December 21, 2016

United States Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards
Division of Decommissioning, Uranium Recovery,
and Waste Programs
Attn: Mr. Christopher Grossman, Project Manager
11545 White Flint North
Rockville, MD 20852-2738

40-9059

Dear Mr. Grossman:

By this letter, Water Remediation Technology, LLC (WRT) hereby submits its application for renewal of United States Nuclear Regulatory Commission (NRC) License No SUC-1591 issued by NRC Staff on January 25, 2007. WRT's NRC license is classified by NRC Staff as a performance-based, multi-site service provider license thereby allowing WRT to utilize its uranium water treatment technology, processes, and program at multiple sites in NRC-regulated States without the need for a license amendment. In this license renewal application, WRT is seeking a renewal of License No. SUC-1591 for a further ten (10) year period, as well as most of the license conditions contained therein. To the extent that it is seeking the revision, removal or addition of license conditions for License No. SUC-1591, WRT will provide NRC Staff with a detailed proposal and justification for such action in this transmittal memorandum, as well as in the attached Environmental Report (ER) prepared pursuant to NUREG-1748 entitled *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs.* This attached ER also has been prepared in the same manner as WRT's previously submitted and approved ER from its initial 2005 NRC license application. As required by NRC Staff guidance, this license renewal package was prepared in accordance with the requirement that a licensee evaluate the "delta" or change in the manner in which licensed activities have been handled under the current license and what the licensee believes is necessary and appropriate going forward. To date, WRT has not contracted with a CWS in a non-Agreement State that meets NRC specific license requirements.

By way of background, prior to 2005, the United States Environmental Protection Agency (EPA) promulgated new regulations in the form of drinking water standards to comport with statutory amendments to the federal Safe Drinking Water Act (SDWA). Among other amendments, EPA was required to amend the standard for uranium in drinking water to a level much lower than the previous standard. This unfunded mandate was immediately imposed on community water systems (CWS) and other sources of drinking water falling under the SDWA's statutory mandate. As a result, hundreds of SDWA-regulated CWS drinking water sources were forced to remove uranium to comply with this new standard and would be responsible for the safe management and disposition of what would become Atomic Energy Act of 1954 (AEA) *licensable* source material.

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For up to one (1) year, WRT engaged in a series of public meetings with NRC Staff to discuss the potential licensing formats that would be applicable to the uranium removal processes envisioned to be implemented under the AEA. Several different forms of NRC's guidance were consulted and tailored to reflect WRT's proposed approach to assisting CWSs that either did not have the ability to or did not want to accept the responsibility for the safe handling and disposition of source material as prescribed for AEA licensees.

On September 27, 2005, WRT submitted a license application to NRC Staff for its review and consideration. At that time, NRC guidance recognized a class of source material licenses known as "service provider" licenses, but WRT sought additional, recognized NRC licensing options to fit the way it would provide uranium removal services on a national basis to multiple CWS or other eligible drinking water sources using the same legally compliant processes and safeguards. With this in mind, WRT prepared and submitted an NRC license application seeking what was later called a performance-based, multi-site source material service provider license. The service provider component of this proposed license encompassed numerous items including, but not limited to, the contracting of a uranium removal system (URS) with a CWS or other eligible drinking water provider, the operation of the URS, the possession and use of the generated source material, whether above or below 10 CFR Part 40.1_ general license limits, the media exchanges to remove the source material generated from the URS, and the disposition of such source material with the preferred option of sending the source material to a properly licensed uranium recovery facility for recycling and introduction into the nuclear fuel cycle.

The performance-based, multi-site component of this proposed license requested that NRC Staff allow WRT to "register" multiple sites under the same license without the need for a license amendment each time a site was to be added. WRT's URS and the manner in which it is placed and monitored at a CWS site and used to remove source material from drinking water sources with ion-exchange resins which are virtually identical to those used by *in situ* leach uranium recovery (ISR) facilities and by other entities that use such resins to engage in activities such as mine de-watering was substantially similar, if not identical, for each CWS site. Based on this and using the Commission's approved performance-based licensing approach to AEA regulation, WRT proposed that it establish a safety and environmental review panel (SERP) as initially implemented under 10 CFR Part 50.59 for nuclear power reactors and later transferred by license condition to other AEA-licensed facilities such as uranium recovery facilities. This SERP would be primarily responsible for reviewing the technical specifications of a proposed CWS site and the placement and operation of a URS at that site and determining whether such site would meet 10 CRR Part 40.1_ specific license limits for source material (i.e., at the time, more than 15 pounds of source material at any one time or more than 150 pounds in a year for all Part 40 licensees) and could be registered under the license. This determination would be based primarily on a review of the bounding conditions established in WRT's license application and NRC Staff's approval of such conditions and a conclusion that the proposed CWS site falls within such conditions. The primary bounding condition established by WRT in its ER, and later evaluated by NRC Staff, was a wide range of URSs, defined by flow rate capacity (or gallons per minute (gpm), that provided NRC Staff with a range of potential safety and environmental impacts and would permit WRT to install and operate any URS within that range at a CWS site without the need for a license amendment. In the event that a conclusion that a proposed CWS fell within these bounding conditions could be reached, then WRT could register the CWS site under the proposed license and maintain the SERP's findings on file for NRC inspection. If such a conclusion could not be reached, then NRC Staff would require WRT to prepare and submit a

license amendment application to add the proposed site to the proposed license. This approach to a license format was approved by NRC after a full detailed technical and environmental review, as documented in its Technical Evaluation Report (TER) and Environmental Assessment (EA) (License Condition 20).

In some instances, CWS sites will generate *licensable* source material (i.e., above 500 parts per million (PPM)) but will not generate enough source material to exceed the aforementioned NRC specific license limits. Indeed, the subject CWS site for WRT's license application did not meet specific license requirements. By rule, WRT could be issued a general license for this site and for many others that failed to meet the specific license requirements without the need for a specific license for registering such CWS site on the proposed performance-based multi-site license. However, the imposition of the new SDWA uranium in drinking water standard and the way the generated source material would be handled and disposed of was new to the regulated and regulating communities. Thus, NRC requested that WRT agree to an additional requirement that a site operating under a service contract with WRT and meeting the general license requirements but not the specific license requirements would simply be registered with NRC Staff without the need for evaluation by the SERP or for imposition of conditions under the proposed license such as financial assurance. During NRC Staff's review, WRT agreed to this request and the requirement was placed in its approved license (License Condition 20).

In addition to seeking renewal of its existing license for conducting uranium water treatment operations at CWS facilities, WRT is also seeking NRC Staff approval for one (1) additional type of activity utilizing its technologies. This activity is to extend the scope of the use of WRT's uranium water treatment technologies for uranium removal from other types of groundwater or surface water sources such as mines requiring de-watering, pit lakes, and other groundwater sources. As will be shown in the attached ER, the use of WRT's uranium water treatment technology at these sites will not result in any changes to the technology, its flow-rates as specified in the current license or the procedures associated with media exchanges and transfer of the uranium-loaded resins to a properly licensed facility for recycling or disposal. Indeed, WRT already is performing such uranium water treatment in one Agreement State and is currently preparing to conduct similar operations at a second site. In the event that it secures a contract to perform such services that do not result in the generation of uranium source material in excess of 15.4 pounds at any one time or 154 pounds in any calendar year, WRT will honor its commitment to NRC Staff to register such a site and to maintain records of such registration in its corporate offices for NRC inspection. In the event that it secures a contract to perform such services that do result in the generation of greater than these general license limits, WRT commits to register this site through its SERP and fulfill its license conditions regarding radiation protection and other related standard operating procedures which should result in no change from previously approved operations.

It is worth noting at this point that there were two (2) significant regulatory developments that directly affect WRT's license renewal application since the 2007 issuance of its current NRC license. First, in 2012 and at the behest of WRT, NRC Staff developed and issued a Regulatory Issue Summary (RIS) entitled *NRC Policy Regarding Submittal of Amendments for Processing of Equivalent Feed at Licensed Uranium Recovery Facilities* (hereinafter "EFRIS") allowing entities possessing uranium-loaded ion-exchange resins from water treatment plants or mine de-watering operations to transfer such loaded resins to uranium recovery licensees for recovering

the contained uranium and recycling without the need for a license amendment. The policies outlined in this RIS represent a practicable approach to the management of these resins generated, at a minimum, from water treatment operations given the large amount of CWS sites that will require compliance with the new SDWA uranium in drinking water standard. Since compliance with the SDWA standard directly implicates protection of public health and safety, the need for multiple license amendments to dispose of uranium-loaded resins from water treatment operations would unnecessarily burden water treatment providers without identifying any discernable, significant public health and safety or environmental impacts. However, for purposes of this license renewal application, it is important to note that the primary focus of the EFRIS is the material generated (i.e., uranium-loaded IX resins) and not the activity that produces such material. Even though the RIS identifies water treatment operations and uranium recovery facilities, other types of activities can generate similar materials. But, for WRT, the proposed expanded scope of licensed activities/operations fall squarely within the category of "water treatment operations." Thus, WRT's request to utilize the equivalent EFRIS to allow for transfer of the generated uranium-loaded IX resins to a licensed uranium recovery facility should be allowed under the renewed license without the need for license amendments.

Second, in 2013, NRC Staff engaged in a rulemaking to amend the 10 CFR Part 40.22 general and specific license limits for source material licensees. Whereas the previous rule established general license limits of 15 pounds of source material at any one time or 150 pounds in any one year, the new Final Rule greatly reduced these limits to 3.3 pounds of source material at any one time and 15.4 pounds of source material in any one calendar year, which potentially could change licensing requirements for many source material licensees. However, within the confines of the Final Rule, NRC Staff also established a specific exemption for licensees such as WRT that engage in water treatment operations. *See* 10 CFR § 40.22(a)(3). This exemption allows for WRT's general and specific licensing requirements to remain at the prior limits and does not affect any currently licensed Agreement State sites.[1] Thus, there should be no further evaluation by NRC Staff on licensing limits for the current performance-based, multi-site license.

Financial Assurance

The other major item reviewed in WRT's license application was the appropriate financial assurance mechanism to be used for public and private CWSs. Initially, WRT proposed that CWSs be permitted to provide financial assurance on behalf of WRT. WRT's ER also provided NRC Staff with a list of financial assurance costs estimates based on the flow-rate specific range of URSs that would be applicable to each such system. The calculation of a URS-specific financial assurance cost estimate was more realistic than the need for a CWS-specific decommissioning plan and cost estimate because of the substantially similar nature of each URS, the building or other facility they would be placed in, and the maximum amount of source material that would have to be exchanged and disposed of for each URS. These financial assurance costs estimates were provided to NRC Staff for its review and consideration and were subsequently approved. With respect to private CWSs, WRT proposed that financial assurance be provided using any of the financial assurance mechanisms specifically approved by NRC

[1] Indeed, the specific exemption carved out of the new Part 40.22 rule for water treatment operations slightly increased the general license limits to 15.4 pounds of source material at any one time and 154 pounds of source material in any one calendar year.

Staff in 10 CFR Part 40 regulations and Appendix A Criteria, including but not limited to: (1) surety bonds; (2) letters of credit; (3) certificates of deposit; or (4) prepayment. This approach also was approved by NRC Staff when issuing WRT its proposed license.

With respect to public CWSs such as those controlled by municipal governments, WRT recognized that many such CWSs were not able to post financial assurance in the amounts proposed by WRT and approved by NRC Staff using any of the aforementioned approved financial assurance mechanisms. In its license application, WRT proposed that public CWSs use statements of intent to guarantee the payment of the full financial assurance amount if and when WRT were to declare bankruptcy and would be unable to conduct site decommissioning activities. CWSs would be in a position to post a statement of intent guaranteeing the required financial assurance amount for a prescribed period of time or in perpetuity, whichever is permissible, and in the event that there is a change in government such as a mayor or city council, a new statement of intent can be proffered if it needed to be re-authorized. In the cases of both private and public CWSs, the executed financial assurance documents would be made available for NRC inspection. WRT was also required to create a standby trust in accordance with NRC requirements (License Condition 38). This proposal was approved by NRC Staff after its review.

WRT's experience in Agreement States demonstrates that the previously approved financial assurance format has been effective in fulfilling the goals of financial assurance and in allowing CWSs and WRT to cost-effectively satisfy the SDWA's unfunded mandate while adequately protecting public health and safety by preventing uncontrolled the re-introduction of source material into the environment after removal from drinking water. NRC regulations continue to allow for the use of statements of intent for governmental entities, such as CWSs operated by municipalities, and WRT requests that NRC Staff renew its previous license condition allowing for such CWSs to post statements of intent for WRT as it will be standing in the shoes of the CWS for purposes of SDWA compliance. In addition, for the other types of water treatment services such as mine de-watering or other groundwater treatment that are operated by governmental entities, WRT also requests that NRC Staff approve the use of statements of intent for these facilities. With respect to privately owned/operated CWSs or other water treatment operations described in the attached ER, WRT requests that NRC Staff renew its current license condition allowing for the use of any of the approved financial assurance mechanisms in 10 CFR Part 40 and associated guidance.

Scope of Licensed Activities

Prior to addressing the specific NRC license conditions and whether any revisions are requested, since the issuance of its performance-based, multi-site license on January 25, 2007, WRT has also obtained at least eight (8) Agreement State licenses to remove uranium from drinking water sources or, in some cases, other water sources such a mine water. By engaging in Agreement State-licensed activities under these licenses, WRT has been able to develop significant data and has performed detailed technical analyses of radiation safety procedures and dose calculations and has compared such results to those offered in WRT's initial NRC license application. Even though there have been no specifically licensed sites registered under its NRC license, WRT believes it is prudent to provide NRC Staff with the data and analyses from these systems so that the "delta" between the initial license application projections and the current data may be analyzed during the detailed technical and environmental review. After reviewing these

materials and as will be shown in the license renewal ER, WRT has determined that the radiation safety processes and the dose results are well within the parameters established by WRT's NRC performance-based, multi-site license. For members of the public, WRT's dose measurements in Agreement States have shown a negligible dose well below NRC 10 CFR Part 20 members of the public dose limits. For occupational doses involved in media exchanges, transport, and for CWS operators, WRT's dose calculations indicate that the initial assessments presented in its initial license application were accurate. WRT system specialists have performed media exchanges on twenty (20) to twenty-five (25) uranium and radium treatment systems annually and have experienced less than 1 mrem per quarter. For purposes of transporting the uranium-loaded IX resins, such material is classified in the two (2) lowest categories of Class 7 material under United States Department of Transportation (DOT) regulations (i.e., UN2910 (Ltd Quantity) and UN2912 (LSA-1). In addition, with respect to the other resource areas, WRT also has not observed any adverse "delta" between the initial license application and the current operating conditions at Agreement State sites.

WRT's license renewal application addresses all relevant resource areas necessary to renew NRC License No. SUC-1591 and reflects additional items and analyses contained in recent Agreement State license and license renewal applications. Unlike the initial NRC license application where a separate SER or technical report was submitted along with an ER, WRT is submitting a comprehensive ER that includes all relevant technical and environmental data and analyses such as corporate structure and other items typically found in a technical report. This transmittal memorandum will provide NRC Staff with guidance as to what, if any, changes are requested to specific license conditions or whether WRT seeks renewal of such conditions as they are currently constituted. The discussion below will provide NRC Staff with this information.

When submitting its initial NRC license application, WRT had identified CWSs as the primary need for water treatment operations due to the promulgation of EPA's new uranium in drinking water treatment standards. As time progressed, WRT discovered new applications for its URS product. Since the CWS sites that it had or later would engage were seeking removal of uranium from groundwater sources, WRT determined that its URS product would be equally applicable to other sources of groundwater (or even surface water) such as mine sites requiring de-watering or remediation of a pit lake or other surface water source. All such sites would use the same WRT processes and associated protection procedures and safeguards and would generate the same licensable source material as that generated at CWS facilities. WRT's intent is that final disposition of the generated licensable source material be transported as an equivalent feed under NRC guidance to a licensed uranium recovery facility for recycling and introduction into the nuclear fuel cycle. Indeed, WRT already is engaging in uranium groundwater treatment operations in an Agreement State and has begun preparations for engaging in similar uranium groundwater treatment operations at a second site.

Since its initial NRC license application did not address other types of groundwater treatment sites such as mines or pit lakes, WRT's ER provides NRC Staff with a description of the affected environment for such sites and whether there is any significant difference between such environment at these sites versus CWS sites. After conducting detailed analyses of the conduct of uranium groundwater treatment at these sites and comparing them to the bounding conditions previously approved by NRC Staff, WRT has found that licensed operations at these sites are no different from those at CWS sites.

In summary, WRT's proposed expanded scope of its current performance-based, multi-site license does not include the addition of any new licensed operations; but rather, it merely requests NRC Staff approval to perform the same, previously approved licensed activities at different types of sites. WRT's ER shows that there are no significant, if any, differences between the newly requested expanded scope of licensed operations and those that were previously approved. Therefore, WRT asserts that this proposed expanded licensing scope does not result in any potentially significant public health and safety or environmental impacts.

Specific License Conditions

For purposes of its license renewal application, WRT is seeking to renew the vast majority of its current License No. SUC-1591 conditions as they are currently written. In some instances, WRT will be requesting revisions to certain license conditions based on the information provided in its license renewal ER. Where such revisions are requested, WRT will specifically identify the requested change and the corresponding justification.

1. **License Conditions #1-8:** Other than the required administrative changes such as expiration date, WRT is seeking no changes to these eight (8) license conditions.
2. **License Condition #9:** License Condition 9 is a standard NRC license condition that requires a licensee to operate within the parameter of its submitted license application, except where superseded by specific license condition. Thus, except for changing the date of the ER, WRT is seeking no changes to this license condition.
3. **License Condition #10:** License Condition 10 specifies the manner in which WRT is required to contract with a CWS to possess and use source material generated at CWS sites in a URS. As required under the AEA, the licensee must possess and use source material in accordance with NRC regulations and cannot delegate it to another entity unless said entity also is licensed. Thus, as the licensee, WRT is required to either own the URS and possess and use the source material or sell the equipment to the CWS and lease back the URS to retain possession of the source material.

WRT is seeking an amendment to this license condition for the following reasons. In the typical WRT water treatment agreement, WRT does contractually own the uranium source material, but WRT does not possess the uranium at all times because it is not on the CWS premises at all times. The current requirement that WRT lease back the URS to show it is completely in possession of the uranium source material provides no additional safeguards that protect public health and safety. WRT's typical water treatment agreement does indeed require that WRT conduct media exchanges and take possession of the uranium source material that it owns for final disposition. Further, in the vast majority of Agreement State-licensed systems, WRT sells the URS and associated equipment to the CWS owner/operator and rarely is a full-time URS leased. Many CWSs have found that leasing the equipment is cost-prohibitive and would be unlikely to enter a treatment agreement under such circumstances. In addition, WRT has inserted language into its typical water treatment agreement to comply with NRC's expectations for both ownership and control (and possibly possession) of the uranium source material. For example, WRT's typical treatment agreement includes language that: (1) states that WRT owns treatment media at all times and takes ownership of the uranium source material as it loads on such media; (2) states that one of the CWS' obligations is to grant and provide WRT with full access to the URS and associated equipment at all times to show that WRT has adequate control of the URS, treatment media, and generated uranium source material; and (3)

states that WRT will have access to the URS and associated equipment in the event of an accident or upset condition. WRT believes that this language adequately addresses the issue of access to and control of all AEA-licensed material and equipment. Thus, WRT requests that NRC Staff amend this license condition to remove the language on leasing back the treatment system and/or treatment building and replace such language with the commitments outlined in the treatment agreement noted above.

4. **License Condition #11:** License Condition 11 requires WRT to consult with State and/or local historic preservation officers before beginning construction of a URS outside of or away from existing CWS structures and/or buildings. WRT recognizes that, as a federal agency, NRC Staff has a responsibility under the National Historic Preservation Act (NHPA) to address any federal undertaking that potentially could impact historic or cultural resources. However, the scenarios where WRT may install an URS or multiple systems, regardless of whether a new building would be constructed to house the URS, likely already have been assessed for potential impacts on these types of resources. WRT has no control over where a CWS or other water treatment facility would site its treatment systems and, typically, the CWS or other facility is responsible for all zoning, permitting, and other approvals for its structures and buildings. Since these responsibilities rest with the CWS or other facility, WRT requests that NRC Staff amend License Condition 11 to require WRT to merely provide copies of documentation from the contracted CWS or other facility showing that relevant approvals with respect to historic and cultural resources have been obtained and maintain such documentation in its corporate offices for NRC inspection.

5. **License Condition #12:** License Condition 12 requires secondary containment measures for URSs that are located near a direct outlet to a storm sewer, sanitary sewer or drain field. Additionally, it requires that a URS not be located on the 100-year flood plain unless approved by WRT's SERP and NRC Staff. As is the case with License Condition 11, WRT has no control over where a CWS or other water treatment facility locates its URS or multiple systems. It is likely that the issue of water control in a 100-year flood plain already has been evaluated at these sites and, if that is the case, that analysis would be available to NRC Staff for review. Thus, WRT requests that NRC Staff amend License Condition 12 to remove the requirement to obtain NRC Staff approval and allow WRT's SERP to approve such operations while maintaining the documentation on such analyses on file for NRC inspection.

6. **License Condition #13:** License Condition 13 requires WRT to consult with federal and/or State fish and wildlife agencies to identify potential endangered or threatened species before constructing a URS outside of or away from existing CWS structures and/or buildings. As is the case with License Condition 11, WRT has no control over where a CWS or other water treatment facility locates its URS or multiple systems. It is likely that these evaluations already have been conducted by the CWS or other water treatment facility when their initial and subsequent permits were issued. Thus, WRT requests that NRC Staff amend License Condition 12 to remove the requirement to obtain NRC Staff approval and allow WRT's SERP to approve such operations while maintaining the documentation on such analyses on file for NRC inspection.

7. **License Condition #14:** License Condition 14 requires WRT to document any corporate changes affecting assignments or reporting responsibilities described in the previous ER and that such documentation be made available by WRT's SERP for NRC inspection. WRT does not seek any amendment to this license condition.

8. **License Condition ##15-17:** License Condition 15 describes the requirements for WRT's corporate radiation safety officer (CRSO), WRT system specialists, and local utility managers and operators and requires that documentation of satisfaction of such requirements be

maintained by WRT's SERP and made available for NRC inspection. WRT does not seek any amendment to this license condition.

9. **License Condition #18:** License Condition 18 is WRT's performance-based license condition which typically has been translated from 10 CFR § 50.59 into 10 CFR Part 40 licenses for licensees such as uranium recovery licensees. WRT does not seek any amendment to this license condition.

10. **License Condition #19:** License Condition 19 describes the requirements for composition of WRT's SERP. WRT does not seek any amendment to this license condition.

11. **License Condition #20:** License Condition 20 describes the requirements for registration of CWS systems that operate under a general license and the reporting requirements for CWS systems operating under a specific license, including but not limited to financial assurance. WRT requests that this license condition be amended to include other water treatment sites where WRT's URSs, as described in the ER, operate within the performance parameters approved by NRC Staff. Inclusion of such sites would be approved by the SERP and notification would be provided to NRC Staff in accordance with this license condition. Further, documentation of the SERP approval would be made available for NRC inspection.

12. **License Condition #21:** License Condition 21 imposes requirements on WRT's SERP for making documents available for NRC inspection. WRT does not seek any amendment to this license condition.

13. **License Condition #22:** License Condition 22 provides information regarding notification by mail or phone to NRC Staff in accordance with other license conditions. WRT does not seek any amendment to this license condition other than any applicable changes of address or phone numbers.

14. **License Condition #23:** License Condition 23 requires that WRT develop standard operating procedures (SOP) for all licensed operations, including but not limited to the handling of licensed materials during normal operating situations and highly unlikely but credible accident scenarios. WRT does not seek any amendment to this license condition except that WRT will commit to developing SOPs, to the extent necessary, for other uranium water treatment facilities that are not CWSs. WRT also requests that NRC allow WRT to maintain SOPs at specifically licensed sites or with WRT field personnel responsible for a specifically licensed site.

15. **License Condition #24 & 27:** License Conditions 24 & 27 requires that WRT implement a radiation safety program, including a radiation monitoring program, consistent with its previous ER. WRT has found that the existing radiation safety program, as previously approved by NRC Staff, has been effective in Agreement States and, therefore, does not seek to amend this license condition other than referring to the appropriate section in the license renewal ER. WRT also does not object to revising this license condition to require implementation of this program at uranium water treatment facilities that are not CWSs.

16. **License Conditions #25-26:** License Conditions 25 sets forth the requirements for URS installation and functionality of all URS equipment, including the equipment necessary for media exchanges. WRT does not seek any amendments to these license conditions other than those that may reflect application of the URS to non-drinking water treatment operations.

17. **License Conditions #28-29:** License Condition 28 requires that WRT use an environmental monitoring program and emergency response procedures as described in the ER. License Condition 29 also requires WRT to notify the fire marshal or the equivalent of the potential hazards associated with handling of uranium source material or a fire. WRT does not seek any amendment to these license condition.

18. **License Condition #30:** License Condition 30 requires that WRT use a contamination control program in accordance with the ER. WRT does not seek any amendment to this license condition.

19. **License Conditions #31-32:** License Condition 31 requires that WRT utilize security procedures and measures as described in the ER and that it commit to implementing any NRC compensatory measures or security requirements issued by the Commission. License Condition 32 requires that WRT's URSs be housed in locked sheds or within the CWS' secured area and be properly marked at all times. WRT does not seek any amendment to this license condition.

20. **License Conditions #33-34:** License Condition 33 requires that WRT use SOPs for media exchanges and other related procedures as described in the ER. License Condition 34 requires that SOPs be used for transportation accident scenarios and that follow-up surveys be conducted at accident sites. WRT does not seek any amendment to this license condition.

21. **License Condition #35:** License Condition 35 requires that WRT dispose of uranium-loaded resins at properly licensed facilities under a properly executed contract before shipping. WRT already has obtained a contract with an NRC-licensed ISR facility where these resins generated at Agreement State facilities have been sent. WRT also recognizes that it does not require that the recipient facility obtain a license amendment to receive these resins due to the aforementioned RIS on "equivalent feed." Thus, WRT does not seek any additional requirements for this license condition and further requests that the condition be amended to remove the requirement for obtaining properly executed contracts, as this condition precedent has been satisfied. Additionally, WRT believes deletion of the last sentence of the condition is warranted.

22. **License Conditions #36 & 37:** License Condition 36 requires that uranium-loaded resins not be stored at a CWS for greater than sixty (60) days after a media exchange and should only be stored in the IX vessel or DOT-approved containers. WRT seeks an amendment to this license condition to reflect the storage of uranium-loaded resins at non-drinking water treatment sites and to make clear that storage of the licensed material for now more than 60 days is after a media exchange. License Condition 37 requires that WRT conform its decommissioning activities to those reflected in the ER. WRT does not seek any amendment to this license condition.

23. **License Conditions #38-40:** License Condition 38 is WRT's financial assurance requirements for CWSs that are specifically licensed and permits the use of statements of intent or guarantees from publicly-owned CWSs. Further, WRT is required to obtain acceptable

financial assurance instruments for privately-owned CWSs as described in 10 CFR Part 40.36. WRT does not seek any amendment to these license conditions except to reflect that government owned or controlled sites where non-drinking water treatment will occur be permitted to post similar statements of intent or guarantees and add a clarification that WRT's clients be allowed to provide financial assurance on behalf of WRT.

License Condition 39 provides for model language for contracts between CWSs and WRT for drinking water treatment operations. License Condition 40 requires that WRT prepare site specific decommissioning cost estimates for each site where licensed operations will take place. WRT does not seek any amendment to these license conditions. WRT also requests that the timeframe for adjusting site-specific decommissioning costs be every five (5) years or at the time of license renewal.

WRT appreciates the opportunity to continue its working relationship with NRC Staff for purposes of this license renewal. WRT requests that, at the conclusion of its acceptance review, NRC Staff inform WRT of any potentially significant requests for additional information (RAI) so that the relevant information may be compiled and submitted. In addition, WRT requests that a public meeting be scheduled within 7-10 business days following issuance of any RAIs so that all parties may understand what is required to complete NRC Staff's detailed technical and environmental review.

Additionally, WRT is aware that NRC's Office of Nuclear Materials Safety and Safeguards (NMSS) is currently exploring the potential for expanding the timeframe for materials licenses from the current term of ten (10) years. WRT believes that its current license is an ideal candidate for such an extension and respectfully requests that NRC Staff consider this type of extension in the course of this license renewal. Thank you for your time and consideration in this matter, and we are looking forward to working with NRC Staff to complete this license renewal review.

Sincerely,

Duane W. Bollig
Director – Environmental & Regulatory Affairs

Enclosure:
Environmental Report in Support of License Renewal, 12/21/2016

cc: Ted Adams
Christopher Pugsley, Esq.
file NRC 1.05

Water Remediation Technology LLC (WRT)
URANIUIM WATER TREATMENT PROGRAM

Source Material License SUC-1591

Environmental Report in Support of a
Multi-Site, Performance-Based
License Renewal Application

Submitted to:
U. S. Nuclear Regulatory Commission
Office of Nuclear Materials Safety and Safeguards
Division of Decommissioning, Uranium Recovery, and Waste Programs

December 21, 2016

WRT LICENSE SUC-1591 RENEWAL APPLICATION

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FIGURES

PREFACE

1.0 Introduction

Water Remediation Technology LLC (WRT) is endeavoring to continue to design and implement an innovative water treatment program to remove uranium, among other contaminants, from Clients/Community Water Systems (CWSs) to assist cities, municipalities, and states and private Clients (see Section 1.3 for details on the definition of Clients and types) in their efforts to comply with relevant regulations for such sources promulgated pursuant to provisions of the Safe Drinking Water Act (SDWA) or other established cleanup limits. Using WRT-designed water treatment equipment (hereinafter the "Uranium Removal System" or "URS"), affected public or private Clients will be able to remove and safely contain uranium from Client sites using proven technology and mechanisms, and to accomplish the disposition of such uranium residuals at Atomic Energy Act of 1954 (AEA)-licensed facilities, thereby constituting the first commercially available and appropriately licensed "cradle-to-grave" service for water supplies requiring removal of uranium to comply with the SDWA's requirements or other established cleanup limits.

This United States Nuclear Regulatory Commission (NRC) performance-based, multi-site materials license renewal application/ER is being submitted in the name of WRT. Under this license WRT, acting in part as a service provider, will: (1) assure that all of its Uranium Removal Systems are properly installed at each Client water treatment facility, (2) monitor and service the uranium water treatment system during its operation, especially service activities that may result in coming in contact with the licensed source material, and (3) be responsible for all aspects of handling the licensed source material (uranium) associated with the system, including performing treatment media exchanges, packaging uranium-laden "spent" treatment media, assuring that all spent treatment media is transported in accordance with United States Department of Transportation (DOT) requirements to an appropriately licensed facility for final disposition (i.e., processing as an equivalent feed or direct disposal), and responding to any system malfunctions or releases of licensed material during active operations, media exchanges or decommissioning.

WRT's use of uranium water treatment systems at Client water treatment facilities and the subsequent removal of uranium from the Client's drinking water or other contaminated water source, possession of such licensed material, treatment media exchanges, and transportation and final disposition of such licensed material shall hereinafter be referred to as the "WRT Uranium Water Treatment Program." The uranium water treatment equipment, including all relevant WRT-designed technology, shall hereinafter be referred to as the "Uranium Removal System."

This Environmental Report (ER) is in support of WRT's NRC license renewal application to authorize the removal and concentration of source material uranium by WRT at each individual treatment site under the provisions of a performance-based, multi-site materials license, which will permit the initiation of WRT's uranium water treatment program, including the installation of WRT's Uranium Removal System, to be added to WRT's NRC license pursuant to NRC-approved requirements contained in the license. WRT's uranium water treatment program is

based on a self-contained Uranium Removal System that minimizes or eliminates potential occupational and environmental exposure to uranium residuals removed from Client's drinking water or other contaminated water sources (see examples in Preface Sections 1.2.2 and 1.3). This ER will provide NRC with conservative "upper-bound" data and analyses for a range of potential Uranium Removal Systems (e.g., volumes of water treated and corresponding levels of uranium concentrated within a given time period) to evaluate the potential impacts to public and occupational health and safety and the environment from day-to-day licensed activities and potential release scenarios. Consistent with its initial license application/ER, WRT intends that the exposure scenarios and parameters developed in this ER serve as the control parameters for its performance-based, multi-site materials license.

This ER strives to address all issues relevant to a comprehensive analysis of the potential health and safety and environmental issues analysis associated with the Uranium Removal System and potential alternatives thereto. Using the information provided in NUREG-1748 entitled *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs* (NUREG-1748), WRT has prepared this ER to address all such issues perceived to be relevant to its uranium water treatment program. After preparing this ER and reviewing all data and analyses contained therein, WRT has determined that there are no significant potential impacts to public or occupational health and safety or the environment from its continued licensed uranium water treatment program and that, indeed, WRT's continued uranium water treatment program for assisting Client's provides the means for such entities to cost-effectively and safely comply with the mandated SDWA uranium MCL or other established cleanup limits..

Finally, WRT's continued licensing action is designed to address an issue (i.e., compliance with drinking water standards) than implicates *national*, as well as *local,* concerns. As a result, given that many Clients/CWSs requiring uranium water treatment are expected to be located in Agreement States, WRT believes that it is crucial that appropriate Agreement State authorities are included in this licensing process. Therefore, WRT requests that NRC Staff facilitate the involvement of Agreement States in this licensing process so that, once an NRC license protocol is developed, issuance of Agreement State licenses will be streamlined. WRT also urges the active involvement of *non*-Agreement States in the licensing process.

1.1 General Overview

At the time that WRT contracts with a Client to provide water treatment, WRT will register/inform the NRC of new uranium treatment systems and will provide the NRC with specific site information for the Client's water treatment/well site(s) where the radioactive material will be removed from the feed water and stored in the treatment vessel(s). The site-specific information will include the Client physical address, the Client point of contact, and the sizes (flow rates, activity loading(s) for the system(s). Additional information will also be included in the site-specific information packages. In this manner, the Client will be "registered" under WRT's license.

For drinking water treatment, the subject treatment typically will be a point-of-entry system; therefore, a Uranium Removal System will be located at each well or water treatment site,

upstream of where the water enters the CWS distribution system. This treatment is not intended for point-of-use treatment, for example, after distribution at an individual residence. In some instances, where multiple wells require treatment and are in reasonable close proximity to each other, the multiple wells may be connected to a single treatment system. Typically, the uranium removal equipment will be located in a dedicated water-treatment building constructed by the Client or a treatment room within an existing treatment/well house building. Alternately, especially for the small systems, the systems can be operated in the open outside of a structure, and secured inside a fenced property.

1.2 Format of the Application and License

1.2.1 Format Continuing from the Initial License Application

This license renewal is requested to be issued to Water Remediation Technology LLC ("WRT"). WRT is requesting that this license apply to the radionuclide-removal water treatment services that WRT will perform for multiple Clients throughout the non-Agreement States. These services can include either, providing and servicing a proprietary WRT Uranium Removal System or performing activities on a Client's non-WRT water treatment system.

The basic services provided by WRT will be very similar with respect to each individual Client, and in particular, the following information presented in this license renewal application/ER will be standard for all Client facilities.

Consistent with the initial license application/ER, WRT is requesting that this license renewal application serve as the basis for supporting a multi-site, performance-based, service-provider license format ("Master License"). See Section 1.4 for a more detailed explanation of this multi-site, performance-based structure. In this license renewal application, WRT presents the information that is common to all uranium water treatment systems that it would install and/or service throughout the non-Agreement States. This information includes the training program, radiation safety program, the general description of the range of sizes of treatment systems, and the associated stored activity, for treatment systems that are expected to be operated or serviced throughout the U.S. With this license renewal application/ER, the NRC can review and evaluate this common information once, instead of every time that a new Client is contracted with for water treatment that requires licensure.

When performing service work for a new Client or at a new treatment site, WRT will "register" the new Client or activity under the WRT Master License before the URS goes online and licensed activities begin. This would be a straightforward notification process where WRT would provide site-specific information for Client contact information, the location of service/treatment activities, the radionuclide(s) contaminant and associated activity, a brief description of treatment equipment, and the project timeline. This information package also will include a confirmation that the radionuclide removal system(s) that is either at or proposed for the Client's work is within the overall range of systems and/or service parameters that were reviewed and approved by the NRC in this license application/ER.

1.2.2 Expanded Scope of Work Requested with this Renewal Application

With this license renewal application WRT requests that its authorized scope of work be expanded to include uranium removal from not only drinking water resources, but also from other groundwater and surface water resources, in general.

From time to tine WRT is approached by potential Clients needing uranium water treatment in water resources other than identified drinking water supplies, both groundwater and surface water. Examples of these applications include, but are not limited to, remediating either groundwater or surface waters impacted by mining operations, including treating surface water collected in mined-out open pit mines (pit lake); remediating a uranium contamination plume in groundwater other than in a currently-used drinking water aquifer; and removing uranium from drilling fluids and other solutions resulting from oil and gas exploration, and from waters impacted by construction. These possible non-drinking-water applications are further defined in the definitions of "licensed activity" and "water treatment" presented in Preface Section 1.3.

WRT has already provided its uranium treatment equipment and services in several non-drinking-water situations in at least one Agreement State, Colorado, and WRT wants to have this same flexibility to treat similar non-drinking-water resources in non-Agreement States as part of this renewed license. In July 2010, WRT installed and, as of this writing, continues to service a WRT Uranium Removal System for treating near-surface alluvial groundwater and other groundwater down-gradient from a closed underground uranium mine. Twice it also provided short-term uranium treatment of surface water at construction sites where the uranium concentration in the water was above the allowed discharged standard.

The same type of WRT equipment and treatment media will be used to treat both drinking water and other water resources. In the following sections of this renewal application, describing the continuing action, the environment, and the impacts, WRT's primary focus will be on discussing drinking water treatment, which is the clear majority of its jobs, but the other-waters scenario will also be identified and discussed in the application subsections, where applicable. As a general note, these other-water scenarios closely resemble those for drinking water treatment.

1.3 Name and Label Conventions and Service Timelines

Throughout this license renewal application/ER and related support information, the following names, labels, concepts, and service timetable understandings have the meanings and interpretations that are presented below.

1. **"Agreement States"** and **"non-Agreement States"**

   - Agreement States are those where a State government has taken over the primacy from the federal government for regulating source material (or at a minimum, for regulating

source material in drinking water and other water treatment), through an "agreement" between both parties.

- Non-Agreement States are those (including also Washington D.C. and all Tribal lands) where the federal government, through the U.S. Nuclear Regulatory Commission (NRC), retains primacy for the regulating source material (or at a minimum, for regulating source material in drinking water and other water treatment).

2. "**Client**" includes, but is not limited to, the following entities.

   - A community water system (CWS), either publicly or privately owned.

   - The owner and/or responsible party related to any other type of water remediation or treatment project.

     Note: Because WRT can provide a vertically-integrated "total solution" for water treatment – providing treatment equipment, treatment media, a radiation protection program appropriate for the project or work, and disposal of spent treatment media – a Client may not need to be a licensee itself. WRT essentially will be "standing in the shoes" of the Client to provide the water treatment system and necessary radiation safety program, so that the Client would not have to develop this capability itself.

3. "**Licensed Activity**" and "**Water Treatment**" included, but are not limited to, the following activities.

   - Drinking Water Treatment – Removal of naturally-occurring radionuclides (typically uranium source material) from current or potential drinking water sources;

   - Removal of naturally-occurring radionuclides (see above) from water sources that are impacted by mining operations. These water sources can include water stored or collected in either open pit or underground mines and/or groundwater resources impacted by mining operations. For this and the following two applications below, this treatment is allowed, to the extent that these solutions can be treated with the equipment and treatment media described in this license renewal application;

   - Removal of naturally-occurring radionuclides (see above) from drilling fluids or other solutions resulting from mineral or oil and gas exploration operations;

   - Removal of naturally occurring radionuclides (see above) from other groundwater or surface water resources, as part of a remediation or general water treatment operation.

4. "**Water Treatment System**", "**Water Treatment Equipment**", etc. can refer to either proprietary WRT Radionuclide Removal Systems or non-WRT-supplied treatment equipment already present at a Client's water treatment facility (for example, for a one-time, purely service job).

1.4 Performance-Based, Multi-Site, Service-Provider License Structure

1.4.1 Overview

Consistent with the initial license renewal application/ER, this performance-based, multi-site radioactive materials license ("Master License") renewal application is being submitted in the name of WRT. With respect to its own proprietary treatment systems, WRT is responsible for: (1) development of the uranium treatment technology, (2) providing the Uranium Removal System, (3) providing the uranium treatment media, (4) monitoring the installation of the System, and (5) ongoing maintenance of the System.

As the licensee, or also as the Client's service provider under a commercial treatment agreement, WRT also will be responsible for all aspects of handling the licensed radioactive material (uranium) associated with the water treatment, including but not limited to the following activities, some of which are not licensed activities.

- Performing treatment media exchanges, including the installation of fresh media;
- Preparing and packaging the uranium laden spent media for transport;
- Arranging for the transport of the spent media by a common carrier appropriately licensed by the U.S. Department of Transportation (DOT) (not a licensed activity);
- Maintaining long-term disposal agreements with facilities appropriately licensed to accept the radioactive water treatment residual for final disposition (e.g., direct disposal or recovery/recycle) (not a licensed activity);
- Maintaining all components of the Uranium Removal System that potentially could come in contact with the radioactive treatment media;
- Performing clean-up and decontamination operations in the event of a release of the radioactive treatment media, whether during normal operations or in an accident situation;
- Performing decommissioning and decontamination (D&D) operations at the termination of a treatment agreement with a Client.

WRT's uranium water treatment systems at water treatment facilities and the subsequent removal of uranium from Client drinking water or other contaminated water source, possession of such licensed material, treatment media exchanges, packaging the spent media for transportation, and final disposition of such licensed material shall hereinafter be referred to as the "WRT Radionuclide Water Treatment Program." The uranium water treatment equipment, including all relevant WRT-designed technology, will hereinafter be referred to as the "Uranium Removal System."

WRT's radionuclide water treatment program is based on self-contained Uranium Removal System that minimizes or eliminates potential occupational and environmental exposure from uranium residuals treated at the Client facilities. Consistent with the initial license application, this license renewal application provides the NRC with conservative "upper-bound" data and

analyses for a range of potential Uranium Removal Systems expected to be operated at Client sites. This range of data will "bracket" the System dimensions, amount of treatment media, and the amount of stored radioactivity. It can also be used to evaluate the potential impacts to public and occupational health and safety and the environment from day-to-day licensed activities.

1.4.2. Basis and Intent

This license renewal application/ER presents specific information on the expected uranium treatment systems and/or activities that would be associated with the range of water treatment applications (flow rates of 20 or less to 3,000-gpm) that could require treatment throughout the non-Agreement States.

WRT intends that the exposure scenarios and parameters presented in this license renewal application/ER serve as the control parameters for its continued performance-based, multi-site, service-provider materials license. The basis and intent of WRT's performance-based, multi-site license is summarized in the following points:

1. The treatment system components, although differing in size, essentially will be identical in process operation and general safety requirements at each individual water treatment site;

2. WRT will be responsible for assuring that all uranium removal systems equipment is properly installed and operated during licensed operations

3. WRT System Specialists will be responsible for handling the radioactive uranium treatment media and the operational and radiation safety training they receive will be the same and will apply at each treatment site;

4. The operational oversight and radiation safety training that WRT will provide to the Client will basically be the same at each water treatment site, and commensurate with the associated potential exposures;

5. Consistent with the initial license application/ER, this license renewal application/ER provides an assessment of potential public and occupational health and safety and environmental impacts, including a conservative "upper-bound," from a range of flow-rate-specific Uranium Removal Systems to be operated throughout non-Agreement States;

6. With the full range of potential impacts and exposures addressed in this ER, and the license renewal application, the initiation of WRT's uranium water treatment program at new Client water treatment facilities and the addition of such programs to WRT's NRC license will be a straightforward6 "registration" process. The fundamental purpose of the "registration" process will be to document for the relevant regulatory agency (NRC or Agreement State) that the site specific information for each water provider's treatment/well sites (e.g., number, size, and location of wells, contact information,

quantity of treatment media at the sites, approximate maximum activity of the loaded resin, etc.) fall within the "bracketed" conditions presented in this ER and license renewal application.

As part of a formal WRT Safety Environmental Review Panel (SERP) process WRT will verify that each new Client's Uranium Removal System, the system(s) fall within the "bracketed", or bounding, conditions presented in this ER, the license renewal application, and license conditions as approved in the WRT renewed license. Records of such SERP verification will be maintained by WRT for NRC or relevant Agreement State inspection.

7. Final management and disposition of AEA-licensed radioactive material (uranium) from all of its Clients' treatment sites, will be handled under WRT's contracted arrangements with appropriately licensed facilities, so that each Client does not have to address final disposition of licensed material.

With respect to persons doing work in accordance with this license, (e.g., WRT System Specialists-"users"), WRT requests that the same performance-based, multi-site license structure that was approved by the NRC in the original license/ER be continued with this renewed license/ER. This structure will allow WRT individuals to work under this license without having to specifically add or delete these individuals from the license through a license amendment. The WRT Corporate RSO will approve the individual WRT employees (WRT System Specialists, RSOs, RCTs, etc.), and WRT will maintain training and other associated records on these individuals.

WRT proposes a training program in this license application/ER that will be used for its employees and the Client's appropriate managers and operators, and will document that the training has been successfully completed as the employees begin to work with or around the Uranium Removal System. The WRT Corporate RSO or qualified designee will provide the required training.

1.0 INTRODUCTION

1.1 Purpose and Need for Continued Action

Over forty years ago, the United States Congress enacted the SDWA. Regulations promulgated pursuant to the SDWA impose specific requirements on the levels of contaminants (including *uranium*) that may be present in drinking water sources used for public consumption. In 1990, the United States Environmental Protection Agency (EPA) promulgated a proposed rule mandating that the levels of uranium in drinking water sources (i.e., maximum contaminant levels or "MCLs") be limited to 20 micrograms/liter (ug/L) or 20 parts per billion (ppb). In 2000, EPA promulgated a final uranium MCL of 30 ug/L or 30 ppb and imposed strict deadlines for compliance.

In response to this promulgated MCL or other established cleanup limits , WRT desires to continue to license an innovative uranium water treatment program, as is described in this ER, and the license renewal application, for removing uranium from Client drinking water or other contaminated water sources, storing uranium residuals in a self-contained Uranium Removal System, and dispositioning of such uranium residuals in AEA-licensed facilities to assure safe and secure final disposition thereof. As described in this ER, final disposition of uranium residuals will either be as a waste or as an equivalent feed for processing at AEA-licensed uranium recovery facilities for introduction into the commercial nuclear fuel cycle as "yellowcake."

The WRT uranium water treatment program will provide Clients with the capability to safely and cost-efficiently remove uranium from drinking water or other contaminated water sources in compliance with the SDWA uranium MCL or other established cleanup limits without the need to procure relevant radioactive materials handling expertise *and* to permanently remove such uranium from their respective environments instead of releasing it without meaningful controls (e.g., backwashing to sanitary sewers or, otherwise, to the environment).

1.1.1 The Continued Action

WRT has designed a comprehensive uranium water treatment program to remove, uranium from Client drinking water or other contaminated water sources to assist them in their efforts to comply with relevant provisions of SDWA or other established cleanup limits. Using the Uranium Removal System, WRT will provide relevant Clients with the ability to remove uranium from their drinking water or other contaminated water sources, to safely contain uranium residuals using proven technology and equipment, and to dispose of such uranium residuals at properly licensed facilities, thereby constituting the first commercially available and properly licensed "cradle-to-grave" service for uranium water treatment. WRT's systems also potentially may provide the commercial nuclear fuel cycle with additional sources of uranium by processing uranium residuals from WRT's uranium water treatment systems as equivalent feed materials to recover source material uranium.

With respect to the treatment of drinking water sources, WRT's uranium removal program requires the installation and operation of water treatment equipment (Uranium Removal System) in existing or newly constructed water treatment facilities where public drinking or other water resources are affected by naturally occurring uranium. For drinking water, the System is designed for Point of Entry (POE) treatment, prior to entering the municipal distribution system to individual homes, and will typically be located at either an individual water well site or a common treatment facility for multiple wells. If several wells are located close together, to allow a connecting pipeline prior to entering the distribution system, one Uranium Removal System can treat multiple wells. The size of a System will be proportional to and designed specifically for the flow rate of the particular water well(s) or other water resource it will service.

With respect to the treatment of other contaminated water sources (non-drinking water), WRT's uranium removal program requires the installation and operation of water treatment equipment (Uranium Removal System to be constructed, installed and operated so that the contaminated water is treated appropriately to allow for discharge into the environment.

This ER presents design information and impact assessments for a range of Uranium Removal Systems with flow rates from less than 100 gallons/minute (gpm) up to 3,000-gpm. The System relies on conventional ion exchange technology as the uranium removal mechanism. Although the system components will vary in size with the size of a particular well, each WRT Uranium Removal System will consist of two primary components:

- **Treatment Vessel(s)** – one or two treatment vessels per site, depending on the size of the well(s) or other water resource and the configuration of the treatment/well house. These vessels will hold the treatment media, and it is here that the uranium is removed from the feed water.

- **Ion Exchange Treatment Media** – required at each site, a minimum of two stages of synthetic, strong base, anion-exchange resin.

The Uranium Removal System typically will be located in either a separate treatment building/structure or in a separate treatment room attached to the Client's existing well house building or treatment building. After construction and installation, the system will be monitored and operated by the Client's WRT-trained Utility Operators on a day-to-day basis. When removal of uranium residuals is required or in the case of any accidental releases of such residuals, WRT System Specialists will take responsibility for and control of the removal of uranium residuals from the treatment vessel(s), replacement of uranium removal resins, packaging of the uranium residuals and "spent" treatment media, and arranging for transport of the spent treatment media and uranium residuals to an appropriately licensed facility for final disposition.

Since the uranium residuals concentrated in the Uranium Removal System at many Client water treatment facilities likely will be in excess of 500 parts per million (ppm) or 0.05%, by weight, the concentrated uranium will exceed NRC's 10 CFR § 40.13 limit for unimportant quantities of

source material, thereby being *licensable* source material. In addition, these Uranium Removal Systems potentially may exceed NRC's 10 CFR § 40.22 which requires specific licenses where uranium concentrated will exceed 15.4 pounds of uranium at any one time or 154 pounds in a calendar year.

Thus, WRT continues to seek an NRC performance-based, multi-site license to possess such *licensable* uranium residuals and to facilitate the transfer of such residuals to appropriately licensed facilities for final disposition. WRT currently has contractual relationships with licensed facilities for the final disposition of uranium residuals prior to the transfer of such materials from a given water treatment site(s). This "cradle-to-grave" process will provide affected Clients with a water treatment option that complies with SDWA (or other established cleanup criteria) and AEA requirements that adequately protect public health and safety and the environment.

1.1.2 Benefits of the Continued Action

WRT will use its uranium water treatment systems to provide several different benefits to Clients. First, such water systems seeking to comply with the SDWA uranium MCL will be able to notify EPA or the relevant State-delegated authority that compliance has been effectuated by the relevant compliance deadline. WRT's water treatment program provides CWSs with proven technology that will demonstrate that uranium levels in drinking water sources will be compliant with the SDWA uranium MCL. Similarly, for Clients who require treatment of their wastewater, WRT's water treatment program provides these Clients with a proven technology that will demonstrate that uranium in their water sources will be compliant with established cleanup limits.

Second, unlike some other forms of water treatment where the treatment media is regenerated on-site and radioactive residuals are "backwashed" from a water treatment facility and discharged to Publicly Owned Treatment Works (POTWs) through sanitary sewers or otherwise returned to the environment in an uncontrolled manner, WRT's uranium water treatment program involves the removal of uranium from drinking water and other contaminated water sources and the final disposition of uranium residuals at appropriately licensed facilities. This aspect of the WRT program will provide an additional level of protection for public health and safety and the environment because uranium residuals will not be returned to the local environment in any manner.

Third, final disposition of uranium residuals at NRC or Agreement State-licensed uranium processing/recovery facilities can result in the recovery of a valuable energy source (i.e., uranium oxide, "yellowcake") which can be introduced into the nuclear fuel cycle for energy production. Nationally, the potential uranium recovery from drinking water/other contaminated water sources using WRT's uranium water treatment systems could contribute significant quantities of uranium to U.S. domestic production. Given that the current administration has endorsed the use of nuclear power and the price of uranium has steadily increased due to impending shortages of supply for commercial nuclear reactor facilities, the use of a uranium resource that must be removed from drinking water sources pursuant to federal mandate (SDWA) or by other

established cleanup limits and that will not require any substantial environmental impacts should, if practicable, be pursued.

1.2 Applicable Regulatory Requirements, Permits, and Required Consultations

This ER has been prepared using the guidance outlined in NUREG-1748 entitled *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs* (NUREG-1748). WRT's uranium water treatment program at Client sites will be regulated under 10 CFR Part 40 requirements for the possession and transfer of uranium source material. The continued licensing action that is the subject of this ER involves the concentration of uranium source material in the self-contained treatment system, the possession of such *licensable* uranium source material until the treatment media is fully loaded, and the removal and transfer of spent treatment media to properly licensed facilities (all the proceeding activities under the WRT license). This ER does not assess receipt and processing of uranium residuals at either NRC/Agreement State-licensed uranium recovery facilities or disposal of such residuals at appropriately licensed disposal facilities.

1.2.1 Regulation by the U.S. Nuclear Regulatory Commission (NRC)

In this license renewal application/ER, WRT recognizes that at specific points in its uranium removal process, the collected uranium will be concentrated to levels that both meet the definition of "source material", and exceed thresholds for licensure (either a general license or a specific source material license). *Source material* is defined at 10 CFR § 40.4 as "(1) uranium or thorium, or any combination thereof, in any physical or chemical form, or (2) ores which contain by weight 0.05 percent or more of uranium, thorium or any combination thereof." The threshold for *licensable* source material levels are set forth at 10 CFR § 40.13, and it is also based on the 0.05-percent concentration used in the definition above:

> "Any person is exempt from the regulations in this part and from the requirements for a license set forth in section 62 of the Act to the extent that such person receives, possesses, uses, transfers or delivers source material in any chemical mixture, compound, solution, or alloy in which the source material is by weight less than one-twentieth of 1 percent (0.05 percent) of the mixture, compound, solution or alloy."
>
> 10 CFR 40.4

WRT's smaller treatment systems, the smaller MCS and PES units (see Sections 2.3.2.3 and 2.3.2.5, respectively) in certain situations will be able to operate under the general license for small quantities of source material, issued and in place by regulation per 10 CFR 40.22(a). The larger treatment systems likely will concentrate uranium above the general-license limit, and will operate under the multi-site specific license resulting from this renewal process.

By July 2014 the NRC had promulgated revisions to the general license provisions of 10 CFR 40.22(a) which, with a few exceptions, significantly reduced the amount of source material that

could be possessed at a site at any point in time or be received/transferred annually, in a calendar year, under the general license. Drinking water treatment was one of the exceptions that left these amounts of source material essentially unchanged from those that applied at the time of WRT's initial license application. The allowed weights of uranium are slightly greater with the revised rule, presumably because of the conversion from metric to U.S. units. The current limits for the general license for drinking water treatment are presented in 10 CFR 40.22(a)(3):

> (a) A general license is hereby issued authorizing commercial and industrial firms, research, educational, and medical institutions; and Federal, State, and local government agencies to receive, possess, use, and transfer uranium and thorium, in their natural isotopic concentrations and in the form of depleted uranium, for research, development, educational, commercial, or operational purposes in the following forms and quantities: . . .
>
> . . . (3) No more than 7 kg (15.4) of uranium, removed during the treatment of drinking water, at any one time. A person may not remove more than 70 kg (154 lb) or uranium from drinking water during a calendar year under this paragraph; or . . .
>
> 10 CFR 40.22(a)(3)

2.0 ALTERNATIVES

2.1 No-Action Alternative

The no-action alternative encompasses maintaining the status quo water treatment activities at existing Client/CWS water treatment facilities (i.e., no active uranium removal). Thus, the no-action would result in, 1) the failure of affected public or private Client/CWS drinking water providers to comply with the SDWA uranium MCL, or 2) the failure of other Clients/CWS required to remediate their water source from complying with established cleanup limits, or 3) the potential releases of uranium residuals to the environment, if for example, a conventional ion exchange process was operating as part of the status quo. In this event, such Clients/CWS could be subject to fines for noncompliance or other civil penalties to relevant regulatory authorities and could result in potentially significant adverse impacts on public health and safety because, as determined by EPA, levels of uranium in drinking water above the EPA standard or other established cleanup limits represents a potential significant adverse risk to public health.

Denial of WRT's license renewal request/application likely will result in attempts by Clients/CWSs to comply with the SDWA uranium MCL or other established cleanup limits, perhaps without the expertise, resources, and controls necessary to properly address handling and disposal of removed uranium. If such residuals are released in an uncontrolled manner into the environment, the result could be the concentration of uranium at POTW facilities that potentially, if not likely, could exceed NRC *licensable* source material levels in the sewage sludge produced and create unlicensed concentrations of uranium that could result in an exceedance of discharge standards and a substantial adverse impact to public and occupational health and safety. Where no sanitary sewer options are available, Clients/CWSs potentially could release uranium residuals to surface waterways or soils, which also could result in substantial adverse impacts to public health and safety and the environment.

2.2 Conventional Ion Exchange with On-Site Regeneration and Backwash to the Sanitary Sewer

The use of water treatment technologies for removal of uranium from Clients/CWSs that do not provide a "cradle-to-grave" solution likely will involve on-site regeneration of treatment media and "backwashing" of uranium residuals to POTWs through sanitary sewers or through other transport mechanisms in an uncontrolled manner resulting from their normal operating procedures. Such procedures, in part, may be designed to avoid reaching *licensable* source material concentrations and quantities that would require a specific NRC license. While this approach will result in the removal of uranium from drinking water or other contaminated water sources, it also will result in the removed uranium being re-introduced into the environment in POTW effluents to surface waters or through land application. WRT views this alternative as undesirable as it could result in undue exposure to workers at POTWs or at other water treatment facilities or to members of the public at large.

Further, this option potentially may lead to generation and release of *licensable* source material to the environment without the benefit of appropriate regulatory controls. The generation of *licensable* concentrations of source material uranium could potentially occur both in the drinking water treatment process or treating other contaminated water sources and at the POTW.

2.3 Details of the Applicant's Continued Action

Note: WRT's current license was issued for drinking water treatment, specifically for community water systems (CWS). The clear majority of WRT's treatment system installations continue to be for treating drinking water. A new aspect of this license renewal application, however, is WRT requesting to expand the scope of its licensable work to include treating water resources other than drinking water. Accordingly, this renewal application will describe the equipment, operating parameters, operating environment, and impacts for both scenarios. The terms "non drinking water" or "other water" will be used to refer to the water treatment applications other than those specific to drinking water treatment.

In many areas throughout the United States, drinking water supplies, typically from groundwater, contain naturally-occurring uranium. The uranium concentration for drinking water is limited to 30 ug U/L (ppb) by SDWA uranium MCL. Laboratory test work, field pilot tests, and full-scale operations using the WRT Uranium Removal System have demonstrated the ability to remove uranium from drinking water feed to below the SDWA uranium MCL. For other contaminated water sources which contain naturally-occurring uranium or other forms of uranium, the same ability to remove uranium has been demonstrated

As discussed throughout this ER, there will be no significant potential impacts to public health and safety or the environment from granting the renewed license. Therefore, the environmental impacts associated with the continued action do not warrant denying the renewed license or imposing any additional conditions or requirements.

2.3.1 Facilities and Equipment

While this license will allow WRT to perform licensed service activities on any applicable water treatment system throughout the U.S, regardless of a system's manufacturer, WRT expects that the majority of the treatment systems that it will service will be provided by WRT. Accordingly, this section presents descriptions of and operating parameters for the range of WRT treatment system types and sizes that WRT expects to install in the states where uranium water treatment is regulated by the NRC, i.e., the "non-Agreement States." Presenting this information supports WRT's approach for a multi-site license application where the NRC reviewer can assess the complete range of expected treatment systems at one time. The design of other manufacturers' treatment equipment, the associated activities of the collected radioactive material, and the form of the uranium treatment residuals are expected to be materially similar to that of WRT's treatment systems.

2.3.2 Description of the WRT Uranium Removal Systems

This section presents a general description of the different types and configurations of WRT Uranium Removal Systems and their layout within a typical community water treatment facility. This description is intended to support WRT's performance-based, multi-site material license application for all its uranium water treatment systems that will be operating in the non-Agreement States throughout the U. S. For a drinking water application, the WRT treatment system typically is a Point of Entry treatment system, where the raw water is treated before it enters the utility's drinking water distribution system. Normally there will be a treatment system at each treatment site or at a common site where water from multiple wells can be efficiently delivered to the treatment facility prior to introduction into the distribution system.

This section will describe the expected range of water treatment systems that could be encountered in the non-Agreement States that potentially need treatment and the corresponding Uranium Removal Systems that could be used for the treatment. The goal is to "bracket" the possible range of Systems to be able to develop an upper bound to the possible environmental, health and safety impacts. This approach will allow NRC to evaluate the full range of treatment systems expected to be seen in this multi-site license application. Design criteria and information will be presented for various sizes of Uranium Removal Systems, based on various water supply flow rates (e.g., 50, 200, 1,000, 1,500, and 3,000 gallons/minute (gpm).

With the master, multi-site license in place, when WRT contracts with a new Client for uranium water treatment, site-specific information for the Client's treatment system(s) will be "registered" via submittal to the NRC and maintained by WRT in its corporate files for record keeping purposes. The WRT SERP will verify that the treatment system(s) fall within the "bracketed" conditions presented in this ER and the license renewal application, and the license conditions as approved in the issued NRC license. Records of WRT's registration and SERP review process will be maintained for NRC or relevant Agreement State inspection.

2.3.2.1 System Components

WRT will use a WRT patented Uranium Removal System that relies on beds of treatment media and ion-exchange technology to remove the radionuclides from the feed water. To provide a level of redundancy, the overall system at a treatment site will typically contain two stages of treatment media (Z-92® for uranium). As described below, the configuration for a Uranium Removal System typically will be one (1) stage of treatment media in each of two (2) treatment vessels.

Uranium-laden water is pumped through the treatment vessels, typically in an upflow direction, but in certain situations, in a downflow direction. In the ion-exchange treatment mechanism, the radionuclide ions in solution in the raw feed water are adsorbed onto the treatment media particles.

All the Uranium Removal System components that contact treated drinking water, including the physical equipment and the treatment media, will be certified to meet NSF/ANSI Standard 61 for

drinking water system components. The treatment vessel is a pressure vessel designed to operate at relatively low pressures (i.e., less than 100 psi).

The size of a uranium treatment vessel and the amount of (Z-92®) treatment media required is determined, in part, by the following criteria:

- The flow rate and overall utilization of the feed water;
- The uranium concentration in the raw feed water;
- Height and/or room restrictions in the particular treatment building;
- The vessel is designed with enough media to allow for a relatively-long interval between media exchanges, typically three (3) to five (5) years or longer for a Uranium Removal System.

Each Uranium Removal System will consist of the following major components.

- **Treatment Vessel(s)** – Typically two (2) treatment vessels per site, depending on the flow rate of the well and the configuration of the treatment/well house. These two vessels will be connected in series; the total treated flow will pass through both vessels. These treatment vessels will hold the treatment media where the uranium is removed from the feed water. For smaller wells, up to 200- to 250-gpm flow rates, these vessels will be standard-pre-engineered units, constructed of fiberglass-reinforced plastic (FRP). These vessels are small enough to be part of a pre-fabricated, skid-mounted treatment system that can be delivered to the treatment site as a complete unit.

  Vessels for larger systems will be designed and custom-fabricated for a specific site and will be constructed of stainless steel (SS) or epoxy-coated carbon steel (ECS). These vessels will include flow distribution plates or pipe works, screens, and check valves to ensure that the treatment media is safely contained in the treatment vessel.

- **Ion Exchange Treatment Media** – The Z-92® Uranium Removal Media is a sand-sized synthetic resin media. Once again, the amount of media required at a treatment site is dependent on the flow rate/size of a particular well or remediation flow of other water source, and the contaminant concentration in the water supply. Typically, a single uranium treatment system will have two stages of treatment media. Occasionally, particularly in the case of a water supply with an exceptionally-high contaminant concentration in the feed water, the properly-sized and designed treatment system could have a third treatment vessel to have enough additional treatment media to operate properly. This additional media could be required to have either a longer contact time with the water to remove the higher concentration of contaminants and/or a reasonable time period between spent media exchanges.

- **External Safety Screen or Filter** – In addition to the screens internal to the treatment vessels, the Systems will include external safety screens or filters, downstream of the

treatment vessels, as a secondary control measure to prevent a possible release of treatment media.

- **Control Valves, Instrumentation, and Control Panel** – Typically the Uranium Removal System will include valves and check valves to eliminate surges through the System and allow for temporary bypass of the Systems, pressure and differential-pressure indicators, and flow meters for monitoring and controlling the System.

- **Pretreatment Filter or Screen (Optional)** – Some water/treatment wells may produce small amounts of sands and silts that need to be removed from drinking water regardless if the water is also treated to remove uranium. This equipment is separate from the Uranium Removal System and may or may not be provided along with the WRT treatment system. This filter always will be located upstream of the treatment vessel(s), and the solids removed by this filter will not be radioactive.

WRT will ensure that all Uranium Removal System equipment will be installed properly prior to the commencement of license activities. After the commencement of licensed activities WRT will ensure that no alterations/modifications are made to the components of the Uranium Removal System that do or potentially may contain licensed material unless approved by the SERP, NRC, or relevant Agreement State as required.

2.3.2.2 Range of Treatment Vessels

As described in this section, WRT has three basic configurations for its water treatment systems. The configuration that is used is generally tied to the size (flow rate) of the water system being treated.

- Modular Component System (MCS) – Small to medium capacity water wells, from less than 100-gpm up to about 200-gpm flow rates can be treated with a pre-engineering, pre-fabricated, skid-mounted system that can be delivered to the treatment site as a complete unit.

- Field Erected System – Larger water wells, from about 500-gpm up to about 1,500-gpm flow rate for a single treatment "train", and as envisioned in this renewal application, up to about 3,000-gpm flow rate for two (2) treatment systems or trains connected in parallel. This would be a custom system designed for the subject treatment site. The treatment vessels would be fabricated offsite, and would be either epoxy-coated steel or stainless steel. The overall system, treatment vessels, piping, and ancillary components would be field-erected on site.

- Portable Exchange System (PES) – Again for smaller water wells, up to about 50- to 60-gpm flow rates, WRT has developed a modular system that's a very cost effective solution for the smaller Client. A PES unit would be an alternative to using a skid-mounted MCS system.

Table 2-1 presents the expected range of uranium treatment system sizes and the associated quantities of treatment media. A system's size is proportional to the well flow rate, and secondarily to the uranium concentration in the raw feed water. In Table 2-1 the media amounts

are shown for both a single stage of media and the total amount at a particular treatment site. The uranium treatment systems expected to operate in the non-Agreement States are estimated to range from less than 50 gpm up to approximately 1,500 gpm. **Note:** While the range of treatment systems analyzed in this ER is the same as that in the original license application (see below), because of changes in WRT's design criteria, the quantities of treatment media presented for each system configuration in Table 2-1 are greater than those presented in the original application.

Starting with Table 2-1 and continuing throughout this document, the following five (5) treatment system configurations are used as example systems to characterize the operating parameters, radiologic aspects (activity concentrations and quantities), and impacts from the range of treatment systems that could be operated. **Note:** This is the same range of treatment flow rates that was presented in the original license application.

- 50-gpm Portable Exchange System (PES)
- 200-gpm, skid-mounted Modular Component System (MCS)
- 1,000-gpm Field Erected System
- 1,500-gpm Field Erected System, the largest single-system treatment unit
- 3,000-gpm Field Erected System. Applications for this large-capacity treatment could include a drinking water source from a water table aquifer, or remediation of a contaminated mine pool or groundwater plume. This treatment could be accomplished by using two, 1,500-gpm treatment units connected in parallel.

2.3.2.3 Modular Component Systems (MCS)

For small to medium flow rates. MCS units, using standard, pre-engineered fiberglass-reinforced (FRP) treatment vessels can be used for well flow rates from less than 100 gpm up to about 200 gpm for a single-train system. Each of these small vessels will hold one stage of treatment media. Most regulatory agencies require some level of redundancy in a system's treatment approach, and this approach is used in WRT's Uranium Removal Systems. There will be a minimum of two (2) stages of media with each treatment system. MCS units typically will have two, single-stage vessels per unit and the treatment components will be skid mounted. The entire unit will be fabricated and assembled offsite and shipped to the treatment site as several major component pieces.

Treatment for flow rates greater than 200 gpm can be accomplished with MCS units by breaking up the total flow by connecting and operating several individual MCS units ("trains") in parallel. WRT is currently providing uranium treatment for over 700 gpm of total flow at both Desert Hot Springs CA and Morongo Valley CA, using three (3) individual MCS units connected in parallel, using common inlet and discharge headers. WRT is also providing similar parallel-treatment configurations with MCS units at several of its radium treatment installations in Agreement States.

Plan and elevation views of a WRT uranium MCS are presented in Figure 2-1. Photos of an installed Small System are presented in Figure 2-2.

2.3.2.4 Field Erected Systems

Large Uranium Removal Systems, for flow rates generally up to a maximum of 1,500 gpm for a single system, will have engineered vessels, designed and fabricated specifically for a particular well site. Treatment vessels, holding only a single stage of media, will be fabricated offsite. Treatment vessel diameters will range from Components of the large systems will be delivered to the treatment site as individual pieces of equipment, and the complete system will be field-erected on site.

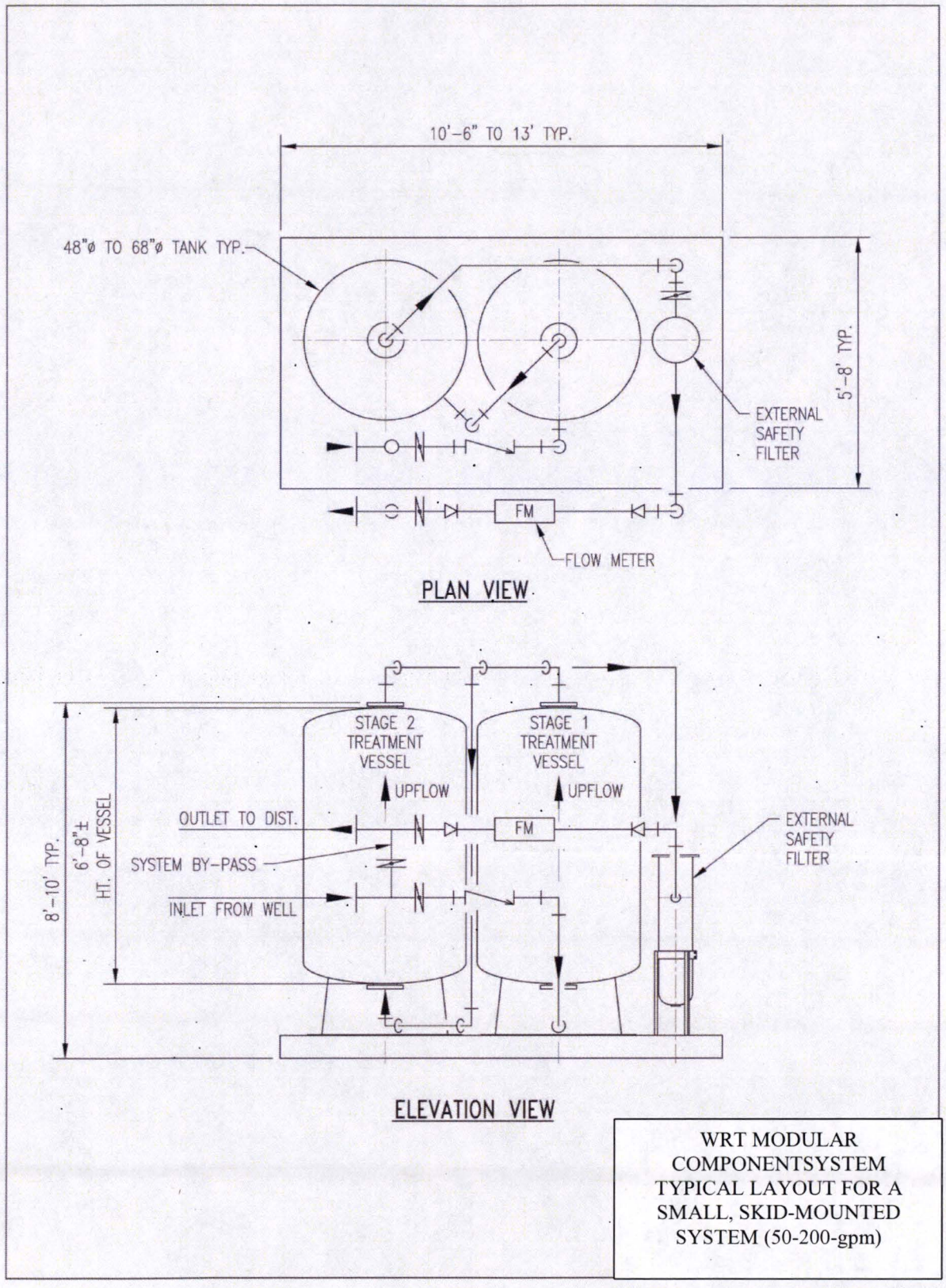
Plan and elevation drawings showing the general arrangement of a large field-erected WRT treatment system, typical for flow rates of 500 to 1,500 gpm, are presented in Figure 2-3. A photo of a 500-gpm, two-vessel system is presented in Figure 2-4.

Variations in Large System Arrangements – For applications with flow rates greater than 1,500 gpm, WRT could use multiple systems connected through common feed and discharge manifold piping and operating in parallel to treat the total flow. WRT has two field-erected uranium systems operating in the parallel configuration in Grand Island, Nebraska, to treat a total flow of over 3,000 gpm. A schematic layout of this parallel configuration at Grand Island is presented in Figure 2-5.

Table 2-1
WRT Uranium Removal Systems
Typical Treatment Vessel Sizes and Media Quantities
for WRT's Uranium Water Treatment Program

Item	Well Size 50 gpm	Well Size 200 gpm	Well Size 1,000 gpm	Well Size 1,500 gpm	Well Size 3,000 gpm
System Configuration	**PES**	**MCS**	**Field Erect**	**Field Erect**	**Field Erect**
Media Stages per Treatment Vessel	1	1	1	1	1
Treatment Vessels per Site	15	2	2	2	4
Media Bed Height per Stage (ft)	3	5	5	5	5
Media Volume per Stage (cu ft)	3	80	740	1,100	2,200
Total Media Volume on Site (cu ft)	45	160	1,480	2,200	4,400
Media Weight per Stage (lb)	132	3,520	32,600	48,400	96,800
Total Media on Site (lb)	1,980	7,040	65,200	96.800	193,600
Vessel – Materials of Construction	FRP	FRP	ECS or SS	ECS or SS	ECS or SS
Vessel Size (ft dia x ft ht)	1.2 x 4	5 x 7	12.5 x 13	14.5 x 13	14.5 x 13

Notes:
1. System Configurations: PES = Portable Exchange System; MCS = Modular Component System; Field Erect = Custom-designed, field-erected system.
2. FRP = fiberglass-reinforced plastic; ECS = Epoxy-coated Steel; SS = stainless steel.



WRT MODULAR COMPONENTSYSTEM TYPICAL LAYOUT FOR A SMALL, SKID-MOUNTED SYSTEM (50-200-gpm)

Figure 2-1

Figure 2-2
Uranium Removal System – Typical Small System (MCS) - Approx. 50-200-gpm system

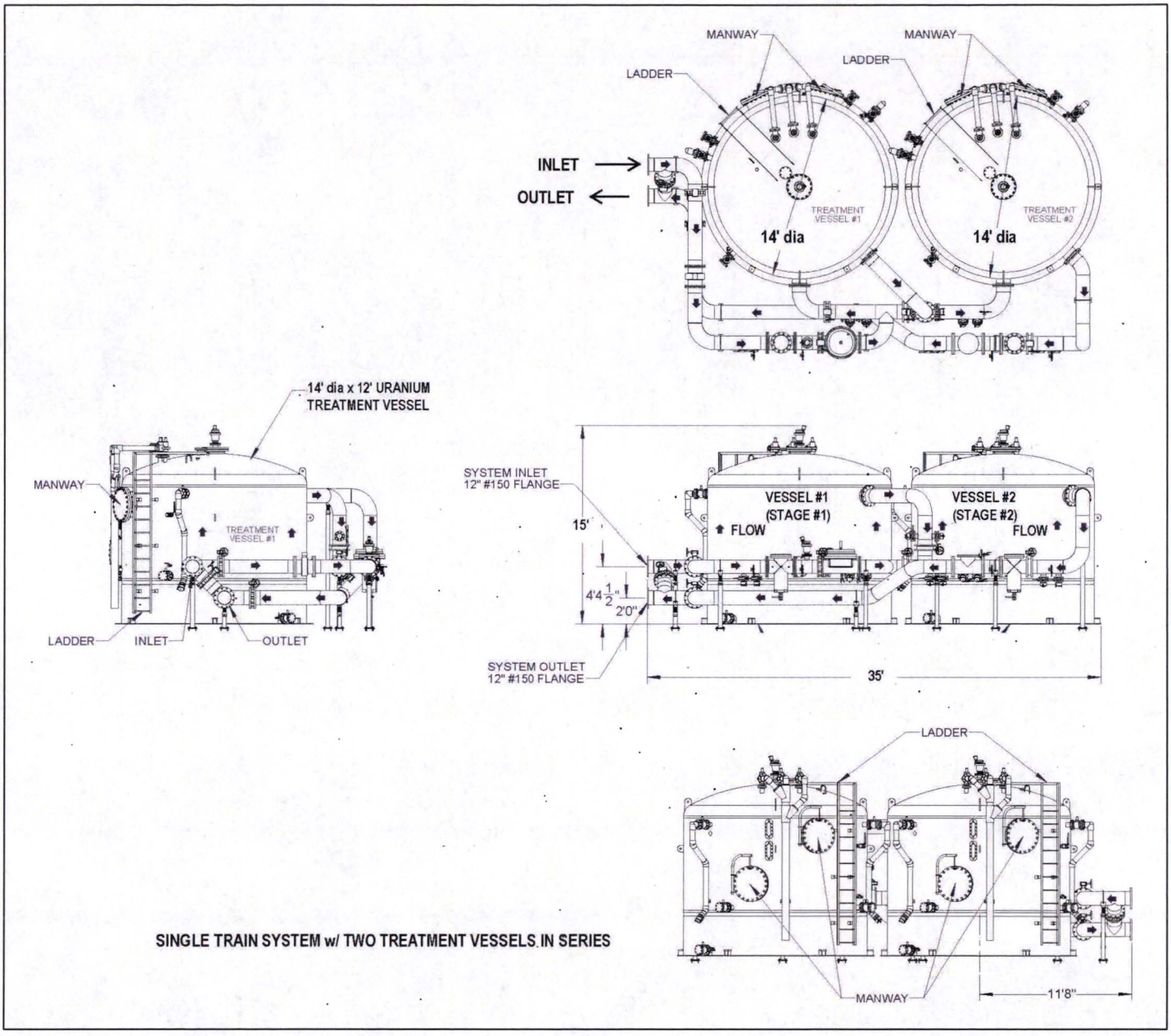
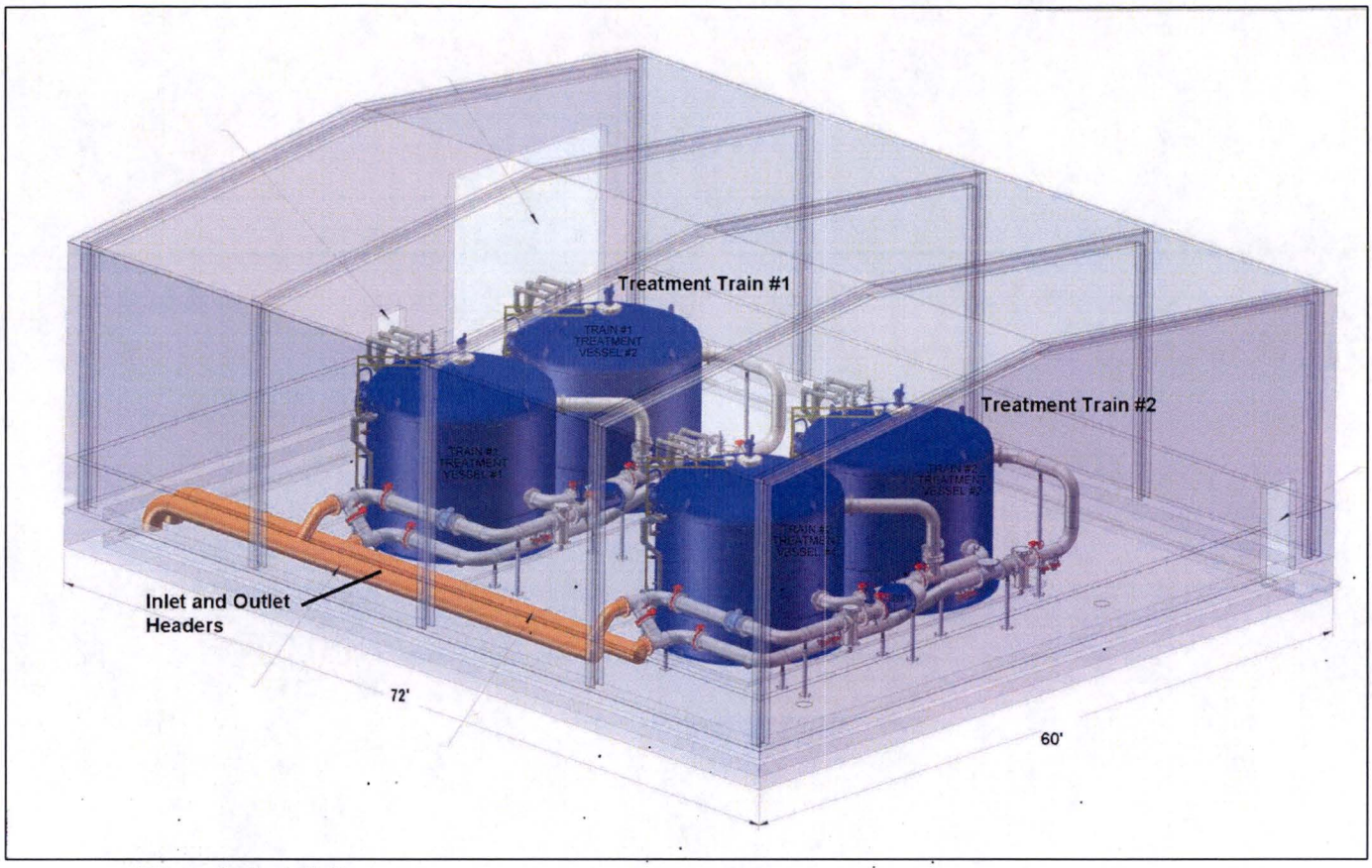


Figure 2-3

WRT Field-Erected System – Plan and Elevation Views

Figure 2-4
Typical 500-gpm, 2-Vessel Field-Erected Uranium System



Example Installation:
-- Uranium drinking water treatment, Grand Island NE
-- 2 x 1,750-gpm trains treating a total flow of 3,500 gpm

Figure 2-5
General Arrangement – Parallel Connection of Multiple Treatment Trains to Treat Larger Flows

2.3.2.5 Portable Exchange Systems (PES)

Since the original license application WRT developed a cost-effective solution, for uranium treatment for small wells with flow rates up to approximately 60 gpm – the Portable Exchange System. This is an alternate configuration to using a MCS, with its two (2) larger FRP treatment vessels. A PES unit is a modular system that will use a group of smaller FRP treatment vessels (also referred to as "bottles"), connected in series and in parallel, to better match the flow rate of a smaller well. An example of a PES unit, this one for a 20-gpm uranium treatment application, is presented in Figure 2-6.

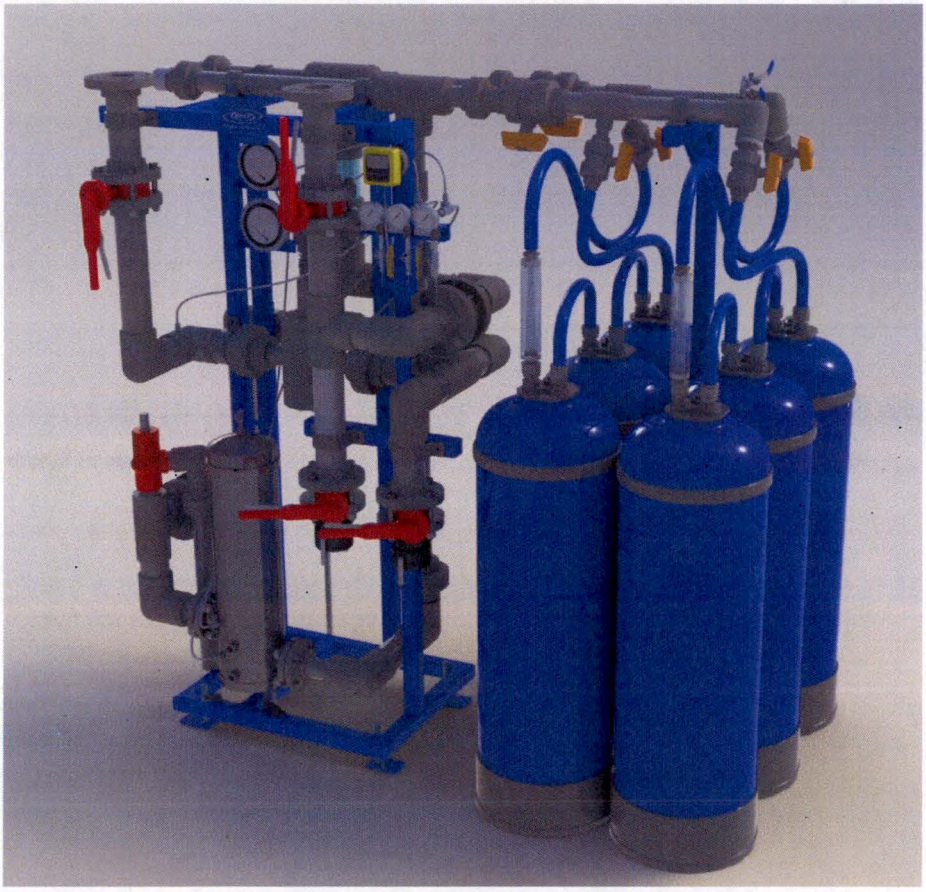


Figure 2-6
Two (2)-Train PES Unit for Uranium Treatment, 20-gpm

Each treatment vessel or bottle is about the size of an industrial-gas cylinder, approximately 14-in diameter by 4.5-ft tall, and each one will contain approximately three (3) cu ft of treatment media. The media used will be the same Z-92® media that is used in the larger treatment systems.

The water flow through the PES bottles will be set up in a combination of series and parallel flow, to match to flow rate of the well. The flow rate can be matched in increments of approximately 10-gpm in the following manner.

- For uranium treatment PES units, typically two (2) treatment vessels connected in series (a treatment "train" of vessels) can effectively treat approximately 10-gpm. In some uncommon applications, where the uranium concentration in the raw feed water is unusually high, a third treatment vessel may have to be added to a train, to effectively remove and collect all the uranium, and to extend the time period between media exchanges. Note – To document this more-conservative scenario in this application the media quantities for the PES unit presented in Table 2-1 are based on, and the two figures in this section illustrate this expanded treatment, with three vessels per train.

- Multiple "trains" of bottles can then be connected in parallel to match the flow rate of a particular well, with each train meant to treat approximately 10 gpm of the total flow rate. For example, the PES unit presented in Figure 9-7 has two (2) trains of treatment bottles connected and operating in parallel, therefore, it can treat a total flow of approximately 20 gpm. The unit presented below in Figure 2-7 has 6 trains of bottles in parallel, to treat approximately a 60-gpm flow rate.

Figure 2-7
Six (6)-Train PES Unit for Uranium Treatment, 60-gpm

Other operating parameters of the PES units include the following.

- The cumulative total volume of the treatment media in a PES unit is similar to that in a skid system sized for the same flow rate, so the expected time period between media exchanges should be similar, between one (1) and two (2) years.

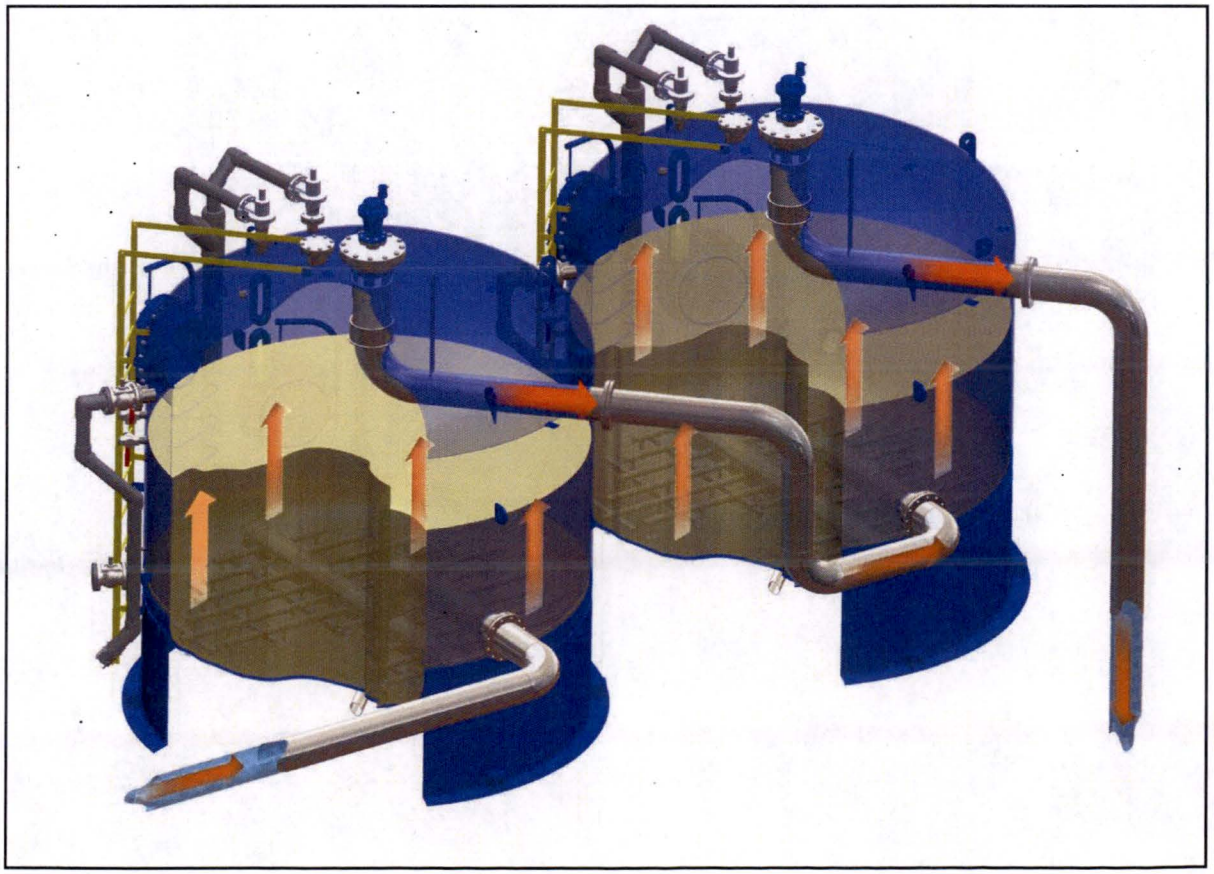
- The PES units will have similar flow control, inlet bag filters, and screens to retain media in the treatment bottles to that of the skid systems, but downsized for the smaller flow rates.

- As with the other WRT treatment systems, the PES units are passive-operating systems. Water flows through the system by operation of the water well pump, and the normal duty of the utility operator is to simply monitor the system.

- The potential for contamination with radioactive material at the treatment site is greatly reduced, if not eliminated, because typically the radioactive spent media will not be removed from the PES vessels at the treatment site. The treatment vessels with the spent or exhausted media will be exchanged, as whole components, for fresh vessels. The treatment vessels themselves can function as the container for transportation off site.

2.3.2.6 General Operation of the Uranium Treatment System

The Uranium Removal System is a passive treatment system, in that the raw water flows through the two (2) stages of treatment media driven by the power of the existing water well pump (see sketch below). Also, no chemical additions are needed for the operation of the system, as can be required with other treatment technologies.



Uranium Removal System
Concept of Operation

For uranium, a negatively–charged anion when in solution, the anion-exchange Z-92® media, consisting of synthetic resin beads, will be used. For the uranium treatment, the radionuclides in solution in the raw water will be adsorbed onto the treatment media through the chemical mechanism of ion exchange. This uranium ion exchange process used in the WRT systems with the Z-92® resin media process is very similar to that used for decades by the uranium recovery industry, specifically with in situ recovery (ISR) operations.

Variation in Direction of Water Flow Through the Systems – The radionuclide removal system could operate in either an up-flow or down-flow configuration. The direction of water flow does not materially affect the amount of uranium or the uranium activity collected in a treatment vessel, nor does it materially affect the service activities that WRT will perform. Most the WRT field-erected, large systems and the skid-mounted MCS systems will operate in an upflow direction. Some of these treatment systems, because of site-specific conditions of the feed water, may instead operate in a downflow direction. The WRT PES units will operate in a downflow direction, primarily to be able to maximize the amount of treatment media that can be installed in a PES treatment bottle.

2.3.2.7 Discharges

Chemicals are not required for the normal/routine operation of the Uranium Removal System. Because of the upflow direction of water, and fluidized bed of media, non-radioactive solids, for example small amounts of silt or clay particles that may be naturally present in the feed water will not be captured in the treatment vessel(s). Other treatment technologies using a downflow direction can act more like a filter, trapping these residuals and building up a layer in the treatment media that inhibits flow. Since the Uranium Removal System will not trap such solids on top of the media bed, thus reducing the potential to degrade system performance by fouling the media, this should eliminate the need to backwash and discharge, to remove this fine material from the treatment vessel(s). With no backwashing required, this eliminates the practice required by other technologies, of reintroducing the radioactive residuals back into the local environment, through backwashing to the sanitary sewer or storm sewer, where the radioactive residuals ultimately report to surface waters and land applications.

Additionally, with the Uranium Removal System, the uranium-loaded treatment media will not be regenerated onsite to remove the buildup of uranium collected on the media, as is done with a conventional ion exchange system. This regeneration step could result in a discharge of the strong brine eluant solution that contains the stripped uranium to a sanitary sewer, surface waterway, or other point of discharge, along with a significant volume of water that makes up the eluant and rinse solutions.

2.3.2.8 Uranium Treatment Facilities Security

Typically, a WRT treatment system will be located inside a treatment building at the utility's treatment/well house facility. Because the need to remove uranium from drinking water is a

relatively new requirement, requiring relatively large equipment, many utilities may need to construct new treatment buildings adjacent to the current well houses. A WRT treatment system can be installed in a pre-existing treatment or well house building or structure, if adequate room exists. In either event, the system will be operating in an area that has restricted access (because it is already a public water supply) and work tasks in the immediate vicinity of the vessel are limited. The treatment buildings or well houses are locked facilities when utility operators are not present, and most, if not all, are within fenced sites. Alternatively, some treatment systems, especially the smaller systems, may be located outside of a structure, on Client property. In this case, the treatment system will be secured within a locked fence.

The site-specific layout details of a particular treatment site and the treatment building showing the location of uranium treatment vessel will be submitted to the NRC by WRT, as part of registering the site under the WRT license.

2.3.2.9 Design Features for Secondary Containment

With respect to secondary containment of the treatment media, federal hazardous-materials regulations related to explosives, fuels, chemicals, etc. do not apply directly to the radioactive treatment media. Where practicable, however, developing secondary containment (in addition to the treatment vessel itself) for the treatment media to provide an additional level of containment can minimize additional clean-up expenses in the event of a spill of the treatment media. Secondary containment also further prevents the migration of any licensed radioactive material to the environment.

Features are included in the design of the treatment Systems (internal screens, backflow preventers, check valves, etc.) to ensure that the treatment media remains in the treatment vessel. WRT also works with the Client's Engineer responsible for the treatment building design to allow for secondary containment of the treatment media in the unlikely event that media is released from the treatment vessel.

Ultimately, however, the specific design of the water treatment facility is the responsibility of the Client and its Engineer, including any possible secondary containment feature, and usually is out of WRT's control. In some situations, providing secondary containment may not be possible.

WRT's suggested approaches for providing secondary containment include combinations of the following:

- Containment for a minimum of 100 percent of the volume of the media in a single treatment vessel. It is not necessary to contain the treated water in a vessel, as the licensed radioactive material is attached to the treatment media and the water is not radioactive; it is, in fact, treated water.

- Possible Secondary Containment Approaches.

  — Containment within the floor and foundation walls of the treatment building;
  — Sloped or recessed floors;

- A concrete or block berm around the treatment vessel(s);
- A floor-drain collection system with a remote sump. The sump pump can be either manually operated or instrumented to provide for operation of the pump in the event of a system failure and release of treatment media;
- A floor-drain collection system that retains the treatment media. With any floor-drain system, properly-sized gratings/screens could be used on the drain openings that will allow the water to drain while retaining the treatment media beads;
- Where secondary containment within the treatment building is not feasible (e.g., a building on an at-grade slab), the floor and walls of the treatment building or enclosure would provide effective secondary containment. Even if an outside door was opened after a major release of treatment media, the spilled media at the doorway would migrate only just beyond the doorway. Also, to provide containment outside the building, the ground surface just outside the door could be graded to form a depression or small basin that would collect any treatment media that may be released outside of the treatment building. The treatment media could then be removed from the depression with minimal cleanup of impacted soil.

- WRT also recommends that the Client Engineer check local ordinances and fire code for any additional requirements.

2.3.2.10 Site Specific Information for the Treatment Systems

The site-specific information for a Uranium Removal System that will operate at a particular Client will be submitted to the NRC after WRT has contracted with the Client to provide water treatment. This site-specific information will include, for example, the following items.

- Client name, address, and name/title of the local point of contact.
- Address/location of the treatment site(s).
- Description of the treatment system(s) and the estimated maximum expected activity of the collected radioactive material.
- Confirmation that the type and size of the treatment system and amount of activity that could be present onsite are within the range of these parameters that were presented and analyzed in this multi-site license application.

Radionuclides Handled

The primary radionuclide handled by and stored within the Uranium Removal System is naturally-occurring uranium. Using a conservative "upper-bound" assumption (i.e., for the highest flow rate in the range of flow rates examined in this ER), the following Table 2-2 presents the estimated uranium loadings and the activities that apply to the range of Uranium Removal Systems. **Note:** The maximum uranium concentration, 60,000 ppm U and 54,000pCi/g media, is unchanged from the original license application. As noted earlier, however, each of the system configurations contain more treatment media compared with the same size system in the original application; therefore, larger amounts of collected uranium and uranium activity are reported in Table 2-2 below.

The synthetic resin treatment media is designed to be relatively selective for uranium. Because of this selectivity and the extremely long half-life of uranium, few other radionuclides will be collected by the treatment media. For example, thorium, also an anion in solution and the first decay product of uranium, has a significantly lower affinity for the treatment media than does uranium. Some thorium probably will adsorb onto the media, but it will tend to be displaced off the media as uranium continues to load. Radium, if present in the feed water, is a cation and would require a cation exchange media to be collected. Treatment technology similar to the Uranium Removal System is available for removing radium from drinking water and that technology also collects and stores the removed radium on a cation-exchange treatment media. If a Client/CWS has drinking water or a contaminated water source that requires both radium and uranium removal, two separate ion exchange processes would be needed, and the radium portion of the treatment system will be licensed or permitted with the appropriate State radiation protection agency.

Table 2-2
WRT Uranium Removal System
Maximum Uranium Loading and Activities for a Range of Water Wells

Item	Well Size 50 gpm	Well Size 200 gpm	Well Size 1,000 gpm	Well Size 1,500 gpm	Well Size 3,000 gpm
System Configuration	PES	MCS	Field Erect	Field Erect	Field Erect
Input Items:					
Example U Concentration in Raw Feed (ug U/L)	100	100	100	100	100
Overall Well Utilization (%)	40	40	40	40	40
Max. U Loading, Stage 1 (ppm U)	60,000	60,000	60,000	60,000	60,000
Max. U Loading, Stage 1 (%)	6.0	6.0	6.0	6.0	6.0
U Activity Conversion (pCi/ug U)	0.9	0.9	0.9	0.9	0.9
Media Weight per Stage or Treatment Vessel (lb)	132	3,520	32,600	48,400	96,800[3]
Uranium Loading/Activity:					
Max. Contained U, Stage 1 (lb)	84[1]	225	2,100	3,100	6,200
Total Contained U on Site (lb)[2]	90	259	2,415	3,560	7,120
Max. Activity Concentration, Stage 1 (pCi/g)	54,000	54,000	54,000	54,000	54,000
Max. U Activity, Stage 1 (mCi)	34	92	858	1,270	2,540
Total U Activity on Site (mCi)[2]	37	106	990	1,460	2,920
Time Lines:					
Grams U/day @ 100% util.	27	109	545	818	1,636
@ 40 % overall util.	11	44	218	325	650
At 40% Overall Well Utilization:					
Days to 500 ppm U in Stage 1	27[1]	18	34	68	68
Months to 15 lb U on site	20.6	5.2	1.0	0.7	0.35
Months to Max Loading in Stage 1 (assuming 85% U reports to Stage 1)	136	92	170 (14.2 yr)	170 (14.2 yr)	170 (14.2 yr)

Notes:

1. For this conservatively-large PES configuration, with a treatment train of three (3) vessels connected in series, instead of the typical two (2), the set of "Stage 1" vessels is taken to be the first two (2) vessels in each train, for a total of ten (10) vessels.

2. Assumes that the Stage 2 media charge contains 15% of the maximum loading in Stage 1.

3. This overall 3,000-gpm system is made up of two, 1,500-gpm treatment systems, connected in parallel; therefore there are two (2) Stage-1 vessels. This weight is the total of both Stage-1 media charges.

2.3.3 Operations and Personnel

Note: A new aspect of this renewal application is WRT requesting to expand the scope of its work to include treating water resources other than drinking water. Accordingly, in the following subsections any personnel position/title references to, for example, "Utility Manager/Water Superintendent" and "utility operators" have the similar meaning corresponding to titles of "Remediation Project Manager" or "water treatment operators", or similar, for the other-water-resource scenario.

All licensed material contained within the Uranium Removal System, including treatment media and uranium residuals, will be controlled and owned by WRT. The operation of the Uranium Removal System will be controlled by WRT pursuant to commercial terms in a water treatment agreement between WRT and the Client CWS, including but not limited to the following items.

1. WRT at all times owns the Z-92® treatment media and takes ownership of the uranium as it loads onto the media.

2. WRT is involved with and monitors the installation of the treatment system by the Client's general construction contractor, and WRT is responsible for the startup of the system to ensure its proper operation.

3. The Client is required to allow/provide WRT access to the Client's facility and the treatment system at all times, especially for WRT to respond to an upset situation.

4. As part of this public water supply facility, already a sensitive installation, the Client will ensure that the uranium treatment system is contained within a secured site.

5. During the operation of the system WRT is responsible for all service activities that have the potential for coming in contact with the licensed material.

6. WRT is responsible for all spent media exchanges, including the removal of the final charge of media at the termination of the operation.

WRT will develop the overall radiation protection program and will implement this program at each Client/CWS water treatment facility where the Client has contracted with WRT for long-term service including WRT's radiation protection program. The program will be carried out and administered under the direction of a WRT Corporate Radiation Safety Officer (CRSO). Due to the design, construction, and simplicity of operation of the Uranium Removal System, including no addition of chemicals or the need to regenerate and backwash uranium residuals, the daily tasks associated with the system essentially will be a "walk-around" inspection to monitor pressures and flow rates, to check for any possible leaks, and to evaluate overall operating conditions. The local Utility Operators will perform these daily tasks and report directly to the local Utility Manager. These Operators will not be required to handle licensed material and will not be considered radiation workers. They are simply local Utility Operators whose duties result in them *potentially* being exposed to a small amount of radiation from a licensed activity. The local Utility Manager typically will be the primary point-of-contact at a

particular Client/CWS water treatment facility. There will not be a site-specific RSO, however, the local Utility Manager and all the local Utility Operators that deal with the Uranium Removal System will be trained in the appropriate level of radiation awareness, safety, and emergency procedures by WRT. This training will typically be a two (2) hour initial course with follow-up training.

All the operations and tasks related to handling the treatment media and the radioactive material in and around the Uranium Removal System will be handled by WRT's System Specialists. These tasks will include, but are not limited to, the following.

- Installing the initial charge of treatment media and Uranium Removal System startup;
- Exchanging the uranium-loaded ("spent") treatment media with new treatment media and restarting the treatment system;
- Packaging the spent treatment media for transport and/or transferring the treatment media from the treatment vessel(s) to a USDOT-approved tanker container;
- Preparing shipping manifests and arranging for transport of uranium residuals by an appropriately-permitted transportation contractor;
- Performing repairs and replacement of any components of the Uranium Removal System (the vessel itself, valves, flanges, screens, etc.) that may contain licensed material;
- Performing contamination surveys, as necessary, after media exchanges, normal equipment maintenance, and after cleaning up the facility after an upset incident.

As the authorized "handlers" of the licensed material, WRT System Specialists will receive a higher level of radiation safety training than the local Utility Manager and Operators. As will be described in greater detail in Section 3.16.2, WRT System Specialists will receive at least sixteen (16) hours of initial training in radiation safety, the equivalent of a NORM (Naturally Occurring Radioactive Materials) supervisors course, meant for the individuals who will be handling and packaging the radioactive spent treatment media. A full description of the training that will be required of the CRSO, the WRT System Specialists, and the local Utility Manager and Operators is presented in Section 3.13, as part of WRT's Radiation Safety Program.

2.3.4 Waste Management

WRT's waste management philosophy is that uranium removed from drinking water sources pursuant to SDWA requirements and other contaminated water sources pursuant to Federal and/or State cleanup limits/standards *should not* be disposed of by discharging uranium residuals back into the local environment by backwashing or releasing uranium residuals to a sanitary sewer, surface waterway or other uncontrolled point of discharge. In WRT's proposed uranium water treatment program, the uranium-laden spent media (the water treatment residuals) will be removed from the treatment vessels at a well site(s) and transported to a facility properly licensed to accept AEA-licensed materials, including source material. As described in Section

2.3.3, WRT's System Specialists will perform all the tasks related to handling the radioactive material. WRT will arrange for transportation of the spent treated media in USDOT-approved transportation packages and vehicles by a properly permitted transportation contractor.

WRT is proposing two (2) alternatives for the final disposition of the licensed material. The preferred alternative is to deliver the spent treatment media to a licensed uranium recovery facility, which will take title to the licensed material as an equivalent feed material and process such material to recover the contained uranium. The other option is to deliver the spent media for disposal at an appropriately licensed facility that can dispose of AEA-licensed source materials in the quantities and activities that correspond to WRT's spent treatment media.

The treatment vessels will be designed to allow for long intervals between required media exchanges. With the high loading capacity of the synthetic treatment media, the time interval between exchanges could be relatively long depending on the flow-rate of the specific Uranium Removal System and the uranium concentrations in the treated drinking water source.

Details of the complete media exchange and waste management process are presented in Section 3.17.

2.4 Alternatives Considered but Eliminated

Several other alternatives are available to a Client/CWS to meet the SDWA uranium MCL or other established cleanup limits/standards, but WRT does not deem the assessment of these alternatives necessary for this ER. These other alternatives include: (1) shutting off an out-of-compliance well and not using it and (2) blending water from an out-of-compliance well with water from a compliant well resulting in a blended water supply that is below the SDWA uranium MCL. The decision to use these alternatives belongs to the Client/CWS and not to WRT. By the time that a Client/CWS has reached the point of deciding to implement the WRT uranium water treatment program, the "shutting off" and "blending" alternatives likely already will have been rejected by the Client/CWS in its analysis and selection of compliance alternatives.

2.5 Cumulative Effects

WRT does not anticipate any adverse cumulative effects from the use of its uranium water treatment program on a national basis that would pose any significant potential impacts to public or occupational health and safety or the environment. The spent uranium treatment media received at these sites are either recycled or disposed of at already-licensed/permitted facilities where the cumulative impacts of disposition of licensed material already have been analyzed. Transportation impacts have been analyzed in not only the individual facility's licensing/permitting process, but also, in the case where spent media is sent to a uranium recovery facility, through NRC's "equivalent feed" RIS (RIS 2012-06), in which it determined no license amendment was necessary for uranium recovery facilities where uranium will be recycled. On the other hand, the cumulative benefits include the improvement in public water supplies and potentially the production of a valuable energy production resource.

3.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT AT TYPICAL WATER TREATMENT SITES

3.1 Introduction

This Section of the ER provides a generic description of the environmental conditions at typical Client water treatment facilities. Descriptions of the typical and expected local environment at these facilities provide an overview of the sites' existing environmental conditions so that the potential impacts of licensed operations on them, if any, can be evaluated.

Note: Unless noted otherwise, the information presented in the following subsections apply to both drinking water treatment, and to WRT's requested authorization for non-drinking-water (aka other water) treatment. The information regarding drinking water presented here is identical or similar to that provided in the initial license application in September 2005. Where information is needed to address any differences with the other-water treatment scenarios it will be noted and added near the end of a subsection. The information presented in section 3.13 through 3.18 – WRT's organization and management controls; Radiation Protection Program; waste disposal; and decontamination & decommissioning and financial assurance – directly apply to both drinking water and other water treatment.

To demonstrate that there are no significant potential public or occupational health and safety or environmental impacts associated with the use of WRT's uranium water treatment system to remove uranium from drinking water or other contaminated water sources, this ER addresses conditions relevant to potential exposure pathways that could be impacted by the implementation of WRT's uranium water treatment system at Client sites. The exposure pathways evaluated are the following:

- Potential occupational exposure
- Potential exposures to members of the public
- Potential process safety issues
- Potential highly unlikely but credible accident scenarios such as:
    - Failure of containment of uranium residuals at the facility
    - Releases during media exchange at the facility
    - Releases during transportation of uranium residuals

A more detailed discussion of potential exposure pathways is contained in Section 3.16.6, *Dose Assessment*.

3.2 Generic Site and/or Facility Description

For both drinking- and non-drinking water treatment, WRT's uranium water treatment program, including the Uranium Removal System, will be implemented at existing Client water treatment facilities or at newly constructed facilities adjacent to locally- and state-permitted drinking water wells or other contaminated water sites where water treatment is deemed to be necessary by the Client. This Section will present the range of treatment system sizes and operating parameters

possible at Client sites, once again to bracket the environmental conditions at typical water treatment facilities so that the WRT uranium water treatment program can be evaluated.

3.2.1 Generic Description of the Surrounding Water Treatment Facilities[1]

Client water treatment facilities vary in size and dimensions based on the type of water treatment operations performed and the volume of water supplied. In almost all cases, for both old and new treatment/well sites, the Uranium Removal System will be delivered and installed in an already-existing (or under construction) water treatment facility, typically the site of the water well(s) and well house(s). The facility can also be a centrally-located treatment facility where water from multiple wells is combined before entering the municipal distribution system. In general, potential land use impacts by the existing Client water treatment facility likely have been assessed previously and new assessments may not be necessary. As such, the Client/CWS will own or control the facility site, and whatever land disturbance that is required for the Uranium Removal System already will have taken place before the WRT system arrives on-site for installation.

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

The smaller Uranium Removal Systems, the PES and MCS units, can be placed in structures the size of small storage buildings, 400 to 500 square feet. For example, a small skid-mounted, MCS-type unit is currently operating at a well site owned by the Fox Run Water Company near Petersburg, Virginia, originally under a NRC general license, but now under VA Department of Health licensure. This is an 80- to 100-gpm system with a uranium concentration in drinking water of approximately 80 ug/L. In this case, a new separate frame building was constructed for the unit. Photos of both the MCS unit and the building it is housed in are presented in Figure 2-2. The well's original treatment equipment is located in a building of similar size.

The treatment room/building for larger Uranium Removal Systems could be 1,200 to 2,000 square feet, potentially requiring a new addition to the treatment/well house for the System. Figure 2-3 presents a typical layout of a large Uranium Removal System, up to approximately 1,500-gpm. This Uranium Removal System would require two large, field-erected treatment vessels, up to approximately 15-ft diameter. Figure 2-4 presents a photo of a smaller field-erected treatment system, with a capacity of 500 gpm. Operation of most treatment/well houses generally is automated to the point where an operator's constant presence at the facility is not required. The Uranium Removal System will be operating in an area that already has restricted

[1] While it is understood that Section 3 descriptions only involve the *existing* environment at water treatment facilities *prior to* implementation of its uranium water treatment program, WRT has included Uranium Removal System-specific information in this subsection to provide a more comprehensive overview because water treatment facilities will be constructed prior to the installation of the Uranium Removal System.

access and where limited work tasks in the immediate vicinity of the treatment vessel are required.

These water supply sites will vary in overall size, depending on the size of the supply system and the other ancillary water treatment processes that occur at the site. The size can vary from less than an acre of land for a small 100-gpm well with relatively small storage tanks located directly on the ground, up to several acres for a large 1,000-gpm well or more with a half-million-gallon water tower located on the site. Possible locations of these facilities can range from a rural location, to a separate lot in a residential setting within a city, to a separate portion of a large municipal complex. Typically, the Uranium Removal System will be located within an enclosed building, in a treatment/well house as described above. On rare occasions where inclement weather is not a major concern (e.g. southern California), the Uranium Removal System may be located on a pad in the open or under a covered structure with open sides.

In general, because of the facility's importance and sensitivity as a public water supply, the water treatment facility will be secured, regardless of the need for treatment for removal of radionuclides. As a minimum, the treatment/well houses will be locked. Almost all sites will also be secured with locked fences. In the more atypical situation of the Uranium Removal System being located in the open, outside of a building, it is anticipated that such treatment sites will be fenced and locked.

One other potential feature at a water supply site or other contaminated water source site that could affect the potential level of impacts from a uranium treatment system, whether it is the WRT uranium water treatment program or one of the alternate approaches, is the presence or lack of access to a sanitary sewer. If a site does have a drain to a sanitary sewer, then a treatment alternative such as conventional ion exchange with backwash to the sewer can be considered. Selecting this alternative means, however, that uranium in the backwash brine solution will be discharged to the sanitary sewer. While federal and state limits allow for certain prescriptive amounts of radioactive material to be discharged to the sewer, choosing this alternative means that the uranium that was recently removed from the drinking water is being re-introduced into the local environment. Also, if a drinking water system can afford the infrastructure costs to have a sanitary-sewer access point, it likely means it is a relatively large water system. The larger the system, the larger the potential impacts of discharging uranium to the local environment, possibly to the point of not being able to comply with the regulatory discharge standards.

A number of water supply systems, especially those located in rural areas, do not have access to a sanitary sewer. If conventional ion-exchange with backwash is selected for such a water system, the likely alternative available for disposal of the radioactive backwash brine solution will be to haul such solution by truck to the nearest access point to a sanitary sewer or other discharge point. Haulage of these radioactive treatment residuals could increase worker exposure and environmental impacts. In possibly the worst-case scenario, the system operator may decide to discharge these uranium-laden backwash brine solutions to the ground or to surface water in an uncontrolled manner.

Non-Drinking-Water Treatment Uranium treatment of other water resources also will take place at a facility where security, locked treatment building and/or fenced area, is provided by WRT's Client. The treatment equipment may be located in an existing or newly-constructed treatment building, or on a pad in the open, possibly with temporary cover, at the treatment location. Treatment of other water resources likely may have a shorter duration than that of drinking water treatment, although it could still operate for multiple years. Examples included treating and discharging water from a mined-out pit lake, or pumping, treating, and re-injecting water from a contaminated plume in either a surface alluvial or deep groundwater aquifer. In these cases, the work could have an expected, somewhat finite end, which could justify a temporary installation. Remediation of mining impacts or the contamination of a significant groundwater aquifer likely could require relatively-large flow rates and the larger treatment systems that are evaluated in this ER. On the other end of the range of other-water treatment scenarios, uranium treatment at a construction site may have a duration of only months, require smaller treatment systems, and operate temporarily on a pad in the open. As a point of reference, WRT has installed and serviced uranium treatment systems in both the mine water remediation and temporary construction site scenarios, in an Agreement State (Colorado).

3.2.2 Hazardous Material Handled

Hazardous materials handled by existing CWS Clients vary depending on the method of water treatment used by such providers in their treatment operations. For CWS Client's, normally, there will be chlorine or sodium hypochlorite solution in tanks for chemical addition to drinking water to disinfect. There may also be a fluoride solution (as fluorosilicic acid) tank if fluoride has to be added to the water. Depending of the size of the Client's CWS, these chemicals may or may not be present in quantities above the Reportable Quantity (RQ) limit.

In addition to chlorine, anhydrous ammonia also may be used as a disinfectant. Both chlorine and anhydrous ammonia are delivered as a pressurized liquefied gas. Typically, minimum container size is a 150-lb industrial-gas-type cylinder bottle. However, one-ton cylinders and up to 15- to 17-ton tank trucks are commonly used for large CWS Client systems. The fluorosilicic acid is stored as a liquid.

Clients who possess groundwater, surface water or other water sources contaminated with uranium may have similar hazardous material or unique material specific to their treatment needs.

3.3 Land Use

Section 3.2.1 presents a description of the possible features at the Client's facility that presently requires land use, which likely has been assessed previously. The Client's total water facility site typically covers from less than one to up to two acres. Existing water treatment facility structures generally are sufficient to initiate the continued action, regardless of the flow-rate-specific System's size. If a new building is required to be constructed, it is likely that approximately 1,200 to 2,000 square feet of land will be used for this addition. Land needed for

additional access and parking areas may result in a cumulative total of 2,000 to 3,000 square feet of affected area needed for a large Uranium Removal System.

3.4 Transportation

Transportation issues at existing Client water treatment facilities vary depending on the geographic location of each facility. In general, Client water treatment facilities may be located in urban areas close to residential or commercial properties or in rural areas at significant distances from such properties. Transportation infrastructure also may vary depending on the size and location of the water treatment facility. Roads to such facilities may be paved or graveled and normal "wear-and-tear" on such roads will vary depending on the number of Client workers at each facility.

Smaller Client water treatment facilities generally utilize one (1) to three (3) workers traveling round-trip over public and facility roads five (5) to seven (7) days per week. Larger Client water treatment facilities generally utilize ten (10) to twenty (20) workers traveling round-trip over public and facility roads five (5) to seven (7) days per week. Operations at Client water treatment facilities are sufficiently automated that additional use of facility roads to operate wells is minimal. Additionally, facility roads are used relatively infrequently to receive supplies for water treatment operations (e.g., treatment chemicals, maintenance equipment).

3.5 Client Water Treatment Facility Geology and Soils

Surface geology and soil conditions at Client water treatment facilities geology vary depending on the geographic location of the specific facility. In all cases, Client water treatment facilities are constructed to prevent releases of constituents either through expulsion from the treatment facility to local soils or through leaching beneath the facility to local subsurface soils or groundwater. Subsurface geologic structures generally do not play a role in the construction of Client water treatment facilities, except when water wells are constructed and connections to such wells are installed to facilitate the transport of water to the facility.

3.6 Client Water Resources

Client water resources at existing facilities are addressed in the subsections below.

3.6.1 Groundwater/Other Contaminated Water Sources

Typically, CWS Clients that require uranium treatment, regardless of whether the treatment system is supplied by WRT or others, use groundwater as their primary resource. CWSs that rely on surface water as their source for drinking water usually do not have a uranium compliance problem. Groundwater is removed from local aquifers through water wells, which are constructed in accordance with state standards for such wells and for groundwater protection.

CWS Clients draw water from formations that are typically below a confining layer which provides protection from surface water contamination.

Non-CWS Clients with other water sources may have uranium-contaminated groundwater, surface water or stored water that requires treatment. For example, a mining Client may have surface water accumulated in a mine-out open pit (pit lake) with uranium concentrations above discharge standards, or groundwater down-gradient of the facility that has a uranium contamination plume that requires pumping and treating.

3.6.2 Surface Water and Potential Flooding

Some Clients currently discharge treatment residuals directly to surface waterways or to sanitary sewer systems pursuant to appropriate discharge permits. Any potential for flooding of existing water treatment facilities likely has been addressed by the Client previously. Newly constructed treatment facilities likely would require additional assessment prior to construction, but would include similar safeguards against flooding. The uranium water treatment site typically is either owned or controlled by WRT's Client. Any analysis of surface or flood water impacts related to the permitting of the treatment site, along with any required mitigation measures, usually will be accomplished by the Client, before WRT's involvement with the project.

3.7 Ecological Resources

Ecological resource issues at Client water treatment facilities will be discussed in the subsections below.

3.7.1 Generic Ecological Description

Ecological issues at Client water treatment facilities and associated lands are highly site-specific. As a general matter, Client CWS water treatment facilities requiring uranium treatment are constructed in areas where groundwater may be accessed as a water resource for local consumption. These areas may vary from urban areas with multiple residential developments, to remote rural areas where plant and animal resources may be more prevalent. Generally, ecological issues will have been assessed by the Client previously. Similarly, Clients with groundwater, surface water or impounded contaminated water in impoundments may be in residential or remote rural areas will have previously addressed any ecological issues.

3.7.2 Typical Transportation Corridors

Typical transportation corridors at Client water treatment facilities vary depending on the geographic location of the facility. Transportation corridors are described in Section 3.4 above. Usually, CWS- and/or privately-owned roads at the treatment site provide treatment facility workers and other members of the public with access to major highways or other public roads. Distances from water treatment facilities to such highways or other roads vary greatly depending on the size of the municipality and the location of the treatment site.

3.7.3 Identification of Threatened and Endangered (T&E) Species

Existing Client water treatment facilities are constructed to prevent escape of contaminants removed from water, and generally there are no issues of potential adverse impacts to endangered species. In cases where endangered species have been identified and safeguards have been implemented, existing facilities are required to observe such safeguards.

For new facilities, WRT's Client will determine whether any such T&E issues exist prior to construction of the new facility structure within which the uranium treatment is to be installed, and usually prior to WRT's involvement with the project. WRT's Client will be responsible for mitigating any adverse impacts. Installation of new uranium treatment within the boundaries of an existing water treatment facility likely will not require new T&E assessments or mitigation.

3.7.4 Identification of Ecological Studies

Depending on the geographic location of a given Client water treatment facility, ecological studies will have been conducted and local ecology will have been assessed. However, Client water treatment facilities typically are constructed to prevent escape of contaminants removed from water and generally there are no issues of potential adverse impacts to local ecology.

3.8 Meteorology, Climatology, and Air Quality

Meteorology, climatology, and air quality conditions are site-specific. As stated above, Client water treatment facilities may be located in urban or rural areas, as well as in locations where the climate is arid or wet and are constructed to prevent escape of contaminants removed from water, including escape as airborne particulates. Existing Client water treatment operations generally do not pose a potential threat to air quality.

3.9 Noise

It is anticipated and expected that existing Client water treatment facilities comply with Occupational Safety and Health Administration (OSHA) noise standards and any local noise ordinances.

3.10 Historic and Cultural Resources

For existing water treatment structures and facilities, the potential impacts to historic and cultural resources would have been assessed previously, and mitigated as necessary, also at an earlier time. New water treatment structures and facilities may require analysis of potential impacts to historic and cultural resources. Even if a new structure is required, this cultural resource analysis, any required mitigation of impacts, and the actual land disturbance and construction

likely will have taken place prior to WRT's involvement with the project before any licensed activity occurs.

3.11 Socioeconomic Impacts

Generally, drinking water treatment or other water treatment provides tangible public health benefits to affected populations and does not result in significant adverse socioeconomic impacts.

3.12 Public and Occupational Health

According to EPA, CWS drinking water sources containing uranium, which are not currently treated to remove uranium, may pose a significant public health hazard. CWSs currently removing uranium from drinking water sources and, subsequently, discharging uranium residuals in an uncontrolled manner to sanitary sewer systems or to the environment may pose significant public and occupational health hazards.

Water treatment chemicals may also pose significant public and occupational health hazards. CWSs will likely have safeguards in place to prevent improper occupational exposure to such chemicals during water treatment operations.

Similar concerns may apply to Clients who possess uranium-contaminated ground water, surface water or impounded water, which requires treatment.

3.13 Management Organization of WRT – Overview

Figure 3-1 presents the current organizational chart of Water Remediation Technology LLC and its corporate position with its parent company, WRT International LLC. Water Remediation Technology LLC is a U.S. company, 100 percent privately owned by WRT International LLC, which is itself privately owned.

3.13.1 WRT Personnel Involved with Radiation Safety

The positions and duties of the WRT personnel responsible for and involved with the licensed activities and material are described below, in descending order of authority. Qualifications and experience requirements are noted where applicable, and are presented in more detail in Sections 3.16.1.1 and 3.16.1.2. The organizational arrangement allows radiation safety matters to be considered at appropriate management levels. Of significant importance in the organization is the direct access that the Corporate Radiation Safety Officer has to the WRT President, primarily to have the authority to control and deal with any radiologic incident or with a serious health-and-safety issue.

Any corporate organizational changes affecting the assignments or reporting responsibilities described in this ER or in any other WRT licensing documents will be documented by WRT's Safety and Environmental Review Panel (SERP) and maintained for inspection by NRC or relevant Agreement State.

President and CEO of WRT

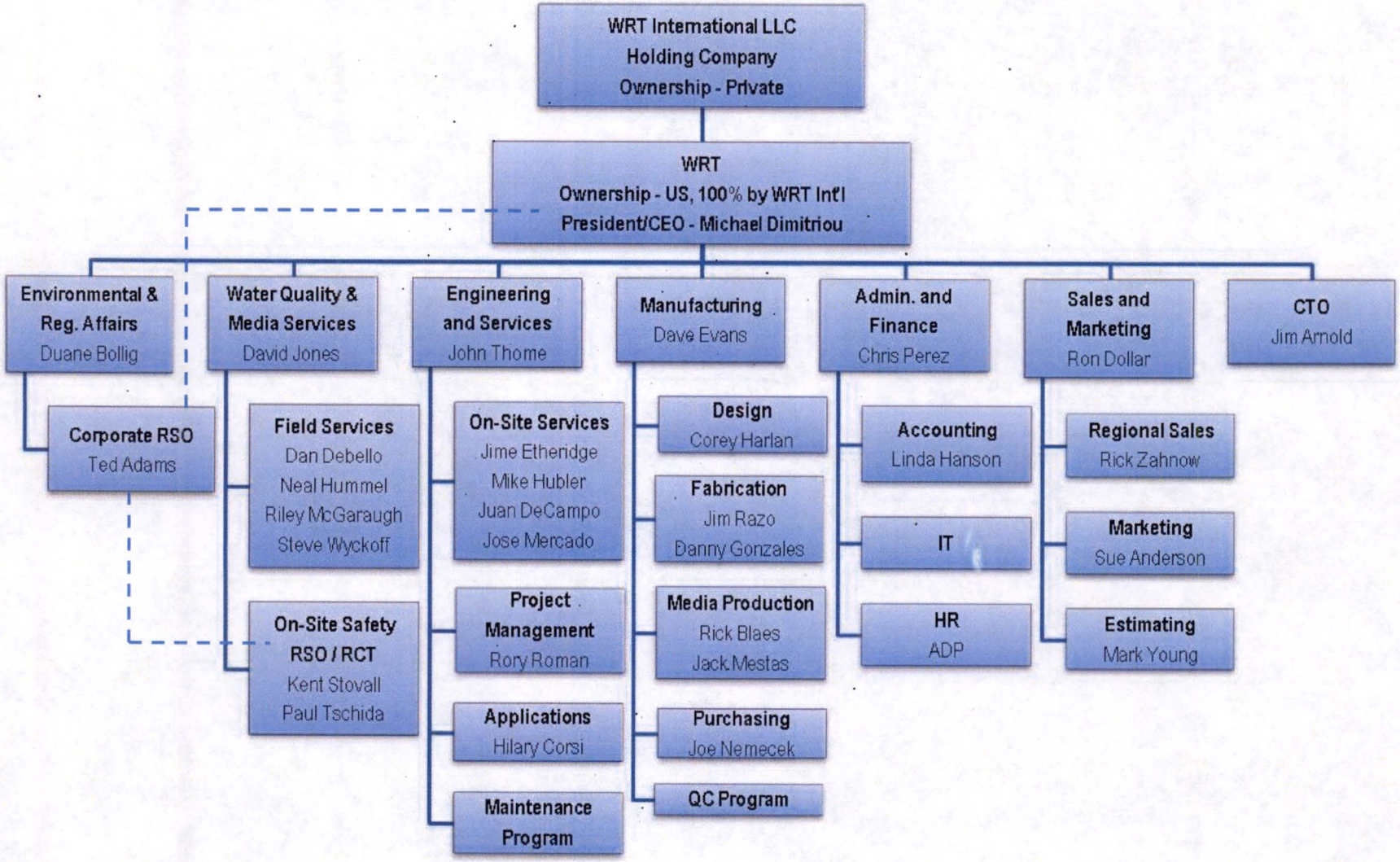
The President and CEO of WRT will have the ultimate responsibility for WRT water treatment program operations, including any and all Client uranium water treatment systems. This individual has management and financial responsibilities for all aspects of WRT's day-to-day operations, including engineering, construction, and installation of the uranium water treatment systems (including the WRT Uranium Removal Systems); developing and employing WRT's service network; operations and maintenance of the Uranium Removal Systems including exchanging and disposing of the spent treatment media; environmental and government affairs; and accounting/finance. The President and CEO has signatory authority for WRT licenses and permits and the authority to enter into water treatment agreements with Clients/CWSs and uranium recovery/disposal agreements for spent treatment media.

Chief Operating Officer (COO)

Note: This position of Chief Operating Officer (COO) was both presented in and the position was staffed at the time of the initial license application in September 2005. The COO, or a similar position of Senior Vice President – Services, have been staffed during most of the initial ten years of WRT's license, however, it is not in WRT's organization chart at the time of this writing. The position is retained in this renewal application because as WRT grows in the future, the current work load of the President/CEO will grow to the point where many of the operational responsibilities will once again be delegated to a COO/Senior VP-level person. With this position still recognized in this renewal application, when this position is re-established, the SERP can review its addition and acknowledge that it is in accordance with the intent of this renewal application. This SERP review will be documented for the NRC's review.

The Chief Operating Officer (COO) of WRT will report to the President of WRT and will take over a portion of the management and financial responsibilities that are currently under the President and CEO. These responsibilities are likely to include, but are not limited to, all the site service related activities, including construction and 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 disposing of the spent treatment media.

Figure 3-1 Water Remediation Technology LLC (WRT) Organization Chart - 2016



Director – Environmental and Regulatory Affairs

The Director – Environmental and Regulatory Affairs reports to the President/CEO. 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. This individual directs the activities of the Corporate Radiation Safety Officer (CRSO) and has oversight direction of the activities, pertaining to radiation safety and license compliance, of the field Radiation Safety Officer (RSO) and Radiation Control Technicians (RCT) who work in the Media Services group. He/she is responsible for the radiation safety and USDOT hazardous materials training for both WRT and WRT's Client employees, establishing financial assurance arrangements required by the licenses, and negotiating and maintaining the disposal agreements for the spent radioactive treatment medias. The Director has signatory authority on behalf of WRT for WRT license and permit applications and for radioactive material recovery/disposal agreements for spent treatment medias.

Corporate Radiation Safety Officer

The Corporate Radiation Safety Officer reports to the Director – Environmental and Regulatory Affairs, but also has dashed-line reporting directly to the President/CEO. is responsible for managing, implementing, and enforcing the WRT Radiation Program and all environmental programs for WRT's uranium water treatment program. The CRSO sits on the WRT SERP, implementing its directives, and will also interface with other corporate officers to ensure that all system operations are conducted consistent with license conditions and applicable regulations and requirements. Through his dashed-lined reporting to the President/CEO the CRSO has the authority to stop. intervene, and mitigate any radiologic upset activity or serious health-and-safety situation. The CRSO also has the authority to direct (and/or intervene with) the field RSO and RCTs who work in the Media Services group, for activities pertaining to radiation safety and license compliance.

The CRSO is responsible for supervising and monitoring of the environmental protection and radiation safety programs for all uranium water treatment facilities and for advising the WRT System Specialists and the site-specific local Client/Utility Managers and local Utility Operators on environmental and radiation safety issues. Responsibilities will include developing and implementing all radiation safety and environmental programs, ensuring that all records will be correctly maintained, and assisting in ensuring compliance with applicable regulations and license conditions.

The CRSO will conduct routine training programs for corporate and site employees with regard to the proper application of radiation protection, emergency response, and environmental control programs. The CRSO, when necessary, will inspect uranium water treatment facilities to verify compliance with all applicable radiological health and safety requirements and any quality assurance/quality control (QA/QC) requirements. Additionally, the CRSO will annually review the WRT 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 be maintained as low as reasonably achievable (ALARA).

The CRSO will be responsible for routinely auditing all operational and monitoring procedures, QA/QC and ALARA programs, and will be a member of the ALARA audit team, and a member of the SERP. The CRSO is authorized to terminate immediately any activity that may be a threat to employees, public health and safety or the environment, as indicated in reports from any site-specific Client/ CWS Utility Manager. The CRSO will serve as the primary point-of-contact for purposes of addressing site-specific public health and safety or environmental issues.

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/training. The CRSO also will attend the following training courses: (1) initial 40-hour RSO training course, (2) initial U.S. DOT Hazardous Transportation training course, at a minimum for DOT Class 7, radioactive material, and (3) refresher training for radiation safety and hazardous material transportation, as necessary.

Details of the CRSO qualification/training, roles, responsibilities, and authority are presented in Section 3.16.1.1. The CRSO will possess the professional qualifications and will satisfy the professional training requirements presented in this ER prior to engaging in any CRSO activities.

Radiation Safety Officer and Radiation Control Technicians

The field Radiation Safety Officer and Radiation Control Technicians report to the Vice President-Media Services, and will support the field service crews, the WRT System Specialist. The RSO and RCTs will implement the WRT Radiation Protection Program during all field service operations that involve handling the radioactive licensed material; primarily during spent treatment media exchanges, but also for other system maintenance events that have the potential of coming in contact with the licensed material. Their services provided will include contamination monitoring and control of the work areas and WRT System Specialists during the service activity, complying with all applicable USDOT requirements for packaging and transporting the Class 7 radioactive material, conducting pre- and post-job contamination surveys, and mitigating any contamination found as necessary. Other responsibilities include maintaining the license, service, transportation, and disposal records in WRT's electronic and hard-copy central files, as well as at WRT's state offices of record or at Client's offices; conducting periodic contamination/emission surveys at treatment sites, maintaining WRT's dosimetry program (for WRT's employees and at Client treatment sites), and assisting in presenting radiation safety training, also at WRT and Client sites.

WRT System Specialists

In addition to the CRSO, WRT will employ System Specialists that will be responsible for monitoring the installation of and maintaining and decommissioning Uranium Removal Systems. WRT System Specialists will perform the following tasks related to treatment media: (1) assure that all Uranium Removal System equipment has been installed and operates pursuant to license requirements at each water treatment facility, (2) perform

maintenance, repair, and/or replacement operations on components of the Uranium Removal System containing licensed material, (3) monitor performance of local Client/Utility Operators and Uranium Removal System operating data; (4) monitor performance and useful life of treatment media, (5) install fresh treatment media in the Uranium Removal System, (6) perform media exchanges to remove licensed material attached to spent treatment media, (7) arrange for the packaging and transportation of spent treatment media, (8) arrange for the final disposition of licensed material either at an NRC/Agreement State-licensed uranium recovery facility for processing as an equivalent feed or at a properly licensed disposal facility for direct disposal. It is also anticipated that WRT System Specialists will provide a portion of the "on-the-job" training for local Client/CWS Utility Managers and Operators.

WRT System Specialists will be instructed in all the topics covered in the radiation safety training for Utility Operators. In addition, they will attend an initial USDOT Hazardous Material Awareness and Transportation Training Course. As appropriate, this course will be customized to the Uranium Removal System and associated equipment to emphasize the areas related to sampling/handling the treatment media, personal protective equipment (PPE) requirements, minimizing surface contamination, and shipping/manifesting requirements. Both the radiation safety and the USDOT hazardous material training will include end-of-course tests, for which a passing score must be attained.

Details of the training, roles and responsibilities of the WRT System Specialist are presented in Section 3.16.1.2 of this ER. WRT's System Specialists will possess the professional qualifications and will satisfy the professional training requirements outline in this ER prior to engaging in any licensed activities.

3.13.2 WRT's Client Personnel Involved with Radiation Safety (non-WRT Personnel)

Employees of WRT's Client CWSs and other water treatment Clients will not be required at any time to handle or come in contact with the radioactive licensed material. There are, however, several of a Client's employees that will play a role in the safe operation of a WRT treatment system and general radiation safety at the site.

Site Utility Manager – the Local Point of Contact

Local Utility Managers will serve as the primary point-of-contact for the CRSO, RSO, and WRT System Specialists when performing licensed activities. They also will likely be the contact for regulators wanting to make a site inspection or visit. For larger treatment site WRT expects this person will be the utility director or water superintendent; for a smaller system, it could be a water superintendent or even a lead operator. The local Utility Manager will monitor the operation of the treatment system and ensure the system is secure in a locked building and/or locked fenced area. The Utility Manager will be responsible for supervising his/her utility operators regarding monitoring and safely working around the treatment system. Details of the responsibilities and training for local Client/ Utility Managers are described in Section 3.16.1.5 and Section 3.16.2.3, respectively, of this ER.

Client Utility Operators

Local Client/ Utility Operators report to the local Utility Manager, who serves as the primary point-of-contact for the CRSO. Tasks to be performed by local utility operators are described in Section 3.16.1.4 of this ER. Although they will not directly handle the spent treatment media, local utility operators who will monitor the Uranium Removal System on a daily basis may incidentally be exposed to radiation as a result of proximity to the system. Training requirements for local utility operators are described in Section 3.16.2.3 of this ER.

WRT will ensure that local um their operators will satisfy appropriate basic training requirements outlined in this ER prior to initiating licensed activities.

3.14 Management Control Program

3.14.1 Performance-Based License

Consistent with its initial license application request and subsequent license issued by the NRC, WRT requests that WRT, in conjunction with its SERP, have the latitude to register new uranium water treatment systems, initiate changes to existing systems, and conduct tests in accordance with NRC regulations and/or guidance without obtaining prior NRC review and approval. WRT understands that all changes made by WRT personnel at Client sites are subject to NRC inspection and enforcement actions. WRT also understands that WRT must obtain NRC review and approval of any proposed alteration to a license condition. Requesting changes to license conditions or performance requirements will require filing a license amendment application pursuant to 10 CFR Part 40.

Consistent with its initial license application and subsequent license issued by the NRC, WRT requests to continue to be authorized to register under its multi-site license new uranium water treatment systems at Client sites where the Client has agreed that the system(s) will operate under the WRT Radiation Protection Program, as described in this ER. WRT's SERP will review Client requirements and the operating parameters of the proposed treatment system and will document the conclusion that such requirements and operating parameters are within the performance requirements set forth in this ER. Such documentation will be maintained for NRC and relevant Agreement State inspection.

WRT requests that WRT may, without NRC approval: (a) make changes to standard operating procedures and (b) conduct tests or experiments, if WRT ensures that the following conditions are met:

(1) the change, test or experiment does not conflict with any requirement specifically stated in WRT's license or impair WRT's ability to meet all applicable NRC regulations;

(2) there is no degradation in the safety or environmental commitments made in this ER or other licensing documents;

(3) the change, test or experiment is consistent with NRC's findings in its environmental and technical reviews of the ER.

If any of these conditions are not met, if any alterations to license conditions or to the performance requirements in the ER or if implementation of uranium water treatment programs are outside the scope of such performance requirements, NRC approval through a license amendment will be required. WRT's SERP will ensure that all such determinations are documented and that all records are kept until final license termination. All such determinations will be reported to NRC annually.

3.14.2 Safety and Environmental Review Panel

WRT will establish a Safety and Environmental Review Panel (SERP) to ensure that proposed licensed activities or proposed changes are within the boundaries of the performance based multi-site license requirements/descriptions as detailed in this ER.

The SERP will consist of a minimum of three (3) individuals employed or appointed by WRT and an WRT employee will be designated the SERP Chairperson. One member of the SERP will have expertise in management and be responsible for managerial and financial approval changes; one member will have expertise in operations and/or construction and will have responsibility for implementing any operational changes; and one member will 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 (3) identified above may be consultants or attorneys.

3.14.3 Recordkeeping

The recordkeeping program utilized by WRT will be fully compliant with NRC regulations and requirements. The program addresses two aspects of uranium water treatment facility system operation. The first aspect is a commitment to keep 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 determining if applicable changes were made consistent with the license. The second is a commitment to maintain active records of employee exposure data and to provide employees with access to personal annual dose data in compliance with NRC requirements. WRT will maintain and retain such records in accordance with 10 CFR 40.61(b) requirements. The SERP will document and maintain all decisions and determinations and make such documentation available to the NRC or relevant Agreement States for inspection. WRT will provide the NRC with annual reports of all such decisions and determinations.

3.14.4 Standard Operating Procedures

All principle work assignments/activities for WRT employees will be conducted in accordance with written standard operating procedures (SOPs). Prior to implementation, all new or revised SOPs affecting radiation safety will be reviewed by the SERP. The CRSO will annually audit all operational and monitoring procedures to assure they remain appropriate and are not in conflict with newly established radiation safety policies or regulatory requirements. Additionally, the CRSO will annually review all operating procedures to ensure that radiation exposures will be maintained ALARA. All SOPs for licensed activities will be reviewed and approved by the SERP prior to implementation.

3.15 Audits and Inspections

3.15.1 Inspections

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 Uranium Removal System malfunction, release of treatment media, transportation accident or upon request of the Client/local Utility Manager.

3.15.2 ALARA Audit

As part of the annual audit of the WRT Radiation Protection and ALARA Program, the CRSO will review the current condition of the Client uranium water treatment systems at licensed sites, with the goal of possibly improving ALARA conditions at the site(s). The review will address the state of technology, containment measures, radiation safety procedures, any radiologic incidents during the past year, and any ALARA-based improvements that could be made and confirming that corrective actions recommended in previous audit findings have been implemented. Findings and proposed corrective actions resulting from this audit will be reviewed and approved by the SERP.

3.16 Radiation Protection Program

This Section presents the WRT Radiation Protection and ALARA Program that will be established and maintained by WRT to satisfy the applicable radiation protection and As Low As Reasonably Achievable (ALARA) requirements of Title 10 CFR 20.1101, as applicable. This Section also describes the classification of workers by job function, the level of required training, radiation and personnel monitoring, and general and emergency procedures, which are the key elements of the WRT Radiation Protection and ALARA Program. This program applies to WRT System Specialists and to the Client's personnel who may perform job functions in proximity to the Uranium Removal System.

Performance-Based License Structure and the Designated "Users"

As a point of reference, the licensed material contained in the Uranium Removal System is not "used" in the customary sense as in a nuclear reactor, laboratory or medical facility. The naturally-occurring uranium is present in a Client's drinking water supply at levels above its regulatory MCL or in a Client's groundwater or other contaminated water source at levels above the Agreement State/EPA established regulatory limit.

The specific duties and responsibilities for the WRT System Specialists and the Client personnel are presented in Sections 3.16.1.2 and 3.16.1.3, respectively. The WRT System Specialists are the primary "users" of the radioactive material, as they are the ones who come in contact with and handle the licensed material as part of their system service activities including spent media exchanges. As introduced in Preface Section 1.4, with respect to these groups performing their respective tasks in accordance with this license (and subsequent license amendments), WRT requests to continue the performance-based license structure authorized in the existing license, that allows WRT Systems Specialists and others to work under the license without having to specifically add or delete these individuals from the license through a license amendment. The individual WRT employees (WRT Systems Specialists, RSOs, RCTs, etc.) will be approved by the WRT CRSO.

WRT requests a training program in this application that will be used for its employees, and the Client personnel. As part of the performance-based format requested for this license, WRT will document that the training has been successfully completed before any employee can begin to work with or around the Uranium Removal System. The training will be provided by the WRT CRSO or qualified designee.

3.16.1 Classification of Work Groups Involved with the Uranium Removal Systems

Proper implementation of a Radiation Protection and ALARA Program begins with an understanding of the work to be performed, the personnel/groups responsible for performing the work, and the radiological hazards associated with the work. Individuals normally involved with the operation of the Uranium Removal System include WRT employees such as the WRT Corporate RSO and WRT System Specialists, as well as the Client's personnel for example the Client Utility Manager and Utility Operator. This division of labor results in employees performing different functions in the licensed area as will be described in the subsections below.

WRT System Specialists are the individuals who maintain the WRT uranium treatment system and manage the radioactive material, including performing the exchanges of the uranium-laden spent media and preparing it for shipment from the treatment site to a properly licensed facility for final disposition (i.e., processing as an equivalent feed or direct disposal).

The Client's personnel are responsible for the overall operation of the drinking water supply or water treatment facility. While the operators will not perform work tasks that bring them into contact with the radioactive treatment media, they will be performing other tasks in the treatment building, possibly in the vicinity of the WRT Uranium Removal System.

These job tasks in and around the radioactive material area may expose them to small amounts of radiation from the licensed portion of the Uranium Removal System. The Client Utility Manager will direct their respective personnel in the daily operation of the entire water supply/treatment system and will serve as the primary point-of-contact with WRT's Corporate RSO.

Under the terms of the standard water treatment agreements between WRT and each of its Clients, there is a clear division of labor between the responsibilities and tasks assigned to the WRT System Specialists, to and to the Client personnel. During the term of and upon termination of the Treatment Agreement,

> ". . . WRT will ensure that employees and agents of the Client will not be required, at any time:
>
> - to install, remove or otherwise handle any uranium media (Z-92®) or any spent treatment media with respect to such Uranium Removal Systems; or
>
> - to install in, apply to, or remove from, such Uranium Removal Systems any chemical, compound, material or other substance . . ."

3.16.1.1 WRT Corporate Radiation Safety Officer

Because of the nature of the Uranium Removal System, which require no chemical additions or backwashing of residuals, and which Client or Utility Managers and Operators typically will only monitor and inspect the Systems, there will be no need for an on-site RSO at the Client water treatment facility. As part of the service provided to the Client, when the Client chooses to operate the treatment system under the WRT Radiation Protection Program as part of a water treatment agreement with WRT, WRT's current Corporate Radiation Safety Officer (CRSO), Mr. Theodore G. Adams, will function as the CRSO for each of the individual Client water treatment sites, unless and until a change is completed per WRT's performance-based license through its SERP. Mr. Adams has held this position for over eight (8) years, after the NRC formally reviewed his credentials and experience and approved him as the CRSO in June 2008.

Responsibilities of the CRSO

WRT's designated CRSO has primary responsibility for developing and implementing the Radiation Protection and ALARA Program and has continuing responsibility for oversight and supervision of program implementation at each Client facility.

The CRSO's areas of responsibility include the following:

- Responsibility for the development and administration of the Radiation Protection Program. This program will include setting up the general rules, administrative policies, and operating procedures for worker and public protection consistent with the requirements of 10 CFR 20, as applicable. The Program will be subject to an annual review of its content and implementation;

- Responsibility to assure that radioactive materials possessed under the license conform to the materials listed in the license;

- Responsibility to assure that radioactive materials are properly secured against unauthorized removal at all times when they are not in use;

- Responsibility for approving individuals ("users") who will handle/use radioactive materials; and assuring that radioactive materials are used only by individuals authorized. **Note**: Under the performance-based format of the existing NRC license these "users" do not have to be specifically named on the license;

- Responsibility for conducting and documenting training for both the WRT System Specialists and the Client's personnel whose jobs may have them performing tasks in the vicinity of the treatment system;

- Responsibility for review and approval of equipment design, process changes or changes in operating procedures to ensure that the Radiation Protection Program is maintained;

- Responsibility for the treatment-area and personnel monitoring (dosimetry) program;

- Responsibility for documenting shipment and final disposition of the radioactive spent treatment media;

- Responsibility for auditing/reviewing the Radiation Protection Program effectiveness;

- Responsibility to serve as a point of contact and give assistance in case of emergency to assure that proper authorities are notified promptly in case of accident or release of radioactive material;

- Responsibility to assure that the terms and conditions of the license are met and the required records are maintained.

The CRSO's day-to-day duties and tasks associated with managing the Radiation Protection Program may be delegated to a qualified designee approved by the CRSO. However, the ultimate responsibility for these duties and tasks will remain with the CRSO.

The CRSO will ensure that the qualified RSO designee will be adequately trained in Radiation Protection and in the particular duties/areas that will be delegated to him. In addition, the RSO designee will work under the direct supervision of the WRT CRSO.

Authority of the CRSO

The WRT CRSO will have sufficient authority, organizational freedom and management prerogative to:

(1) enforce regulations and policies that affect any aspect of the Radiation Protection Program;

(2) identify radiation safety problems;

(3) investigate radiation safety problems such as, overexposures, accidents, spills, losses, theft, unauthorized receipts, uses, transfers, disposals, misadministration, and other deviations from approved radiation safety practice and implement corrective actions as necessary;

(4) initiate, recommend or provide corrective actions for radiation safety problems;

(5) verify implementation of corrective actions; and

(6) retain or cause to be retained in WRT's central files records of items listed in Items (1) through (5) above.

Qualifications of the CRSO

The minimum qualifications (i.e., experience and training) for the CRSO are:

- A Bachelor of Science Degree in Biological or Physical Sciences, Engineering or related discipline from an accredited college/university (or equivalent experience/training)
- A minimum of 2 years of applied Radiation Protection experience
- Previous training consistent with NRC NUREG 1556 Vol. 18, Appendix H topics (or equivalent).

A copy of Mr. Ted Adams', the current CRSO, qualifications, education and training related to radiation safety is included in Exhibit 3-1, presented at the end of this Subsection 3.16.1.

3.16.1.2 Alternate Radiation Safety Officers

If at any time the WRT CRSO is not able to carry out his responsibility, WRT designated Alternate Radiation Safety Officers (ARSO), i.e., a "designated CRSO", will be able to provide the required CRSO responsibility during his absence. ARSOs will have the same responsibilities and authority as the CRSO during their time in this position. The qualifications of the ARSOs will be consistent with the qualifications identified for the CRSO, presented in Section 3.16.1.1.

Mr. Duane Bollig, currently the Director-Environmental & Regulatory Affairs and the former WRT CRSO, and Mr. Kent Stovall, currently WRT's field RSO, are the designated ARSOs. Copies of their qualifications, education and training related to radiation safety and the CRSO position are also included in Exhibit 3-1.

3.16.1.3 WRT System Specialists

WRT is responsible for performing all the tasks involved in handling the licensed radioactive material stored in, monitoring, and decommissioning of the Uranium Removal System.

WRT System Specialists are the individuals who will actively handle the radioactive treatment media as required, including performing the exchanges of the uranium-laden spent media and preparing it for shipment from the treatment site to a properly licensed facility for final disposition (i.e., direct disposal or recovery, in the case of the uranium media).

WRT System Specialists will perform the following specific tasks related to handling treatment media:

1. Perform maintenance, repair, and/or replacement operations on components of the Uranium Removal System(s) containing licensed material;
2. Monitor the operating data and performance and the Uranium Removal System;
3. Monitor performance and useful life of treatment media;
4. Install fresh treatment media in the Uranium Removal System;
5. Perform media exchanges to remove the radioactive spent treatment media (the radioactive treatment residuals);
6. Prepare and package the spent treatment media for transport and arrange for transportation of the spent treatment media;
7. Deal with media accidents, spills, and system upset conditions, and assist with performing post-cleanup contamination surveys.

3.16.1.4 Client Personnel

As used in this license application "Client Personnel" means the Client's manager who is responsible for the water treatment project and the Client's water utility operators who may have other water treatment tasks that may take them in the immediate vicinity of the radionuclide removal system. An example of these operators is a CWS's drinking water operator, who have their normal duties at a well house, but now they may be performing those other duties in the vicinity of a radionuclide removal system that is located in the same well house. This work may expose them to small amounts of radiation from the Uranium Removal System.

The Client's personnel will not be directly involved at all with a WRT licensed activity, for example an exchange of spent media, but may be only indirectly involved with or exposed to a longer-term WRT treatment operation. Examples of this indirect involvement are simply monitoring the daily operation of the treatment system(s), possibly performing infrequent minor maintenance on components of the overall water treatment system at the facility that don't involve the treatment vessels or potential contact with the radioactive material, and being in the general area of the uranium treatment system while observing a media exchange.

Although they will not directly handle the radioactive treatment media, the Client personnel who will monitor the Uranium Removal System on a daily basis, may incidentally be exposed to radiation because of proximity to the System.

As with most of the other existing functions at a treatment/well house, the operation of the Uranium Removal System has been automated as much as possible, and very little direct operator involvement will be required. The Client personnel tasks related to the Uranium Removal System(s) are primarily to inspect and observe the System(s) and monitor and record operating data, as summarized below:

1. Perform a general "walk-around" inspection of equipment operation on a daily or other regular periodic basis as determined by WRT and/or the Client personnel.

2. Observe/record System flow-rates and operating pressures. In most cases, these readings can be monitored at a control panel that is not in close proximity to the treatment vessel;

3. Collect inflow and discharge water samples. Sampling usually can be done away from the treatment vessel and can be performed on the utility's normal schedule for water-quality compliance monitoring;

4. Perform miscellaneous general inspection and/or maintenance tasks related to the components necessary for the operation of drinking water supply facility. These tasks may include, but are not limited to, periodic operational checks and maintenance of valves, instrumentation, chemical injection equipment, and strainers/safety filters upstream and downstream of the Uranium Removal System(s).

5. Perform miscellaneous general inspection and/or maintenance tasks related to the components necessary for the operation of overall drinking water supply or water treatment

facility. These tasks may include, but are not limited to, periodic operational checks and maintenance of valves, instrumentation, chemical injection equipment, strainers/safety filters and other equipment in the treatment room, upstream and downstream of the WRT Uranium Removal System. These work tasks, however, may also include infrequently performing minor maintenance on components of the WRT treatment systems, specifically only tasks that do not have the potential to bring the Client's personnel into direct contact with the radioactive treatment media.

3.16.1.5 Client Utility Manager – Local Point of Contact

Typically, the Client Utility Manager will be the primary local point of contact (POC) with WRT's CRSO and also serve as the Client POC for the NRC. At larger CWSs or treatment sites this person may be the public works director, utility manager, or engineering manager; at a smaller CWS it could be the water superintendent or lead operator.

The Utility Manager or the designated POC for each CWS/site will work with the WRT CRSO on issues of site security, notification of system upsets, utility operator training, and posting of notices and dosimetry badges. Any radiological support needed will be provided by WRT trained and qualified radiation personnel. Therefore, the responsibilities/duties of the Utility Manager related to the Uranium Removal system will be those that are non-radioactive related, and essentially will be very similar to those that he/she already has as the manager of a public water supply – security, proper operation, training, etc.

These duties/tasks include but may not be limited to: serving as the primary point-of-contact/designated user; placing/exchanging dosimeters at the site; placing/maintaining appropriate radiation postings/signage/notices; maintaining general housekeeping, ensuring utility operators/managers receive Radiation Safety Awareness Training; instituting initial corrective actions or shutting down operations when unsafe or emergency conditions arises (under the direction of the WRT CRSO or qualified designee); maintaining access control to the site/treatment system, and providing the day-to-day oversight of the facility operations to ensure radiation exposures to local utility operators/managers and/or members of the public are maintained ALARA.

The radiologic education, training, and expertise necessary, as determined by the WRT CRSO, commensurate with the radiation hazards related to the WRT treatment system and the duties and tasks at the treatment site, will be provided to the local Utility Manager and operators – Radiation Safety Awareness Training and ancillary training related to their non-radiological responsibilities.

Exhibit 3-1

Education, Qualifications, and Radiologic Experience of Senior WRT Radiation Safety Staff

1. **Theodore G. Adams, Corporate RSO**

2. **Duane W. Bollig, Alternate RSO**

3. **Kent J. Stovall, Alternate RSO**

THEODORE G. ADAMS, PMP

Title **Senior Radiological Consultant**

Expertise

Radiation Safety and Environmental Protection
Radioactive Waste Management
Remediation, Decontamination and Decommissioning
Quality Assurance
Expert Witness
Project Management
Licensing

Experience

Mr. Adams is a certified Radiation Safety Expert with over 34 years experience in the remediation/ decontamination and decommissioning of chemically and/or radiologically-contaminated commercial and government facilities. Many of these sites have received license termination and have been released for unrestricted use. He has extensive experience with various regulatory agencies, including the Nuclear Regulatory Commission (NRC), Department of Energy (DOE), and Environmental Protection Agency (EPA), as well as, various Agreement States.

Mr. Adams currently serves as President and Senior Radiological Consultant for T. G. Adams and Associates, Inc.

Professional History

President and Founder of T. G. Adams and Associates, Inc.
Springville, New York (2000 - Present)

Provides management and technical support to commercial and government clients facing radiological regulatory, remediation, and/or licensing issues.

Senior Radiological Consultant and Radiation Safety Officer for Northeast Ohio Regional Sewer District
Cleveland, Ohio

Provides radiological coverage and RSO duties to the Northeast Ohio Regional Sewer District's (NEORSD's) Easterly and Southerly Wastewater Treatment Plants.

Senior Consultant to Kiski Valley Wastewater Pollution Control Authority
Leechburg, Pennsylvania

Provides technical expertise to the development of closure plans, radiological control plans, and final status survey plans for the remediation project. Provided on-site radiological coverage during remediation, transportation, and disposal activities.

Corporate RSO and Senior Radiological Consultant to Water Remediation Technology, LLC
Wheat Ridge, Colorado

Provides technical and management consulting support in the area of naturally-occurring and technically-enhanced naturally-occurring radioactive material (NORM/TENORM) to support licensing and operation of radium/uranium drinking water treatment systems. Assists in the preparation of license applications and amendments. Provides radiological support for training, media exchanges, and implementation of the WRT Radiological Safety Program.

Presented testimony before the Illinois Pollution Control Board

Senior Project Manager, URS Group, Inc.
West Valley Demonstration Project, West Valley, New York (2001 - 2004)

Senior Project Manager for West Valley Demonstration Project
West Valley, New York

Managed professional staff of 50 individuals providing technical and administrative support/expertise to DOE contractor (West Valley Nuclear Services Company [WVNSCO]) in the areas of environmental monitoring, quality assurance, laboratory analysis, facility closure engineering, safety analysis, remediation planning, and project risk management.

Radiation Safety Officer (RSO) for BP Chemicals, Inc.
Warrensville, Ohio

Provided technical support as RSO for the cleanup/remediation of facility contaminated with depleted uranium.

Vice President and Office Manager, B. Koh & Associates, Inc. (BKA)
Springville, New York (1993 - 2000)

Managed staff of senior professionals and 20 field personnel.

Project Manager
Chemetron Corporation Remediation Project, Newburgh Heights, Ohio

Provided management and technical oversight for the planning and execution of the remediation of 19 industrial buildings, a three-acre industrial site, and a seven-acre unpermitted landfill contaminated with depleted uranium.

Served as Project/Construction Manager of on-site engineered closure cell.

Managed on-site mobile gamma spectroscopy laboratory.

Managed off-site shipment/disposal of higher activity waste to Envirocare.

Managed preparation of Radiological Control Plan and related procedures,

Health and Safety Plan, Remediation Plan, Quality Assurance Plan, and Final Radiological Survey Report.

Managed preparation of License Amendment Application, Request for License Termination, and provided interface with NRC (HQ and Region III) and Ohio EPA, state representatives, local officials, and the public.

Obtained NRC unrestricted release of all properties and termination of license. Served as RSO.

Project Manager
Coleman Company, Wichita, Kansas

Managed the preparation of the Radiological Control Plan and procedures, Quality Assurance Plan, and Remediation Plan.

Managed the performance of the survey of unaffected areas with the buildings, open land areas, and sewers.

Prepared the Unaffected Area Survey and Sampling Report.

Interfaced with Kansas Department of Health and Environment.

Project Manager
Kiski Valley Wastewater Treatment Plant, Kiski, Pennsylvania

Provided management and technical oversight for the characterization and remediation planning of a one-acre ash lagoon contaminated with enriched uranium.

Interfaced with NRC (HQ and Region I) and Pennsylvania Department of Environmental Protection. Served as RSO.

Project Manager
Kaiser Aluminum, Tulsa Oklahoma

Provided management and technical oversight for the characterization of thorium-contaminated open land areas.

Prepared Radiological Control Plan and Final Characterization Report.

Project Manager
Engelhard Corporation Remediation Project, Cleveland, Ohio

Provided management and technical oversight for planning and execution of the remediation of eight industrial buildings and several large (>10 acres) open land areas contaminated with normal processed uranium from MED/AEC activities.

Managed preparation of Radiological Control Plan and associated procedures, Health and Safety Plan, Remediation Plan, QA Plan, Site Characterization Plan and Report for buildings and open land areas.

Developed remediation plans for buildings and open land areas.

Obtained NRC and Ohio Department of Health release for unrestricted use for all buildings. Served as RSO.

Radiological Manager
Benton Harbor Remediation Project, Benton Harbor, Michigan

Provided management and technical support to prime contractor for the buildings and property contaminated with uranium.

Prepared required remediation documentation, Health and Safety Plan, Radiological Control Plan and procedures, QA plan, and Waste Management Plan.

Interfaced with USEPA, Bureau of Reclamation, and state of Michigan. Served as RSO.

Project Manager
ALCOA Corporation Remediation Project, Cleveland, Ohio

Provided management and technical support for remediation of open land areas contaminated with depleted uranium and thorium.

Managed the remediation and NRC release of property for unrestricted release. Served as RSO.

Project Manager
Chevron Chemical Corporation, Cleveland, Ohio

Provided management and technical support for characterization of open land areas contaminated with depleted uranium and thorium.

Prepared characterization report.

Project Manager
Eliskim Remediation Project, Geneva, Ohio

Provided management and technical support for remediation of open land areas contaminated with chromium, nickel, and PCBs.

Prepared Removal Action Plan and Report.

Interfaced with USEPA Region IV and Ohio EPA.

Project Manager
Westinghouse Specialty Metals Remediation Project, Blairsville, Pennsylvania

Provided management and technical support to characterization and remediation planning of former Zircaloy Burn Area contaminated with depleted and enriched uranium.

Prepared Feasibility Study to preferred remediation alternative.

Developed Health and Safety Plan, Radiological Control Plan and procedures, Quality Assurance Plan, and Remediation Plan.

Senior Technical Manager
BP Chemicals, Inc. Remediation Project, Lima, Ohio

Provided technical radiological support to Project Manager to remediation buildings, open land areas, and industrial surface impoundments contaminated with depleted uranium and acrylonitrile (mixed waste) in accordance with NRC, EPA, and Ohio EPA cleanup criteria.

Developed Health and Safety Plan, Quality Assurance Plan, Radiological Control Plan and procedures.

Prepared License Amendment Application (10 CFR Part 40).

Reviewed site characterization plans, performance of radiological pathway analyses, and closure cell design.

Developed radiological sampling and prepared Safety Analysis Plan.

Provided technical support for the remediation of removal and stabilizing the mixed waste in a RCRA-designed closure cell.

Performed operational readiness review and conducted inspections and audits of remediation contractor activities. Final radiological release survey of selected open land areas.

Obtained NRC and Ohio Department of Health releases for remediated areas for unrestricted use. Served as RSO designee.

Senior Technical Manager
RMI Remediation Project, Ashtabula, Ohio

Provided technical support to RMI Project Manager for remediation of buildings and openland areas contaminated with depleted and enriched uranium and Technicum-99 by DOE- and NRC-licensed activities.

Prepared Site Characterization Report and revised Site Remediation Plan for approval by DOE and acceptance by the NRC.

Provided doses assessment (RESRAD and CAP-88) for residual contamination.

Senior Technical Manager
Lamotite/Horizons Remediation Project, Cleveland, Ohio

Provided technical support to BKA Project Manager for remediation of buildings and open land areas contaminated with thorium from DOE activities.

Developed remediation planning documents and cost estimates.

Profiled waste, packaging, and shipment of waste to off-site LLRW disposal facility. Served as RSO.

Senior Technical Radiological Consultant
NEORSD Ash Lagoon Removal Project, Cleveland, Ohio

Provided technical support to NEORSD Project Manager for planning and execution of characterization and remediation of incinerated sewage sludge ash contaminated with Cobalt-60.

Served as expert witness for NEORSD.

Developed Radiological Control Plan and procedures, Health and Safety Plan, Quality Assurance Plan, Site Characterization Plan and Report.

Obtained NRC release for unrestricted use.

Interfaced with NRC (HQ and Region III) personnel. Served as RSO.

Senior Technical Manager
AAR, Inc., Livonia, Michigan

Provided technical support to BKA Project Manager for characterization of open land areas contaminated with thorium.

Developed Health and Safety Plan, Quality Assurance Plan, Radiological Control Plan and procedures.

Prepared Characterization Report and Remediation Plan Addendum.

Technical Manager
Westinghouse Hanford Company (WHC), Hanford, Washington

Assisted in engineering evaluations for WHC Waste Management Operations, including laboratory analyses (LLW, TRU Waste) support.

Prepared TRU waste section of waste acceptance criteria document.

Technical Manager
Westinghouse Savannah River Company (WSRC), Columbia, South Carolina

Managed the total rewrite of WSRC Waste Management Compliance documents for LLRW, TRU waste, PCB waste, hazardous waste, and solid waste for various on-site facilities (i.e., Consolidated Incineration Facility, Hot Cells/Canyons, PCB Storage Area, Hazardous Waste Storage Area).

Technical Consultant
West Valley Nuclear Services (WVNS), West Valley, New York

Developed LLRW Certification Program Plan, which included complete strategies from initial characterization to final packaging.

Senior Technical Manager
METCOA Company Remediation Project, Pulaski, Pennsylvania

Provided technical support to BKA Project Manager in remediation of buildings and open land areas contaminated with thorium.

Reviewed Health and Safety Plan, Radiological Control Plan and procedures, and Final Survey Plan and Report.
Set up on-site mobile gamma spectroscopy laboratory for sample analysis needs.
Obtained NRC release for unrestricted use and EPA approval.

Senior Technical Manager
Ronson Prometcor Remediation Project, Newark, New Jersey

Provided technical support to BKA Project Manager in remediation of buildings and open land areas contaminated with thorium.

Developed and executed site characterization activities.

Reviewed Site Characterization Report, Remediation Plan, and Radiological Control Plan and procedures.

Interfaced with NRC Region I and New Jersey.

Managing Associate for Radiological and Government Services Division
Dames & Moore, Orchard Park, New York
1990 - 1993

Project Manager
Chemetron Corporation Remediation Project, Newburgh Heights, Ohio

Managed the planning and execution of site characterization and initial remediation planning activities, including design of disposal closure cells for industrial sites contaminated with depleted uranium and solid waste, in accordance with NRC release criteria and EPA, RFI, and RI/FS guidelines.

Provided oversight of the design contractor.

Managed the technical and quality assurance direction to the project and represented client before the NRC, Ohio EPA, and state and local public officials.

Assisted the client and the legal counsel in preparation of license renewal under 10 CFR Part 40, including Health and Safety Plan, the Decommissioning Funding Plan, the Financial Assurance Plan for Decommissioning, and the Safety Analysis and Dose Assessment.

Senior Radiological Manager
Cornell University, Ithaca, New York

Managed the oversight for the characterization of the radioactive burial site, including installation of groundwater monitoring wells.

Conducted initial assessment of the potential radiological impacts to the public and the environment.

Interfaced with Cornell University Radiation Safety Officer.

Senior Radiological Manager
BP Chemicals, Inc. Remediation Project, Lima, Ohio

Managed the planning and execution of radiological activities required to support remediation of industrial surface impoundments contaminated with depleted uranium and acrylonitrile waste (mixed waste) in accordance with NRC, EPA, and Ohio EPA cleanup criteria.

Managed preparation of site characterization plans and performance of radiological pathway analyses.

Reviewed closure cell design.

Developed Radiological Sampling and Analysis Plan.

Prepared Safety Analysis Reports and client Health and Safety Plan and procedures.

Provided technical support regarding radiological protection/control in remediation activities.

Interfaced with NRC (HQ and Region III).

Senior Technical Manager
New York State Energy Research and Development Authority, Albany, New York

Provided technical support for development to design and construct an interim LLRW storage facility in New York State.

Quality Assurance Manager and Licensing Manager
New York State LLRW Siting Commission, Troy, New York (1989 - 1990)

Quality Assurance Manager

Developed and implemented Quality Assurance Program for site and method selection activities. Interfaced between Siting Commission, county officials, technical consultants, and the general public.

Licensing Manager

Managed technical and programmatic preparation of LLRW Disposal Facility License Application. Prepared license application matrix per NUREGs 1199 and 1200.

DOE Safety and Decommissioning and Decontamination Manager
West Valley Demonstration Project, West Valley, New York (1983 – 1989)

Provided technical and programmatic administration support in areas of environmental protection, safety and health, quality assurance, radiological protection for start-up and operations of new facilities constructed on site (HLW Vitrification Facility, Supernatant Treatment System, LLW Treatment Facility, Cement Solidification, LLW Storage Facility, TRU Waste Assay System) and decontamination/decommissioning of selected areas of the Main Processing Plant.

Assisted in shipment of 625 spent fuel assemblies to original owners.

Managed WVDP D&D operations of Main Plant and associated facilities, including special removal/ remediation of waste previously disposed in burial ground. Remediation of extraction cells (high airborne, low exposure, plutonium, and uranium), process cells (high exposure), and cutting into the HLW tanks to support Supernatant Treatment System/Vitrification activities.

Assisted in development of Quality Assurance program for HLW glass producers.

Interfaced with federal and state agencies (EPA, NRC, DOT, OSHA, NYSDEC, NYSDOH, NYSDOT), national laboratories, public officials, and concerned private groups on ES&H/QA, waste management, and D&D issues.

Obtained federal and state permits and NRC and DOE approvals to support start-up of liquid high-level radioactive Supernatant Treatment System.

Provided oversight of the Site Security Program to ensure compliance with DOE security requirements.

DOE-Chicago
Argonne, Illinois (1981 - 1983)

Waste Management Specialist

Provided technical and programmatic specialist in D&D and hazardous radioactive waste.

Conducted appraisals of DOE facilities, identification of potential ES&H problems, and evaluation of regulatory compliance.

Coordinated packaging and shipment of LLRW and TRU wastes to Hanford, Washington.

Served as Project Manager to DOE for D&D of New Brunswick Laboratory, ANL Plutonium Glovebox Facility, and Zero Gradient Synchrotrons.

Health Protection Specialist

Served as technical specialist in the areas of environmental protection, industrial hygiene/occupational health and safety, and health physics.

Performed appraisals of DOE facility, identification of potential ES&H problems, and evaluation of regulatory compliance.

Assisted in the development and review of environmental assessments and impact statements.

Academic Background

B.S., Biology; Minor, Chemistry
University of Pittsburgh, Pittsburgh, Pennsylvania

M.S., Health Physics
Purdue University, 1978

PhD, Environmental Assessment
Purdue University (candidate)

Clearances

"Q" Clearance (inactive)

Certifications

NQA-1 Lead Auditor
State of Ohio-Certified Radiation Expert
40-Hour Hazardous Waste Operations and Emergency Response Training
8-Hour Supervisory Training
10-Hour OSHA Construction Training
30-Hour OSHA Construction Training
Confined Space Competent Person Training
Certified Project Manager (PMI #185793)

Other Training

Project Management
Public Speaking/Media Interaction
Human Factors
Operational Readiness
Job Task Analysis
Management Oversight Risk Tree (MORT) Analysis
Risk Analysis
Quality Assurance (Auditor and Lead Auditor)

Professional Affiliations

American Nuclear Society
Health Physics Society
Western New York Chapter of Health Physics Society
Project Management Institute
Project Management Institute, Buffalo Chapter
Gideons International

Presentations/ Publications

Adams, T.G., "Summary of EPA's Sludge and Ash Radiological Survey Report," presented at the 2004 Greater Buffalo Environmental Conference, Buffalo, New York

Adams, T.G., "Non-traditional Approach to Site Release," presented at the Waste Management '99 Conference, Tucson, Arizona

Adams, T.G., "Industrial Mixed Waste Management," presented at the Mixed Waste Regulation Conference, Washington, DC

Adams, T.G., "Environmental Monitoring Program Interaction Between the West Valley Demonstration Project and New York State Agencies," presented at the 5th Annual DOE Environmental Protection Information Meeting, Albuquerque, New Mexico

Duane W. Bollig
Water Remediation Technology, LLC
5525 West 56th Avenue, Suite 100, Arvada, Colorado 80002

SUMMARY of QUALIFICATIONS

- Extensive and varied experience with increasing responsibility in copper, gold, industrial minerals, uranium, and coal. Broad technical background includes project management, environmental baseline and project permitting, engineering/feasibility studies, and operations. Demonstrated ability to adapt to numerous demanding tasks.

- Successfully managed federal, state, and local permitting processes for three major open pit mines and two in situ recovery uranium projects. Proven track record working with federal and state regulatory agencies, conducting public meetings, and interacting with media.

- Related leadership and training experience with the Colorado Air National Guard. Completed service in January 1999, with the rank of Major, as Chief of Intelligence for the 140th Fighter Wing. Responsible for operation of wing intelligence office and supervision of ten officer and enlisted members.

PROFESSIONAL EXPERIENCE RELATED TO RADIATION SAFETY

Water Remediation Technology, LLC 2003 to Present
VP – Environmental & Government Affairs – As the Corporate Radiation Safety Officer (through 2008), initially developed and implements WRT's Radiation Safety Program for water treatment systems nationwide. Responsible for licensing and compliance activities for multi-site licenses with the USNRC and at least twelve Agreement States, for removing radionuiclides and metals from drinking water and other groundwater resources. Environmental baseline activities include analyzing water quality, conducting/managing pre- and post-job contamination surveys, and managing the dosimetry program for WRT employees and client utility's operators. Developed similar program and procedures for the transportation of the hazardous treatment residuals. Develops radiation safety and transoportation training presentations, presenting to both to internal and client's personnel. Negotiates and manages waste disposal contracts, and ensures the proper documentation of the final disposition of the treatment residuals.

Conoco, Inc. (Conoco Minerals), Denver, Colorado 1979 to 1983
Senior Mining Engineer and Project Manager – Ruby Ranch Insitu Leach and Sand Rock Mill Uranium Projects. Responsible for exploration, mine engineering, environmental baseline studies, and permitting related to insitu-leach and open-pit uranium projects. Exploration work included understanding of radiation theory and radioactive decay series as they related to uranium depositon and interpretation of deday-product "roll fronts". Environmental baseline studies (i.e., air and water quality) and permitting required an understanding of occupational-health exposure limits.

Homestake Mining Company - Pitch Project, Gunnison, Colorado 1977 to 1979
Mine Engineer and Shift Foreman – Responsible for mine design, short-term planning, and supervising of mining/production crew for an open pit uranium mine. Interpretation of exploration results required understanding of radiation theory and radioactive decay theory. Mining operations included management of dosimetry monitoring.

Colorado Air National Guard, 140th Fighter Wing 1972 to 1999
Intelligence Officer – Experience Applicable to Radiation Safety Programs – responsible for preparing and presenting pilot and intelligence-personnel training briefings, situation briefings to commanders, and overall deployment brirefings; managing classified material library and records; conducting self inspections.

EDUCATION and TRAINING

- B.S. - Mineral Engineering/Mathematics - Colorado School of Mines, 1972
- Graduate Studies - Operations Research - Colorado School of Mines

- *Radiation Safety Officer Course,* 40 hours, Radiatioin Safety Academy, Gaithersburg MD, July 2003
- *USDOT Requirements for Shipping/Receiving Radioactive Materials*, Radiation Safety Academy, July 2003
- *Hazardous Materials/Waste Manager Training Course*, Institute of Chemical and Hazardous Materials Managers and Colorado State University, June 2003
- *NORM Radiation Supervisor Course*, American Radiation Services, Inc., November 2003.
- *Advanced Radiation Safety Officer Course*, 40 hours, Radiation Safety Academy, April 2005

Certificate of Training

Awarded To

Duane Bollig

Recognizing completion of 40 hours of specialized instruction in

Radiation Safety Officer

July 11, 2003

Presented By

CSI-Radiation Safety Academy
481 North Frederick Avenue, Suite 302
Gaithersburg, Maryland 20877

AAHP has awarded this course 32 Continuing Education Credits, 2003-00-018
ABIH has awarded this course 4.5 CM Points, CM Approval # 03-021

Raymond Johnson, CHP, PE, RSO
Training Director

Certificate of Training

This Certifies That

Duane Bollig

has been trained, tested and successfully completed the specialized instruction in

DOT & NRC Requirements for Shipping and Receiving Radioactive Materials

July 7, 2003

Presented By: Sean M. Austin, Instructor
CSI-Radiation Safety Academy
481 North Frederick Avenue, Suite 302, Gaithersburg, Maryland 20877
www.RadiationSafetyAcademy.com -- 301-990-6006

Presented For: Water Remediation Technology, LLC

Presented At: Gaithersburg, MD

This certifies that the employee named on this certificate has been trained and tested in accordance with the training requirements of 49 CFR, Subpart H.

Employer's Signature

This certificate is valid for 24 months for ICAO IATA and for three years for U.S. Department of Transportation and U.S. Nuclear Regulatory Commission or Agreement State Agencies.

Sean Austin, CHP
Senior Health Physicist

Certificate of Training

Awarded To

Duane Bollig

Recognizing completion of 5 days of specialized instruction in

Advanced Radiation Safety Officer

April 28, 2005

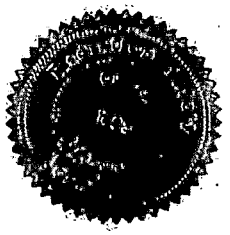
Presented By

Radiation Safety Academy
481 North Frederick Avenue, Suite 302
Gaithersburg, Maryland 20877

AAHP has awarded this course 32 Continuing Education Credits, 99-00-011
ABIH has awarded this course 4.5 CM Points, CM Approval #05-403

Ray Johnson

Raymond Johnson, MS, PE, RSO, FHPS, CHP
Academy Director



Certificate of Participation

DUANE BOLLIG

HAZARDOUS MATERIALS/WASTE MANAGER
TRAINING SHORT COURSE
JUNE 17-19, 2003

SPONSORED BY
DEPARTMENT OF CIVIL ENGINEERING

Colorado State University

Thomas G. Sanders, Ph.D., P.E., DEE, Course Director

David R. Stewart, Ph.D., P.E., CHMM, Course Director

Certificate of Qualification

This is to certify that

Duane W. Bollig

has successfully completed an approved 16-hour training course as a

NORM Radiation Supervisor

Certification Date: March 1 through March 2, 2005

Location: Arvada, Colorado

Mark W. Krohn
Instructor
American Radiation Services, Inc.

ARS AMERICAN RADIATION SERVICES, INC.

Certificate of Qualification

This is to certify that

Duane W. Bollig

has successfully completed a training course in

Transportation of Naturally Occurring Radioactive Material

The course met the training requirements of 49CFR172.700 through 172.704

Certification Date: March 1 through March 2, 2005 *Location:* Arvada, Colorado

Mark W. Krohn
Instructor
American Radiation Services, Inc.

ARS AMERICAN RADIATION SERVICES, INC.

Certificate of Training

This is to certify that

Duane W. Bollig

has successfully completed four (4) hours of specialized training in the following course related to WRT Water Treatment Systems

U.S. DOT Hazmat Transportation Training
Shipping of Class 7 Radioactive Material
May 17, 2007

Presented for
R.M.D. Operations, LLC

Charles T. Simmons, Esq.
Instructor
Thompson-Simmons, PLLC
Washington, DC

Presented by
Water Remediation Technology, LLC (WRT)
9500 W. 49th Avenue, Suite D100
Wheat Ridge, Colorado 80033

WRT

Kent J. Stovall

(720) 935-3431

11307 Navajo Cir, Unit A
Westminster, Co. 80234
kstovall@wrtnet.com

SUMMARY OF QUALIFICATIONS:

- 15 years experience in key operations support function in highly regulated Department of Energy facility
- 10 years experience working in the NORM drinking water industry
- Q Security Clearance (1992-2002) L Security Clearance (2002-2005) File #AB206945
- 5 years direct supervisory experience with up to 10 person crew accountability
- Qualified in risk based management decision making process practices
- Proficient in documentation of detailed surveys and performance testing of instrumentation for quality control
- 15 years experience in support of lab work, lab personnel, and Procedural Compliance
- Facilitated and participated in Process and Productivity Improvement Teams
- 24 years experience in leadership position for community wide volunteer organization
- Proven track record of motivation, direction and team building
- Excellent interpersonal, verbal and written communication skills
- Computer proficient

EXPERIENCE:

04/07-Present **Radiation Safety Officer** – Water Remediation Technology LLC, Responsible for day to day NORM radiation safety operations, including direct management of dosimeter program, training, Instrumentation, ALARA, and radiation safety procedural compliance. Interface with multiple departments to plan, schedule, and carry-out field maintenance operations when working with NORM regulated materials and/or components. Coordinate with operations team on field activities to ensure safe handling of NORM material as well as proper packaging and shipping of DOT regulated NORM shipments. Responsible for radioactive materials license records management. Communications with regulators and state agencies to insure regulatory compliance during radioactive materials license inspections.

02/06-10/06 **Customer Care Representative** - As a Customer Care Rep. with Lennar Homes one of the industries major builders, I was accountable as the primary contact for new home owners with customer care and warranty issues. Position requires excellent customer service skills, ability to multi task to meet numerous contractor and client schedules, determining warrantability of homeowner issues, and home owner follow up. Routine communications with home owners, conflict resolutions, coordinating repair projects, and scheduling are the primary skills used day to day. Position is also responsible for contractor billing, account follow-up, and customer relations to insure mutual satisfaction of timely work completion and quality.

04/90-04/05 **Radiation Control Technician/ Crew Leader** - *Kaiser Hill, Rocky Flats; Golden, Co.:* Specialized position highly trained within Department of Energy for express purpose of understanding nuclear radiological protection and implementing radiological controls. RCT responsibilities require extensive involvement in facility process operations, laboratory procedures, and environmental remediation projects, including safety, protocol, and compliance. Position requires the knowledge of chemistry, physics, radiological, and chemical material properties and hazards. Routine RCT responsibilities include: Air sampling, monitor and control work groups and conditions, recognize out of tolerance conditions and

take corrective actions, measurements and data collection using various instrumentation, document and record results into survey spread sheets, accountable for implementation of appropriate emergency response controls, ability to perform basic geometric and algebraic calculations, and interface with multiple departments as part of a project team. RCT certification requires successful completion of a written and oral review board, as well as, ongoing training, qualification and certification education. As Crew Leader position required daily supervision and leadership for up to 10 personnel.

Radiation Control Technician (RCT) practices are very similar to Quality Assurance inspection practices in that they involve understanding specifications using complex instrumentation to compare field conditions with specific requirements and taking appropriate corrective actions for out of specifications conditions. Additionally, participated in cross functional improvement teams to improve process efficiency, compliance, safety, and emergency preparedness.

1992-2005 **Rocky Flats Project Experience:**

- Building 020 Equipment and Property Remediation (1992-1993)
- Building 881 Operations - Site Survey (1994-1995)
- Environmental Remediation Trench 3&4 (1996)
- Environmental Remediation 374 CERCLA Tank Project (1996)
- Building 884 Repack Granulated Activated Carbon Waste (1997)
- Environmental Remediation Mound Project (1997)
- Environmental Remediation Trench 1 Project (1998)
- Environmental Remediation 903 Pad Characterization (1999)
- Building 707 Operations (1999-2001)
- Building 707 D&D Closure Project (2002-2004)
- Building 707 Demolition (2004-2005)
- Buildings 776/777 D&D Closure Project (2004-2005)
- Buildings 883/444 Demolition (2005)

06/86-04/90 **Warehouseman/ Lead Show Floor Designer** - *American Furniture Warehouse; Denver, Co.:* Hired as warehousemen with responsibility for inventory control, shipping, receiving, and materials management for the facility including but not limited to weekly, monthly and quarterly promotions of merchandise, Daily interface with the public, customer base in the filling of orders, processing of returns and reconciliation of account for customer service satisfaction. Promoted to Lead Show Floor Designer with accountability for promotional reorganization marketing and design of floor displays, new product set -up, as well as, pricing adjustments and supervised staff of two personnel.

VOLUNTEER RELATED EXPERIENCE:

03/93-Present 5 years experience as a coach, mentor, and coordinator for one of the states top girls high school basketball club organizations – BC Denver. Multiple volunteer leadership positions within Broomfield, Colorado Parks and Recreation Department from youth Basketball Coach to Football Coach, Broomfield Youth Football Association Board Member, Assistant Director, and Director; as well as, appointed to Broomfield Parks and Rec. Advisory Committee. I had accountability of volunteer base organization to include 600 youth, 30 coaches and 15 Board members with annual $75K oversight budget responsibility. Over fifteen years proven track record as coach and mentor for Parks and Recreation youth base.

EDUCATION/CERTIFICATION:

04/07-Present	Water Remediation Technology: Current US DOT Hazardous Materials Transportation, HazCom, and Dade Moeller- Radiation Safety Academy, 40 hr Radiation Safety Officer
05/90-04/05	Rocky Flats Training: DOE certified Radiation Control Technician; Hazardous Waste Operations; Respirator Fit Certification: Air Purifying, SCBA, SBA, and PAPR; Basic Nuclear Physics; Routine Air Sampling; Technical Work Documents; Vital Safety Systems Operational Status; Conduct of Operations; DOT Awareness; Emergency Response; Communications Criteria; Chemical Awareness; Beryllium and Asbestos Awareness; Fall Protection; Confined Space Entry Safety Awareness; Computer Security Ethics; Inventory Control, Fork lift/Aerial lift operation.
	Hazardous Waste Operations-3 Day Field Experience: Completed 03/09/05 Hazardous Waste Operations 8 Hour Refresher: Completed 10/07/04
2001-2002	Front Range Community College, Westminster, CO, 12 credit hours general computer classes
1983-1986	Colorado State University, Fort Collins, Co.: Obtained 93 technical credit hours towards B.S. Industrial Technology degree

REFERENCES AVAILABLE UPON REQUEST

Certificate of Training

Awarded To

Kent Stovall

Recognizing completion of 5 days of specialized instruction in

Radiation Safety Officer with DOT Certification

February 17, 2012

Presented By

Dade Moeller Radiation Safety Academy

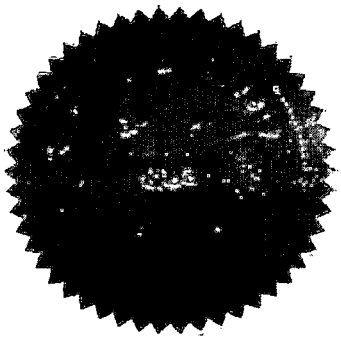
438 N. Frederick Avenue, Suite 220, Gaithersburg, MD 20877

www.moellerinc.com/academy -- 301-990-6006

ABIH has awarded this course 7.35 CM Points, CM Approval # 09-4747
AAHP has awarded this course 32 CEC, #2011-00-021
ARRT and SNMT have awared up to 42.5 CEH's, 027194-027227

Ray Johnson

Ray Johnson, MS, PE, FHPS, CHP
Vice President, Training Programs



3.16.2 Radiation Safety Training Programs

This Section summarizes the minimum radiation safety training requirements for individuals that will work with or in proximity to the Uranium Removal System. In accordance with the performance-based, nature of this license renewal application, it will be WRT's responsibility to:

1) Establish the minimum applicable education, experience and radiation safety training requirements;
2) Identify the specific individuals who will perform the work for both WRT and each Client;
3) Document that the required training has been provided and successfully completed;
4) Periodically review and update training requirements as necessary. This training will be in accordance with 10 CFR 19.12, as appropriate.

3.16.2.1 Training for the WRT Corporate Radiation Safety Officer

The WRT Corporate RSO (CRSO) will have been trained in the applicable areas outlined in NRC NUREG -1556, Vol. 18, Appendix H (or equivalent). The WRT CRSO will also have two or more years' experience in applied radiation protection protocols. WRT's CRSO will have a Bachelor of Science degree in biological or physical sciences, engineering, or related discipline from an accredited college, or equivalent practical experience/training. A copy of the designated CRSO resume and related training, education and qualifications are presented in Exhibit 3-1. The ARSOs will have training and experience similar to that of the CRSO, and commensurate with the duties and responsibilities delegated to them by the CRSO.

3.16.2.2 Radiation Training for the WRT System Specialists

WRT System Specialists will attend an initial Naturally Occurring Radioactive Material (NORM) Training Course or equivalent, eight (8) to sixteen (16) hours in length. This course will include all the topics covered in the General Radiation Awareness Safety training for Client personnel (See Section 3.16.2.3), as well as, additional topics related to their work responsibilities of maintaining the Uranium Removal System and handling the radioactive treatment media. An outline for the NORM training course is presented below.

<u>Basic Radiation NORM Safety Training</u>

Topics to be covered:

1.) Overview of the WRT Uranium Removal System
2.) Fundamentals of Atomic Structure and Radiation
3.) Biological Effects of Radiation
4.) Health Effects of Exposure to Uranium
5.) Risk of Low-Level Occupational Exposures to Radiation (including providing copy of NRC Regulatory Guide 8.29)
6.) Prenatal Exposure (NRC Regulatory Guide 8.13)

7.) Personnel Monitoring and Dosimetry
8.) Comparison of Potential Exposure from WRT Treatment Systems to Natural Background Radiation
9.) Basic Radiation Protection, Exposure and Contamination Control Concepts
10.) ALARA Concepts
11.) Employee and Management Responsibilities for Radiation Safety
12.) WRT Radiation Protection Policies and Procedures (e.g., for media exchanges, packaging media and surveys, etc.)
13.) Signs and Postings
14.) Proper Use of Protective Clothing and Frisking Techniques
15.) Decontamination
16.) Summary of 10 CFR 20, as applicable for Standard Protection Against Radiation
17.) Summary of 10 CFR 19, as applicable for Instructions, and Reports to Workers: Inspections
18.) Emergency Procedures
19.) Federal/State Regulations
20.) Waste Disposal and Management Requirements
21.) Shipping, Manifesting and U.S. DOT Transportation Requirements (10 CFR Part 71)
22.) Radiation Detection Instruments
23.) Extensive practical sessions in Radiation Detection/Survey Instrumentation, Frisking and use (Donning/Doffing) of Protective clothing.

If possible, this course will be customized to the Uranium Removal System and associated equipment to emphasize the areas related to sampling/handling the treatment media, personal protective equipment (PPE) requirements, minimizing surface contamination, and shipping/manifesting requirements. This training will include an end-of-course test for which a passing score (80%) must be attained.

Refresher training will be provided, annually to WRT System Specialists and may include any combination of: review of the basic NORM training topics, as well as, changes/modifications in the Uranium Removal System, license amendments, results of inspections/audits, and lessons learned. Initial radiation training and refresher training will be presented by the WRT Corporate RSO or qualified designee.

3.16.2.3 Radiation Awareness Training for Client Personnel

In some long-term treatment scenarios, there may be potential exposure to small doses of radiation during the performance of tasks in proximity to the Uranium Removal System treatment vessel. If so, the Client personnel will receive Radiation Awareness Training. Otherwise, this awareness training will be at the option of either WRT or the Client. Basically, the amount of this awareness training will be commensurate with the potential exposure risk. Additionally, if the Client is itself a licensee and the Client personnel are already subject to a radiation safety training program, this WRT training is not necessary.

It should be noted that the Client's personnel annual dose is anticipated to be significantly less that the 100 mrem/yr limit that requires radiation awareness training for employees pursuant to

10 CFR 19.12 (See Sections 3.16.4.3 and 3.16.6). The Client Manager's annual dose will be substantially less that of a Client Operator since they are responsible for supervising the Client operators and will spend even less time around/near the treatment vessel(s).

If needed or warranted for a particular water treatment project, WRT will provide this training in a training session that will also include the non-radiologic operational training for the overall system. The radiation portion of this training will be a one (1) to two (2) hours in length, and typically will be presented in a classroom training session, similar to the Client's other periodic safety training, a video conference or other format approved by the CRSO. WRT may also provide follow-on training, as needed, or as requested by the Client, which may be presented live, presented using a training video, or may be assigned readings.

This training will cover general radiation awareness, worker communication and notification, and emergency procedures, as detailed below.

- Overview of Uranium Removal System
    - Uranium System Operation
    - Uranium concentration in the feed water and the buildup and concentration of uranium expected in the treatment media
    - Comparison of expected dose from the Uranium Removal System and natural background radiation
    - Limiting public access to the treatment system area

- Basic Introduction of Radiation From Natural Occurring Radioactive Material (NORM)
    - Fundamentals of Atomic Structure and Radiation
    - Biological/Health Effects of Radiation and Exposure to Uranium
    - Risk of Low Level Occupational Exposure to Radiation
    - Basic Radiation Protection, Exposure, and Contamination Control Concepts
    - ALARA (Time, Distance, Shielding)
    - Signs and Postings
    - Personnel Monitoring and Dosimetry
    - Proper Use of Protective Clothing
    - Decontamination
    - Applicable Contents of 10 CFR 20, Standards for the Protection Against Radiation and Notices, and 10 CFR 19, Instructions and Reports to Workers; Inspections

- Notification, Reporting and Emergency Procedures
    - PPE and isolation and/or clean-up equipment
    - Emergency notification procedures and phone numbers
    - Emergency/clean-up procedures (i.e., general, spill, fire, etc.)

- Employee Awareness and Communications
  - A summary of NRC Radiation Protection Regulatory Guide 8.29, *Risks for Occupational Radiation Exposure* and, if applicable, NRC Regulatory Guide 8.13, *Instruction Concerning Prenatal Radiation Exposure*. Copies of these regulatory guides will be provided to the operators for their reference.

If needed or warranted, periodic refresher training will be provided to the Client's personnel and will include review of the basic General Radiation Awareness Training topics, as well as changes/modifications in the Uranium Removal System, license amendments (if appropriate), results of inspections/audits and lessons learned. Initial radiation awareness and refresher training, if warranted will be presented by the WRT CRSO or qualified designee.

3.16.3 Commitments by WRT

As part of its Radiation Protection Program WRT is committed to the following items, which were presented in the original draft SER that was part of the license application package (September 2005).

1. Implementing its Radiation Protection Program as described in this ER. All training sessions and materials will conform to the requirements presented in this ER and WRT's performance requirements. Any substantive alterations/modifications to the WRT Radiation Protection Program that fail to meet the condition(s) for SERP approval will require NRC review and approval through a license amendment. From Section3.4 of the SER

2. Performing monitoring of radiation levels using appropriate SOPs for monitoring of radiation in the restricted area(s) and to all Client/local CWS Utility Managers and Operators or members of the public. From Section 4.2 of the SER

3. Monitoring all releases of licensed material and responding to such releases in a manner which is adequately protective of public health and safety and the environment. From Section 4.4 of the SER

4. Requiring that all WRT System Specialist and Client/local CWS Utility Mangers and Operators adhere to SOPs and/or emergency procedures regarding contamination control, including surface contamination of the Uranium Removal System and contamination of personnel (e.g., clothing, shoes, etc.) From Section 4.5 of the SER

3.16.4 Experience with Radiation

3.16.4.1 Radionuclides and Removal Systems

The radionuclide (uranium) that will be processed through the Uranium Removal System is natural-occurring source material. The Uranium Removal System will remove, adsorb and collect the uranium onto uranium-selective treatment media. For uranium removal, the treatment

media is a non-hazardous anion exchange resin media (Z-92®). The media is solid and is contained in its treatment vessels.

The Uranium Removal System has been designed to operate passively, using the pressure provided by the existing water well pump(s), with minimal direct support/supervision from the Client. The Client operators do not have to perform chemical additions, backwashing, or other equipment tasks for the system to operate normally. Thus, the Client personnel will spend relatively little time in or around the radioactive materials areas of the treatment systems while performing their other tasks in the treatment building.

3.16.4.2 Work Groups and Tasks

Work tasks have been identified for each worker group (WRT System Specialists and the Client personnel) to support the operation, maintenance and media exchange activities of the Uranium Removal System (see Sections 3.16.1.3 and 3:16.1.4), respectively. Only the WRT System Specialists will "handle" the uranium spent treatment media and related Uranium Removal System. This minimal involvement in or around the radioactive material areas will ensure potential radiation doses to the Client's personnel will be ALARA.

3.16.4.3 Potential Doses to WRT System Specialist and Client Personnel

Potential radiation exposures from the largest Uranium Removal Systems expected to be operating (a single, 1,500-gpm system or two, 1,500-gpm systems operating in parallel) have been estimated for each worker group related to the performance of their assigned tasks (See Sections 3.16.1.3 and 3.16.1.4), respectively. The results of the dose assessments showed potential exposures to the WRT System Specialist from working on or near the Uranium Removal System, using a very aggressive number of exchanges (20) performed in a year, of approximately 1.8 mrem/yr. The potential annual doses to the Client's personnel who will monitor and inspect the systems, will depend on the size of the particular treatment system located at the Client site. These potential annual doses were estimated to be approximately less than one (1) mrem/yr for the uranium systems. These doses are negligible in comparison to natural background radiation exposure.

3.16.4.4 Experience

Installing and servicing over 150 full-scale Radium or Uranium Removal System throughout the country, including over 11 years of experience in performing up to 15 to 25 media exchanges annually, have provided an appropriate level of "hands on" experience for WRT System Specialists operating these systems and working with or near radioactive materials.

3.16.5 Exposure (Dose) Monitoring

Neither WRT System Specialists nor the Client's personnel are expected to receive an annual radiation dose anywhere near the individual monitoring threshold prescribed in 10 CFR 20.1.502/Title 17, Section 30268, as applicable that requires personal monitoring (excess of 500 mrem/yr for adults and excess of 100 mrem/yr for minors and declared pregnant women).

3.16.5.1 Client Personnel

As described in the dose assessment presented in Section 3.16.6, the potential doses to the Client's personnel are estimated to be negligible. Accordingly, the Client's personnel will not be required to wear personal dosimeter badges. However, as a voluntary action that is not license prescriptive, WRT may elect to have the Client's personnel wear personal dosimeter badges. These typically would be optically stimulated luminescence dosimeters (OSLDs) badges.

3.16.5.2 WRT System Specialist

Per 10 CFR 20.1502, as applicable and based on the dose assessment presented in Section 3.16.6, the WRT System Specialists are also not required to wear personal dosimeters. Similar to the approach with the Client's personnel, as a voluntary action, that is not license prescriptive, WRT may elect to have them wear personal dosimeter badges: If worn, the WRT System Specialists would use the same dosimeter badge at all of the Client treatment locations they will be servicing during a monitoring period.

WRT reserves the right to change the frequency of the badge change out period (e.g., quarterly, semi-annually) or to eliminate the issuance of the personal dosimeters to the Client's personnel Client based on review of historical dosimetry results.

3.16.5.3 Treatment Vessel and Area

Also as a voluntary action, to demonstrate that radiation exposures to the WRT System Specialists and the Client's personnel are below the requirements for personnel monitoring, 10 CFR 20.1502, as applicable WRT may install OSLDs badges on the treatment equipment to monitor exposure in the area of the Uranium Removal System. At a minimum, one of these area dosimeter badges may be installed on the side of the Stage 1 treatment vessel at approximately chest height. A second area dosimeter badge may be installed a short distance away from the Stage 1 vessel (nominally 5 to 10 ft). The second badge will allow for estimating the exposure/dose both in the immediate vicinity of the treatment system, and at other distances from the treatment vessel using inverse-squared-ratios. The vessel and area dosimeters may be used to monitor the Client personnel's potential exposure in lieu of issuance of personal dosimetry.

Initially, both WRT personnel and vessel/area OSLD's will be changed out and analyzed on a quarterly basis. However, WRT reserves the right to change the frequency of the badge change-out period (e.g., quarterly, semi-annually) based on the review of dosimetry results.

WRT has selected Landauer, Inc., Glenwood, Illinois as the preferred dosimetry service provider. However, WRT reserves the right to select an equally qualified National Voluntary Laboratory Accreditation Program (NVLAP) accredited dosimetry service provider as an alternative.

3.16.6 Dose Assessment

3.16.6.1 Potential Annual Dose from Uranium Removal System

WRT contracted with a radiation safety-consulting firm (MFG, Inc; now a part of Tetra Tech) to develop an approach for estimating the dose rate from the Uranium Removal System treatment vessel. This exposure model is specific to the Uranium Removal System, as described in the initial license application and in this license renewal application, accounting for treatment vessel size, geometry, amount of media and loading, and relative location of both stages of media to the receptor location. The contractor analyzed possible exposures under normal operating conditions. The contractor's dose rate assessment results are summarized below:

- The contractor evaluated dose rate from a Uranium Removal System treatment vessel at a point in time when uranium loading is at a maximum of 54,000 pCi/g. This would be the time when the Stage 1 media is exchanged, after four (4) to six (6) years of operation. The average dose rate for the prior years, during which concentrations of uranium build up, will be significantly less than the value estimated by the contractor;

- The contractor used two approaches to estimate the possible dose rate from the Uranium Removal System water treatment vessel. First, the dose rate from the treatment media were compared to measured dose rate from a drum of U_3O_8 yellowcake. The short-term decay products will be similar in the treatment media and the drum of yellowcake, and concentrations and material densities were then adjusted down for the media.. The second approach used EPA's Federal Guidance Report (FGR) No. 12 dose conversion factors and assumed an infinite plane of natural uranium and its immediate decay products to estimate the dose rate;

- Based on the two approaches, the contractor estimated the dose rate at the surface of the treatment vessel under this maximum-loading condition would be only 0.2 to 0.3 mrem/hr. Consistent with information presented in NRC Regulatory Guide 8.30, *Health Physics Surveys in Uranium Recovery Facilities*, the contractor estimated that the dose rate at just 30 cm. from the Stage 1 treatment vessel surface decreases by a factor of 100 to approximately 0.003 mrem/hr. Hence, the estimated incremental does rates from the Stage 1 vessel, as well as the dose rates from the Stage 2 vessel which is greater than 30 cm from the Stage 1 vessel are indistinguishable from natural background;

3.16.6.2 Potential Annual Dose to Client Personnel

Section 3.16.1.2 discusses the tasks that the Client personnel will perform in proximity to the Uranium Removal System. Thus, the Client personnel could spend up to 88 hours per year performing these tasks at approximately one (1) meter or more away from the treatment vessel (see Table 3-1). Realizing that the dose rate will decrease in proportion to the inverse-distance-squared from the treatment vessel surface, the dose rate will be significantly less than 0.003 mrem/hr at 30 cm presented above. Accordingly, the estimated/potential annual dose to the Client personnel will be less than 0.3 mrem/year.

Table 3-1

Estimated Time Spent by Client Personnel in Proximity to the Uranium Removal System

Task	Task Duration (min)	Task Frequency	Total Task Time (hr/yr)
Client Personnel:			
Inspect/record flow and pressure readings	3	5 days/wk	13.0
General equipment inspection	4	5 days/wk	17.3
Inspect/service external filters and strainers	10	every 2 weeks	4.3
Collect inflow/discharge water samples	4	2 times/mo	1.6
Miscellaneous task time within tank area	5	5 days/wk	21.7
Miscellaneous task time within treatment room			30.0
Total			88.0

1. Based on instrumentation and remote readout for pressures and flows
2. The Client personnel will not handle treatment media
3. Client Manager supervises his Operators and will spend significantly less time around/near the Uranium Removal System.

3.16.6.3 Potential Annual Dose to WRT System Specialists

Section 3.16.1.3 discusses the tasks that WRT System Specialists will perform in support of the operation maintenance of the Uranium Removal Systems.

Based on the above, the estimated total dose received by a WRT System Specialist during routine media exchange operations of the Uranium Removal System, is estimated to be less than 2 mrem/yr (0.003 mrem/yr x 30 hours/media exchange x 20 media exchanges/yr = 1.8 mrem/yr).

3.16.6.3.1 Summary of WRT Support Personnel Dosimetry

Table 3-2 presents a summary of the WRT personnel dosimetry information since the inception of the WRT Dosimetry Program which was initiated in 2005. The summary presents the year and quarter reported, the range of doses (mRem/Quarter) for that quarter, the number of WRT personnel covered under that year/quarter, and the range of doses for that year.

It should be noted that the summary reflects 11 plus years of recorded dosimetry information for WRT personnel (e.g., System Specialists, RSOs and RCTs, Field Service Representatives and other related personnel) who are responsible for performing maintenance, general inspection, and

media exchanges at all of the WRT radium and uranium systems. WRT currently has installed about 150 radium and uranium system throughout the United States, including 33 uranium treatment systems in 11 Agreement States. As WRT's business has grown, its service crews have supported 15 to 25 media exchanges a year.

It should also be noted that the summary presents dosimetry information for the WRT media/maintenance support personnel for all of the treatment systems (radium and uranium) that they have serviced, and not just for the uranium systems. Thus, doses to WRT support personnel from uranium systems only would be even less.

The summary reveals the following:

- The highest dose received by an individual during a year/quarter was 17 mRem (2013-Q3).
- The highest range of total doses for a year was 2.0-19.5 (2012).
- These results are well below the 100 mRem/yr dose limit established for doses to the general public, much less the occupational dose limit of 5,000 mRem/yr.

A review of the lifetime doses for these WRT personnel indicated that the highest lifetime dose for a WRT support individual was 28 mRem for the 11+ year period. This equates to approximately 2.5 mRem/yr.

Thus, the results of the calculated doses to WRT support personnel based on actual dosimetry data collected over the last 11+ years confirm the results of the theoretical dose estimates as described in Section 16.6.1.

Table 3-2

Summary of WRT Support Personnel Doses

Report (Year/Quarter)	Range (mRem)	Range of Total Dose (mRem/yr)	Number of Personnel**
2005 Q2	0.5*-12	1.5-15.5	3
2005 Q3	0.5-3		2
2005 Q4	0.5-0.5		3
2006 Q1	0.5-2	2.0-6.5	5
2006 Q2	0.5-2		7
2006 Q3	0.5-2		8
2006 Q4	0.5-0.5		12
2007 Q1	0.5-1	2.0-5.0	14
2007 Q2	0.5-3		14
2007 Q3	0.5-0.5		13
2007 Q4	0.5-0.5		13
2008 Q1	0.5-0.5	1.5-9	17
2008 Q2	0.5-8		15
2008 Q3	0.5-0.5		13
2008 Q4			
2009 Q1	0.5-13	2.0-24	16
2009 Q2	0.5-4		16
2009 Q3	0.5-4		16
2009 Q4	0.5-3		16
2010 Q1	0.5-1	2.0-3.0	15
2010 Q2	0.5-1		15
2010 Q3	0.5-0.5		15
2010 Q4	0.5-0.5		15
2011 Q1	0.5-4	2.0-12.5	15
2011 Q2	0.5-2		15
2011 Q3	0.5-6		15
2011 Q4	0.5-0.5		15

Report	Range (mRem)	Range of Total Dose	Number of Personnel**

(Year/Quarter)		(mRem/yr)	
2012 Q1	0.5-6	2.0-19.5	15
2012 Q2	0.5-7		15
2012 Q3	0.5-0.5		16
2012 Q4	0.5-3		17
2013 Q1	0.5-17	2.0-22	16
2013 Q2	0.5-4		16
2013 Q3	0.5-0.5		15
2013 Q4	0.5-0.5		14
2014 Q1	0.5-0.5	2.0-2.0	16
2014 Q2	0.5-0.5		19
2014 Q3	0.5-0.5		19
2014 Q4	0.5-0.5		19
2015 Q1	0.5-14	2.0-15.5	16
2015 Q2	0.5-0.5		18
2015 Q3	0.5-0.5		18
2015 Q4	0.5-0.5		12
2016 Q1	0.5-0.5	1.5-7.5	11
2016 Q2	0.5-3		10
2016 Q3	0.5-4		10

*The minimum detection limit for Landauer badges is M (<1 mRem). For this presentation, a value of 0.5 was used for M.

** The WRT personnel included in this summary includes all the WRT Systems Specialist, Radiation Control Technicians, Service Representatives, and other personnel who support the maintenance, inspection, and media exchange activities.

3.16.6.3.2 Examples of Dose Rates in the Vicinity of the WRT Uranium Removal System

Table 3-3 presents examples of dose rates in the vicinity of the various WRT Uranium Removal Systems documented during actual media exchanges and/ or maintenance of these systems. The dose rates are presented for Field-Erect/Large MCS, MCS and PES Systems.

Dose rate readings for the Landauer badges placed on the Vessel 1 Stage 1 and in the general work area of the various uranium removal systems were taken from quarterly Landauer dosimetry reports. Hourly dose rates were calculated by dividing the reported quarterly dose

values by 2,190 hr/quarter (8,760 hr/yr) to obtain average mRem/hr results. Dose rate calculations for the exposure rate measurements taken with a Ludlum Model 19 exposure rate meter were calculated from actual exposure rates measurements (in μRem/hr) obtained in the field and converted to mRem/hr.

Dose rates (mRem/yr) for each media exchange were calculated using the exposure rates from the Ludlum Model 19 exposure rate meter at the Area Badge location and a 24-hour work period associated with the time it normally takes for a media exchange to be completed. This period includes the time for unloading the media, packaging the media, loading the media packages onto a transport vehicle, and preparation (surveys, securing the load) for transportation to the selected disposal facility or uranium recovery facility.

A review of the presented data reveals:

- Dose rates from the various WRT uranium removal systems including those systems with the highest uranium loadings (CO-COT V4- 54,570 mg U/Kg; CA-BAS- 57,400 mg U/kg; GA-LAW Well 3- 34,300 mg U/Kg; NJ-SUS Well 2- 8,360 mg U/Kg; VA-Fox- 38,080 mg U/Kg; CA-ROY- 18,000 mg U/Kg; CO-MTN Water 36,720 mg U/Kg and 51,200 mg U/Kg, are within or indistinguishable from natural background rates.

- Annual calculated dose rates for all WRT uranium removal systems (even for those systems with the maximum uranium loadings), are less than the established limit of 100 mRem/yr for the general public.

- The dose rates presented in Table 3-3 are consistent with the dose rates presented in Table 3- 2 which summarizes the doses to WRT System support personnel who are the individuals responsible for performing the media exchanges, maintenance, and inspection activities on the various WRT uranium removal systems.

Table 3- 3 Examples of Dose Rates in the Vicinity of WRT Uranium Removal Systems

System Name	Date	Landauer Badge Vessel 1/Stage 1 (mRem/hr)	L 19 Reading at Vessel 1/Stage 1 (mRem/hr)	Landauer Area Badge (mRem/hr)	L 19 Reading at Area Badge (mRem/hr)	Approx Uranium Loading mg U/kg	Estimated Dose (mRem/yr)**	Comments
Field-Erect Sys, or Large MCS Approximating FES								
NE-GRA T-1 V-1	4/20/2016	0.0018	N/A	0.0005*	0.0087	1,660	0.209	at media exchange- 0.0609 mRem/hr at tanker truck
NE-GRA T-1 V-2	5/10/2016	0.0018	0.0087	0.0005	0.0078	1,550	0.187	at media exchange- 0.0609 mRem/hr at tanker truck
NE-GRA T-2 V-1	3/23/2015	0.0018	0.0113	0.0005	0.0104	1,290	0.25	at media exchange
CO-COT V4	11/20/2012	0.1935	0.3913	0.019	0.0348	54,570	0.835	0.246 mRrem/hr at tote storage area
CA-MIS Well 28	2/25/2016	0.0079	0.0487	0.0005	0.0217	5,700	0.502	Estimated per each primary vessel (x3)
MCS Systems								
CA-MIS Skyborne	10/18/2012	0.001	0.0522	0.0014	0.0217	3,590	0.502	0.0739 mRem/hr at tote storage area
CA-GSW	1/23/2014	0.0005	N/A	0.0005	N/A	346	0.12***	Maintenance
CA-GSW train 1	2/25/2016	0.0005	0.0609	0.0005	0.0139	1,039	0.336	Site visit Estimated loading
CA-GSW train 2	2/25/2016	0.0005	0.0609	0.0005	0.0139	1,452	0.336	Site visit Estimated loading
CA-GSW train 3	2/25/2016	0.0005	0.0609	0.0005	0.0139	1,225	0.336	Site visit Estimated loading
CA-BAS	2/23/2015	0.2718	0.6087	0.0134	0.0609	57,400	1.46	at media exchange
GA-LAW Well 3	4/11/2016	0.0968	0.3478	0.0134	0.0522	34,300	1.25	at media exchange
NJ-SUS Well 2	12/5/2013	0.019	0.1739	0.0005	0.0087	8,360	0.209	
VA-FOX	11/15/2012	0.0269	0.4783	N/A	N/A	38,080	0.120****	System badge only
PES Systems								
CA-ROY	6/30/2016	0.0388	N/A	0.0532	N/A	18,000	1.28***	Estimated Loading
CO-MTN Water	10/31/2012	N/A	0.5217	N/A	0.0652	36,720	1.56	at media exchange
CO-MTN Water	1/16/2014	N/A	0.5522	N/A	0.013	51,200	0.312	at media exchange

* "M" = Landauer MDL of < 1 mrem = < 0.0005 mrem/hr

** Based on 8 hrs/day x 3 days for exchange (unloading of media, preparation of media bags for shipping, and transportation) using the Ludlum Model L19 exposure rate measurements at the area badge location.

*** Dose rate based on Landauer area badge reading

****Dose rate based on L19 reading at Vessel (0.4783 mRem/hr), adjusted at 1 foot using Inverse Square Law.

3.16.7 Bioassay Program

The WRT Uranium Removal Systems operate as a closed system, and the radionuclides are chemically and physically absorbed/bound onto the treatment media. Also, when a media exchange is performed, the media remains moist. For these reasons, the potential for airborne uranium activity and hence an internal dose due to inhalation is extremely small. Thus, no bioassay program is required.

3.16.8 Respiratory Protection Program

Consistent with Section 3.16.7, since the potential for air borne uranium radioactivity due to inhalation is extremely low, a respiratory protection program is not required.

3.16.9 General Rules for the Safe Possession of Licensed Material

The following are general rules and good housekeeping procedures that will be enforced in conjunction with the operation of the Uranium Removal System.

1. The Client personnel will not be required to wear Personal Protective Equipment (PPE) during daily Uranium Removal System monitoring.

   While handling the Uranium spent treatment media, WRT System Specialists will wear the following PPE:

   - Lab coat, protective apron, or Tyvek coveralls, or equivalent
   - Disposable gloves
   - Boot covers or overboots
   - Dust mask, as necessary for dust irritant control (e.g., if the treatment media is dry).

2. Hands, shoes, clothing, and work surfaces will be visually checked and/or surveyed with an appropriate survey instrument for possible contamination after each media unloading/exchange operation or equipment repair that potentially could result in a release of media. This survey will include work areas around treatment vessels, pumps, and hose connections used during media exchange operations;

3. Eating, drinking, using tobacco products, or application of cosmetics will not be permitted in any area (e.g., treatment building, around media service trailer and equipment, etc.) where licensed material is stored;

4. Storage of food, drink, or personal items will not be permitted in the immediate vicinity of the treatment vessel;

5. Access to the treatment building or enclosure containing the Uranium Removal System will be controlled and limited;

6. The Client personnel will not be required to wear personal dosimeter badges due to the low radiation levels. Although also not required, WRT System Specialists, with their

tasks related to handling spent media, may wear a whole-body dosimeter badge, typically an Optically Stimulated Luminescent Dosimeter (OSLD);

7. Potentially surface-contaminated waste articles (e.g. booties, gloves, filter elements, etc.) will be disposed of in dedicated receptacles, which will be properly labeled as containing radioactive trash;

8. Uranium Removal System areas and related licensed material will be appropriately stored, labeled and posted with caution signs in accordance with 10 CFR 20.1801-1905, as applicable.

9. A discussion of the radiation safety procedures that will be used during the media exchange and packaging operations are presented in Section 3.17, *Waste Disposal.*

3.16.10 Area Survey Procedures

3.16.10.1 Overview

Sections 2.3.2.1 through 2.3.2.6 describe in detail the operation of the Uranium Removal System, where the radioactive treatment media is contained in the treatment vessel(s). Other than an emergency situation (see Section 13.16.12), the only time that an area survey would be required to check for surface contamination would be during or after a stage of spent treatment media has been exchanged for fresh treatment media.

The Client personnel will perform daily inspection and monitoring of the treatment equipment, which will also include a check for any upset condition that results in a release of treatment media. In the case of the daily inspections and the media exchange operations, a visual observation of treatment media particles on the floor will be the primary method used for the area study.

Figures 3-2 through 3-4 show a uranium media spill through three stages of drying, from the wet spill to the dry media, respectively. The media is sand-sized particles, and will settle out of the water quickly in low to moderate flows.

As discussed in Section 2.3.2.6, the radioactive material (uranium) is adsorbed onto the media. As there are no fine-sized particles (e.g., silts, clays) in the media that potentially could be suspended in water, the water associated with a leak or spill will not be radioactive. In general, if media particles are not observed outside of the treatment vessel, an area contamination survey with a survey instrument is not warranted.

3.16.10.2 Summary of Area Survey Procedures

A summary of the area survey procedures that will be utilized to support the operation of the Uranium Removal System is presented below.

1. In the event of a spill, individuals will monitor hands, shoes, clothing, work surfaces, and the overall area of the spill with a survey meter (see Section 3.16.17) appropriate for the radionuclides involved after the spilled media has been cleaned up.

2. At the conclusion of a media exchange operation, a visual inspection will be made, looking for media particles, of all of the areas of the tank, hose, and pump connections – both in the vicinity of the treatment vessel(s) and on the WRT service trailer. This visual inspection will be followed up with an instrument survey to determine if any surface contamination is present.

3. WRT proposes to use the current Conference of Radiation Control Program Directors (CRCPD) Part N Guidelines (April 2004) for unrestricted release of equipment and sites. These guidelines can be found in Section N-7 of CRCPD Part N.

   For release of equipment and surface areas (e.g., floors) of the Uranium Removal Systems, WRT proposes to implement the acceptable surface contamination levels presented in CRCPD Part N Appendix A. These levels are presented in Table 3-4. Appropriate survey instrumentation as listed in Section 3.16.17 will be used to perform unrestricted release surveys of surface areas.

   It is not expected that any site/soil surrounding the Uranium Removal System will become contaminated with uranium since the uranium removal and exchange processes are performed in closed vessels and piping. WRT proposes to adopt the CRCPD criteria that the average member of the critical group will not receive annually a public dose in excess of 25 mrem Total Effective Dose Equivalent (TEDE) from residual uranium activity. (Section 7.b.i)

   WRT reserves the right to adopt a dose-based release criteria for acceptable levels of surface contamination and soil.

4. As a result of a spill or if surface contamination is found and removed during a media exchange, records of the survey and clean-up will be kept until WRT license termination. The record will at minimum include the following information.

   - Date of the survey.
   - Person(s) conducting the survey and clean up.
   - Manufacturer, model, serial number and calibration dates of the instruments used to perform surveys and analyze wipe tests.
   - Drawings, sketches, maps of the area surveyed identifying relevant features of the surveyed and cleanup of areas.
   - Results of the surveys (in units of dpm/100cm^2 or cpm/100cm^2) keyed to locations of the drawings.
   - Description of corrective actions taken.

Figure 3-2
Wet Media Spill

Figure 3-3
Partially Dry Media Spill

Figure 3-4
Dry Media Spill

Table 3-4

ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR TENORM

	AVERAGE[2,3,6]	MAXIMUM[2,4,6]	REMOVABLE[2,3,5,6]
Alpha	5,000 dpm/100 cm^2	15,000 dpm/100 cm^2	1,000 dpm/100 cm^2
Beta-gamma	5,000 dpm/100 cm^2	15,000 dpm/100 cm^2	1,000 dpm/100 cm^2

NOTES: Adopted from CRCPD Part N Appendix A (April 2004)

[1] Where surface contamination by both alpha and beta-gamma emitting nuclides exists, the limits established for alpha and beta-gamma emitting nuclides should apply independently.

[2] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[3] Measurements of average contamination level should not be averaged over more than one square meter. For objects of less surface area, the average should be derived for each object.

[4] The maximum contamination level applies to an area of not more than 100 cm^2.

[5] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of surface area A (where A is less than 100 sq.cm) is determined, the entire surface should be wiped and the contamination level multiplied by 100/A to convert to a "per 100 sq cm" basis.

[6] The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr (2 μGy/hr) at 1 cm and 1.0 mR/hr (10 μGy/hr) at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber. ----- End of Table -----

3.16.11 Operational Screening and Handling of the Downstream Bag Filters

As described in Section 2.3.2.1, the WRT water treatment systems typically will include an external screen and/or bag filter units downstream of the treatment vessels. The purpose of these screens and filters is to catch any fine particulate material that may pass through the treatment system, to meet the turbidity requirements of the treated water. The fine material may include silts and fine sand from the water well, iron fines originating from either the well or the radium treatment media (a natural industrial mineral), and possibly fine media particles that could be radioactive.

The external screen units are self-cleaning under normal operation, however, the fabric bags in the filter units will likely need to be changed-out and replaced periodically, if they start to collect appreciable fines. These filter bags in the units downstream of the treatment vessels will be

serviced by the WRT System Specialists. If the radioactivity dose rate from a bag is higher than the background dose rate, WRT proposes using a screening threshold of 50 microR/hr (μR/hr), below which the filter bag may be disposed of locally. This 50-μR/hr threshold is consistent with the screening level that is used in a number of states such as Texas (25 T.A.C. 289.259, *Licensing of Naturally Occurring Radioactive Material (NORM))*, to exempt material and equipment used in the recycling process (§289.252(d)(2)) and surface equipment used in oil and gas production (§289.252(d) (3)), material and equipment that are contaminated with NORM.

The WRT System Specialist will use a properly-calibrated exposure meter (for example, a Ludlum Model 19 MicroR meter) to survey the dose rate near the surface of the filter bag. The results of this survey will be compared to the screening level of 50 μR/hr, and all filter bags whose dose rate, less the background dose, is equal to or greater than the screening level will be maintained and stored at the Client's treatment building or other secure facility for future disposition, usually when a full media exchange takes place. Any filter bag whose surveyed dose rate, less background, is less than the screening level may be disposed of as common trash in a local landfill.

3.16.12 Operating and Emergency Procedures

The Uranium Removal System will be operated in accordance with written standard operating procedures (SOPs). These SOPs cover routine operations, maintenance and media exchange operations.

As described in Section 2.3.2.1, the Uranium Removal System treatment vessels are designed with a number of safety features to ensure the containment of the treatment media in the vessel. If implemented, recommendations for the design of secondary containment features in the treatment building also can mitigate impacts from emergency situations. An emergency situation could result from a significant release of the radioactive treatment media from the vessel, a highly unlikely but credible scenario.

A small spill of treatment media would not constitute an emergency situation, but rather an upset condition (e.g., a leaking fitting, poor hose connection during a media exchange) that requires correction and cleanup. The licensed radioactive material is associated with the treatment media, not with the feed water that is passing through the vessel for treatment.

Depending on its size, a treatment media spill will be cleaned up by the WRT System Specialists using a small broom and dust pan, a small shop-type wet/dry HEPA vacuum, or the large capacity industrial HEPA vacuum on the WRT service trailer (see Section 3.17.4.1). Examples of emergency conditions that could result in a release of media include the following situations:

- Small-scale leak due to partial rupture of treatment vessel or leaking flange. This normally will not constitute an emergency, but will require the use of the spill-control steps presented in the emergency procedures;
- Discharge of spent treatment media from a pump or hose connection during media exchange;
- Catastrophic rupture of or damage to treatment vessel as a result of fire, collision from mobile equipment, or other damage to treatment building structure.

WRT RADIONUCLIDE REMOVAL SYSTEM EMERGENCY PROCEDURES

Rev. 0

General

- No eating, drinking or chewing in the vicinity of treatment equipment.
- Make certain all personnel are in a safe environment – **health or injury situations, fire, etc. take precedence over any type of radiation hazard.** Perform first aid as necessary.
- In an emergency, the water supply can be shut down or can bypass the treatment vessel.
- Contact WRT and the Corporate Radiation Safety Officer (CRSO).
- The primary radiation hazard is the spread of the radioactive media to uncontaminated areas. Airborne inhalation may be a secondary hazard if the media dries out.
- Wear the proper Personal Protective Equipment (PPE) as necessary.
- Contact the appropriate local authorities, e.g., fire and police.
- Contact the NRC/State Radiation Protection Agency
- Keep an incident log including activity, time and personnel involved.

Personal Decontamination

- Contaminated clothing will be removed and stored for further evaluation by the CRSO.
- If the media particles are on the skin or in the hair, they can be removed by washing with mild soap and flushing thoroughly with water.
- Small amounts of surface contamination (media particles) can also be removed from clothing by patting down the area with duct tape turned sticky side out.
- Injured persons should be decontaminated as practical, but first aid should not be delayed.
- If **life-threatening injuries – perform immediate first aid** and transport to hospital regardless of contamination, notify first responders of possible contamination.

Spills – the intent is that **only WRT personnel will handle any radioactive material**

- Remember – the treatment media is the only radioactive material, not the water in the treatment vessel.
- **Stop:** Stop the spill, either shut off the water supply completely or bypass the treatment system.
- **Warn:** Warn other personnel in the area that a spill has occurred.
- **Isolate**: Isolate the spill area, set up a barrier, tape or cones, as necessary to restrict access. Further isolation of the spill, and to prevent the spread of contamination, the area should be kept moist, cover with plastic sheet, drop cloth, or etc.
- **Minimize:** Minimize personnel exposures by keeping potentially contaminated individuals in a designated area until whole body frisks can be performed and the individuals cleared.

WRT RADIONUCLIDE REMOVAL SYSTEM EMERGENCY PROCEDURES (CONT.)

- **Secure:** Secure the appropriate equipment, ventilation or other operating equipment may be selected for shut down due to the nature of the spill/release.
- ***Notify:*** *CALL the **EMERGENCY CONTACTS LISTED BELOW** as necessary and the **WRT CRSO** and COORDINATE the cleanup plan with the CRSO.*
- **Cleanup: WRT personnel will perform** any cleanup of spilled/loose radioactive media.
- **Survey:** After the spill cleanup, **WRT will perform** an area contamination survey to confirm that the spilled/loose radioactive media has been removed.

Spills (cont.)

- **For Major Spills** – all of the above, plus:
  - **Control Discharges** – If applicable, confirm that the treatment building floor-drain sump pump is set to manual/off.
  - Determine whether to bypass water supply feed around the treatment system or shut down the water supply well.
  - Determine whether the situation requires closing off the treatment room completely.

Fire

- Firefighters' normal PPE is adequate for working a fire in the vicinity of the treatment vessel with a potential of a media spill.
- In case of a fire, spray water on the equipment from an up wind position.
- Keep media in one location or confined to as small an area as possible.
- CALL the WRT RSO and COORDINATE cleanup plan with CRSO.

CONTACT THE FOLLOWING IN CASE OF AN EMERGENCY

Address of this location: To be provided

Local Authorities:

Fire Department: To be provided

Sheriff/Police Department: To be provided

Business Hours, Main No.
24-hour Incident Reporting No.

WRT: Business Hours – (303) 424-5355

CRSO: After Hours – Ted Adams: Cell (716) 725-5874
Alternate (716) 592-4264

13.16.13 Posting of Treatment Areas

Typically, if WRT supplies a Client with a Uranium Removal System, in accordance with 10 CFR 1902, as applicable, either the treatment vessels and/or the area of the treatment building in the immediate vicinity of the treatment system(s) will be posted with "CAUTION: RADIOACTIVE MATERIAL" signs. However, WRT will be sensitive to "over-posting" the treatment area, primarily for security reasons. For example, rather than placing the posting on the outside of an exterior door to a treatment structure, the caution sign will usually be placed on the interior of the structure, in a location where it can be seen on entering the structure.

3.16.13 Transportation of Radioactive Materials

The transportation of the spent uranium media is described in Section 3.17.2.

3.16.14 Security and Control of Radioactive Materials

The security procedures and measures for Client/CWSs using WRT's uranium treatment system are acceptable active and passive restraints on ingress to licensed and restricted areas. In general, because of the facility's importance as a Client site or a community water supply, the water treatment facility will already be a secured site, regardless of the need for treatment for removal of radionuclides. Thus, the standard safe guards and security requirements for Client sites will be followed. As a minimum, the well /treatment houses containing the Uranium Removal System will be locked when the Client personnel are not present and it is also expected that most facilities will be secured within locked, fenced sites. In addition to site security, the uranium-laden media is contained in closed treatment/storage vessels with no direct access to the radioactive media by the public or intruders.

Furthermore, WRT will comply with and implement in conjunction with appropriate site-specific personnel any NRC Compensatory Measures or other security requirements ordered by the NRC, as well as the Client/CWS security requirements.

3.16.15 Disposal of Radioactive Material

The handling and disposal of the uranium-laden media is described in detail in Section 3.17.

3.16.16 Annual Review of the Radiation Protection Program

An annual review/audit of the WRT Radiation Protection and ALARA Program will be conducted by the WRT CRSO or qualified designee to document the effectiveness of the Program. The goal of the audit is to identify deficiencies in the program and/or to identify areas where improvements can be made to lower doses to workers and the public.

The review will evaluate all areas/content of the Program as documented in the license application and Program implementation. These areas include but are not limited to (as applicable): CRSO and worker responsibilities; worker and public dose assessment and ALARA considerations; training; operating and emergency procedures; maintenance, adequacy, and use of personnel protective equipment. Results of the review/audit will be documented in a formal report.

3.16.17 Radiation Detection Instrumentation

3.16.17.1 Instrumentation

The types of radiation detection instrumentation that will be available to be used at the various Client treatment sites are presented in Table 3-5. These instruments or equivalent will be used to perform routine exposure rate measurements and surface contamination surveys during spent treatment media exchanges and during accidental releases of spent treatment media, should they occur. These instruments will also be used to support final release/unrestricted use surveys.

WRT will use check sources to confirm an instrument is working properly. These check sources may include, but are not limited to: lantern mantles, thoriated welding rods, as well as National Institute of Standards and Technology (NIST) traceable and non-NIST-traceable Technetium 99 (Tc-99), Thorium 230 (Th-230), and Cesium 137 (Cs-137) check sources. WRT's current inventory of check sources are listed in Table 3-6.

It is WRT's intent to have the listed instruments/check sources available for use but not necessarily at the Client facility. Rather, these instruments/check sources (or equivalents) will be stored/located at one or more of the following locations:

- On the WRT Service Vehicle that will be used to support spent treatment media exchange (or accidental releases spent treatment media)
- At the WRT Arvada, Colorado Office
- At the WRT Radiological Consultant's Office

WRT reserves the right to upgrade and add to its inventory any of these instruments and check sources as deemed necessary.

3.16.17.2 Method, Frequency, and Standards used in Calibrating Instruments

The radiation detection instrumentation listed in Table 3-5 has been selected for the appropriate radiation types and uses intended to support exposure rate measurements and contamination/ unrestricted release surveys at the Client facilities.

These instruments will be calibrated with radiation sources traceable to the NIST having energy spectrum consistent with the radionuclides (uranium) being measured and in compliance with ANSI N323.

These instruments will be calibrated on an annual basis (i.e., intervals not to exceed twelve months). WRT intends to use the following companies as the principal calibration service providers. WRT, however, reserves the right to select another qualified calibration service provider at any time.

- Griffin Instruments, Inc., 977 Hamilton Lane, Kingston TN 33763 (TN Calibration License No.865-376-1313);

- Ludlum Instruments Inc., 501 Oak Street, Sweetwater TX 79556, (TX Calibration License No. LO-1963)

TABLE 3 - 5
LIST OF RADIATION DETECTION INSTRUMENTATION

INSTRUMENT		NO. OF UNITS	RADIATION DETECTED (α, β, γ)	SENSITIVITY RANGE (mR/hr, cpm)	USE:	CALIBRATION FREQUENCY
Meter/Analyzer (Make & Model)	Probe/Detector (Make & Model)			*Cs-137 gamma	M-Monitor S-Survey Q-Measure	Q-Quarterly S-Semi-Annual A-Annual
Ludlum Model 3, 12	Ludlum Model 44-9 (pancake probe)	1	α, β, γ	3,300 cpm/mR/hr 0-500,100 cpm 0-200 mR/hr	S/M	A
and/or	Ludlum Model 43-5 (alpha scintillator)	1	α		S/M	A
Ludlum Model 2241-2	Ludlum Model 44-9	1	α, β, γ	3,300 cpm/mR/hr 0-500,100 cpm 0-200 mR/hr	S/M	A
	Ludlum Model 43-5	1	α		S/M	A
	Ludlum Model 44-10 (2 x 2, NaI)	1	gamma	0–900 cpm/μR/hr	S/M	A
Ludlum Model 2929/3030	Ludlum Model 43-10-1	1	α, β	0-999,999 cpm	Q/S	A
Ludlum Model 19	n/a	1	γ	175 cpm/μR/hr 0-5,000 μR/hr	S/M	A
Ludlum Model 2401-P	n/a	1	α, β, γ	3,300 cpm/mR/hr 0-15 mR/hr 0-50,000 cpm	S/M	A

TABLE 3- 6
List of WRT Check Sources

Check Source Radionuclide	Manufacturer	Serial No.	Ref. Date	Activity (μCi)	Comment
Th-230 (alpha), NIST traceable	Eckert & Ziegler	F5-050	1 Nov 08	0.01538	Calibrated source, used w/ meter Mdls. 3030 and 2241-2 w/ 43-5 alpha detector.
Tc-99 (beta), NIST traceable	Eckert & Ziegler	F5-049	1 Oct 08	0.01593	Calibrated source, used w/ meter Mdls. 3030 and 2241-2 w/ 44-9 beta-gamma detector.
Th-230 (alpha), NIST traceable	Eckert & Ziegler	L5-927	15 July 14	0.05804	Calibrated source, used w/ meter Mdls. 3030 and 2241-2 w/ 43-5 alpha detector.
Tc-99 (beta), NIST traceable	Eckert & Ziegler	L5-928	15 July 14	0.03979	Calibrated source, used w/ meter Mdls. 3030 and 2241-2 w/ 44-9 beta-gamma detector.
Cs-137 (gamma)	Spectrum Techniques	1901	June 07	1	Attached to Ludlum Mdl. 2241-2 meter, used for simple response check.

3.17 Waste Disposal

While WRT requests that the renewed NRC license will allow WRT to perform licensed service activities on any applicable uranium water treatment system in the U.S., regardless of a system's manufacturer, WRT expects that the majority of the treatment systems that it will service will be provided by WRT. This section presents descriptions of and operating parameters for the range of WRT uranium treatment systems that are expected to be operating in the non-Agreement States. Presenting this information supports WRT's approach for a multi-site license application where the NRC reviewer can assess the complete range of expected treatment systems at one time.

The design and operation of other manufacturers' treatment equipment, and the associated activities of the collected radioactive material, are expected to be materially similar to that of WRT's treatment systems. WRT has performed about a half dozen treatment media exchanges on non-WRT treatment systems in several states, and WRT has seen that its service and media-exchange processes will work equally well on WRT- or non-WRT-supplied treatment equipment.

3.17.1 General Overview

WRT's waste management philosophy is that once the uranium is removed from the drinking water feed, it should not be disposed of by discharge back into the environment in an uncontrolled manner, as in backwashing or releasing to a sanitary sewer system. Under WRT's approach, the uranium-laden spent treatment media (the water treatment residuals) will be removed from the treatment vessels at the Client treatment site(s) and transported to a facility properly licensed to accept the licensed uranium residuals as "equivalent feed". NRC developed and adopted the concept of equivalent feed (to a uranium producer) in its Regulatory Issues Summary (RIS) 2012-06, adopted in April 2012. WRT assisted NRC during the development of the RIS. In accordance with the requirements and specifications presented in the RIS, a uranium producer can accept and process uranium-laden water treatment resins that are similar in form and function to those that the producer uses for uranium recovery without the need for the producer to get a license amendment to do so. This ability greatly facilitated WRT being able to realize its preferred alternative to recover the collected uranium and reuse the resin treatment media, as opposed to disposing of the resin and the uranium.

WRT will transfer spent treatment media only to properly licensed or permitted facilities for final disposition. WRT will obtain properly executed contracts, purchase orders, or similar agreements with these facilities prior to initiating license activities at the water treatment site.

3.17.1.1 Uranium Disposal

WRT desires to continue to implement two (2) alternatives for the final disposition of the spent uranium treatment residuals. The preferred choice is to deliver the spent treatment media to a licensed uranium recovery facility, which will take title to and process the licensed material to recover the contained uranium. WRT currently has a long-term contract with Cameco Resources, Inc., that operates uranium in situ recovery (ISR) facilities in Nebraska and Wyoming. With this preferred alternative, the uranium-laden treatment media is not a waste, but rather, NRC-designated "equivalent" feed" material with the uranium ultimately going into the fuel cycle.

With the second alternative, the spent treatment media could be disposed of at an appropriately-licensed disposal facility which can dispose of licensed source material in the quantities and activities that correspond to WRT's spent treatment media. Such facilities include, but may not be limited to, Energy*Solutions*, Inc. in Utah, U.S. Ecology Washington, Inc. in Hanford, Washington, and Energy Fuels, Inc.'s White Mesa Mill, in Blanding Utah.

The treatment vessels will be designed to allow for long intervals between required media exchanges. Depending on the uranium content of the feed water and the overall utilization of the water well or other feed water and given the high loading capacity of the treatment media, a treatment system may nominally operate efficiently three (3) to five (5) years between exchanges.

3.17.1.2 WRT Spent Media Handling and Disposal Services

The services that WRT can provide to a Client include the following activities related to handling and disposing of spent uranium treatment media:

- Removal of spent treatment media from the treatment vessel and dewatering the treatment media as necessary;
- If both stages of treatment media are not exchanged, advancing the partially-loaded treatment media in Stage 2 to the Stage 1 position in the treatment vessel or system, so that it will see the higher concentrations of uranium in the feed water and continue to load efficiently;
- Preparing the spent treatment media for transport by packaging the treatment media and preparing appropriate shipping documents. "Packaging" typically means using an exclusive-use tanker trailer or bulk rolloff container or placing the media in package containers such as, but not limited to, large, polyfabric "Super Sacks" bags (nominally 48- to 96-cu-ft capacity) or industrial bulk containers (IBC) approved for transport of radioactive material;
- Arranging for the transportation by a contracted common carrier appropriately permitted to transport radioactive material;
- Obtaining the necessary commercial agreements and licenses/permits for uranium disposal/recovery;
- Installing fresh treatment media into the treatment vessel(s), and performing the final on-site conditioning and disinfecting operation in preparation of putting the Uranium Removal System back on-line;
- Performing a contamination survey at the well site facilities after each media exchange, and decontaminating any affected areas, if necessary;
- Decommissioning (including removing the final charge of treatment media) and decontaminating the Uranium Removal System equipment as necessary at the termination of the treatment agreement between WRT and the Client.

WRT will ensure that all equipment used for media exchanges is functional and operates within the specifications described in this ER. WRT System Specialists will ensure that all media exchanges are conducted in accordance with this ER and in a manner, which minimizes releases of spent treatment media.

3.17.2 Transportation of the Radioactive Treatment Media

Typically, WRT will arrange for transportation of the packaged spent treatment media by a contracted commercial carrier. WRT will comply with the applicable U.S Department of

Transportation (DOT) regulations (primarily 49 CFR Parts 171 through 173, DOT Pipeline and Hazardous Materials Safety Administration), as well as the applicable NRC/Agreement State's regulations for transportation of radioactive material.

For the uranium treatment residuals, if this material is classified as Class 7 radioactive material for transportation, it is expected to be classified no higher than either of the following categories of Hazardous Material Description and Proper Shipping Name (see table 49 CFR 172.101). These DOT Class 7 categories are the two lowest activity categories of radioactive material for DOT hazmat transportation.

- UN2910 – Radioactive material, excepted package – limited quantity of material.
- UN2912 – Radioactive material, low specific activity (LSA) non-fissile or fissile-excepted.

Package selection, packaging, labeling, preparation of shipping papers, placarding, and transportation requirements for the Class 7 spent treatment residuals will comply with both the general requirements of the following subsections of the DOT Hazardous Material Regulations, and any site-specific packaging requirements of the subject waste disposal facility.

1. The selection of allowable container or package types will be in accordance with (IAW):
    - Packaging requirements of the Waste Acceptance Criteria of the particular disposal facility.
    - Packaging will meet the general design requirements of 49 CFR §173.410.
    - Packaging requirements for UN2910 limited-quantity material found in §173.421 and §173.422, and for UN2912 LSA-1 material found in §173.427.
2. In general, labeling of individual waste packages is not required for either UN2910 or UN2912 Class 7 material.
3. Preparation of shipping papers IAW §172.200 through §172.205 and the particular disposal facility's waste manifest requirements.
4. In general, the placarding and the actual transporting requirements will be met by the contract carrier, but will be verified by WRT. These requirements are identified in §173.422 (UN2910 material) and §173.427 (UN2912 material).

3.17.3 Management and Disposition of Spent Treatment Media

WRT will implement two (2) alternatives for the disposition of the uranium laden spent treatment media. The preferred alternative is to deliver the spent treatment media to a licensed uranium recovery facility, which will take title to the licensed material as an equivalent feed material and process such material to recover the uranium (see Section 12.1.2). Similar to the

disposal of Radium spent treatment media, WRT will obtain and maintain operating contracts with properly licensed uranium recovery facilities.

WRT will package and present the spent uranium treatment media for transportation (using an appropriately permitted common carrier) for delivery to a uranium recovery facility for processing as an equivalent feed material. After the uranium is stripped off of and recovered from the treatment media, the stripped media will either be transported back to the WRT Media Production Plant for recertification and reuse or, if the treatment media has no further function and value, the spent treatment media could be disposed of by the uranium processor, most likely as AEA 11.e.(2) byproduct material, in a uranium mill tailings impoundment.

The alternative to uranium recovery is to dispose of uranium-laden spent treatment media, from the water treatment site, at an appropriately licensed facility that can dispose of the material in the quantities and activities that correspond to WRT's spent uranium treatment media. WRT will obtain and maintain operating contracts, as necessary, with licensed facilities for the disposal of this spent uranium treatment media.

3.17.4 Media Exchange Process

3.17.4.1 Overview

The following subsections summarize the general steps that will be performed during a uranium media exchange operation at a water treatment site. In keeping with the conservative nature of this license application, the equipment described below reflects the size that will be used for one of the larger-capacity treatment systems (e.g., 750 to 1,500-gpm). Equipment that services smaller-capacity wells will be downsized accordingly, but will have the same essential function.

The movement of both the spent (uranium-laden) treatment media and the new media during a media-exchange operation can be accomplished using two different processes:

- A wet process where media and water are moved using pumps or eductors (a media-water slurry process). In this process the water will be drained or screened from the spent treatment media, to prepare it for packaging and transport. This slurry method is expected to be the usual method for moving the treatment media;

- A pneumatic (vacuuming) process where the media is moved using a large-capacity, industrial vacuum. In this process, the treated water contained in the treatment vessel(s) will be drained from the vessel(s) before vacuuming the media.

Typically, WRT will arrive on site with three (3) large vehicles during a Uranium media exchange service call – a service trailer, a container vehicle for dewatering and/or transporting the spent treatment media, and a vehicle carrying the fresh treatment media.

One 40-ft-long enclosed trailer will be the WRT service trailer. A general layout of the equipment in this trailer is presented in Figure 3-5. Equipment in this service trailer will be used

to perform the operations required to remove the spent media from the treatment vessel, prepare this spent treatment media for transportation to an appropriate disposal/recovery facility, and load fresh treatment media into the treatment vessel. The service trailer could house the following typical major equipment components (equipment sizes are representative only, not prescriptive). This list of equipment is neither all-inclusive, nor license prescriptive; it's presented here for informational purposes only.

- 80-kw generator set;
- 40-hp MaxVac high-capacity industrial vacuum, or similar;
- 1,100-gal water tank;
- Single-deck, vibratory media dewatering screen;
- Bag- and/or cartridge-type water filter unit(s);
- "Super Sack" bag loading frame;
- 60-cu-ft media hopper;
- 10-hp slurry pump(s), portable;
- 5-hp return water pump(s), portable;
- Treatment media transfer hoses, air compressor, tools, and safety equipment.

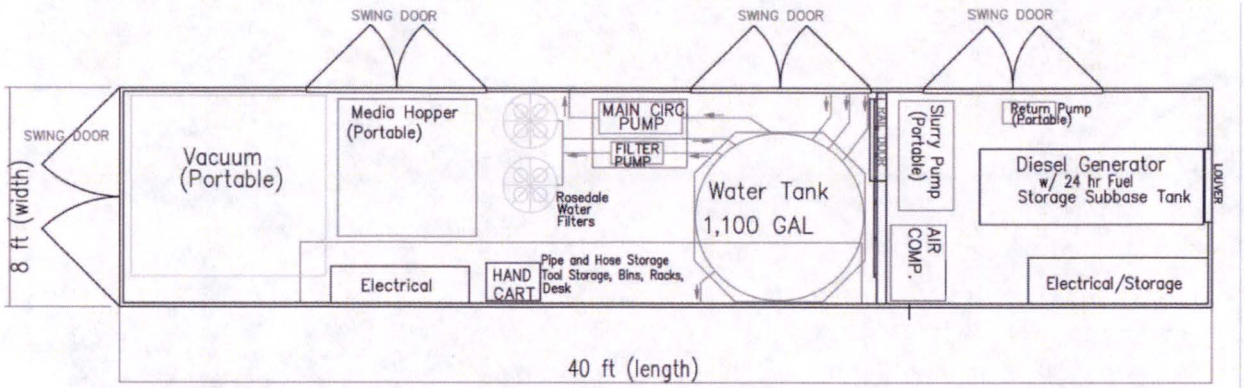
As an alternate to its large service trailer, especially at the smaller treatment sites, WRT may use a smaller trailer equipped with pumps for circulating both media slurries and conditioning/disinfection solutions, and a smaller surge tank. This trailer can be towed by a pickup.

If used, the second vehicle for the media exchange operation could be a highway transport similar to the tanker trailer or the roll off-type box or dewatering containers presented in Figure 3-6. In fact, the two tanker trailers in the bottom photo of figure 3-6 are owned by WRT. To date they have been used to transport spent resin from ten (10) large-volume uranium media exchanges to the Cameco Crow Butte Project. The roll off dewatering container could have a capacity up to approximately 30 cubic yards. Internally, the container will have a screened false bottom or a porous drainage grid, which allows water to drain from the treatment media. This roll-off dewatering unit can also function as the highway transport container. The tanker trailer will also be equipped to retain and dewater the treatment media. The spent treatment media will be pumped into the container from the treatment vessel. The screen will prohibit the treatment media from re-entering the System(s) and water collected in the bottom of the tank or container will be pumped through the bag- or cartridge-type water filter units. This treated water will then be either filtered and discharged on site or, if applicable, recycled to the treatment vessel.

An alternative to the use of large-capacity bulk containers described above would be to package the spent media in polyfabric "Super Sack"-type bags, with a typical capacity of 48 to 96 cu ft. The Super Sack bags will be rated and approved for the transportation classification corresponding to the type and activity of the radioactive material they would contain. The bags would also comply with any packaging requirements of the disposal/recovery facility. This packaging rating is expected to have to be no greater than an Industrial Package-1 (IP-1) rating. More details of this alternate packaging method are described in Section 3.17.4.2.

A third alternate packaging method for the small-capacity treatment systems, applicable to the uranium systems, would use smaller approved containers, tanks, or drums, holding much less material than the large bulk tankers or containers described above. Examples of these smaller containers include industrial bulk containers (IBC), typically 275- to 550-gal capacity, usually constructed with a plastic tank with a surrounding metal-reinforced frame and metal base, but also constructed solely of metal; and 55- to 96-gal drums. Examples of the plastic-metal IBCs that WRT typically uses are presented in Figure 3-7. The packaged media would then be transported by an appropriately-permitted common carrier to the licensed disposal or uranium recovery facility.

The third vehicle for the media exchange operation will carry new uranium treatment media, either in bulk tanks or bagged in polyfabric Super Sack bags (2,000 to 4,000 lb of treatment media per bag). Other ancillary equipment used for a media exchange may include at least one forklift, a parts trailer for miscellaneous supplies and consumables, and service pickup trucks.



WRT Service Trailer Layout

MaxVac High-Capacity Industrial Vacuum

Figure 3-5

20- to 30-cu-yd
Dewatering Container/
Transport Box

800- to 1,000-cu-ft Tanker Trailer

Figure 3-6 Examples of Bulk Media Transport Containers

Schutz-brand, 325-gal IBC

IBC Tote in use at a WRT PES System

Figure 3-7
Examples of Industrial Bulk Containers (IBC) "Totes"

3.17.4.2 General Description of a Media Exchange Operation

Typically, the media exchange operation will include the six (6) general operations, which are presented schematically in Figure 3-8.

1. Take the treatment system off-line;
2. Unload the spent treatment media from the Stage 1 treatment vessel;
3. Advance the Stage 2 media to the Stage 1 position;
4. Load fresh media into the Stage 2 treatment vessel;
5. Condition and disinfect the fresh media and treatment vessel(s);
6. Put the treatment system back on-line.

The following summary generally describes the activities involved in accomplishing the six operations listed above. Not all of these activities involve handling the radioactive spent treatment media. This general description applies to the two (2) different methods that WRT will use to move the spent treatment media.

- **Pumping/Slurry Method** of moving the spent media along with the treated water (a slurry) contained in the treatment vessel(s).

- **Pneumatic/Vacuuming Method** of moving just the drained spent media from the treatment vessel(s).

Distinctions between the two methods are identified and presented in the summary below.

1. Take the Treatment Vessel Off Line – A representative of the Client will isolate the WRT treatment system from the water supply system. For the Vacuum Media Transfer Method – the contained treated water will be drained from the treatment vessel(s) at this point in the process, before continuing with the steps below.

2. Unload Treatment Media (see Figure 3-8, Step II.)

   2.a. For the Pumping/Slurry Media Transfer Method –
   A water slurry operation will either pump or move under pressure the spent treatment media from Stage 1 of the treatment vessel to a dewatering container/transport vehicle and dewatered in preparation for transport. The dewatering of the spent treatment media will be accomplished by gravity as the water naturally drains out of the media through screens in the false bottom of the dewatering container, or at the bottom of the tanker trailer. With the dewatering container, either air or a vacuum can also be pulled through the media to increase dewatering. Water removed in this operation is not radioactive. This treated water will be either re-circulated back to the treatment vessels, or pumped through bag- or cartridge-type filters and discharged on site.

   An alternative to the use of large-capacity bulk containers described above would be packaging the spent media in polyfabric "Super Sack" bags approved for the radioactivity classification of the spent media. Examples of this Super Sack bag are presented in Figure 3-9; the typical capacity of a bag will be 48 to 96 cu ft. In this operation, the spent media-water slurry would report to a vibrating screen, for dewatering. The dewatered media will then discharge to a Super Sack bag, positioned in a loading frame. As described above, the water removed in this step will be either returned to the treatment vessel, or passed through a bag- or cartridge-type filter unit and discharged on site.

   2.b. For the Vacuum Media Transfer Method –
   This method will also use bulk containers, rolloff boxes, and Super Sack bags for spent media packaging. After the treated water has drained from the treatment vessel(s), the spent media will be accessed through a service hatch or door that is mounted on the side of the treatment vessel, for each stage of media. Using a rigid wand attachment, the drained, spent media will be vacuumed through a hose to a small receiver/dump hopper that is positioned above a rolloff box, Super Sack bag, drum, or other type of container. Absorbent material may be used at the bottom of the bag and/or interspersed throughout the spent media, as necessary, for moisture control. With this vacuuming method, typically there will not be any separated water that would need to be recycled back to the treatment vessel or discharged.

   2.c. Packaging Options for Transport –
   In summary, the dewatered treatment media can be transported to the disposal/recovery facility using one of the following packaging methods. This listing is not all-inclusive. The type of package/container that can be used will determined by what is allowed by the material-acceptance criteria at the particular disposal/recovery facility. .

- Transported directly in bulk in a rolloff container or tanker trailer. This method would be used in the situations where a facility could receive material in bulk, for example, at a uranium recovery facility (Cameco Resources, Inc.,).

- Super Sack bags, approved for the radioactivity classification and mode of transport (for example, an exclusive-use shipment) – These bags can be used with either the pumping/slurry or vacuum methods of media transfer.

- Miscellaneous Other Packaging – "B-25" metal boxes, IBC containers smaller than Super-Sack capacities, and drums (typically 55- to 96-gal capacity). These containers probably would be used more with the vacuum method of media transfer, but could also be used with the pumping/slurry method, as well.

- WRT's Portable Exchange System (PES) treatment bottles – The fiberglass-reinforced plastic (FRP) treatment bottles used in the PES units can be used as their transport and disposal containers. Minimal post-operation preparation of the bottles is required, primarily moisture control (for certain disposal scenarios). An additional advantage with the PES bottles is that, typically, the spent media will not need to be removed from the bottle or otherwise handled at the water treatment site, thereby minimizing the potential for contamination at the site.

3. Advance the Stage 2 Treatment Media (Figure 3-8, Step III.) – Typically, a Uranium Removal Systems will contain at least two stages of treatment media to provide redundancy for the uranium removal, to prevent breakthrough of uranium concentrations above the MCL. Advancing the partially-loaded treatment media in Stage 2 to the Stage 1 position in the treatment vessel or System, will allow the treatment media to see the higher concentrations of uranium in the feed water in Stage 1 and continue to load efficiently.

   In some situations, typically based on the contaminant concentration in the Stage 2 media, WRT may exchange both stages of treatment media during an exchange operation. In this case, this Stage 2-advance step will not take place.

4. Survey Areas for Contamination – Perform site clean-up and an area survey for potential contamination, at the conclusion of the operation of handling/packaging the radioactive spent media and before starting the steps dealing with the non-radioactive, fresh media. Decontaminate any impacted areas, as necessary. See Section 3.16.10 for more details regarding area surveys.

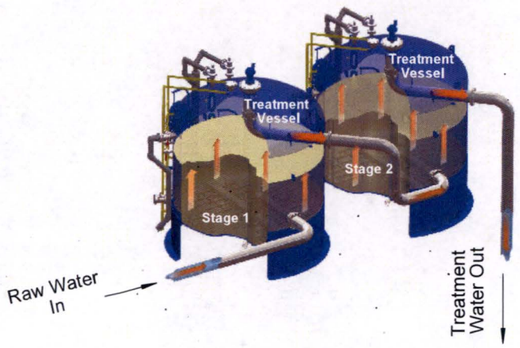
5. Load New Treatment Media – Loading fresh treatment media, which typically arrives on-site in bulk in either a tanker truck or Super Sacks, into the Stage 2 position in a multiple-stage vessel or an individual Stage 2 column. This loading operation will be accomplished by either pumping a water/media slurry or pneumatically transferring (vacuuming) the dry media. If both stages of spent media have been removed, then two (2) stages of fresh media will be loaded.

6. Condition the Fresh Treatment Media – A final water conditioning operation that rinses out fine material remaining in the fresh media (slit/clay, iron fines, zeolite fines, etc.), and disinfects the stages of media.

7. Reconnect the Treatment Vessel – After the conditioning and disinfection process is complete, the uranium treatment vessel system will be reconnected to the local water system by a Client representative.

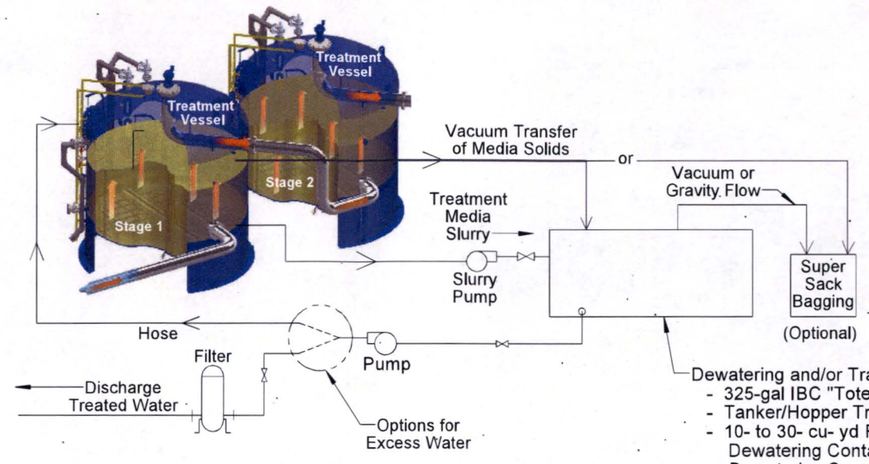
REVISIONS					
REV.	REVISION DESCRIPTION	DATE	DRAWN BY	APPROVED	MGR APPROV
1.0	RELEASED DOCUMENT	4/2/08	DWE	DWE	DB
2.0	ADD VACUUM OPTION DETAILS TO PROCESS	12/23/09	DWE	DWE	DB
3.0	UPDATED TO A 2 VESSEL STANDARD SYSTEM. WAS SINGLE VESSEL, 2 STAGE	11/16/2016	DWE	DWE	DB

I. Isolate Treatment Vessels From Service



- For All-Vacuum Transfer, Drain Treated Water From The Isolated Treatment Vessel

II. Unload Spent Media From Stage 1 (Slurry or Pneumatic Process)



Typical Treatment Vessel Service Sequence of Operation

I. Isolate Treatment Vessel from Water Service
II. Unload Spent Media from Stage 1
III. Advance Partically-Loaded Media from Stage 2 to Stage 1
IV. Load New Media into Stage 2
V. Condition and Disinfect New Media
VI. Return Treatment Vessel to Service

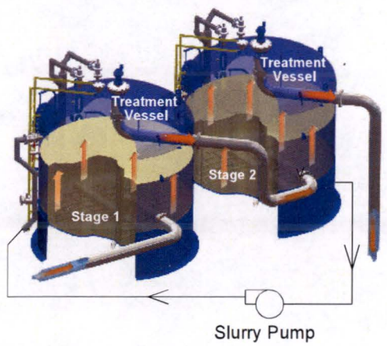
Typical Major Equipment

A. Service Trailer
* Power System
* Fork Lift
* Vacuum
* Pumps
* Filters
* Dewatering Screen

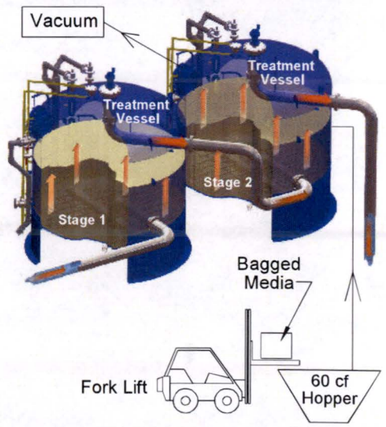
B. Dewatering/Highway-Transport Container or Highway Flatbed For Spent Media Bags

C. Truck/Trailer with New Media Bags

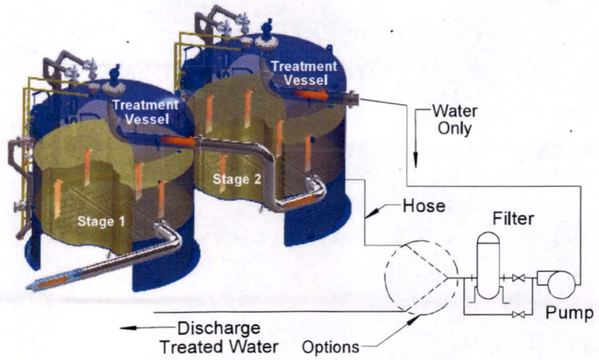
III. Advance Stage 2 Media to Stage 1 Optional Step (Slurry Process)



IV. Load New Media in Stage 2 (Slurry or Pneumatic Process)



V. New Media Condition/Disinfect



VI. Return To Service

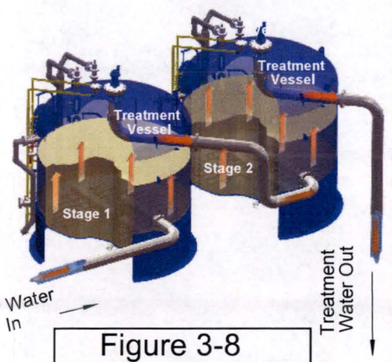


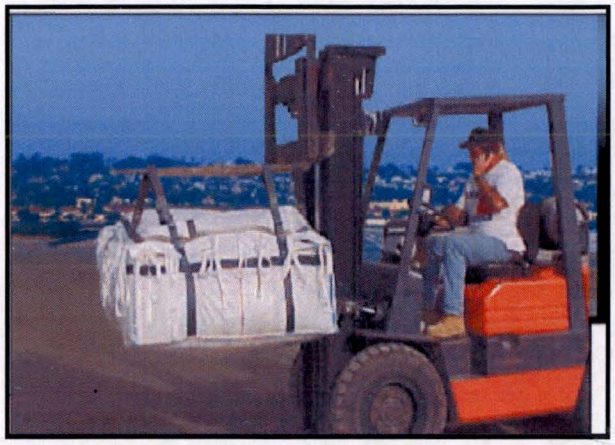
Figure 3-8

ISSUED FOR INFORMATION 11/21/2016

Monday, November 21, 2016 4:02:47 PM

PROJECT:	WRT STANDARD
TITLE:	RADIONUCLIDE REMOVAL SYSTEMS TYPICAL MEDIA EXCHANGE OPERATIONS
SIZE	D
DWG. NO.	WRT-LIC-010
REV	3.0
SCALE:	1:6
SHEET 1 OF 1	

WRT DRAWING TEMPLATE D_SIZE.SHT 1 REV 2.0



48-cu-ft capacity flexible Lift Liner™ package

96-cu-ft capacity flexible Lift Liner™ package

Figure 3-9
Typical Polyfabric "Super Sack" Packages for Media Handling

The WRT crew will consist of at least two (2) System Specialists. In addition to handling the treatment media in the above operations, the WRT System Specialists will perform any general maintenance, service and repair of the treatment vessel(s) and ancillary equipment. As described in Section 3.16.10, WRT will also perform an area survey upon completion of a media exchange operation looking for any surface contamination, (e.g. spent treatment media).

Equipment will be available (the large HEPA vacuum system, portable wet/dry HEPA vacuum, small hand brooms, etc.) for collecting spilled treatment media and decontaminating the area. The WRT crew will employ radiological controls and good housekeeping procedures to eliminate or mitigate the possibility of surface contamination during a media exchange. In addition to the use of PPE, tarping in work areas in the immediate vicinity of the treatment vessel(s), secondary containment, and/or removable plastic sleeving around hose and flange connections will be used where practical to mitigate potential treatment media spills.

3.17.4.2.1 Variations in Media Handling and Packaging for the PES Units

Because of the relatively small flow rates of the wells that they would service, PES units offer a simpler operation and service ability compared with that of the larger WRT systems. Because the PES treatment bottles are relatively small and inexpensive, the bottles can be used not only for the water treatment process, but also for the transportation and disposal container for the spent media. This means that the radioactive spent media will, under normal conditions, not need to be removed from the treatment bottles or otherwise directly handled at the treatment site.

A media exchange at a PES site will simply involve disconnecting hoses between the PES bottles and replacing the spent treatment bottles with new ones that have been shipped to the site, full of fresh media. Neither the fresh nor the spent media will be handled directly at the site. This bottle exchange can be performed by the WRT system Specialists or by the utility operators, and the spent treatment bottles can be set aside and secured in the Client's treatment building.

Only the WRT System Specialists, however, will prepare the spent treatment bottles for transport and disposal/recovery. This preparation process is greatly simplified, compared to the steps taken with the larger treatment systems where the spent media must be removed from the treatment vessels. The treated water remaining in a bottle will be drained and/or blown out and absorbent will be added, as necessary, to stabilize any residual moisture in the spent media.

Alternately, there may be advantages at a treatment site that uses a PES unit for re-using the individual PES bottles, rather than exchanging them for new ones. If this is the case at a particular site, WRT, at its discretion, may decide to remove the spent treatment media from the PES bottles on site, in similar, but simpler, steps to those used at the larger treatment sites. The spent media can be slurried or vacuumed, as appropriate for the container, into Super Sack bags or into the other smaller-capacity containers described in Steps 2.a. and 2.b. of Section 3.17.4.2. (IBC totes, drums, etc.).

Regarding transportation of the spent PES bottles, typically there won't be enough spent bottles at one treatment site to fill a highway truck, for efficient and cost-effective transportation to a disposal or recovery site (for uranium media). WRT will attempt to schedule a number of either PES unit exchanges or the picking-up of stored bottles from a number of sites (a "milk run") to make the transportation as efficient as possible. To facilitate this scheduling, WRT is requesting that the spent PES bottles can be secured and stored at a treatment site for up to 12 months.

3.17.4.2.2 Variation in Media Handling for Other Small Treatment Systems

In order to move the spent treatment media across the country in the most efficient and cost effective manner, typically highway transport vehicles will need to carry 20 to 25 tons of treatment media in a load. At smaller treatment systems (e.g., 50- to 500-gpm), Uranium Removal Systems will only contain enough treatment media to fill a portion of a full transport truck load. Additionally, these small treatment sites may not have enough room for the two (2) or three (3) large tractor-trailer units that would typically service the large-capacity treatment systems. For the smaller systems, WRT proposes to downsize the WRT service vehicles, equipment, and containers/packaging. The media exchange procedures used at the small well will be identical to the procedures described above, and WRT System Specialists will perform the work.

WRT's experience indicates that some Clients will have a number of small treatment sites in relatively close proximity. As described in the subsection above, WRT will attempt to schedule a group media exchange from such wells in order to fill a highway transport vehicle, in a milk-run process. The highway transport vehicle may be located at one of the treatment sites for several days, as the WRT service truck and crew will go to each small treatment site to perform the media exchange. As an alternative, all of the media exchanges may be performed at the several treatment sites before the highway transport arrives to pick them up in the milk run. In this scenario, the containers containing the spent media at each treatment site may be stored at the treatment site for several days before the highway transport arrives.

As with the small PES units described in the section above, it may not be possible to schedule a number of media exchanges within a short period of time, to make the transportation of the spent

media more efficient. Accordingly, WRT requests that if packages of spent media from this small treatment system can be secured at the treatment site, then they can be stored there for up to 12 months after the media exchange, to more-efficiently schedule the transportation of a larger volume of spent media from multiple treatment sites.

3.17.5 WRT Commitments

Based on the above, WRT is committed to implementing SOPs for media exchanges to ensure all spent treatment media is transferred from the Uranium Removal System to DOT-approved containers and is transported in DOT-approved vehicles to properly licensed facilities for final disposition in a manner which minimizes potential release of spent treatment media and which is adequately protective of public health and occupational safety and the environment.

3.18 Decommissioning and Financial Assurance

The water treatment agreement between WRT and a Client typically is a long-term agreement, (e.g., 10 to 20 years). Upon termination of a treatment agreement, regardless of the reason, WRT usually is responsible for removing and disposing of the treatment media in use at the Client site, decontaminating the Uranium Removal System equipment and the treatment site as necessary. The decommissioning of the treatment site also will include the performance of a final area survey of the treatment building or room where the Uranium Removal System is located and the areas outside the treatment building that likely may have removable contamination resulting from media exchanges. Any removable contamination will be cleaned up for unrestricted use of the area.

In some instances, the Client may have purchased the Uranium Removal System as part of its treatment agreement with WRT. In these cases, WRT will still perform the decontamination and decommissioning of the equipment and the treatment site and, if treatment system equipment is cleared for unrestricted use, its final disposition (e.g., re-use or removal) will be decided by the Client. This means that depending on the ownership of the treatment equipment, WRT potentially could then use the Uranium Removal System at another Client treatment site.

Given the self-contained nature of the Uranium Removal System and the limited amount of licensed material contained therein prior to media exchanges, WRT's experience to date with decontaminating and/or decommissioning equipment and areas has determined that decommissioning will be a relatively straightforward procedure.

Because the systems operate without chemical additions and most of the system components are constructed either of stainless steel or epoxy-coated steel, it is expected that the potential for buildup of significant amounts of radioactive scale on the inside surface of the treatment vessel is low. If such scale or other radioactive residuals are present, it is expected that this removable surface contamination can be cleaned for unrestricted use of the equipment. In some instances, the Client may have purchased the Uranium Removal System as part of its treatment agreement with WRT. In these cases, WRT will still perform the decontamination and decommissioning of the equipment and the treatment site and, if treatment system equipment is cleared for unrestricted use, its final disposition (e.g. re-use or removal) will be decided by the Client.

WRT will conform its decommissioning activities to the methodology and requirements presented in this ER. WRT is committed to providing adequate financial assurance for decommissioning activities at Client/CWSs sites utilizing the uranium treatment system. WRT is also committed to a financial assurance methodology to calculate decommissioning cost estimates for its Uranium Removal Systems. This methodology will allow WRT to calculate decommissioning cost estimates for each of its Uranium Removal Systems on a site-specific basis and document such estimates in the accepted statement of intent, guarantee or other financial assurance mechanism, as part of registering the subject Client treatment site(s) under the WRT master license.

Decommissioning cost estimates (DCE) for the Uranium Removal System and other relevant aspects of the uranium water treatment program depend on the size of the System and the final disposition pathway for spent treatment media. Spent treatment media destined for processing at a licensed uranium recovery facility as an equivalent feed (WRT's preferred disposition pathway) will result in one range of decommissioning costs, and spent media destined for direct disposal at an appropriately licensed or permitted facility will result in a second range of costs. As expected, the costs for disposal of the spent media are larger than those for recovering the uranium at a uranium producer's facility.

As part of its initial license application in September 2005, WRT estimated total decommissioning costs for three sizes of its treatment systems – for treated flow rates of 100, 1,500, and 3,000 gpm – to illustrate the approximate range of those costs. These were total decommission costs that included not only the media unloading and decontamination activities at the treatment site, but also costs for packaging, transporting, and disposing (or uranium recovery) of the final charge of spent media, plus an overall 20-percent contingency. For the higher-cost, media-disposal scenario the total estimated costs in 2005 were the following.

• 100-gpm system, similar to a current PES unit or a small MCS	$18,000
• 1,500-gpm system, a large field-erected system	$174,000
• 3,000-gpm system, consisting of two 1,500-gpm, field-erected systems operating in parallel	$288,000

For this license renewal WRT does not intend to update this illustrative, but still hypothetical, range of possible decommissioning cost estimates. Current cost estimates for the same range of systems would obviously be higher, not only because of inflation in all components of the costs, but also because of the larger volumes of treatment media that WRT now installs in the same sized systems (see Section 2.3.2.2 and Table 2-1). Given the system- and site-specific nature of the actual decommissioning costs, WRT will continue with its commitment made with the initial license application and will prepare and document DCEs for each Uranium Removal System prior to the commencement of licensed operations. A DCE specific to a particular Client and its treatment site(s) will be the basis for financial assurance at each Client treatment site. WRT will document such decommissioning cost estimates in its financial assurance mechanism for each Client/CWS. WRT periodically will review and adjust decommissioning cost estimates. Consistent with many of its Agreement State licenses, WRT proposes that it will review and

adjust DCEs no more frequently than five-year intervals after the start of licensed activities at a Client site(s) and/or as part of a license renewal.

3.18.1 Decontamination and Decommission Plans

Upon termination of a Treatment Agreement, and in accordance with the WRT-Client water treatment agreement, WRT likely will be responsible for removing and disposing of the treatment media in use at the Client site, decontaminating the Uranium Removal System equipment and treatment site as necessary, and possibly removing the system from the site. WRT will also perform a final area survey of the site, as appropriate. WRT will prepare a Decontamination and Decommissioning (D&D) Plan, as appropriate, (including the final survey) to implement the work.

3.18.2 Financial Assurance

WRT is committed to providing adequate financial assurance for decommissioning activities at Clients sites utilizing the uranium water treatment system. WRT's financial assurance alternatives are described in greater detail in the WRT's license application letter. The information provided in this application letter is hereby made part of the license renewal application package by reference.

With this license renewal WRT requests to continue with the same overall framework for providing financial assurance that is in place in the current license, namely:

1. There will be a separate, stand-alone financial assurance arrangement for each individual WRT Client. A single DCE and financial assurance arrangement can cover multiple treatment sites controlled by a Client. The arrangement will be put in place prior to the start of licensed activities.

2. WRT's Clients, regardless if they are a public/government or private entity can provide the financial assurance on behalf of WRT, the licensee.

3. A public or government entity – federal, state, or local – pursuant to 10 CFR 40.36(e)(4), may provide a statement of intent as the financial assurance arrangement on behalf of WRT. Private-entity Clients will provide any of the other financial assurance arrangements described in 10 CFR 40.36(e) (excluding a statement of intent), or an alternate arrangement approved by the NRC, on behalf of WRT.

4.0 ASSESSMENT OF POTENTIAL IMPACTS FROM WRT's URANIUM WATER TREATMENT PROGRAM

WRT has assessed the potential environmental impacts from each of the alternatives discussed above including: (1) no-action, (2) "regenerating/backwashing" uranium residuals down sanitary sewers or other uncontrolled re-introduction into the environment, and (3) the implementation of WRT's water treatment program, including the installation and operation of the Uranium Removal System. Based on this assessment, WRT has determined that the use of its technology does not create any significant potential impacts to public health and safety or the environment. In fact, WRT's uranium water treatment program minimizes potential adverse impacts to public health and safety as compared to other potential alternatives.

Note: The assessments in the following subsections that discuss the impacts for the "Continued Action" alternative apply to both drinking-water and non-drinking-water treatment (aka other-water treatment), which is WRT's request to expand the scope of work covered by the renewed license.

4.1 Land Use Impacts for Each Alternative

Land use impacts for each of the alternatives discussed above are as follows:

4.1.1 Land Use Impacts for No-Action Alternative

Land use impacts for the no-action alternative are minimal. Since the SDWA uranium MCL is a federal mandate, drinking water providers cannot refuse to comply with the standard, as such, potential land use impacts associated with the no-action alternative should be irrelevant. Over time, Clients/CWSs will construct new water treatment buildings or other structures if only to address increases in water consumption based on population increases or based on elevated contaminant levels in other untreated water sources. The same regulatory compliance situation applies to Clients required to treat other contaminated water sources.

4.1.2 Land Use Impacts for "Regenerating/Backwashing" Alternative

Land use impacts from the "regenerating/backwashing" alternative will not be dissimilar to the land use impacts from the no-action alternative. CWS Clients and other Clients likely will construct new water treatment buildings or other structures only in response to increases in demand for drinking water or elevated contaminant levels in other untreated water sources. Given that any existing water treatment facilities that use regenerating/backwashing as part of their treatment processes *presumably* already have addressed land use impacts, there should be no additional land use impacts from the use of "regenerating/backwashing" at such facilities. Potential land use impacts that may have arisen would be based on releases of uranium residuals from water treatment to land by "regenerating/backwashing" as a disposal option.

The presence of elevated uranium concentrations in soils potentially may impact the potential future uses of such lands such as residential, commercial or recreational. Given that populations

may increase over time and that such lands could be purchased for residential development, it is possible that residential development could be negatively impacted by the presence of elevated uranium concentrations in soils.

4.1.3 Land Use Impacts for Continued Action

The following discussion has been expanded somewhat from that presented in the initial ER and license application, to address the other-water treatment scenarios. Potential land use impacts from WRT's uranium water treatment program exist if Clients expand existing facilities for uranium removal or identify new drinking water sources or other contaminated water sources that require treatment for their uranium content. The construction of new water treatment structures or extensions of existing structures are the actions that will cause any potential additional impact on land use. While the installation of new wells and associated infrastructure will impact the subsurface, subsurface conditions are not directly impacted by the installation of the Uranium Removal System.

As stated above, if new water treatment structures need to be constructed, the amount of land to be used is minimal (i.e., 400-500 square feet for smaller Systems and 2,000-3,000 square feet for larger Systems). However, given that land use assessments for lands to be used for new construction likely have been completed and that the Uranium Removal System does not require additional land to install, the implementation of WRT's uranium water treatment program likely will not add any incremental impacts above and beyond the construction of such water treatment structures.

WRT's Clients likely have completed land use analyses for each of their existing water treatment sites and the available information from such analyses can be used to anticipate any issues associated with the construction of extensions to such facilities or new facilities.

WRT's uranium water treatment program eliminates potential land use impacts from the land application of uranium residuals. In the scenario of the treatment of other water resources, WRT's uranium treatment could also improve water quality for irrigation, thereby potentially having a beneficial impact on land use. WRT provides a "cradle-to-grave" service that includes final disposition of uranium water residuals at appropriately licensed facilities.

4.2 Transportation Impacts

Transportation impacts for each of the alternatives discussed above are as follows:

4.2.1 Transportation Impacts from the No-Action Alternative

Transportation impacts associated with the no-action alternative will result in no changes to transportation patterns or routes from Client treatment sites to/through other municipalities, states or across the country. However, as stated above, the SDWA uranium MCL is a federal mandate and, thus, this alternative is not feasible. The same regulatory compliance situation applies to Clients required to treat other contaminated water sources.

4.2.2 Transportation Impacts from the "Regenerating/Backwashing Alternative

Transportation impacts associated with the "regenerating/backwashing" alternative will result in no apparent changes to transportation routes from Client's treatment sites to/through other municipalities, states or across the country. If a sewer connection is not available at the CWS/ Client site (a common occurrence in many rural communities), Client/CWSs will be required to transport uranium-loaded brine solutions to a discharge point into the sanitary sewer system. In instances where the Clients/CWS is regenerating/backwashing frequently enough to avoid creating *licensable* source material levels, the backwash brine solution would have to be transported every five (5) to ten (10) days, depending on the size of the well. In addition to increases in transport corridor use for discharging uranium-loaded brine solutions, this alternative also results in an increase in the use of transport corridors for deliveries of salt for brine solutions and acids for treatment media regeneration.

4.2.3 Transportation Impacts from Continued Action

The following discussion has been expanded from that presented in the initial ER and license application, to add information related to WRT's partnership with Cameco Resources, Inc. for recovering uranium from WRT's spent treatment media, primarily at the Crowe Butte Project, Crawford NE. Transportation impacts associated with the use of WRT's uranium water treatment program will be minimal and will result from the disposition component of WRT's "cradle-to-grave" service. "Media exchanges" or loading of uranium-bearing resins from water treatment facilities into transport vehicles for final disposition at licensed facilities will be required.

4.2.3.1 Transportation Modes and Packaging

WRT will contract with licensed transportation contractors and will use DOT-approved containers/packages, tanker trucks, or other conveyances and vehicles to transfer the uranium residuals to properly licensed processing or disposal facilities. See Section 3.17.4.1 for descriptions of transportation modes and packaging. While the shipments of spent media normally will be classified as DOT hazardous material Class 7, radioactive material, they will be classified as one of the two lowest-activity (and lowest risk) subcategories of Class 7 material, either UN2910 or UN2912 (see Section 3.17.2 for more details)

4.2.3.2 Transportation Traffic Requirements

Using conservative "upper-bound" assumptions which reflect WRT's estimated number of Clients under contract, WRT will require "media exchanges" and the use of transport vehicles at the following rates.

The Uranium Removal Systems are designed to operate for an extended period of time to reduce the number of media exchanges required. WRT projects that up to 1,000 Client/CWSs could be under contract for uranium removal at any one time. Based on the Uranium Removal System's

performance characteristics and a representative five (5) year exchange interval, WRT projects an average of approximately 200 trips per year from Client/CWSs sites. Although Client/CWSs are located throughout the country, WRT projects a weighted average distance between those Client/CWSs sites and a uranium recovery or disposal facility to be approximately 1,000 miles.

The above estimated number of trips per year is considered conservative since most Uranium Removal Systems smaller than 1,000-gpm will represent less than a truckload and, therefore, the spent treatment media from two or more nearby treatment sites possibly could be consolidated into a single trip.

4.2.3.3 Transportation of Uranium Residuals

The transportation of uranium residuals along public roads has been evaluated extensively in the context of ISL and conventional uranium recovery operations. The operation of the Uranium Removal System requires that the spent treatment media used for the uranium removal be transferred from the Client treatment site to a licensed processing or disposal facility. The recovered uranium attaches to the treatment media. When the treatment media is exchanged, it will be transported in specially designed, DOT-approved tanker trucks or Super Sacks. Spent treatment media typically will be transported in loads of 15 to 25 tons. The integrity of loaded tanker trucks or Super Sacks will not be breached under normal transportation conditions, including most accidents.

In the highly unlikely but credible event of an accident that ruptures a loaded tanker truck or Super Sack, however, some treatment media and residual water could spill on the ground. The treatment media will retain the uranium and prevent contamination of soils at the accident site. Such a spill also will only spread a limited distance and will be easily recovered. All treatment media, its contained uranium, and any contaminated soils will be removed and disposed of at an appropriately licensed facility. All disturbed areas would then be reclaimed in accordance with applicable State and NRC regulations. Thus, the risk of potential impacts from such accidents is negligible.

Based on its dose assessments summarized in the following sections, WRT's radiation safety consultant concluded: "The radiation doses from uranium-bearing water treatment resins under normal and spill conditions in the water treatment plant and transportation are, in general, negligible and in the range of background variability."

This assessment is consistent with the NRC's conclusion in NUREG-1569, *Standard Review Plan for in Situ Leach Uranium Extraction License Application* (NRC, June 2003). In Section 7.5.1, under Effects of Accidents, NUREG-1569 says:

> "The NRC has evaluated the effects of accidents at *in situ* leach facilities (NUREG-0706 (NRC, 1980): Center for Nuclear Waste Regulatory Analyses, 2001). These analyses demonstrate that, for the most credible potential accidents, consequences are minor so long as effective emergency procedures and properly trained personnel are used."

The spent uranium treatment received at these sites are either recycled or disposed of at already-licensed/permitted facilities where the cumulative impacts of disposition of licensed material already have been analyzed. Transportation impacts have been analyzed in not only the individual facility's licensing/permitting process, but also, in the case of the spent media sent to a uranium recovery facility, through NRC's "equivalent feed" RIS (RIS 2012-06), in which it determined no license amendment was necessary for uranium recovery facilities where uranium will be recycled.

WRT relies on the existing transportation and shipment-receiving procedures at a uranium ISR facility, which are already deemed adequate by the NRC. Based on the above information, WRT's uranium water treatment program will not create any significant, adverse potential impacts on public health and safety or the environment from transportation of uranium residuals.

4.2.3.4 Transport Incidents of Loaded Treatment Media from Client/CWSs Sites

The loaded resins will be shipped by truck by a contracted commercial carrier from the water treatment facility to a licensed uranium recovery or direct disposal facility. As introduced above, in most cases the spent media will be classified as DOT Class 7 radioactive material, as either UN2910, "Radioactive material, excepted package – limited quantity of material", or UN2912, "Radioactive material, low specific activity I (LSA-1) non-fissile or fissile-excepted." WRT will comply with the applicable DOT regulations (primarily 49 CFR Parts 171 through 173), as well as applicable NRC/Agreement State regulations for the transportation of radioactive material.

4.2.3.4.1 Calculated Statistical Probability of a Truck Accident during Shipment

Statistics from the Bureau of Transportation Statistics are shown in Table 4-1 for Single unit and combination trucks traveled over two (2) billion road miles during 2001. During the same year, light trucks and large trucks combined for 3,663,000 accidents. Light trucks are defined as those weighing less than 10,000 pounds gross vehicle weight rating or less, including pickups, vans, truck-based station wagons and utility vehicles. Large trucks are defined as those over 10,000 pounds gross vehicle weight including single-unit trucks and truck tractors. Truck definitions vary between accident statistics and mileage statistics. The definition of light truck is so broad that is likely that most of the accidents counted for this classification are not vehicles involved in shipping. Conversely, "single unit trucks" in the mileage statistics are two (2) axles or more, which makes them feasible as a shipping vehicle. If all truck classifications are included in the accident statistics, there was an average of 17.5 accidents per million miles in 2001. If only large trucks are considered, the accident rate drops to approximately two per million miles traveled. Because large trucks, those with gross vehicle weight in excess of 10,000 lb, will be used for nearly all spent treatment media shipping, WRT assumes the rate of two accidents per million miles. The accident statistics presented in Table 4-1 are not differentiated by accident severity. These numbers cover the full range of accidents, from no-injury fender benders to serious accidents that could result in a treatment media release. Regarding Cameco Resources, WRT's partner for uranium recovery from the spent treatment media, to WRT's knowledge Cameco has not reported any serious incidents involving the commercial hauling of either uranium-loaded resin media or product uranium yellowcake at the Crow Butte Project.

Table 4-1
Truck Accident Statistics

Type of Truck	Millions of Miles Driven (2001)
Single unit truck(2-axle, 6-tire or more)	72,448
Combination truck	136,584
Total truck miles	209,032
	Number of Accidents (2001)
Light truck	3,254,000
Large truck	409,000
Total accidents	3,663,000

Assuming 1,000 operating Client/CWS water treatment systems, each of which has a five-year operational period for loading purposes, an average of 200 shipments of spent treatment media will occur each year. WRT has estimated that a uranium recovery or direct disposal facility could be located an average of 1,000 miles from a specific C Client/WS water treatment facility, this will mean a total of 200,000 shipping miles annually. At the 2.0 /million-mile accident rate, this will equate to the probability of an accident involving a spent treatment media shipment occurring on the average of once every 2.5 years. Only a small fraction of such accidents will involve loss of containment of the spent treatment media.

4.2.3.4.2 Direct Radiation Dose from Spill Cleanup

The dose assessments presented in the following three sections were prepared for WRT by the same radiation consulting firm that performed the occupational dose assessment (Section 3.13.4). Dose rates are conservatively estimated assuming an "infinite plane" of spilled treatment media. This continues to be a hypothetical, estimated assessment because there have been no serious transportation accidents resulting in an actual spill or release of loaded treatment media.

For the sake of conservatism in calculating the potential dose to a transportation spill cleanup worker, WRT assumes that each accident will result in a spill releasing spent treatment media in the immediate vicinity of the accident. Because of the nature of the resin, which will be shipped moist, WRT projects that none of the released material will be dispersed into the atmosphere. Further, because the uranium is tightly bound onto the treatment media, it will not become soluble. Any dispersion of the spent treatment media via water could only be a physical, and not a chemical, process. Thus, potential adverse impacts to waterways will be minimal in the unlikely event that the treatment media reaches one.

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

- Loading on the spent treatment media is 60,000 ppm, which equal a resin concentration of 54,000 pCi/g U-nat,
- The treatment media will contain the immediate decay products of natural uranium, including U-238, Th-234, Pa-234m, Pa-234, U-234, U-235, and Th-231.
- Transport tankers, up to 1000 ft^3 capacity, may contain up to 20 tons of spent treatment media.
- Doses are calculated assuming an infinite plane of spilled material, which is a maximizing assumption.

The dose rate at the surface of a spill with a resin U-nat concentration of 54,000 pCi/g will be approximately 0.37 mrem/hr. If a cleanup required 8 hours of effort, less than 3 mrem will be received by the cleanup worker. 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.

Because the primary emissions from the nuclides of interest are beta particles, there is a potential for external dose to the skin of workers. The dose conversion factors for skin are shown in Table 4-2.

Table 4-2
Estimated Skin Dose to a Cleanup Worker

	FGR No. 12 Dose Coefficients			Estimated conc., pCi/g	Estimated Surface Dose Rate mrem/h
Nuclide	Soil, Sv m^3/Bq s	Resin, Sv m^3/Bq s	Resin, mrem g/pCi h		
U-238	3.55E-21	1.29E-20	7.56E-08	1.98E04	1.50E-03
Th-234	1.50E-19	5.46E-19	3.20E-06	1.98E04	6.33E-02
Pa-234m	8.27E-18	3.01E-17	1.76E-04	1.98E04	3.49E00
Pa-234	7.18E-17	2.61E-16	1.53E-03	2.57E01	3.93E-02
U-234	5.99E-21	2.18E-20	1.28E-07	3.33E04	4.25E-03
U-235	4.40E-18	1.60E-17	9.37E-05	9.11E02	8.55E-02
Th-231	2.56E-19	9.32E-19	5.45E-06	9.11E02	4.97E-03
				Total	**3.69E00**

U-235 and Th-231 activities each equal 1.7% of U-nat activity
U-238, Th-234, and Pa-234m, activities each equal approximately 37% of U-nat activity
U-234 equals about 62 % of the U-nat activity
Pa-234 activity equals 0.05% of U-nat activity

The maximum estimated potential dose to uncovered skin for a worker spending 8 hours cleaning up a spill is approximately 30 mrem. Since the beta particles contribute almost the entire skin dose and the betas are easily shielded by protective clothing, the actual potential dose to a cleanup worker will be much lower than the estimated maximum dose. By comparison, the

maximum allowable dose to the skin of a radiation worker is 75,000 mrem. There are no specific dose limits for skin for members of the public.

4.2.3.4.3 Inhalation Dose

The dose to a cleanup worker from inhalation of re-suspended resin will be negligible since the treatment media particles, at approximately 600 um in diameter (sieve size 30), are too large to be respirable and are unlikely to remain re-suspended for any significant period of time. Any remote possibility of inhaling treatment media particles can be eliminated by wearing a dust mask.

4.2.3.4.4 Ingestion Dose

As with spill cleanup in the Client/CWS water treatment facility, ingestion of radioactive materials under a highway spill situation is almost entirely preventable using good work practices. Although highly unlikely, some ingestion may occur by swallowing inhaled particles that reach the esophagus by mucocilliary transport or other mechanisms involving clearance of inhaled large particles.

Assuming a dust concentration of 1 mg/m^3, the total amount of radioactive material inhaled during an 8-hour workday at an inhalation rate of 1.25 m^3/hr will be as follows:

Inhaled U-nat activity = 54,000 pCi/g * 0.001 g/m^3 * 1.25 m^3/h * 8 h = 540 pCi

A worker might also inadvertently ingest some of the materials during cleanup. Assuming a soil ingestion rate of 200 mg/d, the total activity that might be ingested, including the inhaled activity, will be 11,340 pCi.

The potential dose from ingestion of 11,340 pCi U-nat with its immediate decay products is shown in Table 4-3.

Table 4-3
Estimated Dose from Ingestion of Spilled Resin in a Highway Cleanup

Nuclide	Activity (pCi)	Ingestion Dose Coefficient* (Sv/Bq)	Ingestion Dose Coefficient (mrem/pCi)	Potential Dose (mrem)
U-238	4107	4.5E-08	1.7E-04	6.8E-01
Th-234	4107	3.4E-09	1.4E-04	5.9E-02
Pa-234m	4107	Incl. with U-238		
Pa-234	5	5.1E-10	1.9E-06	9.9E-06
U-234	7041	4.9E-8	1.8E-04	1.3E00
U-235	189	4.7E=8	1.7E-04	3.3E-02
Th-231	189	3.4E-10	1.3E-06	2.4E-04
Total			**Total**	**2.1E00**
*Dose coefficients from ICRP 68 (2001 CD)				

The potential dose from ingestion of resin with U-nat during cleanup of a transportation accident is negligible.

The potential maximum total effective dose to a worker cleaning up a spill of loaded resin would be less than 5 mrem. By comparison, the annual average radiation dose from background radiation ranges from approximately 6 mrem per week to over 30 mrem per week depending on where the individual lives. The dose from a round-trip cross-country flight is approximately 5 mrem.

Therefore, given the low probability of spill involving loaded resin and the very small potential dose, transportation spills are not a concern with regard to transport of the material for the purpose of uranium recovery or disposal.

Accident Response

In the event of a transportation accident, the primary level of response will be with the transportation contractor's established response team and procedures. WRT will coordinate transportation accident response procedures with the transportation contractor, including post-remediation accident site surveys, and will conduct additional accident site surveys, as necessary.

4.3 Impacts to Geology and Soils

Impacts to geology and soils for each of the alternatives discussed above are as follows:

4.3.1 Impacts to Geology and Soils from the No-Action Alternative

Impacts to geology and soils from this alternative are likely to have been assessed by the Client/CWS in question. However, as stated above, this alternative is not feasible as the SDWA uranium MCL is a federal mandate. For Clients required to treat other contaminated water sources, cleanup limits/standards are established by appropriate federal and/or State regulatory agencies.

4.3.2 Impacts to Geology and Soils from the "Regenerating/Backwashing" Alternative

Impacts to geology and soils from this alternative will result from the selection of land application of uranium residuals as a disposal option. As described above, applying uranium residuals contained in POTW sludges to surrounding lands will introduce elevated concentrations of uranium to soils that may be used for residential or commercial purposes at a future date. This option potentially will result in the contamination of local soils to levels that could be unsuitable for multiple future uses. Leaching or surface runoff of uranium residuals also will occur depending on the average rainfall and potential for erosion at each location.

4.3.3 Impacts to Geology and Soils from Continued Action

The following assessment has no substantive changes from that presented in the initial ER and license application. Impacts to geology and soils from WRT's uranium water treatment program will be negligible. The Uranium Removal System is self-contained and, therefore, will not result in the release of uranium residuals to the environment. During water treatment operations, WRT's treatment media is contained within the Uranium Removal System and is not exposed to the surrounding environment at any time. Should a leak occur from the Uranium Removal System, the local Client/CWS Operator(s) will shut down the water supply and take the System off-line, and the WRT System Specialists will initiate cleanup activities which are described in Section 3.16.10 and 3.16.12. This cleanup activity will negate any potential exposure of uranium residuals to geology or soils.

The construction of water treatment facilities where WRT's uranium water treatment systems will be implemented can also mitigate potential exposure of uranium residuals to geology and soils by providing a barrier to releases outside the treatment area if recommended secondary containment is installed by the Client/CWSs. See Section 2.3.2.9 regarding secondary containment recommendations.

Further, in the highly unlikely but credible event that uranium residuals are released to surrounding soils during a "media exchange," during normal water treatment operations or during a transportation accident, WRT has created response procedures for cleanup of a release. These response procedures are described in Section 3.16.12.

Finally, WRT removes all spent treatment media from Uranium Removal Systems and provides a final disposition pathway for such media that does not result in re-introduction of removed uranium into the environment. Thus, there will be no impacts to soils or geology from the final disposition of removed uranium.

Therefore, based on this information, WRT's uranium water treatment program will not result in any significant, potential adverse impacts to geology or soils.

4.4 Water Resource Impacts

Water resource impacts for each of the alternatives discussed above are as follows:

4.4.1 Water Resource Impacts from No-Action Alternative

Water resource impacts from the no-action alternative will be based on the continued presence of uranium in drinking water sources at levels exceeding the SDWA uranium MCL, which EPA has determined presents a significant threat to public health and safety. No new impacts will occur as a result of the no-action alternatives. However, as stated above, a no-action alternative is not feasible as the SDWA uranium MCL is a federal mandate. For Clients required to treat other contaminated water sources, cleanup limits/standards are established by appropriate federal and/or State regulatory agencies.

4.4.2 Water Resource Impacts from "Regenerating/Backwashing" Alternative

There could be several potential water resource impacts from the backwashing alternative. Regeneration/backwashing uranium residuals to surface waters could lead to impacts to ground or surface water resources. Depending on the uranium concentration in the feed waters and the frequency of regeneration, it is possible for the uranium concentration in the discharged backwash and rinse solutions to significantly exceed the average monthly uranium concentration (3,000 pCi/L) allowed by 10 CFR 20, Appendix B, Table 3. Also, releases of uranium residuals to sanitary sewers could affect ground or surface water resources if such residuals are not properly contained there.

This alternative also results in a loss of water resources on the order of three (3) to five (5) percent of well production, because the water required for the regeneration and backwash operation is discharged.

In addition, selection of land distribution as an option for disposal of backwashed uranium residuals could result in additional contamination of surface water resources due to migration as a result of erosion and/or to groundwater due to leaching through soils, depending on the levels of rainfall at or near a given Client/CWS.

4.4.3 Water Resources Impacts from Continued Action

The following assessment has been expanded from that presented in the initial ERE and license application, to address the other-water treatment scenario. Negative water resource impacts from the continued action will be negligible. WRT's uranium water treatment program does not pose any likely scenarios where spent treatment media will be discharged to ground or surface water resources when water is being treated or during a "media exchange."

Expanding WRT's scope of work to include treating other water resources has the potential for beneficial impacts to water resources. Water resources not currently being used as a water supply can be treated for uranium, thereby possibly becoming available as a future water supply. Groundwater and surface water contaminated with uranium can be treated under the WRT program, without discharging the uranium residuals back to the local environment, and improve the water quality, at a minimum, for agricultural, livestock, or aquatic/wildlife uses.

As stated above, the Uranium Removal System is designed to be a "self-contained" water treatment system, so releases of uranium residuals to any water resources are highly unlikely. In the highly unlikely but credible event that uranium residuals are released from the Uranium Removal System within the water treatment building or other structure, no potential threats to ground or surface water exist as uranium residuals are contained within the enclosed treatment space in the building. Should uranium residuals escape the containment area, WRT will initiate response procedures as described in Section 3.13.6.

In the highly unlikely but credible event that uranium residuals escape the water treatment building during treatment operations or a "media exchange" and are exposed to the environment, WRT has prepared a detailed cleanup protocol that will eliminate migration of such residuals through soils to ground or surface water sources, as described in Section 3.13.6. There is no potential for migration of uranium residuals to surface water resources as airborne particulates, because such residuals are not sufficiently dry to be carried as airborne particulates.

As described above, the continued action does not create any significant, potential incremental impacts to water resources above and beyond authorized water treatment operations at existing Client/CWSs.

4.5 Ecological Resource Impacts

Impacts to ecological resources for each of the alternatives discussed above are as follows:

4.5.1 Ecological Resource Impacts from No-Action Alternative

Potential ecological impacts from the no-action alternative will be similar to those already present from ongoing water treatment operations. However, as stated above, the no-action alternative is not feasible because the SDWA uranium MCL is a federal mandate. For Clients required to treat other contaminated water sources, cleanup limits/standards are established by appropriate federal and/or State regulatory agencies.

4.5.2 Ecological Resource Impacts from "Regenerating/Backwashing" Alternative

Potential ecological impacts from the "regenerating/backwashing" alternative may result from the release of backwashed uranium residuals in elevated concentrations to POTWs or to surface waters. Should uranium residuals not be properly contained at the water treatment facility or at

the POTW, such residuals can be released to the environment and impact local biota, flora or fauna.

In addition, land distribution of uranium residuals potentially can impact ecological resources as the presence of elevated concentrations of natural uranium on local land may either be distributed as windblown particulates to local biota, flora or fauna or via erosion or leaching to aquatic life in surface water sources.

4.5.3 Ecological Resource Impacts from Continued Actions

The following assessment has been expanded from that presented in the initial ER and license application, to address the other-water treatment scenarios. Potential negative ecological impacts from the continued action will be negligible; as described in the water resources subsection above, there could be beneficial impacts from treating for uranium using the WRT program, e.g., improved groundwater and surface water quality for aquatic/wildlife uses. As stated above, since the Uranium Removal System is designed to be a self-contained water treatment system, releases of uranium residuals should not occur.

In the highly unlikely but credible event that uranium residuals are released from the treatment system during active operations, such residuals will be contained within the containment area in the water treatment building. See Section 2.3.2.9 regarding secondary containment. WRT has created cleanup procedures to address releases of uranium residuals during leakages from the Uranium Removal System. See Sections 3.16.10 & 3.16.12 for further discussion.

In the highly unlikely but credible event that uranium residuals escape the water treatment building during operations or during a "media exchange," WRT will implement cleanup procedures to address such a release, including the use of the WRT service trailer's industrial vacuum. See Section 3.13.6 for further discussion. Based on this information, WRT's uranium water treatment program will not pose any significant, potential incremental threats to ecological resources above current water treatment activities.

4.6 Air Quality Impacts

Impacts to air quality for each of the alternatives discussed above are as follows:

4.6.1 Air Quality Impacts from No-Action Alternative

Potential impacts to air quality from the no-action alternative will not be different from the current impacts to air quality as a result on ongoing water treatment operations. However, as stated above, the no-action alternative is not feasible because the SDWA uranium MCL is a federal mandate. For Clients required to treat other contaminated water sources, cleanup limits/standards are established by appropriate federal and/or State regulatory agencies.

4.6.2 Air Quality Impacts from "Regenerating/Backwashing" Alternative

Clients/CWSs currently engaging or seeking to engage in "regenerating/backwashing" uranium residuals down sanitary sewers or releases to surface waters are not expected to generate any significant impacts to air quality.

4.6.3 Air Quality Impacts from the Continued Action

The following assessment has no substantive changes from that presented in the initial ER and license application. The continued action minimizes or eliminates potential public or occupational exposure to airborne particulates from the Uranium Removal System. As stated above, the Uranium Removal System is designed to be self-contained, thereby limiting, if not eliminating potential public or occupational exposure to airborne uranium residuals or other particulates. Potential releases of such uranium residuals or particulates from the System will be contained and remediated pursuant to WRT's emergency procedures described in Section 3.16.6. Therefore, WRT's uranium water treatment program does not pose any significant potential incremental threats to air quality above and beyond those assessed for current water treatment operations.

4.7 Noise Impacts

Potential noise impacts for each of the alternatives discussed above are as follows:

4.7.1 Noise Impacts from the No-Action Alternative

Potential noise impacts from the no-action alternative will not alter the current impacts created by existing water treatment operations. However, as stated above, the no-action alternative is not feasible as the SDWA uranium MCL is a federal mandate. For Clients required to treat other contaminated water sources, cleanup limits/standards are established by appropriate federal and/or State regulatory agencies.

4.7.2 Noise Impacts from the "Regenerating/Backwashing" Alternative

Potential noise impacts from the "regenerating/backwashing" alternative will not alter the current impacts created by existing water treatment operations. Installation of new "regenerating/backwashing" water treatment technologies in existing water treatment buildings should not cause any additional noise impacts. While it is possible that some noise impacts may be realized by the construction of new water treatment facilities or expansion of existing facilities for "regenerating/backwashing" systems, there should be no significant incremental noise impacts.

4.7.3 Noise Impacts from the Continued Action

The following assessment has no substantive changes from that presented in the initial ER and license application. Potential noise impacts from the continued action will not alter the current

impacts created by existing water treatment operations. Implementation of the WRT uranium water treatment system in existing water treatment facilities should not cause any significant, incremental noise impacts. While it is possible that some noise impacts may be realized by the construction of new water treatment facilities or expansion of existing facilities for the WRT uranium water treatment system, no significant incremental noise impacts should occur.

During media exchanges, WRT's service trailer will utilize a diesel generator set which will result in a minimal increase in noise impacts on limited occasions. WRT's diesel generator set is compliant with OSHA and local requirements.

4.8 Historic and Cultural Resources Impacts

Potential historic and cultural resource impacts for each of the alternatives discussed above are as follows:

4.8.1 Potential Historic and Cultural Resources Impacts from the No-Action Alternative

Potential historic and cultural resource impacts from the no-action alternative will not alter potential impacts from existing water treatment operations. However, as stated above, this alternative is not feasible as the SDWA uranium MCL is a federal mandate. For Clients required to treat other contaminated water sources, cleanup limits/standards are established by appropriate federal and/or State regulatory agencies.

4.8.2 Potential Historic and Cultural Resources Impacts from the "Regenerating/ Backwashing" Alternative

Potential impacts from the "regenerating/backwashing" alternative should not be significant for installation of "regenerating/backwashing" technologies in existing water treatment facilities. Some potential impacts may be realized by the construction of new water treatment facilities for such technologies and assessments of any such impacts may be required, but such impacts likely will be negligible.

In addition, Clients/CWSs selecting land application as a final disposition option for uranium residuals potentially may cause adverse impacts on historic and cultural resources. Land distribution of uranium residuals potentially may cause contamination of such lands, and this contamination and subsequent remediation of those lands may threaten historic and cultural resources in the future.

4.8.3 Potential Historic and Cultural Resources Impacts from the Continued Action

The following assessment has been expanded from that presented in the initial ER and license application, to address the other-water treatment scenarios. Potential impacts from the continued action should not be significant for implementation of WRT's uranium water treatment program in existing water treatment facilities. The construction of new buildings for containment of the Uranium Removal System potentially may require assessment of historic and cultural resources,

but any such impacts likely will be negligible. Depending on the location of new water treatment facilities, WRT and Clients/CWSs will assess relevant impacts as required.

Potential impacts from expanding WRT's scope of work for treating other water resources also should not be significant, even though this type of water treatment has more of a chance to be located in an open, rural, under-developed setting. Examples of this type of location could include adjacent to an open pit lake, or in an open field or adjacent to an impacted stream in a pump-treat-reinject scenario. These applications are still similar to WRT's drinking water treatment in that WRT is still providing a treatment system to a Client who owns or is responsible for the property where the system will operate; and the Client is responsible for all other approvals and permitting related to the water treatment. Even with a more rural location, the area likely has already been disturbed and WRT's Client likely has completed the Section 106 process, including mitigation and resource recovery, prior to WRT delivering the treatment system to the site.

4.9 Visual/Scenic Impacts

The following discusses the potential visual/scenic impacts for each of the three alternatives.

4.9.1 Potential Visual/Scenic Impacts from the No-Action Alternative

Potential visual/scenic impacts from the no-action alternative should not alter impacts from existing water treatment operations. Depending on the geographic location of proposed new water treatment buildings, some potential impacts may be realized when new buildings are constructed and operating to address demand for increased drinking water supplies. Discharges from existing or future water treatment operations generally are not visible and, as such, would not create any potential impacts. However, as stated above, the no-action alternative is not feasible because the SDWA uranium MCL is a federal mandate. For Clients required to treat other contaminated water sources, cleanup limits/standards are established by appropriate federal and/or State regulatory agencies.

4.9.2 Potential Visual/Scenic Impacts from the "Regenerating/Backwashing" Alternative

Potential visual/scenic impacts from the "regenerating/backwashing" alternative should be similar to the no-action alternative. Existing water treatment operations should not present significant impacts based on the installation of "regenerating/backwashing" technologies. Depending on the geographic location of proposed new water treatment buildings, some potential impacts may be realized when such buildings are constructed and operating. Discharges from existing or future water treatment operations generally are not visible and, as such, would not create any potential impacts.

4.9.3 Potential Visual/Scenic Impacts from Continued Action

Potential visual/scenic impacts from the continued action should be similar to the previously discussed alternatives. Existing water treatment operations should not present significant

impacts based on the implementation of WRT's uranium water treatment program as it is contained fully in a water treatment building or other structure. Depending on the geographic location of proposed new water treatment buildings, some potential impacts may be realized when such buildings are constructed and operating. Discharges from existing or future water treatment operations generally are not visible and, as such, would not create any potential impacts. "Media exchanges" will not create any significant impacts as the transport vehicle is merely a tanker or flatbed truck. In addition, the relative infrequency of media exchanges should not cause any impacts as a result of truck traffic.

4.10 Socioeconomic Impacts

The following discusses the potential visual/scenic impacts for each of the three alternatives.

4.10.1 Potential Socioeconomic Impacts from the No-Action Alternative

Potential socioeconomic impacts from the no-action alternative will result in continued contamination of drinking water sources with uranium in excess of the SDWA uranium MCL. By not complying with the SDWA uranium MCL, Clients/CWSs may incur substantial non-compliance fines or other civil penalties that potentially will cause water or other taxes to increase. However, as stated above, the no-action alternative is not feasible because the SDWA uranium MCL is a federal mandate. For Clients required to treat other contaminated water sources, cleanup limits/standards are established by appropriate federal and/or State regulatory agencies.

4.10.2 Potential Socioeconomic Impacts from the "Regenerating/Backwashing" Alternative

The use of "regenerating/backwashing" technologies likely will result in treatment of drinking water down to below the SDWA uranium MCL. The backwashing on uranium residuals down sanitary sewers potentially may require the additional expenditure of funds to provide incremental occupational radiation safety measures for POTW workers and, if uranium residuals are not safely contained in the water treatment facility, the expenditure of funds to remediate releases. Public water suppliers selecting land distribution as a final disposition option also may be required to remediate such lands in the event that contamination exceeds applicable standards. These expenditures potentially may increase water tax rates for local citizens.

4.10.3 Socioeconomic Impacts from the Continued Action

The following assessment has no substantive changes from that presented in the initial ER and license application. The implementation of the WRT uranium water treatment program will minimize potential socioeconomic impacts. Given that the SDWA uranium MCL is an unfunded mandate, WRT's uranium water treatment systems have been designed to be "cost-competitive" with other treatment technologies. As such, increases in local taxes from the implementation of WRT's uranium water treatment system will be similar to those for alternative treatment technologies. Further, WRT's "cradle-to-grave" option prevents the release of uranium residuals at any point in the water treatment process, including disposal, so that future expenditures for

remediation are unnecessary. In addition, processing uranium residuals as equivalent feed materials allows waste byproducts from such processing to be classified as 11e. (2) byproduct material, which is regulated in perpetuity by a federally mandated long-term custodian. This effectively removes any potential future liabilities for future releases of uranium residuals.

4.11 Environmental Justice Considerations

The following discusses the potential visual/scenic impacts for each of the three alternatives.

4.11.1 Environmental Justice Considerations for the No-Action Alternative

Environmental justice considerations for the no-action alternative should be irrelevant because, as stated above, the no-action alternative is not feasible because the SDWA uranium MCL is a federal mandate. For Clients required to treat other contaminated water sources, cleanup limits/standards are established by appropriate federal and/or State regulatory agencies.

4.11.2 Environmental Justice Considerations for the "Regenerating/Backwashing" Alternative

Environmental justice considerations for the "regenerating/backwashing" alternative should vary based on the location of each water treatment facility. Some water treatment facilities engaging in "regenerating/backwashing" may be located in areas with large concentrations of minority or low-income groups. As discussed above, "backwashing" uranium residuals create a potential risk of undue exposure of workers and members of the public to such residuals. Thus, in locations where minority or low income groups may be located, this potential risk of exposure may give rise to environmental justice considerations.

4.11.3 Environmental Justice Considerations for the Continued Action

The following assessment has been expanded from that presented in the initial ER and license application, to address the other-water treatment scenarios. Environmental justice considerations for the continued action should be eliminated as WRT's uranium water treatment program is designed to remove uranium from drinking water sources well below the SDWA uranium MCL, of other contaminated water sources below their established cleanup limit/standards, to safely contain uranium residuals at all times, and to finally dispose of such residuals at appropriately licensed facilities. Further, as a general proposition, NRC guidance does not require an evaluation of environmental justice considerations where no EIS is warranted and a categorical exclusion is implicated. Given the extremely low levels of potential risk to workers and members of the public associated with WRT's uranium water treatment systems, no EIS should be required. While the implementation of WRT's uranium water treatment systems will result in a minimal increase in water prices, such increase should not implicate environmental justice considerations. Also, any potential increase in water rates for uranium treatment is offset or mitigated by the resulting improvement in the quality of the treated water. Treating other water resources could result in a beneficial environmental justice impact. For example, treating groundwater or surface water impacted by mining likely would take place in rural areas, areas

where many times negative environmental justice considerations are raised in association with commercial or industrial project development. Treating contaminated water resources using the WRT program, with no re-introduction of the uranium residuals to the local environment, will result in an improvement in the environment – and the local residents benefit from improved water quality resulting from a remediation treatment that they likely could not justify or afford to perform on their own. Summarizing this subsection, since there are no significant environmental impacts resulting from WRT's uranium water treatment program, there should not be any negative environmental justice considerations associated with the continued action, while there could be beneficial ones.

4.12 Public and Occupational Health Impacts

The following discusses the potential public and occupational health impacts for each of the three alternatives.

4.12.1 Potential Public and Occupational Health Impacts from the No-Action Alternative

Potential public and occupational health impacts from the no-action alternative are not relevant as the SDWA uranium MCL is a federal mandate with which Clients/CWSs must comply. Clients required to treat other contaminated water sources, cleanup limits/standards are established by appropriate federal and/or State regulatory agencies.

4.12.2 Potential Public and Occupational Health Impacts from the "Regenerating/ Backwashing" Alternative

Potential public and occupational health impacts from the "regenerating/backwashing" alternative is associated with potential radiological exposure to uranium residuals that have been "backwashed" to sanitary sewers or, in the absence of such sewers, transported to other points of discharge such as POTWs. Further, potential dose risks may arise from land application of uranium residuals if such application is the preferred disposition pathways for a Client/CWS.

These potential impacts to the downstream POTW have been identified by the EPA. According to a recently published EPA document, *A Regulators' Guide to the Management of Radioactive Residuals from Drinking Water Treatment Technologies* (EPA, July 2005), in Section I-D.3.2.2 Discharge to Publicly Owned Treatment Works, the guide says:

> "Drinking water systems may be able to discharge liquid wastes to a POTW indirectly through sanitary sewers or force mains or by transporting the waste directly to the POTW. In most cases, such systems are not required to obtain a NPDES permit, but must ensure that their wastes meet the general and specific prohibitions of the Pretreatment Program and any Technically Based Local Limits (TBLL) that may be established by the state or by the POTW itself. TBLLs should ensure that the POTW systems meet federal (40 CFR 403), state, and local pretreatment regulations, and prevent the discharge of any waste that would interfere with or pass through the POTW treatment process and cause a violation

> of the POTW's NPDES permit, or inhibit recycling or reuse of the POTW's biosolids. Municipalities (POTW owners) can refuse to accept waste that might trigger these events, and they generally have the legal authority to refuse any wastewater that may pose other disposal problems for the POTW. Refer to Interagency Steering Committee on Radiation Standards (ISCORS') *Assessment on Radioactivity in Sewage Sludge: Recommendations on Management of Radioactive Materials in Sewage Sludge and Ash at Publicly Owned Treatment Works* for more information on POTW legal and regulatory authority, and for guidance on identifying circumstances where discharge of liquid residuals to a POTW may interfere with sewage sludge management practices or may pose a potential worker or general public exposure concern."

EPA goes on to say:

> "Systems that exceed both the 'unimportant quantity' and 'small quantity' thresholds for uranium will normally be specifically licensed by NRC or Agreement State; there are strict limits set by 10 CFR 20.2003 for disposal into any sanitary sewer system."

EPA's concern is that Client/CWSs using conventional ion exchange technology to remove uranium from drinking water or other sources contaminated water sources and wanting to avoid obtaining an NRC license will backwash the treatment resins frequently enough to ensure that the uranium concentrations never exceed the NRC *unimportant quantities* threshold (i.e., 0.05%, by weight, source material (uranium). According to 10 CFR § 40.13, such systems would be exempt from the requirements of an NRC license.

Based on the uranium concentration in the source water, number of wells, well flow rate, and overall well utilization, mass balance calculations have indicated that a Client/CWS with uranium in its source water potentially can remove up to hundreds of pounds of uranium per year, above the 154-pound annual limit for "small quantities of source material" prescribed in 10 CFR § 40.22 for a general license. If the ion exchange resins are backwashed often enough, the Client/CWS will never be subject to the radiological oversight of the NRC or Agreement State, but could be discharging what normally would be specific-license quantities of source material to the sanitary sewer and POTW. Depending on the concentration of uranium in brine solutions, POTW workers potentially may experience a dose from such uranium when it reports to the POTW sludge.

This alternative requires the addition of chemicals during the regeneration step – strong salt brine and acid and possibly caustic for pH control. This alternative could result in potential increased occupational health impacts due to handling hazardous materials not required by the other alternatives.

This alternative could result in potential increased public health impacts due to the loaded treatment media being regenerated on site. Not following proper regeneration procedures could result in an upset condition that could release of a portion of the contained uranium into the water distribution system.

4.12.3 Potential Public and Occupational Health Impacts from the Continued Action

The following assessment has no substantive changes from that presented in the initial ER and license application. Potential public and occupational radiological impacts from the continued action are negligible. With respect to potential dose to members of the public, WRT's uranium water treatment program is designed to use a self-contained Uranium Removal System that will prevent any releases of uranium residuals in a manner that would expose members of the public to increased radiological doses. The Uranium Removal System is contained within the confines of a water treatment facility which mitigates potential exposure to members of the public. In the highly unlikely but credible event of a release of uranium residuals in the water treatment facility, members of the public would not have access to uranium residuals and, thus, would not receive increased radiological doses. In the highly unlikely but credible event of a release of uranium residuals outside the water treatment facility, WRT will initiate emergency response procedures design to safely contain and remediate such release. As discussed above, WRT's water treatment media is designed to remove and hold uranium residuals without permitting the release of such residuals. Thus, any release of uranium residuals will not result in an increased radiological dose to members of the public.

Further, WRT's waste management philosophy is to prevent re-introduction of uranium residuals into the environment in an uncontrolled manner after they have been removed from drinking water sources. Thus, no land application or other release of uranium residuals will occur.

With respect to potential dose to workers, WRT has assessed potential doses associated with the Uranium Removal System, with "media exchanges," and with the transportation of uranium residuals to licensed processing or disposal sites. This assessment demonstrates that potential doses to workers are a miniscule fraction of NRC 10 CFR Part 20 occupational dose limits. Further, there are no potential occupational risks at POTWs or other discharge points because WRT does not permit re-introduction of uranium residuals into the environment after removal. Therefore, there are no significant potential public or occupational impacts associated with the continued action.

4.13 Waste Management Impacts

Potential waste management impacts for each of the alternatives discussed above are as follows:

4.13.1 Waste Management Impacts from No-Action Alternative

Potential waste management impacts associated with the no-action alternative are not relevant as the SDWA uranium MCL is a federal mandate with which water providers must comply. Clients required to treat other contaminated water sources, cleanup limits/standards are established by appropriate federal and/or State regulatory agencies.

4.13.2 Waste Management Impacts from "Regenerating/Backwashing" Alternative

Potential waste management impacts associated with the "regenerating/backwashing" alternative are based on the disposition of uranium residuals after they are re-introduced into the environment in an uncontrolled manner (i.e., backwashed to sanitary sewers or injected for disposition at POTWs or other points of discharge).

4.13.3 Waste Management Impacts from Continued Action

The following assessment has no substantive changes from that presented in the initial ER and license application. Potential waste management impacts associated with the continued action are negligible as WRT's uranium water treatment program is designed to promote seamless transfer of uranium residuals from the Uranium Removal System to transport vehicles for final disposition at licensed processing or disposal facilities. Uranium Removal Systems will remove uranium from drinking water or other contaminated water sources and store such residuals without permitting the release of any uranium particulates.

When uranium loading in the System reaches appropriate levels, WRT System Specialists will initiate media exchanges in which uranium residuals will be transferred, without exposing such residuals to workers or other members of the public, to DOT-approved tanker-trucks or other packages and vehicles. At no time during the media exchange will uranium residuals or other wastes be left at the water treatment facility site after media exchanges have concluded. Further, no chemicals are required in the Uranium Removal System, so no chemical residuals or other wastes will be stored at water treatment facilities.

With respect to the transportation of uranium residuals to properly licensed processing or disposal facilities, WRT will utilize DOT-approved tanker trucks or packages and vehicles to safely contain and transport such residuals to licensed facilities. The potential impacts from such transportation are described in Section 4.2.3 of this ER. Transportation of uranium residuals will not result in any significant potential adverse impacts to public health and safety or the environment.

With respect to final disposition of uranium residuals from WRT's uranium water treatment systems after transport, uranium residuals will be transferred to properly licensed facilities for processing as an equivalent feed or for direct disposal. In the case of the former, WRT will transfer uranium residuals to NRC or Agreement State-licensed uranium recovery facilities for final disposition. These licensed uranium recovery facilities will process the uranium residuals to extract their uranium content, and any wastes generated from the processing of such residuals will constitute 11e. (2) byproduct material and will be directly disposed of in a uranium recovery facility's mill tailings impoundment.

Such wastes will then be subject to UMTRA's robust regulatory program for management and oversight of uranium mill tailings, including a mandatory, NRC-licensed, governmental long-term custodian. In the case of the latter, uranium residuals will be transported to AEA or Agreement State-licensed disposal facilities that can accept *licensable* source material for direct disposal.

In summary, at no time during the waste management process will uranium residuals or wastes generated from the processing or disposal thereof be released or emplaced outside the boundaries of properly licensed facilities. Thus, there are no significant, potential impacts from waste management associated with the continued action.

5.0 MITIGATION MEASURES

Potential mitigation measures for each of the alternatives discussed above are as follows:

5.1 Potential Mitigation Measures for the No-Action Alternative

Potential mitigation measures for the no-action alternative should be irrelevant because the SDWA uranium MCL is a federal mandate with which drinking water providers must comply. For Clients required to treat other contaminated water sources, cleanup limits/standards are established by appropriate federal and/or state regulatory agencies.

5.2 Potential Mitigation Measures for the "Regenerating/Backwashing" Alternative

Potential mitigation measures for the "regenerating/backwashing" alternative would require that Clients/CWS drinking water providers install additional radiological control measures (secondary radionuclide adsorption equipment) at points of discharge and/or at POTWs to prevent undue releases of and exposures to uranium residuals. POTWs could be required to implement radiological monitoring systems or other safeguards to ensure that occupational health and safety was maintained within 10 CFR Part 20 limits. Further, if land application of uranium residuals is employed, municipalities could be required to monitor activity levels of lands used for disposal to ensure that members of the public do not receive radiological doses above Part 20 limits. At least one Agreement State, Illinois through the Illinois Emergency Management Agency, requires monitoring of both the POTW water treatment sludge and the farm fields where it is applied, in areas where radionuclides, primarily radium, are being removed from drinking water supplies using this treatment alternative. Moreover, as stated above, chemicals may be required when using this treatment process and appropriate mitigation measures will be required to safely contain such chemicals.

5.3 Potential Mitigation Measures for the Continued Action

Potential mitigation measures for the continued action should be negligible, because WRT's uranium water treatment program is designed to provide a "cradle-to-grave" uranium removal service that minimizes, if not eliminates, potential exposure to uranium residuals and removes such uranium residuals from the environment *permanently*. The Uranium Removal Systems do not permit releases of uranium residuals from treating drinking water or other contaminated water sources and no chemicals are needed or stored on-site, except for the uranium residuals stored in the Uranium Removal System prior to treatment media exchanges. After media exchanges are completed, uranium residuals are transported off-site for final disposition in conformance with DOT requirements. After transportation is complete, uranium residuals will be disposed of in conformance with appropriate licensee requirements at a licensed processing or disposal facility. Thus, WRT's uranium water treatment program does not require any mitigation measures.

6.0 COST-BENEFIT ANALYSIS

Any cost-benefit analysis of the continued action must begin with the assumption that the SDWA uranium MCL is a federal mandate with which Clients/CWSs must comply. In the case of non-drinking-water treatment WRT's Clients likely would be under an administrative or regulatory order to remediate the affected water resource. If such providers do not comply with the SDWA uranium MCL or cleanup standard, the CWS or other entity may be subject to civil monetary penalties.

The implementation of the WRT uranium water treatment program likely will result in a slight increase in water rates to customers. Any such increase will be far outweighed by the benefit of cleaner drinking water and compliance with the SDWA uranium MCL. It is reasonable to conclude that noncompliance or civil monetary penalties experienced by municipalities or other CWSs will be passed on to customers and increases in water rates will be experienced. The non-drinking-water Clients will bear the cost of the remediation to comply with the regulatory orders.

WRT's continuing licensing action is designed to provide a cost-effective "cradle-to-grave" solution whereby Clients/CWSs can provide the benefit of uranium removal from drinking water and other contaminated water sources and of final disposition of removed uranium at properly licensed facilities without significant potential risk to workers or members of the public. Approving WRT's request to expand the scope of work to included treatment of "other" water resources will result in potentially expanding the number of water resources that can be treated using WRT's unique cradle-to-grave approach. Denial of WRT's license renewal application could result in either non-compliance with the SDWA or other remediation uranium MCLs or the use of other uranium removal technologies that potentially will permit re-introduction of uranium residuals to the environment in an uncontrolled manner.

In addition, WRT's performance-based, multi-site license format is consistent with the NRC's own internal performance goals used to assess recommendations:
(1) maintaining safety, protection of the environment, and common defense and security;
(2) increasing public confidence; (3) making NRC activities and decisions more effective, efficient, and realistic; and (4) reducing unnecessary regulatory burdens. Just reducing the regulatory burden to Clients/CWSs trying to meet yet another unfunded federal mandate, as well as reducing the regulatory burden to both the NRC and Agreement States justifies NRC adopting the proposal.

Denial of WRT's license renewal application also will preclude Clients/CWSs from taking advantage of the waste management benefits inherent in WRT's uranium water treatment program. In the absence of WRT's program, Clients/CWSs will be required to ensure that uranium residuals are properly disposed of in accordance with relevant regulations. This requirement potentially will result in Clients/CWSs resorting to "backwashing" uranium residuals to sanitary sewers or transportation of such residuals to other points of discharge such as POTWs or other uncontrolled release to the environment, which will create additional potential risks to public health and safety. As anecdotal, positive evidence of the acceptance of WRT's preferred approach of recovering the contained uranium for the fuel cycle, several municipal CWSs in an Agreement State would not consider using WRT unless WRT guaranteed

that the uranium in the residuals would be recovered (thereby ending the CWS's liability), rather than the residuals going to disposal.

Finally, denial of WRT's license renewal application will deprive the commercial nuclear fuel cycle of a potential source of uranium for nuclear fuel. Uranium residuals from WRT's uranium water treatment program will contain high concentrations, by weight, of natural uranium that may be recovered at a conventional or ISL uranium recovery facility. Thus, if conventional or ISL uranium recovery techniques are utilized with acceptable potential impacts to public health and safety, WRT's uranium water treatment program will remove uranium from drinking water sources in compliance with a federal mandate or from other contaminated water sources in compliance with established limits/standard and, as a residual benefit, provides a viable source of uranium for conversion into nuclear fuel. Failure to pursue this option could result in the loss of a valuable energy resource.

For these reasons, WRT submits that the benefits of granting its license renewal application/request significantly outweigh any costs.

7.0 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

For the reasons cited above, WRT has determined that its license renewal application and uranium water treatment program do not pose any significant adverse impacts to public health and safety or the environment. WRT's uranium water treatment program, including its Uranium Removal System, provides adequate protections for workers and members of the public during active water treatment operations, media exchanges, and transportation of spent treatment media to properly licensed facilities for final disposition.

WRT's uranium water treatment program also provides the benefit of preventing the re-introduction of uranium removed from drinking water and other contaminated water sources into the environment in an uncontrolled manner. Therefore, WRT respectfully requests that NRC approve its license renewal application for a performance-based, multi-site license based on the environmental analyses contained herein, as well as the other components of its license renewal application.