Safety Evaluation Report

Renewal and Amendment for a Performance-Based, Multisite Service Provider License for the Removal of Uranium from Water Resources

License No. SUC-1591

Docket No. 40-9059

WATER REMEDIATION TECHNOLOGY, LLC

January 2019

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Enclosure 1

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1.0 INTRODUCTION

On September 27, 2005, RMD Operations, LLC (RMD), now Water Remediation Technology, LLC (WRT), submitted an application (RMD, 2005a-c) to the U.S. Nuclear Regulatory Commission (NRC) for a source materials license.[1] In its application, RMD sought approval to use its ion exchange technology to remove uranium from community drinking water systems, thereby enabling operators of those systems to comply with the drinking water standards promulgated by the U.S. Environmental Protection Agency (EPA) in 2000 in accordance with the Safe Drinking Water Act of 1974, as amended. After treating, or removing a sufficient amount of the uranium from the community water system, RMD would possess and then ultimately transfer and disposition the uranium.[2] The NRC staff reviewed the source materials license application and concluded in a technical evaluation report (NRC, 2007a) that the requirements of Title 10 of the Code of Federal Regulations (CFR), Part 40, "Domestic Licensing of Source Material," and other applicable criteria were satisfied. As a result, the NRC issued a performance-based, multi-site service provider license, SUC-1591, to RMD on January 25, 2007 (NRC, 2007b). In 2009, the NRC amended the license to reflect the licensee's name change from RMD to WRT (NRC, 2009).

Since the issuance of its license, WRT has continued to provide its ion exchange technology to community water systems. Per the current license, WRT is required to lease-back the uranium removal systems that it provides to community water systems in order to ensure WRT maintains possession of the licensed materials. At the writing of this safety evaluation report, WRT does not service operating uranium removal systems in non-Agreement States, [3] but does service operating uranium removal systems using its ion exchange technology in several Agreements States, including California, Colorado, Georgia, Nebraska, New Jersey, South Carolina, and Virginia. At these sites, WRT is responsible for developing the uranium treatment technology, providing the uranium removal system, providing the uranium treatment media (i.e., ion exchange resin), monitoring the installation of the uranium removal

[1] Sections 62 and 63 of the Atomic Energy Act of 1954, as amended, authorizes the NRC to issue licenses for the transfer, delivery, receipt, possession and use of source material (42 U.S.C. §§ 2092-93). The NRC's implementing regulations for source material licensing are set forth in 10 CFR Part 40. Source material is defined to mean: (1) Uranium or thorium, or any combination thereof, in any physical or chemical form or (2) ores which contain by weight one-twentieth of one percent (0.05%) or more of: (i) Uranium, (ii) thorium or (iii) any combination thereof. Source material does not include special nuclear material. (10 CFR 40.4).

[2] The phrase "water treatment," "treatment," and similar terms, as used in this document, are synonymous with removing uranium from a water source in sufficient quantities to meet the applicable EPA drinking water standards, or other applicable standards for non-drinking water sources.

[3] Section 274 of the Atomic Energy Act of 1954, as amended, provides a statutory basis under which the NRC relinquishes to the States portions of its regulatory authority to license and regulate byproduct materials (radioisotopes); source materials (uranium and thorium); and certain quantities of special nuclear materials. The mechanism for the transfer of NRC's authority to a State is an agreement signed by the Governor of the State and the Chairman of the Commission, in accordance with section 274b of the Act. States that enter into agreements with the NRC are referred to as Agreement States. The NRC retains its regulatory authority in States that have not entered into agreement (i.e., non-Agreement States).

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system, and ongoing maintenance of the uranium removal system. WRT is also responsible as the service provider for all aspects of handling the licensed radioactive material associated with the water treatment, including performing media exchanges; preparing, packaging, and arranging transport of uranium-laden treatment; maintaining agreements for long-term disposition of the residual uranium on the treatment media; performing cleanup and decontamination in the event of a release and at the termination of a treatment agreement.

WRT offers three basic configurations for uranium removal systems that it generally ties to the flow rate of the water system that the uranium removal system treats: a lower-flow portable exchange system, a mid-flow modular component system, and a higher flow field-erected system. Each configuration consists of one or more treatment vessels that contain WRT's ion exchange treatment media, which is a synthetic, strong base, anion-exchange resin that removes uranium.

1.1 WATER REMEDIATION TECHNOLOGY, LLC APPLICATION

On December 21, 2016, WRT submitted its application to renew and amend it license (WRT, 2016). Specifically, the December 21, 2016 application requested a renewal term of 10 years and sought to expand the scope of licensed activities beyond the removal of uranium from community water systems to include the removal of uranium from non-drinking water sources. The expiration date for WRT's current license was January 25, 2017. Because WRT submitted a renewal application within the required timeframe, WRT's current license continues in effect until a decision is made by the NRC on the renewal application in accordance with 10 CFR 40.42(a). If the NRC approves the renewal of WRT's license, the renewal period begins at the time of the NRC staff's approval of the application, not the expiration date of the existing license.

WRT's December 21, 2016 license renewal and amendment application consisted of a letter and an environmental report which was an enclosure to the letter. The letter provided detailed information on the facilities, equipment, and procedures to be used in WRT's water treatment program; the environmental report also included detailed information on several safety issues and will be referred to in this safety evaluation report, as appropriate. The application also analyzed the changes in the occupational and public health and safety impacts and relevant alternatives from WRT's initial application (RMD, 2005a-c) that WRT believes are necessary and appropriate going forward. In its application, WRT also includes a description of the proposed format of the renewed license, including amendments to the initial license, which primarily center on an expanded scope of work to allow treatment of other water resources beyond those used for drinking water (e.g., contaminated groundwater or surface waters).

The NRC staff accepted WRT's application and began its detailed technical review on February 8, 2017 (NRC, 2017a). After accepting WRT's application, the NRC staff issued a notice of opportunity for hearing on the application in the *Federal Register* on April 24, 2017 (82 FR 18939). The NRC staff received no requests for an opportunity for hearing from members of the public in response to this notice. On July 18, 2017, the NRC staff issued a request for additional information (NRC, 2017b) regarding WRT's application to complete its detailed technical review of WRT's application. On November 17, 2017, WRT provided responses (WRT, 2017) to the NRC staff's request.

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By letter dated January 16, 2018 (WRT, 2018a), WRT submitted to the NRC a request to extend the license renewal term from 10 to 20 years based on Commission direction in the Staff Requirements Memorandum (SRM) for Commission Paper SECY-17-0086, "Increasing License Terms for Uranium Recovery Facilities" (NRC, 2017e). In SECY-17-0086 (NRC, 2017d), the NRC staff evaluated license term extensions for uranium recovery facilities including conventional, heap leach and in-situ uranium recovery (ISR) facilities. Although WRT's uranium removal treatment program was not specifically evaluated by the NRC staff in SECY-17-0086, the ion exchange resins used by WRT are similar to the ion exchange resins used at ISR facilities. Because the NRC staff's original notice of opportunity for hearing only described a license term of 10 years, the NRC staff issued another notice of opportunity for hearing limited to the extended term request in the *Federal Register* on July 20, 2018 (83 FR 36630). The NRC staff received no requests for an opportunity for hearing from members of the public in response to this notice.

This safety evaluation report documents NRC's safety review of WRT's NRC-license renewal and amendment application and WRT's request for extending the term of its license from 10 to 20 years. This safety evaluation report also identifies and describes those relevant safety commitments made by WRT in its application and incorporated by the NRC staff in the renewed and amended license as enforceable license conditions.

1.2 REVIEW SCOPE

In reviewing WRT's application for renewal and amendment, the NRC must find that the regulatory requirements of 10 CFR Part 40, "Domestic Licensing of Source Material," and other applicable regulatory requirements are satisfied, including:

- 10 CFR Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations;"
- 10 CFR Part 20, "Standards for Protection Against Radiation;" and
- 10 CFR Part 21, "Reporting of Defects and Noncompliance."

The NRC can renew and amend WRT's license if, among other things, WRT satisfies the requirements of 10 CFR 40.43, "Renewal of licenses," and 10 CFR 40.44, "Amendment of licenses at request of licensee." These regulations require compliance with criteria in 10 CFR 40.31, "Application for specific licenses." In accordance with 10 CFR 40.45, "Commission action on applications to renew or amend," the NRC staff's standards for determining whether to approve the renewal and amendment of WRT's license are set forth in 10 CFR 40.32, "General Requirements for Issuance of Specific Licenses." Specifically, the NRC can renew and amend WRT's service provider if:

- The application is for a purpose authorized by the Atomic Energy Act of 1954, as amended.
- The applicant is qualified by reason of training and experience to use the source material for the purpose requested in such a manner as to protect health and minimize danger to life or property.

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- The applicant's proposed equipment, facilities, and procedures are adequate to protect health and minimize danger to life or property.

- The issuance of the renewed and amended license will not be inimical to the common defense and security or to the health and safety of the public.

To determine whether WRT has met the above requirements, the NRC staff evaluated the safety aspects of the license renewal and amendment application. The NRC staff conducted its evaluation, as described in the sections below, in accordance with the guidance provided in NUREG-1556, Volume 18, Revision 1, "Consolidated Guidance about Materials Licenses – Program-Specific Guidance about Service Provider Licenses," (NRC, 2017c). Because WRT's uranium removal systems utilize ion exchange technology similar to that used at ISR facilities, the NRC staff also consulted the guidance in part, from NUREG-1569, "Standard Review Plan for In Situ Leach Uranium Extraction Applications," (NRC, 2003a) for ISR facilities.

This safety evaluation report documents the NRC staff's technical and safety review of the relevant issues associated with the operation of uranium removal systems at multiple geographic locations across the United States. The safety evaluation report focuses on those aspects of radiation protection discussed in the license application.

In addition, the NRC staff has prepared an environmental assessment to address the environmental impacts of the proposed action (NRC, 2018b) as required by 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." The WRT application (WRT, 2016) presents the licensee's evaluation of the health, safety, and environmental impacts, as well as the measures to mitigate such impacts. The NRC's environmental assessment also discusses these impacts in detail. Based upon the NRC staff's analyses, as set forth in the environmental assessment, the NRC staff prepared a "finding of no significant impact" (FONSI) in accordance with 10 CFR 51.31(a), 10 CFR 51.32, and 10 CFR 51.34(a). Pursuant to 10 CFR 51.35(a), the NRC published the FONSI in the *Federal Register* on October 29, 2018 (83 FR 54378). Safety and environmental considerations found to be important by the NRC staff are included as conditions in the NRC license.

1.3 OVERALL FINDINGS

Based on the information provided in WRT's license renewal and amendment application and the detailed review conducted by the NRC staff of WRT's proposed activities at clients' facilities, as discussed in more detail in subsequent sections of this safety evaluation report, the NRC staff concludes that WRT's application has met the requirements of 10 CFR 40.31, "Application for Specific License," and that the proposed WRT activities are acceptable and comply with the requirements for NRC approval of the application in accordance with 10 CFR 40.32, "General requirements for issuance of specific license." Based on the information contained in WRT's application and the review conducted by NRC staff that is documented in succeeding sections of this safety evaluation report, the NRC staff concludes that the findings described in this safety evaluation report supports renewal and amendment of NRC License SUC-1591.

Regarding WRT's request to extend the term of the renewed and amended license from 10 to 20 years (WRT, 2018a) per Commission direction in SRM-SECY-17-0086, "Increasing License Terms for Uranium Recovery Facilities" (NRC, 2017e), the NRC staff has performed an analysis

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of WRT's program against the seven areas considered in SECY-17-0086 (NRC, 2017d) to assess the licensee's request for an extended license term. Based on its analysis of the similarities that exist between WRT's uranium removal systems and uranium recovery facilities for the seven areas considered in SECY-17-0086, the NRC staff considers WRT's request for a license term extension from 10 years to 20 years to be acceptable. See Section 2.0 of this safety evaluation report for more detail on the NRC staff's analysis.

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2.0 LICENSE TERM EXTENSION

This section of the safety evaluation report presents the NRC staff review and analysis, and evaluation findings pertinent to WRT's request to extend the term of its license from 10 to 20 years.

2.1 SUMMARY OF APPLICATION

WRT requested that the term of its renewed license be extended from 10 to 20 years based on Commission direction in SRM-SECY-17-0086, "Increasing License Terms for Uranium Recovery Facilities" (NRC, 2017e). In SECY-17-0086 (NRC, 2017d), the NRC staff evaluated license term extensions for uranium recovery facilities including conventional, heap leach and ISR facilities and recommended that the license term for such facilities be extended from 10 to 20 years. WRT's uranium removal systems were not specifically evaluated by the NRC staff in SECY-17-0086. The Commission approved the staff's recommendation to implement a maximum license term of 20 years for new applications and license renewals for uranium recovery facilities in SRM-SECY-17-0086 (NRC, 2017e).

2.2 NRC STAFF REVIEW AND EVALUATION FINDINGS

To evaluate WRT's request for extending the license renewal term to 20 years, the NRC staff performed an analysis of the seven areas considered in SECY-17-0086 (NRC, 2017d) to extend the maximum license term for uranium recovery facilities to 20 years. The NRC staff considered the similarity of WRT's processes to that of an ISR facility, which of the three facility types analyzed in SECY-17-0086, is the closest to WRT's uranium removal system because the ion exchange resins used by WRT are similar to those used at ISR facilities . Although WRT's uranium removal systems use ion exchange resins similar to those employed at ISR facilities, WRT's uranium removal processes do not involve the injection of lixiviant into subsurface exempt aquifers nor result in any related groundwater remediation issues. In addition, the purpose of WRT's uranium removal processes is to treat drinking and non-drinking water resources to remove uranium. In contrast to ISR and other types of uranium recovery facilities, WRT's uranium removal processes do not involve concentrating uranium ores primarily for their source material content, producing yellowcake or the use of other hazardous chemicals. Therefore, aspects of WRT's uranium removal systems share similarities with those of an ISR facility but are, in comparison, of lower risk.

The NRC staff acknowledges that WRT specifically, and the industry responsible for removal of uranium from water resources generally, is not as mature as the uranium recovery industry, which has facilities that have been licensed for many years, in some cases over 40 years. Thus, the NRC lacks the extensive operational or inspection history with activities associated with the removal of uranium from water resources that it has with uranium recovery activities. Nevertheless, the NRC staff does not consider this lack of operational or inspection history to be a sufficient basis to deny WRT's license term extension request given the low risk associated with WRT's uranium removal activities. Other than this lack of operational and inspection history, the NRC staff finds that the relevant technical considerations for evaluating WRT's request to extend its license renewal term are bounded by the SECY-17-0086 analyses (NRC, 2017d). Therefore, the NRC considers WRT's request for a license term extension from 10 years to 20 years to be acceptable. The following sections discuss in more detail the analysis of each of the seven areas considered in SECY-17-0086 (NRC, 2017d).

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2.2.1 URANIUM RECOVERY TECHNOLOGY

In SECY-17-0086 (NRC, 2017d), the NRC staff considered the stability and maturity of uranium recovery facility technology and its impact on the NRC's or Agreement State's ability to safely regulate conventional, heap leach, and ISR facilities. WRT's current principal activity is the removal of uranium from drinking water. In its application (WRT, 2016), WRT requested that the NRC renew its current license and further requested an expansion of its principal activities to include uranium removal from non-drinking water resources. The NRC staff does not consider WRT's removal of uranium from water sources to be a uranium recovery activity because WRT is not concentrating uranium from ores primarily for the source material content.

WRT's uranium removal technology, which relies upon ion exchange resin treatment media, is similar to the ion exchange resin technology used at ISR facilities. In fact, WRT's ion exchange resins are sufficiently similar to those used in ISR facilities that when they become laden with uranium, WRT currently sends them to a licensed uranium recovery facility to remove the uranium from the resins as "equivalent feed" in accordance with Regulatory Issues Summary 2012-06, "NRC Policy Regarding Submittal of Amendments For Processing of Equivalent Feed at Licensed Uranium Recovery Facilities," (NRC, 2012b). Because of the similarities to ISR resin technology, WRT's ion exchange resin treatment media is stable and well understood by the NRC. Therefore, extending WRT's license term would have minimal impact on the NRC's or an Agreement State's ability to safely regulate WRT.

2.2.2 URANIUM RECOVERY REGULATIONS

In SECY-17-0086 (NRC, 2017d), the NRC staff considered the impact of increasing the license term of uranium recovery facilities on the stability of the regulatory environment. Similar to uranium recovery facilities, WRT's principal activities, though different than the principal activities at uranium recovery facilities, are regulated by the NRC or by Agreement States. The NRC regulations in 10 CFR 40, "Domestic licensing of source material," or compatible Agreement State regulations, apply to WRT because it generates source material as the uranium in the water loads onto the ion exchange resin treatment media. Although there are no specific NRC regulations for either WRT's uranium removal systems or for ISR activities, the NRC utilizes existing regulations and license conditions to ensure adequate protection of public health and safety and the environment for both WRT and ISR licensees. The NRC has developed ISR guidance and generic communication documents but has not done the same for a category of licensees that remove uranium from water sources (to date, WRT is the only multi-site licensee and its current license is limited to the removal of uranium from drinking water sources).

Under the risk-informed, performance-based regulatory licensing practices that have been in place at the NRC and incorporated into WRT's license, WRT has had the ability to make a limited set of operational changes without the NRC's approval. WRT's Safety and Environmental Review Panel (SERP) reviews and approves these proposed changes to ensure they meet the applicable license conditions; the SERP's changes are subject to the NRC inspection. WRT's SERP process is similar to the SERP process used by many ISR licensees.

Financial assurance requirements for WRT ensure funding will be available through the decommissioning phase of their uranium removal systems. Regulations at 10 CFR 40.36 and related license conditions require WRT to establish mechanisms that are acceptable to the NRC to cover the anticipated costs of uranium removal system decommissioning. WRT is also

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required, upon entering into an agreement with a public or private community water system client, to evaluate its decommissioning cost estimates on an annual basis and/or at license renewal and to submit an annual surety update to the NRC to demonstrate that the appropriate funds will be available if needed.

Although the NRC has not developed extensive regulations or guidance specific to the removal of uranium from water sources, the NRC has been able to use existing regulations at 10 CFR Part 20, "Standards for protection against radiation," and Part 40, "Domestic licensing of source material," as well as guidance for ISR facilities and environmental reviews to license WRT. Because the current regulations and guidance are well-established, the impact of increasing WRT's license term from 10 years to 20 years will be minimal.

2.2.3 INSTITUTIONAL STABILITY

The NRC has licensed WRT to remove uranium from drinking water sources for over 10 years. The operation of WRT's uranium removal system at a client's community water system provides a mechanism for that client to comply with EPA regulations that limit the quantities of uranium present in drinking water. During the initial term of its NRC license, WRT registered three uranium removal systems. However, regulatory oversight of those three systems was later transferred to their respective states when the states became NRC Agreement States. Presently, WRT services several uranium and radium removal systems in Agreement States. In its recent application (WRT, 2016), WRT identified several key personnel who have extensive experience in the uranium recovery industry. The NRC staff expects that WRT has the potential to attract staff from the uranium recovery industry as promotional and professional growth opportunities arise. This availability of experienced staff from the uranium recovery industry would offer the potential for stability and a good knowledge base to WRT due to the similarities in the ion exchange resin technologies. Therefore, increasing WRT's license term is expected to have little impact on the personnel and experience available to WRT and its ability to operate uranium removal systems safely.

2.2.4 PERFORMANCE AND INSPECTION HISTORY

In SECY-17-0086 (NRC, 2017d), the NRC staff proposed that consideration of licensee performance in determining the length of a license was not necessary because the NRC staff believed there were adequate regulatory mechanisms (e.g., increased inspections, confirmatory orders, and enforcement processes) available to address licensee performance issues.

The NRC has the same suite of regulatory mechanisms to address any WRT performance issues. The NRC can conduct routine announced, routine unannounced, and reactive inspections of WRT's uranium removal systems. The NRC's Region IV conducts inspections of WRT, and if needed, can be accompanied by the NRC's headquarters staff that are subject matter experts depending on the focus of the inspection. The NRC inspects WRT approximately every five years and has conducted two inspections during WRT's initial 10-year license term. Region IV inspected WRT's main offices in 2007 and again in 2013, which was after the transfer of the three sites that WRT registered during the initial license term to Agreement States. WRT received no notices of violation from the NRC during its initial license term. WRT also services several uranium and radium removal systems in Agreement States. WRT has received only two Notices of Violations from Agreement States for its uranium removal systems, neither of which were related to occupational or public health and safety, or to any environmental issue. The Notices of Violation focused on records maintenance and financial

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assurance. WRT has had three incidents occur at either its uranium or radium removal systems in total (all located in Agreement States). Two of the incidents involved radium removal systems and the release of a small amount of radium media within the treatment building. The other incident involved a small pipe leak at a uranium removal system. WRT responded with corrective actions and actions taken to prevent re-occurrence.

By license condition, the NRC requires WRT to submit site registration packages by the last day of the month for any uranium removal system that becomes operational in the preceding month as well as annual reports of all decisions and determinations made by the SERP. Because of the information provided by WRT in the required reports and the NRC's licensing and inspection activities, the NRC staff was able to effectively monitor WRT's performance during the initial license term and is confident that it will be able to effectively monitor WRT's performance if WRT registers a uranium removal system at a non-Agreement State site in the future. The NRC's oversight process will ensure that operation of WRT's uranium removal systems, exchanges of the uranium-laden treatment media, and transportation of the uranium-laden treatment media for disposition are conducted in accordance with WRT's license and the NRC's regulatory requirements. An increase in the license term will not affect oversight activities.

The NRC has the inherent regulatory flexibility to renew an operating license for a reduced term because of a licensee's past poor performance. However, WRT's performance in both non-Agreement and Agreement States has shown that violations are uncommon. In addition, the NRC has found that the use of increased oversight, increased inspections, confirmatory orders, and enforcement processes are adequate to address licensee performance issues. The NRC expects these mechanisms would be equally effective should WRT exhibit poor performance going forward.

2.2.5 RISK ASSOCIATED WITH WRT'S URANIUM REMOVAL SYSTEMS

WRT's uranium removal program effectively and permanently removes uranium from drinking water sources in a community, and thus is likely beneficial to the short- and long-term health of the host community. WRT's uranium removal systems present low risk to the public from exposures to radiation from the uranium loaded onto the ion exchange treatment media during the treatment of water. The exposure risk is primarily to WRT's clients' managers and operators from incidental exposure to external radiation while in the proximity to the uranium removal systems. There is also risk to the public from accidental releases of uranium-laden treatment media during operations, exchanges of uranium-laden treatment media, or transportation for disposition of the uranium-laden treatment media. Because the uranium is tightly bound to the treatment media ion exchange resins, spills are localized, and the contamination is minimized. Spills at WRT's clients' facilities would be cleaned up by WRT's personnel. Spills during transportation would be cleaned up by the common carrier's personnel with assistance from WRT's personnel. These types of low-risk events have the potential to occur regardless of the license term. In the NRC staff's view, the NRC inspections, enforcement, licensing actions, licensee corrective actions, industry lessons-learned and best practices, and NRC issued generic communications to its licensees have been sufficient to address these events and minimize their frequency in the uranium recovery industry and would also be sufficient in WRT's case. There have been no generic safety issues for which the NRC staff used the license renewal process to impose additional safety requirements related to either uranium recovery or removal of uranium from drinking water.

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NUREG/CR-6733, "A Baseline Risk-Informed, Performance-Based Approach for In Situ Leach Uranium Extraction Licensees," (NRC, 2001), discussed risk at ISR facilities, which use ion exchange treatment media similar to that used by WRT, and stated,

> "Participation in licensing activities, information gained from site visits, and discussions with NRC staff members supported a broad assumption that uranium ISL [in-situ leach] facilities pose inherently low risk. These facilities contain no operating reactors, no fission products, and no high radiation areas requiring extensive shielding; and they have operating records that confirm low exposures to workers and the public."[4]

As noted above, WRT's uranium removal systems, including those in Agreement States, use similar ion exchange resins to those used at ISR facilities and are similar to ISR facilities in that the uranium removal systems do not contain any operating reactors, fission products, or high radiation areas requiring extensive shielding. In addition, WRT's uranium removal processes do not involve the injection of lixiviant into subsurface exempt aquifers nor result in any related groundwater remediation issues. Furthermore, WRT's uranium removal processes do not involve producing yellowcake or the use of hazardous chemicals. Therefore, the NRC expects the risk associated with WRT's uranium removal systems to be lower than the risk associated with ISR facilities and that the aforementioned assessment from NUREG/CR-6733 (NRC, 2001) is generally applicable to WRT's uranium removal systems.

2.2.6 FACILITY LIFESPAN AND RECENT LICENSING HISTORY

WRT's initial license term was issued for 10 years. WRT often signs long-term service agreements with its clients that range from 10 to 20 years. Either a 10- or 20-year license term would closely align with the duration of these long-term service contracts. The increase in license term to 20 years will not impact the lifespan of uranium removal systems that WRT installs but would reduce the number of license renewals incurred by WRT over a 20-year service agreement from two to one.

2.2.7 RESOURCE IMPLICATIONS

As discussed above, in the case of a 20-year service agreement, the number of renewals would be reduced from two to one. Cost savings for one less renewal would be approximately $175,000, in 2018 dollars, in fees paid by the licensee pursuant to NRC 10 CFR Part 170, "Fees for facilities, materials, import and export licenses, and other regulatory services under the Atomic Energy Act of 1954, as amended," and approximately 0.5 NRC full-time equivalent directly related to licensing activities over the 20-year service agreement. These cost savings do not include potential savings to WRT for the preparation of the additional renewal application and contractor fees.

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[4] See Page 3-2 of NUREG/CR-6733 (NRC, 2001).

3.0 DESCRIPTION OF THE RADIOACTIVE MATERIAL AND PROPOSED ACTIVITIES

This section of the safety evaluation report presents the regulatory requirements, acceptance criteria, NRC staff review and analysis, and evaluation findings pertinent to WRT's principal activities, which involve the installation and operation of a uranium removal system at its clients' facilities.

3.1 REGULATORY REQUIREMENTS

The regulation at 10 CFR 40.32(a) requires that the NRC staff find that the application is for a purpose authorized by the Atomic Energy Act of 1954, as amended.

3.2 ACCEPTANCE CRITERIA

The NRC staff reviewed the application for compliance with 10 CFR 40.32(a), and 10 CFR 40.41, "Terms and conditions of licenses," using the acceptance criteria presented in Sections 8.5.2 and 8.6 of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c).

3.3 SUMMARY OF APPLICATION

Under its existing NRC license, WRT offers a water treatment program that involves the installation of a uranium removal system that utilizes ion exchange treatment media at community water system treatment facilities to remove natural uranium from drinking water sources in non-Agreement States. When the treatment media is fully laden with uranium, WRT removes it from the uranium removal system and ships it via U.S. Department of Transportation (DOT)-approved transport vehicles and containers to a properly licensed and/or permitted facility for final disposition. Final disposition of uranium-laden treatment media currently includes processing such treatment media as an equivalent feed at a licensed uranium recovery facility to recover the uranium content for introduction into the commercial nuclear fuel cycle, although it may include direct disposal as a waste if a uranium recovery facility is not available to process such treatment media.

While WRT does not currently maintain any uranium removal system in non-Agreement States, WRT maintains uranium removal systems for both drinking water and non-drinking water resources in several Agreement States. WRT's program for treatment of water containing uranium has enabled community water systems to safely remove uranium from drinking water sources to comply with the uranium maximum contaminant level specified in EPA regulations and owners of non-drinking water resources to comply with other regulatory requirements without the need to procure relevant radioactive materials handling expertise. Because of WRT's program, community water systems and other entities have permanently removed the uranium from their respective environments.

3.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

The renewed NRC license will authorize WRT to continue to implement its uranium removal treatment program for the removal of natural uranium from drinking water sources at community water systems in non-Agreement States. The NRC will authorize the renewed license for a term of 20 years. WRT's license will also be amended to authorize WRT to expand the implementation of its uranium removal treatment program at non-drinking water treatment facilities. WRT's program for treatment of water with uranium at non-drinking water facilities may include removal of uranium from the following resources:

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- groundwater and surface water sources impacted by mining operations;

- drilling fluids or other solutions resulting from mineral or oil and gas exploration operations; and

- other groundwater or surface water resources, as part of a remediation or general water treatment operation.

WRT created a SERP as required by its initial 2007 license. The purpose of the SERP is to compile all relevant information for all clients that choose to install WRT's water treatment system. The SERP will continue to ensure that such installations are in accordance with the safety and environmental evaluations performed by the NRC staff in renewing and amending WRT's license. The SERP will continue to document its decisions to the NRC (see Section 9 of this safety evaluation report for a discussion of WRT's reporting requirements). The uranium removal system at each client's facility will be subject to NRC inspection.

Sections 2.3.1 and 2.3.2 of WRT's environmental report (WRT, 2016) acceptably describes the uranium removal system and its components, uranium removal processes, and other relevant requirements. To ensure that the WRT uranium treatment program remains within the bounds of the performance requirements specified in WRT's application, the following license condition will be included in the renewed and amended license as:

> License Condition #10
>
> *The Water Remediation Technology LLC (WRT) uranium water treatment program, including operation of its uranium removal system, media exchanges, and final disposition pathways, shall operate as specified in its December 21, 2016 transmittal letter and enclosed document entitled "Source Material License SUC-1591, Environmental Report in Support of a Multi-Site, Performance-Based License Renewal Application" (hence, Environmental Report) also dated December 21, 2016, as amended by WRT Responses to NRC Requests for Additional Information, dated November 17, 2017, except where superseded by licensed conditions contained in this specific license or as otherwise approved in writing by the NRC. Whenever the words "will" or "shall" are used in the above referenced documents, it shall denote a requirement. As used herein, the term "Client" shall mean a person or entity that WRT has entered into a contract with to provide uranium removal services. The term "Client" is further defined to include all employees, agents and contractors of the person or entity that WRT has entered into a contract with to provide uranium removal services.*

In its 2016 application (WRT, 2016), WRT requested permission to amend license condition in the 2007 license that required WRT to lease back the uranium removal system from its client. WRT indicated that its long-term service agreements with its clients ensure that WRT possesses the uranium source material once it loads onto the treatment media. The NRC staff asked WRT in its requests for additional information, dated July 18, 2017 (NRC, 2017b), to confirm that specific commitments are present in the long-term service agreements that will ensure that WRT meets the requirements at 10 CFR Part 40, "Domestic Licensing of Source Material," for possession and use of the licensed material. In its response, dated November 17, 2017 (WRT, 2017), WRT confirmed that its long-term service agreements with clients contain the commitments requested by the NRC staff. To ensure that WRT retains possession of the

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uranium source material it removes from its clients' facilities, the NRC removed the requirement that WRT lease back the uranium removal system from its clients and revised the license condition as follows in the renewed and amended license:

License Condition #13

For all uranium removal systems that WRT is required by license condition to register, WRT, prior to installation of the uranium removal system, shall execute a contract with the Client that will require WRT to take title to the uranium source material as such source material is loaded onto the treatment media within the uranium removal system. WRT shall ensure that the contract shall include the following terms and conditions:

(A) That at all times, the treatment media is and shall remain the property of WRT and that WRT will take title to the uranium source material as it is loaded onto the treatment media.

(B) WRT shall monitor the installation of the uranium removal system by the Client, and WRT shall be responsible for the initial activation of the uranium removal system to ensure its proper operation.

(C) That WRT shall be afforded access to the uranium removal system at all times.

(D) That the uranium removal system is contained within a secured site that complies with security requirements issued by the NRC.

(E) During the operation of the uranium removal system, WRT shall be responsible for all uranium removal system repair, maintenance, and service activities that have the potential for contact with the licensed material.

(F) During the operation and decommissioning of the uranium removal system, WRT shall be responsible for the containment and remediation of any inadvertent release or spill of licensed material.

(G) WRT shall be responsible for all treatment media exchanges, including the removal of the final charge of spent treatment media and final disposition at an appropriately licensed facility at the termination of the operation of the uranium removal system (any unloaded treatment media may continue to be used by WRT at other sites).

Section 62 of the Atomic Energy Act of 1954, as amended, (42 U.S.C. § 2092) authorizes the NRC to issue specific licenses for the possession and transfer of source material. As License Condition #13 will ensure the appropriate possession and transfer of any uranium extracted from the operation of the WRT uranium removal system, the NRC staff finds that 10 CFR 40.32(a) is satisfied.

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4.0 LOCATIONS OF USE OR POSSESSION

This section of the safety evaluation report presents the regulatory requirements, acceptance criteria, NRC staff review and analysis, and evaluation findings pertinent to the siting of WRT's uranium removal systems at its clients' facilities, including the locations that source material will be possessed by WRT. As of the date of issuance of the renewed and amended license, WRT conducts no activities under its license in non-Agreement States.

4.1 REGULATORY REQUIREMENTS

A potential regulatory issue arises as two NRC regulations can be construed as requiring an applicant or licensee to identify the specific site locations of its proposed license activities as a prerequisite to receiving NRC authorization to operate at those sites: 10 CFR 40.32(c) and 10 CFR 40.41(c). Subsection (c) of 10 CFR 40.32, "General requirements for issuance of specific licenses," states that an application will be approved if "the applicant's proposed equipment, facilities and procedures are adequate to protect health and minimize danger to life or property." Subsection (c) of 10 CFR 40.41, "Terms and conditions of licenses," states that "[e]ach person licensed by the Commission pursuant to the regulations in this part shall confine his possession and use of source or byproduct material to the locations and purposes authorized in the license."

4.2 ACCEPTANCE CRITERIA

With respect to compliance with the applicable requirements of 10 CFR 40.32, "General requirements for issuance of specific licenses," and 10 CFR 40.41, "Terms and conditions of licenses," the NRC staff evaluated the application using the acceptance criteria presented in Section 8.3 of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c).

4.3 SUMMARY OF APPLICATION

Unless otherwise stated, the information presented in this section was obtained from Sections 2.0 and 3.0 of WRT's environmental report (WRT, 2016). The WRT uranium removal system will typically be installed at clients' existing water treatment facilities or at newly constructed facilities adjacent to locally permitted water wells or other water resources where water treatment for uranium removal is necessary, such as a mined-out pit lake. The clients' facilities may be located in urban, suburban, or rural areas and in various climates throughout the United States.

WRT expects its potential clients' water treatment facilities to vary in size and dimensions based on the type of water treatment operations performed and the volume of water supplied. Depending on the capacity of the supply system, these water treatment facilities may vary in size from less than an acre of land for a small 100-gallons-per-minute (gpm) [379-liters-per-minute (Lpm)] well with relatively small storage tanks located directly on the ground to several acres for a large 1,000-gpm (3,785-Lpm) well or more with a 500,000-gallon (1,892,700-liter) water tower located onsite. The general location of these facilities can range from a rural area, to a separate lot in a residential setting within a city, to a separate portion of a large municipal complex.

WRT will deliver to, and install or assist its client in installing, the uranium removal system in an existing or new water treatment facility, typically at the site of the water well(s) and well house(s). The facility can also be a primary distribution point where WRT's client combines

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water from multiple wells before entering a distribution system. In some applications, the uranium removal could have an expected, finite end, which could justify a temporary installation, such as installation and operation on an open pad at a construction site.

4.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

The renewed and amended license will continue to authorize WRT to use a facility registration system as a means to notify the NRC of those locations in non-Agreement States where WRT will install, and either WRT or its client will operate, the uranium removal system.

4.4.1 FACILITY REGISTRATION

Under License Condition #20 of its current NRC specific license (NRC, 2009), WRT is authorized to "register," with the NRC, those community water system facilities where WRT intends to install and operate a uranium removal system.[5] The registration is performed by written notification to the NRC staff. Specifically, License Condition #20 states, in part, that "Notification to the NRC shall be made by the last day of the month for any uranium removal system that becomes operational in the preceding month." Thus, the notification to the NRC staff may be made after the uranium removal system has been installed and becomes operational. The written notification must also contain the name and location of community water system facility where the uranium removal system has become operational and a facility description summary. WRT is required to make these notifications, regardless of whether the uranium removal activity at the community water system would be covered under the 10 CFR 40.22(a)(3) general license or whether it would fall outside the scope of the general license, and thus be subject to the current specific license.

The current registration system serves as an alternative to WRT submitting a site-specific license amendment request that seeks NRC approval prior to installing and operating the uranium removal system at a given community water system. Although the NRC staff does not expressly approve the expansion of WRT's activities to new community water systems under the current license, such activities are subject to NRC enforcement.

The renewed and amended license will continue to authorize the registration system (as License Condition #12). The NRC, however, has added additional license condition requirements to account for the expanded scope of WRT's licensed activities, namely, the installation and operation of its uranium removal system at non-drinking water sources:

> License Condition #12
>
> *WRT will be permitted to register and install new uranium removal systems at Client's facilities that will operate within the scope of the performance requirements delineated in Section 2.3 of the Environmental Report and meet the terms and conditions of this specific license. WRT must register, track the status of, and inform the NRC of all Client's facilities it enters into contracts with to provide uranium removal services, so that the number of such Client facilities, uranium removal systems, and their locations can be readily determined at any given time, including those operating under a general license pursuant to 10 CFR 40.22 and*

[5] This site registration system was authorized in the initial 2007 license issued to RMD.

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those operating under this specific license. Notification to the NRC shall be made by the last day of the month for any uranium removal system that becomes operational in the preceding month. The notification must contain the name and location of the Client's facility where the uranium removal system has become operational and include a description of the facility that houses or contains the uranium removal system as well as any ancillary facilities. The facility description shall, to the extent feasible, incorporate the information requested in Tables A.3.4 and A.3.5 of Appendix A, NUREG-1757, Volume 3, Revision 1. The SERP will review the Client's requirements and document the conclusion that such requirements are within the performance requirements set forth in the Environmental Report and meet the terms and conditions of this specific license.

This License Condition #12 will ensure that WRT adequately informs the NRC about installations of its uranium removal system at WRT's client facilities and that the installed uranium removal system will operate in accordance with the performance requirements set forth in Section 2.3 of the environmental report (WRT, 2016). The license condition also reflects the expanded scope of licensed activities to include the installation of a uranium removal system at non-drinking water sources by replacing the phrase "Community Water Systems" with the phrase "Client's facility." The license condition also requires the facility description summary to align with the format of NUREG-1757, Volume 3, Revision 1, "Consolidated Decommissioning Guidance – Financial Assurance, Recordkeeping, and Timeliness" (NRC, 2012a). Together with the approved exemption described in section 4.4.2. below, this License Condition #12 will satisfy the requirements of 10 CFR 40.32, "General requirements for issuance of specific license," and 10 CFR 40.41, "Terms and conditions of licenses".

As described in the October 2018 environmental assessment (NRC, 2018b), the NRC staff considered the environmental impacts of granting WRT's request to expand the scope of its licensed activities to include non-drinking water facilities. The NRC staff noted that the approval of the amendment request would likely increase the number and the variability of the types of facilities at which WRT or its client may install and operate the uranium removal system. Thus, to allow WRT to continue to use the registration system, and at the same time, to properly account for the expanded scope of licensed activities, the renewed and amended license will include siting requirements to ensure that the installation and operation of a uranium removal system will not result in any significant environmental impact.

Specifically, License Condition #12 requires that the uranium removal system operate within the scope of the performance requirements delineated in Section 2.3 of the environmental report (WRT, 2016), and that the notification to the NRC must include the name and location of the Client's facility where the uranium removal system has become operational and contain a facility description summary and relevant features summary similar to Appendix A.3.4 and A.3.5 of NUREG-1757, Volume 3, Revision 1 (NRC, 2012a).

In addition, the amended license will include a new license condition, License Condition #14, that requires WRT to install its uranium removal system in either a building or structure (1) that existed prior to the client entering into a contract with WRT for uranium removal services, or (2) that will be constructed by the client in a previously cleared area, provided that the client cleared the area prior to entering into its contract with WRT. License Condition #14 will also include a license condition that authorizes WRT to install its uranium removal system only at those sites that are accessible either by (1) a public street, road, or highway, (2) a private road constructed by the client prior to entering into a contract with WRT for uranium removal services, or (3) a

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private road constructed by the client after it enters into a uranium removal services contract, with the road being constructed for a purpose other than the installation and operation of a uranium removal system. These license conditions will apply to both drinking water and non-drinking water facilities. If WRT seeks to install a uranium removal system at a facility not meeting these license conditions, WRT would then need to submit a license amendment to the NRC for that specific facility. Specifically, License Condition #14 will require that:

> License Condition #14
>
> *Any uranium removal system installed by WRT under this specific license must be installed in either (A) a building or structure that existed prior to the Client entering into a contract with WRT for uranium removal services, or (B) a building or structure to be constructed by the Client in a previously cleared area located within a Client's facility or site, provided that the Client cleared the area prior to the Client entering into a contract with WRT for uranium removal services. A facility or site where a uranium removal system is to be installed must also be accessible to a public street, road or highway and to the extent that WRT relies upon a private road to either install or service the uranium removal system, such private road must have been constructed by the Client prior to entering into a contract with WRT for uranium removal services and such private road must have been constructed by the Client for a primary purpose other than installation and operation of a uranium removal system. Approval by the NRC of a license amendment to this specific license shall be a condition precedent for the installation of a uranium removal system at any Client's facility or site that does not meet the criteria of this license condition.*

4.4.2 GRANT OF EXEMPTIONS

In the interests of regulatory clarity and efficiency, the NRC exempts WRT from the regulatory requirements of 10 CFR 40.32(c) and 10 CFR 40.41(c), to the extent that such regulations can be construed as prohibiting the use of a registration system. The NRC's authority to grant an exemption from a 10 CFR Part 40 regulation is 10 CFR 40.14(a). An applicant or a licensee may request an exemption from an NRC regulation, or the NRC, on its own initiative, may grant an exemption to its own regulations. In order to grant these exemptions, the NRC must make the requisite findings under 10 CFR 40.14(a), namely, that the grant of these exemptions are authorized by law, will not endanger life or property or the common defense and security, and are otherwise in the public interest.

The Atomic Energy Act of 1954, as amended, the NRC's primary statutory authority, does not prohibit the registration system put into place by the 2007 license. Additionally, the NRC staff finds that WRT's operational experience with its uranium removal system, as described in this safety evaluation report and in the October 2018 environmental assessment (NRC, 2018b), has not and will not endanger life or property or the common defense and security. Furthermore, the NRC staff finds that WRT's installation and operation of its uranium removal system is in the public interest, in that, by contracting with community water systems, the removal system removes uranium from drinking water sources to meet the 30 ug/l maximum contaminant limit set by EPA, and that in addressing uranium contamination in non-drinking water sources, the removal system will allow the client to meet applicable Federal and State regulatory standards for the discharge of the affected and treated waters.

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Further, the NRC staff finds that the registration system remains an appropriate mechanism to account for uranium removal system installations at community water systems and will be an appropriate mechanism to account for such installations at non-drinking water sites. From an administrative and regulatory perspective, a registration system is less expensive and burdensome, for both the NRC, WRT, and WRT's prospective clients, than processing each proposed installation as a site-specific license amendment. An increased use of WRT's uranium removal system should result in a reduction of levels of uranium in both drinking water and non-drinking water sources.

The siting requirements that will be included in the amended and renewed license (License Conditions #12 and #14; see Section 4.4.1 above) should ensure that any environmental impacts arising from the installation and operation of a uranium removal system will not be significant (if WRT cannot meet the siting criteria for a particular installation, it will then be required to submit a license amendment request). Similarly, the NRC staff finds that this registration system does not endanger the public health and safety or the common defense and security as WRT, as required by License Condition #12, will notify the NRC of those facilities where it has installed its uranium removal system and will ensure that the installed system meets the performance requirements identified in the WRT application.

Therefore, pursuant to 10 CFR 40.14(a) and as set forth in this safety evaluation report, the NRC, upon its own initiative, grants WRT exemptions from the requirements of 10 CFR 40.32(c) and 10 CFR 40.41(c), to extent that such regulations can be construed as prohibiting the use of a registration system.

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5.0 INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAM, TRAINING, AND EXPERIENCE

This section of this safety evaluation report presents the regulatory requirements, acceptance criteria, NRC staff review and analysis, and evaluation findings pertinent to the corporate entity involved and the individuals responsible for the radiation safety program, their training, and their experience.

5.1 REGULATORY REQUIREMENTS

The NRC's regulations at 10 CFR 40.32(b)-(d) require that NRC staff find that the applicant is qualified by reason of training and experience to use the source material for the purpose requested in such a manner as to protect health and minimize danger to life or property; that the applicant's proposed equipment, facilities, and procedures are adequate to protect health and minimize danger to life or property; and that the issuance of the license will not be inimical to the common defense and security or to the health and safety of the public. Further, 10 CFR 20.1101, Radiation protection programs," requires licensees to develop and implement a radiation safety program. In addition, 10 CFR 40.61, "Records," specifies additional recordkeeping requirements for source material licensees beyond those required as part of the licensee's radiation protection programs. Finally, 10 CFR 19.11, "Posting of notices to workers," 10 CFR 19.12, "Instruction to workers," and 10 CFR 19.13, "Notifications and reports to individuals," require certain notices, instructions, and reports be provided to workers participating in NRC-licensed and regulated activities.

5.2 ACCEPTANCE CRITERIA

The NRC staff reviewed the application for compliance with the applicable requirements using the acceptance criteria presented in Sections 8.7 and 8.8 of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c) and Sections 5.1, 5.2, 5.4, and 5.5 of NUREG-1569 (NRC, 2003a). Areas of review include the licensee's corporate organization and administrative procedures and the qualifications and training of authorized users of the licensed material and those responsible for radiation safety.

5.3 SUMMARY OF APPLICATION

5.3.1 CORPORATE ORGANIZATION

Figure 3-1 of WRT's environmental report (WRT, 2016) is an organizational chart of the WRT corporate position within its parent company, WRT International LLC. This section of this safety evaluation report describes the position and duties of WRT personnel in descending order of authority, and if applicable, notes qualifications and experience requirements. WRT's organizational arrangement allows it to consider radiation safety matters at appropriate management levels.

5.3.1.1 PRESIDENT OF WATER REMEDIATION TECHNOLOGY, LLC

The President of WRT will have the ultimate responsibility for WRT's operations, including any and all such uranium extraction operations at clients' facilities. This position has management and financial responsibilities for all aspects of WRT's day-to-day operations including engineering, construction, and installation of the uranium removal systems; developing and employing WRT's service network; operations and maintenance of the uranium removal

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systems including exchanging and dispositioning uranium-laden treatment media; environmental and government affairs; and accounting/finance. The President has signatory authority for NRC and Agreement State issued licenses and permits and the authority to enter into water treatment agreements with clients and disposition agreements for uranium-laden treatment media.

5.3.1.2 CHIEF OPERATING OFFICER OF WATER REMEDIATION TECHNOLOGY, LLC

The Chief Operating Officer position was presented in the initial license application in September 2005 and was staffed during most of the initial term of WRT's license, however, it is not in WRT's current organizational chart. However, WRT retains the position in its application (WRT, 2016) because it anticipates the workload of the President will grow to the point where WRT will once again delegate many of the operational responsibilities to a Chief Operating Officer or another Senior Vice President-level position.

If a Chief Operating Officer is appointed, then under the current WRT organizational chart, he/she will report to the President and will take over some of the management and financial responsibilities that are currently held by the President. These responsibilities are likely to include, but not be limited to, all the site service related activities, including the site preparation for and the installation of the WRT uranium removal systems, developing and employing WRT's service network, operations and maintenance of the uranium removal systems including exchanging and dispositioning the uranium-laden treatment media.

5.3.1.3 DIRECTOR OF ENVIRONMENTAL AND REGULATORY AFFAIRS OF WATER REMEDIATION TECHNOLOGY, LLC

The Director of Environmental and Regulatory Affairs (Director) reports to the President. The Director is primarily responsible for license acquisition and compliance for all of WRT's multi-site radioactive material licenses nationwide and for the overall development and compliance oversight of WRT's radiation protection program. The Director directs the activities of the Corporate Radiation Safety Officer (CRSO) and has oversight of the activities pertaining to radiation safety and license compliance of the field Radiation Safety Officer (RSO) and Radiation Control Technicians (RCTs) who work for WRT. The Director is responsible for the radiation safety and DOT hazardous materials training for both WRT and its clients' personnel, establishing financial assurance arrangements required by the licenses, and negotiating and maintaining the disposition agreements for the uranium-laden treatment media.

5.3.1.4 CORPORATE RADIATION SAFETY OFFICER OF WATER REMEDIATION TECHNOLOGY, LLC

The CRSO reports directly to the Director, but also has direct reporting to the President and is responsible for managing, implementing, and enforcing WRT's radiation program and all environmental programs. The CRSO sits on the WRT SERP (see Sections 3.4 and 5.3.3 of this safety evaluation report for more detail on WRT's SERP), implementing its directives, and interfaces with other corporate officers to ensure that the system operates consistent with license conditions and applicable regulations and requirements. Through the direct report to the President, the CRSO has the authority to stop, intervene, and mitigate any radiologic activity or other situation involving health and safety. The CRSO has the authority to direct WRT's field RSO and RCTs for activities pertaining to radiation safety and license compliance.

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The CRSO is responsible for supervising and monitoring the environmental protection and radiation safety programs for all treatment facilities for water containing uranium and for advising WRT system specialists and the clients' managers and operators on environmental and radiation safety issues. The CRSO's responsibilities include developing and implementing all radiation safety and environmental programs, ensuring that WRT personnel correctly maintain records, and assisting in assuring compliance with applicable regulations and license conditions.

The CRSO will conduct routine training programs for WRT's corporate and clients' personnel regarding the proper application of radiation protection, emergency response, and environmental control programs. The CRSO, when necessary, will inspect operating uranium removal systems to verify compliance with all applicable radiological health and safety requirements and any quality assurance/quality control requirements. Additionally, the CRSO will annually review WRT's radiation protection program and all corporate operating procedures to ensure that the program is being implemented effectively, that the radiation safety procedures are being implemented properly, and that radiation exposures are being maintained as low as reasonably achievable (ALARA).

The CRSO will be responsible for routinely auditing all operational and monitoring procedures, quality assurance/quality control, and ALARA programs, and will be a member of WRT's ALARA audit team. WRT authorizes the CRSO to terminate any activity that may be a threat to employees, public health and safety or the environment, as indicated in reports from any client facility manager. The CRSO will serve as the primary point-of-contact for purposes of addressing site-specific public health and safety or environmental issues.

If at any time the CRSO is not able to carry out their responsibility, WRT has designated Alternate Radiation Safety Officers (ARSO), i.e., a "designated CRSO", who will be able to provide the required CRSO responsibility during the CRSO's absence. ARSOs will have the same responsibilities and authority as the CRSO.

5.3.1.5 FIELD RADIATION SAFETY OFFICER AND RADIATION CONTROL TECHNICIANS OF WATER REMEDIATION TECHNOLOGY, LLC

The field RSO and RCTs report to the Vice President of Media Services and will support the WRT system specialists. In addition, the CRSO has the authority to direct (and intervene with) the field RSO and RCTs. The field RSO and RCTs will implement the WRT radiation protection program during all field service operations that involve handling the licensed material, primarily during exchanges of uranium-laden treatment media, but also for other system maintenance events that have the potential for coming in contact with the licensed material. The field RSO and RCTs will monitor radioactive contamination and control the work areas and WRT system specialists during the service activity, comply with all applicable DOT requirements for packaging and transporting the radioactive material, conduct pre- and post-job contamination surveys, and mitigate any radioactive contamination found as necessary. The field RSO's and RCTs' other responsibilities include the following:

- recordkeeping, including the maintenance, transportation, and disposition of records in WRT's electronic and hard-copy central files, as well as at WRT's state offices of record or at clients' offices

- conducting periodic contamination or emission surveys at clients' facilities

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- maintaining WRT's dosimetry program

- assisting in presenting radiation safety training at WRT and general radiation awareness training at its clients' sites

5.3.1.6 WATER REMEDIATION TECHNOLOGY, LLC SYSTEM SPECIALISTS

In addition to the CRSO, WRT will employ system specialists who will be responsible for monitoring the installation, operation, maintenance and decommissioning of the uranium removal systems. WRT system specialists will perform the following tasks related to treatment media:

- assure that all uranium removal system equipment has been installed and operates pursuant to license requirements at each client facility that has entered into a contract with WRT

- perform maintenance, repair, and/or replacement operations on components of the uranium removal system containing licensed material

- monitor performance of clients' operators and uranium removal system operating data

- monitor performance and track useful life of treatment media

- install fresh treatment media in the uranium removal system

- perform media exchanges to remove licensed material attached to uranium-laden treatment media

- arrange for the packaging and transportation of uranium-laden treatment media

- arrange for the final disposition of licensed material either at an NRC- or Agreement State-licensed uranium recovery facility for processing as an equivalent feed or at a properly permitted or licensed disposal facility for direct disposal

5.3.1.7 CLIENT PERSONNEL (NON-WATER REMEDIATION TECHNOLOGY, LLC PERSONNEL)

Sections 3.13.2 and 3.16.1.4 of WRT's environmental report (WRT, 2016) describe the tasks that clients' personnel will perform, and Section 3.16.2.3 of WRT's environmental report describes their training requirements.

Per License Condition #13 (see Section 3.4 of this safety evaluation report), WRT will, at all times, possess the uranium as it loads onto the treatment media and perform all activities that have the potential to come in contact with the uranium-laden treatment media. A WRT's client's personnel may be in the vicinity of the operating uranium removal system during normal daily activities (e.g., performing general inspections of equipment operation on a periodic basis, observing flow rates and operating pressures, collecting inflow and discharge water samples, performing miscellaneous inspection and/or maintenance tasks related to components of the facility other than the uranium removal system), but will not be performing tasks that have the potential to bring the client's personnel into direct contact with the uranium-laden treatment

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media. Thus, the NRC considers WRT's client's personnel as members of the public and as such, subject to the public dose limits of Subpart D, 10 CFR Part 20, "Radiation Dose Limits for Individual Members of the Public."

WRT's clients' managers will serve as the primary points-of-contact for the CRSO and WRT system specialists when WRT's personnel are performing licensed activities and for NRC inspectors wanting to make an inspection or site visit. Each client's manager will monitor the operation of the treatment system and secure the system in a locked building or fenced area. Additionally, each client's manager will be responsible for supervising the client's operators regarding monitoring and safely working around the uranium removal systems. Although clients' managers will not directly handle the uranium-laden treatment media, they may receive incidental exposures to radiation because of their periodic proximity to a uranium removal system.

A client's operators report to the client's manager. Although they will not directly handle the uranium-laden treatment media, a client's operators who will monitor the uranium removal system on a daily basis may receive incidental exposures to radiation because of their proximity to the uranium removal system.

5.3.2 QUALIFICATIONS AND TRAINING FOR INDIVIDUALS RESPONSIBLE FOR THE RADIATION SAFETY PROGRAM

Section 3.16.2 of WRT's environmental report (WRT, 2016) presents the specific radiation safety training required for the CRSO and WRT system specialists. WRT may also provide voluntary general radiation awareness training for clients' personnel whose job assignments take them in the vicinity of the uranium removal systems since these personnel may receive a slight exposure.

5.3.2.1 CORPORATE RADIATION SAFETY OFFICER OF WATER REMEDIATION TECHNOLOGY, LLC

WRT will require that the CRSO has, at a minimum, a Bachelor of Science degree in biological or physical sciences, engineering, or related discipline from an accredited college or equivalent practical experience or training. The CRSO also will attend the following training courses: (i) initial 40-hour RSO training course; (ii) initial DOT hazardous material transportation training; and (iii) refresher training for radiation safety and hazardous material transportation, as necessary. The qualifications of the ARSOs will be consistent with the qualifications identified for the CRSO.

5.3.2.2 FIELD RADIATION SAFETY OFFICER AND RADIATION CONTROL TECHNICIANS OF WATER REMEDIATION TECHNOLOGY, LLC

WRT did not identify the professional qualifications and training requirements necessary for the field RSO and RCT positions in its application (WRT, 2016), although WRT does list the qualifications of an individual identified as a field RSO.

5.3.2.3 WATER REMEDIATION TECHNOLOGY, LLC SYSTEM SPECIALISTS

WRT system specialists will be instructed in all the topics covered in the general radiation awareness training. In addition, they will attend an initial DOT hazardous materials awareness and transportation training course. Both the radiation safety and DOT hazardous material

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training will include end-of-course tests for which the WRT system specialists must obtain a passing score. As appropriate, WRT will customize this course to the uranium removal system and associated equipment, as appropriate, to emphasize the areas related to sampling and handling the treatment media, implementing personal protective equipment requirements, minimizing surface contamination, and shipping and manifesting requirements. Both the radiation safety and DOT hazardous material training will include end-of-course tests for which WRT system specialists must obtain a passing score.

5.3.2.4 CLIENT PERSONNEL (NON-WATER REMEDIATION TECHNOLOGY, LLC PERSONNEL)

Client personnel are anticipated to receive an annual dose significantly less than the 100 millirem (mrem) [1 milliSievert (mSv)] occupational dose and as such, are not required to receive radiation awareness training pursuant to 10 CFR 19.12, “Instructions to workers.” However, WRT’s CRSO will determine, commensurate with the radiation hazards related to the uranium removal system and duties of the client’s personnel, whether general radiation awareness training and ancillary training related to their non-radiological responsibilities are warranted.

5.3.3 MANAGEMENT CONTROL PROGRAM

Because the SERP and its members are a vital part of the performance-based license concept, WRT will establish a SERP with at least three individuals representing expertise in management/financial, operations/construction, and radiation safety matters. WRT has committed that the SERP will address specific technical issues with support from other qualified staff members or consultants, as appropriate. The NRC staff reviewed the process by which WRT, in conjunction with its SERP, will keep track of and inform the NRC of all clients’ facilities it enters into service contracts with, so that the number of such clients’ facilities and their locations can be readily determined at any given time. The WRT SERP will evaluate and approve the use of a uranium removal system at a client’s facility to ensure installation and operation of the uranium removal system in a safe and environmentally acceptable manner. The SERP may evaluate and approve or disapprove the installation of uranium removal systems, make certain changes to existing systems, and conduct tests without obtaining prior NRC review and approval, provided the changes are permitted by License Condition #14 (see Section 4.4.1 of this safety evaluation report for a discussion of License Condition #14). WRT will notify the NRC of newly installed uranium removal systems when they become operational and of changes made to existing systems. All changes made by WRT personnel at clients’ facilities are subject to NRC inspection and enforcement actions.

5.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

5.4.1 CORPORATE ORGANIZATION

NRC has completed its review of the corporate organization and administrative procedures proposed. This review included an evaluation using the review procedures in Section 5.1.2 and the acceptance criteria outlined Section 5.1.3 of NUREG-1569 (NRC, 2003a) and Sections 8.7 of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c).

The applicant has an acceptable corporate organization that defines management responsibilities and authority at each level. The applicant’s definition of the responsibilities and procedures with respect to development, review, approval, implementation, and adherence to

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operating procedures, radiation safety programs, routine/non-routine maintenance activities, and changes to any of these is acceptable. The applicant has demonstrated integration among corporate support groups and groups that support operation and maintenance of the uranium removal system, including media exchanges and disposition of the uranium-laden treatment media. The applicant has also acceptably delineated responsibilities between WRT personnel and its clients' personnel.

Based on the information provided in the application and the detailed review conducted of the corporate organization and administrative procedures for the licensee, the NRC staff concludes that the proposed corporate organization and administrative procedures are acceptable and are in compliance with 10 CFR 20.1101, "Radiation protection programs," which defines radiation protection program requirements as well as 10 CFR 19.11, "Posting of notices to workers," 10 CFR 19.12, "Instruction to workers," and 10 CFR 19.13, "Notifications and reports to individuals". In addition, the requirements of 10 CFR 40.32(b)-(d) are also met as they relate to the proposed corporate organization.

5.4.2 QUALIFICATIONS AND TRAINING FOR PERSONNEL

NRC has completed its review of the qualifications and training of personnel conducting the radiation safety program. Based on the information provided in the application and the detailed review conducted of the qualifications of the personnel conducting the radiation safety program, the NRC staff concludes that the qualifications of the personnel are acceptable and are in compliance with 10 CFR 20.1101, "Radiation protection programs," which defines radiation protection program requirements, and 10 CFR 40.32(b), which provides requirements for applicant qualifications. The qualifications of personnel conducting the radiation safety program are acceptable and consistent with Sections 8.7, 8.8, and, more specifically, Appendix D of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c) , and Regulatory Guide 8.31, "Information Relevant to Ensuring That Occupational Radiation Exposures at Uranium Mills Will Be As Low As Is Reasonably Achievable" (NRC, 2002), subject to License Conditions #16-19, which are identified in subsequent sections.

Based on the information provided in the application and the detailed review conducted of the radiation safety training program, the NRC staff concludes that the radiation safety training program, as bounded by the conditions of the renewed and amended license, is acceptable. The NRC staff finds that WRT's training program complies with 10 CFR 19.12, "Instructions to workers," which defines requirements for instructing workers who receive an occupational dose in excess of 100 mrem (1 mSv), and 10 CFR 20.1101, "Radiation protection programs," which defines radiation protection program requirements, and satisfies 10 CFR 40.32(b), as it relates to applicant qualifications through training. The training program proposed by WRT, as bounded by the conditions of the renewed and amended license, is consistent with the guidance contained in the following:

- Appendix D of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c)
- Regulatory Guide 8.31 (NRC, 2002)
- Regulatory Guide 8.13, "Instruction Concerning Prenatal Radiation Exposure" (NRC, 1999)

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- Regulatory Guide 8.29, “Instruction Concerning Risks from Occupational Radiation Exposure” (NRC, 1996)

The NRC staff finds the proposed content of the training material, testing, on-the-job training, and the extent and frequency of retraining to be acceptable. Furthermore, the NRC staff finds the radiation safety instructions for WRT employees to be acceptable.

5.4.2.1 CORPORATE RADIATION SAFETY OFFICER OF WATER REMEDIATION TECHNOLOGY, LLC

To ensure that the CRSO possesses the stated qualifications and fulfills training requirements, the renewed and amended license will include the following license condition:

License Condition #16

The WRT Corporate Radiation Safety Officer shall possess the professional qualifications and shall satisfy the professional training requirements set forth in Sections 3.16.1.1 and 3.16.2.1 of the Environmental Report and Appendix D of NUREG-1556, Volume 18, Revision 1, before engaging in any corporate radiation safety officer activities.

5.4.2.2 FIELD RADIATION SAFETY OFFICER AND RADIATION CONTROL TECHNICIANS OF WATER REMEDIATION TECHNOLOGY, LLC

To ensure that WRT’s field RSOs and RCTs possess adequate qualifications and fulfill training requirements, the renewed and amended license will include the following license condition:

License Condition #17

The WRT field radiation safety officer and radiation control technicians shall, at a minimum, possess the professional qualifications and shall satisfy the professional training requirements for health physics technicians described in NRC Regulatory Guide 8.31 or for authorized users in Appendix D of NUREG-1556, Volume 18, Revision 1, before engaging in any licensed activities.

5.4.2.3 WATER REMEDIATION TECHNOLOGY, LLC SYSTEM SPECIALISTS

To ensure that WRT system specialists possess the necessary qualifications and fulfill training requirements, the renewed and amended license will include the following license condition:

License Condition #18

The WRT system specialists shall possess the professional qualifications and shall satisfy the professional training requirements set forth in Sections 3.16.1.3 and 3.16.2.2 of the Environmental Report before engaging in any licensed activities.

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5.4.2.4 CLIENT PERSONNEL (NON-WATER REMEDIATION TECHNOLOGY, LLC PERSONNEL)

To ensure that clients' managers and operators will minimize their exposure to radiation resulting from WRT's licensed activities, the renewed and amended license will include the following license condition:

License Condition #19

WRT will ensure that WRT Clients' managers and operators satisfy appropriate basic training requirements set forth in Section 3.16.2.3 of the Environmental Report before initiating licensed activities.

5.4.3 MANAGEMENT CONTROL PROGRAM

NRC has completed its review of the licensee's management control program. This review included an evaluation using the review procedures in Section 5.2.2 and the acceptance criteria outlined in Section 5.2.3 of NUREG-1569 (NRC, 2003a). The applicant has an acceptable management control program, subject to the license conditions. The management control program includes a:

- radiation control program (see Section 7 of this safety evaluation report for the NRC staff's review),
- recordkeeping and retention program (see Section 9 of this safety evaluation report for the NRC staff's review), and
- SERP that assures that all activities can be conducted safely.

The SERP will keep track of and inform the NRC of all clients' facilities it enters into service contracts with, so that the number of such clients' facilities and their locations can be readily determined at any given time. The SERP will evaluate and approve the use of a uranium removal system at a client's facility to ensure installation and operation of the uranium removal system in a safe and environmentally acceptable manner. The SERP may evaluate and approve or disapprove the installation of uranium removal systems, make certain changes to existing systems, and conduct tests without obtaining prior NRC review and approval as long as those uranium removal systems fall within the performance requirements specified in WRT's application (WRT, 2016) and are bounded by the conditions of the renewed and amended license.

The renewed and amended license will include the following license condition to reflect the role of the SERP:

License Condition #11

WRT shall establish the Safety and Environmental Review Panel (SERP) in accordance with the commitments in Section 3.14.2 of the Environmental Report. The SERP shall consist of a minimum of three individuals employed or appointed by WRT and a WRT employee shall be designated the SERP Chairperson. One member of the SERP shall have expertise in management and be responsible for

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managerial and financial approval changes; one member shall have expertise in operations and/or construction and shall have responsibility for implementing any operational changes; and one member shall be the Corporate Radiation Safety Officer with the responsibility of ensuring that changes conform to radiological safety and environmental requirements. WRT may include additional members on the SERP as necessary to address health physics or other technical disciplines and legal/regulatory issues. Temporary members or permanent members other than the three identified above may be consultants. Any corporate organizational changes affecting the assignments or reporting responsibilities described in the Environmental Report or in any other WRT licensing documents shall be reviewed and documented by the SERP

Based on the information provided in the application and the detailed review conducted of the management control program, the NRC staff concludes that the proposed management control program, as bounded by the conditions of the renewed and amended license, is acceptable and is in compliance with:

- 10 CFR 20.1101, “Radiation protection programs,” which defines radiation protection program requirements;

- Subparts L, “Records,” and M, “Reports,” of 10 CFR Part 20, “Standards for Protection Against Radiation,” which define requirements for record keeping and reporting; and

- 10 CFR 40.61, “Records,” which define requirements for recordkeeping for source material licensees.

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6.0 FACILITIES AND EQUIPMENT

This section of this safety evaluation report presents the regulatory requirements, acceptance criteria, NRC staff review and analysis, and evaluation findings pertinent to the licensee's facilities and equipment used to remove uranium from water resources, minimize contamination, and keep exposures ALARA.

6.1 REGULATORY REQUIREMENTS

Criteria at 10 CFR 40.32(c)-(d) require that applicant proposed equipment, facilities, and procedures be adequate to protect health and minimize danger to life or property and not be inimical to the common defense and security or the health and safety of the public. Further, requirements at 10 CFR 20.1101(b) require the licensee to use, to the extent practical, engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. Finally, 10 CFR 20.1406, "Minimization of contamination," requires applicants to describe how facility design will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.

6.2 ACCEPTANCE CRITERIA

The NRC staff reviewed the application for compliance with the applicable requirements using the acceptance criteria presented in Section 8.9 of NUREG-1556 (NRC, 2017c).

The NRC staff reviewed the physical descriptions and reported operating characteristics for the major equipment used in the licensee's facilities for removal of uranium from water resources and for controlling releases from the facilities. Facilities and equipment must be adequate to protect health and minimize danger to life or property and not be inimical to the common defense and security and public health and safety. Additionally, they must minimize the possibility of contamination, and keep exposure to occupationally exposed workers and the public ALARA.

6.3 SUMMARY OF APPLICATION

WRT describes proposed engineering designs of its uranium removal systems, including the treatment media, in Sections 2.3.1 and 2.3.2 of its environmental report (WRT, 2016). Each uranium removal system will consist of the treatment vessel(s), ion exchange treatment media, external safety screen or filter, control valves, instrumentation, and control panel, and, where necessary to remove sands and silts, a pretreatment filter or screen. WRT offers three basic configurations for uranium removal systems for its water treatment program that it generally ties to the flow rate of the water system that the uranium removal system treats. WRT has set an operating upper boundary for uranium removal systems of no greater than 3,000 gpm (approximately 11,356 Lpm) based on the evaluations in its application.

The three configurations include:

- A portable exchange system that is for smaller flow rates up to about 50 to 60 gpm (approximately 189 to 227 Lpm). Depending upon the flow rate, a portable exchange system typically consists of one or more treatment trains. A treatment train consists of a minimum of two stages or treatment vessels connected in series and can treat up to

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10 gpm (approximately 38 Lpm). A treatment vessel in a portable exchange system is a standard, pre-engineered fiberglass reinforced vessel that is about the size of an industrial-gas cylinder and will contain approximately 3 cubic feet (ft^3) (approximately 85 liters) of treatment media.

- A modular component system that is for small to medium flow rates ranging from less than 100 gpm (approximately 379 Lpm) up to about 200 gpm (approximately 757 Lpm) per treatment train, which includes a minimum of two stages or treatment vessels per treatment train. A treatment vessel in a modular component system is a standard, pre-engineered fiberglass reinforced vessel that contains approximately 80 ft^3 [approximately 2 cubic meters (m^3)] of treatment media.

- A field-erected system that is for larger flow rates ranging from about 500 gpm (approximately 1,893 Lpm) to about 1,500 gpm (approximately 5,678 Lpm) for a single treatment train and 3,000 gpm (approximately 11,356 Lpm) for two treatment systems or trains connected in parallel. A treatment vessel in a field-erected system will be designed and fabricated specifically for a particular facility and may contain up to 2,200 ft^3 (approximately 63 m^3) of treatment media.

Other features and structures on the facility site typically will include the water well(s), treatment or well house(s), and water storage tanks. The treatment or well house contains the local control equipment and instrumentation for the water well(s) and/or existing water treatment activities (e.g., chloride and fluoride additions, sand removal).

Smaller uranium removal systems (e.g., portable exchange system or modular component system) can be installed in structures the size of small storage buildings (i.e., 400 to 500 square feet (ft^2) [approximately 37 to 46 square meters (m^2)]). A small WRT uranium removal system has operated since December 2016 at a well site owned by the Fox Run Water Company near Petersburg, Virginia. This uranium removal system is an 80- to 100-gpm (approximately 303- to 379-Lpm) system with a uranium concentration in drinking water prior to treatment of approximately 80 µg/L. The uranium removal system was installed in a new, separate frame building as a replacement for the well's original treatment equipment that was located in a building of similar size. Figure 2-2 of WRT's environmental report (WRT, 2016) provides photos of both the uranium removal system and the building that houses it. WRT's smaller uranium removal systems can also be installed on an open pad or under a covered structure with open sides, such as at a construction site.

The treatment room or building for larger uranium removal systems (e.g., field-erected systems) could range in size from 2,000 to 3,000 ft^2 (approximately 190 to 280 m^2) and may require a new addition to an existing treatment or well house. Figure 2-3 in WRT's environmental report (WRT, 2016) presents a generic layout of a large uranium removal system, handling up to approximately 1,500 gpm (approximately 5,700 Lpm). This uranium removal system would require two large treatment vessels, which would be up to approximately 15 feet (4.6 meters) in diameter each. Figure 2-4 in WRT's environmental report presents a photo of a smaller field-erected treatment system with a capacity of 500 gpm (approximately 1,890 Lpm).

Generally, WRT's clients automate the operation of most treatment or well houses and an operator's constant presence at the facility is not required. The uranium removal system will be operating in an area that has restricted access and will require limited work tasks by client personnel in the immediate vicinity of the treatment vessel. Typically, the uranium removal

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system will be located within an enclosed building, such as a treatment or well house as described above. On rare occasions in which inclement weather is not a major concern (e.g., southern California), a client may locate the uranium removal system on an open pad or under a covered structure with open sides. In the event a client locates a uranium removal system in the open, outside of a building, the client will fence and lock the treatment site.

6.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

NRC has completed its review of the facilities and equipment proposed for use. This review included an evaluation using the review procedures in Section 8.9 of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c). Based on the information provided in the application, the NRC staff concludes that the use of the proposed equipment and facilities, by either WRT or its clients, as bounded by the conditions of the renewed and amended license, are acceptable and are in compliance with 10 CFR 40.32(c) and 10 CFR 40.32 (d). In addition, the NRC staff finds that the design features will help to ensure acceptable implementation of the radiation protection program as required by 10 CFR 20.1101(b). WRT has acceptable design features for the control of radioactive releases at clients' facilities using its uranium removal system and has demonstrated that releases of spent treatment media will be controlled and monitored. WRT has committed to use acceptable containment design features to minimize the potential risk of releases per 10 CFR 20.1406, "Minimization of contamination," as set forth in the following license conditions of the renewed and amended license:

> License Condition #25
>
> *WRT will ensure that all uranium removal system equipment is installed properly before the commencement of licensed activities. After the commencement of licensed activities, WRT will ensure that no alterations are made to components of the uranium removal system that contain, or potentially contain, licensed material unless approved by either the SERP or the NRC, as required.*
>
> License Condition #26
>
> *WRT will ensure that all equipment used for media exchanges are functional and operate within the specifications described in Section 3.17 of the Environmental Report. WRT system specialists will ensure that all media exchange activities are conducted in accordance with the written procedures required by license condition 22 and in a manner that minimizes potential releases of uranium-laden treatment media into the environment.*

A uranium removal system removes uranium from groundwater and other water resources in self-contained treatment vessels containing ion exchange treatment media. When the treatment media is near capacity, WRT will remove it and arrange for its transport from the client's facility. Spills or releases of the treatment media, and the uranium adhered to it, could affect water resources. If a spill or release were to occur, surface spillage could easily be isolated and contained within the treatment shed, client's facility, or even on the ground until WRT personnel are able to clean up the released treatment media and the uranium adhered to the media. If a client houses the uranium removal system in a structure that has a floor drain, sump, or similar water catchment leading to a sanitary sewer, storm sewer, or drain field, a major spill from the uranium removal system could cause treatment media and uranium source material to enter the sewer or the drain field and directly affect water resources. If a possible direct outlet to a storm sewer, sanitary sewer, or drain field exists at the facility, WRT will

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design and have the uranium removal system installed with a secondary containment system to protect against a release of radionuclides that could affect water resources.

As it is possible that a WRT client facility will be located on the 100- year flood plain, the current license requires WRT to obtain NRC approval prior to locating a uranium removal system in a 100-year floodplain. WRT requested that the NRC amend this license condition because if the client's treatment facility is located on the 100-year flood plain, it is likely that the client has already evaluated the issue of water control in a 100-year floodplain, which would protect the uranium removal system from the effects of flooding. Therefore, the NRC will require WRT's SERP to determine that reasonably foreseeable impacts of any floods upon the uranium removal system can be mitigated through use of best management practices and other prudent measures, consistent with the intent of Executive Order No. 11988, "Floodplain Management," (E.O., 1977) before locating the uranium removal system on the 100-year flood plain. NRC's requirement does not preclude WRT from being required to obtain other necessary state and local permits required for construction or installation of the uranium removal system on the 100-year flood plain.

License Condition #15

If a possible direct outlet to storm sewers, sanitary sewers, or drain field exists at the Client's facility where the uranium removal system will be operated, the uranium removal system will be designed and installed with a secondary containment system to protect against a release of any treatment media containing source material that could affect water resources. The uranium removal system shall not be located on the 100-year flood plain unless the SERP determines that the reasonably foreseeable impacts of any floods upon an installed uranium removal system, including any uranium-laden treatment media, can be appropriately mitigated through application of best management practices and other prudent measures.

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7.0 RADIATION SAFETY PROGRAM

This section of this safety evaluation report presents the regulatory requirements, acceptance criteria, NRC staff review and analysis, and evaluation findings pertinent to the licensee's radiation safety program, including standard operating and emergency procedures, material receipt and accountability, occupational and public dose, transportation, audits and inspections, and security procedures and measures. First, this section presents the NRC staff's review of the overall radiation safety program. Then each significant component of the radiation safety program is discussed individually.

7.1 REGULATORY REQUIREMENTS

The NRC regulations at 10 CFR 40.32 specify the general requirements for issuance of a license. Specifically, under 10 CFR 40.32(b)-(d) an applicant must that it is qualified by to use the licensed material safely; demonstrate that its proposed equipment, facilities and procedures are adequate to protect health and minimize danger to life or property; and that issuance of the license will not be inimical to common defense and security or public health and safety. Each applicant must establish and submit to the NRC a radiation safety program per the requirements in 10 CFR 20.1101, "Radiation safety programs". The program must be commensurate with the scope and extent of activities for the use of licensed materials in service operations. Each applicant must develop, document, and implement a radiation protection program that is specific to its types of operations.

7.2 ACCEPTANCE CRITERIA

The NRC staff reviewed the application for compliance with the applicable requirements using the acceptance criteria presented in Sections 8.10.1 and 8.10.9 of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c).

7.3 SUMMARY OF APPLICATION

WRT presented a comprehensive radiation safety program in Section 3.16 of its environmental report (WRT, 2016). WRT's radiation safety program addresses the following elements:

- development, implementation, and maintenance of written operating and emergency procedures to address all likely situations
- development and implementation of an access authorization program, if required
- development and implementation of an ALARA program
- description of equipment and facilities adequate to protect personnel, the public, and the environment
- confirmation that licensed activities are conducted only by individuals qualified by training and experience
- description of organization structure and individuals responsible for ensuring day-to-day oversight of the radiation safety program

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- establishment and management of a radiation safety and decommissioning records system

- implementation of an audit program to ensure that, at least annually, the radiation safety program is reviewed

- development of an agreement between the applicant and the applicant's client acknowledging the use of radioactive materials at the customer's site

- development and implementation of a program to ensure the security and control of licensed material

7.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

Based on the information provided in the license application and the detailed review conducted of the proposed training program for radiation safety, the NRC staff concludes that WRT's radiation safety program, as bounded by the conditions of the renewed and amended license, is acceptable.

The renewed and amended license will include the following license condition:

License Condition #20

WRT will implement its radiation safety program as described in Section 3.16 of its Environmental Report. All training sessions and materials shall conform to the commitments in Section 3.16 of the Environmental Report and requirements in license conditions 16 through 19.[6]

To enable WRT to make certain reasonable changes to its radiation safety program without prior approval from the NRC, the renewed and amended license will include the following license condition:

License Condition #21

WRT may, without NRC approval, make changes to the radiation safety program and standard operating procedures, and conduct tests or experiments, provided that they are reviewed by the SERP and WRT ensures that the following three conditions are met:

(A) The change, test, or experiment does not conflict with any requirement specifically stated in this specific license or impair WRT's ability to meet all applicable NRC regulations.

[6] See Section 5.4.2 of this safety evaluation report for a description of those license conditions.

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(B) WRT continues to comply with the safety or environmental commitments made in the Environmental Report or other licensing documents identified in license condition 10.[7]

(C) The change, test, or experiment is consistent with the NRC's findings in its environmental assessment and safety evaluation report.

If any of these conditions are not met, or if WRT seeks to change any conditions of this specific license or any of the performance requirements in Sections 2.3, 3.13, 3.14, 3.15, 3.16, 3.17, and 3.18 of the Environmental Report, or if WRT determines that the proposed installation and operation of any uranium removal system is outside the scope of such performance requirements, then NRC approval through a license amendment will be required.

The inclusion of the above license condition does not alter or affect the NRC's inspection function or allow WRT to alter license conditions without first obtaining NRC review and approval. Requesting changes to license conditions or performance requirements would require filing a license amendment application pursuant to 10 CFR Part 40, "Domestic Licensing of Source Material".

7.5 STANDARD OPERATING AND EMERGENCY PROCEDURES

7.5.1 REGULATORY REQUIREMENTS

According to 10 CFR 40.32(c), an applicant's procedures must be adequate to protect health and minimize danger to life or property. As part of the application, the licensee must develop, implement, and maintain operating and emergency procedures.

7.5.2 ACCEPTANCE CRITERIA

The NRC staff reviewed the application for compliance with the applicable requirements using the acceptance criteria presented in Sections 8.10.1 and 8.10.9of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c).

The purpose of operating and emergency procedures is to provide personnel specific guidance for all operations they will perform. The operating and emergency procedures should include each topic important to safe operation as applicable to the materials and uses proposed in the application. Each licensee must develop, implement, and maintain operating and emergency procedures for all likely scenarios that might be encountered.

7.5.3 SUMMARY OF APPLICATION

The licensee has described operating procedures in Sections 3.14.4 and 3.16.12 of its environmental report (WRT, 2016). WRT's application indicates that it will conduct its activities in accordance with written standard operating procedures. The SERP will review all new or revised standard operating procedures affecting radiation safety before WRT personnel implement them. The CRSO will annually audit all operational and monitoring procedures to

[7] See Section 3.4 of this safety evaluation report for a description of this license condition.

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assure that they are still appropriate and do not conflict with newly established radiation safety policies or regulatory requirements. In addition, the CRSO will annually review all operating procedures to ensure that WRT maintains radiation exposures ALARA.

WRT's emergency procedures are described in Section 3.16.12 of its environmental report (WRT, 2016). Because the licensed material is associated with the treatment media, WRT designs the treatment vessels with safety features to ensure containment of the uranium-laden treatment media in the vessel. Further, design of secondary containment features can also mitigate impacts from emergencies. An emergency could result from a significant release of the uranium-laden treatment media from the vessel, including discharge from a pump or hose connection during media exchanges or catastrophic rupture of or damage to a treatment vessel because of fire, collision from mobile equipment, or other damage to treatment structures. Even though smaller-scale spills, such as a leaking fitting, partial rupture of treatment vessels, or leaking flanges would normally not constitute an emergency, WRT has committed to the use of spill-control steps presented in its emergency procedures. Section 7.7.4 of this safety evaluation report discuss license conditions that require WRT to use programs for contamination control and environmental monitoring and response.

7.5.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

NRC has completed its review of the standard operating and emergency procedures proposed for use. This review included an evaluation using the review procedures in Sections 8.10.1 and 8.10.9, and of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c).

Based on the information provided in the license renewal and amendment application and the detailed review conducted of the standard operating and emergency procedures, as bounded by the conditions of the renewed and amended license, the NRC staff concludes that the emergency procedures will ensure compliance with applicable NRC requirements.

WRT has an acceptable management control program, as bounded by the conditions of the renewed and amended license, which assures that it conducts all safety-related operating activities according to written operating procedures. WRT has provided a process to develop standard operating and emergency procedures and has demonstrated that non-routine work activities will comply with radiation safety requirements. The standard operating and emergency procedures described above are procedures to maintain radiation doses ALARA, in accordance with applicable requirements. The use of a SERP to approve changes to the facility commensurate with licensed activities is in accordance with NRC regulations and requirements (see Sections 5.4.3 and 7.4 of this safety evaluation report for a description of license conditions regarding the SERP's approval of changes).

The NRC views the scope of standard operating and emergency procedures to be critical to safe operations. Therefore, the renewed and amended license will include the following license condition:

> <u>License Condition #22</u>
>
> *Standard operating procedures shall be developed and followed for all licensed activities, including the handling of licensed materials during media exchange activities. The standard operating procedures shall also include provisions to prevent and to respond to the range of reasonably foreseeable potential accidents, such as a release or spill of licensed material. A copy of the current standard*

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operating procedures shall be kept in the area(s) of the facility housing the uranium removal system. The SERP will review and approve all standard operating procedures before they are implemented.

In order to ensure adequate accident response during operations, including notification to the appropriate fire marshal or equivalent individual prior to the operation of the uranium removal system the renewed and amended license will include the following license condition:

License Condition #32

Prior to the initial operation of a uranium removal system, and prior to a re-start of a uranium removal system following major overhaul or modification, WRT shall ensure the fire marshal or equivalent individual who has responsibility for the site has been contacted and provided instruction on uranium source material hazards and possible effects from a fire. The SERP shall document WRT's or the Client's contacts with the fire marshal or equivalent individual.

7.6 MATERIAL RECEIPT AND ACCOUNTABILITY

7.6.1 REGULATORY REQUIREMENTS

As part of the application, the licensee shall develop, implement, and maintain procedures for ensuring accountability of licensed materials at all times. Requirements for storage and control of license material are specified at 10 CFR Part 20, Subpart I, "Storage and Control of Licensed Material". Requirements for procedures for receiving and opening packages are specified at 10 CFR 20.1906, "Procedures for receiving and opening packages". Criteria for reporting theft or loss of licensed material are specified in 10 CFR 20.2201, "Reports of theft or loss of licensed material".

7.6.2 ACCEPTANCE CRITERIA

The NRC staff reviewed the application for compliance with the applicable requirements using the acceptance criteria presented in Sections 8.10.2 of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c).

7.6.3 SUMMARY OF APPLICATION

The licensee describes its processes for material control and accountability in Sections 3.14.3, 3.16.9, and 3.17 of its environmental report (WRT, 2016). WRT has adequately described procedures for storage and control of licensed material in its possession, including transferring of uranium-laden treatment media during exchanges and storage of uranium-laden treatment media at client facilities. The licensee has also committed to recordkeeping that is fully compliant with NRC regulations.

7.6.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

WRT has an acceptable management control program, as bounded by the conditions of the renewed and amended license, which assures that it will maintain control and accountability of licensed material. In its application for renewal and amendment, WRT requests that the NRC amend a previous license condition authorizing storage of uranium-laden treatment media for up to 60 days to clarify that the storage cannot exceed 60 days following a media exchange. The

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NRC staff agrees with WRT that this clarification was the intent of the original requirement by license condition. Therefore, the renewed and amended license will include the following license condition:

License Condition #35

Uranium-laden (spent or fully loaded) treatment media shall not be stored at the Client's facility for greater than 60 days following a media exchange and shall only be contained within the ion exchange vessel or DOT-approved containers.

7.7 RADIATION MONITORING

7.7.1 REGULATORY REQUIREMENTS

The regulations at 10 CFR 20.1501, "General," and 10 CFR 20.2103, "Records of surveys," specify the requirements for surveys and monitoring of radiation and records of surveys, respectively.

7.7.2 ACCEPTANCE CRITERIA

The NRC staff reviewed the application for compliance with the applicable requirements using the acceptance criteria presented in Sections 8.10.3 and 8.10.4 of NUREG-1556, Volume 18, Revision 1, (NRC, 2017c). The NRC staff also reviewed the application for compliance with the applicable requirements using the acceptance criteria in Section 5.7.6 of NUREG-1569 (NRC, 2003a).

7.7.3 SUMMARY OF APPLICATION

WRT has committed to performing monitoring of radiation levels using appropriate standard operating procedures for monitoring of radiation in the restricted area and to all clients' managers and operators or members of the public. WRT describes its monitoring programs for radiation in Section 3.16.5 of its environmental report (WRT, 2016).

WRT has committed to requiring that all WRT system specialists adhere to standard operating procedures and/or emergency procedures regarding contamination control, including surface contamination of the uranium removal system and contamination of personnel (e.g., clothing, shoes). WRT describes these standard operating procedures and requirements in Sections 3.16 and 3.17 of its environmental report (WRT, 2016).

WRT has committed to monitoring all potential releases of licensed material and to responding to such releases in a manner that is adequately protective of public health and safety and the environment. In this regard, WRT presents detailed information regarding emergency response procedures for releases of spent treatment media during water treatment operations, media exchanges, and transportation of such treatment media in Sections 3.16 and 3.17 of its environmental report (WRT, 2016). Additionally, WRT describes its recommended secondary containment measures for potential releases of treatment media in Section 2.3.2 of its environmental report.

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7.7.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

WRT has acceptable programs for monitoring radiation exposures in the treatment area at clients' facilities using its treatment program for water containing uranium. WRT has provided an acceptable description of the location and number of radiation monitors. The NRC staff finds the placement of radiation monitors acceptable.

WRT has established appropriate criteria to determine which WRT employees should receive radiation monitoring, and WRT has committed to using radiation monitors with the appropriate range and sensitivity that will support protection of the health and safety of its employees during the full range of licensed activities. All planned radiation surveys are acceptable and planned documentation of such surveys and exposures are acceptable.

The NRC staff finds WRT's monitoring program acceptable and that it will protect its workers and members of the public from exposure to radiation resulting from licensed activities.

Based on the information provided in the renewal and amendment application and the detailed review conducted of the radiation exposure monitoring program at water treatment facilities using WRT's uranium treatment program, as bounded by the conditions of the renewed and amended license, the NRC staff has concluded that the radiation monitoring programs are acceptable and ensure compliance with applicable NRC regulations, including:

- 10 CFR 20.1101, "Radiation protection programs," which defines a radiation protection program and ALARA requirements
- 10 CFR 20.1201(a), which defines occupational dose limits
- 10 CFR 20.1501, "General," which provides requirements for surveying and radiation monitoring
- 10 CFR 20.1502, "Conditions requiring individual monitoring of external and internal occupational dose"
- Subpart L, "Records," of 10 CFR Part 20, "Standards for Protection Against Radiation"
- Subpart M, "Reports," of 10 CFR Part 20, "Standards for Protection Against Radiation"

In order to ensure adequate radiation monitoring at clients' facilities using WRT's treatment program for water with uranium, the renewed and amended license will include the following license condition:

> License Condition #27
>
> *WRT shall, at a minimum, use a radiation monitoring program in as described in Section 3.16.5 of the Environmental Report.*

WRT has also described an acceptable contamination control program for clients' facilities using its uranium water treatment program. Based on the information provided in the license renewal and amendment application and the detailed review conducted of the contamination control program, as bounded by the conditions of the renewed and amended license, the NRC staff has concluded that the program is consistent with applicable NRC regulations and acceptable

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controls will be in place to prevent contaminated employees from entering clean areas or leaving the facility.

To ensure adequate contamination control at clients' facilities using the WRT's program for treatment of water with uranium, the renewed and amended license will include the following license condition:

License Condition #29

WRT shall, at a minimum, use a radiological contamination control program as described in Section 3.16 and 3.17 of the Environmental Report.

Based on the information provided in the license renewal and amendment application and the detailed review conducted of the environmental monitoring program, as bounded by the conditions of the renewed and amended license, the NRC staff has also concluded that the environmental monitoring and response program is acceptable and will ensure compliance with applicable NRC requirements.

In order to ensure adequate environmental monitoring and response at clients' facilities using WRT's program for treatment of water with uranium, the renewed and amended license will include the following license condition:

License Condition #28

WRT shall, at a minimum, use an environmental monitoring program and emergency response procedures as described in Sections 3.16 and 3.17 of the Environmental Report.

7.8 PUBLIC AND OCCUPATIONAL EXPOSURES

7.8.1 REGULATORY REQUIREMENTS

Each licensee must evaluate the potential exposures of all workers and monitor occupational exposure to radiation when required and control the occupational dose to individual adults to comply with the dose limits set forth in 10 CFR 20.1201, "Occupational dose limits for adults." If monitoring of occupational doses is required in accordance with 10 CFR 20.1502, "Conditions requiring individual monitoring of external and internal occupational dose," then the licensee must determine the occupational radiation dose received during the current year, in accordance with 10 CFR 20.2104, "Determination of prior occupational dose," and maintain records of the monitoring, regardless of the actual dose received, in accordance with 10 CFR 20.2106, "Records of individual monitoring results".

Each licensee must also comply with the regulations at 10 CFR Part 20, Subpart D, "Radiation Dose Limits for Individual Members of the Public". Licensees should design a monitoring program to ensure compliance with 10 CFR 20.1302(b). The extent and frequency of monitoring will depend upon each licensee's specific needs. Under 10 CFR 20.2107, "Records of dose to individual members of the public," licensees must maintain records sufficient to demonstrate compliance with the dose limits for members of the public until the NRC terminates the license.

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7.8.2 ACCEPTANCE CRITERIA

The NRC staff reviewed the application for compliance with the applicable requirements using the acceptance criteria presented in Sections 8.10.6 and 8.10.7 of NUREG-1556, Volume 18, Revision 1, (NRC, 2017c).

7.8.3 SUMMARY OF APPLICATION

7.8.3.1 PUBLIC AND OCCUPATIONAL EXPOSURES

WRT evaluates public and occupational exposures in Section 3.16.6 of WRT's environmental report (WRT, 2016). A uranium removal system may be located in an urban, suburban, or rural area of the country. The client will typically house the uranium removal system inside of a shed or within an existing building of the client's facility or otherwise within a locked fence to restrict public access. A slight chance of public exposure exists if a person were to break into the shed or client's facility housing the uranium removal system. WRT expects the total radiological exposure associated with this scenario to be minimal. The exposure resulting from contact with the treatment vessel should be no greater than 0.3 millirem per hour (mrem/hr) [3 microSieverts per hour (μSv/hr)], which equates to an exposure level of 7.2 mrem [72 microSieverts (μSv)] over a 24-hour period. However, this exposure rate assumes that the individual remains in physical contact with the vessel for a full 24 hours. Because the client's personnel will most likely be in close proximity to the uranium removal system on a daily basis, and would take action to remove the intruder, it is unlikely that anyone breaking into a facility housing the uranium removal system would be exposed longer than 24 hours or at an exposure rate greater than 7.2 mrem (72 μSv), which is considered to be a minor exposure. The calculated on-contact exposure in a 24-hour period is equivalent to about a chest x-ray. If the client's personnel are not likely to be in close proximity to the uranium removal system on a daily basis, however, it is unlikely that an intruder would remain in physical contact with the vessel and remain undetected for longer than the approximately two weeks needed to exceed the public dose limit. If the intruder were in the building for a 24-hour period but remained 30 centimeters away from the vessel (a more likely break-in scenario), the exposure rate would be 0.003 mrem/hr (0.03 μSv/hr). This exposure scenario equates to an exposure level of 0.072 mrem (0.72 μSv) in a 24-hour period, which is a minor exposure. The chart below is a comparison of radiation doses from various sources that puts the potential dose in perspective to other natural and manmade sources.

WRT has also provided support for the low estimated public exposures in its application (WRT, 2016). Performance-based data presented in Table 3-3 of WRT's environmental report indicate that dose rates from various operating uranium removal systems including those with the highest uranium loadings are less than 0.61 mrem/hr (6.1 μSv/hr) at the first stage vessel. Note that WRT observed the highest dose rate readings during media exchanges rather than during routine operation. Table 3-3 lists quarterly averaged dose rate readings obtained from dosimetry badges placed on the first stage vessel, which are expected to be more typical of routine operation, were at least 2 times lower than the highest dose rate readings observed during media exchanges. Even considering the highest dose rate observed during a media exchange (i.e., 0.61 mrem/hr [6.1 μSv/hr]) equates to 14.6 mrem (146 μSv) over 24 hours, assuming a full 24 hours of physical contact with the vessel. It would take nearly a week for an intruder to exceed the public dose limit while maintaining physical contact with the vessel and remaining undetected by facility personnel, which is unlikely.

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In the unlikely event of a major spill, WRT will initiate emergency response procedures designed to safely contain and remediate the release. In facility areas with drains or other discharge points to the environment, WRT must provide secondary containment per License Condition #15, which is discussed in Section 6.4 of this safety evaluation report. In facility areas with no discharge points, WRT will ensure that a major spill cannot leave the facility. The NRC staff considers the small risk to the public to be acceptable because the uranium removal system will provide a benefit by reducing uranium concentrations, thus protecting the public from either ingesting uranium in its drinking water or exposures to uranium in non-drinking water resources. In addition, WRT will remove the extracted uranium from the community as WRT dispositions the uranium-laden treatment media at a properly licensed or permitted facility.

COMPARISON OF RADIATION DOSES FROM VARIOUS SOURCES

Radiation Source	Dose to an Individual
From natural sources (cosmic, terrestrial, radon)	300 mrem/yr (30 mSv/yr)
From manmade sources (medical, consumer products, fallout)	60 mrem/yr (600 μSv/yr)
Annual background radiation—U.S. average total	360 mrem/yr (36 mSv/yr)
Daily background radiation—U.S. average	1 mrem/d (10 μSv/d)
Increase in cosmic radiation dose from moving to a higher altitude, such as from Miami, Florida, to Denver, Colorado	25 mrem/yr (250 μSv/yr)
Chest x-ray	10 mrem (100 μSv)
U.S. transcontinental flight (5 hours)	2.5 mrem (25 μSv)
Dose from naturally occurring radioactive material in agricultural fertilizer—U.S. average	1 to 2 mrem/yr (10 to 20 μSv/yr)
Dose to worker from a uranium-laden treatment vessel for 88 hours	0.3 mrem (3 μSv)

Source: National Council on Radiation Protection and Measurements (1987)

WRT's radiation protection program details the roles and responsibilities of the CRSO and WRT system specialists working in a radioactive materials area and provides for the safe possession of licensed material and the monitoring of radiation levels in both the general vicinity of the uranium removal system and for specifically designated personnel. WRT calculates a potential annual dose to a client's operators of less than 0.3 mrem (3 μSv) assuming an operator spends 88 hours per year performing tasks at approximately 1 meter from the treatment vessel and a maximum uranium load producing a 0.003- mrem/hr (0.03-μSv/hr) dose rate at 30 centimeters. Similarly, performance-based data presented in Table 3-3 of WRT's environmental report (WRT, 2016) from operating uranium removal systems, including those with the highest uranium loadings, confirm that calculated doses to clients' operators have remained well below the public dose limit. The annual dose to a client's manager will be substantially less than that of a client's operator since the client's manager supervises the client's operators and will spend even less time near the treatment vessels.

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WRT has calculated the potential annual external dose to WRT personnel to be less than 2 mrem (20 μSv) assuming a system specialist performs 20 media exchanges per year and spends 30 hours per media exchange at a maximum uranium load producing a 0.003- mrem/hr (0.03-μSv/hr) dose rate at 30 centimeters. WRT presents performance-based data from WRT personnel dosimetry in Table 3-2 of its environmental report (WRT, 2016). The data indicates that the highest *lifetime* external dose was 28 mrem (280 μSv), and that on an annual basis WRT personnel are receiving external exposures that range from less than 2 up to 22 mrem (20 up to 220 μSv) all of which are below the public dose limit and much less than the occupational dose limit.

WRT expects inhalation hazards for workers to be low. Yellowcake dust inhalation is a primary concern at uranium recovery facilities that produce yellowcake. Moist uranium-laden resin beads of the type used by WRT, however, are unlikely to become airborne because they are significantly larger than yellowcake dust.

7.8.3.2 ACCIDENT ANALYSIS

WRT considers three potential accident scenarios: (1) failure of containment of uranium residuals at the facility; (2) releases of uranium-laden treatment media during media exchange at the facility, and (3) releases during transportation of uranium residuals. WRT designed its uranium removal system to be a self-contained water treatment system so releases of uranium residuals are highly unlikely. However, WRT will initiate response procedures, as described in Section 3.13.6 of its environmental report (WRT, 2016), should uranium residuals escape the containment area either during normal operations or media exchanges. These response procedures will limit exposures to the released uranium residuals. Therefore, WRT evaluated the exposures from releases of uranium-laden treatment resin during transportation because WRT expects them to be the bounding worst-case accident for operations involving the uranium removal system.

For the sake of conservatism in calculating the potential dose to a transportation-spill cleanup-worker, WRT assumed that each accident would result in a spill releasing uranium-laden treatment media in the immediate vicinity of the accident site. Because WRT will ship the uranium-laden treatment media moist, WRT projects that none of the released material would disperse into the atmosphere. Further, because the uranium would be tightly bound to the treatment media, it would not become soluble. Any dispersion of the uranium-laden treatment media via water could only be a physical and not a chemical process. Thus, potential adverse impacts to waterways would be minimal in the unlikely event that the treatment media would reach one.

To estimate dose to cleanup workers and the public, WRT made the following assumptions:

- spent treatment media uranium loading is 60,000 parts per million, which is equal to a resin concentration of 54,000 picocuries per gram (pCi/g) [approximately 2,000 Becquerel per gram (Bq/g)] of natural uranium;

- treatment media will contain the immediate decay products of natural uranium, including uranium-238, thorium-234, protactinium-234m, protactinium-234, uranium-234, uranium-235, and thorium-231;

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- transport tankers, up to a 1,000-ft^3 (approximately 28-m^3) capacity, containing up to 20 tons (approximately 18 metric tons) of uranium-laden treatment media; and

- an infinite plane of spilled material, which is a maximizing assumption, for calculated doses.

The dose rate at the surface of a spill with a resin concentration of natural uranium of 54,000 pCi/g (approximately 2,000 Bq/g) will be approximately 0.37 mrem/hr (3.7 μSv/hr). If a cleanup were to require 8 hours of effort, the cleanup worker would receive approximately 30 mrem [0.3 milliSievert (mSv)] of exposure within that 8-hour period. The actual dose rate will be considerably less than the calculated external dose since most of the energy emitted by the above nuclides is in the form of beta particles that would be absorbed in air and the worker's clothing. However, because the primary emissions from the nuclides of interest are beta particles, a potential exists for external dose to the skin of a worker. Table 4.2 of WRT's environmental report (WRT, 2016) lists the dose conversion factors for skin. WRT calculated direct radiation doses for skin from a spill cleanup. WRT estimated the skin dose rate to be 3.69 mrem/hr (36.9 μSv/hr).

WRT has also calculated doses from a spill cleanup for inhalation and ingestion. In Section 4.2.3.4.3 of its environmental report (WRT, 2016), WRT considered the estimated inhalation dose rate to be negligible since the treatment media particles, at approximately 600 micrometers in diameter, are too large to be respirable and are unlikely to remain suspended for any significant period. WRT estimated the ingestion dose to be 2.1 mrem (21 μSv) in Section 4.2.3.4.4 of its environmental report.

7.8.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

7.8.4.1 PUBLIC AND OCCUPATIONAL EXPOSURES

The NRC staff expects the health impacts related to public and occupational exposures to be minimal. WRT's client's personnel, who are considered members of the public, are not expected to receive an annual radiation dose anywhere near the 100-mrem (1-mSv) public dose limit prescribed in 10 CFR 20.1301, "Dose limits for individual members of the public." In addition, WRT's system specialists are not expected to receive an annual radiation dose anywhere near the individual monitoring threshold of 500 mrem (5 mSv) for adults or 100 mrem (1 mSv) for children or pregnant women prescribed in 10 CFR 20.1502, "Conditions Requiring Individual Monitoring of External and Internal Occupational Dose Rate." WRT has provided performance data to support its dose assessments.

The NRC staff has concluded that WRT estimates of the time that a client's personnel will spend working in proximity to the treatment vessels to be reasonable. A maximum exposure of 3 millirem per year (mrem/yr) [30 microSievert per year (μSv/yr)] results from that working time. This expected maximum dose is a small fraction of the 360 mrem/yr [36 milliSievert per year (mSv/yr)] dose from background radiation an average individual living in the United States receives from natural sources and a small fraction of the 100-mrem (1-mSv) annual dose limit for members of the public. Therefore, the NRC staff finds the potential exposures to be reasonable.

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7.8.4.2 ACCIDENT ANALYSIS

The NRC staff compared the effects of the hypothetical spill discussed above to the effects of accidents at ISR facilities (Section 4.2.3 of NRC, 2001). These analyses demonstrate that the consequences for the most credible potential accident should be minor. During inspections, the NRC staff will review the procedures WRT is using to ensure compliance with the commitments made within the licensing documents.

WRT acceptably described the likely effects of uranium-laden treatment spills during facility operations and transportation of material. WRT provided an acceptable analysis of such accidents and their consequences. The analysis is consistent with the design of the uranium removal system, site features, and planned operations. WRT identified likely impacts from such accidents and included an analysis of the mitigation measures. Adequate response and remediation procedures have either been identified or referenced, and WRT has committed that its clients' personnel will be trained to implement such procedures.

Therefore, based on the information provided in the application and the detailed review conducted of the effects of accidents involving the uranium removal system, the NRC staff concludes that WRT has adequately analyzed the effects of such accidents. The accidents, when mitigated by the procedures and processes WRT has committed to have in place, will not have a significant impact on public or occupational health and safety.

7.9 TRANSPORTATION

7.9.1 REGULATORY REQUIREMENTS

Applicants that will be packaging and transporting licensed material must develop, implement, and maintain safety programs for transport of radioactive material to ensure compliance with NRC and DOT regulations. Regulations at 10 CFR 40.41, "Terms and conditions of licenses," require preparation for shipment and transport of source material to be in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material." In 10 CFR 71.5, "Transportation of licensed material," the NRC regulations require all licensees who transport radioactive materials outside the site of usage or where transport is on public highways to comply with DOT regulations at 49 CFR, Chapter I, Subpart C, "Hazardous Materials Regulations," and 49 CFR Part 178, "Specifications for Packagings".

7.9.2 ACCEPTANCE CRITERIA

The NRC staff reviewed the application for compliance with the applicable requirements using the acceptance criteria presented in Section 8.10.8 of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c).

7.9.3 SUMMARY OF APPLICATION

WRT will arrange for transportation of the resin, or "exchanged media," laden with uranium from the treatment vessel to either a licensed uranium recovery facility for use as equivalent feed material or to a licensed or permitted disposal facility. Material will be transported in either DOT-approved tanker trucks or large, polyfabric "super sacks" that have been approved for transport of radioactive material. WRT expects 200 trips per year per 1,000 facilities served. Based on accident statistics and an average nationwide travel distance of 1,000 miles (approximately 1,600 kilometers) to the site of final disposition, WRT expects that an accident

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involving spent treatment media shipment will occur no more than once every 2.5 years. These accidents statistics do not approximate the severity of the accident, which could range from severe to relatively minor (i.e., a fender bender).

WRT has committed to continue using standard operating procedures to transfer uranium-laden treatment media from the uranium removal system to DOT-approved containers and to transport the media in DOT-approved vehicles that comply with DOT regulations for the transportation of radioactive material. WRT personnel will be responsible for preparing uranium-laden treatment media for transport and final disposition. WRT will arrange transportation of uranium-laden treatment media with appropriately licensed or permitted contracted commercial carriers to transfer the treatment media from the clients' facilities to properly licensed facilities for final disposition. WRT describes the transportation of uranium-laden treatment media from clients' facilities for final disposition in Section 3.17.2 of its environmental report (WRT, 2016). In the event of a transportation accident, the primary response will be the responsibility of the contracted commercial carrier's established response team, acting in accordance with the carrier's procedures. WRT will coordinate response procedures with the transportation contractor in the event of a transportation accident, including post-remediation accident site surveys, and will conduct additional accident site surveys as necessary. In Section 4.2 of its environmental report, WRT analyzes impacts from transportation of uranium-laden treatment media for final disposition including potential accidents involving release of the treatment media. WRT concludes that the likelihood of a transportation accident involving uranium-laden treatment media from clients' facilities for final disposition is low. Should an accident occur, WRT estimates that the maximum total effective dose to a worker cleaning up a spill of uranium-laden treatment media would be less than 5 mrem (50 μSv).

The roads used for the transportation of the uranium removal system and resulting source material will vary depending on the size and geographic location of each client's facility. WRT will likely use existing paved highways, secondary roads, and local roads, as well as gravel or dirt roads, to install and access the uranium removal system. Impacts to roads will vary depending on the number of client workers at each facility. Smaller client facilities generally utilize one to three workers travelling round trip five to seven days per week. Larger client facilities generally utilize 10 to 20 workers travelling round trip five to seven days per week. Operations at client's facilities are sufficiently automated that additional use of facility roads to operate wells is expected to be minimal. Facility roads are also used to receive supplies for water treatment operation (e.g., treatment chemicals, maintenance equipment).

If new private roads must be constructed to install and access a uranium removal system at a client's facility that will exceed the limits specified in 10 CFR 40.22, "Small quantities of source material," the renewed and amended license will require WRT, by operation of License Condition #14, as described in Section 4.4.1 of this safety evaluation report, to seek a license amendment. In such a case, the NRC staff would conduct a site-specific review prior to making its decision on whether to approve or disapprove the license amendment request.

7.9.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

The NRC staff finds the description of roads surrounding clients' facilities where WRT will install the uranium removal systems and the method of transportation of the uranium removal systems and uranium-laden treatment media to be acceptable.

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In order to continue to ensure adequate accident response during transportation, the renewed and amended license will include the following license condition:

License Condition #33

WRT shall, at a minimum, use transportation accident response standard operating procedures in accordance with the DOT-approved transportation contractor's response procedures. In the event of a transportation accident resulting in the release or spill of licensed material, WRT will conduct the appropriate follow-up accident site surveys.

7.10 AUDITS AND INSPECTIONS

7.10.1 REGULATORY REQUIREMENTS

The regulations at 10 CFR 20.1101(c) require licensees to periodically review the radiation protection program content and implementation. Licensees must maintain records of audits and other reviews of program content and implementation for 3 years after the record is made, in accordance with subsection (b) of 10 CFR 20.2102, "Records of radiation protection programs".

7.10.2 ACCEPTANCE CRITERIA

The NRC staff reviewed the application for compliance with the applicable requirements using the acceptance criteria presented in Section 8.10.10 of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c). The NRC staff also reviewed the application for compliance with the applicable requirements using the acceptance criteria in Section 5.3 of NUREG-1569 (NRC, 2003a).

7.10.3 SUMMARY OF APPLICATION

The CRSO is primarily responsible for the conduct of inspections and the maintenance of inspection records, as required. The CRSO or his qualified designee will conduct site-specific inspections under appropriate circumstances, such as malfunction of a uranium removal system, release of treatment media, and transportation accidents, or upon request of a client's manager.

Annually, the CRSO will review the conditions of the clients' facilities with the goal of improving ALARA conditions. The review will address the state of technology, containment measures, radiation safety procedures, any radiologic incidents during the past year, and the feasibility of any ALARA-based improvements. The review will also confirm that WRT personnel have implemented corrective actions recommended in previous audit findings. The SERP will review and approve the findings and proposed corrective actions resulting from this audit.

WRT will also conduct an annual audit of the radiation protection program to document the effectiveness of the program. The goal of the audit is to identify deficiencies in the program and to identify areas where WRT can make improvements to lower doses to workers and the public. The review will evaluate all areas of the radiation protection program, including, but not limited to the following:

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- CRSO and work responsibilities
- work and public dose assessment and ALARA considerations
- training
- operating and emergency procedures
- maintenance, adequacy, and use of personnel protective equipment

WRT will document the audit for the radiation safety program in a formal report.

7.10.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

WRT has established an acceptable program of audits and inspections. The NRC staff concludes that the proposed programs are acceptable and ensure compliance with relevant NRC regulations requiring periodic reviews of radiation protection programs.

7.11 SECURITY PROCEDURES AND MEASURES

7.11.1 REGULATORY REQUIREMENTS

The regulations at 10 CFR Part 20, Subpart I, "Storage and Control of Licensed Material," specify requirements for security of stored material and control of material not in storage.

7.11.2 ACCEPTANCE CRITERIA

The NRC staff reviewed the application for compliance with the applicable requirements using the acceptance criteria presented in Section 5.6 of NUREG-1569 (NRC, 2003a).

7.11.3 SUMMARY OF APPLICATION

WRT describes the security procedures and measures in Sections 2.3.2.8 and 3.16.4 of its environmental report (WRT, 2016). Typically, the uranium removal system will be located within an enclosed building, such as a treatment or well house. License Condition #13(D) of the renewed and amended license requires that the uranium removal system be "contained within a secured site that complies with NRC security requirements. At a minimum the treatment or well houses will be locked and almost all sites will be secured with locked fences. On rare occasions in which inclement weather is not a major concern, the uranium removal system may be located on a pad in the open or under a covered structure with open sides. In the event a uranium removal system is located in the open, outside of a building, the treatment site will be fenced and locked. In Section 3.16.4 of its environmental report (WRT, 2016), WRT has also committed to comply with and implement in conjunction with clients' personnel any NRC compensatory measures or other security requirements ordered by the NRC. In addition, members of the public, including intruders, have no direct access to uranium-laden treatment media contained within a closed treatment or storage vessel.

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7.11.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

Based on the information provided in WRT's application and the detailed review conducted of the security procedures and measures for clients' facilities using WRT's uranium removal system, as bounded by the conditions of the renewed and amended license, the NRC staff has concluded that the security procedures and measures are acceptable and will ensure compliance with applicable NRC requirements.

WRT's clients' facilities are typically secured regardless of the need to remove radionuclides from the water. License Condition #13(D) of the renewed and amended license requires that the uranium removal system be contained within a secured site that complies with NRC security requirements. At a minimum, clients will lock well houses at these facilities. Many clients will also secure their facilities, although not all, with locked fences. If WRT locates a uranium removal system in the open, outside of a building, which is an atypical situation, the NRC will require treatment sites to be fenced and locked. To ensure adequate security at clients' facilities using WRT's treatment program for water with uranium, the renewed and amended license will include the following license conditions in addition to License Condition #13(D), which is discussed in Section 3.4 of this safety evaluation report:

License Condition #30

WRT shall, at a minimum, use security procedures and measures as described in Section 3.16.14 of the Environmental Report. WRT shall also comply with and implement, in conjunction with appropriate Client personnel, all applicable NRC and any Client security requirements.

License Condition #31

To prevent any unauthorized persons from accessing the uranium removal system when unattended, the system shall be housed in a locked shed or locked structure, be within the locked Client facility, or be within a locked fenced-in, and properly marked area at all times, in accordance with the requirements of 10 CFR Part 20, Subpart I.

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8.0 WASTE MANAGEMENT

This section of this safety evaluation report presents the regulatory requirements, acceptance criteria, NRC staff review and analysis, and evaluation findings pertinent to the licensee's waste management program.

8.1 REGULATORY REQUIREMENTS

NRC regulation 10 CFR 40.51, "Transfer of source or byproduct material," prescribes the requirements for the transfer of source material. The NRC regulations in 10 CFR Part 20, Subpart K, "Waste Disposal," prescribe the requirements for the disposal of licensed material.

8.2 ACCEPTANCE CRITERIA

The NRC staff reviewed the application for compliance with the applicable requirements using the acceptance criteria presented in Section 8.11 of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c) and NRC's Regulatory Issue Summary 2012-06 (NRC, 2012b).

8.3 SUMMARY OF APPLICATION

WRT discusses waste management alternatives in Section 3.17 of its environmental report (WRT, 2016). WRT's waste management philosophy is that once removed from a given water source, uranium should not be re-introduced into the local environment. WRT will attempt to transfer its uranium-laden treatment media to an NRC- or Agreement State-licensed uranium recovery facility for processing as an equivalent feed consistent with NRC's Regulatory Issues Summary 2012-06 (NRC, 2012b). Typically, WRT will reuse the unloaded resins from equivalent-feed processing in a client's uranium removal system. If no such equivalent-feed processing facility is available, WRT will transfer the spent treatment media to a properly licensed or permitted facility for direct disposal.

8.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

Under the current license, WRT is required, before initiating licensed activities at a given client facility, to obtain properly executed contracts with uranium recovery or disposal facilities that designate a final disposition location for the spent uranium treatment media from that client facility. In its application for license renewal and amendment, WRT requested that the NRC amend the license condition to remove the requirement for obtaining properly executed contracts, as WRT has satisfied this condition by the contract it obtained with an NRC-licensed ISR facility.

The NRC staff requested additional information (NRC, 2017b) regarding WRT's proposed disposition path for uranium-laden treatment media. In its responses to the NRC (WRT, 2017), WRT indicates it has an agreement with Cameco Resources, Inc., for disposition of its uranium-laden treatment media as equivalent feed. WRT also identifies that it has a disposal agreement with U.S. Ecology Washington, Inc. for uranium-laden treatment media with a concentration greater than or equal to 0.05 percent and with U.S. Ecology Idaho, Inc. for uranium-laden treatment media with a concentration less than 0.05 percent (WRT, 2017). In addition, WRT asserts that the license condition is redundant and unnecessary because WRT is already required to comply with 10 CFR 20.2001, "General requirements," which requires transfer to an NRC-licensed disposal facility. Further, WRT asserts in its response to the NRC that 10 CFR 20.2001, "General requirements," does not require properly executed contracts be in effect prior

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to the start of licensed activities. Finally, WRT asserts that its preferred alternative is to send the uranium-laden media to an NRC-licensed uranium recovery facility; therefore, the uranium-laden treatment media is not even classified as a waste material. In this case, WRT will transfer the uranium-laden treatment media to a licensed uranium recovery facility according to the regulatory requirements of 10 CFR 40.51, "Transfer of source or byproduct material".

NRC staff determined that WRT has described acceptable final disposition pathways for uranium-laden treatment media from its clients' facilities that will provide adequate protection of public health and safety.

NRC permits a uranium recovery facility to receive uranium-laden treatment media as equivalent feed without the need for a license amendment, per NRC's Regulatory Issue Summary 2012-06 (NRC, 2012b), if:

- the received uranium-laden treatment media are chemically and physically essentially the same as the resins processed at the uranium recovery facility
- the uranium-laden treatment media would be processed using existing equipment and in the same way as resins processed at the receiving facility
- the processing of the uranium-laden treatment media as equivalent feed material does not exceed the uranium production limits in the receiving uranium recovery facility's license and remains within the existing safety and environmental review envelope for the receiving uranium recover facility

The NRC has determined that WRT's request to remove the license condition requiring that WRT obtain prior executed contracts is reasonable. Therefore, in order to ensure adequate waste management at clients' facilities, the renewed and amended license will include the following license condition:

License Condition #34

WRT shall transfer uranium-laden (spent or fully loaded) treatment media only to properly licensed or permitted facilities for final disposition as described in Section 3.17 of the Environmental Report.

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9.0 RECORDKEEPING AND REPORTING

This section of this safety evaluation report presents the regulatory requirements, acceptance criteria, NRC staff review and analysis, and evaluation findings pertinent to the licensee's recordkeeping and reporting.

9.1 REGULATORY REQUIREMENTS

In accordance with 10 CFR 40.36(f), all licensees must maintain records of structures and equipment where licensed materials are used or stored at locations specifically listed in the license. Requirements for recordkeeping for source material licensees are specified in 10 CFR 40.61, "Records." Furthermore, pursuant to 10 CFR 40.61(f), prior to license termination, each licensee must forward the records required by 10 CFR 40.36(f) to the appropriate NRC regional office.

9.2 ACCEPTANCE CRITERIA

The NRC staff reviewed the application for compliance with the applicable requirements using the acceptance criteria presented in Section 8.5.3 of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c).

9.3 SUMMARY OF APPLICATION

WRT has specified in its application (WRT, 2016) that it will maintain records according to 10 CFR 40.61(b) requirements (Section 3.14.3 of WRT's environmental report). Subsection 40.61(b) specifies requirements for recordkeeping and retention. WRT commits to retain records of any actions taken or authorized by the SERP until license termination. These records will include written safety and environmental evaluations made by the SERP as part of its analysis for justifying any changes, made without prior NRC approval, to its radiation safety program and standard operating procedures under License Condition #21. In addition, WRT will furnish an annual written report to the NRC that provides the bases for any changes made under License Condition #21. WRT also commits to maintain active records of employee exposure data and to provide employees with access to personal annual dose data in compliance with NRC requirements.

9.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

Based on the information provided in WRT's application, the NRC staff finds the WRT recordkeeping and reporting program, as bounded by the conditions of the renewed and amended license, to be acceptable.

Adequate recordkeeping is necessary to allow the NRC to inspect and review the performance of a licensee. In addition to the applicable requirements of 10 CFR 40.61, the renewed and amended license will include the following license conditions:

> License Condition # 23
>
> *The SERP shall document all decisions and determinations required by this specific license and as set forth as commitments in the Environmental Report and make such documentation available for NRC inspection. WRT shall provide the NRC with annual reports of all such decisions and determinations. Records shall*

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be maintained at the address listed in license condition 2 and reports shall be made in accordance with all applicable NRC regulations.

License Condition # 24

All written notices and reports to the NRC required under this specific license shall be addressed in care of the Document Control Desk, Director, (Mail Stop T-5 A10), Division of Decommissioning, Uranium Recovery, and Waste Programs, Office of Nuclear Material Safety and Safeguards, Nuclear Regulatory Commission, Washington D.C. 20555-0001, or by express delivery to 11545 Rockville Pike, Two White Flint North, Rockville, MD 20852-2738. Required telephone notification shall be made to the NRC Operations Center at (301) 816-5100 unless otherwise specified.

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10.0 DECOMMISSIONING ACTIVITIES

This section of this safety evaluation report presents the regulatory requirements, acceptance criteria, NRC staff review and analysis, and evaluation findings pertinent to the licensee's proposed decommissioning approach.

10.1 REGULATORY REQUIREMENTS

Decommissioning activities proposed for removing and disposing of structures and equipment used during operations and approaches for managing radioactive waste materials must meet the applicable regulatory requirements in 10 CFR 40.32(c) and 10 CFR 40.42, "Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas."

10.2 ACCEPTANCE CRITERIA

The NRC staff reviewed the application for compliance with the applicable requirements using the acceptance criteria presented in Section 8.5.3 of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c). The NRC staff also reviewed the application using acceptance criteria presented in Sections 6.3 and 6.4 of NUREG-1569 (NRC, 2003a).

10.3 SUMMARY OF APPLICATION

Section 3.18 of WRT's environmental report (WRT, 2016) describes decommissioning tasks and other requirements for a uranium removal system. WRT has also committed to a financial assurance methodology to estimate decommissioning costs for its uranium removal systems. This methodology will allow WRT to estimate decommissioning costs for each of its uranium removal systems on a site-specific basis and to document such estimates in its financial assurance mechanism. Section 3.18 of WRT's environmental report presents this methodology. Decommissioning cost estimates for the uranium removal system and other relevant aspects of WRT's program to remove uranium from water depend on the size of the system and the final disposition pathway for uranium-laden treatment media. Uranium-laden treatment media destined for processing at a licensed uranium recovery facility as an alternate feed (WRTs preferred disposition pathway) will result in one range of decommissioning costs. Uranium-laden treatment media destined for direct disposal at an appropriately licensed or permitted facility will result in a second range of decommissioning costs. WRT (then operating as RMD) has estimated a hypothetical range of decommissioning costs for both disposition pathways in its initial license application (RMD, 2005a-c); WRT has not updated these decommissioning costs in its current application (WRT, 2016).

WRT is committed to meeting the unrestricted use criteria in 10 CFR 20.1402, "Radiological criteria for unrestricted use" for its clients' facilities upon completion of decommissioning. Given the self-contained nature of the uranium removal system and the limited amount of licensed material contained within the treatment media, WRT has determined, based on its experience to date, and the NRC staff agrees, that decommissioning should be not be a complex matter. Because the uranium removal systems operate without chemical additions and most of the components are constructed of stainless steel or epoxy-coated steel, the potential for buildup of significant amounts of radioactive scale on the inner surfaces of the vessels is low. If such scale or other radioactive residuals are present, the removable surface contamination can be cleaned for unrestricted use of the equipment. Further, because the physical footprints of the uranium removal systems are small compared to other licensed facilities, the amount of radioactive material at a decommissioning site will be limited. In addition, WRT's emergency

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procedures should provide an effective response to any radioactive contamination from spills or leaks, thereby further limiting the amount of radioactive material expected to be present at decommissioning. Regulations at 10 CFR 40.42 require WRT to notify the NRC once the determination has been made to cease principal activities at a client's facility, to complete decommissioning activities no later than 24 months following the initiation of decommissioning, certify the disposition of all licensed material, and conduct a radiation survey.

Further, WRT has committed in its application (WRT, 2016) that its recordkeeping program will be fully compliant with NRC regulations, which included the requirements at 10 CFR 40.36(f). Section 40.36(f) specifies requirements for recordkeeping and retention of records important to the decommissioning of a facility.

10.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

NRC staff has evaluated the range of decommissioning cost estimates presented in WRT's application (WRT, 2016) and continues to find them to be reasonable and acceptable. In addition to the applicable requirements of 10 CFR 40.42, the renewed and amended license will include the following license conditions:

> License Condition #36
>
> *WRT shall conform its decommissioning activities to the methodology and requirements described in Section 3.18 of the Environmental Report and the NRC regulations in 10 CFR Part 20, Subpart E, and 10 CFR 40.42.*

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11.0 FINANCIAL ASSURANCE

This section of this safety evaluation report presents the regulatory requirements, acceptance criteria, NRC staff review and analysis, and evaluation findings pertinent to the licensee's proposed financial assurance mechanisms.

11.1 REGULATORY REQUIREMENTS

A licensee who will be authorized to possess licensed material above the thresholds specified in 10 CFR 40.36, "Financial assurance and recordkeeping for decommissioning," must provide evidence of financial assurance for decommissioning.

11.2 ACCEPTANCE CRITERIA

The NRC staff reviewed the application for compliance with the applicable requirements using the acceptance criteria presented in Section 8.5.4 of NUREG-1556, Volume 18, Revision 1 (NRC, 2017c).

11.3 SUMMARY OF APPLICATION

NRC's approval (NRC, 2007a) of WRT's (then operating as RMD) initial license application included an exemption from the financial assurance requirements in 10 CFR 40.36, "Financial assurance and recordkeeping for decommissioning." This exemption allowed WRT's community water system clients to provide the financial assurance mechanisms on behalf of the licensee, with the NRC as the intended third-party beneficiary with the right to enforce the provisions of the contract as it applies to decommissioning or other related activities.

In addition, WRT (then operating as RMD) agreed to the following license conditions being included in its initial license:

- the creation of a standby trust to receive, if necessary, funds for decommissioning of each specific site, with the NRC as the beneficiary and financial assurance provided by the community water system client prior to operations

- the designation of the NRC as intended third party beneficiary of the financial assurance mechanisms with the right to enforce the provisions of each contract between WRT (then RMD) and a community water system client as it relates to decommissioning activities

- the preparation of site-specific decommissioning cost estimates pursuant to applicable NRC requirements

WRT has committed to providing adequate financial assurance for decommissioning activities at its clients' sites that utilize its uranium removal systems. Section 3.18.2 of WRT's environmental report (WRT, 2016) describes WRT's framework for providing financial assurance. WRT commits to a separate, stand-alone financial assurance arrangement for each client, which will be put in place prior to the start of licensed activities. The framework also permits WRT's clients, whether public or private, to provide financial assurance on behalf of WRT. Public (e.g., municipal or other local government) clients may provide a statement of intent as the basis for financial assurance and private clients will provide any of the other financial assurance arrangements described in 10 CFR 40.36(e).

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11.4 NRC STAFF REVIEW AND EVALUATION FINDINGS

NRC approval of WRT's license renewal and amendment will allow for WRT to continue with the same overall framework for providing financial assurance that is in place in the current license. The framework includes:

- a separate stand-alone financial assurance arrangement for each individual WRT client put in place prior to the start of licensed activities
- financial assurance provided by public or private WRT clients on behalf of WRT
- ability of either public or government clients to provide a statement of intent or private clients to provide any other financial assurance arrangements acceptable to NRC
- WRT's commitment to prepare and document decommissioning cost estimates for each uranium removal system prior to commencement of licensed operations. WRT will document such decommissioning cost estimates in its financial assurance mechanism for each client

As required by 10 CFR 40.36, "Financial assurance and recordkeeping for decommissioning," the NRC staff has reviewed WRT's application and finds that the proposed renewal and amendment of WRT's performance-based, multi-site service provider license does not meet the NRC's financial assurance criteria. However, pursuant to the previously approved specific exemption request by WRT (then operating as RMD), which remains in effect, the NRC staff finds that WRT's practice of obtaining properly executed statements of intent or guarantees from public clients and other acceptable financial assurance mechanisms from private clients for estimated decommissioning costs, prior to the initiation of any licensed activities, is acceptable.

In its current application (WRT, 2016), WRT requested that the NRC amend the timeframe for adjusting site-specific decommissioning costs from an annual basis to every five years. At a public meeting on January 10, 2018 (NRC, 2018a), the NRC staff informed WRT that 10 CFR 40.36 permits updates up to every three years and the requested amendment to five years would require additional justification. WRT indicated a three-year timeframe was acceptable.

On April 13, 2018, WRT requested an amendment to permit standby trusts created by its clients (under the current license, only WRT can create such standby trusts) (WRT, 2018b). WRT indicated that it requested the amendment because its experience in Agreement States has resulted in the occasional preparation of standby trust agreements by its clients rather than by WRT. WRT also expects the amendment would increase flexibility for clients and not cause undue impact to public health and safety or the environment. The NRC staff finds this amendment acceptable because the requirements of 10 CFR 40.36 do not specify which entity can draft and provide the standby trust agreement for a given financial assurance instrument and the NRC's requirements would continue to be satisfied regardless of whether WRT or its client provides the standby trust.

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To continue to ensure the completion of all radiological decommissioning activities, the renewed and amended license will include the following license conditions:

License Condition # 37

Before a uranium removal system becomes operational, WRT shall create, or caused to be created by the Client, a standby trust, acceptable to the NRC, for the uranium removal system located at a Client's facility. WRT shall obtain acceptable financial assurance mechanisms for site-specific Client facilities before the uranium removal system becomes operational. For Clients that are federal, state, or local government entities, WRT may obtain statements of intent or guarantees pursuant to 10 CFR 40.36(e)(4) in accordance with WRT license application dated September 27, 2005; subsequent supporting documentation dated August 14, 2006, August 30, 2006 and September 13, 2006; and Section 3.18.2 of the Environmental Report dated December 21, 2016. For private Clients, WRT will obtain acceptable financial assurance mechanisms pursuant to 10 CFR 40.36 in accordance with WRT license application dated September 27, 2005; subsequent supporting documentation dated August 14, 2006, August 30, 2006 and September 13, 2006; and Section 3.18.2 of the Environmental Report dated December 21, 2016. WRT will not be required to create or cause to be created a standby trust, or obtain an acceptable financial assurance mechanism, as required by applicable NRC regulations and this license condition, for those Client uranium removal systems operating under a general license pursuant to 10 CFR 40.22.

License Condition # 38

The contract between WRT and each Client shall include the statement, "For purposes of this Agreement, the NRC shall be considered an intended third-party beneficiary of any financial assurance mechanism required for activities under this Agreement and shall be granted rights to enforce the provisions of such financial assurance mechanism for decommissioning or other related activities."

License Condition # 39

WRT will prepare site-specific decommissioning cost estimates pursuant to the methodology delineated in Section 3.18.2 of the Environmental Report before initiating licensed activities. WRT will document such decommissioning cost estimates in its financial assurance mechanism for each Client. WRT will adjust decommissioning cost estimates pursuant to applicable NRC requirements, such as changes in engineering or design, and economic conditions, such as inflation, on a triennial basis or at license renewal.

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12.0 LIST OF PREPARERS

This document was prepared by Christopher Grossman, Project Manager, Division of Decommissioning, Uranium Recovery, and Waste Programs, Low-Level Waste and Projects Branch, and Reginald Augustus, Financial Analyst, Division of Decommissioning, Uranium Recovery, and Waste Programs, Risk and Technical Analysis Branch.

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