for the operational and restoration phases), and monitoring to meet the initial and long-term stability standards. The proposed rule also includes a requirement to establish a corrective action program. Once finalized, these standards will be implemented by the regulatory agency. Once the regulatory agency incorporates the new standards into its regulations, or takes other appropriate steps to implement the new standards, this will provide a nationally consistent approach for the licensing process for ISR facilities.<sup>5</sup>

### D. Summary of the Costs and Benefits

The costs and benefits of this rulemaking are described briefly in Table 2 of this preamble. The costs reflect the difference in costs that would be incurred by ISR licensees under the

proposed rule and costs that would be incurred by those facilities in the absence of the proposed rule. These incremental costs include added costs associated with monitoring and non-monitoring compliance actions under the proposed rule. For additional details on the incremental costs of the proposed rule, see section V.B of this preamble and section 3 of the document titled, "Economic Analysis: Revisions to the Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings Rule (40 CFR part 192)," available in Docket ID No. EPA-HQ-OAR-2012-0788.

Complying with the proposed standards may require some existing ISR facilities to monitor groundwater for additional constituents that they are not currently monitoring. It would also require all ISR facilities to continue monitoring for a period of at least three years after the initial stability standard is met, and to conduct geochemical modeling and other analysis to demonstrate that the applicable constituent concentration standards will continue to be met in the future. The additional monitoring, modeling and analysis that would be required under this proposed rule could increase costs to ISR facilities. The additional years during which ISR facilities' license, surety, insurance, maintenance and other non-monitoring activities would have to be maintained would also increase costs. The EPA estimates the rule imposes annualized incremental costs on the ISR industry of approximately \$11.9 million, including incremental monitoring costs and other non-monitoring costs.

In its economic analysis, the EPA analyzed potential economic impacts of the rule on small entities (7 companies) using a range of assumptions about revenues of firms that own ISR facilities and costs of complying with the rule. The "average revenue" assumption is based on a market price of \$55 per pound of U3O8e and production that is 25% of facility capacity. The "low revenue" assumption reflects revenues 10% lower, and the high revenue assumption reflects revenues that would be 20% higher. With average costs, cost-to-sales ratios for small firms range from 0.7% to 3.1% for the low revenue scenario and from 0.5% to 2.3% under the higher revenue scenario. These assumptions are intended to reflect the range of possible market conditions at the time when the rule would take effect (likely 2022 to 2025). Uranium market projections for the longer term are generally optimistic, reflecting growth in nuclear power in China and India and other countries; 57 new reactors are

currently under construction with 65% of those projected to come online by 2020, and world-wide electricity consumption is projected to increase by 50% between 2013 and 2035 (only part of the increase is estimated to be met by nuclear energy) (Cameco, 2016). Outlook for the near term, however, is less positive, and the rate of recovery is uncertain.

The EPA acknowledges that current uranium market conditions reflect depressed demand for uranium (due to lingering effects of the Fukushima incident, slow recovery of demand for electricity since the recession and low prices of substitute sources of energy) and some reliance on alternative (non-mine) sources of uranium. As a result, both the price and production of uranium have fallen. The long-term contract price of uranium has declined from around \$60 per pound of U3O8e in 2012 to around \$40 per pound in 2016. Spot prices have generally been 20% lower than contract prices. While market forces have driven the market price for uranium down by \$20 to \$30 dollars over the past 5 years, the rule is estimated to increase the cost of producing uranium using ISR methods by between \$1.27 per pound U3O8e and \$2.45 per pound of U3O8e, depending on the cost scenario.

Because of these market conditions, several ISR facilities that are fully licensed and permitted are not currently producing uranium (including previously operational facilities that have been placed on standby and licensed and permitted facilities that have never gone into production), and development of new ISR facilities has largely been put on hold. Further, several ISR facilities have changed ownership in the past few years, as companies have been forced by market conditions to sell assets. In other words, some ISR firms currently are unable to profitably operate their facilities even in the absence of the rule. Several of the small firms report little or no revenue from sales of uranium. Even the relatively small incremental costs required to comply with the rule's provisions would not currently be affordable for such firms. This is not due to the magnitude of the rule's costs; it is due to current conditions in the world's economy generally and in the market for uranium in particular. The EPA considers that when the market for uranium recovers, as it is projected to do, ISR uranium production and price will increase; under those conditions, facilities that are currently unprofitable without the rule would likely be profitable with the rule's costs included. However, the EPA solicits public

<sup>5</sup> Currently, the process used by the NRC for licensing ISR facilities is based on a combination of NRC regulations, site-specific license conditions, and guidance. The process used by the Agreement States is based on regulations that vary by state for Agreement States that regulate ISR facilities. The NRC and many of the Agreement States have an established hearing process that allows for interested parties to request a hearing on the merits for the issuance and amendment of ISR facility licenses.

comment on this rule's expected impact on the domestic ISR industry.

The EPA compared these costs to the potential financial, ecological and human health benefits that would result from the proposed rule. Although the EPA is unable to quantify all the potential benefits, the EPA has identified several categories of benefits that can be attributable to the rule. The proposed rule would require groundwater at ISR facilities to be restored to the constituent concentration standards. Licensees would have to demonstrate stability of groundwater at those constituent concentration standards by completing at least 6 years of monitoring (3 years to meet the initial stability standards plus 3 years to meet the long-term stability standards), and conduct modeling and analysis to demonstrate there is a reasonable assurance that the applicable constituent concentration standards will continue to be met in the future. This provision would minimize the risk of degradation of valuable groundwater resources and the potential exposure of human, domestic livestock or ecological receptors to radiological or other

constituents. The proposed rule would also minimize the potential contamination of surface water and potential adverse health impacts resulting from such contamination. In addition, the proposed rule would avoid the potential costs associated with remediating contaminated aquifers; the cost of remediating a single plume of contamination could exceed the nationwide incremental costs associated with the proposed rule. The EPA estimated the cost savings due to avoided pump and treat remediation for hypothetical contaminant migration examples using the Conceptual Mine Unit, under three plume scenarios. For each scenario, the EPA computed the estimated cost savings by computing the difference in the cost of remediating a large plume (which might result if the plume were not detected for many years) and the cost of remediating a small plume discovered through monitoring prior to facility closure. The total estimated avoided costs over the entire remediation episode in this illustration, remediating three different sized plumes, ranged from \$23.7 million to \$608 million, depending on the

scenario. Annualized, these avoided costs range from \$1.5 million to \$11.1 million per year. To reflect the recognition that the proposed rule would reduce the likelihood of contamination relative to existing regulatory requirements, but not eliminate it entirely, the EPA further assumed a range of probability that the illustrative example contamination episode would be prevented by the proposed rule, but not identified under current requirements. The EPA assumed that the likelihood that the proposed rule would prevent the contamination, but current requirements would not, would range from 20% to 80%. Thus, the values shown in the table are 20% of the lower bound value (\$0.3 million) to 80% of the upper bound value (\$8.9 million). However, because the EPA is unable to quantify the number or characteristics of contamination episodes that could occur in the absence of the proposed rule, the EPA is unable to estimate nationwide cost savings. Thus, the EPA has not compared these illustrative costs savings with the estimated national costs of the proposed rule or computed the net benefits.

TABLE 2—CHARACTERIZATION OF THE COSTS AND BENEFITS OF 40 CFR PART 192, SUBPART F

Incremental costs (2015 dollars)	Benefits
Annualized costs of monitoring, modeling and analysis ranging from \$0.2 to \$7.3 million. Annual non-monitoring costs, including license, surety, lease, maintenance: \$7.6 million.	Protection of groundwater quality.  Possible protection of surface water quality.  Potentially reduced risk of exposure of human or ecological receptors to radiological pollutants. Potentially reduced human health impacts, including cancer. Annualized avoided cost of single remediation effort would be between \$0.3 million and \$8.9 million. <sup>1</sup>

<sup>1</sup> The costs presented are not an estimate of the nationwide remediation cost savings. They are the estimated cost of remediation for a simplified example of a single wellfield, for three contaminant plume scenarios.

#### E. Statutory Authority for This Action

The EPA is proposing the new standards and amendments under its authority in section 275 of the Atomic Energy Act (AEA), as added by section 206 of UMTRCA.<sup>6</sup> Section 206 of UMTRCA authorizes the EPA to promulgate standards of general application for the protection of public health, safety, and the environment from radiological and non-radiological hazards associated with (a) residual radioactive materials located at specifically listed inactive uranium milling sites, nearby contaminated "vicinity properties," and depository sites for such materials selected by the Secretary of Energy (commonly referred

to as Title I sites); and (b) the processing and the possession, transfer and disposal of byproduct material at sites that process ores primarily for their uranium and thorium source material content<sup>7</sup> or disposal of such byproduct material (commonly known as Title II sites). See 42 U.S.C. 2022.<sup>8</sup> These public health, safety and environmental standards are contained in 40 CFR part 192 and are implemented by the NRC

<sup>7</sup> "Source material" is defined as "(1) Uranium or thorium or any combination of uranium or thorium in any chemical or physical form; or (2) Ores that contain, by weight, one-twentieth of one percent (0.05 percent), or more, of uranium or thorium, or any combination of uranium or thorium." See 42 U.S.C. 2014(z), 10 CFR 20.1003.

<sup>8</sup> Although the statute covers both uranium and thorium mill tailings sites, there are no existing thorium mill tailings sites.

and its Agreement States, as well as the DOE.

Title I of UMTRCA covers inactive uranium milling sites, nearby contaminated "vicinity properties" and depository sites. The EPA was directed to set general standards that are consistent with the requirements of the Solid Waste Disposal Act (later amended as the Resource Conservation and Recovery Act, or RCRA) to the maximum extent practicable. The Title I standards are located in EPA regulations at 40 CFR part 192, subparts A–C.

This proposed rule is based on Title II of the Act, which covers operating uranium processing or disposal facilities licensed by the NRC or NRC Agreement States. The EPA has authority to promulgate standards of general

<sup>6</sup> See 42 U.S.C. 2022.

application to protect public health, safety and the environment from hazards associated with processing, possession, transfer and disposal of byproduct material at such facilities. Such standards must address both radiological and non-radiological hazards; further, standards applicable to non-radiological hazards must be consistent with the standards required under Subtitle C of the Solid Waste Disposal Act (*i.e.*, RCRA).<sup>9</sup> The NRC is required to implement these standards at Title II sites. See 42 U.S.C. 2022(b), (d).

## II. Summary of the Proposed Rule

### A. Proposed Standards for Uranium ISR Operations

In today's action, the EPA is proposing to add a new subpart, subpart F, to the EPA's existing regulations for uranium and thorium mill tailings in 40 CFR part 192. The proposed standards would apply only to ISR facilities and are designed to protect public health, safety and the environment from contamination associated with their uranium recovery operations. The proposed standards are summarized in the following sections.

#### 1. Who is subject to the proposed standards?

Subpart F would apply to new and existing ISR facilities, including facilities that have temporarily ceased uranium production (*i.e.*, ISR facilities in standby). Subpart F would not apply to Title I sites, facilities that use only conventional or heap leach uranium production methods, or Title II ISR wellfields that have already begun or completed restoration within three years of the rule's effective date. The NRC and NRC Agreement States would develop regulations or take other appropriate steps to implement the new subpart F standards, once they are finalized.

#### 2. What are the proposed surface and groundwater standards for ISR facilities?

In the proposed new subpart, the EPA has cross-referenced subpart D to indicate that the existing standards for protecting surface waters and groundwater also apply to ISR facilities. The subpart D standards were initially written to address the handling, storing and disposal of byproduct material produced from the processing of uranium ore.

<sup>9</sup>With the restriction that the EPA not require any RCRA permit for the processing, possession, transfer or disposal of byproduct material at such facilities.

#### 3. What are the proposed groundwater protection standards for ISR facilities?

Consistent with the original proposal, this proposed rule includes the following three types of groundwater protection standards for ISR facilities: (1) Constituent concentration standards (including provisions for Alternate Concentration Limits (ACLs)); (2) initial stability standards; and (3) long-term stability standards.<sup>10</sup> These standards of general application would apply to all ISR facilities and are intended to prevent the mobilization of uranium and other constituents beyond the production zone during the operational and restoration phases and to ensure, once the wellfield is restored, that the restoration is complete and stable, both immediately after restoration and into the foreseeable future.

**Constituent Concentration Standards.** The constituent concentration standards are numerical concentration limits for a set of groundwater constituents that are present in or affected by ISR operations. When corrective action is necessary after an excursion has occurred, the licensee would have to clean-up the groundwater to meet these proposed constituent concentration standards. In addition, during the restoration and stability monitoring phases, these proposed constituent concentration standards would be the levels to which restoration must be achieved and maintained.

In this proposal, the appropriate constituent concentration standards for an ISR facility would be determined by the regulatory agency for each licensee. The constituent concentration standard for each constituent would be the highest level of the following values: (1) The lowest regulatory standard for that constituent found in 40 CFR 141.62, 141.66, 141.80, 143.3, 264.94, and Table 1 to subpart A of 40 CFR part 192; (2) that constituent's preoperational background level in the wellfield; or (3) an ACL for that constituent as approved by the regulatory agency. When setting the constituent concentration standards for a licensee, the regulatory agency would consider a minimum of 12 constituents. The regulatory agency would not be required to set standards for all 12 constituents, but the regulatory agency would have to set a

<sup>10</sup>The initial stability standards and the long-term stability standards were originally included in the proposed monitoring programs section of the rule. The initial stability standards (called "short-term stability" in the proposal) was proposed in 40 CFR 192.53(d)(2)(i) and the long-term stability standards were proposed in 40 CFR 192.53(e)(1)(iii). To improve clarity, the initial and long-term stability standards have been moved to 40 CFR 192.52(c)(2) and (c)(3), respectively.

constituent concentration standard for each of the listed constituents that is present in or could be affected by the ISR operation. The regulatory agency would have to identify the constituents during the preoperational monitoring phase. The regulatory agency would need to consider the following 12 constituents when setting the constituent concentration standards for an ISR operation: Arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, nitrate (as N), molybdenum, combined radium-226 and radium-228, and uranium (total). The original proposal included gross alpha particle activity (excluding radon and uranium), however, this constituent was not included in this proposal for the reasons explained in section III.3.2. The EPA is specifically requesting comment on the deletion of gross alpha particle activity (excluding radon and uranium) from the list of constituents. The regulatory agency may also set constituent concentration standards for additional constituents beyond these 12 constituents for situations where the regulatory agency considers concentration standards for other constituents necessary due to facility-specific conditions.

Once these proposed standards are finalized and the regulatory agency implements the subpart F standards, the constituent concentration standards would have to be established in accordance with the provisions in § 192.52 for all new wellfields and expansions to existing wellfields, and for all existing wellfields that are already operating, excluding those that are in and remain in the restoration and stability monitoring phases, as of the date three years after the effective date of this rule. Wellfields that begin and remain in restoration, initial stability monitoring or long-term stability monitoring at a licensed facility prior to the date three years after the effective date of the rule would need to meet the standards established when their license was issued or as otherwise specified by the regulatory agency.

**Alternate Concentration Limits.** Consistent with the original proposal, this proposal would allow licensees the flexibility to request ACLs when the best practicable active restoration has taken place, as determined by the regulatory agency, and the licensee demonstrates one or more of the constituent concentration standards cannot be met through further groundwater restoration. The best practicable active restoration must be used before the licensee can apply to the regulatory agency for a provisional ACL. Under this proposal, once the regulatory



agency establishes a provisional ACL, and the licensee can demonstrate the ACL has been met for three consecutive years, the regulatory agency can consider finalizing the ACL.

It must be understood that granting an ACL is an indication that restoration has not returned the affected groundwater to either preoperational background levels or other health-based levels. However, there are some overarching principles that must be considered when establishing ACLs. In general, as described in § 192.54, any provisional or final ACL should not pose a substantial present or potential hazard to human health and the environment, as determined by the regulatory agency. Points of exposure are defined in the proposal as locations identified by the regulatory agency that represent possible future areas of exposure where the receptor can come into contact with groundwater (e.g., areas of recoverable groundwater). The groundwater at the point of exposure should be protective of the receptor. The EPA specifically requests comment on this approach, especially with regard to the overall regulatory model of how ACL application would work, the definition of points of exposure and the use of this term, and the overall environmental, human health and safety protection goals for setting and using ACLs. Commenters, including interagency commenters, raised questions concerning the integration of an aquifer exemption under the SDWA and point of exposure as it was defined in the EPA's original proposal and the differing jurisdictions of the SDWA and UMRCA.

Under this proposal, when considering setting an ACL, the regulatory agency would consider a list of factors, including potential adverse effects on groundwater quality, physical and chemical characteristics of the constituent, including the potential for migration, hydrogeological characteristics of the area, proximity and withdrawal rates of local groundwater users, current and anticipated future uses of the groundwater, existing quality of the groundwater, potential for health risks, potential to damage wildlife, crops, vegetation and physical structures, the persistence and permanence of the potential effects, adverse impacts on hydraulically connected surface water (including several factors) and the presence of any USDW.

The EPA expects that setting a provisional and final ACL will require consideration of the hydrologic and other characteristics of the wellfield and surrounding area, any potential areas of

groundwater withdrawal or discharge and be protective of human health into the foreseeable future.

Consistent with UMRCA, the Tenth Circuit Court of Appeals in the *Environmental Defense Fund v. NRC* decision,<sup>11</sup> and current practice, the regulatory agency would be responsible for reviewing and approving ACL requests. Although not a proposed provision, the EPA considers it good practice for the regulatory agency to make public the information used for determining whether a provisional ACL is warranted and at what concentration before approving a provisional ACL. Although the NRC has not issued an ACL to date for an ISR wellfield, the NRC current practice would result in making such information publicly available and would support the EPA's effort to increase the effectiveness of the rule.

*Stability Standards.* In addition to the constituent concentration standards discussed above, licensees would also need to meet initial and long-term stability standards. The initial stability standards would require three consecutive years of quarterly monitoring results showing no statistically significant increasing trends exceeding the ISR facility's constituent concentration standards at the 95 percent confidence level. The long-term stability standards would require an additional three consecutive years of quarterly monitoring results showing no statistically significant increasing trends exceeding the ISR facility's constituent concentration standards at the 95 percent confidence level and also would require the licensee to demonstrate through geochemical modeling and other analysis that the applicable constituent concentration standards will continue to be met in the future. Consistent with the original proposal, the regulatory agency issuing the license would be responsible for determining whether there is reasonable assurance that the applicable constituent concentration standards will continue to be met at the ISR facility in the future.

#### 4. What are the proposed general and preoperational monitoring requirements?

In order to understand the hydrogeology and geochemistry of the production zone and surrounding area and to set the preoperational background for the constituent concentration standards, licensees would develop a preoperational monitoring plan for the wellfield. The preoperational monitoring plan would

characterize the hydrogeology and geochemistry of the area, support identification of any potential future excursions from the production zone during the operational and restoration phases, and support the monitoring, modeling and other analysis as determined by the regulatory agency to be necessary to meet the proposed initial and long-term stability standards.

The preoperational monitoring determines the groundwater flow regime and the background groundwater concentrations of the 12 listed constituents and any additional constituents required by the regulatory agency. The data collected during this period would be used to select the indicator parameters and set the upper control limits (UCLs) for these parameters. The indicator parameters would be monitored during the operational and restoration phases and, when the UCL is exceeded, indicate that lixiviant or other constituents are migrating beyond the production zone. The preoperational monitoring would be conducted at wells within the production zone and in areas surrounding the production zone, including aquifers immediately above and below the production zone, and in areas laterally adjacent to the production zone, both up and down gradient. A sufficient number of wells would have to be installed and monitored so that the sampling data collected could be used to statistically determine appropriate background levels and support statistical tests, modeling and other analysis determined by the regulatory agency to be necessary during the operational, restoration, initial stability and long-term stability phases. The licensee would collect a sufficient number of sample sets per well over a time period sufficient to indicate a statistically valid background concentration that is not affected by well installation or temporal variations. In areas where temporal (e.g., seasonal) variation could occur (e.g., ore zones in unconfined aquifers), the preoperational monitoring would be conducted for at least one year in a sufficient number of wells to adequately represent the hydrologic system.

In addition to monitoring the concentrations of the constituents required by the regulatory agency, the licensee would collect any other data necessary to establish background conditions to support future modeling and other analysis in preparation to meet the proposed long-term stability standards in § 192.52(c)(3).

<sup>11</sup> 866 F.2d 1263 (10th Cir. 1989).

5. What are the proposed monitoring requirements for the operational and restoration phases?

To ensure that no lixiviant, uranium or other constituents are migrating outside of the production zone, the licensee would monitor groundwater for specified indicator parameters at a set of monitoring wells surrounding the production zone. These excursion monitoring wells would be located around the perimeter of the production zone and in any aquifers immediately above or below the production zone that may be impacted by ISR activities. That is, the excursion monitoring wells need to surround the production zone in three dimensions. The excursion monitoring wells would be of sufficient number, density, and placement to detect the possibility of an excursion from the production zone. The regulatory agency would be responsible for reviewing and, when appropriate, approving well placement and installation, indicator parameters, the UCLs for the indicator parameters, as well as background levels for constituents for which constituent concentration standards are set.

Typical indicator parameters used to identify possible excursions include chloride, conductivity and total alkalinity. Other parameters may be appropriate as well. In the proposed rule, an excursion has occurred when either (1) two indicator parameters exceed their respective UCLs in any excursion monitoring well; or (2) as determined by the regulatory agency, one indicator parameter significantly exceeds its UCL in any excursion monitoring well. The EPA specifically requests comment on this proposed definition of an excursion and suggestions for other approaches for determining when an excursion has occurred. If an excursion occurs, the licensee would need to initiate corrective action in accordance with its facility-specific corrective action program and would be required to test for all constituents for which a constituent concentration standard was established. At a minimum, the constituents from Table 1 that are typically present and that warrant monitoring during an excursion are uranium, radium, arsenic and selenium. The regulatory agency would be allowed to identify additional constituents that are present in the groundwater and need to be monitored on a facility-specific basis.

In some cases, a licensee may have temporarily stopped recovering uranium and the facility may be in a phase commonly called "standby" by the

industry. In such instances, the EPA considers the facility to be in the operational phase and the licensee would be required under the proposed rule to continue monitoring and taking actions, such as maintaining an inward hydraulic gradient, to prevent excursions.

6. What monitoring is proposed for the initial stability standards?

Once the licensee believes restoration is near completion and believes they can, over time, demonstrate that the proposed initial stability standards in § 192.52(c)(2) can be met, the EPA expects that the licensee would begin monitoring the groundwater constituent concentrations throughout the wellfield to determine when the initial stability standards have been met. To meet the proposed initial stability standards, the licensee would need to demonstrate stability by providing three consecutive years of quarterly monitoring results showing no statistically significant increasing trend exceeding each established constituent concentration standard. For all monitored constituents, this trend would need to be demonstrated at the 95 percent confidence level. The licensee would be required to develop and implement a compliance monitoring program approved by the regulatory agency that identifies compliance points encompassing the entire affected area of the wellfield.

The purpose of the proposed stability monitoring is to determine whether constituent levels in the entire affected area of the wellfield, including the production zone, have returned to levels below the established constituent concentration standards and stable conditions are established. Hence, compliance wells must include wells previously used as excursion monitoring wells and those previously used as production related wells. The location of the compliance wells used to determine compliance with the initial stability standards would need to be approved by the regulatory agency and would need to be located in areas likely to be affected by ISR operations. Therefore, compliance well would be located within the production zone, adjacent to the production zone and in aquifers located immediately above and below the production zone, as approved by the regulatory agency. The number and location of compliance wells will vary depending on the size and characteristics of the wellfield, but should encompass the entire affected area of the wellfield.

To meet the proposed initial stability standards of § 192.52(c)(2),

measurements would need to be taken quarterly at each well. If one or more constituents exceed a constituent concentration standard during the initial stability monitoring, then the licensee would follow the corrective action program approved by the regulatory agency. When monitoring to assess whether the initial stability standards have been met, constituent concentrations may fluctuate above the respective standard. The corrective action program should address the possibility of and the regulatory agency should consider potential responses to an exceedance of the constituent concentration standards while the licensee is establishing a statistically adequate trend. The regulatory agency may allow continued monitoring, if appropriate, or require the licensee to undertake a remedy. Regardless of the action taken, the licensee would be required by the proposed standards to achieve three consecutive years of stable measurements. Furthermore, as in all phases, if lixiviant or other constituents escape the production zone, the licensee would be required to take the necessary actions to return the aquifer to below the constituent concentration standards.

When the licensee demonstrates three consecutive years of quarterly monitoring results showing no statistically significant increasing trends exceeding the established constituent concentration standards at the 95 percent confidence level, then the facility has met the proposed initial stability standards and the licensee may, upon the determination of the regulating agency that the initial stability standards have been satisfied, begin long-term stability monitoring.

7. What are the proposed requirements for the long-term stability standards?

During the proposed long-term stability monitoring, the licensee continues quarterly monitoring to demonstrate compliance with the constituent concentration standards using the compliance wells established for monitoring during the initial stability phase. To meet the proposed long-term stability standards in § 192.52(c)(3), the licensee would need to first demonstrate quarterly monitoring results for a minimum of three consecutive years showing no statistically significant increasing trends exceeding the established constituent concentration standards (including any approved ACLs) at the 95 percent confidence level.

To approve cessation of long-term stability monitoring, the regulatory agency would be responsible for determining whether there is reasonable

assurance that the applicable constituent concentration standards will continue to be met at the ISR facility in the future. To make this determination, an analysis of geochemical hydrologic and other conditions within and around the production zone should be prepared by the licensee and reviewed by the regulatory agency. The EPA requests comment on the specificity of the regulatory language for this final determination of stability and the elements to be considered. In general, the EPA expects that the review should examine various features within the production zone and use a combination of sample collection and analysis of the restored production zone, data review, geochemical modeling and analysis to integrate the various types of data and to assess groundwater conditions. Various types of geochemical models may be employed from saturation index calculations to reactive transport models that can evaluate changing hydrologic and geochemical conditions within the wellfield. The EPA believes the licensee's long-term stability assessment should include the following elements:

- (i) Conceptual hydrogeochemical modeling for the mine unit/production zone;
- (ii) Ground water and solid (core) data used for geochemical model(s), including field parameters;
- (iii) Incorporation of ground water data in an initial geochemical model (i.e., saturation indices calculations and assessment);
- (iv) Demonstration that stability (mainly reduction-oxidation or redox) conditions can be maintained in the production zone;
- (v) Demonstration that ground water migrating into the production zone will not significantly change the geochemical stability within the production zone;
- (vi) Demonstration of alternative geochemical conditions that demonstrate stability (uranium and other elements); and

(vii) Inter-relationships and contradictory claims (unintended consequences) for these various elements need to be identified and assessed in the context of the conceptual hydrogeochemical model.

The EPA requests comment on whether these seven elements should be required at all sites and thus included in the standards in 40 CFR part 192, subpart F.

The regulatory agency has the responsibility to establish the timeframe for long-term stability monitoring, based on facility-specific conditions at the wellfield and the results of long-term stability monitoring, modeling and analysis. If one or more constituents exceed their concentration standard (or approved ACL) or show a statistically significant increasing trend during the long-term stability phase, the regulatory agency may require the licensee to take corrective action as specified in the facility's corrective action program.

8. What are the proposed corrective action requirements?

Each licensee would be required to develop a corrective action program that addresses the actions it will take when an excursion is detected during the operational and restoration phases, or when monitoring during the stability phases shows a concentration higher than the established constituent concentration standard or a statistically significant increasing trend. Corrective action, as identified in the corrective action program and approved by the regulatory agency, would be initiated as soon as practicable and would begin within 60 days of the date the excursion or exceedance of a constituent concentration standard is detected. The corrective action program would consider a range of possibilities for action from the operational phase through the long-term stability monitoring phase. Corrective action may include removing or treating in place any constituents that exceed the constituent concentration standards (or

approved ACL). If the concentration of one or more constituents exceeds the constituent concentration standard (or approved ACL) during long-term stability monitoring, the licensee would be required to take corrective action to restore the groundwater to comply with the proposed constituent concentration standards; once restoration is complete, the licensee would begin again with initial stability monitoring.

*B. Proposed Amendments to 40 CFR Part 192, Subparts C and D*

As part of this rulemaking, the EPA is also proposing several minor amendments to the provisions in 40 CFR part 192, subparts C and D. These amendments are described in this section and are not related to the new standards for ISR facilities added in 40 CFR part 192, subpart F.

1. What are the proposed revisions to § 192.32(a)(2)(v)?

This proposed rule deletes the requirement in § 192.32(a)(2)(v) for the NRC to obtain concurrence from the EPA before the NRC may approve alternative requirements or proposals under AEA section 84(c).<sup>12</sup> As the EPA stated in the proposal, this portion of § 192.32(a)(2)(v) was effectively struck down by the Tenth Circuit Court of Appeals in *Environmental Defense Fund vs. U.S. Nuclear Regulatory Commission*, 866 F.2d 1263 (10th Cir. 1989). In its decision, the Court ruled that the NRC has authority under AEA section 84(c) to independently make these facility-specific determinations, and that the NRC has no duty to obtain the EPA's concurrence.

2. What are the proposed miscellaneous updates and corrections?

The EPA is also proposing several minor amendments to subparts C and D to correct cross-references, typographical and punctuation errors. These amendments include the following:

Section	Description of proposed technical correction	Rationale for correction
<b>40 CFR part 192, subpart C</b>		
192.20(b)(3) .....	Delete reference to "Pub. L. 92-314 (10 CFR part 712)" ..	The Grand Junction Remedial Action Criteria to which this reference applied no longer exist in the CFR.
192.20(b)(3) .....	Delete language referencing sealants and filtration .....	Methods were found to be ineffective and are no longer recommended as remedial options for radon mitigation.
<b>40 CFR part 192, subpart D</b>		
§ 192.31(a) .....	Replace "Uranium Mill Tailings Radiation Control Act" with "Uranium Mill Tailings Radiation Control Act".	Corrects a typographical error.

<sup>12</sup> See 42 U.S.C. 2114(c).

Section	Description of proposed technical correction	Rationale for correction
§ 192.31(f) .....	Replace “pile containing uranium by product materials” with “pile containing uranium byproduct materials”.	Corrects a typographical error.
§ 192.32(a)(2)(v) .....	Replace “laser fusion, of soils, etc.” with “laser fusion of soils, etc.”.	Corrects a punctuation error.

### III. Summary of Changes Made to the Original Proposal and Rationale for Those Changes

As previously indicated, the standards proposed in today’s action differ from those standards proposed on January 26, 2015 (80 FR 4156). This section of the preamble describes the most significant changes made to the original proposal and the rationale for those changes. Many of the changes were made in response to public comments and additional information provided by stakeholders. In response to the original proposal, the EPA received over 5,380 public comment letters on the proposed amendments, of which 5,192 were duplicate letters. The comments covered more than 80 different topics and were submitted by a wide range of stakeholders, including private citizens, public interest groups, industry, Indian tribes, state agencies and other federal agencies. For the original proposal, the EPA also held public hearings in Corpus Christi, TX (April 14, 2015); Washington, DC (March 10, 2015); Casper, WY (May 13 and 14, 2015); and Chadron, NE (May 12, 2015), where 114 stakeholders provided comments.

In addition to describing the changes made to the original proposal, this section also discusses and responds to the significant comments that resulted in many of those changes. The significant comments received that did not result in changes to the original proposal are discussed in section IV of the preamble.

#### A. Incorporation of the Initial and Long-Term Stability Standards in Proposed 40 CFR 192.52

For clarity, the EPA has restructured the proposed rule to move the initial and long-term stability standards that were originally included with the monitoring requirements in § 192.53 to the standards in § 192.52. The initial stability standards (called “stability” or “short-term stability” in the original proposal) were proposed in § 192.53(d)(2)(i), and the long-term stability standards were proposed in § 192.53(e)(1)(iii). In this proposal, the initial and long-term stability standards have been moved to § 192.52(c)(2) and (c)(3), respectively.

#### B. Groundwater Protection Standards

##### 1. Clarifications to Terminology

The original January 2015 proposal listed 13 constituents for which a facility-specific concentration limit must be set for each constituent that is present in the groundwater. In the original proposal, the EPA referred to these facility-specific concentration limits as “groundwater protection standards” and “restoration goals” (see § 192.52(c) of the original proposed rule). Since the use of these two terms may lead to confusion, the EPA is no longer using the term “restoration goals” but is instead using the term “constituent concentration standards” throughout the proposed rule to refer to these facility-specific concentration limits.

In the original proposed rule, the EPA also used the phrase “identified in the groundwater” when referring to constituents for which constituent concentration standards should be established (see § 192.52(c) of the original proposed rule). The EPA intended concentration standards to be set for any constituent that is present in groundwater before or after ISR activities have begun. Some constituents may not be initially present in the groundwater but may become soluble only after lixiviant is injected and groundwater chemistry has been altered. However, the phrase “identified in the groundwater” could be misinterpreted to mean only those that are present during preoperational monitoring. For clarification, the EPA has revised the original proposal to specify that constituent concentration standards must be established for all constituents that are “identified as present or affected by operations in the groundwater.”

##### 2. Gross Alpha Particle Activity

In the original proposal, the list of constituents in Table 1 of subpart F included gross alpha particle activity.<sup>13</sup> Several commenters opposed listing gross alpha particle activity, stating that it provided no useful information that could not be otherwise obtained from the required measurement of

<sup>13</sup> The SDWA MCL of 15 pCi/L for gross alpha particle activity excludes alpha particle activity contributions from radon and uranium.

radionuclides, such as radium 226. In addition, commenters noted the wide uncertainty range for the radiochemistry analytical methodology currently used to measure gross alpha activity.

The EPA tends to agree with commenters who suggested that gross alpha measurements are likely to be of limited value when other radionuclides of concern are also being sampled. The Agency also recognizes that the uncertainty associated with gross alpha measurements may be greater than those for other constituents, which may make the application of statistical tests especially complicated. However, gross alpha is specified as a constituent to be sampled in other subparts of 40 CFR part 192, and it does have a maximum contaminant level (MCL), which cannot be overlooked. Further, there may be instances where gross alpha measurements provide information regarding the presence of decay products such as lead and polonium. The EPA is specifically requesting comment on the deletion of gross alpha particle activity as one of the original proposal’s 13 constituents, whether it provides useful information, and how measurement uncertainty might be addressed.

#### C. Preoperational Monitoring Requirements

In the original proposal, the EPA included provisions for preoperational monitoring that were designed to characterize the groundwater flow regime, geology and geochemistry. The EPA originally proposed that preoperational monitoring would measure the background concentrations of radiological and non-radiological constituents, including all the constituents listed in Table 1 of subpart F, and any additional constituents or parameters specified by the regulatory agency or needed for calculations or groundwater modeling. The original proposal required preoperational monitoring be continued for a minimum of one year in order to account for any temporal changes occurring in the aquifer. The EPA also proposed some requirements for the location of the wells, requiring monitoring wells to be located in overlying aquifers, underlying aquifers, inside the exempted aquifer and outside the exempted aquifer, including areas that

are up- and downgradient from the future production zone. The original proposal specified standards for installing the monitoring wells, including requirements for casings and for sealing the wells to prevent contamination.

#### 1. Duration of Preoperational Monitoring

The EPA received a number of comments on the duration of the proposed preoperational monitoring requirements. Some commenters supported the one-year timeframe, while others recommended the time period be extended to up to two years. Many commenters cited the NRC Criterion 7 from 10 CFR part 40, Appendix A, which requires uranium mills to complete one or more years of preoperational monitoring before a company can submit a license application. Two commenters noted that some aquifers do not experience seasonal variations in groundwater constituents. For example, commenters asserted there may be no seasonally influenced fluctuation in the concentrations of groundwater constituents in deeper target ore production aquifers.

Based on all of these comments, the EPA has refined the approach to preoperational monitoring. Instead, the Agency is proposing that preoperational monitoring of wells screened in areas where temporal variations are not expected to occur, such as in deep ore zones in confined aquifers, would be allowed to monitor for periods of less than one year. However, the licensee would collect several sets of samples over a time period sufficient to demonstrate seasonal variability does not occur. For example, in some cases, four sets of samples collected over several months would be adequate to determine the background for systems that do not exhibit seasonal changes. In this proposal, sample sets collected over a period of at least one year would still be necessary for facilities that operate in areas where constituent concentrations are expected to exhibit seasonal fluctuations. The regulatory agency would determine whether the licensee's preoperational monitoring is of sufficient duration and that sampling occurs at appropriate intervals to establish the background concentrations for all 12 constituents, as well other constituents identified by the regulatory agency and all indicator parameters. To provide flexibility where appropriate, the EPA did not propose an across-the-board two-year monitoring requirement, although the regulatory agency would be allowed to do what is necessary to

reflect seasonal or other variation in background constituent concentrations or flow.

#### 2. Changes to the Well Completion Requirements

The Agency received several comments on the original proposed requirements for well completions. A general concern expressed by the commenters is that true baseline conditions of the groundwater constituents cannot be established if the well drilling and development methods introduce oxygen into the groundwater. The commenters explained that since oxygen may increase the solubility of uranium, elevated baseline concentrations will lead to artificially high restoration goals. Commenters suggested several methods to alleviate this concern, including air-rotary drilling with recirculated nitrogen gas instead of air and a foam surfactant that contains organic constituents to eliminate oxygen.

After considering these comments, the EPA believes sufficient monitoring should be completed to ensure all perturbations associated with well construction are resolved prior to establishing the background concentrations. To achieve this goal, under this proposed action, the licensee would collect several sets of samples over a time period sufficient to demonstrate baseline conditions that are unaffected by monitoring well construction. In the proposal, the EPA requires the sampling frequency to be sufficient to ensure statistically valid background levels that are not influenced by well construction. The samples used for this purpose may be the same as those used for the temporal variability analyses, if technically feasible. The regulatory agency would determine whether the licensee's well construction follows appropriate protocols and that sampling occurs at appropriate intervals to establish accurate background concentrations.

#### D. Exempted Aquifers

The EPA originally proposed that preoperational monitoring wells, excursion monitoring wells used during the operational and restoration phases, and compliance wells used during the initial and long-term stability monitoring phases (referred to as "point(s) of compliance") be located inside and outside of "exempted aquifers" (see the proposed definition for "point(s) of compliance" at 80 FR 4184). In the original proposal, the EPA also defined the term "point(s) of exposure" as the "intersection of a vertical plane with the boundary of the

exempted aquifer" and the term "adjacent aquifer" as an aquifer or portion of an aquifer that "shares a border or end point with the exempted aquifer or the exempted portion of an aquifer" (see 80 FR 4183–4184). As the EPA explained in the original proposal, the term "exempted aquifer" refers to aquifers that are exempted from the protections afforded by the SDWA (see 80 FR 4160).

Under the SDWA, the EPA sets health-based standards for drinking water to protect against naturally occurring and anthropogenic contaminants that may be found in surface and groundwater sources of drinking water. Additionally, under SDWA authority, the EPA promulgated Underground Injection Control (UIC) Program regulations to ensure protection of USDWs,<sup>14</sup> which may be consumed now or in the future, where injection activities are occurring. The UIC regulations at 40 CFR 144.12 prohibit any injection activity that allows the movement of fluid containing any contaminant into USDWs if the presence of that contaminant may cause a violation of any primary drinking water standard or otherwise adversely affect the health of persons. Under UIC Program regulations, an aquifer or a portion of an aquifer may be exempted from the protections afforded USDWs, under the SDWA, if (a) it does not currently serve as a source of drinking water; and (b) it cannot now and will not in the future serve as a source of drinking water because one of four specified conditions is met, or (c) the total dissolved solids content of the groundwater is more than 3,000 mg/L and less than 10,000 mg/L and it is not reasonably expected to supply a public water system (see § 146.4). The four conditions referenced above for the aquifer exemption criteria at 40 CFR 146.4(b) are:

(1) It is mineral, hydrocarbon or geothermal energy producing, or can be demonstrated by a permit applicant as part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible.

(2) It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical;

<sup>14</sup> USDWs are defined, by regulation at 40 CFR 144.3, as: "An aquifer or its portion: (a)(1) Which supplies any public water system; or (2) Which contains a sufficient quantity of ground water to supply a public water system; and (i) Currently supplies drinking water for human consumption; or (ii) Contains fewer than 10,000 mg/l total dissolved solids; and (b) Which is not an exempted aquifer."

(3) It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or

(4) It is located over a Class III well mining area subject to subsidence or catastrophic collapse.

#### 1. Removal of References to “Exempted Aquifer”

In this proposal, the EPA has removed references to “exempted aquifers”, deleted the definitions of “adjacent aquifer” and “exempted aquifer” from § 192.51, and removed the phrase “exempted aquifer” from the definition of “background” in § 192.51 and from the requirements specifying where monitoring wells must be located. This change to the original proposal was made to help clarify that these standards under UMTRCA complement, and do not overlap with, the requirements of the SDWA. As discussed in section I.B., the scope and level of protection of the SDWA differs from the UMTRCA as groundwater at uranium ISR sites could have beneficial uses even if the aquifer has been exempted from protection under the SDWA. Since UMTRCA provides authority that can be used to protect aquifers during and after uranium recovery operations, regardless of whether the aquifer meets the definition of an USDW as defined in EPA’s UIC regulations or is exempted from the protections of the SDWA, the scope of UMTRCA’s protection should be reflected in the regulatory text of these standards rather than relying on the SDWA UIC exemption regulations. Thus, the regulatory text proposed in this action does not depend on or use the term exempt aquifer. Also, although a remote possibility, because ISR facilities may be located in aquifers that are not designated as “exempted aquifers” under the SDWA, under the original proposal there would have been a lack of clarity on how a facility located in a non-exempt aquifer would comply with a rule using “exempt aquifer” boundaries in the regulatory text.

*Aquifer Exemptions at ISR facilities.* The EPA recognizes that almost all ISR facilities may be considering Class III injection into a formation that meets the UIC regulatory definition of a USDW and is afforded SDWA protection. In such scenarios, in addition to applying for a Class III permit, a Class III owner or operator must (1) apply to the appropriate UIC Program for an aquifer exemption pursuant to requirements at 40 CFR 144.7 and 146.4 (or applicable state requirements), or (2) ensure that the boundaries of an existing exemption are appropriately delineated for the proposed injection activity. While

aquifer exemptions facilitate commercial production of minerals and hydrocarbons under specific conditions, the UIC Program requirements are intended to ensure protection of non-exempted portions of a formation which meet the definition of a USDW even where ACLs may be established at an ISR site located within an exempted portion of that aquifer.

As stated above, this proposed rule is established under the UMTRCA and not under the SDWA; however, both the UMTRCA and the SDWA requirements may apply to ISR facilities. As discussed above and in section I.A., the requirements of these statutes are complementary and not overlapping or duplicative. The SDWA requirements provide for permits to inject lixiviant and recover uranium and possible exemption of the production zone from SDWA requirements. The proposed UMTRCA requirements protect adjacent aquifers that are not exempt from SDWA by requiring monitoring and corrective action, if necessary, during the operational and restoration phases in and around the ore zone after production ceases. The SDWA does not prevent recovery and use of the water within exempted aquifers (including where ISR operations were previously conducted) for private drinking water supply, public water supply, or other uses.

#### 2. Changes to the Definition of “Point(s) of Exposure”

Points of exposure are defined in the proposal as locations identified by the regulatory agency that represent possible future areas of exposure where the receptor can come into contact with groundwater (e.g., areas of recoverable groundwater). The groundwater at the point of exposure should be protective of the receptor. As noted earlier in this preamble, commenters, including interagency commenters, raised questions concerning the integration of an aquifer exemption under the SDWA and point of exposure as it was defined in the EPA’s original proposal and the differing jurisdictions of the SDWA and UMTRCA. The EPA specifically requests comment on this approach, especially with regard to the overall regulatory model of how ACL application would work, the definition of points of exposure and the use of this term, and the overall environmental, human health and safety protection goals for setting and using ACLs.

#### *E. Excursions*

In the original proposal, the EPA defined an excursion as “the movement of fluids containing uranium byproduct

materials from an ISR production zone into surrounding groundwater” and specified that an excursion has occurred when “. . . any two indicator parameters . . . exceed their respective upper control limits” (see 80 FR 4184).

#### 1. Changes to the Definition

Although the EPA generally considers that an excursion has occurred when any two parameters are above the UCL, in this proposal, the EPA provides flexibility for the regulatory agency to determine that an excursion has occurred when any single indicator parameter significantly exceeds its UCL. The EPA made this change to the proposed definition because in some situations a single parameter may be sufficiently high to indicate a possible excursion. The EPA emphasizes that this would be a judgement of the regulatory agency, and the Agency’s understanding is that it is consistent with current NRC practice.

In this proposal, the EPA also revised the definition of excursion to indicate that an excursion includes the movement of fluids containing lixiviant, as well as any fluids containing uranium byproduct material, because these fluids may migrate outside of the ISR production zone. The EPA replaced the reference to “the ISR production zone” with “ISR wellfield” to indicate a broader scope of consideration is necessary in order to ensure that background is appropriately addressed and to ensure that areas within and surrounding the production zone are stable.

#### 2. Changes to the Constituents Required To Be Monitored During the Different Phases of Operation

The EPA originally proposed that licensees would be required to monitor for all constituents listed in Table 1 of 40 CFR part 192, subpart F, during the different phases of operation at an ISR facility. In this proposal, the EPA changed this requirement such that facilities would be required only to monitor for those constituents that are expected to be present (e.g., uranium, radium, selenium and arsenic) based on the preoperational monitoring and any other constituents identified by the regulatory agency. The EPA made this change to the monitoring parameters to ensure monitoring requirements are established based on data indicating the expected contaminants. This change reduces the monitoring burden for ISR facilities compared to the original proposal. This proposed change also provides the regulatory agency flexibility to specify any other constituents not listed in Table 1 of 40

CFR part 192, subpart F, that are expected to be present. Under this proposal, the EPA considers it unnecessary to monitor for constituents that are not present. Hence, facilities would be required to monitor only for those constituents that are likely to be present.

#### F. Initial and Long-Term Stability

After restoration ends, ISR facilities must demonstrate compliance with the proposed constituent concentration standards, and also demonstrate those levels will persist and remain stable in the future. In the original proposal, to demonstrate stability, the EPA proposed three consecutive years of stability monitoring with stability demonstrated at the 95 percent confidence level followed by long-term monitoring for an additional period of 30-years. The originally proposed long-term stability monitoring would have allowed facilities to cease monitoring once they had completed monitoring for 30 years. However, the original proposal also allowed a licensee to shorten the 30-year long-term stability monitoring period by demonstrating geochemical stability through monitoring and geochemical modeling.

##### 1. Statutory Authority and 30-Year Long-Term Monitoring

The EPA derived the 30-year long-term stability monitoring period in the original proposal based on consideration of the Agency's statutory mandate to be consistent with the requirements applied to managing hazardous waste under RCRA.

Numerous commenters thought the proposed 30 years of long-term monitoring was not justified, and was excessive and unnecessary. The general positions of these commenters were that these very specific monitoring time frames were outside the EPA's statutory authority under the UMTRCA to promulgate "standards of general application" and that there is no evidence that ISR facilities have impacted offsite underground sources of drinking water. Commenters also thought the requirement would have a significant economic impact, including impacts on leasing and surety costs that would place a number of ISR companies out of business. Other commenters noted that ISR facilities are not equivalent to RCRA hazardous waste facilities and should not be similarly regulated. Some commenters were concerned the long-term monitoring requirements would increase radiologic dose to employees maintaining the processing plant and well fields, which would be inconsistent with the NRC's

ALARA (As Low As Reasonably Achievable) regulations found in 10 CFR part 20. However, other commenters strongly supported the 30-year monitoring time frame or recommended a longer time frame. These commenters felt that 30 or more years of monitoring would provide sufficient time to detect instability and potential migration of constituents.

##### 2. Proposed Requirements for Initial and Long-Term Stability

Under UMTRCA, the EPA has authority to promulgate "standards of general application" for the protection of public health, safety and the environment from the radiological and non-radiological hazards associated with the processing and the possession, transfer and disposal of byproduct material at uranium ISR facilities. 42 U.S.C. 2022(b). The Tenth Circuit Court of Appeals has clearly recognized that this authority encompasses the ability for the EPA to include monitoring as part of its "standards of general application." *American Mining Congress et al. v. Thomas*, 772 F.2d 640, 644, 647-649 (10th Cir. 1985) ("The regulations necessitate monitoring programs."). In the proposal, the EPA has retained the initial and long-term stability monitoring requirements but has removed the default requirement for 30 years of long-term monitoring. The initial stability monitoring period remains the same as in the original proposed rule (*i.e.*, at least three years). Under this proposal, the duration of the long-term stability monitoring must be at least three years, and the regulatory agency would determine the appropriate length of any additional long-term stability monitoring based on criteria that will enable the licensee to demonstrate, as appropriate, that there is reasonable assurance that the applicable constituent concentration standards will continue to be met in the future. Similar performance criteria were part of the standards in the original proposed rule, where the EPA had proposed that licensees would be required to demonstrate three consecutive years of initial stability monitoring and then maintain long-term stability monitoring for an additional period of 30 years. The original proposal included an option that allowed a licensee to shorten the 30-year timeframe by demonstrating long-term geochemical stability through modeling. Under this proposal, modeling would no longer be optional. Consistent with the original proposal, the EPA is proposing that the regulatory agency would be responsible for reviewing the licensee's data and analysis, and making

the determination of when the licensee could discontinue long-term stability monitoring and initiate decommissioning.

While many commenters supported the 30-year monitoring requirement, and some even preferred a longer period, the proposal maintains the same performance-based standards for the long-term stability phase as the original proposal and hence ensures the same level of protection the EPA anticipated in the original proposal. The Agency emphasizes the role of modeling in achieving that objective. As explained in the original proposal, the Agency expected that licensees would make extensive efforts to develop robust models that would significantly shorten the long-term monitoring period. In fact, as presented in the proposal, it would have been possible for a licensee to submit modeling such that no (or minimal) long-term monitoring would be necessary. However, should licensees be unable to provide such modeling, or choose not to, the additional monitoring would have provided the level of confidence necessary for the regulatory agency to determine that long-term stability had been demonstrated. This revised proposal relies on modeling and analysis to as an essential element in concluding that groundwater will continue to meet the applicable constituent concentration standards into the foreseeable future, leading to the Agency's judgment that the revised approach is comparable in protectiveness to the original proposal.

As noted above, other commenters stated that 30 years of monitoring would not add value and would put many companies out of business. ISR facilities that disturb groundwater and mobilize constituents of concern are responsible for restoring disturbed groundwater to background or health-based conditions regardless of the time required to achieve this goal. However, the EPA also agrees with commenters who noted the time period necessary to establish stability at an ISR facility is variable due to differences in geology, hydrology and geochemistry. As reflected by one of the commenters, after 10 years of monitoring at the Kingsville Dome ISR facility, it appears that reducing conditions have not been re-established in the production zone. Restoration at Christensen Ranch has not been approved by the NRC because the NRC found that restoration was not complete and water quality was not stable after completion of uranium recovery in 2005.<sup>15</sup> Uranium concentrations also

<sup>15</sup> NRC (2012), "Technical Evaluation Report: Christensen Ranch Mine Units 2 through 6

increased in a production monitoring well at Smith Highlands Ranch after restoration was completed.

This proposal defines the initial stability standards as “three consecutive years of quarterly monitoring results with no statistically significant increasing trends exceeding the constituent concentration standards at the 95 percent confidence level.” These performance-based standards would apply after the licensee completes restoration and, once met, would demonstrate that restoration was initially successful. The EPA requests comment on this approach and the wording of the regulatory text. Alternative language the EPA considered for this proposal for both initial and long term stability, included requiring the licensee to show “. . . three consecutive years of quarterly monitoring results demonstrating a statistically significant non-increasing trend at the 95 percent confidence level remaining below each constituent concentration standard.” This alternative approach, which would require the licensee to demonstrate that the trend line is either horizontal or decreasing (“non-increasing”), has been applied in the Superfund program. It has the clear advantage of accepting only trend lines that are not increasing, which can provide some additional confidence that the trend is not in a direction that could (eventually) threaten to exceed the constituent concentration standards.

However, based on discussions with the NRC, the agency responsible for implementing this rule after promulgation, it is clear that licensees may see increasing, but not statistically significant trends in constituent concentrations during stability monitoring. Consequently, the EPA opted to change the language to “no statistically significant increasing trend” to provide the NRC flexibility in addressing this specific scenario. Further, the EPA is concerned that specifying a non-increasing trend may introduce complications in applying statistical techniques, particularly when working from the hypothesis that there is no slope to the trend line. The level of natural variation present may itself forestall the ability to determine a non-increasing slope with the level of confidence the EPA believes necessary. The level of statistical significance associated with an increasing trend that would be unacceptable is left to the

regulatory agency to determine based on site-specific conditions.

The EPA requests public comment on the proposed approach as well as the alternatives. Specifically, the EPA would like to know whether this language is sufficiently protective and whether there are any other practical approaches the Agency should consider as possible alternatives.

In this proposal, the EPA has defined the long-term stability standards as a two-part test, with the following elements: (1) The licensee must provide an additional three consecutive years of quarterly monitoring data demonstrating no statistically significant increasing trend exceeding the constituent concentration standard for each applicable constituent at the 95 percent confidence level; and (2) the licensee must provide geochemical modeling and other analysis to demonstrate that constituent concentrations within the production zone will be met in the future. The regulatory agency would evaluate the modeling and other analysis and make a determination as to whether there is reasonable assurance that the applicable constituent concentration standards will continue to be met in the future. In this proposal, only after this determination has been made by the regulatory agency would the licensee cease long-term monitoring.

The three-year long-term monitoring period represents a different application of the RCRA paradigm than the 30-year post-closure monitoring. The three-year monitoring period is consistent with RCRA corrective action requirements, which can be seen as analogous with groundwater restoration at ISR sites. The Agency believes the three-year performance standard for the long term is appropriate to provide additional confidence in restoration of these sites and provides sufficient time to conduct a trend analysis, as well as being consistent with RCRA requirements of three years of monitoring to demonstrate no exceedance associated with corrective action. The EPA finds that this alternative approach will provide the necessary protectiveness and is particularly responsive to industry comments regarding the potential costs associated with a 30-year monitoring period.

#### G. Corrective Action Program

The EPA originally proposed that facilities be required to take corrective action as soon as practicable but no later than 90 days after an excursion or exceedance is detected. The original proposal also required that the concentrations of constituents be returned to the constituent

concentration standards “within the production zone and the maximum constituent level in adjacent aquifers” (see § 192.54(a) of the proposed rule). Groundwater monitoring for a period of at least three years after corrective action had been terminated was proposed with reference to the proposed monitoring requirements for the initial and long-term stability phases.

A few commenters supported the requirement to take corrective action as soon as practicable. However, most commenters disagreed with the original proposed requirement to require ISR facilities to implement a corrective action program within 90 days. One commenter was concerned the compliance costs would be high because the wellfield and associated equipment would have to be maintained at the ISR facility for many years in order for corrective action to be started within the required 90 days. Another commenter thought a longer time period was justified due to the low velocity of groundwater at ISR facilities. This commenter asserted that additional time may be needed for drilling wells and installing pump and treat equipment, particularly during the long-term stability period when equipment has been removed. This commenter recommended a period of two years be allowed for implementing a corrective action program and stated that groundwater may move only 10 to 20 feet over this time period. Another commenter noted that the NRC already has regulations covering corrective action in 10 CFR part 40, Appendix A, Criterion 5D, which specify that a licensee has up to 18 months to implement a corrective action program. One commenter found the proposed requirements for groundwater monitoring confusing and questioned why the proposed rule referenced the initial and long-term stability monitoring requirements. This commenter thought the groundwater monitoring applied to excursions and questioned why additional monitoring was necessary for excursions occurring during the operational phase.

The EPA has made several changes to the corrective action requirements in this proposal. First, the EPA would require ISR facilities to *begin* (but not necessarily complete) corrective action no later than 60 days after an excursion or exceedance is detected. The EPA made this change to be consistent with the NRC’s current practice for excursions.<sup>16</sup> Full implementation may

Restoration Report, Uranium One USA, Inc. Willow Creek ISR Project.” Available at <http://www.nrc.gov/docs/ML1217/ML1217A048.pdf>.

<sup>16</sup>NRC (2003), “Standard Review Plan for In-Situ Leach Uranium Extraction License Applications



take additional time, as recognized by the NRC in 10 CFR Appendix A, Criterion 5D. The time for the initiation and completion of the corrective action in all phases of operation would be addressed in the corrective action program and approved by the regulatory agency.

Second, the EPA is acknowledging that corrective action in the initial stability phase may be different than in the long-term stability phase, as during the initial stability phase data are being collected to show the initial trend and may be more subject to fluctuation. One exceedance may be acceptable during the initial stability phase, but not for the long-term stability phase, without taking corrective action. The EPA is proposing the regulatory agency would have the authority to determine whether an exceedance truly warrants action or continued monitoring while the licensee is trying to establish the data trend during the initial stability phase. The need for action or monitoring during each phase of operation would be anticipated and addressed in the corrective action program. Whether or not the regulatory agency has determined that corrective action is necessary does not negate or affect the proposed initial stability standards requiring three consecutive years of quarterly monitoring results with no statistically significant increasing trends exceeding the constituent concentration standards at the 95 percent confidence level. The corrective action program would have to return the constituent concentrations to levels below the constituent concentration standards established by the regulatory agency.

Finally, the EPA is proposing to change the groundwater monitoring provisions proposed for § 192.54(c) (80 FR 4187) to better reflect the requirements applicable to ISR facilities that experience exceedances of constituent concentration standards during the long-term stability phase. The EPA agrees with a commenter who stated that the proposed rule language for the groundwater monitoring requirements in § 192.54(c) could easily be misinterpreted. The change to the original proposed rule makes it explicit that corrective action is followed by another round of initial stability monitoring followed by long-term stability monitoring. Under this proposal, the ISR facility would need to first meet the three-year initial stability standards, and then meet the long-term stability standards of § 192.53(c)(3)(i) and (ii), before it is eligible to apply to

the regulatory agency for approval to cease long-term stability monitoring. These changes to § 192.54(c) would not add any new requirements but simply clarify the requirements that were originally proposed.

#### H. Costs and Economic Impacts

##### 1. Compliance Costs

Commenters expressed concern that the EPA had not considered the entire spectrum of legal, regulatory and other costs required to hold and preserve the ISR facility, lands and wellfields during the stability monitoring periods. The EPA reviewed and updated the economic analysis to incorporate estimated non-monitoring costs (e.g., licensing, leasing fees, continued surety, maintenance) identified in the comments. Commenters also recommended that the EPA consult the ISR industry to better characterize costs, and the EPA requested additional information from some of the uranium recovery companies that had provided cost data during the public comment period to clarify the information provided. The additional cost information received from the uranium recovery companies was incorporated into the economic analysis. A listing of the non-monitoring costs that were identified in the comments and added to the revised analysis, along with a comparison of non-monitoring costs provided by industry and the average values used in the economic model, can be found in the economic analysis report (see sections 3.2 and 3.3). The addition of non-monitoring costs added \$2,300 per acre to the modeled average facility costs excluding license and surety. The estimated total annualized incremental non-monitoring costs projected to be incurred by firms owning existing ISR facilities ranged between \$0.1 million and \$4.1 million, with total national non-monitoring costs of \$7.6 million for all firms. All costs in the economic analysis have been adjusted from 2011 to 2015 dollars, as suggested by commenters.

Another concern expressed by commenters was that the EPA had not considered additional costs to self-funded regulatory programs, and that these costs would be passed along to the uranium recovery companies. The revised standards reflect the practices that have become more common between the NRC and ISR facilities; therefore, this proposal is not expected to add significant burden to regulatory programs.

Compliance for existing ISR facilities also concerned commenters. As in the proposal, § 192.52(a) of this proposal

makes clear that these standards would not apply to wellfields that are currently in and remaining in restoration or stability monitoring.

Commenters also expressed concern that the costs of monitoring were not adequately reflected due to inaccurate assumptions for current monitoring requirements. The EPA adjusted the monitoring costs in the economic analysis based on guidance received from the NRC regarding current monitoring practices and requirements, as opposed to historical practices that were noted by some commenters as common to more developed ISR facilities. Also, a commenter noted that the rule discussion in the proposal preamble at 80 CFR 4186 (§ 192.53(a)(3) of the original proposal) required monitoring well locations outside of the monitoring well ring and that these costs were not included in the economic analysis. The proposal maintains the requirement in the original proposal for down-gradient monitoring wells outside the monitoring well ring where needed, and at the discretion of the regulating agency, especially when an adjacent aquifer is present. Initially, the EPA's proposal required monitoring at locations down-gradient from the wellfield in exempted aquifers. However, placement of down-gradient monitoring wells outside the well ring was not found to be common practice at existing sites and the EPA removed these wells from the cost model. The EPA also assumed in the proposal that monitoring and hydrogeologic and geochemical modeling requirements would allow most sites to demonstrate that groundwater conditions down-gradient of the wellfield would trap any mobilized constituents, thus ensuring that groundwater quality is protected. Reference to the "exempted aquifer" has also been removed from this proposal, as discussed in section III.D of this preamble.

Comments were also received on the methodology used to extrapolate a cost per acre for operating ISR facilities based on a conceptual ISR unit, and while it was acknowledged that the method may be appropriate for fully developed ISR facilities, the commenters were concerned that this methodology may not capture the full costs of implementation for facilities in earlier stages of development. The EPA further reviewed and used available information from facility surety and license reports to estimate and account for the proposed and anticipated number of ISR units at each ISR facility that was included in the cost model.

In light of the adjustments described above, the EPA considers the estimated

monitoring costs for existing ISR facilities that it developed for purposes of the proposal to be reasonable; however, the Agency continues to recognize that there are uncertainties inherent to the process used to extrapolate the monitoring costs associated with these standards as compared to actual costs to ISR facilities.

## 2. Energy Impacts Summary

Several commenters noted the importance of nuclear power to shift the nation's reliance away from carbon-based energy resources and expressed concern that the proposed standards would reduce the viability of uranium recovery and continued development of nuclear energy. In response to these comments, the EPA reevaluated the incremental costs of the selected option to existing and planned ISR facilities, which further substantiated that this action is not a "significant energy action" as defined in Executive Order 13211 (66 FR 28355, May 22, 2001). The proposed standards, in large part, codify groundwater monitoring practices and requirements already being implemented at permitted operations; further, domestic uranium has historically provided less than 10 percent of total uranium supplied to civilian owners and operators (COOs) of nuclear power stations. Because the proposal would increase the costs of facilities that produce a relatively small share of uranium traded in U.S. markets, the EPA estimate that a \$1.96 increase per pound in the cost of ISR uranium production would increase the price of uranium paid by COOs by only \$0.11 per pound. Because nuclear generation provides a relatively small share of total domestic electricity, the \$0.11 increase in the price of uranium would increase the price of electricity very little (less than 0.1 percent). Although the proposal would slightly increase the costs of domestic uranium production relative to international sources, this rule is not expected to directly and adversely affect productivity, competition or prices in the energy sector. For more information, please see section VI.H of this preamble and sections 5.3 and 6.9 of the document titled, "Economic Analysis: Revisions to the Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings Rule (40 CFR part 192)," available in Docket ID No. EPA-HQ-OAR-2012-0788.

## 3. Groundwater Resource Impacts of Restoration

Several commenters expressed concern that the proposed rule would

cause an unnecessary waste of groundwater resources beyond diminishing returns, due to prolonged additional restoration to satisfy the proposed requirement for 95 percent statistical confidence of groundwater stability. The EPA disagrees and believes that the 95 percent statistical confidence level is widely accepted and used in other environmental standards. For more information on the 95 percent confidence level, see section IV.D of the preamble.

One commenter stated that the EPA ignored its authority under CERCLA that allows the Agency to require former operators and their successors to clean up post-license termination, thereby unnecessarily increasing monitoring costs for ISR facilities. The EPA does not believe it is appropriate to rely upon expectations of future cleanup rather than make reasonable efforts to prevent groundwater contamination in the first place. The intent of this rule is to protect groundwater and prevent its degradation, thereby eliminating the need for remedial actions under CERCLA that, by the time discovered, could be far costlier. This approach is fully consistent with the EPA's Groundwater Protection Strategy, which emphasizes pollution prevention over remediation. Also, commenters asserted that the groundwater modeling was inadequate, and flawed inputs were used to estimate the duration of remediation to clean up a plume after facility closure. The EPA understands that the contaminant transport models used to estimate costs of remediating a contaminant plume are simplistic, the inputs used are based on limited ISR facility data, and selected parameterizations are based on assumptions. Nevertheless, the flow model provides a reasonable estimate for the duration of an illustrative general pump and treat remediation scenario, based on the EPA's extensive pump and treat remediation experience under CERCLA and other remedial programs, and, upon review, the models and inputs were determined to be adequate to illustrate potential cost savings for purposes of the economic analysis.

### *I. Other Miscellaneous Changes*

#### 1. Clarification of "Operational Phase"

In the original proposal, the EPA defined the operational phase of an ISR facility as "the time period during which uranium extraction by in-situ recovery occurs" and noted that "operations end when the operator permanently ceases injection of lixiviant and recovery of uranium-bearing solution for processing" (see 80 FR

4160). However, the EPA notes there are periods when the ISR facility is not actively recovering uranium for various reasons (e.g., market conditions), but production is intended to resume when conditions are more favorable. These periods are sometimes referred to as "standby" by operators. In the original proposal, the EPA expressed the view that it would not be appropriate to allow a standby period for ISR facilities if the gradient within the wellfield is not being maintained, and that stopping the extraction cycle should require the operator to enter the restoration phase. Commenters acknowledged that ISR facilities can experience extended periods of standby and noted that active pumping during these periods is necessary to prevent contamination of groundwater in areas outside the production zone. One commenter recommended the EPA minimize the amount of time during which an ISR facility in standby is not pumping. Other commenters thought ISR facilities entering standby should be required to initiate restoration and recommended that the EPA require ISR facilities to commence restoration within a specified time period after ceasing active uranium recovery.

The EPA agrees with the commenters who said ISR facilities must be responsible for ensuring that lixiviant and constituents do not migrate outside of the production zone during standby periods. The EPA disagrees with the commenter who suggested ISR facilities that temporarily cease operations should be required to commence restoration. The EPA agrees, however, that during standby periods the migration of constituents mobilized by the prior injection of lixiviant may continue even if the decision is made to stop extracting uranium. Excursions beyond the production zone are more likely to occur if the hydraulic gradient within the wellfield is not maintained. For this reason, the EPA considers standby to be part of the operational phase, and facilities should not cease pumping during standby periods since it is important that an inward hydraulic gradient is maintained during these periods. For this reason, the EPA is proposing that all requirements applicable to the operational phase remain in effect during these standby periods. Provided the licensee complies with the operational phase monitoring and corrective action requirements in the proposed rule, ISR facilities in standby would not need to enter restoration because groundwater in areas surrounding the production zone will be afforded the same level of

protection as required during restoration. In this proposal, the EPA has revised the definition of “operational phase” in original proposal to clarify that standby mode is considered part of the operational phase and that ISR facilities in standby must maintain appropriate groundwater controls to prevent constituents from leaving the production zone.

#### 2. Changes to the Definition of “Point(s) of Compliance”

As stated in the original proposal, during the restoration phase, the definition of “point(s) of compliance” may include “monitoring, injection, and extraction wells in the production zone” (see 80 FR 4184). Points of compliance during the initial stability and long-term stability phases should include locations within the former production zone, including existing monitoring, injection and extraction wells. To clarify these requirements, in this proposal, the EPA revised the definition of “point(s) of compliance” to indicate that excursion monitoring wells are considered points of compliance during all phases of ISR operation and that during the initial and long-term stability monitoring phases, points of compliance should also include locations, identified by the regulatory agency, where a potential receptor can come into contact with contaminated groundwater. The EPA is specifically requesting comment on the definition of “point(s) of compliance” and how it is applied. Again, the EPA is requesting comment on the definition of point of exposure and conceptual framework for establishing ACLs.

#### IV. Responses to Other Significant Comments That Did Not Result in Changes to the Original Proposal

The EPA carefully reviewed and considered comments from a wide range of different groups in preparing this proposal. As discussed in section III of this preamble, the EPA modified and clarified various aspects of the proposed rule based on the information and views provided, including comments on the original proposal. However, not all comments resulted in modifications to the proposed rule. Those significant comments that did not result in changes, together with the EPA’s responses, are summarized in this section of the preamble.

##### A. Authority To Set Generally Applicable Standards

Some commenters thought the proposed rules were legally invalid and felt the EPA was overreaching its authority under UMTRCA by proposing

standards that are too detailed and prescriptive. The commenters argued the EPA was redefining what UMTRCA established as the EPA’s role to set general standards while making the NRC responsible for implementing those standards through its licensing process. These commenters believe that UMTRCA limits the EPA’s authority to setting general standards that do not include any prescriptive implementation requirements. Some of these commenters cited a statement from the legislative history of UMTRCA in which a House Committee advised that “[t]he EPA standards and criteria should not interject any detailed or site-specific requirements for management, technology, or engineering methods on licensees or the Department of Energy.”

However, other commenters thought the proposal was an appropriate exercise of the EPA’s authority under the UMTRCA because the proposed rule would not supplant the NRC’s jurisdiction or impede its licensing authority. They cited the statutory provisions that assign the authority to set standards to the EPA and the authority to implement and enforce the standards to the NRC (See 42 U.S.C. 2022(b), (d)). The commenters thought the proposed standards were an appropriate application of the EPA’s authority under the UMTRCA and felt that the EPA had correctly left implementation of the new standards to the NRC and Agreement States.

The Agency disagrees with those commenters who believe the EPA has redefined its role or overreached its authority in developing the new standards for ISR facilities. Section 206 of the UMTRCA clearly authorizes the EPA to promulgate standards of general application for the protection of public health, safety and the environment from radiological and non-radiological hazards associated with the processing and the possession, transfer and disposal of byproduct material at uranium ISR facilities. See 42 U.S.C. 2022(b). The Tenth Circuit Court of Appeals affirmed EPA’s authority to set such standards under UMTRCA in two companion cases challenging the original part 192 rules. See *American Mining Congress et al. v. Thomas*, 772 F.2d 617 (10th Cir. 1985) (“*AMC I*”); *American Mining Congress et al. v. Thomas*, 772 F.2d 640 (10th Cir. 1985) (“*AMC II*”). Consistent with the reasoning of these opinions, the new standards proposed in this action would apply the same requirements to all ISR facilities and would establish general requirements to (1) meet constituent concentration standards and demonstrate groundwater conditions are

stable with 95 percent confidence; (2) conduct monitoring; and (3) develop and implement a corrective action program. Within the framework of these generally applicable standards, the regulatory agency would be responsible for implementing the proposed new standards on a site-specific basis through the licensing process and would retain the authority to determine when an ISR license can be terminated. *AMC II*, 772 F.2d at 647–648 (“General application standards that allow the Nuclear Regulatory Commission (NRC) to choose the means of implementation are consistent with the authority Congress vested in the EPA.”).

The first of these three components of the proposed standards has two integral parts—numerical constituent concentration standards and groundwater stability standards. This proposal sets forth minimum requirements for the constituent concentration standards, but implementation of those standards on a site-specific basis remains the responsibility of the regulatory agency. However, a numerical concentration standard by itself is not sufficient to address “the risk to public health, safety, and the environment” that the EPA is required by statute to consider when setting general standards. 42 U.S.C. 2022(b)(1). Since ISR facilities alter the natural groundwater flow, this risk includes the risk that constituent concentrations in the groundwater will not remain the same over time if the groundwater remains unstable. Thus, to address this risk, the proposed rule contains a general requirement to demonstrate that groundwater conditions are stable after production ends at a site. For example, to satisfy the proposed initial stability standards, ISR facilities would provide three consecutive years of quarterly monitoring results demonstrating no statistically significant increasing trends exceeding the constituent concentration standards at the 95 percent confidence level. This proposed requirement to demonstrate groundwater stability is an integral part of the standard. The proposed general standard for stability is defined by a level of statistical confidence that is applicable to all sites. EPA believes this level of statistical confidence is necessary at all sites to ensure that the stability standards are sufficiently stringent to address the risk that groundwater exceeding the applicable constituent concentration standards poses to public health, safety and the environment from ISR facilities that have ceased operation. Contrary to some commenters’ remarks (see Section

IV.D below), the proposal does not include any “detailed or site-specific requirements” regarding how an ISR facility must satisfy the 95 percent confidence level. Hence, these proposed standards lack any “management, technology or engineering methods” pertaining to this confidence level. The proposed stability standards do not prescribe what specific statistical methods, sampling methods, or monitoring equipment should be used to show 95 percent confidence. Such decisions are left to the regulatory agency through its licensing of each facility. The Tenth Circuit has recognized that other provisions with these characteristics are within EPA’s standard-setting authority under UMTRCA. *AMC I*, 772 F.2d at 630 (“Furthermore, because the standards are general in nature—they apply to all sites—we do not view them as site-specific ‘management, technology or engineering methods.’”); *AMC II*, 772 F.2d at 645–646 (“Most of the arguments by the various petitioners are substantially identical to those in the consolidated *Inactive Sites Case* decided this day. On the basis of the analysis in that opinion, we again hold . . . that the EPA’s standards do not unlawfully impose management, design, and engineering requirements. . . .”).

Some commenters argued the long-term monitoring requirements in the original proposal were too prescriptive and that the EPA would be effectively dictating when a license could be terminated. As noted above, the Tenth Circuit has clearly recognized that the EPA’s standard-setting authority under UMTRCA enables the EPA to include monitoring as part of its “standards of general application.” *AMC II*, 772 F.2d at 644 (“The regulations necessitate monitoring programs.”). In affirming the monitoring provisions in the original part 192 rule (monitoring provisions that are very similar to those in this proposal), the Court in *AMC II* readily distinguished between monitoring that is properly included as part of a standard the EPA promulgates and more prescriptive monitoring requirements that should be left to the regulatory agency. *AMC II*, 772 F.2d at 647–648 (“The regulations require the industry to satisfy SWDA drinking water concentration standards at specified distances from the pile, but they do not dictate the kind of monitoring system that must be used or the method by which purity levels must be achieved. These decisions are left to the implementing agency, the NRC.”). The EPA has not included detailed

monitoring requirements in these proposed standards (e.g. what kind of monitors to use), but has instead left those details up to the review and approval of the NRC or the Agreement State.

Several comments were also critical of the EPA’s authority to require corrective action programs. While the term “standard” includes numerical limitations, such as the concentration-based limits for the listed constituents in groundwater, the EPA has long interpreted this term to also encompass the actions a source must take to reduce, remediate or otherwise avoid release of pollutants. The EPA notes that the existing rule, in subpart D, includes similar non-numerical standards to those included in this proposed rule. For example, 40 CFR 192.32(a)(2)(iii) requires affected sources to implement detection monitoring programs, while 40 CFR 192.32(a)(3)(i) requires uranium mill tailings piles or impoundments to have a permanent barrier.

In sum, the regulatory agency must determine the constituent concentration standards applicable to each site, approve the number, location, and installation of all wells used for monitoring, and determine when the initial and long-term stability standards are satisfied. See *AMC II*, 772 F.2d at 647–648 (Court affirms standards because “they do not dictate the kind of monitoring system that must be used or the method by which purity levels must be achieved. These decisions are left to the implementing agency, the NRC.”) The regulatory agency is also responsible for approving the licensee’s corrective action program and, when an excursion has occurred, determining when corrective action should begin and when it can cease. The regulatory agency may also bring enforcement actions against any non-compliant ISR facility. Thus, as required by UMTRCA, and consistent with the case law affirming the EPA’s previous part 192 rulemakings, the implementation and enforcement of the proposed new standards remain with the regulatory agency.

#### *B. Need for New Standards for Uranium ISR Facilities*

Several commenters concurred with the EPA’s assessment that new standards are necessary for ISR facilities. These commenters noted that environmental impacts from ISR are significantly different from the impacts of conventional mining and milling. Commenters supported the EPA’s conclusion that a more rigorous approach is warranted for determining background groundwater

concentrations. They considered the preoperational monitoring requirements as necessary to establish appropriate concentration-based standards for each ISR facility. They also supported the stability-phase monitoring, which they considered important for demonstrating groundwater stability after restoration and for providing assurance groundwater quality will not degrade over time and that constituent migration will not occur in the future. One commenter felt that more rigorous standards with detailed restoration and long-term stability demonstrations were necessary to bring “coherency and accountability” to ISR facilities. However, other commenters thought the rule was unnecessary and provided a variety of reasons to support their contentions. Most commenters felt the standards were not justified because the industry was already regulated, arguing that the EPA had failed to provide or quantify sufficient evidence that ISR poses a risk, or had failed to consider relevant data. A number of commenters asserted that EPA had not adequately addressed recommendations of the Agency’s SAB. Many commenters noted that ISR facilities are already regulated by the EPA, the NRC, and states, and that the success of the existing regulatory oversight over the last 40 years proved that further regulation was not needed. In support of their statements, these commenters stated that there were no documented cases of off-site contamination of drinking water supplies from ISR activities in the United States. Other commenters noted that the new standards were unnecessary because ISR facilities are located in exempted aquifers under the SDWA in 40 CFR 146.4 and cannot serve as sources of drinking water because the EPA has already determined the water is unsafe for human consumption. One commenter stated that the SDWA UIC program has requirements prohibiting injection of fluids where production fluids could migrate into non-exempt aquifers and stated that these existing requirements were sufficient to protect groundwater. Other commenters argued the regulations were unnecessary because ISR facilities already collect background water quality data, restore groundwater impacted during recovery, and monitor for stabilization after restoration under the existing regulations. Some commenters felt the migration of uranium from ISR facilities was unproven. These commenters cited papers they said showed uranium had

not migrated from ISR facilities.<sup>17</sup> A few commenters recommended the EPA postpone promulgation of the rule until additional research could be completed and the health and environmental risks better understood.

The EPA disagrees with commenters who contend that new standards are unnecessary. First, it is in the national interest to protect groundwater resources. Water is becoming a scarce resource, particularly in the arid regions where most ISR currently operate. Groundwater in this region is not exclusively used for human consumption, and has other uses such as livestock production, crop irrigation, and wildlife support. The best way to preserve groundwater for all such uses is to prevent contamination by addressing the source of contamination. The SDWA UIC program plays an important role in protecting underground sources of drinking water. However, as discussed in section I.A. above, the scope and level of protection of the SDWA differs from the UMTRCA. The SDWA does not prevent recovery and use of the water within exempted aquifers (including where ISR operations were previously conducted) for private drinking water supply, public water supply, or other uses. UMTRCA provides authority that can be used to require restoration of the groundwater in the production zone and to protect the groundwater outside the production zone aquifer, during and after uranium recovery operations, regardless of whether the aquifer has been exempted from the protections of the SDWA.

Thus, this proposed rule under UMTRCA is needed to establish generally-applicable groundwater standards for ISR facility restoration and require more extensive monitoring, modeling and analysis to ensure that groundwater restoration will endure. ISR alters the chemical composition of groundwater and creates reasons to be concerned about risk of mobilization of constituents. The EPA notes that several NRC-regulated sites are continuing to work toward restoring groundwater with restoration and monitoring being conducted for as long as 10 years after

ceasing production.<sup>18</sup> In addition, restoration does not always meet original background levels as evidenced by the number of restoration goals above background or Table 1 levels.<sup>19</sup> In addition, the NRC acknowledges that efficiency could be gained by codifying its longstanding effective regulatory regime into regulations specific to ISRs. As described in the original proposal, this rulemaking was initially prompted by the NRC's conclusion that ISR-specific rules are needed to create a more workable and sustainable regulatory framework for this activity, and is not based on any specific instances of identified contamination.<sup>20</sup> The EPA considers the approach to protecting groundwater in this proposal to be reasonable and responsible. The EPA further notes that remediation of contaminated groundwater is more expensive and difficult to achieve than for surface waters because it is not easily accessible. It is more cost-effective to prevent contamination by ISR facilities than to clean it up after wide-spread contamination occurs.

Second, the information the EPA has reviewed indicates that current industry practices for restoration and monitoring of the affected aquifer may not be adequate to prevent degradation of water quality at ISR facilities or the more widespread contamination of surrounding groundwater that is suitable for human consumption. Historically, once restoration is halted, stability demonstrations at ISR facilities are typically conducted for only a short period, which may not be adequate to determine that restoration is complete and long-term stability established. Several instances are noted in section III.F.2 where facilities have monitored for lengthy periods after restoration was deemed to be complete, but have not been able to demonstrate stability for even the more limited times typically required under current practice. The initial and long-term stability monitoring and corrective action program included in the new proposed rule would provide greater confidence that both of these requirements are met before ISR facilities can be decommissioned.

Finally, the EPA considers the existing regulations at 40 CFR part 192

to be inadequate for addressing groundwater contamination from ISR facilities. Subparts A, B and C of 40 CFR part 192 apply to inactive uranium milling facilities, vicinity properties, and depository sites (*i.e.*, Title I sites). Only subpart D is applicable to active uranium processing and disposal sites; however, subpart D primarily targets conventional milling as it contains provisions for managing uranium byproduct materials during and following the processing of uranium ore and for the restoration of disposal sites. Although the standards in subpart D applied to ISR facilities, ISR was not the predominant uranium extraction method at the time the standards were promulgated. ISR differs significantly from conventional mining and milling and consequently presents different environmental concerns from those of conventional mining and milling operations. For example, ISR does not generate large volumes of solid waste materials or require permanent tailings impoundments as does conventional mining and milling. At ISR facilities, the groundwater is directly impacted by the injection of lixiviant into the aquifer, which alters the geochemistry of the ore-bearing formation and increases the concentration of radionuclides and other metals in the water. The purpose of restoration activities is to restore the groundwater to the applicable constituent concentration standards. Although subpart D addresses contamination of aquifers, it explicitly addresses only contamination resulting from releases from uranium mill tailings impoundments used to store uranium byproduct material (*e.g.*, conventional tailings impoundments, evaporation or holding ponds). Under subpart F, the operator would be required to restore the groundwater in the production zone aquifer and surrounding aquifers to the applicable constituent concentration standards, to the extent possible, and to show some level of stability in the production zone prior to terminating the license. Because ISR changes the geochemistry of the groundwater, more rigorous stability-based standards together with corrective action programs are necessary to ensure that the production zone is restored and that restoration will persist in the future.

Regarding comments that the EPA did not request or collect data from industry, the Agency disagrees. The EPA has appropriately considered available data to support its proposed rules and requested additional data from industry. During the SAB's public teleconferences in 2011, industry stakeholders stated that additional data

<sup>17</sup> The commenter cited the following two papers: (1) Basu, Anirban, et al., "Isotopic and Geochemical Tracers for U(VI) Reduction and U Mobility at an In Situ Recovery U Mine", *Environmental Science Technology*, April 24, 2015, 49(10), pages 5939–5947; and (2) Reimus, Paul, "Field Evaluation of the Restorative Capacity of the Aquifer Down Gradient of a Uranium In Situ Recovery Mining Site" presented at the "2015 In situ Recovery of Uranium Research Symposium" held at the University of Wyoming, Laramie, Wyoming, April 21, 2015.

<sup>18</sup> EPA (2016), "Considerations Related to Post Closure Monitoring of Uranium In-Situ Leach/In-Situ Recovery Sites", available in Docket ID No. EPA-HQ-OAR-2012-0788.

<sup>19</sup> *Ibid.*

<sup>20</sup> NRC (2006), "Regulation of Groundwater Protection at In-Situ Leach Uranium Extraction Facilities," COMJSM-06-001, January 17, 2006; <http://www.nrc.gov/reading-rm/doc-collections/commission/comm-secy/2006/2006-0001comjism.pdf>.

was available beyond that contained in EPA's draft report. The EPA requested this information from the National Mining Association in January 2012; however, the EPA found that the data provided by NMA had already been considered by the EPA. The EPA also provided an additional 60 days for public comment on the original proposal for industry stakeholders to provide additional data. While the data did in some cases appear to involve longer-term monitoring at some sites, the information was largely piecemeal and lacking in context. Consequently, the EPA did not find this information useful.

The EPA further believes the commenters have misinterpreted the SAB recommendation to constructing a database to support modeling and build an evidence base for EPA's rulemaking. In section 3.2, page 8, the SAB discusses the development of such a database. However, in section 3.3, the SAB goes on to recommend that "for the near term, *until the needed large evidence base is accumulated and systematized*, that the EPA [should] articulate a set of guiding principles and assumptions on which to base regulations. The proposed standards *can be based on these assumptions during the next several years*, and superseded if evidence of their unsuitability becomes available." (emphases added). The SAB clearly did not intend for EPA's rulemaking to be held in abeyance until all available data had been collected, systematized, and analyzed. Rather, the SAB viewed this as a longer-term effort in which EPA's standards could be modified should the underlying assumptions not be supported by additional data. Further, because of the limited long-term data available for sites once they have been deemed "stable," which the SAB members recognized during the July 2011 meetings, in EPA's view this necessarily involved a period during which EPA's standards would be effective and require collection of such longer-term data.

However, as mentioned earlier, given the concern about data collection and the comments concerning lack of state data, the EPA will consider additional data collection and analysis, including review of affected state regulatory programs. The Agency also takes issue with some comments characterizing the UIC program requirements. An aquifer exemption is not a judgment that the water is unsafe for human consumption. In most, if not all, cases, an ISR facility is provided with an aquifer exemption solely because of the presence of uranium that is economically producible. Further, while the UIC

program objective is to prevent endangerment of USDWs, it is the responsibility of the permittee to operate in a manner that does not allow production fluids to migrate into non-exempt aquifers. 40 CFR 144.12(a).

### C. Applicability

Consistent with the original proposal, this proposed rule does not apply to licensed ISR facilities that are engaged in restoration, initial stability monitoring, or long-term stability monitoring. However, some commenters stated that the original proposed rule should not apply to existing ISR facilities that are currently operating. These commenters noted that it was not clear how an existing ISR facility would comply with the proposed rule for ISR wellfields that are already in the operational, restoration or stability monitoring phase. Commenters stated that preoperational background water quality would have already been established for operational wellfields, but the methods used to establish the background concentrations may not be consistent with the requirements in the proposed rule. They noted that it would not be possible to resample for background water quality for operating wellfields since the aquifers have already been changed by uranium recovery operations.

The EPA sees no need to omit existing ISR facilities from this rule due to preoperational considerations. The NRC already requires ISR facilities to establish background conditions prior to beginning operation under 10 CFR part 40, Appendix A, Criterion A. Under this NRC guideline, an ISR facility must implement a preoperational monitoring program that provides complete baseline data on the facility and its surrounding area. In addition to the NRC guidelines, ISR facilities conduct studies of the ore zone prior to beginning production to collect data necessary for designing the ISR facility. Although the most appropriate monitoring would consist of a statistically representative sample of wells spatially distributed throughout the wellfield, the EPA recognizes that operating facilities cannot collect unaffected background samples at ISR facilities that are already operating. However, facilities that are already operating, but have not yet entered the restoration phase, can use the background data they collected prior to operation to set their constituent concentration standards. Even with limited data, existing ISR facilities can analyze the preoperational data they collected and develop a statistically meaningful data set to use as the basis

for the constituent concentration standards and also define other aspects of the system, such as the flow regime, that are necessary to develop site models. Selecting high or the highest values of the chemical monitoring data would not be considered an appropriate basis for establishing background conditions. Further the collection of data to demonstrate stability would be essentially the same for all facilities.

### D. The 95 Percent Confidence Level

The original proposed rule contained a requirement to gather monitoring data sufficient to demonstrate the stability of groundwater with 95 percent confidence. Some commenters thought the 95 percent confidence level was too restrictive. These commenters stated that the EPA did not address properly the cost, both in dollars and water resources, required to achieve a 95 percent confidence level. Some of these commenters misinterpreted the 95 percent confidence requirement as a restoration goal requiring the constituent concentrations to be reduced by 95 percent, rather than a level of confidence in the statistical tests used to assess stability. Most commenters thought the 95 percent confidence level was too high, while a few thought it was too low. A few comments addressed the general requirements to demonstrate that the hydrogeological and geochemical properties have been returned to preoperational condition and expressed concern the 95 percent confidence level would be required for the statistical tests. Many of these comments indicated a concern with the high variability of these properties at ISR facilities. Concerns were raised that many of the ionic species are reported in the parts per billion and parts per million concentrations and duplication of analysis on the same sample can vary a few parts per million when samples are rerun.

Some commenters thought that the original proposed rule was not sufficiently prescriptive. Several commenters expressed concern with the statistical tests recommended for detecting trends and for the comparison with baseline values. These commenters noted that important details required to implement the statistical tests are not provided in the proposed rule, including whether the statistical analysis is conducted for the well field as a whole, within clusters or well-by-well; what parameter should be tested; and what requirements there are for the tests, particularly for the trend test.

This proposal retains a 95 percent confidence level but makes it clear that

this is part of the generally applicable stability standard in both the initial and long-term stability phases. The 95 percent confidence level is used to define stability, and EPA considers a confidence level a measure of stringency of the standard. This is one approach for defining stability, but not necessarily the only approach. However, the EPA is concerned that a stability standard that lacks any statistical criterion would provide insufficient assurances that full restoration has been achieved and allow stringency of the standard to vary from site-to-site, thus failing to fulfill EPA's obligation to produce standards of general application. See *AMCI*, 772 F.2d at 638–639 (finding the EPA failed to specify generally applicable standards by directing the regulatory agency to determine standards that could vary on site-specific basis). The EPA requests comment on alternative approaches that would present a rigorous benchmark against which to measure and ensure stability.

The 95 percent confidence criterion would apply for all constituents. The proposed standards to demonstrate initial and long-term stability with 95 percent confidence would be applied after restoration has been completed to confirm that the restoration was successful and likely to persist. Again, the EPA requests that commenters share examples where the 95 percent confidence level cannot be used or met and the limitations of these examples and the Agency invites commenters to propose other options that would clearly represent a valid and explicit groundwater stability standard that includes a measure of stringency.

The EPA understands that NRC staff has attempted to use the 95 percent confidence level for at least one facility (see the NRC presentation in the BID) but has concerns about its use in every case. The Agency considered changing the level of confidence, however the 95 percent confidence level is the standard used under other regulatory programs, including the EPA's hazardous waste program. It is a widely accepted standard used across many industries that must monitor groundwater. Again, the EPA requests comment on the use of the 95 percent confidence level as part of the stability standard and whether there are better or more practical ways to word the standards such that they present a clear level of stringency.

The costs of conducting the statistical tests are related largely to the number of wells monitored and the duration and frequency of baseline and post-restoration monitoring. These costs are not related to the dollar and resource costs of restoration. The EPA recognizes

there is a trade-off between the cost of additional monitoring and the level of confidence achieved in the confirmatory statistical tests. Due to the high variability in hydrogeological and geochemical properties it may be necessary to do more monitoring to compensate for the higher variability.

While the proposed initial and long-term stability standards define stability as attaining 95 percent confidence, the methods to be used to demonstrate compliance would be determined by the regulatory agency. The BID<sup>21</sup> provides suggested sampling plans for stability monitoring that include instructions for applying the parametric and nonparametric statistical tests to detect trends and for comparing with baseline values. Each statistical test has its own set of parameters, null and alternative hypotheses, decision rules and underlying assumptions about the data. However, it was not the intention of the EPA to provide detailed instructions for conducting the statistical tests in the rule. The licensee would be responsible for selecting the specific statistical test to be used for stability monitoring and comparisons with the baseline values. EPA expects that the regulatory agency would provide additional guidance regarding the statistical analysis required and the reasons for using the statistical test, the concepts of Type 1 and Type 2 errors, the calculations required to perform the test, and how test results are interpreted. Information about what parameter is tested, the null and alternative hypotheses, requirements for implementing the statistical tests and tables for interpreting test results is included in the BID. Decisions concerning whether the statistical analyses are conducted for the well field as a whole, within clusters, or well-by-well would remain a responsibility of the regulatory agency.

## V. Summary of Environmental, Cost and Economic Impacts

### A. Environmental Impacts of the Proposed Rule on Groundwater Quality

This proposed action reduces the risk of undetected contamination of groundwater resources surrounding ISR facilities both during uranium production and after production has ceased. During uranium production, the fluids injected to mobilize uranium change the chemistry of the aquifer from its original state, thereby mobilizing uranium and many other minerals and metals. Groundwater from the ISR

production zone can migrate from the production zone and contaminate nearby groundwater with arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, nitrate, molybdenum, radium and uranium and other constituents. The new standards proposed in this action would reduce the risk of groundwater degradation both during the ISR operational phase and after an ISR operator's license is terminated and the facility is closed. This would be achieved through provisions requiring characterization of groundwater prior to uranium recovery and standards set to protect groundwater from excursions during the operational phase and standards for restoration to pre-operating conditions and stability after the operational phase ends. These proposed requirements would significantly reduce the probability that groundwater down-gradient from an ISR facility will become contaminated by radiological and non-radiological constituents. Through monitoring and corrective action programs, the new proposed standards would ensure potential excursions are detected and remedied in a timely manner. The proposed initial and long-term stability standards would ensure the ISR aquifer is stable prior to closure, reducing the potential for contamination to occur after uranium recovery has ceased and the ISR facility's operating license has been terminated following closure.

### B. Incremental Costs of Complying With the Proposed Rule

Using information on the uranium extraction industry, the EPA estimated incremental costs resulting from this proposal. Under this proposal, ISR facilities would be required to complete the following additional activities: (1) A comprehensive preoperational characterization of the area (including characterization of geochemical conditions); (2) monitoring for excursions during the operational and restoration phases; (3) three years of initial stability monitoring; and (4) long-term stability assessment, with a minimum of three years of additional monitoring, with the total duration of the long-term stability monitoring determined by the regulatory agency based on modeling and monitoring of geochemical conditions.

Incremental costs attributable to the proposal are costs that would be higher under the proposal than they would be if 40 CFR part 192 was not revised. If no revisions were made to 40 CFR part 192, ISR facilities would be required by the NRC or agreement states to characterize preoperational conditions,

<sup>21</sup> EPA (2016), "Considerations Related to Post Closure Monitoring of Uranium In-Situ Leach/In-Situ Recovery Sites", available in in Docket ID No. EPA-HQ-OAR-2012-0788.

monitor for excursions during operational and restoration phases, and monitor after restoration to show that conditions are stable. The EPA consulted with the NRC to ensure that its characterization of compliance requirements in the absence of the rule accurately reflected current trends in the NRC's permit requirements. To estimate incremental costs of complying with the proposed rule, the EPA estimated the costs of complying with the proposal and then subtracted the costs of complying with the NRC's requirements in the absence of the rule. EPA requests comment on this approach.

Under the proposal, the EPA estimates that ISR facilities would incur higher costs, for several reasons: (1) More monitoring wells would be required under the proposal; (2) more constituents would be monitored under the proposal; and/or (3) monitoring during the preoperational and stability phases would be required to continue for a longer period of time under the proposal. In addition, because the overall duration of monitoring prior to closure and license termination would be longer under the proposal, other non-monitoring costs would be incurred for several additional years, compared to requirements in the absence of the proposal.

To estimate the incremental costs for complying with these additional proposed requirements, the EPA used ISR operations listed by the U.S. Energy Information Administration as likely affected ISR operations and a projected 2017 ISR uranium production of 3.3 million pounds. From this analysis, the EPA estimated low, average and high incremental costs of complying with the proposal; average incremental costs of complying with the proposal at approximately \$1.96 per pound of uranium and an annual cost of \$181,000 to \$6.4 million for firms owning ISR facilities, depending on the number and scale of the ISR facilities they own. Nationally, the EPA estimates the incremental total annual cost of the proposal to be approximately \$11.9 million, including incremental annualized capital costs and monitoring costs (\$4.3 million) and incremental annual non-monitoring costs (\$7.6 million). The EPA's estimated national incremental annualized costs for the original proposed rule totaled \$13.5 million for monitoring and capital costs alone. Since the original proposal, the EPA learned from discussions with the NRC that many of the monitoring requirements of the proposed rule (and also those of the proposal) would already be embodied in expected NRC

license requirements in the absence of the proposal. In addition, the EPA revised some of the rule's requirements to increase flexibility and reduce burden. For these reasons, the difference between the monitoring requirements and costs for the proposal and those for current practice (the incremental monitoring costs of the proposal) are estimated to be considerably lower than the estimates for the proposed rule. This reduction in incremental monitoring costs is largely offset by including, in response to public comment, estimated incremental non-monitoring costs). Overall, the EPA's estimate of incremental annualized costs of complying with the proposed rule is slightly lower than the costs estimated for the original proposal. For additional information regarding the methodology used to estimate the costs, see the technical document titled, "Economic Analysis: Revisions to the Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings Rule (40 CFR part 192)" available in Docket ID No. EPA-HQ-OAR-2012-0788.

### *C. Economic Impacts of the Proposed Rule on the Market for Uranium and the Uranium Industry*

The EPA estimated the impact of the proposal on the market for uranium using a simplified model of the U.S. market for uranium in 2017, using 2015 market quantities as a proxy for market quantities in 2017. EPA requests comment on this approach. The partial equilibrium model of the U.S. uranium market estimated market impacts and revealed the following: (a) Changes in the quantity of uranium purchased by U.S. COOs of nuclear power plants; (b) changes in the sales of domestically produced uranium and imports; and (c) changes in the market price for uranium. Based on average incremental costs of complying with the proposal, the EPA found that the market quantity of uranium purchased for use in electric generation is expected to decline by less than 0.01 percent and the market price to increase by approximately 0.2 percent. Domestic ISR facilities are projected to decrease their production by approximately 6.7 percent, and imports of uranium are expected to increase by 0.4 percent. Because the cost of uranium is a very small share of the cost of electricity, the EPA estimates that the cost of generating electricity will likely increase by less than 0.1 percent due to this action. Although the national total annual cost of the proposal (approximately \$11.9 million, based on average costs) is well below the \$100 million threshold that is one of

the criteria used to identify a significant regulatory action, the industry has only a small number of companies operating a small number of ISR facilities.

The EPA used existing and planned ISR operations and the companies that own them as models for the types of facilities and companies affected by the proposal. This proposal would affect approximately 15 ISR facilities that are currently operating or may operate in the near future. The 15 ISR facilities are owned by 9 firms. This action would apply to the following ISR facilities identified by the Energy Information Administration in 2015 as either operating, permitted and licensed, developing, or partially permitted and licensed: (1) Crow Butte (Nebraska) and (2) Smith Ranch-Highland (Wyoming), both owned by Cameco Resources; (3) Alta Mesa (Texas), and (4) Nichols Ranch (Wyoming) both owned by Energy Fuels; (5) Willow Creek, (6) Jab and Antelope, and (7) Moore Ranch (Wyoming), all owned by Uranium One/Rosatom; (8) Hobson-La Palangana and (9) Goliad (Texas), both owned by Uranium Energy Corp.; (10) Lost Creek (Wyoming), owned by Ur-Energy Inc.; (11) Church Rock and (12) Crownpoint (New Mexico), both owned by Laramide; (13) Reno Creek (Wyoming), owned by Bayswater; (14) Dewey Burdock (South Dakota), owned by Azarga Uranium Corp.; and (15) Ross (Wyoming), owned by Peninsula Energy. Three other ISR projects (Kingsville Dome, Rosita, and Vasquez, owned by Uranium Resources, Inc.) are out of scope for the analysis because they are undergoing restoration or reclamation as of 2015. Using the Small Business Administration size standard for NAICS code 212291 (*i.e.*, fewer than 250 employees) all the parent company firms except Cameco Resources and Rosatom/Uranium One Americas, Inc. qualify as small businesses. Thus, the majority of the firms in NAICS 212291 are small firms.

To evaluate the magnitude of the economic impacts of the proposed revisions to 40 CFR part 192 on firms owning ISR facilities, the EPA estimated the incremental costs that would be incurred by affected facilities including both monitoring and non-monitoring costs, summed costs to the firm-level, and compared each firm's estimated costs to estimated or reported firm revenues. EPA requests comment on this approach.

Compiling these estimated costs at the parent company level and comparing them to estimated sales or reported sales for the parent company, average estimated annualized costs would range from 0.66 percent to 2.78 percent of



average company sales for the seven small businesses, and 0.2 percent and 2.6 percent for the two large businesses. Of the seven small businesses, one firm has cost-to-sales ratio below 1 percent, three firms have cost-to-sales ratios between 1 percent and 2 percent, and three have cost-to-sales ratios between 2 percent and 3 percent. The EPA's estimated costs may overstate actual annual costs, especially for ISR facilities with large acreage, because the cost estimates are scaled based on the entire wellfield acreage, while ISR facilities typically have some wellfields in the operational phase and others in various stages of development and restoration or reclamation. Average costs based on total acreage may overstate costs incurred at some times during the life of the project. Further, the EPA included costs associated with all phases of operation for all ISR facilities; this would overstate costs for all wellfields currently operating, because it includes costs for preoperational monitoring and assessment. In addition, the EPA assumed that all ISR facilities would monitor for all Table 1 constituents during all phases of monitoring; in fact, the regulatory agency may specify monitoring for only those constituents expected to be present based on preoperational monitoring, which would reduce costs. While some costs may have been over-estimated, the EPA considers that values for firm revenues may be under-estimated. For facilities for which the EPA estimated sales revenues, the EPA assumed that production equaled 25 percent of capacity (based on average levels of capacity utilization over the period 2011 to 2015, which is a period with relatively low production). The EPA multiplied these relatively low estimated production values times market price to estimate revenue. For firms for which the EPA used 2015 reported revenues, these revenues similarly represent a time period when both production and price are lower than usual. Thus, the EPA may have underestimated the revenues ISR firms may earn in the future. Because no small firms incur costs exceeding 3 percent of sales, and because the costs may be overestimated while the future revenues underestimated, the EPA concludes that the proposal will not result in a significant impact to a substantial number of small entities. In addition to the direct economic impacts on ISR producers, the proposal may have indirect impacts on businesses that supply inputs to ISR producers (supply chain impacts), businesses located in areas near ISR facilities (consumption

impacts), and local governments in those areas (revenue impacts). Some businesses and governments potentially indirectly affected by the proposal may be small entities. EPA's analysis projects that the costs of the proposal and direct impacts on ISR producers will generally be small; indirect impacts are typically smaller than direct impacts. Thus, the EPA projects that indirect impacts of the proposal would generally be small. Details of the economic analysis are presented in the technical document titled, "Economic Analysis: Revisions to the Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings Rule (40 CFR part 192)" available in the docket for this action. EPA requests comment on the economic analysis.

#### *D. Benefits of the Proposed Rule*

The EPA has conducted a qualitative assessment of the benefits of the proposal and has identified three principal benefits. First, the proposed rule would reduce the potential human health risks associated with human exposure to radionuclides, metals and other constituents in well water used for drinking and agriculture. The EPA considers water contaminated with radionuclides to be a potential pathway for exposure to radiation that can cause cancer and other health effects (*e.g.*, kidney damage). Likewise, heavy metals and other contaminants can cause cancer and/or non-cancer health effects. By reducing the potential for contaminants to migrate into aquifers adjacent to ISR facilities, the proposal would reduce the potential human exposure to radionuclides, heavy metals and other groundwater contaminants from ISR operations and thus reduces the potential human health risks from these contaminants.

Second, the proposal would protect valuable groundwater resources for future generations. Groundwater provides a valuable resource that is increasingly threatened by population growth and technological advances that have significantly increased groundwater extraction. Declining groundwater resources, especially in arid regions where ISR operations are mostly located, are a growing concern. Although the EPA is unable to quantify the value of the groundwater resources that would be protected by the proposal, groundwater resources are likely to become more valuable over time. By reducing the potential for groundwater contamination and ensuring that any migration of constituents from ISR operations is detected early, the proposal would help protect groundwater from contamination. Rapid

detection of constituent migration from an ISR operation reduces the overall amount of contamination that must be remediated; early detection can trigger corrective action before a contaminated plume migrates into overlying and underlying aquifers and in areas located down-gradient from ISR facilities, thus reducing the risk of exposure to hazardous constituents. Reducing the risk of contamination of groundwater also protects the surface water bodies to which affected aquifers discharge. By combining sufficient duration of stability monitoring with hydrogeological and geochemical modeling and other analyses to demonstrate that groundwater constituent concentration standards will continue to be met, the proposal would reduce the risk that such migration of constituents above constituent concentration standards might occur after the ISR site is decommissioned and its license terminated.

Finally, the proposed standards would reduce or avoid the costs of remediating contaminated groundwater by reducing the potential for groundwater contamination to occur and by causing any contamination that does occur to be discovered and remedied sooner than would be the case if the new standards were not issued. The costs incurred for cleaning up a plume of contamination may be significant. To illustrate the potential magnitude of the benefits associated with reduced or avoided remediation costs, the EPA compared remediation costs for a model facility under two scenarios: One without the proposed rule and one with the proposed rule. The difference in the total pump and treat remediation under the two scenarios illustrates the cost savings that could result from the rule for this hypothetical contamination episode. Using this approach, the EPA was able to illustrate the benefits of the proposed rule to be between \$23.7 million and \$608 million in avoided remediation costs over the entire remediation period for a single plume, including capital/well development costs and annual costs. The EPA was unable to estimate the potential avoided costs of remediation that would result from the proposed rule on a national scale because the EPA could not predict the number of incidents of groundwater contamination that would require remediation with and without the rule, or how long it would take for the groundwater contamination to be detected. However, the avoided remediation costs of this rule at the national level could be substantial based

on the estimated avoided remediation costs for a single model plume. The EPA requests comment on this approach. For additional information regarding the methodology used to estimate avoided costs, see section 4.2.3 in the document titled, "Economic Analysis: Revisions to the Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings Rule (40 CFR part 192)." available in Docket ID No. EPA-HQ-OAR-2012-0788.

## VI. Statutory and Executive Order Reviews

### A. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review

This action is a significant regulatory action that was submitted to the OMB for review. This action is considered a significant regulatory action because it may "raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order." Accordingly, the EPA has described the need for the proposal, prepared an economic analysis of the potential costs and benefits associated with this action, considered non-regulatory approaches, and submitted the rule to OMB for review. The economic and benefits analysis is contained in the document "Economic Analysis: Final Revisions to the Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings Rule (40 CFR part 192)," December 2016, available in the docket for this action. Any changes made in response to OMB recommendations have been documented in the docket.

### B. Paperwork Reduction Act (PRA)

This action does not impose an information collection burden under the provisions of the PRA because it does not impose any reporting requirements on affected facilities.

### C. Regulatory Flexibility Act (RFA)

I certify that this action will not have a significant economic impact on a substantial number of small entities under the RFA. The small entities subject to the requirements of this action are small businesses with fewer than 250 employees that are primarily engaged in leaching or beneficiation of uranium, radium or vanadium ores as defined by NAICS code 212291. No small organizations or small governmental entities have been identified that would be impacted by this proposed rulemaking.

The Agency has determined that the seven small firms owning ISR facilities may experience an impact to average estimated annualized costs of between 0.66 percent and 2.78 percent of average company sales, with one firm expected to have a cost-to-sales ratio of below 1 percent, three firms between 1 percent and 2 percent, and three between 2 percent and 3 percent. Details of this analysis are presented in the technical document titled, "Economic Analysis: Revisions to the Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings Rule (40 CFR part 192)," December 2016, available in the docket for this action.

### D. Unfunded Mandates Reform Act (UMRA)

This proposed action does not contain an unfunded mandate of \$100 million or more as described in the UMRA, 2 U.S.C. 1531-1538, and does not significantly or uniquely affect small governments. The action imposes no enforceable duty on any state, local or tribal governments or the private sector. This action contains no regulatory requirements or obligations that apply to small governments.

### E. Executive Order 13132: Federalism

This proposed action does not have federalism implications. It will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government.

### F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

This proposed action does not have tribal implications, as specified in Executive Order 13175 (65 FR 67249, November 9, 2000). The action imposes requirements on licensees of ISR facilities and not on tribal governments. Thus, Executive Order 13175 does not apply to this action.

Consistent with the EPA Policy on Consultation and Coordination with Indian Tribes, the EPA solicited and considered information submitted by tribal officials during the development of this action.

### G. Executive Order 13045: Protection of Children From Environmental Health Risks and Safety Risks

This proposed action is not subject to Executive Order 13045 because it is not an economically significant regulatory action as defined by Executive Order 12866. This action's health and risk

assessments are contained in the document titled "Ground Water Modeling Studies at In-Situ Leaching Facilities and Evaluation of Doses and Risks to Off-Site Receptors from Contaminated Ground Water" available in Docket EPA-HQ-OAR-2012-0788. The EPA evaluated several regulatory strategies for assuring groundwater restoration and stability at ISR facilities and selected the option providing greatest assurance that groundwater systems will remain in a chemically reduced state. By setting new groundwater standards, which include improved monitoring and requirements to plan for and implement corrective measures for excursions and exceedances, this proposed rule reduces children's risk of exposure to contaminated groundwater.

### H. Executive Order 13211: Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution or Use

This proposed action is not a "significant energy action" because it is not likely to have a significant adverse effect on the supply, distribution or use of energy. This action proposes standards applicable for uranium ISR facilities that do not directly impact energy supply, distribution or use. The proposed rule would increase the costs of domestic uranium producers relative to foreign producers; however, because domestic-source uranium generally constitutes between 10 percent and 15 percent of total uranium purchased by COOs of nuclear power plants, the EPA does not expect the proposed rule to have a significant impact on uranium quantities or prices available to nuclear power generators, and essentially no impact on the quantity or price of electricity. Thus, the EPA has concluded that this proposed action is not likely to have any adverse effects on productivity, competition, or prices in the energy sector.

### I. National Technology Transfer and Advancement Act

This proposed rulemaking does not involve technical standards.

### J. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations

The EPA believes that this proposed action does not have disproportionately high and adverse human health or environmental effects on minority populations, low-income populations or indigenous peoples, as specified in Executive Order 12898 (59 FR 7629, February 16, 1994).

The documentation for this decision in contained in the document titled "Ground Water Modeling Studies at In-Situ Leaching Facilities and Evaluation of Doses and Risks to Off-Site Receptors from Contaminated Ground Water" available in Docket EPA-HQ-OAR-2012-0788. The proposed rule will reduce exposure to all populations by setting new groundwater standards, which include improved monitoring and requirements for planning for and implementing corrective measures when excursions and exceedances occur at ISR facilities. By increasing the level of environmental protection for all affected populations, including minority and low-income populations, this action will have a positive impact on human health and the environment.

List of Subjects in 40 CFR Part 192

Environmental protection, Hazardous substances, Radiation protection, Radioactive materials, Reclamation, Uranium, Waste treatment and disposal, Water resources.

Dated: January 3, 2017.

Gina McCarthy, Administrator.

For the reasons stated in the preamble, title 40, Chapter I of the Code of Federal Regulations is proposed to be amended as set forth below:

PART 192—HEALTH AND ENVIRONMENTAL PROTECTION STANDARDS FOR URANIUM AND THORIUM MILL TAILINGS

1. The authority citation for 40 CFR part 192 continues to read as follows:

Authority: Sec. 275 of the Atomic Energy Act of 1954, 42 U.S.C. 2022, as added by the Uranium Mill Tailings Radiation Control Act of 1978, Pub. L. 95-604, as amended.

Subpart C—Implementation

2. Section 192.20 is amended by revising paragraph (b)(3) as follows:

§ 192.20 Guidance for implementation.

(b) (3) Compliance with § 192.12(b) may be demonstrated by methods that the Department of Energy has approved for use or methods that the implementing agencies determine are adequate. Residual radioactive materials should be removed from buildings exceeding 0.03 WL so that future replacement buildings will not pose a hazard [unless removal is not practical, see § 192.21(c)]. However, ventilation devices and other radon mitigation methods recommended by the EPA may provide reasonable assurance of reductions from

0.03 WL to below 0.02 WL. In unusual cases, indoor radiation may exceed the levels specified in § 192.12(b) due to sources other than residual radioactive materials. Remedial actions are not required in order to comply with the standard when there is reasonable assurance that residual radioactive materials are not the cause of such an excess.

Subpart D [Amended]

3. The heading for Subpart D is revised to read as set forth below. 4. Section 192.31 is amended by revising paragraphs (a), (f), and the second sentence of paragraph (m). The revisions read as follows:

Subpart D—Standards for the Management of Uranium Byproduct Materials

§ 192.31 Definitions and cross-references.

(a) Unless otherwise indicated in this subpart, all terms shall have the same meaning as in Title II of the Uranium Mill Tailings Radiation Control Act of 1978, subparts A and B of this part, or parts 190, 260, 261, and 264 of this chapter. For the purposes of this subpart, the terms "waste," "hazardous waste" and related terms, as used in parts 260, 261, and 264 of this chapter, shall apply to byproduct material.

(f) Disposal area means the region within the perimeter of an impoundment or pile containing uranium byproduct materials to which the post-closure requirements of § 192.32(b)(1) apply.

(m) This term shall not be construed to include extraordinary measures or techniques that would impose costs that are grossly excessive as measured by practice within the industry or one that is reasonably analogous (such as, by way of illustration only, unreasonable overtime, staffing or transportation requirements, etc., considering normal practice in the industry; laser fusion of soils, etc.), provided there is reasonable progress toward emplacement of a permanent radon barrier.

5. Section 192.32 is amended by revising paragraph (a)(2)(v) as follows:

§ 192.32 Standards.

(a) (2) (v) The 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.

6. Part 192 is amended by adding subpart F to read as follows:

Subpart F—Public Health, Safety and Environmental Protection Standards for Byproduct Materials Produced by Uranium In-Situ Recovery

- Sec. 192.50 Purpose and applicability. 192.51 Definitions and cross-references. 192.52 Standards. 192.53 Monitoring programs, modeling and other analysis. 192.54 Alternate concentration limits. 192.55 Corrective action program. 192.56 Effective date.

Subpart F—Public Health, Safety and Environmental Protection Standards for Byproduct Materials Produced by Uranium In-Situ Recovery

§ 192.50 Purpose and applicability.

(a) This rule contains standards of general application that the regulatory agency will implement and enforce to protect groundwater at in-situ uranium recovery facilities.

(b) This subpart applies to the management of uranium byproduct materials prior to, during and following the processing of uranium ores utilizing uranium in-situ recovery methods, and to the protection of groundwater at such facilities. Within three years of the effective date of this rule, the regulatory agency shall apply these standards of general application to ISR facilities licensed to process uranium byproduct material.

§ 192.51 Definitions and cross-references.

(a) Unless otherwise indicated in this subpart, all terms shall have the same meaning as in Title II of the Uranium Mill Tailings Radiation Control Act of 1978, subparts A, B, and D of this part, or parts 190, 260, 261, and 264 of this chapter.

(b) Agreement State. Any State with which the Nuclear Regulatory Commission (NRC) or the Atomic Energy Commission has entered into an effective agreement under subsection 274b of the Atomic Energy Act.

(c) Alternate Concentration Limit (ACL). An alternate concentration limit approved by the regulatory agency for a groundwater constituent after the regulatory agency determines that best practicable restoration activities have been completed and that concentrations of the constituent cannot be restored to the applicable standards in 40 CFR 192.52(c)(1)(i) or (c)(1)(ii), following the process prescribed in § 192.54.

(d) *Aquifer*. A geological formation, group of formations, or part of a formation that is capable of yielding a significant amount of water to a well or spring. See 40 CFR 144.3.

(e) *Background*. The condition of groundwater, including the radiological and non-radiological constituent concentrations, prior to the beginning of ISR operations.

(f) *Constituent*. A detectable component within the groundwater.

(g) *Constituent concentration standard*. A concentration limit for a constituent in groundwater set according to § 192.52(c)(1).

(h) *Exceedance of a constituent concentration standard*. An exceedance has occurred when, during stability monitoring, a constituent concentration standard is exceeded at any point of compliance well, as determined by the regulatory agency.

(i) *Excursion*. The movement of fluids containing lixiviant or uranium byproduct materials from the production zone into surrounding groundwater. An excursion is considered to have occurred when two indicator parameters (e.g., chloride, conductivity, total alkalinity) exceed their respective upper control limits in any excursion monitoring well, or, as determined by the regulatory agency, when one indicator parameter significantly exceeds its upper control limit in any excursion monitoring well.

(j) *Excursion Monitoring Wells*. Wells located around the perimeter of the production zone, including in overlying and underlying aquifers, which are used to detect any excursions from the production zone. These wells may also be used to demonstrate compliance with stability standards once restoration has been completed.

(k) *Extraction Well*. Well used to extract uranium enriched solutions from the ore-bearing aquifer; also known as a production well. Extraction and injection wells may be converted from one use to the other.

(l) *Indicator Parameter*. A constituent, such as chloride, conductivity or total alkalinity, whose upper control limit is used to identify an excursion. Indicator parameters are not necessarily contaminants, but relate to geochemical conditions in groundwater.

(m) *Initial Stability Phase*. The period immediately following the restoration phase when the wellfield is monitored to determine if and when the initial stability standards are met. This is the period in which provisional alternate concentration limits may be established and implemented, if necessary.

(n) *Injection Well*. A well into which fluids are being injected. See 40 CFR 144.3.

(o) *In-Situ Recovery (ISR)*. A method by which uranium is leached from underground ore bodies by the introduction of a solvent solution, called a lixiviant, through injection wells drilled into the ore body. The process does not require the extraction of ore from the ground. The lixiviant is injected, passes through the ore body, and mobilizes the uranium; the uranium-bearing solution is pumped to the surface via extraction wells. The pregnant leach solution is processed to extract the uranium.

(p) *Listed Constituent*. One of the twelve groundwater constituents specified in Table 1 to this subpart.

(q) *Lixiviant*. A liquid medium used to recover uranium from underground ore bodies through in-situ recovery. This liquid medium typically contains native groundwater and an added oxidant, such as oxygen or hydrogen peroxide, as well as sodium carbonate, sodium bicarbonate or carbon dioxide.

(r) *Long-Term Stability Phase*. The period after the constituent concentration standards have been met and initial stability has been demonstrated according to § 192.52(c)(2), as determined by the regulatory agency. The regulatory agency sets the extent of time the facility remains in the long-term stability phase.

(s) *Maximum Constituent Concentration*. The maximum permissible level of a constituent in groundwater, as established under § 192.52(c)(1).

(t) *Maximum Contaminant Level (MCL)*. The maximum permissible level of a contaminant in water delivered to any user of a community water system. See 40 CFR 141.2.

(u) *Monitoring Wells*. Wells used to obtain groundwater levels and water samples for the purpose of determining the hydrogeological regime and the amounts, types and distribution of constituents in the groundwater. Wells are located in the production zone, around the perimeter of the production zone and in overlying and underlying aquifers.

(v) *Operational Phase*. The time period during which uranium recovery occurs. Operation begins when extraction begins and lixiviant is injected. Operation ends when the operator permanently ceases injection of lixiviant and recovery of uranium-bearing solution for processing purposes. The operational phase includes periods during which the ISR temporarily ceases uranium recovery

(i.e., when the ISR is in “stand-by” mode) but the ISR still needs to maintain appropriate groundwater controls to prevent contaminants from leaving the production zone.

(w) *Overlying Aquifer*. An aquifer that is immediately vertically shallower than (i.e., directly above) the production zone aquifer.

(x) *Point(s) of Compliance*. Locations where groundwater protection standards are generally applied. The regulatory agency reviews and approves the location of points of compliance for the wellfield. During all phases of ISR, points of compliance should include excursion monitoring well locations; during the initial and long-term stability phases, points of compliance should also include wells in the production zone.

(y) *Point(s) of Exposure*. Used in setting ACLs, points of exposure are locations identified by the regulatory agency that represent possible future areas of exposure where the receptor can come into contact with groundwater (e.g., areas of recoverable groundwater). The groundwater at that point of exposure must be protective of the receptor.

(z) *Preoperational Monitoring*. Measurement of groundwater conditions in the production zone, up and down gradient of the production zone and in overlying and underlying aquifers, when present. Preoperational monitoring plans are subject to approval by the regulatory agency prior to the operational phase.

(aa) *Production Zone*. The portion of the aquifer in which in-situ recovery occurs. The production zone lies within the wellfield.

(bb) *Regulatory Agency*. The NRC or an Agreement State.

(cc) *Restoration (Act of)*. The process of remediating groundwater to a state where it meets the constituent concentration standards listed in 40 CFR 192.52(c)(1).

(dd) *Restoration Phase*. The period immediately after lixiviant injection permanently ceases, during which restoration activities occur.

(ee) *Underlying Aquifer*. An aquifer that is immediately vertically deeper (i.e., directly below) than the production zone aquifer.

(ff) *Upper Control Limit (UCL)*. Upper control limits are maximum concentrations for excursion indicator parameters that, when exceeded, indicate lixiviant or other constituents are migrating beyond the production zone.

(gg) *Uranium Recovery Facility*. A facility licensed to process uranium ores primarily for the purpose of recovering

uranium (and/or thorium) and to manage uranium (and/or thorium) byproduct materials that result from processing of ores. Common names for these facilities include, but are not limited to, the following: A conventional uranium mill, an in-situ recovery (or leach) facility, and a heap leach facility or pile.

(hh) *Wellfield.* The area of an ISR operation that encompasses the array of injection, extraction and monitoring wells, ancillary equipment and interconnected piping employed in the uranium in-situ recovery process. The area of the wellfield exceeds that of the production zone.

**§ 192.52 Standards.**

(a) No later than three years after the effective date of this rule, all operating wellfields, new wellfields and expansions of wellfields at ISR facilities must meet the standards in this section. These standards do not apply to those wellfields at licensed ISR facilities that, within three years of the effective date of this rule, are in and remain in the restoration, initial stability monitoring or long-term stability monitoring phases.

(b) *Surface impoundments.* (1) Surface impoundments associated with ISR activities shall conform to the standards of § 192.32.

(2) Disposal of solid uranium byproduct materials produced by ISR activities shall conform to the standards in § 192.32.

(c) *Groundwater protection standards.* The constituent concentration standards, in paragraph (c)(1) of this section, must be met after restoration or corrective action and are also incorporated into the initial and long-term stability standards. The initial stability standards, in paragraph (c)(2) of this section, are a measure of the effectiveness of restoration and must be met prior to meeting the long-term stability standards. The long-term stability standards, in paragraph (c)(3) of this section, must be met prior to decommissioning and termination of the ISR facility's license.

(1) *Constituent concentration standards.* The licensee shall propose and the regulatory agency shall review and approve constituent concentration standards for each of the constituents listed in Table 1 to this subpart that are identified by the licensee and approved by the regulatory agency as being

present or affected by operations in the production zone. The limit for each constituent is the highest level of the following values:

(i) That constituent's preoperational background level in and around the wellfield, as determined by preoperational monitoring conducted under § 192.53(a); or

(ii) the lowest regulatory standard for that constituent found in 40 CFR 141.61, 141.62, 141.66, 141.80, 143.3, 264.94, or Table 1 of subpart A of this part. For any constituent not listed in Table 1 to this subpart, but designated by the regulatory agency for monitoring, a constituent concentration standard at or above the background level should be established from the values in 40 CFR parts 141, 143 or 264, if such values exist. For a constituent not found in 40 CFR parts 141, 143 or 264, the constituent concentration standard above the background level should be established at a concentration level that represents a cumulative excess lifetime risk no greater than  $10^{-4}$  to an average individual;

(iii) an alternate concentration limit for that constituent as approved by the regulatory agency under § 192.54.

TABLE 1 TO SUBPART F—MAXIMUM CONCENTRATION OF CONSTITUENTS FOR GROUNDWATER PROTECTION AT ISR FACILITY SITES

Constituent	Maximum concentration
Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver, Nitrate (as N), Molybdenum, Radium-226 and radium-228 (combined), Uranium (uranium-234, uranium-235 and uranium-238 combined).	The constituent concentration standard is the primary or secondary MCL listed in 40 CFR 141.61, 141.62, 141.66, 141.80, and 143.3, the maximum concentration of hazardous constituents for groundwater protection under 40 CFR 264.94, or the maximum constituent concentration specified in Table 1 to subpart A of this part, whichever value is the lowest. Where a background concentration is determined to be higher than the lowest value in the applicable regulations, the background concentration will serve as the constituent concentration standard.

(2) *Initial Stability Standards.* The licensee must demonstrate to the satisfaction of the regulatory agency that groundwater conditions are stable by showing three consecutive years of quarterly monitoring results with no statistically significant increasing trends that would exceed the constituent concentration standards at the 95 percent confidence level. This showing shall be based on monitoring data collected in accordance with § 192.53(c).

(3) *Long-term Stability Standards.* After meeting the initial stability standards in paragraph (c)(2) of this section, the licensee must demonstrate to the satisfaction of the regulatory agency that groundwater conditions will

remain stable into the future by showing:

(i) Three consecutive years of quarterly monitoring results demonstrating no statistically significant increasing trends that would exceed the constituent concentration standards at the 95 percent confidence level. This showing shall be based on monitoring data collected in accordance with the § 192.53(d); and

(ii) the applicable constituent concentration standards will continue to be met into the future. This showing shall be based on the information collected under § 192.53(d), including monitoring data, geochemical modeling, and other analysis required by the regulatory agency.

**§ 192.53 Monitoring programs, modeling and other analysis.**

Licensees subject to this subpart must conduct a groundwater monitoring program, subject to review and approval by the regulatory agency, at prospective and licensed ISR wellfields. The components of the program include preoperational monitoring to determine statistically valid background levels, excursion monitoring to identify and correct excursions, and initial and long-term stability monitoring. This program shall address all phases of the uranium recovery activities and must be conducted as follows:

(a) *General monitoring program requirements and preoperational monitoring.*

(1) A sufficient number of wells, at appropriate locations and depths, shall

be installed in such a manner as to yield representative samples in order to define the groundwater flow regime and measure preoperational conditions and water quality during background determination, operations, restoration, initial stability and long-term stability.

(2) All monitoring wells must be installed and developed as directed by the regulatory agency to maintain well integrity, allow for accurate sample collection and prevent contamination of samples.

(3) The preoperational monitoring shall include the production zone and areas immediately surrounding the production zone, as identified by the regulatory agency, including up- and down-gradient areas outside of the production zone.

(4) During the preoperational monitoring effort, relevant data documenting geology, hydrology and geochemistry for radiological and non-radiological constituents shall be collected as required by the regulatory agency, both in the production zone and in surrounding areas that may be affected by the ISR operations.

(i) The monitoring effort shall be of sufficient scope and duration to adequately characterize temporal (*e.g.*, no less than one year where seasonal variation is expected) and spatial variations in groundwater, using statistically valid approaches to evaluate groundwater quality trends and ensure adequate background characterization of the wellfield and adjacent areas. If monitoring is to be conducted for less than one year, it must be sufficient to demonstrate that the measured constituents do not reflect impacts associated with well construction.

(ii) Preoperational monitoring shall be focused on determining background concentrations of constituents and indicator parameters in the following locations:

- (A) Points of compliance within the proposed production zone; and
- (B) Points of compliance outside the production zone including point of compliance screened in potentially affected overlying and underlying aquifers (when present); and points of compliance screened in upgradient and downgradient aquifers (when present).

(5) The licensee shall employ appropriate statistical techniques to analyze background concentrations measured in individual wells within the wellfield and in any other wells identified by the regulatory agency for the purpose of determining constituent concentration standards. Background concentrations used to establish the constituent concentration standards may be representative of individual

wells, multiple wells, or all wells within the proposed production zone and are subject to review and approval by the regulatory agency.

(6) Radiological and non-radiological constituents to be monitored during the preoperational phase shall include:

(i) All constituents listed in Table 1 of this subpart;

(ii) Constituents and parameters as determined by the regulatory agency to be necessary to characterize the geochemistry of the groundwater and to demonstrate that the applicable constituent concentration standards have been met and will continue to be met into the future; and

(iii) Any additional constituents or parameters required by the regulatory agency, such as metals potentially mobilized by the recovery process.

(b) *Excursion Monitoring.*

(1) Indicator parameters, as established by the regulatory agency, shall be monitored in excursion monitoring wells surrounding the production zone, including aquifers above and below the production zone, at a minimum throughout the operational and restoration phases of ISR activities.

(2) If an excursion is detected as evidenced by indicator parameters exceeding established upper control limits, as determined by the regulatory agency, corrective action under § 192.55 must be initiated and constituents listed in Table 1 of this subpart expected to be present (*e.g.*, uranium, radium, arsenic, and selenium) and any other constituent identified by the regulating agency shall be monitored until the excursion is controlled.

(c) *Initial Stability Monitoring.*

(1) Once the regulatory agency determines restoration is complete, the licensee shall begin its initial stability monitoring as described in paragraphs (c)(2), (3), and (4) of this section to meet its initial stability standards as described in § 192.52(c)(2).

(2) The constituents to be monitored at the points of compliance shall include:

(i) All constituents having a constituent concentration standard and expected to be present, as determined by the regulatory agency under § 192.52(c)(1);

(ii) Any additional constituents required by the regulatory agency, such as:

(A) Constituents and parameters necessary to characterize the geochemistry of the groundwater and other analysis to demonstrate that the applicable constituent concentration standards have been met and will continue to be met into the future;

(B) Components of the lixiviant fluids injected during uranium recovery and any fluids injected during restoration; or

(C) Metals potentially mobilized by the uranium recovery process that could reasonably be expected to be found in the groundwater.

(3) If the licensee finds that the initial stability standard in § 192.52(c)(2) cannot be demonstrated for one or more constituents, the regulatory agency may:

(i) Require the licensee to resume active restoration efforts; or

(ii) After all best practicable active restoration activities have been completed, establish a provisional alternate concentration limit according to the requirements of § 192.54. Once initial stability according to the standard in § 192.52(c)(2) at the provisional alternate concentration limit has been documented, the regulatory agency may establish a final alternate concentration limit according to the requirements of § 192.54.

(4) If the regulatory agency determines that a constituent exceeds a constituent concentration standard in § 192.52(c)(1) at a point of compliance, the licensee, as directed by the regulatory agency, must undertake corrective action under § 192.55 until the regulatory agency determines that the exceedance of the constituent concentration standard is adequately remedied.

(d) *Long-term stability monitoring, modeling and other analysis.*

(1) Once the regulatory agency determines the initial stability standards have been met, the licensee shall begin conducting long-term stability monitoring as described in paragraph (d)(2) of this section to demonstrate it meets its long-term stability standards, established under § 192.52(c)(3).

(2) The constituents to be monitored at the points of compliance shall include:

(i) All constituents having a constituent concentration standard expected to be present, as determined by the regulatory agency under § 192.52(c)(1);

(ii) Any additional constituents required by the regulatory agency, such as:

(A) Constituents and parameters necessary to characterize the geochemistry of the groundwater and modeling and other analysis to demonstrate that the applicable constituent concentration standards have been met and will continue to be met into the future;

(B) Components of the lixiviant fluids injected during uranium recovery and any fluids injected during restoration; or

(C) Metals potentially mobilized by the uranium recovery process that could

reasonably be expected to be found in the groundwater.

(3) If the regulatory agency finds that one or more constituents at a point of compliance within the wellfield exceeds a constituent concentration standard as defined in § 192.52(c)(1) then, as directed by the regulatory agency, the licensee must undertake corrective action under § 192.55 until the regulatory agency determines that the exceedance of the constituent concentration standard(s) is adequately remedied.

(4) If the licensee finds that the long-term stability standard in § 192.52(c)(3) cannot be demonstrated for one or more constituents, the regulatory agency may:

(i) Require the licensee to resume active restoration efforts; or  
(ii) After all best practicable active restoration activities have been completed, establish an alternate concentration limit according to the requirements of § 192.54.

(5) In addition to the long-term stability monitoring requirements described in paragraph (d)(2) of this section, the licensee must provide to the regulatory agency geochemical modeling and other analysis sufficient to demonstrate that the long-term stability standard in § 192.52(c)(3) has been met.

(6) The licensee must continue its long-term stability monitoring until the regulatory agency determines that the long-term stability standard in § 192.52(c)(3) has been met and releases the facility from monitoring.

#### § 192.54 Alternate Concentration Limits.

(a) *Provisional Alternate Concentration Limits.* The regulatory agency may establish a provisional alternate concentration limit within the production zone for any constituent that meets the following conditions:

(1) The regulatory agency determines that all best practicable active restoration activities have been completed in accordance with the license, and that the previously approved constituent concentration standard under § 192.52(c)(1)(i) or (ii) are not reasonably achievable; and

(2) The constituent will not pose a substantial present or potential hazard to human health or the environment as long as the provisional alternate concentration limit is not exceeded; and

(3) The constituent concentration standard, as determined under paragraph (c)(1) of this section, is satisfied at all points of exposure in the wellfield and in surrounding aquifers.

(b) *Final Alternate Concentration Limits.* The regulatory agency may approve a final alternate concentration

limit provided that the following conditions are met:

(1) The licensee has demonstrated initial groundwater stability as defined in § 192.52(c)(2); and (2) The constituent will not pose a substantial present or potential future hazard to human health or the environment as long as the final alternate concentration limit is not exceeded.

(c) In deciding whether to approve a provisional or a final alternate concentration limit, the regulatory agency shall consider, at a minimum, the following factors:

(1) Potential adverse effects on groundwater quality, considering:

(i) The physical and chemical characteristics of constituents in the groundwater at the site, including their potential for migration;

(ii) The hydrogeological characteristics (e.g., groundwater velocity) of the site and surrounding land;

(iii) The quantity of groundwater and the direction of groundwater flow;

(iv) The proximity and withdrawal rates of local groundwater users;

(v) The current and anticipated future uses of groundwater in the region surrounding the site;

(vi) The existing quality of groundwater, including other sources of contamination and their cumulative impact on groundwater quality;

(vii) The potential for health risks caused by human exposure to constituents;

(viii) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to constituents; and

(ix) The persistence and permanence of the potential adverse effects.

(2) Potential adverse effects on hydraulically-connected surface-water quality, considering:

(i) The volume and physical and chemical characteristics of the groundwater at the site;

(ii) The hydrogeological characteristics of the site and surrounding land;

(iii) The quantity and quality of groundwater, and the direction of groundwater flow;

(iv) The patterns of rainfall in the region;

(v) The proximity of the site to surface waters;

(vi) The current and future uses of surface waters in the region surrounding the site and any water quality standards established for those surface waters;

(vii) The existing quality of hydraulically-connected surface water, including other sources of contamination and their cumulative impact on surface water quality;

(viii) The potential for health risks caused by human exposure to constituents;

(ix) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to constituents; and

(x) The persistence and permanence of the potential adverse effects.

(3) The presence of any underground source of drinking water.

#### § 192.55 Corrective action program.

(a) A corrective action program shall be developed by the licensee and approved by the regulatory agency for each ISR site at the time of licensing. The plan shall address a range of possible scenarios (e.g., types and routes of potential excursions) and list options for corrective action for operational through long-term stability phases. If an excursion is detected at a licensed ISR facility at any time, a constituent concentration standard is exceeded during the initial or long-term stability phases, or the regulatory agency is concerned about an increasing trend in stability monitoring results, the applicable portions of the corrective action program shall be initiated as soon as is practicable, and in no event later than 60 days after such an occurrence. With the objective of returning constituent concentration levels in groundwater to the constituent concentration standards established under § 192.52(c)(1), the corrective action program shall address removing constituents at the point of compliance or treating them in place.

(b) The licensee shall continue corrective action measures to the extent necessary to achieve and maintain compliance with the constituent concentration standards in § 192.52(c)(1). The regulatory agency will determine when the licensee may terminate corrective action measures based on data from the groundwater monitoring program and other information that provides reasonable assurance that the constituent concentration standards in § 192.52(c)(1) will not be exceeded.

(c) Upon termination of any corrective action initiated during long-term stability monitoring, the licensee shall then be subject to the initial and long-term stability standards specified in § 192.53(c)(2) and (3).

#### § 192.56 Effective date.

Subpart F shall be effective on [60 DAYS AFTER DATE OF PUBLICATION OF FINAL RULE IN FEDERAL REGISTER].

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