

R.M.D. Operations, LLC

URANIUM WATER TREATMENT PROGRAM

**ENVIRONMENTAL REPORT
IN SUPPORT OF A
PERFORMANCE-BASED, MULTI-SITE LICENSE
APPLICATION**

Submitted to:

**UNITED STATES NUCLEAR REGULATORY COMMISSION
NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
DIVISION OF FUEL CYCLE SAFETY AND SAFEGUARDS
URANIUM PROCESSING SECTION**

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TABLE OF ABBREVIATION

As Low As Reasonably Achievable	ALARA
Atomic Energy Act of 1954	AEA
Community Water System	CWS
Corporate Radiation Safety Officer	CRSO
Environmental Report	ER
Federal Guidance Report	FGR
Fiberglass Reinforced Plastic	FRP
Gallons/Minute	GPM
In Situ Leach	ISL
International Atomic Energy Agency	IAEA
Low Specific Activity, Class 1	LSA-1
Maximum Contaminant Level	MCL
Micrograms/Liter	UG/L
Naturally Occurring Radioactive Material	NORM
Occupational Safety and Health Administration	OSHA
Optically Luminescent Dosimeter	OLD
Parts Per Billion	PPB
Parts Per Million	PPM
Personal Protective Equipment	PPE
Point of Entry	POE
Publicly Owned Treatment Works	POTW
R.M.D. Operations, LLC	RMD

Reportable Quantity	RQ
Safe Drinking Water Act	SDWA
Safety Environmental Review Panel	SERP
Standard Operating Procedure	SOP
United States Department of Transportation	DOT
United States Environmental Protection Agency	EPA
United States Nuclear Regulatory Commission	NRC
Water Remediation Technology, LLC	WRT

PREFACE

R.M.D. Operations, LLC (RMD), in conjunction with Water Remediation Technology, LLC (WRT), is endeavoring to design and implement an innovative water treatment program to remove uranium, among other contaminants, from Community Water Systems (CWSs) to assist cities, municipalities, and states in their efforts to comply with relevant regulations for such sources promulgated pursuant to provisions of the Safe Drinking Water Act (SDWA). Using WRT-designed water treatment equipment (hereinafter the "Uranium Removal System"), affected public or private drinking water providers will be able to remove and safely contain uranium from CWSs using proven technology and mechanisms, and to dispose 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.

This United States Nuclear Regulatory Commission (NRC) performance-based, multi-site materials license application is being submitted in the name of RMD. Both WRT and RMD are companies within the group of Water Remediation Technology International companies. While WRT has developed the Uranium Removal System and provides the physical treatment system equipment, RMD is the company that will: (1) assure that all water treatment equipment has been properly installed at each CWS water treatment facility (2) manage the uranium water treatment system during its operation, 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 alternate feed or direct disposal), regenerating, if practicable, spent media at the final disposition facility, and responding to any system malfunctions or releases during active operations, media exchanges or decommissioning. RMD's use of uranium water treatment systems at water treatment facilities and the subsequent removal of uranium from drinking water supplies, possession of such licensed material, treatment media exchanges, and transportation and final disposition of such licensed material shall hereinafter be referred to as the "RMD 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 RMD's NRC license application to authorize the removal and concentration of source material uranium by RMD at each individual treatment site under the provisions of a performance-based, multi-site materials license, which will permit the initiation of RMD's uranium water treatment program, including the installation of RMD's Uranium Removal System, to be added to RMD's NRC license pursuant to NRC-approved requirements contained in the license. RMD'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 CWSs. 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. RMD intends that the exposure scenarios and parameters developed in this ER serve as the control parameters for its proposed performance-based, multi-site materials license. The basis and intent of RMD's proposed performance-based license is summarized in the following points:

1. The treatment system components, although differing in size, essentially will be identical in process operation and safety requirements at each individual water treatment site;
2. RMD will be responsible for assuring that all Uranium Removal System equipment is properly installed and operated during licensed operations;
3. RMD System Specialists will be responsible for handling licensed source material;
4. RMD will provide necessary oversight and training to local Utility Managers and Operators which will be the same at each water treatment site;
5. The ER is intended to provide 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;
6. With the full range of potential impacts and exposures having been addressed in the ER, the draft Safety Evaluation Report (SER), and the license application, the initiation of RMD's uranium water treatment program at new CWS water treatment facilities and the addition of such programs to RMD's NRC license can be a relatively simple "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 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 the ER and license application. The Safety Environmental Review Panel (SERP) also will verify that they fall within the "bracketed" conditions presented in the ER, the final SER, the license application, and license conditions as approved in the license.
7. Final management of licensed source material (uranium) from all of its water treatment systems will be handled under RMD's contracted arrangements with appropriately licensed facilities, so that each water provider does not have to address final disposition of licensed material.

The 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), RMD 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, RMD has determined that there are no significant potential impacts to public or occupational health and safety or the environment from its proposed licensed uranium water treatment program and that, indeed, RMD's proposed uranium water treatment program for assisting publicly or privately operated drinking water suppliers provides the means for such entities to cost-effectively and safely comply with the mandated SDWA uranium MCL.

Finally, RMD's proposed 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 CWSs requiring uranium water treatment are expected to be located in Agreement States, RMD believes that it is crucial that appropriate Agreement State authorities are included in this licensing process. Therefore, RMD 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 may be streamlined. RMD also urges the active involvement of *non*-Agreement States in the licensing process.

1. INTRODUCTION

1.1 Purpose and Need for Proposed Action

Over thirty 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 new MCL, RMD proposes to license an innovative uranium water treatment program, as is described in this ER, a draft SER, and a license application, for removing uranium from CWSs, storing uranium residuals in a self-contained Uranium Removal System, and disposing 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 alternate feed for processing at AEA-licensed uranium recovery facilities for introduction into the commercial nuclear fuel cycle as “yellowcake.” The RMD uranium water treatment program will provide CWSs with the capability to safely and cost-efficiently remove uranium from drinking water sources in compliance with the SDWA uranium MCL 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 Proposed Action

RMD has designed a comprehensive uranium water treatment program to remove, uranium from CWSs to assist cities, municipalities, and states in their efforts to comply with relevant provisions of SDWA. Using the Uranium Removal System, RMD will provide relevant CWSs with the ability to remove uranium from their drinking 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. RMD’s systems also potentially may provide the commercial nuclear fuel cycle with additional sources of uranium by processing uranium residuals from RMD’s uranium water treatment systems as alternate feed materials to recover source material uranium.

RMD’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 water sources are affected by naturally occurring uranium. 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 an individual water well site. 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) it will service. 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 RMD 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 and the configuration of the 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 will typically be located in either a separate treatment building/structure or in a separate treatment room attached to the CWS's existing well house building. After construction and installation, the system will be monitored and operated by the CWS' RMD-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, RMD 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 CWS water treatment facilities ultimately 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 threshold level for unimportant quantities of source material (i.e., *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 pounds of uranium at any one time or 150 pounds in a year. Thus, RMD is seeking 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. RMD will have 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 CWSs with a water treatment option that complies with SDWA and AEA requirements and that adequately protects public health and safety and the environment.

1.1.2 Benefits of the Proposed Action

RMD will use its uranium water treatment systems to provide several different benefits to CWSs. 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. RMD'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.

Second, unlike some other forms of water treatment where the treatment media is regenerated on-site and radioactive residuals are “backwashed” from a drinking water treatment facility and discharged to Publicly Owned Treatment Works (POTWs) through sanitary sewers or otherwise returned to the environment in an uncontrolled manner, RMD’s uranium water treatment program involves the removal of uranium from drinking water sources and the final disposition of uranium residuals at appropriately licensed facilities. This aspect of the RMD 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 using RMD’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) and that will not require any substantial environmental impacts should, if practicable, be pursued.

1.2 Applicable Regulatory Requirements, Permits, and Required Consultations

RMD’s uranium water treatment program at CWSs will be regulated under 10 CFR Part 40 requirements for the possession and transfer of uranium source material. The proposed 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 of the proceeding activities under the RMD 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 Nuclear Regulatory Commission

In its license application, RMD recognizes that at specific points in its uranium removal process, uranium source material will be concentrated to levels exceeding NRC *licensable source material* levels (i.e., greater than 500 ppm or 0.05% by weight) and to quantities exceeding NRC requirements for specific licenses (i.e., 15 pounds at any one time or 150 pounds in a year), thus requiring an NRC specific 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.” Requirements for *licensable* source material levels are set forth at 10 CFR § 40.13:

“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.”

In addition, RMD recognizes that, at specific points in its uranium removal process, concentrated uranium residuals will exceed NRC limits for general licenses (i.e., 15 lbs at any one time or 150 pounds in a year), thus requiring a specific license under 10 CFR Part 40.22(a). This requirement specifically states:

“[a] general license is hereby issued authorizing commercial and industrial firms, research, educational and medical institutions and Federal, State and local government agencies to use and transfer not more than fifteen (15) pounds of source material at any one time for research, development, educational, commercial or operational purposes. A person authorized to use or transfer source material, pursuant to this general license, may not receive more than a total of 150 pounds of source material in any one calendar year.”

As stated above, 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).

2. ALTERNATIVES

2.1 No-Action Alternative

The no-action alternative encompasses maintenance of status quo water treatment activities at existing CWS water treatment facilities (i.e., no active uranium removal). As a result, the no-action alternative would result in the failure of affected public or private water providers to comply with the SDWA uranium MCL or potential releases of uranium residuals to the environment. In this event, such CWSs would be required to pay 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 represents a potential adverse risk to public health.

Denial of RMD's license application likely will result in attempts by CWSs to comply with the SDWA uranium MCL, 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 substantial adverse impacts to public and occupational health and safety. Where no sanitary sewer options are available, 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 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 as a result of 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 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. RMD 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 and at the POTW.

2.3 Details of the Applicant's Proposed Action

In certain 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/L/30 ppb by SDWA uranium MCL. Laboratory test work, field pilot tests, and full-scale operations using the Uranium Removal System have demonstrated the ability to remove uranium from drinking water feed to below the SDWA uranium MCL.

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

2.3.3 Operations and Personnel

All licensed material contained within the Uranium Removal System, including treatment media and uranium residuals, will be controlled and owned by RMD. The operation of the Uranium Removal System will be controlled by RMD pursuant to one of the two following commercial arrangements: (1) RMD will own the Uranium Removal System or (2) in the event that a CWS elects to purchase the Uranium Removal System, RMD can, if NRC deems it necessary, execute a commercial lease of the CWS' System to ensure licensee control.

RMD will develop the overall radiation protection program and will implement this program at each CWS water treatment facility under the direction of a corporate Radiation Safety Officer (CRSO). Due to the ease of operation of the Uranium Removal System, including no addition of chemicals or backwash of 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 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 RMD. This training will typically be a two (2) hour initial course with follow-up training.

All of 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 RMD'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 Uranium Removal System re-startup;
- Packaging the spent treatment media for transport and/or transferring the treatment media from the treatment vessel(s) to a DOT-approved disposal tanker;
- Preparing shipping manifests and arranging for transport of uranium residuals by a licensed 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 or normal equipment maintenance.

As the authorized "handlers" of the licensed material, RMD 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 3.14, RMD System Specialists will receive at least sixteen (16) hours of initial training, the equivalent of a NORM (Naturally Occurring Radioactive Materials) Supervisors Course. A full description of the training that will be required of the CRSO, the RMD System Specialists, and the local Utility Manager and Operators is presented in Section 3.13, as part of RMD's Radiation Safety Program.

2.3.4 Waste Management

RMD's waste management philosophy is that uranium removed from drinking water sources pursuant to SDWA requirements *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 point of discharge. In RMD'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 2.3.2, RMD's System Specialists will perform all of the tasks related to handling the radioactive material. RMD will arrange for transportation of the spent treated media in DOT-approved transportation packages and vehicles by a properly licensed transportation contractor.

RMD 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 alternate 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 RMD'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 3.14.

2.4 Alternatives Considered but Eliminated

Several other alternatives are available to a CWS to meet the SDWA uranium MCL, but RMD 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 CWS and not to RMD. By the time that a CWS has reached the point of deciding to implement the RMD uranium water treatment program, the "shutting off" and "blending"

alternatives already will have been rejected by the CWS in its analysis and selection of compliance alternatives.

2.5 Cumulative Effects

RMD 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. 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. 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 CWS 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.

In order to demonstrate that there are no potential public or occupational health and safety or environmental impacts associated with the use of RMD's uranium water treatment system to remove uranium from drinking water sources, this ER addresses conditions relevant to potential exposure pathways that could be impacted by the implementation of RMD's uranium water treatment system at CWSs. 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 4.

3.2 Generic Site and/or Facility Description

RMD's uranium water treatment program, including the Uranium Removal System, will be implemented at existing CWS water treatment facilities or at newly constructed facilities adjacent to locally and State permitted drinking water wells where water treatment is deemed to be necessary by CWSs. This Section will present the range of expected CWS site sizes and conditions, once again to bracket the environmental conditions at typical water treatment facilities so that the RMD uranium water treatment program can be evaluated.

3.2.1 Generic Description of the Surrounding Water Treatment Facilities¹

Typically, CWS water treatment facilities vary in size and dimensions based on the type of water treatment operations performed and the volume of water supplied. In all cases, for both old and new well sites, the Uranium Removal System will be delivered and installed in an already-existing water treatment facility, typically the site of the water well(s) and well house(s).

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, RMD 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.

The facility can also be a primary distribution point where water from multiple wells is combined before entering the municipal distribution system. In general, potential adverse land use impacts by the existing CWS water treatment facility likely have been assessed previously and new assessments may not be necessary. As such, the 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 system arrives on-site for installation.

Features and structures on the facility site typically will include the water well(s), well house(s), and water storage tanks. Even at a site that has a storage tank(s), at times the water may be pumped directly from the well house into the distribution system, precluding the use of storage tanks. The 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.). For smaller Uranium Removal Systems, these treatment activities can be placed in structures the size of small storage buildings, 400 to 500 square feet. A small Uranium Removal System is currently operating at a well site owned by the Fox Run Water Company near Petersburg, Virginia. 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 Uranium Removal System. Photos of both the Uranium Removal System 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 well house for the System. Figure 2-3 presents a generic layout of a well house for a large Uranium Removal System, up to approximately 1,500 gpm. This Uranium Removal System would require only one large treatment vessel, up to approximately 15-ft diameter. Figure 2-4 presents a generic layout of a well house for a system larger than 1,500 gpm, which would require two treatment vessels. Operation of most 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 has restricted access and will require limited work tasks in the immediate vicinity of the treatment vessel.

These water supply sites may vary in size, depending on the size of the supply system, 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. The general location 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 well house as described above. On rare occasions where inclement weather isn't 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, as a result of the facility's importance as a CWS, the water treatment facility will be secured, regardless of the need for treatment for removal of radionuclides. As a minimum, the well houses will be locked. Many sites, although not all, 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 that could affect the potential level of impacts from a uranium treatment system, whether it is the RMD uranium water treatment program or one of the alternate approaches, is the presence of 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. A number of water supply systems, especially those located in rural areas, do not have access to a sanitary sewer. If 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.

3.2.2 Hazardous Material Handled

Hazardous materials handled by existing CWSs vary depending on the method of water treatment used by such providers in their treatment operations. 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 on the size of the 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 systems. The fluorosilicic acid is stored as a liquid.

3.3 Land Use

Section 3.2.1 presents a description of the possible features at the CWS' facility that presently requires land use, which likely has been assessed previously. The CWS' 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 proposed 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 CWS water treatment facilities vary depending on the geographic location of each facility. In general, CWS 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 municipal workers at each facility. Smaller CWS water treatment facilities generally utilize one (1) to three (3) workers traveling round-trip over facility roads five (5) to seven (7) days per week. Larger CWS water treatment facilities generally utilize ten (10) to twenty (20) workers traveling round-trip over facility roads five (5) to seven (7) days per week. Operations at CWS 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 CWS Water Treatment Facility Geology and Soils

CWS water treatment facility geology varies depending on the geographic location of the specific facility. In all cases, CWS 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 CWS 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 CWS Water Resources

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

3.6.1 Groundwater

Typically, CWSs that require uranium treatment use groundwater as their primary resource. Groundwater is removed from local aquifers through water wells, which are constructed in accordance with state standards for such wells and for groundwater protection. CWSs draw water from formations that are typically below a confining layer which provides protection from surface water contamination.

3.6.2 Surface Water and Potential Flooding

Some CWSs currently discharge treatment residuals directly to surface water ways 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 CWS previously. Newly constructed treatment facilities likely would require additional assessment prior to construction, but would include similar safeguards against flooding.

3.7 Ecological Resources

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

3.7.1 Generic Ecological Description

Ecological issues at CWS water treatment facilities and associated lands are highly site-specific. As a general matter, 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 CWS previously.

3.7.2 Typical Transportation Corridors

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

3.7.3 Identification of Endangered Species

Existing CWS 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, CWSs will determine whether any such issues exist prior to construction of the new facility structure, within which treatment technologies are to be installed. Installation of new technologies within the boundaries of such facility structures likely will not require new assessments.

3.7.4 Identification of Ecological Studies

Depending on the geographic location of a given CWS water treatment facility, ecological studies will have been conducted and local ecology will have been assessed. However, CWS 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, CWS 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 CWS water treatment operations generally do not pose a threat to air quality.

3.9 Noise

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

3.10 Historic and Cultural Resources

Existing water treatment buildings or structures already will have assessed potential impacts to historic and cultural resources and presumably found no significant impacts. New water treatment buildings or structures may require analysis of potential impacts to historic and cultural resources. Even if a new structure was required, this cultural resource analysis, any required mitigation of impacts, and land disturbance and construction will have taken place before any licensed activity occurs.

3.11 Socioeconomic Impacts

Generally, drinking 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 likely have safeguards in place to prevent improper occupational exposure to such chemicals during water treatment operations.

3.13 Radiation Protection and ALARA Program

This Section presents the radiation protection and as low as reasonably achievable (ALARA) program that will be established and maintained by RMD to satisfy the radiation protection and ALARA requirements of 10 CFR Part 20. This program applies to RMD System Specialists and local Utility Managers and Operators who may perform job functions in proximity to the Uranium Removal System and its associated equipment. This Section also describes the classification of workers by job function, the level of required training, proposed radiation monitoring, and general and emergency procedures.

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 CWS' drinking water supply at levels above the regulatory MCLs. The Uranium Removal System removes uranium and a portion of its

immediate decay products, and this material is absorbed and stored onto the inert treatment media in an enclosed treatment vessel. In this and subsequent Sections of this ER, "Uranium Removal System" refers to the treatment column/vessel and ancillary equipment, valves, and piping supplied by RMD for the purpose of removing uranium from drinking water supplies.

3.13.1 Job Positions Involved with the Uranium Removal System

Individuals normally involved with the operation of the Uranium Removal System include RMD employees such as the CRSO and RMD System Specialists, as well as local Utility Managers and Operators, who are employees of the CWS. RMD System Specialists are the individuals managing 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 alternate feed or direct disposal). The local Utility Operators will typically only monitor the daily operation of the treatment system and possibly perform infrequent minor maintenance on system components away from the treatment vessels. This division of labor results in employees performing different functions in the licensed area as will be described in the subsections below. One group of workers – the RMD System Specialists – will actively manage the radioactive treatment media as required, while the local Utility Operator performs job tasks in and around the radioactive material area that may expose them to small amounts of radiation from the licensed portion of the Uranium Removal System. The local Utility Manager will be the primary point-of-contact with RMD's CRSO.

3.13.1.1 Corporate Radiation Safety Officer

As a result of the nature of the Uranium Removal System, which requires no chemical additions or backwashing of residuals, and which local Utility Operators typically will only monitor and inspect, there will be no need for an on-site RSO at the water treatment facility. As part of the service provided to the CWS, RMD's CRSO will function as the RSO for each of the individual CWS water treatment sites.

RMD's 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 CWS facility.

The CRSO's areas of responsibility include the following:

- Responsibility for the development and administration of the radiation protection and ALARA 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 Part 20 and will be subject to annual review;
- Authority to enforce regulations and policies that affect any aspect of the radiation protection and ALARA program;

- Responsibility for conducting and documenting training for both the RMD System Specialists and the local Utility Managers and Operators;
- Responsibility for review and approval of equipment design, process changes or changes in operating procedures to ensure that the radiation protection and ALARA program is maintained;
- Responsibility for the local-area and personnel monitoring (dosimetry) program, and documenting shipment and final disposition of the radioactive spent treatment media.

The minimum training requirements for the CRSO are described in Section 3.13.2.1.

The local point-of-contact for a particular CWS typically will be the local Utility Manager (e.g., Director of Public Works, Drinking Water Superintendent, or similar level position). This person will coordinate with RMD's CRSO with respect to training requirements, posting required notices, exchanging dosimeter badges, and overall operation of the Uranium Removal System with respect to radiation protection issues.

3.13.1.2 RMD System Specialists

RMD is responsible for operating, maintaining, and decommissioning the Uranium Removal System. RMD System Specialists will perform the following tasks related to handling treatment media:

1. Assure that all Uranium Removal System equipment has been installed and operates pursuant to license requirements at each CWS 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 Utility Managers and 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 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 alternate feed or at a properly licensed/permitted disposal facility for direct disposal.

It is also anticipated that RMD System Specialists may provide a portion of the “on-the-job” training for local Utility Managers and Operators at specific CWS water treatment facilities. The minimum training requirements for the RMD System Specialists are described in Section 3.13.2.2.

3.13.1.3 Local Utility Operators Working in the Radioactive Material Area

Although they will not directly handle the radioactive 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.

As with most of the other existing functions at a 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 local Utility Operators' tasks related to the Uranium Removal System are primarily to inspect and observe the System 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 RMD and local Utility Managers and Operators;
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 wells. 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 treatment vessel, and the exchange of polyfabric bag filters from the safety filters. The filters are intended to collect the natural sand, silt, and clay particles that may be present in the well water, but it is conceivable that a downstream filter may collect a very small amount of undersized treatment media beads (broken beads) containing licensed material. Changing filter bags and proper disposal of spent filter elements will be performed in accordance with written standard operating procedures (SOPs) developed by the corporate CRSO.
5. Perform miscellaneous tasks not related to the Uranium Removal System within the treatment room. Although the Uranium Removal System typically will be located in a separate building or in a portion of the well house building dedicated to its operation, there likely will be other valves, piping or ancillary equipment in the building, not related to the Uranium Removal System that may require periodic maintenance.

The following Table 3-1 presents a conservative estimate of the amount of time a local Utility Operator might spend in proximity to the Uranium Removal System in a year. This estimate is based on a larger system that will be inspected daily as part of the CWS' procedures. Daily inspection and additional time for maintenance/repairs in the treatment room results in approximately 100 hours annually in proximity to the System. Smaller, more-remote systems that do not require daily inspections will result in fewer hours working in proximity to the Uranium Removal System.

Table 3-1
Estimated Time Spent in Proximity to a Uranium Removal System
by a Local Utility Operator

Task	Distance from Tank (m)	Task Duration (min)	Task Frequency	Total Task Time (hr/yr)
Inspect/record flow and pressure readings	3.0	3	5 days/wk	13
General equipment inspection	1.5	5	5 days/wk	22
Inspect/service external filter	1.5	10	Every other month	2
Collect inflow/discharge water samples	3.0	5	Every month	1
Miscellaneous task time within vessel area	1.5	5	5 days/wk	22
Miscellaneous task/repair time within treatment room	4.0			40
Total				100

Notes:

1. Based on instrumentation and remote readout for pressures and flows
2. Utility operators will not handle treatment media

The local Utility Managers and Operators will be provided with Radiation Awareness Training as described in Section 3.13.2.3. A conservative estimate of the potential radiation exposure to the local Utility Operators is discussed in Section 4.12. The dosimetry monitoring plan for the licensed material area is presented in Section 3.13.6.

3.13.2 Radiation Safety Training Programs

This Section presents 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, multi-site nature of the proposed license, no specific individuals are named for these positions. The minimum applicable education and radiation safety training requirements are presented, and it will be RMD's responsibility to identify the specific individuals that will perform the work for both RMD and each CWS, to document that required training has been provided, and to periodically review and update training requirements as necessary.

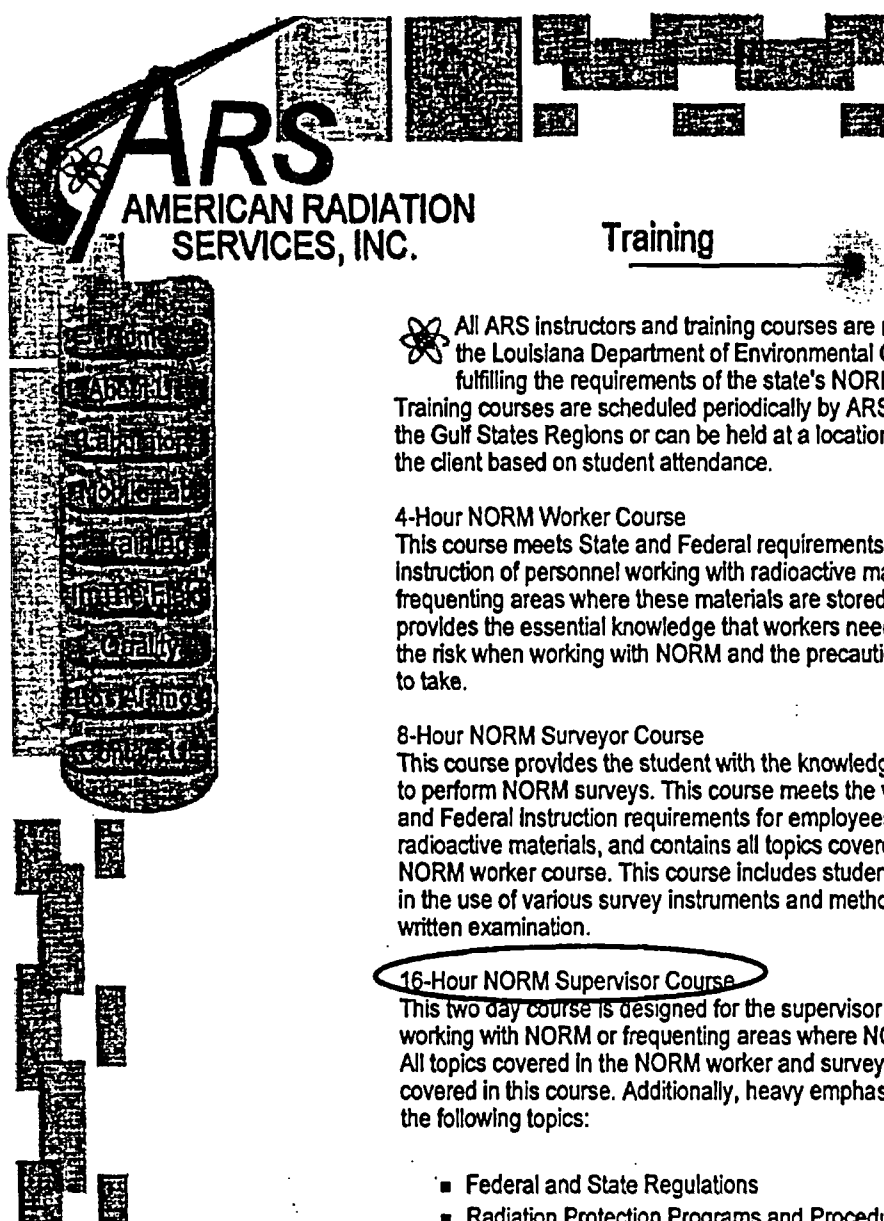
3.13.2.1 Training for the Corporate Radiation Safety Officer

At a minimum, RMD'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. The CRSO will also attend the following training courses.

- Initial 40-hour CRSO training course
- Initial 16-hour Naturally Occurring Radioactive Materials (NORM) training course
- Refresher CRSO and/or NORM courses, or related follow-on training as necessary.

3.13.2.2 Training for the RMD System Specialists

RMD System Specialists will be instructed in all the topics covered in the radiation safety training for local Utility Managers and Operators (see Section 3.13.2.3). In addition, they will attend an initial NORM (Naturally Occurring Radioactive Material) Training Course, eight (8) to sixteen (16) hours in length. A course outline for a typical course, this one presented by American Radiation Services, Port Allen, LA, is presented in Figure 3-3. If necessary, 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 must be attained.



Training

All ARS instructors and training courses are recognized by the Louisiana Department of Environmental Quality as fulfilling the requirements of the state's NORM regulations. Training courses are scheduled periodically by ARS at locations in the Gulf States Regions or can be held at a location designated by the client based on student attendance.

4-Hour NORM Worker Course

This course meets State and Federal requirements for the instruction of personnel working with radioactive materials or frequenting areas where these materials are stored. This course provides the essential knowledge that workers need to understand the risk when working with NORM and the precautions they need to take.

8-Hour NORM Surveyor Course

This course provides the student with the knowledge and abilities to perform NORM surveys. This course meets the various State and Federal instruction requirements for employees surveying for radioactive materials, and contains all topics covered in the NORM worker course. This course includes student participation in the use of various survey instruments and methods and a written examination.

16-Hour NORM Supervisor Course

This two day course is designed for the supervisor of personnel working with NORM or frequenting areas where NORM is stored. All topics covered in the NORM worker and surveyor course are covered in this course. Additionally, heavy emphasis is placed on the following topics:

- Federal and State Regulations
- Radiation Protection Programs and Procedures
- State Notification Requirements
- Waste Management Requirements
- Disposal Options
- Respiratory Requirements and Programs
- Shipping and Manifesting
- Legal Responsibilities and Liability Prevention

This course includes an extensive surveying practical session and a written examination.

Figure 3-1

3.13.2.3 Radiation Awareness Training for Local Utility Managers and Operators

Due to potential exposure to small amounts of radiation during the performance of tasks in proximity to the Uranium Removal System's treatment vessel, local Utility Managers and Operators will receive radiation-awareness training. It should be noted that a local Utility Operator's annual dose is anticipated to be dramatically less than the 100 mrem/year limit for employee awareness training pursuant to 10 CFR § 19.12. Local Utility Managers' annual dose will be substantially less than that of a local Utility Operator. In accordance with its Agreement with the CWS, RMD will provide this training in an initial on-site training session that will also include the non-radiation operational training for the overall system. The radiation portion of this training will be one (1) to two (2) hours in length, and typically, will be presented in a live classroom training session, similar to the CWS' other periodic safety training. RMD is also responsible for providing follow-on training, at the request of the CWS, which may be live training or presented using a training video.

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

- Basic introduction of radiation – types of radiation, explanation of common terms and units, concept of radioactive decay and decay products, etc.;
- Uranium concentration in the feed water and the buildup and concentration of uranium expected in the treatment media;
- Results of radiation dosimetry monitoring (exposure) at other RMD pilot-systems and/or full-scale operations;
- Expected dose from the Uranium Removal System and comparison of that dose to the typical dose received from natural radiation;
- Application of ALARA principle to work in proximity to the treatment vessel;
- Limiting public access to the treatment system area;
- 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.

3.13.3 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. Local Utility Operators will not be required to wear PPE during daily Uranium Removal System monitoring.

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

- Lab coat or protective apron
 - Disposable gloves
 - Boot covers or overboots
 - Dust mask, as necessary (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. Local Utility Operators will not be required to wear personal dosimeter badges due to the low radiation levels. RMD System Specialists, with their tasks related to handling spent media, will wear a whole-body dosimeter badge, typically an Optically Luminescent Dosimeter (OLD);
 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. Licensed materials will be stored and labeled;
 9. Areas will be posted with caution signs in accordance with 10 CFR Part 20, Subpart J or applicable Agreement State regulations, whichever applies to the particular CWS water treatment facility.

A discussion of the radiation safety procedures that will be used during the media exchange and packaging operations are presented in Section 3.14 entitled *Waste Management*.

3.13.4 Area and Personnel Monitoring

Neither RMD System Specialists nor the local Utility Managers or Operators are expected to receive an annual radiation dose anywhere near the individual monitoring threshold prescribed in either 10 CFR § 20.1502 or corresponding Agreement State regulations that requires personal monitoring (500 mrem/yr for adults and 100 mrem/yr for minors or pregnant women). As described below, the potential dose to a local Utility Operator is estimated to be negligible and that to the local Utility Manager is estimated to be even lower. Accordingly, neither the local Utility Manager nor the local Utility Operators will wear personal dosimeter badges. Although not required, the RMD System Specialists will wear personal dosimeter badges. These typically will be OLD badges, and these RMD System Specialists will use the same personal dosimeter badge at all of the well locations they will be servicing during a monitoring period.

To meet 10 CFR § 20.1502's requirement to monitor radiological exposures from licensed and unlicensed radiation sources under its control, RMD will install OLD 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 will 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 if it is expected that this badge may experience exposures above background levels.

Dose Rate Assessment

RMD contracted with a private radiation safety consulting firm to develop a model for estimating the dose rate from the Uranium Removal System. This exposure model is specific to the Uranium Removal System, as described in this ER, 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 and assessed several conservative spill scenarios considered to be highly unlikely but credible. The contractor's dose rate assessment is presented in more detail in Section 4.12, *Public and Occupational Radiological Health Risks*, but the 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 60,000 ppm (6-percent uranium). 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 treatment vessel surface decreases by a factor of 100 to approximately 0.003 mrem/hr. The estimated incremental dose rate above natural background is negligible;
- The estimated total dose received by a worker (RMD System Specialist) during cleanup of a treatment media spill, including the highly unlikely but credible assumption that media is ingested, is estimated to be less than 3 mrem.

Potential Annual Dose to the Local Utility Operators

Section 3.13.2.3 above discusses the tasks that the local Utility Operators will perform in proximity to the Uranium Removal System. An operator could spend up to 100 hours per year performing these tasks at approximately one (1) meter or more away from the treatment vessel. 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 annual dose to the local Utility Operator will be approximately 0.1 mrem/year.

3.13.5 Area Survey Procedures

This Section's proposed survey procedures are based, in part, on recommendations presented in two (2) NRC publications:

- NRC Regulatory Guide 8.30, *Health Physics Surveys in Uranium Recovery Facilities*, Rev. 1, (May 2002);
- NRC Regulatory Guide, *Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material*.

Other than an operational upset or other emergency situation (see Section 3.13.6), the only time that an area survey will be required to check for removable surface contamination will be after spent treatment media has been exchanged for fresh treatment media.

The local Utility Operators will perform the daily inspection and monitoring of the Uranium Removal System, which will also include a check for any upset condition that results in

a release of treatment media. In the case of daily inspections and media exchange operations, a visual observation of treatment media particles on the floor will be the primary method used for the area survey. The resin beads are nominally the size of coarse- to medium-sized sand grains, about 0.6 mm, white in color, and should be easily visible on the treatment room floor. The treatment media will also settle out of the water relatively quickly in low to moderate flows. Taking into account that uranium is a relatively low-activity alpha emitter, there will be limited uranium decay products present. Given that uranium concentrations on the treatment media may be low, a survey meter may not detect any contamination. In general, if treatment media particles are not observed outside of the treatment vessel, an area survey with a survey instrument will not be required.

Surveys for Surface Contamination in Restricted Areas

NRC Regulatory Guide 8.30 presents exposure and survey information with respect to uranium recovery facilities (e.g. uranium mills, etc.). At those facilities, one of the primary areas of concern is the yellowcake drying and packaging area. As described in Section 4.12, the dose rate from the water treatment resin will be more than an order of magnitude less than that from recovered yellowcake, the following guidance items from NRC Regulatory Guide 8.30 will apply as survey recommendations for the Uranium Removal System:

- NRC regulations provide no specific limit on surface contamination levels in restricted areas (in this case, at least the immediate area around the Uranium Removal System). The limits on intake of radionuclides presented in 10 CFR § 20.1204, however, apply if yellowcake dust is re-suspended and inhaled or ingested. Unlike yellowcake, however, re-suspension of uranium-laden treatment media is very unlikely;
- The International Atomic Energy Agency (IAEA) recommends a limit for alpha contamination on walls, floors, benches, and clothing of 10^{-3} uCi/cm² (220,000 dpm/100 cm²). IAEA concludes that, if surface contamination levels are kept below this value, the contribution to airborne radioactivity from surface contamination will be below applicable limits;
- NRC Staff considers surface contamination levels of 220,000 dpm/100 cm² acceptable to satisfy the ALARA principle in uranium recovery facilities. These levels are low enough to ensure little contribution to airborne radioactivity, yet are practical to meet. This amount of contamination is readily visible and does not require a survey instrument for detection. Daily visual inspections are adequate in these areas.

Due to their larger size compared to yellowcake dust, it is less likely that moist uranium-laden resin beads will become airborne. As the risk of inhalation is much less, the allowable surface contamination limit above is conservative for the operation of the Uranium Removal System.

Surveys for Surface Contamination in Areas of Unrestricted Use

Unrestricted use applies to areas that can be used by members of the general public. With respect to the Uranium Removal System, these areas would include the following:

- Areas of the well house away from the immediate vicinity of the Uranium Removal System;
- Areas outside of the well house that could be impacted by media exchange operations (e.g., locations of hose connections along sidewalks or parking lots, transport tank connections, etc.);
- The general area of the Uranium Removal System and treatment building after system decommissioning;
- The skin and clothing of workers handling the licensed material.

NRC Regulatory Guide 8.30, Table 2, entitled *Surface Contamination Levels for Uranium and Daughters on Equipment to be Released for Unrestricted Use, on Clothing, and on Non-Operating Areas of Uranium Recovery Facilities*, recommends the same limit for Removable Contamination for all of the above areas – 1,000 dpm alpha/ cm². This activity threshold is also consistent with the recommendations of the final CRCPD Part N TENORM Guidelines for surface contamination. Once again, using this limit as the unrestricted-use limit for the Uranium Removal System is conservative as the treatment media is less likely to become airborne. Also, alpha radiation from uranium on the skin or clothing is not a direct radiation hazard, because the alpha particles do not penetrate the skin. Due to the media particle's size, a visual inspection is adequate to detect surface contamination on the skin and clothing. Release of areas for continued unrestricted use after media exchanges and upon decommissioning may require swipe tests and survey with an appropriate alpha survey instrument.

General Area Survey Procedures

1. In the event of a spill, individuals will visually monitor hands, shoes, clothing, work surfaces, and the overall area of a spill after the spilled treatment media has been cleaned up, and, if necessary, will be followed by an instrument survey checking for remaining removable contamination.
2. At the conclusion of a media exchange operation, a visual inspection will be made of all areas of the tank, hose, and pump connections – both in the vicinity of the treatment vessel and the RMD service trailer – looking for media particles. If necessary, this visual inspection will be followed up with an instrument survey to detect any removable surface contamination.
3. Removable surface contamination will be considered present and will be cleaned if the contamination level exceeds 1,000 dpm per 100 cm² above background. A survey instrument

reading in cpms may be used for this survey, using the appropriate conversion factor for dpm to cpm for the instrument.

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 for five (5) years after the survey. The record will include, at a minimum, the following information:
 - Date of the survey;
 - Person(s) conducting the survey and clean-up;
 - Manufacturer, model, and serial number of the instruments used to perform surveys and analyze wipe tests;
 - A drawing or sketch of the area surveyed identifying relevant features and the surveyed and clean-up areas;
 - Detected contamination readings (in units of dpm/100 cm² or cpm/100 cm²) keyed to locations on the drawing;
 - Description of corrective action taken.

Note: If no abnormal radiation levels are detected, only the date of survey and identification of the person performing the survey need to be recorded. If surface contamination is found, then the steps outlined in Item 4 above will be followed.

3.13.6 Emergency Procedures

As described in Section 3.2.2, the Uranium Removal System's treatment vessel is 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 RMD System Specialists using a broom and dust pan, a small shop-type wet/dry vacuum, or the large capacity industrial vacuum on the RMD service trailer (see Section 3.14.3). 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.

URANIUM-REMOVAL SYSTEM

EMERGENCY PROCEDURES

General

- No eating, drinking or using tobacco products in the treatment room;
- Make certain all personnel are in a safe environment – **injuries, fire, etc. take precedence over radiation hazards.** Perform first aid as necessary;
- In an emergency, the water supply can be shut down or bypass the treatment vessel;
- The primary radiation hazard is through inhalation and ingestion – keep the treatment media moist;
- Wear the proper Personal Protective Equipment (PPE) as necessary. Wash hands and, as necessary, face and hair after any operation involving handling the treatment media;
- Contact the corporate Radiation Safety Officer;
- The corporate Radiation Safety Officer shall immediately evaluate the consequences of a spill or other accidental release against 10 CFR Part 20, Subpart M and 10 CFR § 40.60 entitled *Reporting Requirements*;
- Contact the appropriate local authorities (e.g., fire and police);
- Contact NRC and the appropriate State Radiation Control Agency;
- Maintain an incident log including activity, time, and personnel involved.

Personal Decontamination

- Contaminated clothing should be removed and stored for further evaluation by the corporate RSO.
- Small amounts of surface contamination (media particles) can be removed from clothing by washing or patting down the area with duct tape to pick up the particles.
- 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.
- 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 paramedics of possible contamination.

Spills

- Remember that the treatment media is the only licensed radioactive material, not the water in the treatment vessel;
- **Notify:** Notify persons in the area that a spill has occurred;
- **Control Access:** Set up a barrier, tape or cones, at least five feet from the spill.
- Keep unnecessary personnel out of the area of the spill;
- Keep the treatment media moist to eliminate airborne particles;
- **Prevent the Spread:** Cover the media with a plastic sheet, drop cloth, etc. to contain the spill;

- **Report:** Formulate cleanup plan with corporate Radiation Safety Officer;
- **Survey:** After the cleanup, visually inspect the area around the spill, hands, feet, and clothing for any remaining contamination. Perform wipe tests and instrument survey as necessary;
- **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 vessel or shut down the water supply well;
 - Determine whether situation warrants closing the treatment room and preventing entry.

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;
- Formulate cleanup plan with corporate Radiation Safety Officer.

CONTACT THE FOLLOWING IN CASE OF AN EMERGENCY

Local Authorities:

Fire Department: _____

Sheriff/Police Department: _____

State Radiation Control Agency: _____

State Spill Reporting Center: _____

Corporate Radiation Safety Officer: Business Hours – (303) 424-5355

After Hours – Duane Bollig: (303) 204-4256

3.14.1 Transportation of the Radioactive Treatment Media

RMD will not operate its own highway trucks for transporting the licensed material for uranium recovery/disposal, but rather will arrange for transportation of the packaged treatment media by a contracted commercial carrier. RMD will comply with the requirements of the applicable NRC/Agreement State's regulations for transportation of radioactive material, as well as changes to 49 CFR §§ 171-173 (DOT) (effective October, 2004) that address the compatibility of DOT/NRC transportation regulations with IAEA Transportation Safety Standards. RMD will comply with the applicable regulations related to marking, manifesting, and transporting the spent treatment media.

The new federal regulations replace the previous threshold of 2,000 pCi/g total-activity for the definition of radioactive material (for transport) with radionuclide-specific activity concentrations. The spent treatment media shipments will still be considered radioactive (for transportation) under the new regulations, and the treatment media will remain classified as Low Specific Activity (LSA-1) material.

3.14.2 Disposal of Spent Treatment Media

Using the scenario of transporting the spent treatment media to a uranium recovery facility for processing as an alternate feed material, the uranium recovery facility would take title to the licensed material at the time that the media arrives at the recovery facility. After the uranium is stripped off of and recovered from the treatment media, the spent treatment media will either be:

- Disposed of as AEA 11.e.(2) byproduct material in a mill tailings impoundment;
- Regenerated and returned to RMD for re-use (e.g. in continued uranium-removal water treatment, sold for uranium ISL recovery, etc.)

Using the scenario of transporting the spent treatment media to a licensed/permitted facility for direct disposal, the facility would take title to the licensed material at the time the spent treatment media arrives at the disposal facility. The direct disposal facility will directly dispose of the spent treatment media and will not regenerate any treatment media for reuse by RMD.

As part of the performance-based, multi-site nature of the proposed license, RMD will obtain and maintain operating contracts with the properly licensed uranium recovery or direct disposal facilities. These contracts will ensure that RMD has the right to use those facilities and that the facilities are licensed/permitted to accept the licensed material.

4. ASSESSMENT OF POTENTIAL IMPACTS FROM RMD'S URANIUM WATER TREATMENT PROGRAM

RMD 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 RMD's water treatment program, including the installation and operation of the Uranium Removal System. Based on this assessment, RMD 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, RMD's uranium water treatment program minimizes potential adverse impacts to public health and safety as compared to other potential alternatives.

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, 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.

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. CWSs 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.

4.1.3 Land Use Impacts for Proposed Action

Potential land use impacts from RMD's uranium water treatment program exist if CWSs expand existing facilities for uranium removal or identify new drinking 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 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 RMD's uranium water treatment program will not add any incremental impacts above and beyond the construction of such water treatment structures.

CWSs 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.

RMD's uranium water treatment program eliminates potential land use impacts from the land application of uranium residuals. RMD provides a "cradle-to-grave" service that includes final disposition of uranium drinking 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 CWSs to other municipalities, states or across the country. However, as stated above, the SDWA uranium MCL is a federal mandate and, as a result, this alternative is not feasible.

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 CWSs to other municipalities, states or across the country. If a sewer connection is not available at the CWS (a common occurrence in many rural communities), CWSs will be required to transport uranium-loaded brine solutions to a discharge point into the sanitary sewer system. In instances where the 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 Proposed Action

Transportation impacts associated with the use of RMD's uranium water treatment program will be minimal and will result from the disposition component of RMD'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

RMD will contract with licensed transportation contractors and will use DOT-approved tanker trucks or other packages and vehicles to transfer the uranium residuals to properly licensed processing or disposal facilities. See Section 3.14.3 for descriptions of transportation modes and packaging.

4.2.3.2 Transportation Traffic Requirements

Using conservative "upper-bound" assumptions which reflect RMD's estimated number of CWS under contract, RMD 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 in order to reduce the number of media exchanges required. RMD projects that up to 1,000 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, RMD projects an average of approximately 200 trips per year from CWSs. Although CWSs are located throughout the country, RMD projects a weighted average distance between those CWSs 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 truck load and, therefore, the spent treatment media from two or more nearby well sites will 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 CWS 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, RMD'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."

Based on this information, RMD'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 Truck Shipments of Loaded Treatment Media from CWSs

The loaded resins will be shipped from the water treatment facility to a licensed uranium recovery or direct disposal facility. The resins are Low Specific Activity, Class I (LSA I) materials according to the definitions in 49 CFR § 173.403 and will be shipped in accordance with the requirements in 49 CFR § 173.427.

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 lbs, will be used for nearly all spent treatment media shipping, RMD 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.

**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 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. RMD has estimated that a uranium recovery or direct disposal facility could be located an average of 1,000 miles from a specific CWS 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 RMD 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.

For the sake of conservatism in calculating the potential dose to a transportation spill cleanup worker, RMD 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, RMD 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, RMD 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 ft³ 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.

Due to the fact that 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

Nuclide	FGR No. 12 Dose Coefficients			Estimated conc., pCi/g	Estimated Surface Dose Rate mrem/h
	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 resuspended resin will be negligible since the treatment media particles, at approximately 600 μm in diameter (sieve size 30), are too large to be respirable and are unlikely to remain resuspended 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 CWS water treatment facility, ingestion of radioactive materials under a highway spill situation is almost entirely preventable by the use of 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 work day at an inhalation rate of $1.25 \text{ m}^3/\text{hr}$ will be as follows:

$$\text{Inhaled U-nat activity} = 54,000 \text{ pCi/g} * 0.001 \text{ g/m}^3 * 1.25 \text{ m}^3/\text{h} * 8 \text{ h} = 540 \text{ pCi}$$

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 5.

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.

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 CWS in question. However, as stated above, this alternative is not feasible as the SDWA uranium MCL is a federal mandate.

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 Proposed Action

Impacts to geology and soils from RMD'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, RMD'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 Utility Operator(s) will shut down the water supply and take the System off-line, and the RMD System Specialists will initiate cleanup activities which are described in Section 3.13.5 and 3.13.6. This cleanup activity will negate any potential exposure of uranium residuals to geology or soils.

The construction of water treatment facilities where RMD'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 CWSs. See Section 2.3.2 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, RMD has created response procedures for cleanup of a release. These response procedures are described in Section 3.13.6.

Finally, RMD 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, RMD'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.

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 CWS.

4.4.3 Water Resources Impacts from Proposed Action

Water resource impacts from the proposed action will be negligible. RMD’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.”

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, RMD 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, RMD 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 proposed action does not create any significant, potential incremental impacts to water resources above and beyond authorized water treatment operations at existing 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.

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 Proposed Actions

Potential ecological impacts from the proposed action will be negligible. 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 regarding secondary containment. RMD has created cleanup procedures to address releases of uranium residuals during leakages from the Uranium Removal System. See Section 3.13.6 & 3.14 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,” RMD will implement cleanup procedures to address such a release, including the use of the RMD service trailer’s industrial vacuum. See Section 3.13.6 for further discussion. Based on this information, RMD’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.

4.6.2 Air Quality Impacts from “Regenerating/Backwashing” Alternative

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 Proposed Action

The proposed 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 RMD’s emergency procedures described in Section 3.16.6. Therefore, RMD’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.

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 additional incremental noise impacts.

4.7.3 Noise Impacts from the Proposed Action

Potential noise impacts from the proposed action will not alter the current impacts created by existing water treatment operations. Implementation of the RMD 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 RMD uranium water treatment system, no additional incremental noise impacts should occur.

During media exchanges, RMD’s service trailer will utilize a diesel generator set which will result in a minimal increase in noise impacts on limited occasions. RMD’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.

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, 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 Proposed Action

Potential impacts from the proposed action should not be significant for implementation of RMD'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, RMD and CWSs will assess relevant impacts as required.

4.9 Visual/Scenic Impacts

Potential visual/scenic impacts for each of the alternatives discussed above are as follows:

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.

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 Proposed Action

Potential visual/scenic impacts from the proposed action should be similar to the previously discussed alternatives. Existing water treatment operations should not present significant impacts based on the implementation of RMD'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

Potential visual/scenic impacts for each of the alternatives discussed above are as follows:

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, 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.

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 Proposed Action

The implementation of the RMD uranium water treatment program will minimize potential socioeconomic impacts. Given that the SDWA uranium MCL is an unfunded mandate, RMD’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 RMD’s uranium water treatment system will be similar to those for alternative treatment technologies. Further, RMD’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 alternate feed materials allows waste byproducts to be classified as 11e.(2) byproduct material which is regulated in perpetuity by a federally mandated long-term custodian. This removes any potential future liabilities for future releases of uranium residuals.

4.11 Environmental Justice Considerations

Potential visual/scenic impacts for each of the alternatives discussed above are as follows:

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.

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 creates 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 Proposed Action

Environmental justice considerations for the proposed action should be eliminated as RMD’s uranium water treatment program is designed to remove uranium from drinking water sources well below the SDWA uranium MCL, 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 RMD’s uranium water treatment systems, no EIS should be required. While the implementation of RMD’s uranium water treatment systems will result in a minimal increase in water prices, such increase should not implicate environmental justice considerations. Thus, since there are no significant environmental impacts resulting from RMD’s uranium water treatment program, there should not be any environmental justice considerations associated with the proposed action.

4.12 Public and Occupational Health Impacts

Potential public and occupational health impacts for each of the alternatives discussed above are as follows:

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 CWSs must comply.

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 are 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 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 CWSs using conventional ion exchange technology to remove uranium from drinking water 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 CWS with uranium in its source water potentially can remove up to hundreds of pounds of uranium per year, above the 150-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 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 increased occupational health impacts due to handling hazardous materials not required by the other alternatives.

This alternative could result in 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 Proposed Action

Potential public and occupational radiological impacts from the proposed action are negligible. With respect to potential dose to members of the public, RMD'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, RMD will initiate emergency response procedures design to safely contain and remediate such release. As discussed above, RMD'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, RMD'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, RMD 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 RMD 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 proposed 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.

4.13.2 Waste Management Impacts from "Regenerating/Backwashing" Alternative

Potential waste management impacts associated with the "regenerating/backwashing" alternative focus 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 Proposed Action

Potential waste management impacts associated with the proposed action are negligible as RMD'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 sources and store such residuals without permitting the release of any uranium particulates. When uranium loading in the System reaches appropriate levels, RMD 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, RMD 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 RMD's uranium water treatment systems after transport, uranium residuals will be transferred to properly licensed facilities for processing as an alternate feed or for direct disposal. In the case of the former, RMD 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 NRC's robust regulatory program for management and oversight of uranium mill tailings, including a mandatory 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 proposed 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.

5.2 Potential Mitigation Measures for the “Regenerating/Backwashing” Alternative

Potential mitigation measures for the “regenerating/backwashing” alternative would require that drinking water providers install radiological control measures at points of discharge and/or at POTWs to prevent undue releases 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. 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 Proposed Action

Potential mitigation measures for the proposed action should be negligible, because RMD’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 to treated drinking water and no chemicals are stored on-site with the exception of uranium residuals in the Uranium Removal System prior to “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, RMD’s uranium water treatment program does not require any mitigation measures.

6.0 COST-BENEFIT ANALYSIS

Any cost-benefit analysis of the proposed action must begin with the assumption that the SDWA uranium MCL is a federal mandate with which CWSs must comply. In the event that such providers do not comply with the SDWA uranium MCL, municipalities and drinking water providers may be subject to civil monetary penalties.

The implementation of the RMD 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.

RMD's proposed licensing action is designed to provide a cost-effective "cradle-to-grave" solution whereby CWSs can provide the benefit of uranium removal from drinking water sources and of final disposition of removed uranium at properly licensed facilities without significant potential risk to workers or members of the public. Denial of RMD's license application could result in either non-compliance with the SDWA uranium MCL 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, RMD's proposal for a 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 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 RMD's license application also will preclude CWSs from taking advantage of the waste management benefits inherent in RMD's uranium water treatment program. In the absence of RMD's program, CWSs will be required to ensure that uranium residuals are properly disposed of in accordance with relevant regulations. This requirement potentially will result in 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.

Finally, denial of RMD's license application will deprive the commercial nuclear fuel cycle of a potential source of uranium for nuclear fuel. Uranium residuals from RMD'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, RMD's uranium water treatment program will remove uranium from drinking water sources in compliance with a federal mandate 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, RMD submits that the benefits of granting its license application significantly outweigh any costs.

7.0 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

For the reasons cited above, RMD has determined that its proposed license application and uranium water treatment program does not pose any significant adverse impacts to public health and safety or the environment. RMD'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. RMD's uranium water treatment program also provides the benefit of preventing the re-introduction of uranium removed from drinking water sources into the environment in an uncontrolled manner. Therefore, RMD respectfully requests that NRC approve its application for a performance-based, multi-site license based on the environmental analyses contained herein, as well as the other components of its license application.