Regulatory Analysis for the Proposed Rule: Groundwater Protection at Uranium *In Situ* Recovery Facilities

NRC-2008-0421; RIN 3150-AI40

U.S. Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards
Division of Rulemaking, Environmental, and Financial Support

Month 2021

ABSTRACT

The purpose of the proposed rule is to amend regulations in Appendix A of title 10 of the *Code of Federal Regulations* (10 CFR) Part 40, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for their Source Material Content." The proposed rule would establish requirements for groundwater protection at uranium *in situ* recovery (ISR) facilities by codifying risk-informed and best management practices that are set forth in site-specific license conditions and other related changes.

This regulatory analysis provides an evaluation of the costs and benefits of the proposed rule and implementing guidance relative to the baseline case, a "no action" alternative.

EXECUTIVE SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) is proposing to amend its regulations in Appendix A of 10 CFR Part 40, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for their Source Material Content." Appendix A regulations are focused on groundwater protection at conventional uranium mills, which was the predominant means of uranium milling in the United States when the NRC issued the rule in 1980. Since the 1990s, uranium ISR has become the predominant means of uranium recovery and milling in the United States.

To date, the NRC has regulated groundwater protection at uranium ISR facilities by applying risk-informed practices through site-specific license conditions. This regulatory approach has been shown to successfully protect groundwater at NRC licensed ISR facilities for over 40 years in that there have been no known adverse, significant impacts to groundwater quality in surrounding aquifers. The proposed rule would codify these groundwater protection practices, thereby increasing regulatory efficiency and effectiveness for both NRC and industry and providing industry with greater regulatory predictability.

This regulatory analysis provides an evaluation of the costs and benefits of the proposed rule and implementing guidance relative to the baseline case, the "no action" alternative.

The NRC staff has made the following key findings:

- Proposed Rule Analysis. The proposed rule recommended by the staff would result in additional costs as shown in Table ES-1.

Table ES-1 Summary of Costs and Benefits

Entity	Total (2021 dollars)		
	Undiscounted	**7% NPV [a]**	**3% NPV**
Industry	$20,600	$68,300	$55,800
Agreement States	($132,700)	($109,100)	($121,600)
U.S. NRC	($113,300)	($170,200)	($140,100)
U.S. Environmental Protection Agency (EPA)	($11,000)	($11,000)	($11,000)
Net Benefit (Cost)	**($236,400)**	**($222,000)**	**($216,900)**

[a] NPV: Net present value

- Non-quantified Benefits. Based upon the assessment of total costs and benefits, the NRC concludes that the proposed rule, if issued, would increase regulatory efficiency and effectiveness for both NRC and industry, and provide industry with greater regulatory predictability. The revised regulations would result in more complete applications with a corresponding reduction in requests for additional information, and would avoid the development and review of several site-specific license conditions. The staff expects that these improvements would streamline the safety review resulting in a simplified, lower-cost licensing process and would contribute to more timely decision making. Additionally, the proposed rule would support the national program for ISR facility groundwater protection with respect to Agreement State compatibility and for the NRC's evaluation and oversight of Agreement State ISR facility groundwater protection

programs. The rule would add requirements for post-restoration monitoring to be comparable to the EPA Resource Conservation and Recovery Act (RCRA) corrective action framework as described in the NRC/EPA 2020 memorandum of understanding (MOU). This post-restoration monitoring requirement would replace the current requirement of at least one year of stability monitoring after groundwater restoration, typically set forth in a site-specific license condition, which while protective of groundwater, is not consistent with the applicable RCRA corrective action regulations that require at least three years of monitoring.

- Uncertainty Analysis. The regulatory analysis contains a Monte Carlo simulation analysis that shows the mean net benefit for this proposed rule is ($222,000) with 90-percent confidence that the net benefit is between ($323,000) and ($122,000) using a 7-percent discount rate. The Agreement State labor rate is the factor responsible for the largest variation in averted costs followed by the amount of time averted for the NRC to prepare and issue site-specific license conditions.

- Decision Rationale. It is expected that the proposed rule would clarify requirements so that applicants would prepare higher quality applications, which would result in a corresponding reduction in time required for both the applicant and the NRC staff, and would make the NRC licensing process more transparent and predictable for the public, thus increasing public confidence in NRC's groundwater protection program for ISRs. The analysis shows that virtually all of the increased costs result from preparation and issuance of the final rule and associated guidance and the costs for the Agreement States to amend their regulations to maintain compatibility with the proposed NRC requirements. The discounted costs for affected ISR facilities, i.e., a new ISR facility, a new wellfield within a licensed ISR facility, or a new production unit within an operating wellfield of a licensed ISR facility, to perform an additional two years of post-restoration monitoring requirements are expected to be completely offset by the efficiencies gained in preparing and submitting the licensing application. Although each licensee may incur additional costs to meet the new post-restoration monitoring requirements, the costs are considered warranted by the increased efficiency and effectiveness for both the NRC and industry and by the establishment of a national ISR facility groundwater protection program for Agreement States. The proposed rule would also benefit the ISR facility industry by providing greater regulatory predictability. This analysis results are sensitive to the number of applicants for new ISR facilities or current licensees that submit a license amendment request for a new wellfield or a new production unit within an existing wellfield. The results of this analysis are based on only one new ISR application being submitted within the next five years. However, if a second licensee would add by calendar year 2030, a new wellfield within a licensed ISR facility or to add a new production unit within an operating wellfield of a licensed ISR facility than the mean net benefit of this rule is at least $4,000 with 90-percent confidence that the net benefit is between ($138,000) and $155,000 using a 7-percent discount rate.

- Implementation. The NRC expects that the effective date of the final rule would be in year 2022. Full implementation by the Agreement States would be approximately three years later. The applicable guidance document is NUREG-1569, "Standard Review Plan for *In Situ* Leach Uranium Extraction License Applications" (NRC, 2003). The NRC plans to issue supplemental guidance to NUREG-1569 with the final rule.

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ABBREVIATIONS AND ACRONYMS

ACL	alternate concentration limit
AEA	Atomic Energy Act of 1954, as amended
ALI	annual limits on intake
BLS	U.S. Department of Labor, Bureau of Labor Statistics
CFR	Code of Federal Regulations
CPI-U	consumer price index for all urban consumers
DAC	derived air concentrations
EIA	U.S. Energy Information Administration
EPA	U.S. Environmental Protection Agency
FTE	full-time equivalent
ISR	*in situ* recovery
MCL	maximum contaminant level
NPV	net present value
NRC	U.S. Nuclear Regulatory Commission
N/S	not significant
NUREG	NRC technical publication
OMB	U.S. Office of Management and Budget
RAI	request for additional information
RCRA	Resource Conservation and Recovery Act
SDWA	Safe Drinking Water Act
SRM	staff requirements memorandum
SWDA	Solid Waste Disposal Act
UIC	underground injection control
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978
USNFWG	United States Nuclear Fuel Working Group

1 STATEMENT OF PROBLEM AND OBJECTIVE

The NRC is proposing to amend its regulations in Appendix A, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for their Source Material Content," of 10 CFR Part 40, "Domestic Licensing of Source Material."[1] The current Appendix A regulations are focused on groundwater protection at conventional uranium mills, which was the predominant means of uranium milling in the United States when the NRC issued Appendix A in 1980. Since the 1990s, uranium ISR has become the predominant means of uranium recovery and milling in the United States.

To date, the NRC has regulated groundwater protection at uranium ISR facilities through risk-informed practices through site-specific license conditions. The purpose of the proposed rule is to establish requirements for groundwater protection at ISR facilities by codifying these practices to increase regulatory efficiency and effectiveness for both NRC and industry, and to provide industry with greater regulatory predictability. Additionally, the proposed rule would support the national program for ISR facility groundwater protection with respect to Agreement State compatibility and for the NRC's evaluation and oversight of Agreement State ISR facility groundwater protection programs. The proposed rule also would update the maximum concentration values for hazardous constituents for groundwater protection for all uranium mills (both conventional mills and ISRs) to be consistent with the EPA's Safe Drinking Water Act (SDWA) current maximum contaminant levels (MCLs) for drinking water and EPA's RCRA maximum concentrations for groundwater protection.

This regulatory analysis provides an evaluation of the NRC proposed rule and two alternatives, a "no action" alternative, for which the NRC would not conduct rulemaking and continue to regulate groundwater protection at ISR facilities primarily through the use of site-specific license conditions and a non-rulemaking alternative, for which the NRC would revise guidance to clarify ISR requirements. The no action alternative is the baseline to which the proposed action is compared.

1.1 Description of the Proposed Action

The proposed action would add a new Section VI, consisting of a new Criterion 14, to Appendix A of 10 CFR Part 40,[2] that would be specific to the operation of an ISR facility and would codify risk-informed groundwater protection practices that the NRC has applied to its licensees through site-specific license conditions. The proposed rule also would revise the opening paragraph to Criterion 5, revise various paragraphs in Criterion 5B, revise Criterion 5C to delete the current Table 5C and replace it with regulatory text that would cross-reference both the drinking water MCLs set forth in the EPA's SDWA regulations and the RCRA maximum concentrations for groundwater protection (the revised Criterion 5C would apply to both

[1] This proposed rule would also amend the definition of the term "Byproduct material" in 10 CFR 40.4, "Definitions."

[2] Uranium milling and the disposal of the resulting waste/byproduct material by NRC licensees are regulated under 10 CFR Part 40, "Domestic Licensing of Source Material" and Appendix A, which sets forth criteria for the operation of uranium mills and the disposition of tailings or wastes from the extraction or concentration of source material from ores processed primarily for their source material content. These tailings or wastes are considered a form of byproduct material, which is one of the classes of radioactive waste regulated by the NRC under the Atomic Energy Act (AEA) of 1954, as amended, section 11e.(2) of the AEA defines this class of byproduct material.

conventional mills and ISR facilities), add several ISR-specific definitions to Appendix A, and revise the definition “byproduct material” in 10 CFR 40.4, “Definitions.” Additionally, the proposed rule would add an applicability paragraph specifying that the proposed requirements would apply to applications and licenses for a new ISR facility, a new wellfield within a licensed ISR facility, or a new production unit within an operating wellfield of a licensed ISR facility, provided that the application for which is submitted after the effective date of the final rule.

The proposed requirements would improve regulatory efficiency and would allow the NRC’s review process for ISR license applications and amendments to be consistent and more transparent to the public and industry. The proposed Criterion 14 rule language is based in part on wording used in site-specific license conditions, and in part on the EPA’s regulations that implement the RCRA.

Specifically, the proposed Criterion 14 would require the applicant to submit specific geologic and hydrologic site characterization information to demonstrate suitability of a site for ISR operations before the NRC approves the ISR facility license. Once the site is licensed by the NRC, Criterion 14 would require the licensee to provide wellfield specific information before operations begin, including: a geological and hydrologic characterization of the wellfield; identification of hazardous constituents that would be expected to be present or increase with ISR operations in the production unit; sampling and analysis to establish background concentration levels for the identified radiological and nonradiological hazardous constituents at point of compliance wells in the production unit, and in the immediately overlying, underlying and adjacent aquifers to the production unit; identification and measurement of indicator constituents to detect an excursion in the immediately overlying, underlying and adjacent aquifers to the production unit; and a wellfield restoration plan.

Additionally, Criterion 14 would require: the well design and construction specifications for injection and production wells and wellfield infrastructure; an operating plan for injection and production wells to ensure an inward hydraulic gradient; monitoring of point of compliance wells for excursions and reporting for excursions; a program for monitoring of the uppermost aquifer and related reporting requirements; mechanical integrity tests for injection and production wells before initial use and before use after servicing; post-restoration monitoring of hazardous constituents in the production unit; a wellfield restoration report; a well plugging and abandonment plan; and corrective action for specific events.

Under the proposed action, the NRC would develop draft supplemental guidance to NUREG-1569 to support the proposed rule changes.

1.2 Need for the Proposed Action

Appendix A of 10 CFR Part 40 contains requirements primarily related to the operation of conventional uranium mills, many of which concern the contamination of groundwater caused by leakage from tailings piles. ISR operations do not produce any tailings but do produce waste streams containing byproduct material, as defined in accordance with the AEA , as amended section 11e.(2) (AEA section 11e.(2) byproduct material), that require proper management to protect groundwater. AEA section 11e.(2) byproduct material contains both radiological and nonradiological constituents. These byproduct waste streams are found (1) on or near the surface in ISR facility infrastructure such as subsurface piping, evaporation ponds, and ion exchange facilities; and (2) in the subsurface, in a portion of an aquifer, known as a production unit, where the injected lixiviant frees the uranium from the host rock.

In the absence of ISR-specific regulations for groundwater protection, the NRC staff has had to rely on site-specific license conditions to regulate ISR facilities that are based on risk-informed and best management practices as informed by NRC guidance. Although this regulatory approach has been demonstrated to be protective of groundwater at ISR facilities, the lack of ISR-specific regulations may lead to inconsistency in licensing reviews by NRC staff. Similarly, regulatory actions between different regulators (NRC/Agreement State or different Agreement States) may be inconsistent. The proposed regulations for groundwater protection are expected to increase regulatory efficiency and make the licensing process more predictable, consistent, and transparent for licensees and the public.

1.3 Existing Regulatory Framework

Prior to 1978, the NRC had limited authority to oversee and regulate the hazards associated with uranium (and thorium) mill tailings because the tailings usually contained less than 0.05 percent uranium by weight. Congress addressed this situation in 1978 by enacting the Uranium Mill Tailings Radiation Control Act (UMTRCA), which amended the AEA, as amended, including AEA section 11e.(2),[3] which established a new class of byproduct material comprising the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its uranium or thorium.[4] UMTRCA also added AEA sections 84 and 275,[5] which established a complementary regulatory regime for the EPA and the NRC over AEA section 11e.(2) byproduct material. Section 275 authorizes the EPA to issue "standards of general application" or "generally applicable standards" for the protection of the public health, safety, and the environment from radiological and nonradiological hazards associated with processing and the possession, transfer, and disposal of AEA section 11e.(2) byproduct material at sites at which ores are processed primarily for their source material content or which are used for the disposal of such byproduct material. For nonradiological hazards, AEA section 275b.(2) directed the EPA to establish standards consistent with those then required under subtitle C of the Solid Waste Disposal Act (SWDA). The SWDA was essentially replaced by the RCRA, as amended, in 1976.

Section 84 directs the NRC to establish a regulatory program to protect the public health and safety and the environment from radiological and nonradiological hazards associated with the processing, possession, and transfer of AEA section 11e.(2) byproduct material. Section 84a.(2) also requires that the NRC conform its management of section 11e.(2) byproduct material to the standards of general application promulgated by the EPA under AEA section 275. Additionally, in accordance with AEA section 84a.(3), the NRC must conform its management of AEA section 11e.(2) byproduct material to those general requirements established by the NRC, with the concurrence of the EPA Administrator, which are, to the maximum extent possible, at least comparable to requirements applicable to the possession, transfer, and disposal of similar hazardous material regulated by the EPA under the RCRA.

Other than its AEA section 84a.(3) concurrence role, the EPA's authority is limited to promulgating standards of general application. In this regard, AEA section 275b.(2) expressly states that "no permit issued by the [EPA] Administrator is required under this Act... for the processing, possession, transfer, or disposal of [Section 11e.(2)] byproduct material." The NRC

[3] 42 U.S.C. § 2014(e)(2).

[4] Title I of UMTRCA concerns inactive uranium mining and milling sites under the jurisdiction of the U.S. Department of Energy.

[5] 42 U.S.C. § 2114 and § 2022, respectively

implements the EPA standards and the NRC or the applicable Agreement State regulatory agency, as appropriate, acts as the licensing and regulatory authority for each AEA section 11e.(2) byproduct material licensee.

To implement the requirements under UMTRCA, the NRC amended 10 CFR Part 40 in 1979 by adding "byproduct material" and "uranium milling" as defined terms in 10 CFR 40.4, "Definitions." The definition of "byproduct material" refers to ISR facilities and includes "discrete surface wastes resulting from uranium solution extraction processes" as a form of byproduct material. As such, groundwater impacted by ISR operations is not expressly covered under the current definition. The term "uranium milling" is defined there as "any activity that results in the production of byproduct material." In a 1980 rulemaking, the NRC amended 10 CFR Part 40 by adding Appendix A.

In 2000, the Commission in response to a 1999 NRC staff paper, found that any waste water generated during or after the uranium extraction phase of ISR operations, and all evaporation pond sludges derived from such waste waters, are properly classified as AEA section 11e.(2) byproduct material.[6] Thus, all liquid wastes resulting from the ISR operations are considered AEA section 11e.(2) byproduct material. Accordingly, uranium and other hazardous constituents in the groundwater that have been freed from underground ore bodies as a result of ISR operations are subject to the NRC's requirements in 10 CFR Part 40, Appendix A.

In April 2009, the NRC published regulatory issues summary (RIS) 2009-05 to clarify that the Criterion 5B(5) requirements are the applicable hazardous constituent concentration limits for groundwater restoration in ISR wellfields.[7] The Criterion 5(B)(5) requirements set out the hazardous constituent concentration limits that must be met at the points of compliance and include alternate concentration limits (ACLs).

NRC guidance for performing safety and environmental reviews of ISR license applications, renewals, and amendments is contained in NUREG-1569, "Standard Review Plan for *In Situ* Leach Uranium Extraction License Applications," dated June 2003 (NRC, 2003). NUREG-1569 provides guidance to the NRC staff on the risk-informed and best management practices for ISR applicants and licensees to meet the NRC's regulatory requirements. The principal purpose of NUREG-1569 is to ensure the quality and uniformity of NRC staff reviews of ISR license applications (for both the initial application and any amendments thereto) by presenting a well-defined base from which to evaluate an application. Additionally, the NRC staff has used NUREG-1569 to inform its development of site-specific license conditions.

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6 "Recommendations on Ways to Improve the Efficiency of NRC Regulation at *In Situ* Leach Uranium Recovery Facilities," SECY-99-0013 (NRC, 1999); Staff Requirements Memorandum (SRM), SRM SECY-99-0013(NRC, 2000).

7 RIS 2009-05, "Uranium Recovery Policy Regarding: (1) The Process for Scheduling Licensing Reviews of Applications for New Uranium Recovery Facilities and (2) the Restoration of Groundwater at Licensed Uranium *In Situ* Recovery Facilities" (April 29, 2009), at 4.

2 IDENTIFICATION AND PRELIMINARY ANALYSIS OF ALTERNATIVE APPROACHES

The NRC analyzed two alternatives to the proposed rule as described in this section.

2.1 Alternative 1: No Action Alternative

The no action alternative is to maintain the status quo. Under the no action alternative, the NRC would not pursue an ISR-specific rulemaking and would rely on its current regulatory approach of relying on site-specific license conditions to regulate groundwater protection at ISR facilities. This alternative would result in no new direct costs to the NRC, Agreement States, EPA, or the industry and serves as the baseline for this analysis.

This alternative would continue to provide reasonable assurance that the public health and safety and the environment would be adequately protected, based upon the established operational record (over 40 years) demonstrating no significant safety or environmental impacts from groundwater contamination arising from ISR activities under the current regulatory framework. In addition, while the NRC staff is aware of the U.S. Nuclear Fuel Working Group (USNFWG) activities,[8] the NRC staff is not aware of any specific information at this time that would indicate an increase in the number of ISR applications in the near future.

This alternative would not clarify the applicability of the current 10 CFR Part 40, Appendix A regulations to groundwater protection at ISR facilities, including the applicability of ACLs for ISR groundwater restoration. There could also be some loss of efficiency in the licensing process for future new license applications because of the lack of clarity of the current regulatory framework. In addition, this alternative would not provide the increased transparency and stability to the ISR licensing process that rulemaking could offer.

Further, this alternative also would not provide the same level of consistency for a national program or the enhancements to the staff's ability to review Agreement State compatibility that rulemaking would provide. Specifically, this alternative would not address potential inconsistencies in the results of licensing reviews between similar ISR applications given differences among individual license reviewers. Similarly, regulatory actions between different regulators (NRC/Agreement State or different Agreement States) may be inconsistent. In addition, under this alternative, current guidance would not be updated to reflect risk-informed best practices for Agreement States to use.

2.2 Alternative 2: Publish ISR-specific Rule

Under this alternative, the NRC staff would issue a proposed rule in the *Federal Register* (FR) that would establish risk-informed regulatory requirements for groundwater protection that specifically address ISR facilities. This rulemaking is limited in scope and would amend the current regulations in Appendix A to 10 CFR Part 40 by codifying those risk-informed and best

[8] On July 12, 2019, President Trump issued an executive memorandum, entitled “Memorandum on the Effect of Uranium Imports on the National Security and Establishment of the United States Nuclear Fuel Working Group,” which directed the establishment of the USNFWG. The USNFWG is tasked to develop recommendations for reviving and expanding domestic nuclear fuel production. As part of its tasking, the USNFWG “shall examine the current state of domestic nuclear fuel production to reinvigorate the entire nuclear fuel supply chain, consistent with U.S. national security and nonproliferation goals.” Memorandum on the Effect of Uranium Imports on the National Security and Establishment of the U.S. Nuclear Fuel Working Group, § 2(c)(iii) (July 12, 2019). The USNFWG issued its final report on April 23, 2020.

management practices that the NRC staff has applied through site-specific license conditions. The proposed rule also would clarify the applicability of various current Appendix A regulations to ISR operations, including the option for a licensee to propose an ACL for a hazardous constituent for NRC approval after groundwater restoration pursuant to the requirements in Criterion 5(B)(6) (e.g. the proposed ACL does not pose a present or potential hazard to groundwater or surface water quality). Additionally, the proposed rule would add several ISR-specific definitions to Appendix A and revise the definition of "byproduct material" in 10 CFR 40.4 to include groundwater impacted by ISR operations. Finally, the proposed rule would update the maximum values for hazardous constituents for all uranium mills (both conventional mills and ISRs) to cross-reference the EPA SDWA MCLs for drinking water and RCRA maximum concentrations for groundwater protection; this change will maintain establish consistency with EPA standards and reduce the need for future rule changes should EPA change those limits.

The NRC's intention is to minimize, to the extent possible, adverse impacts to existing licensees and Agreement State programs. The focus of the rulemaking is to provide a regulatory framework specific to ISR facilities. The NRC would propose rule language that reflects current risk-informed and best management practices. Specifically, the rulemaking could benefit new licensees by addressing requirements for:

- site characterization and suitability
- background, operational, and post-restoration groundwater monitoring
- reporting requirements
- groundwater restoration and applicability of ACLs
- corrective action
- well design and construction
- mechanical integrity
- plugging and abandonment of wells

The proposed rule requirements, if issued, would not apply to a current licensee unless that licensee submitted a license amendment request for a new wellfield within a licensed ISR facility or a new production unit within an operating wellfield of a licensed ISR facility. The NRC staff expects that codifying many of the requirements and standards and implemented through site-specific license conditions will provide increased clarity and enforceability, result in more consistent and complete information provided across applications, and achieve greater transparency and efficiency in reviewing such applications. Also, rulemaking provides for the opportunity for a broad set of external stakeholders to provide input on the specific requirements that the NRC will use to regulate ISR facilities.

The rulemaking would benefit applicants for new ISR facilities or current licensees that submit a license amendment request for a new wellfield or a new production unit within an existing wellfield by clarifying how certain Appendix A requirements would be applied. Furthermore, the proposed rule would codify the applicability of ACLs to the groundwater restoration of the production unit pursuant to the requirements in Criterion 5(B)(6). The rulemaking would increase regulatory stability and efficiency by providing a clear regulatory framework for groundwater protection for ISR activities; this framework should make reviews of future ISR applications consistent, transparent, and efficient. In addition, an ISR-specific rulemaking would streamline the licensing process for those items now covered principally by license conditions. The rulemaking also would allow NRC to revise RIS 2009-05, which was intended to provide a

clarification that the applicable hazardous constituent concentration limits are found in Criterion 5(B)(5) for groundwater restoration at ISR facilities.

2.3 Alternative 3: Revise Regulatory Guidance Without Rulemaking to Clarify ISR Requirements

Under this alternative, the NRC staff would update NUREG-1569, "Standard Review Plan for *In Situ* Leach Uranium Extraction License Applications," to better represent current risk-informed and best management practices for groundwater protection at uranium ISR facilities that have been identified since its initial publication. During the revision of the guidance, the overall licensing process would be evaluated, and potential efficiencies could be identified. NRC staff would involve the Agreement States in the development of the guidance, which would be issued for public comment.

This alternative would provide current and prospective applicants, as well as Agreement State regulators, current information about the NRC's ISR application review process, would help clarify how certain groundwater protection requirements in 10 CFR Part 40, Appendix A would be applied to ISR activities, and would provide a potential framework for Agreement State license programs. Historically, the Agreement States have used NUREG-1569 guidance in performing their regulatory activities. Current NRC licensees and the Agreement States are supportive of revising the NUREG-1569 guidance to update risk-informed groundwater protection practices for ISR facilities. This alternative would likely take less time and require fewer resources to complete than rulemaking and would be able to take advantage of currently available NRC ISR experience.

However, this alternative does not meet the regulatory objective because this alternative would not resolve concerns that the current guidance is not based on ISR-specific regulations for groundwater protection, including resolution of the industry's longstanding concern regarding the applicability of ACLs to ISR wellfield restoration. Moreover, guidance is not binding on licensees nor does ISR-specific guidance by itself (i.e., without an implementing ISR-specific regulation in support) provide a basis for a uniform evaluation by the NRC of the various Agreement State programs. For these reasons, this alternative is not considered viable and is not evaluated further.

2.4 Other Alternatives Considered

Issuing generic communications is not considered viable because this alternative does not provide the necessary regulatory basis to mandate particular licensee actions and does not adequately address concerns directly related to the regulations themselves.

Delaying the rulemaking until there is a demand for uranium is not a practical option. An increase in market demand, as occurred in 2005 and 2006, can be sudden and unpredictable, allowing no lead time for NRC to complete a rulemaking at a time when the same internal NRC resources will be needed to review incoming ISR applications.

3 ESTIMATION AND EVALUATION OF COSTS AND BENEFITS

This section examines the costs and benefits expected to result from the NRC's proposed rule. All costs and benefits are monetized, when possible. The total costs and benefits are then summed to determine whether the difference between the costs and benefits results in a positive benefit. In some cases, costs and benefits are not monetized because meaningful quantification is not possible.

3.1 Identification of Affected Attributes

This section identifies the components of the public and private sectors, commonly referred to as attributes, that are expected to be affected by Alternative 2, the rulemaking alternative, identified in Section 2. Alternative 2 would apply to an application for, and the licensing, operation, and decommissioning of, a new ISR facility, a new wellfield within a licensed ISR facility, or a new production unit within an operating wellfield of a licensed ISR facility, the application for which is submitted after the effective date of the final rule, if ultimately issued. The NRC staff developed an inventory of the impacted attributes using the list in NUREG/BR-0058, draft Revision 5, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," issued January 2020 (NRC, 2020).

The proposed rule would affect the following attributes:

3.1.1 Industry Implementation

The proposed rule should result in improvements in efficiencies for applicants and licensees. The rulemaking should provide more consistent, efficient, and predictable development and review of applications and license amendments and programs related to ISR facilities versus the current regulation of groundwater protection at ISR facilities through site-specific license conditions.

For regulatory analyses, the NRC's fees are neither a cost nor benefit but are considered a distributional effect. To a licensee, however, fees may have a significant impact. In this regard, the Commission has directed in SRM-SECY-19-0123 (NRC, 2020b) that the rulemaking costs should be included in fee relief because of the diminished domestic ISR activity and that it would not be appropriate to require current licensees to subsidize an effort that may have substantially greater benefits for future licensees.

3.1.2 Industry Operation

This attribute accounts for the projected net economic effect on all affected licensees caused by routine and recurring activities required by Alternative 2. Under Alternative 2, licensees would incur increased costs resulting from new requirements for post-restoration monitoring; however, the remaining proposed requirements have been previously implemented through site-specific license conditions.[9]

3.1.3 NRC Implementation

This attribute accounts for the projected net economic effect on the NRC to place the alternative into operation. To implement Alternative 2, the NRC incurs a cost in relation to Alternative 1

[9] For example, licensees currently provide uppermost aquifer monitoring to detect leaks in piping and wellfield infrastructure to comply with license conditions.

(i.e., no action alternative, current regulatory baseline) to issue a rule and to supplement the existing guidance.

3.1.4 NRC Operation

This attribute accounts for the projected net economic effect on the NRC caused by routine and recurring activities required by Alternative 2. The proposed rule may result in reductions in operating costs to the NRC and improvements in efficiency because the regulatory process should result in more consistent and complete applications without as much need to implement site-specific license conditions or make additional requests for information. Also included in this attribute is the NRC review of Agreement States regulations for compatibility.

3.1.5 Other Government Entities

3.1.5.1 Agreement States

Agreement States with regulatory authority to regulate uranium recovery facilities would need to amend their regulations to maintain compatibility with NRC requirements and are expected to base changes to their regulations on the NRC's rulemaking.

3.1.5.2 EPA Coordination

Under section 84a.(3) of the AEA, the NRC staff is required to seek concurrence from the EPA during development of any final rule that would include general requirements to control the nonradiological hazards arising from a licensee's possession, transfer, and disposal of AEA section 11e.(2) byproduct material. The EPA's concurrence is limited to the question of whether the general requirements are comparable, to the maximum extent practicable, with the requirements for the possession, transfer, and disposal of similar hazardous material regulated by the EPA under the RCRA. The NRC and the EPA entered into a MOU (EPA/NRC, 2020) that should help facilitate the concurrence process and the NRC staff plans to engage the EPA staff consistent with this agreement.

3.1.5.3 Federally Recognized Indian Tribal Governments

This rulemaking may affect Tribal nations; however, the proposed changes do not include impacts that would affect these stakeholders more than the general public. The rulemaking alternative might involve slight costs to these stakeholders for reviewing and submitting comments on the proposed rule. The NRC staff plans to provide opportunities for the Tribal nations to participate, including conducting a public meeting during the public comment period for the proposed rule.

3.1.6 Regulatory Efficiency

This attribute accounts for regulatory and compliance improvements resulting from the implementation of Alternative 2 compared to Alternative 1. Alternative 2 would improve regulatory efficiency by establishing groundwater protection requirements for ISR facilities. These requirements would allow for a more predictable and consistent licensing process.

3.1.7 Environmental Considerations

This attribute accounts for environmental improvements resulting from the implementation of Alternative 2 compared to Alternative 1. Alternative 2 would implement additional requirements for post-restoration monitoring to be comparable to the EPA RCRA corrective action framework

as described in the NRC EPA 2020 MOU. This post-restoration monitoring requirement would replace the current requirement of at least one year of stability monitoring after groundwater restoration, typically set forth in a site-specific license condition, which although protective of groundwater, is not consistent with the applicable RCRA corrective action regulations that require at least three years of monitoring.

3.1.8 Other Considerations

The proposed rule is expected to increase public confidence in the NRC's groundwater protection program for ISR facilities as the new regulatory framework will be consistent, predictable, and transparent.

3.1.9 Attributes with No Effects

Attributes that are not expected to contribute to the results under any of the alternatives include:

- Public Health (Accident)
- Public Health (Routine)
- Occupational Health (Accident)
- Occupational Health (Routine)
- Offsite Property
- Onsite Property
- General Public
- Improvements in Knowledge
- Safeguards and Security Considerations

3.2 Analytical Methodology

This section describes the process used to evaluate costs and benefits associated with the proposed alternatives. The benefits include any desirable changes in affected attributes (e.g., monetary savings, improved safety, and improved security). The costs include any undesirable changes in affected attributes (e.g., monetary costs, increased exposures).

Of the eight affected attributes, the analysis quantitatively evaluates six—industry implementation, industry operation, NRC implementation, NRC operation, Other Government, and Environmental Considerations. Quantitative analysis requires a baseline characterization of the affected society, including factors such as the number of affected entities, the nature of the activities currently performed, and the types of systems and procedures that licensees would implement, or would no longer implement, because of the proposed alternatives. Where possible, the NRC calculated costs for these attributes using distributions to quantify the uncertainty in these estimates. The detailed cost tables used in this regulatory analysis are included in the individual sections for each of the provisions. The NRC evaluated the remaining two attributes qualitatively because the benefits relating to regulatory efficiency and the other considerations are not easily quantifiable or because the data necessary to quantify and monetize the impacts on these attributes are not available.

3.2.1 Regulatory Baseline

This regulatory analysis provides the incremental impacts of the proposed rule relative to a baseline that reflects anticipated behavior if the NRC does not undertake regulatory or nonregulatory action. The regulatory baseline assumes full compliance with existing NRC requirements, including license conditions and the applicable current regulations for

groundwater protection in Appendix A to 10 CFR Part 40. This assumption is consistent with NUREG/BR-0058 (NRC, 2020), which states that "in evaluating a new requirement … the staff should assume that all existing NRC and Agreement State requirements have been implemented." Section 3 of this regulatory analysis presents the estimated incremental costs and benefits of the alternatives compared to this baseline. This regulatory baseline is the no-action alternative (i.e. Alternative 1).

3.2.2 Affected Entities

In the 1990s, the ISR process became the predominant means of uranium milling in the United States. The licensed area of a typical uranium ISR facility covers several square miles and may include several discrete or contiguous wellfields, some of which may be operating while others may be in restoration or decommissioning. Each ISR wellfield is composed of a series of injection and production wells drilled into a production unit that is part of an aquifer that contains a uranium ore body that has been identified in a subsurface geologic formation. The ISR process eliminates the steps of mining ore, transporting it to a mill, crushing it, and using chemical means (such as sulfuric acid) to dissolve the uranium. Instead, the ISR process relies upon chemical leaching that occurs underground in the ore body itself. A leaching solution (lixiviant) containing oxygen and/or bicarbonate (alkaline lixiviant) or an acid (acid lixiviant) is pumped through injection wells into the production unit in the ISR wellfield. The injection of lixiviant induces a chemical change in the ore body that frees the uranium from the host rock. The lixiviant then carries the uranium to the surface through production wells. On the surface, an ion exchange process is used to remove the dissolved uranium from the lixiviant. The lixiviant is then pumped back to the production unit. The ISR process does not generate tailings, but it does produce waste streams containing AEA section 11e.(2) byproduct material that require proper management.

The surface production facilities of ISR operations (e.g., ion exchange columns, evaporation ponds), and wastes produced in the ISR wellfield by the production and extraction operations (e.g., waste liquids, soil contaminated from spills), are either under the NRC's regulatory authority (for ISR facilities located in non-Agreement States) or the applicable Agreement State agency's regulatory authority. To help ensure that hazardous constituents stay within the production unit in the ISR wellfield and that hazardous constituents are restored to the approved concentration limits following ISR operations, the NRC or Agreement State agency regulates the construction and operation of wells associated with production, groundwater monitoring, and groundwater restoration in ISR wellfields.

Table 1 identifies ISR facilities currently regulated by the NRC and the Agreement States.

Table 1 ISR Facilities

Parent Company	ISR Facility (Location)	Regulated By	Small Business As Defined in 10 CFR 2.810
Cameco Resources	• Crow Butte (Nebraska)	NRC	No
	• Smith Ranch-Highland (Wyoming)	Agreement State	
Energy Fuels	• Alta Mesa (Texas) • Nichols Ranch (Wyoming)	Agreement State	Yes
Uranium One /Rosatom	• Willow Creek (Wyoming) • Moore Ranch (Wyoming)	Agreement State	No

Parent Company	ISR Facility (Location)	Regulated By	Small Business As Defined in 10 CFR 2.810
Uranium Energy Corporation	• Hobson-La Palangana (Texas) • Burke Hollow (Texas) • Goliad (Texas) • Reno Creek (Wyoming)	Agreement State	Yes
Ur-Energy Inc.	• Lost Creek (Wyoming)	Agreement State	Yes
Uranium Resources, Inc.	• Crownpoint (New Mexico) • Vasquez (Texas) • Kingsville Dome (Texas)	NRC and Agreement State	Yes
Azarga Uranium Corporation	• Dewey Burdock (South Dakota)	NRC	Yes
Peninsula Energy	• Ross (Wyoming)	Agreement State	Yes

The NRC estimated that a new ISR facility application would be submitted in year 2025. Because the NRC is unaware of any licensee plans to add within the next 10 years a new wellfield within a licensed ISR facility or to add a new production unit within an operating wellfield of a licensed ISR facility, these additions were not modeled. In addition, the NRC estimated costs for the proposed revised requirement for post-restoration monitoring and reporting for licensed ISR facilities following an assumed 20 years of operation. After active wellfield restoration is completed in the production unit, such post-restoration monitoring would occur for a minimum period of three years as opposed to the current requirement by license condition of at least one year of stability monitoring after groundwater restoration.

3.2.3 Base Year

All monetized costs are expressed in 2021 dollars. The NRC's implementation costs to prepare and issue a final rule and guidance are expected to be incurred in 2022. Ongoing costs of operation related to Alternative 2 are assumed to begin no earlier than 30 days after publication of the final rule in the *Code of Federal Regulations* unless otherwise stated, and they are modeled on an annual cost basis. Estimates are made for recurring annual operating expenses. The values for annual operating expenses are modeled as a constant expense for each year of the 20-year analysis horizon. The staff performed a discounted cash flow calculation to discount these annual expenses to 2021 dollar values.

3.2.4 Discount Rates

In accordance with guidance from U.S. Office of Management and Budget (OMB) Circular No. A-4, "Regulatory Analysis," issued September 2003 (OMB, 2003), and NUREG/BR-0058 (NRC, 2020), net present value (NPV) calculations are used to determine how much society would need to invest today to ensure that the designated dollar amount is available in a given year in the future. By using NPV calculations, costs and benefits, regardless of when the cost or benefit is incurred, are valued to a reference year for comparison. The choice of a discount rate and its associated conceptual basis is a topic of ongoing discussion within the Federal Government. Based on OMB Circular No. A-4 and consistent with NRC past practice and guidance, present-worth calculations in this analysis use 3-percent and 7-percent real discount rates. A 3-percent discount rate approximates the real rate of return on long-term government debt, which serves as a proxy for the real rate of return on savings to reflect reliance on a social

rate of time preference discounting concept.[10] A 7-percent discount rate approximates the marginal pretax real rate of return on an average investment in the private sector, and it is the appropriate discount rate whenever the main effect of a regulation is to displace or alter the use of capital in the private sector. A 7-percent rate is consistent with an opportunity cost[11] of capital concept to reflect the time value of resources directed to meet regulatory requirements.

3.2.5 Cost/Benefit Inflators

The staff estimated the analysis inputs for some attributes based on the values published in the NUREG/BR-0058 (NRC, 2020), or other sources as referenced, which are provided in prior-year dollars. To evaluate the costs and benefits consistently, these inputs are put into base-year dollars. The most common inflator is the consumer price index for all urban consumers (CPI-U), developed by the U.S. Department of Labor, Bureau of Labor Statistics (BLS). Using the CPI-U, the prior-year dollars are converted to 2021 base year dollars. The following formula is used to determine the amount in 2021 base year dollars from 2019:

$$\frac{(CPI-U)_{\text{BaseYear}}}{(CPI-U)_{2019}}\ x\ Value_{2019} = Value_{\text{Base Year}}$$

Table 2 summarizes the values of CPI-U used in this regulatory analysis.

Table 2 CPI-U Inflator

Year	CPI-U Annual Average [a]
2019	255.65
2021	264.71

[a] Statista Research, "Projected Consumer Price Index in the United States 2010-2026" (Statista, 2021)

3.2.6 Labor Rates

For the purposes of this regulatory analysis, the NRC applied incremental cost principles to develop labor rates that include only labor and material costs that are directly related to the implementation and operation and maintenance of the proposed rule requirements. This approach is consistent with the guidance in NUREG/CR-3568, "A Handbook for Value-Impact Assessment," issued December 1983 (NRC, 1983), and general cost-benefit methodology. The NRC incremental labor rate is $137 per hour.[12]

[10] The "social rate of time preference" discounting concept refers to the rate at which society is willing to postpone a marginal unit of current consumption in exchange for more future consumption.

[11] "Opportunity cost" represents what is foregone by undertaking a given action. If the licensee personnel were not engaged in revising procedures, they would be performing other work activities. Throughout the analysis, the NRC estimates the opportunity cost of performing these incremental tasks as the industry personnel's pay for the designated unit of time.

[12] The NRC labor rates presented here differ from those developed under the NRC's license fee recovery program (10 CFR Part 170, "Fees for Facilities, Materials, Import and Export Licenses, and Other Regulatory Services under the AEA, as Amended"). NRC labor rates for fee recovery purposes are appropriately designed for full-cost recovery of the services rendered and thus include nonincremental costs (e.g., overhead, administrative, and logistical support costs).

The NRC used the 2019 BLS Occupational Employment and Wages data (BLS, 2019), which provides labor categories and the mean hourly wage rate by job type, and used the inflator discussed above to inflate these labor rate data to 2021 dollars. The labor rates used in the analysis reflect total hourly compensation, which includes wages and nonwage benefits (using a fringe factor of 1.7, applicable for contract labor and conservative for Agreement State and ISR facility employees). The NRC used the BLS data tables to select appropriate hourly labor rates for performing the anticipated tasks necessary during and following implementation of the proposed alternative. In establishing this labor rate, wages paid to the individuals performing the work plus the associated fringe benefit component of labor cost (i.e., insurance premiums, pension, and legally required benefits and the time for plant management exceeding those directly expensed) are considered incremental expenses and are included. Table 3 provides the mean labor rates for ISR facility and Agreement State labor. The NRC used BLS labor rates at the 10th percentile, 50th percentile, and 90th percentile and adjusted to 2021 dollars as input into the uncertainty analysis, which is described in Section 4.

Table 3 Industry and Agreement State Labor Rates

BLS Industry	SOC Code	Occupation	Mean Labor Rate (2019 Dollars)	Labor Multiplier	CPI-U Inflator	Burdened Hourly Rate (2021 Dollars)
			(A)	(B)	(C)	(D=A×B×C)
Industry Labor Rates						
Metal Ore Mining (3 State average)	194045	Geological and Hydrologic Technicians	$30.02	1.70	1.04	$52.84
	192041	Environmental Scientists and Specialists	$36.03	1.70	1.04	$63.41
Agreement State Labor Rates						
Government, excluding schools and hospitals	192040	Environmental Scientists and Geoscientists	$33.66	1.70	1.04	$59.24

[a] The modeled industries and occupational classifications are calculated based on the BLS, "May 2019 National Occupational Employment and Wage Estimates" data using the 10 percentile, 50 percentile, and 90 percentile values (BLS, 2019).

[b] SOC code: standard occupational classification code

3.2.7 Sign Conventions

The sign conventions used in this analysis are that all favorable consequences for the Alternative 2 are positive and all adverse consequences are negative. Negative values are shown using parentheses (e.g., negative $500 is displayed as ($500)).

3.2.8 Analysis Horizon

The analysis horizon is 20 years based on the term of a uranium ISR facility license.

3.3 Industry Implementation

The proposed changes discussed in this section relate to adding a new Criterion 14 to Appendix A to 10 CFR Part 40, revising the opening paragraph of Criterion 5, revising several paragraphs of Criterion 5B, revising Criterion 5C, adding several ISR-specific definitions to

Appendix A, and revising the definition of the term “byproduct material” in 10 CFR 40.4. These proposed changes only would apply to applications for a new ISR facility, a new wellfield within a licensed ISR facility, or a new production unit within an operating wellfield of a licensed ISR facility, provided that the application for which is submitted after the effective date of the final rule.

3.3.1 Site Characterization and Suitability

The requirements for a license application to operate an ISR facility are generally set forth in 10 CFR 40.31, “Application for specific licenses.” Those license application requirements include requirements for the applicant to submit an environmental report (10 CFR 40.31(f)). Currently, the NRC reviews license applications and license amendment requests for ISR facilities using NUREG-1569 guidance and, given the absence of ISR-specific regulations, imposes specific requirements for groundwater protection at ISR facilities through site-specific license conditions. The proposed rule would establish requirements for geologic and hydrologic site characterization information to be submitted by the applicant, or as part of a license amendment request, to demonstrate site suitability. ISR applicants for a new facility or to expand an existing wellfield or add a new wellfield at an existing facility are already providing this information.

Costs: The site characterization and suitability portion of the proposed rule should not increase normal operating costs to industry.

Benefits: The benefits of this action are modeled as the reduction in responding to requests for additional information (RAIs) and revisions to the applicant’s license application. The proposed requirements in this section would more directly address the requirements necessary to evaluate the suitability of the ISR facility site. Implementation of this proposed amendment may result in more complete and consistent applications and thereby more efficient licensing actions by the NRC, thereby reducing costs.
In addition, a more transparent licensing process in this regard is expected to increase public confidence in the NRC’s groundwater protection program for ISRs.

3.3.2 Wellfield Pre-Operational Requirements

The groundwater protection requirements for a licensee to operate a wellfield at an ISR facility are generally set forth in Appendix A to 10 CFR 40. Currently, given the absence of ISR-specific regulations, the NRC imposes specific requirements for the licensee to meet before operation of an ISR wellfield through site-specific license conditions to meet these requirements. Once the site is licensed by the NRC, the proposed rule would require the licensee to provide wellfield specific information before operations begin including: a geological and hydrologic characterization of the wellfield; identification of hazardous constituents that would be expected to be present or increase with ISR operations in the production unit; sampling and analysis to establish background concentration levels for the identified radiological and nonradiological hazardous constituents at point of compliance wells in the production unit, and in immediately overlying, underlying and adjacent aquifers to the production unit; identification and measurement of indicator constituents to detect an excursion in the immediately overlying, underlying and adjacent aquifers to the production unit; and a wellfield restoration plan.
ISR licensees are already providing such information to the NRC prior to operations in each wellfield.

3.3.2.1 Wellfield Characterization

The requirements for a licensee to characterize a wellfield before operations begin in that wellfield at an ISR facility are provided in site-specific licensee conditions that are based on risk-informed and best management practices pursuant to the regulations in Criterion 5 set forth in Appendix A to 10 CFR 40. The proposed rule would establish requirements for geologic and hydrologic site characterization of each wellfield before operations.

Costs: The proposed requirements for wellfield characterization before wellfield operations begin are based on current ISR facility license conditions. This provision of the proposed rule should not increase normal operating costs to industry.

Benefits: Moving these requirements for wellfield characterization from site-specific license conditions into regulation would provide some efficiencies by not having to prepare and implement site-specific license conditions. Codifying this requirement into 10 CFR Part 40 should increase transparency, which is expected to increase public confidence in the NRC's groundwater protection program for ISR facilities.

3.3.2.2 Identification of Hazardous Constituents

The requirements for a licensee to identify hazardous constituents in a wellfield before operations begin in that wellfield at an ISR facility are provided in site-specific licensee conditions that are based on risk-informed and best management practices pursuant to the regulations in Criterion 5 set forth in Appendix A to 10 CFR 40. The proposed rule would require the licensee to identify hazardous constituents in groundwater in the production unit, and in the immediately overlying, underlying, and adjacent aquifers to the production unit of each wellfield before operations.

Costs: The proposed identification of hazardous constituents in a wellfield before wellfield operations begin are based on current ISR facility license conditions. This provision of the proposed rule should not increase normal operating costs to industry.

Benefits: Moving these requirements for identification of hazardous constituents into regulation would provide some efficiencies by not having to prepare and implement such site-specific license conditions. Codifying this requirement into 10 CFR Part 40 should increase transparency, which is expected to increase public confidence in the NRC's groundwater protection program for ISR facilities.

3.3.2.3 Background Hazardous Constituent Concentration Levels

The requirements for a licensee to measure background hazardous constituent concentration levels in a wellfield before operations begin the wellfield at an ISR facility are provided in site-specific licensee conditions that are based on risk-informed and best management practices pursuant to the regulations in Criterion 5 set forth in Appendix A to 10 CFR 40. The proposed rule would require the licensee to conduct sampling and analysis of radiological and nonradiological hazardous constituent concentration levels at point of compliance wells in the production unit, and in immediately overlying, underlying, and adjacent aquifers to the production unit before wellfield operations begin. The NRC would use these hazardous constituent concentration levels to establish and approve hazardous constituent concentration limits for corrective action and groundwater restoration that are referenced in paragraph 5B(5)(a) or (b).

Costs: The proposed background hazardous constituent concentration level sampling and analysis requirements before wellfield operations begin are based on current ISR facility license conditions. This provision of the proposed rule should not increase normal industry operating costs.

Benefits: Moving these requirements for background hazardous constituent concentration level sampling and analysis from site-specific license conditions into regulation would provide some efficiencies by not having to prepare and implement such site-specific license conditions. Codifying this requirement into 10 CFR Part 40 should increase transparency, which is expected to increase public confidence in the NRC's groundwater protection program for ISR facilities.

3.3.2.4 Indicator Constituents

The requirements for a licensee to measure and identify indicator constituents and sample and analyze these constituents to establish upper control limits for detection of excursions at point of compliance wells in a wellfield before operations begin in a wellfield at an ISR facility are provided in site-specific licensee conditions that are based on risk-informed practices pursuant to the regulations in Criterion 7 set forth in Appendix A to 10 CFR 40. The proposed rule would require the licensee to conduct sampling and analysis of indicator constituent concentration levels at point of compliance wells in immediately overlying, underlying, and adjacent aquifers to the production unit before wellfield operations begin. The licensee would use these indicator constituent concentration levels to establish the upper control limits for detection of excursions during wellfield operations.

Costs: The proposed indicator constituent sampling and analysis requirements before wellfield operations begin are based on current ISR facility license conditions. This provision of the proposed rule should not increase industry normal operating costs.

Benefits: Moving these requirements for sampling and analysis of indicator constituents from site-specific license conditions into regulation would provide some efficiencies by not having to prepare and implement such site-specific license conditions. Codifying this requirement into 10 CFR Part 40 should increase transparency, which is expected to increase public confidence in the NRC's groundwater protection program for ISR facilities.

3.3.2.5 Wellfield Restoration Plan

The requirement for a licensee to provide a wellfield restoration plan before operations begin in a wellfield at an ISR facility is provided in site-specific licensee conditions that are based on risk-informed and best management practices pursuant to the regulations in Criterion 5 set forth in Appendix A to 10 CFR 40. The proposed rule would require the licensee to provide the restoration plan describing how the licensee will restore the production unit to achieve and maintain the NRC-approved hazardous constituent concentration limits in the production unit in the wellfield.

Costs: The proposed wellfield restoration plan requirement is based on current ISR facility license conditions. This provision of the proposed rule should not increase normal operating costs to industry.

Benefits: Moving these requirements for a wellfield restoration plan from site-specific license conditions into regulation would provide some efficiencies by not having to prepare and

implement such site-specific license conditions. Codifying this requirement into 10 CFR Part 40 should increase transparency, which is expected to increase public confidence in the NRC's groundwater protection program for ISR facilities.

3.3.3 Uppermost Aquifer Monitoring Plan

The requirement for a licensee to provide an uppermost aquifer monitoring plan before operations begin at an ISR facility is provided in site-specific licensee conditions that are based on risk-informed and best management practices pursuant to the regulations in Criterion 5 set forth in Appendix A to 10 CFR 40. The proposed rule would require the licensee to provide the uppermost monitoring plan describing how the licensee will prevent, detect, and evaluate leaks and spills that may contaminate the uppermost aquifer at the ISR facility to determine if corrective action if required.

Costs: The proposed uppermost aquifer monitoring plan requirement is based on current ISR facility license conditions. This provision of the proposed rule should not increase industry normal operating costs.

Benefits: Moving these requirements for an uppermost aquifer monitoring plan from site-specific license conditions into regulation would provide some efficiencies by not having to prepare and implement site-specific license conditions. The proposed requirement to establish a program to prevent, detect, and evaluate leaks and spills that may contaminate the uppermost aquifer should benefit the environment because earlier identification and containment of leaks into the uppermost aquifer may be possible. Codifying this requirement into 10 CFR Part 40 should increase transparency, which is expected to increase public confidence in the NRC's groundwater protection program for ISR facilities.

3.3.4 Well Design and Construction

The proposed injection and production well design and construction requirements would ensure that byproduct material does not leak from these wells into surrounding groundwater including underground sources of drinking water. The proposed rule would require applicants to submit drawings showing the surface and subsurface construction details of the wells that the applicant plans to install. In cases where the information would be repetitive and the wells are of similar age, type, and construction, the NRC may approve for the applicant to submit typical data for the similar wells. The NRC has implemented similar requirements on existing ISRs through license conditions. These proposed requirements are comparable to existing requirements that ISR operators must meet under EPA's Underground Injection Control (UIC) Program requirements in 40 CFR Part 146, "Underground Injection Control Program: Criteria and Standards."

Costs: The proposed well design and construction requirements are based on current ISR facility license conditions. This provision of the proposed rule should not increase industry normal operating costs to industry.

Benefits: Moving these requirements for well design and construction from site-specific license conditions into regulation would provide some efficiencies by not having to prepare and implement such site-specific license conditions. Codifying this requirement into 10 CFR Part 40 should increase transparency, which is expected to increase public confidence in the NRC's groundwater protection program for ISR facilities.

3.3.5 ISR Application Regulatory Efficiency

As discussed in Section 3.2.2of this analysis, the NRC estimated costs and benefits on a per applicant basis for future ISR facility applicants. The NRC anticipates that a new ISR facility application would be prepared in year 2025. The ISR facility application preparer is expected to require approximately 25-percent fewer hours to prepare the application and to respond to RAIs. The estimated incremental savings resulting from these Alternative 2 improvements are summarized in Table 4. Because of the level of uncertainty regarding the number of ISR facility applicants for new wellfields or production units, the NRC did not quantify costs or benefits resulting from expansions to current ISR facilities. However, as market conditions improve, additional ISR facility licensing activities could occur, which would add additional benefits in application and licensing costs for each application.

Table 4 ISR Application Incremental Efficiency

Year	Activity	No. of Applicant Hours	Labor Rate	Total Per Application		
				Undiscounted	7% NPV	3% NPV
2025	Time saved in preparing and submitting the ISR application	650	$52.84	$34,300	$26,200	$30,500
2025	Time saved in preparing and submitting responses to RAIs	600	$52.84	$31,700	$24,200	$28,200
2025	Time saved in reviewing and commenting on site-specific license conditions	700	$63.41	$44,400	$33,900	$39,400
ISR Application Preparation Incremental Benefit (Cost)				**$110,400**	**$84,300**	**$98,100**

[a] Values rounded to nearest hundred dollars.

3.4 Industry Operations

3.4.1 Operational and Post-Restoration Monitoring and Reporting

The proposed rule would apply only to applications for a new ISR facility, a new wellfield within a licensed ISR facility, or a new production unit within an operating wellfield of a licensed ISR facility, provided that the application for which is submitted after the effective date of the final rule. The proposed rule would require affected ISR facility licensees to conduct operational monitoring of specific indicator constituents to detect excursions at point of compliance wells in the immediately overlying, underlying and adjacent aquifers to the production unit. The proposed rule also would require the affected licensees to conduct post-restoration monitoring after wellfield restoration is completed in the production unit to ensure all hazardous constituent concentration levels continue to meet their approved limits. Future ISR licensees for new ISRs or licensees who amend their license to add new wellfields or expand operations in a new production unit in an existing wellfield would be required to increase their post-restoration monitoring period from the current required minimum period of one year to at least three years.

Costs: The proposed operational monitoring requirements for detection of excursions are already addressed by industry. The post-restoration monitoring requirement is already partially addressed under the baseline alternative of one year of stability monitoring on a quarterly basis after groundwater restoration through the NRC's use of site-specific license conditions.

For the operational monitoring requirements for excursion detection already met by industry, the NRC estimates that there are no incremental costs for licensees to install any additional point of compliance monitoring wells. However, the proposed post-restoration monitoring requirements

would incur additional costs for an ISR facility licensee to perform at least two additional years of post-restoration monitoring in the production unit on a quarterly basis to be comparable to the RCRA corrective action framework for groundwater restoration described in the 2020 NRC EPA MOU.

The NRC estimates that the annual costs to implement the proposed post-restoration monitoring programs, including an analysis of the probable hazardous constituents that are identified[13] and measuring water levels at a point of compliance well in the production unit, would cost $1,286 per compliance monitoring well per year based on contract lab hazardous constituent analysis cost quote (Energy Lab, 2021) and industry values contained in a recent surety submission (Cameco, 2020). The estimated cost for measuring indicator constituents to detect excursions at point of compliance wells located in the immediately overlying, underlying, and adjacent aquifers to the production unit is estimated to cost $872 per well per year. These costs include wellfield infrastructure maintenance and operating costs; personnel costs to take, review, and analyze the samples and water levels; cost of travel; and reporting as shown in Table 5.

Table 5 Annual Post-Restoration Monitoring Costs Per Well Type

Activity	Cost	Basis	Frequency	Basis	Annual Costs Per Well	
					Compliance Monitoring Wells	Excursion Monitoring Wells
MIT						
MIT costs	$101.71	per well-year	1	per year	($101.71)	($101.71)
Infrastructure Costs						
Pump Maintenance	$50.00	per well-year	1	per year	($50.00)	($50.00)
Well Maintenance	$50.00	per well-year	1	per year	($50.00)	($50.00)
Sampling Costs						
Sample Materials/handling	$10.00	per well	1	per year	($10.00)	($10.00)
Hazardous Constituent Analysis in Production Unit	$175.00	per well	4	per year	($700.00)	
HP Technician Labor Rate	$52.84	per hour	4	per well	($211.36)	
Supervisor Labor Rate	$63.41	per hour	1	per well	($63.41)	
Excursion Monitoring Well Analysis (3 parameters)	$30.00	per well	6	per year		($180.00)
HP Technician Labor Rate	$52.84	per hour	6	per well		($317.03)
Supervisor Labor Rate	$63.41	per hour	1	per well		($63.41)
Transportation/electricity	$100.00	well /year	1	per year	($100.00)	($100.00)
Annual Cost Per Well					**($1,286.48)**	**($872.16)**

The NRC estimated annual post-restoration monitoring and reporting costs based on a hypothetical 20-acre square wellfield that contains 20 point of compliance wells in the production unit at one well per acre, five overlying and five underlying aquifer point of compliance wells for excursion detection at one well per 4 acres, and 12 point of compliance wells on a 500 foot spacing on the perimeter of the production unit. Costs may increase or decrease dependent upon the number of wellfields restored, size of wellfields, number of point of compliance wells required, and frequency of monitoring for excursion detection.

[13] Uranium, Radium-226, Arsenic, Barium, Selenium, Lead, and Vanadium are the probable hazardous constituents that will require post-restoration monitoring based on NRC staff analysis of NRC approved restorations of eleven ISR wellfields at three NRC licensed ISR facilities.

Table 6 shows the NRC estimated annual post-restoration monitoring costs for a typical 20-acre wellfield.

Table 6 Annual Post-Restoration Monitoring Costs for a Typical 20 Acre Wellfield

Activity	Well Type	No. of Wells	Annual Monitoring Costs	Annual Cost
Post-Restoration Monitoring	Compliance Monitoring	20	($1,286)	($25,730)
	Excursion Monitoring	22	($872)	($19,188)
			Total	**($44,917)**

The proposed rule changes to the post-restoration monitoring requirements would apply only to applications for a new ISR facility, a new wellfield within a licensed ISR facility, or a new production unit within an operating wellfield of a licensed ISR facility, provided that the application for which is submitted after the effective date of the final rule. The proposed rule would require affected ISR facility licensees to conduct operational monitoring of specific indicator constituents to detect excursions at point of compliance wells in the immediately overlying, underlying and adjacent aquifers to the production unit. The proposed rule would also require the affected licensees to conduct post-restoration monitoring after wellfield restoration is completed in the production unit to ensure all hazardous constituent concentration levels continue to meet their approved limits. Future ISR licensees for new ISRs or licensees who amend their license to add new wellfields or expand operations in a new production unit in an existing wellfield would be required to increase their post-restoration monitoring period from the current required minimum period of one year to at least three years.

Table 7 shows the estimated costs for the additional two-year monitoring period for an affected ISR facility after 20 years of operation.

Table 7 ISR Post-Restoration Monitoring and Reporting

Activity	Year Post-Operation	Post-Restoration Monitoring Cost		
		Undiscounted	7% NPV	3% NPV
Post-Restoration Monitoring	2045			
	2046	($44,917)	($8,276)	($21,453)
	2047	($44,917)	($7,735)	($20,828)
Total Incremental Benefits (Costs)		**($89,834)**	**($16,010)**	**($42,281)**

Benefits: Many of the proposed monitoring requirements are required through site-specific license conditions. The proposed post-restoration monitoring and reporting requirement would increase from at least one year of stability monitoring to at least three years of monitoring for an exceedance of the approved limits to be comparable to the RCRA corrective action framework requirements for groundwater restoration as described in the 2020 NRC EPA MOU. Although the current license condition requiring at least one year of stability monitoring after groundwater restoration has been shown to protect surrounding groundwater, the new post-restoration requirement is comparable to the RCRA requirement for monitoring of hazardous constituents after corrective action. Therefore, in the future, this additional requirement should increase public confidence. Additionally, this proposed rule provision should result in more complete and consistent license applications.

3.4.2 Groundwater Restoration

Alternative 2 proposes to require the production unit in an ISR wellfield to be restored at its designated points of compliance to the approved hazardous constituent concentration limits (background or EPA MCLs). The proposed rule would require the licensee to provide a wellfield restoration plan in Section 3.3.2 to demonstrate the licensee can achieve the approved limits. The proposed rule would also require a post-restoration monitoring program as evaluated in Section 3.4.1. The proposed rule would allow the licensee, it they determine that achieving background or MCLs is not practicably achievable for a specific hazardous constituent, to propose, for NRC approval, an ACL for that hazardous constituent. To propose an ACL, the licensee must demonstrate that the hazardous constituent concentration level is as low as reasonably achievable and would not pose a present or potential hazard to public health, safety, and the environment.

Costs: All ISR licensees have site-specific license conditions, which require groundwater restoration of the hazardous constituents in the production unit to the approved concentration limits and require at least one year of quarterly stability monitoring at points of compliance wells to demonstrate the approved limits will not be exceeded. Criterion 9 in Appendix A of 10 CFR Part 40 requires ISR applicants to submit a surety estimate, including groundwater restoration costs, so that the NRC-approved surety will ensure that groundwater restoration will be completed. As a result, the NRC staff does not expect that this aspect of Alternative 2 would increase ISR licensee operating costs.

Benefits: Although the groundwater restoration requirements are not substantively different from what is currently required under the baseline alternative through site-specific license conditions, establishing requirements through regulation would provide increased regulatory predictability for applicants and licensees and potentially increase regulatory efficiency by not requiring as many RAIs or site-specific license conditions. In addition, greater transparency in the licensing process should increase public confidence in the NRC's groundwater protection program for ISR facilities.

3.4.3 Corrective Action

The proposed rule would require corrective action by ISR licensees to remedy specific contamination events to surrounding groundwater that may occur during operations. The proposed rule is based on existing ISR facility license conditions.

Costs: Corrective action requirements are currently implemented through site-specific ISR license conditions. This provision of Alternative 2 are equivalent to the ISR license condition requirements and should not increase ISR licensee operating costs.

Benefits: Implementation of this Alternative 2 provision should result in more complete and consistent applications, as well as more efficient reviews by NRC. In addition, greater transparency of the licensing process should contribute to efficiency and effectiveness of relevant licensing actions and increase public confidence in the NRC's groundwater protection program for ISR facilities.

3.4.4 Mechanical Integrity

The mechanical integrity provision of Alternative 2 would require a demonstration of mechanical integrity for injection and production wells before initial use, before use after servicing, and at

least once every five years. These requirements are comparable to EPA's existing requirements for mechanical integrity in its UIC program contained in 40 CFR Part 146.

Costs: The NRC currently requires these mechanical integrity demonstrations at wellfields through license conditions. The proposed change would not increase ISR applicant or licensee operating costs.

Benefits: Implementation of the mechanical integrity provision of Alternative 2 would reduce the need for the NRC to rely on license conditions. Implementation of this Alternative 2 provision should result in more complete and consistent applications, as well as more efficient reviews by NRC. In addition, greater transparency of the licensing process should contribute to efficiency and effectiveness of relevant licensing actions and increase public confidence in the NRC's groundwater protection program for ISR facilities.

3.4.5 Plugging and Abandonment of Wells

The proposed rule would require each ISR applicant to submit a well plugging and abandonment plan to the NRC for approval. These new requirements are comparable to existing EPA UIC program plugging and abandonment requirements contained in 40 CFR Part 146.

Costs: The NRC currently requires plugging and abandonment through site-specific license conditions. The proposed change would not increase ISR licensee operating costs.

Benefits: Implementation of these requirements would reduce the need for the NRC to rely on site-specific license conditions. Greater transparency in the licensing process should contribute to efficiency and effectiveness of relevant licensing actions and increase public confidence in the NRC's groundwater protection program for ISR facilities.

3.4.6 Revision of Paragraph 5B(5)(b) and Table 5C Effecting All Uranium Mills

Under Alternative 2, Paragraph 5B(5)(b) would be revised to amend the cross-reference to Criterion 5C. The current table in Criterion 5C would be replaced by cross references to the EPA's 40 CFR Part 141 tables that contain MCLs for drinking water and the 40 CFR 264.94, Table 1, "Maximum Concentration of Constituents for Ground-water Protection," only for those constituents not listed in the 40 CFR Part 141 tables (e.g., lead and silver). These cross references would require that the hazardous constituent concentration limits to be met at a point of compliance must be the most recent version of EPA's MCL for a hazardous constituent, or if the constituent has no MCL, the maximum concentration value found in 40 CFR Part 264, Table 1. The proposed amendment to this section would apply to all uranium mills, both conventional mills and ISRs.

Costs: Uranium mill licensees are required to ensure that hazardous constituent concentration levels at the points of compliance do not exceed the approved hazardous constituent concentration limits provided in paragraph 5B(5). For hazardous constituents not covered in the paragraph 5B(5)(b) cross references to the EPA standards in Criterion 5C, the NRC can set limits pursuant to paragraph 5B(5)(a). Therefore, this proposed change should not increase uranium mill operating costs.

Benefits: By cross referencing the EPA's 40 CFR Part 141 tables that contain MCLs for hazardous constituents in drinking water and the maximum values for hazardous constituents in

40 CFR 264.94, Table 1, the NRC can ensure that the latest EPA standard for a hazardous constituent will be applied.

3.5 NRC Implementation

NRC development costs are the costs of preparation of a regulation before its issuance and implementation. Such costs may include expenditures for research in support of this regulatory action, publishing notices of rulemaking, holding public meetings, responding to public comments, and preparing preliminary rule text. NRC implementation costs are those "front-end" costs necessary to put into force the regulatory action and include actions such as performing rulemaking or developing procedures and guidance to assist licensees in complying with the final action. Costs already incurred, including those activities performed by the NRC in making the regulatory decision (e.g., development of the proposed rule), are viewed as "sunk" costs and are excluded from this analysis.

Developmental and implementation costs within the scope of this analysis of Alternative 2 are the costs of preparing a final rule, as well as efforts on guidance development associated with the rule. NRC activities performed to prepare and issue the proposed rule and associated supplemental guidance for public comment are considered sunk costs. The NRC also would revise Regulatory Information Summary 2009-05 by removing that portion of the RIS that was intended to provide clarification of the hazardous constituent concentration limits for groundwater restoration for ISR facilities when the NRC completed the rulemaking.

Table 8 NRC Implementation

Activity	No. of Hours	Labor Rate	Total[a,b] (2021 dollars)
NRC prepare and issue final rule	1,600	$137	($219,200)
NRC prepare and issue final guidance	850	$137	($116,500)
NRC revise RIS 2009-05	130	$137	($17,800)
NRC Net Implementation Benefit (Cost)			**($353,500)**

[a] Values rounded to the nearest hundred dollars.
[b] NRC activities performed to prepare and issue the proposed rule and associated supplemental guidance are sunk costs and not included in this analysis.

3.6 NRC Operations

The NRC expects to incur reductions in operating costs in future ISR application reviews resulting from the submittal of higher quality applications, the reduction in number of additional requests for information during application review, and the reduction of activities to develop and issue site-specific license conditions. Based on historical data, the NRC expends 8,456 hours to review a new ISR facility application, of which approximately 2,600 hours are estimated to involve the review of groundwater issues. The NRC estimates that the staff reviewers will gain 25% efficiency, which results in a 317 hour improvement in reviewing the application and approximately $34,000 decrease in contractor support. Additionally, the NRC saves time in RAI generation and review of the responses and in preparing and issuing site-specific license conditions. Based on a future ISR application submittal in 2025 as discussed in Section 3.3.5, the potential incremental savings are calculated in Table 9.

Table 9 NRC ISR Application Review Incremental Efficiency

Year	Activity	No. of Hours Saved	Labor Rate	Contractor Savings	Total (2021 dollars)		
					Undiscounted	7% NPV	3% NPV
2025	NRC time save in ISR application review	317	$137	$33,788	$77,200	$58,900	$68,600
2025	NRC time saved in RAI generation and review	720	$137		$98,600	$75,300	$87,600
2025	NRC time saved preparing and issuing site-specific license conditions	750	$137		$102,800	$78,400	$91,300
NRC ISR Application Review Incremental Benefit (Cost)					**$278,600**	**$212,600**	**$247,500**

[a] Values rounded to the nearest hundred dollars.

The NRC will review the Agreement States regulations for compatibility. This review would verify that the added definitions were incorporated and meet the specified Compatibility Category requirements and that the essential objectives are met for all other proposed changes. The NRC estimates that this task takes an average of 40 hours per Agreement State to perform this review and respond to the Agreement State as shown in Table 10.

Table 10 NRC Review Agreement State Regulations for Compatibility

Year	Activity	No. of Agreement States with Uranium Authorities	No. of Hours	Labor Rate	Total (2021 dollars)		
					Undiscounted	7% NPV	3% NPV
2025	Review Agreement State regulations for compatibility	7	40	$137	($38,400)	($29,300)	($34,100)
Agreement State Net Implementation Benefit (Cost)					**($38,400)**	**($29,300)**	**($34,100)**

3.7 Agreement States Implementation

The NRC estimated the costs associated for the Agreement States to support the development of the final rule and to review and concur on the final rule, which is shown in Table 11.

Table 11 Agreement State Implementation

Activity	No. of Agreement States with Uranium Authorities	No. of Hours	Labor Rate	Total (2021 dollars)
Agreement States review and concur on draft final rule	7	80	$59	($33,200)
Agreement States Net Implementation Benefit (Cost)				**($33,200)**

3.8 Agreement States Operation

Agreement States would incur costs for development and implementation of compatible regulations. The costs could vary significantly by State because of differences in internal procedures for developing regulations.

The proposed revisions to existing definitions and the proposed addition of new definitions would be required to meet either Compatibility Category B or C[14] as listed in the proposed rule FR notice. As Compatibility Category B definitions need to be essentially word-for-word the same and Compatibility Category C definitions must include the essential objectives of the NRC definitions, the process should be relatively simple.

All other proposed changes would be considered Compatibility Category C. Those States with authority to regulate uranium milling activities should adopt the essential objectives to avoid conflicts, duplications, or gaps. The way the essential objectives are addressed need not be the same as NRC, provided the essential objectives are met. For those States that do not have authority over uranium milling activities, there would be no need to change their regulations.

For this proposed rule, the NRC assumes that those States not having authority over uranium milling activities could revise definitions during a future rulemaking at minimal cost to the State. Currently, there are seven States (Texas, Wyoming, Washington, Colorado, Utah, Illinois, and Ohio) that have authority over uranium milling activities. The NRC estimates it would take an average of 240 hours for each Agreement State to update their regulations and guidance as shown in Table 12.

Table 12 Agreement States Operation

Year	Activity	No. of Agreement States with Uranium Authorities	No. of Hours	Labor Rate	Total (2021 dollars)		
					Undiscounted	7% NPV	3% NPV
2025	Update Agreement State regulations and guidance	7	240	$59.24	($99,500)	($75,900)	($88,400)
Agreement State Net Implementation Benefit (Cost)					**($99,500)**	**($75,900)**	**($88,400)**

3.9 EPA Coordination

Under section 84a.(3) of the AEA, the NRC staff is required to seek concurrence from the EPA during development of any final rule that would include general requirements to control the nonradiological hazards arising from a licensee's possession, transfer, and disposal of AEA section 11e.(2) byproduct material. EPA's concurrence is limited to the question of whether these general requirements are comparable, to the maximum extent practicable, with the requirements for the possession, transfer, and disposal of similar hazardous material regulated by the EPA under the RCRA. The NRC assumed that the memorandum of understanding

[14] Under the "Agreement State Program Policy Statement" approved by the Commission on October 2, 2017, and published in the FR on October 18, 2017 (82 FR 48535), NRC program elements (including regulations) required for adequacy and having a particular health and safety component are those that are designated as Categories A, B, C, D, NRC, and Health and Safety; and those required for compatibility include those regulations and other legally binding requirements designated as Compatibility Categories A, B, C, and D. Compatibility Category B pertains to a limited number of program elements that cross jurisdictional boundaries and should be addressed to ensure uniformity of regulation on a nationwide basis. The Agreement State program element should be essentially identical to that of NRC. Compatibility Category C are those program elements that do not meet the criteria of Category A or B, but the essential objectives of which an Agreement State should adopt to avoid conflict, duplication, gaps, or other conditions that would jeopardize an orderly pattern in regulating agreement material on a national basis. An Agreement State should adopt the essential objectives of the Category C program elements.

(EPA/NRC, 2020) would streamline EPA's review of the final rule. The estimated costs for EPA's review and concurrence of the final rule are in Table 13.

Table 13 EPA Implementation

Activity	No. of Hours	Labor Rate	Total (2021 dollars)
EPA review and concur on final rule	80	$137	($11,000)
EPA Net Implementation Benefit (Cost)			**($11,000)**

3.10 Regulatory Efficiency

Alternative 2 would reduce the need for the NRC to rely on site-specific ISR license conditions. Because some of the Alternative 2 rule requirements are comparable to those currently required as part of EPA's UIC program, the rule should reduce the potential for inconsistency or additional work in meeting the requirements of two agencies. Also, greater transparency in the licensing process should contribute to efficiency and effectiveness of relevant licensing actions and increase public confidence in the NRC's groundwater protection program for ISRs.

The revised regulations would result in an ISR licensing process that has enhanced regulatory stability, predictability, and clarity. The revised regulations would result in a reduction in the need for RAIs for new ISR license applicants and the development and review of case-by-case ISR license conditions. The NRC expects a future net savings of $110,400 from potential improvements in preparing and reviewing of a new ISR application submittal. Because of the level of uncertainty in the number of applicants and the timing, the NRC is presenting undiscounted values to identify the relative benefits of each provision to support a qualitative judgment of improvements in regulatory efficiency. However, if a second licensee would add by calendar year 2030, a new wellfield within a licensed ISR facility or to add a new production unit within an operating wellfield of a licensed ISR facility than the mean net benefit of this rule is at least $4,000 with 90-percent confidence that the net benefit is between $138,000 and $155,000 using a 7-percent discount rate.

Reliance on the RAI processes to address shortcomings in licensing actions is not ideal because these processes require more resources to address license application issues on a case-by-case basis. These processes do not provide the same degree of certainty or finality of agency decisions as would rulemaking. The estimated benefits of the proposed rule action include: (1) fewer RAIs to address shortcomings, inconsistencies, and gaps in the current regulations; (2) consistent regulatory applicability across the 10 CFR Part 40 licensing processes; (3) efficiencies gained from lessons learned during license application reviews; and (4) the use of a more risk-informed performance-based ISR licensing framework.

3.11 Environmental Considerations

Alternative 2 would amend the regulations to include requirements for (1) the applicant to submit specific geologic and hydrologic site characterization information, as part of a license amendment request, to demonstrate site suitability at an ISR; (2) the licensee to provide wellfield specific information before operations begin including: a geological and hydrologic characterization of the wellfield; identification of hazardous constituents that would be expected to be present or increase with ISR operations in the production unit; sampling and analysis to establish background concentration levels for the identified radiological and nonradiological hazardous constituents at point of compliance wells in the production unit, and in immediately

overlying, underlying and adjacent aquifers to the production unit; identification and measurement of indicator constituents to detect an excursion in the immediately overlying, underlying and adjacent aquifers to the production unit; and a wellfield restoration plan; (3) well design and construction specifications for wells, header houses, and pipelines to ensure that byproduct material does not leak into surrounding aquifers; (4) an operating plan for injection and production wells to ensure an inward hydraulic gradient; (5) operational monitoring of point of compliance wells for excursions and reporting for excursions; (6) a program for monitoring of the uppermost aquifer and reporting requirements; (7) demonstration of mechanical integrity for injection and production wells before initial use and before use after servicing; (8) groundwater restoration and post-restoration monitoring of hazardous constituents in the production unit; (9) submittal of a well plugging and abandonment plan; and (10) corrective action to address contamination caused by ISR operations.

The staff intends for the rule to reflect the requirements contained in site-specific license conditions in existing ISR licenses and to comply with the standards of general application set forth in EPA's 40 CFR Part 192, Subpart D regulations. Because these proposed requirements do not substantively differ from those previously imposed by the NRC in ISR license conditions and site-specific environmental reviews, the staff expects that the costs and benefits from these changes would not substantially change between Alternatives 1 and 2 for applicants or ISR licensees submitting new or revised license applications, respectively.

Alternative 2 establishes additional requirements for post-restoration monitoring for ISR wellfields. The alternative would require post-restoration monitoring that is longer than currently implemented. Under Alternative 2, a licensee would be required to demonstrate that the restoration of the production unit is successful by showing that the hazardous constituent concentration levels collected quarterly from point of compliance wells, and measured for three consecutive years, have remained below their approved hazardous constituent concentration limits with no statistically significant exceedance. The post-restoration monitoring will demonstrate that the hazardous constituents have remained below their established limits at the points of compliance. The new post-restoration monitoring program is comparable to the EPA RCRA corrective action monitoring requirements as described in the NRC EPA 2020 MOU. This post-restoration monitoring requirement would replace the current requirement of stability monitoring after groundwater restoration, typically set forth in a site-specific license condition, which although equally protective of groundwater, is not comparable to the applicable RCRA regulations. The industry costs for performing these monitoring programs are included in Section 3.4.1of this analysis.

Under Alternative 2, paragraph 5B(5)(b) would be revised to amend the cross-reference to Criterion 5C. The current table in Criterion 5C would be replaced by cross references to the EPA's 40 CFR Part 141 tables that contain MCLs for drinking water and the 40 CFR 264.94, Table 1, "Maximum Concentration of Constituents for Ground-water Protection," only for those constituents not listed in the 40 CFR Part 141 tables (e.g., lead and silver). These cross references would require that the hazardous constituent concentration limits to be met at a point of compliance must be the most recent version of EPA's MCL for a hazardous constituent, or if the constituent has no MCL, the maximum concentration value found in 40 CFR Part 264, Table 1. Since the time that the maximum concentrations in Table 5C were initially issued, the EPA has revised and added MCLs for various constituents. The proposed revisions to paragraph 5B(5)(b) and Table 5C will avoid the need for future NRC amendments whenever the EPA revises or adds a new MCL, thereby maintaining consistency between NRC and EPA provisions. As this is an administrative action regarding how the MCLs are referenced in the

NRC's regulations, the proposed amendments to paragraph 5B(5)(b) and Table 5C would not involve any significant environmental impact.

Based on the above, the NRC finds that the additional post-restoration monitoring is comparable to the EPA RCRA corrective action requirements as described in the NRC EPA 2020 MOU. This post-restoration monitoring requirement would replace the current requirement of stability monitoring after groundwater restoration, typically set forth in a site-specific license condition, which although equally protective of groundwater, is not comparable to the applicable RCRA regulations. The remainder of Alternative 2 changes are making requirements currently in ISR license conditions generically applicable to future ISR licensees or making an administrative change to avoid the need for future rulemaking to maintain consistency with EPA MCL for drinking water changes.

3.12 Other Considerations

3.12.1 Increased Public Confidence

In addition to regulatory efficiency, rulemaking would incorporate NRC's risk-informed practices into its requirements for groundwater protection at ISRs and address "lessons learned" from ISR license reviews. In addition, making NRC regulations compatible with EPA MCL regulations would increase public confidence in the NRC's ability to improve its regulations, adapt to regulatory needs identified by stakeholders, provide opportunities for stakeholders to provide input to the changes to the ISR licensing process, and maintain the NRC's role as an effective industry regulator. The rulemaking process includes the greatest opportunity for Commission and public engagement on issues related to the ISR licensing process.

3.12.2 Regulates the Prominent ISR Technology

The establishment of ISR-specific regulations would recognize that the ISR process is now the predominant method used for uranium milling. These new regulations would codify risk-informed practices for groundwater protection used by the NRC in site-specific license conditions. The proposed changes would confirm the applicability of specific Appendix A regulations to groundwater protection at ISR facilities for new licensees. The new regulations should result in more consistent and complete information provided across applications and facilitate greater transparency, predictability, and efficiency in the review of such applications, leading to savings in time and resources for both the NRC and industry.

3.12.3 Streamlines the ISR Licensing Process

Alternative 2 would streamline the licensing process and include interactions on the ISR technical basis with a broad set of external stakeholders as part of the rulemaking to address those items now covered principally by license conditions (e.g., the appropriate requirement or standard for proposing an ACL). By addressing these issues through rulemaking, this alternative avoids the need to address these issues on a case-by-case basis during each licensing review and possibly in hearings.

3.12.4 Provides a Strong Regulatory Basis to Establish a National ISR Program

Alternative 2 would provide a stronger basis for the NRC to establish a national program for purposes of Agreement State compatibility and for the NRC's evaluation and oversight of Agreement State programs. Restarting the ISR-specific rulemaking would allow for greater public stakeholder involvement in developing the regulatory framework than the other options considered and allow the NRC to develop a well-thought out rule that would position the agency

to be able to effectively respond to an increase in ISR facility applications should there be a surge in the demand for uranium.

3.12.5 Provides Sufficient Time for Agreement States to Adopt Compatible Regulations

Alternative 2 provides Agreement State programs time to develop and adopt compatible regulations if a future surge of ISR license applications are submitted.

3.12.6 Responsive to Stakeholder Feedback on ISR Regulations

Alternative 2 is responsive to those stakeholders who have expressed concern in the past about the lack of ISR-specific regulations.

3.12.7 Uranium Economic Conditions

Uranium market projections for the longer term are generally optimistic, reflecting growth in small modular and advanced nuclear power reactors domestically and growth in nuclear power internationally. Outlook for the near term, however, is less positive, and the rate of recovery is uncertain.

The NRC 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. As a result, both the price and production of domestic uranium have fallen. The long-term contract price of uranium has declined from around $60 per pound of U_3O_8 in 2012 to around $45 per pound in 2018 (EIA, 2020a). Spot prices from 2015 to 2019 have generally been 30% lower than contract prices.

Because of these market conditions, several ISR facilities that are licensed and permitted are not currently producing uranium and development of new ISR facilities have 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. Some ISR firms currently are unable to profitably operate their facilities. Several of the small firms report little or no revenue from sales of uranium. Thus, even small incremental costs would not currently be affordable for such firms due to current conditions in the world's economy generally and in the market for uranium in particular. Until the market for uranium recovers, as it is projected to do, ISR uranium production and price will increase; under those conditions, new ISR facilities are expected to be licensed. However, if uranium market conditions fail to change, industry is unlikely to license new uranium ISR facilities, which would result in the rule benefits not being achieved.

3.12.8 Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 et seq.), enacted in September 1980, requires agencies to consider the impact of their regulatory proposals on small entities, analyze alternatives that minimize small entity impacts, and make their analyses available for public comment. The NRC uses the following size standards, codified at 10 CFR 2.810, "NRC Size Standards," to qualify a licensee as a small entity:

- A small business is a manufacturing concern with an average number of 500 or fewer employees based upon employment during each pay period for the preceding 12 calendar months.
- A small organization is a not-for-profit organization that is independently owned and operated and has annual gross receipts of $7 million or less.

- A small governmental jurisdiction is a government of a city, county, town, township, village, school district, or special district with a population of less than 50,000.
- A small educational institution is one that is—(1) Supported by a qualifying small governmental jurisdiction; or (2) Not state or publicly supported and has 500 or fewer employees.

Small entities include small businesses, small governments, small nonprofits, and small educational institutions. Small governments, small nonprofits, and small educational institutions are not expected to be affected by this proposed rule; however, six of the firms identified in Table 14 currently operate or own standby ISR facilities are small businesses, based on the these firms employing 500 or fewer employees and these firms are not a subsidiary of a large entity that does not qualify as a small entity.

The NRC assessed the potential for adverse impacts on small businesses by estimating the costs that would be incurred by the firms that own the ISR facilities, then comparing those estimated costs to the firms' revenues.

Table 14 Estimated Impact of the Rule on Small Entities Benefit to Revenue Ratio

Parent Company	Number of Employees [a]	2019 Annual Revenue ($ Millions)	Rule Benefit (Cost) ($ Millions)	Benefit (Cost) Percentage of Revenue
Energy Fuels	95	$5.87	($0.016)[d]	(0.27%)
Uranium Energy Corporation	45	$–[b]		N/S [c]
Ur-Energy Inc.	56	$0.0323		(0.05%)
Uranium Resources, Inc.	33	$–[b]		N/S
Azarga Uranium Corporation	109	$–[b]		N/S
Peninsula Energy	35	$9.22		(0.17%)

a https://www.owler.com/company/energyfuels
b This firm is not producing uranium at this time and currently has no sales.
c Because the firm has no sales, this benefit ratio is not significant (N/S).
d This cost is the post-restoration incremental monitoring costs for an effected ISR facility wellfield provided in Table 7.

In Table 14, the NRC compares the estimated costs for small firms owning existing ISR facilities to their 2019 revenue. For those firms that have revenue, the proposed rule is estimated to have impacts of less than 0.3 percent of revenue, which are deemed insignificant.

4 SUMMARY OF THE RESULTS

4.1 Summary

This regulatory analysis identifies both quantifiable and nonquantifiable costs and benefits that would result from Alternative 2 (rulemaking). Although quantifiable costs and benefits appear to be more tangible, decisionmakers should not discount costs and benefits that cannot be quantified. Such benefits or costs can be as important as or even more important than benefits or costs that can be quantified and monetized.

4.1.1 Quantified Net Benefits

Table 15 provides a summary of the estimated quantified benefits and costs for Alternative 2, compared to the regulatory baseline (Alternative 1).

4.1.2 Non-quantified Benefits

In addition to the quantified costs, the NRC has analyzed numerous benefits and costs that could not be monetized but would affect the general public, industry, and the NRC. These benefits are summarized in Table 15, which provides the quantified and qualified costs and benefits for Alternative 2. The quantitative analysis used best-estimate values.

Table 15 Summary of Totals

Net Monetary Savings or (Costs)—Total Present Value	Non-quantified Benefits or (Costs)
Alternative 1: No Action $0	None
Alternative 2: **Industry: (all provisions)** $68,000 using a 7% discount rate $56,000 using a 3% discount rate **NRC: (all provisions)** ($170,000) using a 7% discount rate ($140,000) using a 3% discount rate **Agreement States (all provisions)** ($109,000) using a 7% discount rate ($122,000) using a 3% discount rate **EPA (all provisions)** ($11,000) using a 7% discount rate ($11,000) using a 3% discount rate **Net Benefit (Cost): (all provisions)** ($222,000) using a 7% discount rate ($217,000) using a 3% discount rate	**Benefits:** • **Regulatory Efficiency–**Alternative 2 would result in an ISR licensing process that has enhanced regulatory stability, predictability, and clarity; the framework would reduce the need for RAIs for new ISR license applicants and eliminate the development and review of case-by-case ISR license conditions. • **Environmental Considerations–**Alternative 2 would include additional post-restoration monitoring requirements that are comparable to the monitoring requirements for corrective action under RCRA. These additional post-restoration monitoring requirements are expected to have an incremental net positive environmental impact over Alternative 1. The remainder of Alternative 2 changes would make requirements currently in ISR license conditions generically applicable to future ISR licensees or make an administrative change to avoid the need for future rulemaking to maintain consistency with future revisions to EPA's SDWA MCL for drinking water or RCRA maximum concentration. • **Increased Public Confidence–**Alternative 2 would address lessons learned from ISR license reviews and would make NRC regulations

Net Monetary Savings or (Costs)—Total Present Value	Non-quantified Benefits or (Costs)
	compatible with EPA MCL and RCRA maximum concentration regulations; these changes would increase public confidence in the NRC's ability to improve its regulations, adapt to regulatory needs identified by stakeholders, provide opportunities for stakeholder to provide input to the changes to the ISR licensing process, and maintain the NRC's role as an effective industry regulator. • **Regulates the Prominent ISR Process–** Alternative 2 would clarify the applicability of existing 10 CFR Part 40 regulations to ISR activities for new and current licensees. The new regulations should result in more consistent and complete information provided across applications and facilitate greater transparency, predictability, and efficiency in the review of such applications, leading to savings in time and resources for both the NRC and industry. • **Streamlines the ISR Licensing Process–** Alternative 2 (an ISR-specific rulemaking) would streamline the licensing process and include interactions on the ISR technical basis with a broad set of external stakeholders as part of the rulemaking to address those items now covered principally by license conditions. By addressing these issues through rulemaking, this alternative avoids the need to address these issues on a case-by-case basis during each licensing review and possibly in hearings. • **Provides a Strong Regulatory Basis to Establish a National ISR Program–**Alternative 2 would provide a stronger basis for the NRC to establish a national program for purposes of Agreement State compatibility and for the NRC's evaluation and oversight of Agreement State programs, especially if a surge in uranium demand occurs resulting in an increase in ISR facility applications. • **Provides Sufficient Time for Agreement States to Adopt Compatible Regulations** • **Responsive to Stakeholder Feedback on ISR Regulations** **Costs**: • **Uranium Economic Conditions Fail to Change–**If uranium market conditions fail to change, industry is unlikely to license new uranium ISR facilities resulting in the rule benefits not being achieved. • **Unanticipated Rule Compliance Complexity–**If the staff has underestimated the number or the

Net Monetary Savings or (Costs)—Total Present Value	Non-quantified Benefits or (Costs)
	complexity of rule compliance, then the costs could increase proportionally.

4.2 Uncertainty Analysis

The NRC completed a Monte Carlo sensitivity analysis for this regulatory analysis using the specialty software @Risk. The Monte Carlo approach answers the question, "What distribution of net costs and benefits results from multiple draws of the probability distribution assigned to key variables?"

4.2.1 Uncertainty Analysis Assumptions

The NRC provides the following analysis of the variables with the greatest uncertainty on estimates of values. To perform this analysis, the staff performed a Monte Carlo simulation analysis using the @Risk software program.[15] Monte Carlo simulations involve introducing uncertainty into the analysis by replacing the point estimates of the variables used to estimate base-case costs and benefits with probability distributions. By defining input variables as probability distributions instead of point estimates, the influence of uncertainty on the results of the analysis (i.e., the net benefits) can be effectively modeled.

The probability distributions chosen to represent the different variables in the analysis were bounded by the range-referenced input and the staff's professional judgment. When defining the probability distributions for use in a Monte Carlo simulation, summary statistics are needed to characterize the distributions. These summary statistics include the minimum, most likely, and maximum values of a triangular or trigen distribution,[16] the minimum and maximum values of a uniform distribution or integers uniform distribution,[17] and the specified integer values of a discrete population.

Appendix A identifies the data elements, the distribution, and the low, most likely, and high estimates of the distribution that were used in the uncertainty analysis.

4.2.2 Uncertainty Analysis Results

The NRC performed the Monte Carlo simulation by repeatedly recalculating the results 10,000 times. For each iteration, the values identified in Appendix A were chosen randomly from the probability distributions that define the input variables. The values of the output variables were recorded for each iteration, and these values were used to define the resultant probability distribution.

For the analysis shown in each figure below, 10,000 simulations were run in which the key variables were changed to assess the resulting effect on costs and benefits. Figures 1 through 5 display the histograms of the incremental costs and benefits from the regulatory

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[15] Information about this software is available at https://www.palisade.com.

[16] A trigen distribution is a triangular distribution with three points representing a bottom percentile, a most likely value, and a top percentile.

[17] An integer uniform distribution is a discrete distribution on the integers from minimum to maximum, where each of the integers in this range is equally likely.

baseline (Alternative 1) for each affected entity and the total net benefit of the rule. The analysis shows that all affected entities would incur costs if this rule is issued.

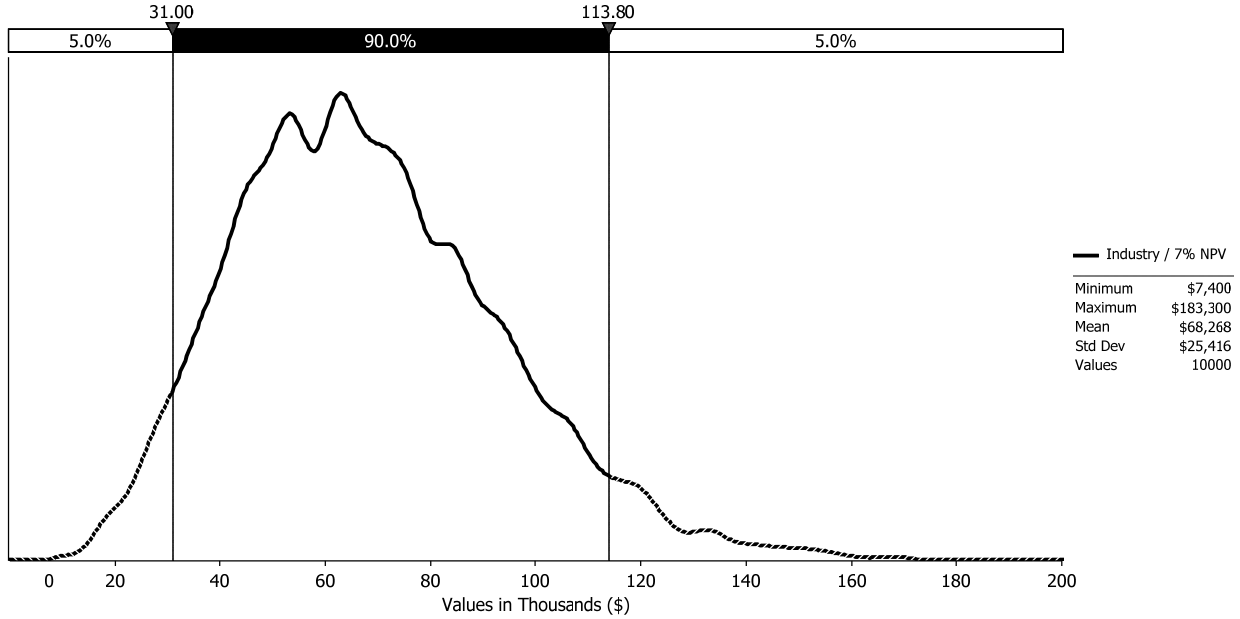

Figure 1 Total Industry Costs (7-Percent NPV)–Alternative 2

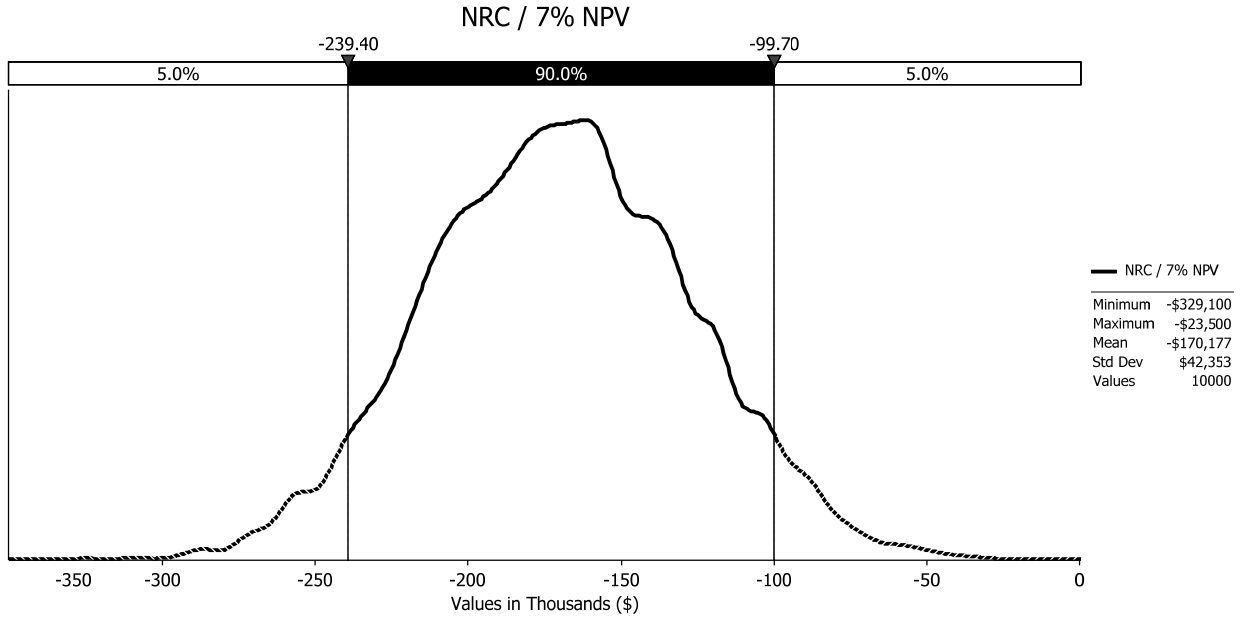

Figure 2 Total NRC Costs (7-Percent NPV)–Alternative 2

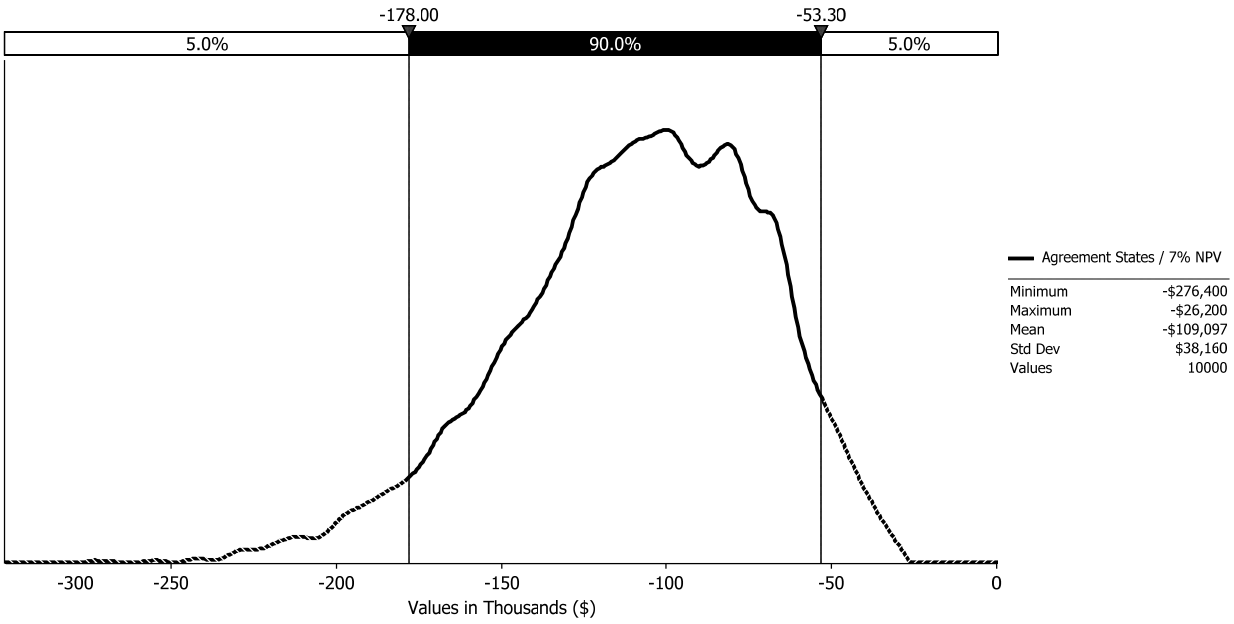

Figure 3 Total Agreement State Costs (7-Percent NPV)–Alternative 2

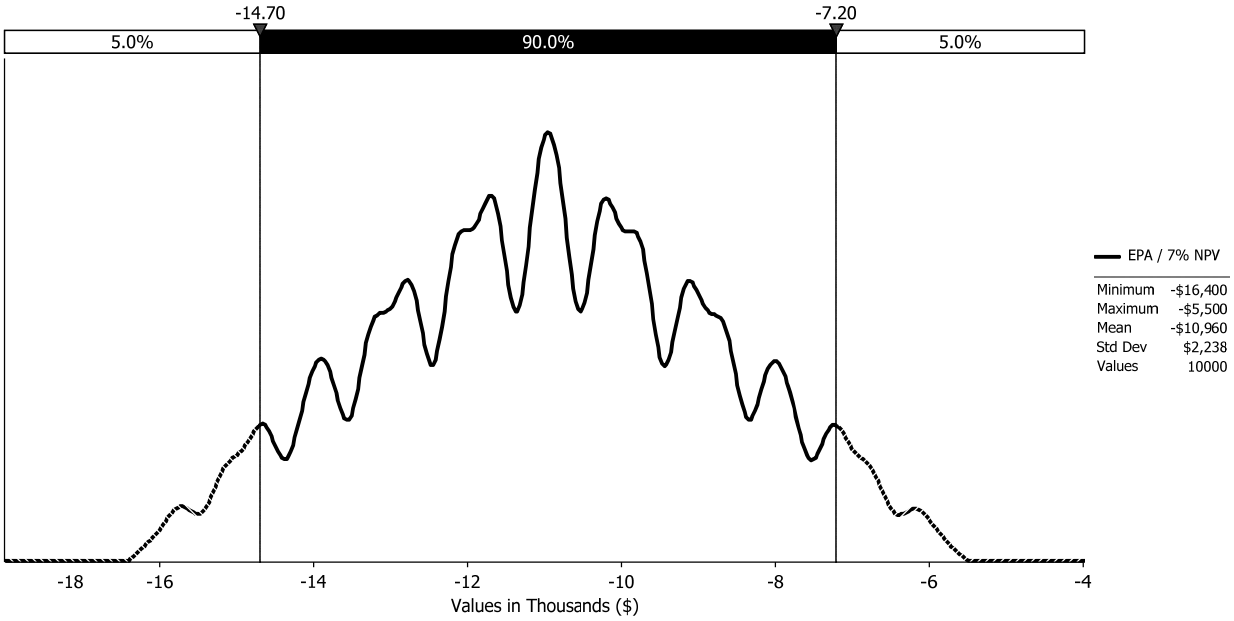

Figure 4 EPA Costs (7-Percent NPV)–Alternative 2

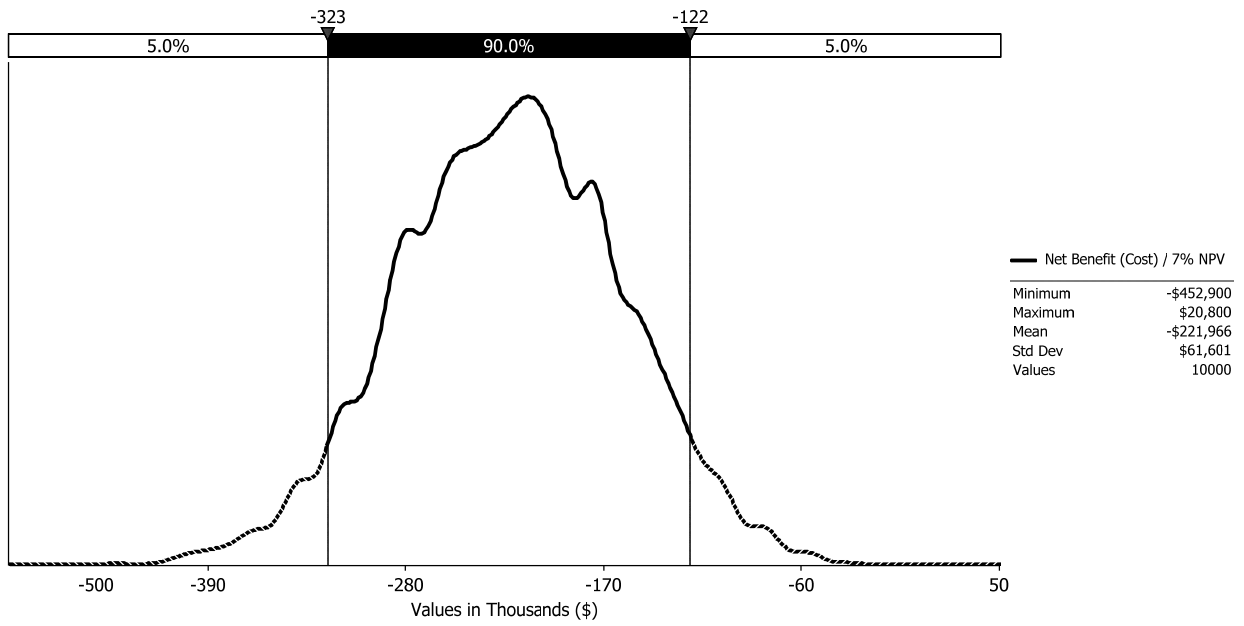

Figure 5 Total Net Benefit (Cost) (7-percent NPV)–Alternative 2

Table 16 presents descriptive statistics for the uncertainty analysis.

Table 16 Descriptive Statistics for Uncertainty Results (7-Percent NPV)

Uncertainty Result	Incremental Cost-Benefit (2021 Thousand Dollars)				
	Min	Mean	Max	5%	95%
Net Industry Benefit (Cost)	$7	$68	$183	$31	$114
Net NRC Benefit (Cost)	($276)	($109)	($26)	($178)	($53)
Net Agreement State Benefit (Cost)	($329)	($170)	($24)	($239)	($100)
Net EPA Benefit (Cost)	($16)	($11)	($6)	($15)	($7)
Total Net Benefit (Cost)	($453)	($222)	$21	($323)	($122)

This table displays the key statistical results, including the 90-percent confidence interval in which the net benefits would fall between the 5-percent and 95-percent values.

Figure 6 shows a tornado diagram that identifies the cost drivers for this proposed rulemaking. This figure ranks the cost drivers based on their contribution to the uncertainty in cost. The largest cost driver is the Agreement State hourly labor rate followed by the amount of time averted for the NRC to prepare and issue site-specific license conditions and the amount of time needed for Agreement States to update their regulations. These three variables are the largest cost drivers and generate the largest variations in the total net benefit due to uncertainty. The remaining cost drivers show diminishing variation on the total net benefit.

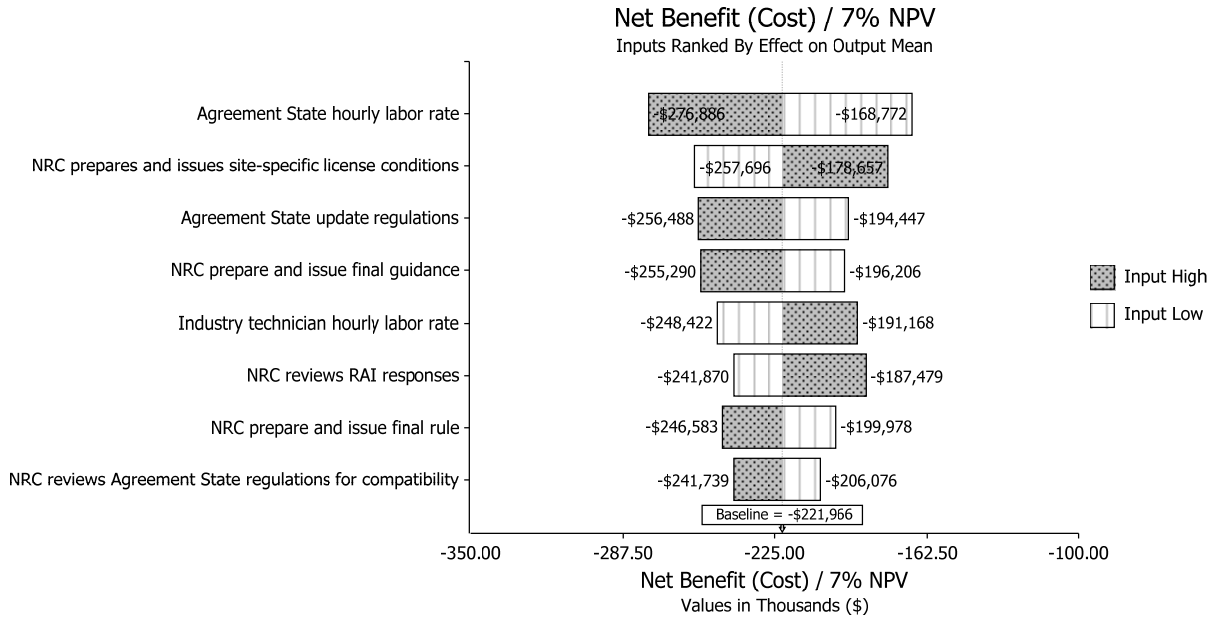

Figure 6 Top Cost Drivers for which Uncertainty Impacts the Total Net Costs (7-Percent NPV)–Alternative 2

4.2.3 Summary of Uncertainty Analysis

The simulation analysis shows that the estimated mean benefit (i.e., positive averted costs or savings) for this proposed rule is ($222,000) with 90-percent confidence that the net benefit is between ($323,000) and ($122,000) using a 7-percent discount rate. The NRC's quantitative estimates show that the rule alternative is only cost beneficial for ISR facilities. However, a major assumption affecting this finding is whether uranium economic conditions change sufficiently such that more than one applicant proceeds with the licensing of a new uranium ISR facility within the next 10 years in order to take advantage of the regulatory benefits that would be achieved by the rule.

4.3 Disaggregation

The NRC performed a screening review to determine whether any of the individual requirements (or set of integrated requirements) of the rule would be unnecessary to achieve the objectives of the rulemaking. The NRC concludes that each of the rule's requirements would be necessary to achieve one or more objectives of the rulemaking and found that the requirements considered separately would not mask the inclusion of other unnecessary requirements. Table 17 provides the results of this review.

Table 17 Disaggregation

Regulatory Goals for Proposed Rule	Objective 1: Establish ISR Facility Groundwater Protection Requirements	Objective 2: Harmonize with EPA Regulations
Site characterization and suitability	X	
Pre-operational, operational, and post-restoration- monitoring and reporting	X	

Regulatory Goals for Proposed Rule	Objective 1: Establish ISR Facility Groundwater Protection Requirements	Objective 2: Harmonize with EPA Regulations
Groundwater quality restoration	X	
Corrective actions	X	
Well design and construction	X	
Mechanical integrity	X	
Plugging and abandonment of wells	X	
Revision of paragraph 5B(5)(b) and Table 5C Effecting All Uranium Mills	X	X

5 DECISION RATIONALE AND IMPLEMENTATION

The assessment of total costs and benefits discussed previously leads the NRC to the conclusion that the proposed rule, if implemented, would maintain protection of the environment, increase regulatory efficiency and effectiveness for both NRC and industry, provide industry with greater regulatory predictability, and the NRC would presumably receive more complete and consistent ISR facility license applications. It is expected that the proposed rule would also make the NRC licensing process more transparent and predictable for the public, thus increasing public confidence in NRC's groundwater protection program for ISRs. Although new licensees following the rule publication may incur additional costs to meet the new monitoring requirements, these costs are relatively small and are considered warranted to conform with the EPA regulations and by the increased assurance that groundwater will be restored to approved limits and remain at or below those limits. This analysis results are sensitive to the number of applicants for new ISR facilities or current licensees that submit a license amendment request for a new wellfield or a new production unit within an existing wellfield. The results of this analysis are based on only one new ISR application being submitted within the next five years. However, if a second licensee would add by calendar year 2030, a new wellfield within a licensed ISR facility or to add a new production unit within an operating wellfield of a licensed ISR facility than the mean net benefit of this rule is at least $4,000 with 90-percent confidence that the net benefit is between ($138,000) and $155,000 using a 7-percent discount rate.

The NRC assumed for this analysis that the effective date of any final rule would be in 2022. Full implementation by the Agreement States would be approximately three years later. A supplement to NUREG-1569 will be issued with the final rule.

Agreement States have three years to make changes to their affected regulations.

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APPENDIX A
UNCERTAINTY ANALYSIS VARIABLES

Description	Mean Estimate	Distribution	Low Estimate	Most Likely Estimate	High Estimate
General Input					
Analysis base year	2021				
Year NRC rule is effective	2022				
Year Agreement State rules are effective	2025				
Timeframe of analysis (years)	20				
Alternative discount factor	3%				
Principal discount factor	7%				
NRC staff hourly labor rate	$137				
EPA staff hourly labor rate	$137				
Fringe benefit cost factor	1.70	triangular	1.50	1.60	2.00
Industry technician hourly labor rate not including fringe (2019 dollars)	$30.02	trigen	$16.13	$25.52	$45.36
Industry supervisor hourly labor rate not including fringe (2019 dollars)	$36.03	trigen	$20.83	$32.16	$52.48
Agreement State hourly labor rate not including fringe (2019 dollars)	$33.66	trigen	$20.80	$31.84	$47.11
No. of Agreement States	38				
No. of Agreement States with uranium milling authorities	7				
No. of Agreement States with ISR Licensees	2				
No. of ISR facilities	16				
No. of ISR facilities regulated by NRC	3				
No. of ISR facilities regulated by Agreement States	13				
Alternative 1 Input Data for Alternative 2 Averted Costs					
NRC Inputs					
NRC prepares and issues ISR application RAIs	240 hours	triangular	160	240	320
NRC reviews RAI responses	480 hours	triangular	160	320	960
NRC prepares and issues site-specific license conditions (per license)	750 hours	triangular	300	600	1,350
NRC reviews new ISR application	8,456 hours	triangular	7,410	8,352	9,607
NRC contractor support for new ISR application review	$901,000	triangular	$237,000	$760,000	$1,706,000
ISR application review related to groundwater	25%	triangular	15%	25%	35%
Agreement States Inputs					
Agreement State prepares and issues ISR application RAIs	60 hours	triangular	40	60	80
Agreement State reviews RAI responses	120 hours	triangular	40	80	240
Agreement State reviews revised ISR application	120 hours	triangular	40	80	240
ISR Applicant Inputs					
ISR application preparation of groundwater sections without rule	2,600	triangular	1,600	2,100	3,600

Description	Mean Estimate	Distribution	Low Estimate	Most Likely Estimate	High Estimate
ISR application preparation efficiency gain with rule	25%	uniform	20%		30%
Reduced time to prepare and submit licensing application	650 hours				
Reduced time to respond to RAIs	600 hours	uniform	200		1,000
Reduced time for ISR applicant to review and comment on NRC site-specific license conditions	700 hours	Uniform	400		1,000
Alternative 2 Input Data					
NRC Inputs					
NRC prepare and issue final rule	1,600 hours	triangular	1,400	1,500	1,900
NRC prepare and issue final guidance	850 hours	triangular	600	750	1,200
NRC revise RIS 2009-05	130 hours	triangular	80	110	200
NRC review and process license amendment request	23 hours	triangular	10	20	40
ISR application review efficiency gain with rule	15%	uniform	10%		20%
NRC reviews Agreement State regulations for compatibility	40 hours	triangular	15	25	80
Agreement States Inputs					
Agreement State review and concur on draft final rule (per State)	80 hours	triangular	40	80	120
Agreement State update to regulations and guidance	240 hours	triangular	120	200	400
ISR Applicant Inputs					
Number of ISR applications	1				
Year of ISR application submittal	2025				
Year of ISR licensee well fields are stabilized and long-term monitoring begins	2045				
Wellfield Inputs					
Average number of compliance wells per wellfield	20				
Average number of overlying excursion detection wells per well field	5				
Average number of underlying excursion detection wells per well field	5				
Average number of perimeter detection wells per well field	12	integer uniform	10	12	14
Average number of wellfields per ISR licensee	7	integer uniform	5		9
Well Infrastructure and Maintenance Inputs					
MIT costs (per well, per year)	$101.71				
Pump maintenance (per well, per year)	$50				
Well maintenance (per well, per year)	$50				
Well Sampling Inputs					
Sample materials handling (per well)	$10				
Hazardous constituent analysis (per compliance well)	$175				
Excursion monitoring well analysis for three parameters (per monitoring well)	$30				
Technician labor to collect samples (per well sample)	4 hours				

Description	Mean Estimate	Distribution	Low Estimate	Most Likely Estimate	High Estimate
Supervisor labor to oversee sampling (per well sample)	1 hours				
Transportation to well and well electricity (per year)	$100				
Well Sampling Frequency Inputs					
Infrastructure and maintenance frequency (per year)	1				
Hazardous constituent analysis frequency (per year)	4				
Three parameter excursion well monitoring frequency (per year)	6				
EPA Inputs					
EPA review and concur on draft final rule	80 hours	triangular	40	80	120

SUBJECT: Regulatory Analysis for the Proposed Rule: Groundwater Protection at Uranium *In Situ* Recovery Facilities. DATED:

ADAMS Accession Nos.: Package: ML21067A112, Regulatory Analysis: ML21067A118

OFFICE	NMSS/REFS/ RASB:TL	NMSS/REFS/ MRPB:PM	NMSS/REFS/ MRPB:BC	NMSS/REFS/ RASB:BC	NMSS/DUWP:D
NAME	FSchofer	GTartal	JCai	CBladey	THolahan
DATE	1/8/2021	1/12/2021	1/21/2021	1/20/2021	1/28/2021
OFFICE	NMSS/REFS:D	NMSS:D	EDO		
NAME	JTappert	JLubinski	MDoane		
DATE	1/29/2021	6/30/2021	7/ /2021		

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