TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

AGENDA ITEM REQUEST

for Rulemaking Adoption

AGENDA REQUESTED: January 11, 2012

DATE OF REQUEST: December 16, 2011

INDIVIDUAL TO CONTACT REGARDING CHANGES TO THIS REQUEST, IF NEEDED: Michael Parrish, (512) 239-2548

CAPTION: Docket No. 2011-0775-RUL. Consideration of the adoption of amendments to 30 TAC Chapter 336, Radioactive Substance Rules, Sections 336.1, 336.2, 336.103, 336.105, 336.210, 336.305, 336.309, 336.331, 336.359, and 336.405; and new Sections 336.351 and 336.357.

The rulemaking revises the commission's radiation control rules to ensure compatibility with regulations promulgated by the United States Nuclear Regulatory Commission . The state must adopt compatible rules to maintain the status of Texas as an Agreement State authorized to administer a portion of the radiation control program under the Atomic Energy Act. The rulemaking also amends the fees charged for facilities regulated under Subchapter L of Chapter 336 (Licensing of Source Material Recovery and By-Product Material Disposal Facilities). The fee shall recover for the state the actual expenses arising from the regulatory activities associated with the license. The rulemaking requires the executive director to invoice and collect on a quarterly basis the annual fee for a license for the commercial disposal of low-level radioactive waste. The rulemaking also clarifies the requirements for license fees to fund the Radiation and Perpetual Care Account. The proposed rules were published in the August 5, 2011, issue of the Texas Register (36 TexReg 4920). (Hans Weger, Don Redmond) (Rule Project No. 2011-011-336-PR)

Brent Wade
Deputy Director

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Division Director

Michael Parrish
Agenda Coordinator

Copy to CCC Secretary? NO ___ YES _X_

Texas Commission on Environmental Quality
Interoffice Memorandum

To: Commissioners **Date:** December 16, 2011

Thru: Bridget Bohac, Chief Clerk
Mark R. Vickery, P.G., Executive Director

From: Brent Wade, Deputy Director
Office of Waste

Docket No.: 2011-0775-RUL

Subject: Commission Approval for Rulemaking Adoption
Chapter 336, Radioactive Substance Rules
Radioactive Substance Rules Update
Rule Project No. 2011-011-336-WS

Background and reason(s) for the rulemaking:

Texas Health and Safety Code (THSC), §401.001 establishes that it is the policy of the state to institute and maintain a regulatory program for sources of radiation that provides for compatibility with federal standards and regulatory programs. This rulemaking revises the commission's radiation control rules to ensure compatibility with regulations promulgated by the United States Nuclear Regulatory Commission (NRC). The state must adopt compatible rules to maintain the status of Texas as an Agreement State authorized to administer a portion of the radiation control program under the Atomic Energy Act.

Scope of the rulemaking:

A.) Summary of what the rulemaking will do:

The rulemaking implements the following NRC rules:

NRC Order Imposing Increased Controls (70 FR 72128). Subsequent to the terrorist attacks of September 11, 2011, the NRC conducted an assessment of security risks posed by uncontrolled sources of radiation. On November 14, 2005, the NRC issued an order imposing requirements for the control of high-risk radioactive materials to prevent inadvertent and intentional unauthorized access. Each agreement state is required to issue legally binding requirements for licensees under state regulatory jurisdiction.

National Source Tracking System (71 FR 65685). Subsequent to the terrorist attacks of September 11, 2011, the NRC conducted a comprehensive review of nuclear material security requirements and established the National Source Tracking System to provide greater accountability and increased controls by licensees for certain tracked sources. These rules impose requirements for the reporting of information on the manufacture, transfer, receipt, disassembly, and disposal of nationally tracked sealed sources.

Requirements for Expanded Definition of Byproduct Material (72 FR 55864, 72 FR 42672). The NRC adopted rules implementing changes established by Congress in the Energy Policy Act of 2005 regarding the regulation of byproduct material under the NRC's regulatory program. New categories of byproduct material under NRC authority include discrete sources of radium-226, accelerator produced radioactive material, and any discrete sources of naturally occurring radioactive materials that the NRC determines should be included under the NRC regulatory because it poses a similar threat as radium-226.

Occupational Dose Records, Labeling Containers, and the Total Effective Dose Equivalent (72 FR 68043, 72 FR 72233). The NRC conducted a review of regulatory requirements imposed on licensees and revised rules to remove unnecessarily burdensome record-keeping and reporting requirements for licensees. Although these rules reduce record-keeping and reporting requirements, the NRC explains that the rules do not change the level of protection for either the health and safety of workers or the public or for the environment.

The rulemaking also amends the fees charged for facilities regulated under Subchapter L of Chapter 336 (Licensing of Source Material Recovery and By-Product Material Disposal Facilities). The fee shall recover for the state the actual expenses arising from the regulatory activities associated with the license. The rulemaking also requires the executive director to submit invoices and collect payment on a quarterly basis for the recovery of the annual fee associated with a license for the commercial disposal of low-level radioactive waste.

The rulemaking also clarifies the requirements for license fees to fund the Radiation and Perpetual Care Account.

B.) Scope required by federal regulations or state statutes:

This rulemaking brings the TCEQ radiation control rules current with federal rules promulgated by the NRC and implements state statutes regarding cost recovery for radioactive material licenses and fees to fund the Radiation and Perpetual Care Account.

C.) Additional staff recommendations that are not required by federal rule or state statute:

None.

Statutory authority:

THSC, §401.011, Radiation Control Agency

THSC, §401.051, Adoption of Rules and Guidelines

THSC, §401.103, Rules and Guidelines for Licensing and Registration

THSC, §401.104, Licensing and Registration Rules

THSC, §401.262, Management of Certain By-Product Material

THSC, §401.2625, Licensing Authority

THSC, §401.301, License and Registration Fees

THSC, §401.305, Radiation and Perpetual Care Account

THSC, §401.412, Commission Licensing Authority

Effect on the:

A.) Regulated community:

There will be an effect on members of the regulated community who are authorized to possess, store, process or dispose of radioactive material under a license issued by the commission. The effect and fiscal impact of adopting the new NRC rules is not expected to be significant. The rules do not create a group of affected persons who were not affected previously.

There may be a fiscal impact for licensees authorized for commercial dispose of by-product material. The annual license fee will change from $60,929.50 to the actual expenses arising from the regulatory activities associated with the license. This could be an increase or decrease depending on the nature and extent of regulatory activities associated with the license in any given year. There is only one licensee currently authorized for commercial disposal of by-product material.

B.) Public:

There will be no effect on the public because the proposed rules only pertain to members of the regulated community.

C.) Agency programs:

Office of Waste: Additional technical review of license applications may be necessary. Additional cost recovery efforts will be necessary for by-product material disposal licenses. No additional full-time employees (FTEs) are required.

Environmental Law Division: Additional support for the technical review of license applications may be necessary. No additional FTEs are required.

Office of Compliance and Enforcement: There will be additional rule requirements to inspect during investigations. No additional FTEs are required.

Stakeholder meetings:

A public hearing on the rules was held on August 30, 2011. It was determined that those that were present did not want to make comments on the record. Therefore, the public hearing was not formally opened for comment and a transcript was not prepared.

Public comment:

The comment period closed on September 6, 2011. The commission received comments from the NRC, the Office of Public Interest Council (OPIC) of the Texas Commission on Environmental Quality, the Uranium Committee of the Texas Mining & Reclamation Association (TMRA), and Waste Control Specialists, LLC (WCS).

Significant changes from proposal:

There were no substantive changes from proposal. Most of the changes made in response to public comments corrected clerical errors or were clarifying in nature.

Potential controversial concerns and legislative interest:

WCS commented that the rules should not provide for quarterly invoicing and payment of the annual fee and that the amount of the annual fee for a license for the commercial disposal of low-level radioactive waste should be established in rule. In response to these comments, the preamble suggests that these issues raised by WCS be taken up in a future rulemaking when the agency's expenses in regulating the entity become more predictable and the licensee's activities at the facility become routine.

Does this rulemaking affect any current policies or require development of new policies?

No.

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What are the consequences if this rulemaking does not go forward? Are there alternatives to rulemaking?

Failure to amend Chapter 336 will leave the TCEQ rules inconsistent with federal requirements and state statutes.

Key points in the adoption rulemaking schedule:

Texas Register proposal publication date: August 5, 2011
Anticipated Texas Register publication date: January 27, 2012
Anticipated effective date: February 2, 2012
Six-month Texas Register filing deadline: February 5, 2012

Agency contacts:

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Attachments

None

cc: Chief Clerk, 2 copies
Executive Director's Office
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The Texas Commission on Environmental Quality (TCEQ, agency, or commission) adopts amendments to §§336.1, 336.2, 336.103, 336.105, 336.210, 336.305, 336.309, 336.331, 336.357, and 336.405. The commission also adopts new §336.351 and §336.357.

Sections 336.2, 336.351, 336.357, and 336.359 are adopted *with changes* to the proposed text as published in the August 5, 2011, issue of the *Texas Register* (36 TexReg 4920). Sections 336.1, 336.103, 336.105, 336.210, 336.305, 336.309, 336.331 and 336.405 are adopted *without changes* to the proposed text and will not be republished.

The sections will be submitted to the United States Nuclear Regulatory Commission (NRC) as revisions to the commission's radiation control rules.

Background and Summary of the Factual Basis for the Adopted Rules

The changes to this chapter will revise the commission's radiation control rules to ensure compatibility with regulations promulgated by the NRC. Compatibility of the commission's rules with the federal program is necessary to preserve the status of Texas as an Agreement State under Title 10 Code of Federal Regulations (CFR) Part 150 and under the "Articles of Agreement between the United States Atomic Energy Commission and the State of Texas for Discontinuance of Certain Commission Regulatory Authority and Responsibility Within the State Pursuant to Section 274 of the Atomic Energy Act of

1954, as Amended." Rules which are designated by NRC as compatibility items must be adopted by an Agreement State within three years of the effective date of the NRC rules, in most cases. Specific changes to the rules that involve incorporation of NRC rules are explained in the Section by Section Discussion of this preamble. These rules along with their *Federal Register* publication dates and effective dates are listed as follows:

Requirements for Expanded Definition of Byproduct Material (72 FR 55864, effective November 30, 2007)

The federal Energy Policy Act of 2005 expanded the Atomic Energy Act of 1954 definition of "byproduct material" to include any discrete source of radium-226, any material made radioactive by use of a particle accelerator, and discrete source material that the NRC determines would pose a similar threat to public health, safety or the common defense and security as radium-226, that are extracted or converted after extraction for use for a commercial, medical or research activity. The expansion of this definition placed the added materials under the NRC's regulatory authority. The federal Energy Policy Act of 2005 directed the NRC to issue regulations to implement the new definition of byproduct material. The NRC published its adopted regulations in the *Federal Register* on October 1, 2007 (72 FR 55864). The NRC explained that the new categories of byproduct material are not considered to be low-level radioactive waste. The first category of new material that is now classified as byproduct material is any discrete source of radium-226 that is produced, extracted, or converted after extraction before, on or after August 8, 2005 for use for a commercial, medical, or research activity. Radium is a chemically reactive, silvery white radioactive metallic element with an atomic number of 88 and symbol of Ra. Radium-226, the most abundant and most stable isotope of radium, emits alpha particles and gamma radiation and decays into radon gas. Because of radium's properties, especially its ability to stimulate luminescence, industries used radium in the early twentieth century in various consumer products, such as glow-in-the-dark watch and clock faces and other instruments that were made to be visible at night. Most of these uses were discontinued for health and safety reasons. In more recent times, radium sources were used in industrial radiography, industrial smoke detectors, or industrial gauges that measure properties such as moisture and density. In the NRC's rules, only "discrete" sources of radium-226 are covered under the new definition. The NRC explains that discrete sources are radionuclides that have been processed so that the concentration within the material has been purposely increased for use for commercial, medical, or research activities. The NRC determined that Energy Policy Act of 2005 gave the NRC authority over discrete sources of radium-226 but not over diffuse sources of radium-226, such as radium-226 as it occurs in nature or over other processes where radium-226 may be unintentionally concentrated. Scale from pipes, fly ash from coal power plants, phosphate fertilizers, or residuals from the treatment of water to meet drinking water standards are not considered to be discrete sources of radium-226 and therefore are not covered under the NRC's new definition of byproduct material. Although certain byproduct materials were added to the NRC's regulatory authority, the materials were already subject to state licensing requirements. The State of Texas and the commission already regulated discrete and diffuse sources of radium-226 as naturally-occurring radioactive material waste prior to the Energy Policy Act of 2005 definitional changes. Consequently, the commission's implementation of the NRC's rules does not change the state requirements for how discrete sources of radium-226 may be disposed. The second category of new byproduct material under the NRC regulation is any material that has been made radioactive by use of a particle accelerator and is produced, extracted, or converted after extraction before, on, or after August 8, 2005 for use for a commercial, medical, or research activity. A particle accelerator is a device that imparts kinetic energy to subatomic particles by increasing their speed through electromagnetic interactions. Particle accelerators are used to produce radioactive material by directing a beam of high-speed particles at a target composed of a specifically selected element, which is usually not radioactive. Usually the nuclide produced is radioactive and is created for the use of its radiological properties. The NRC explains that the majority of accelerator-produced radioactive material is created for use in medicine. Prior to the NRC's regulations, the commission rule in §336.1(g) included accelerator-produced radioactive material within the term "low-level radioactive waste." Because the Energy Policy Act and the NRC regulations now define materials that are made radioactive by use of a particle accelerator as byproduct material and that the newly added material is not considered to be low-level radioactive waste, the commission must revise current

§336.1(g) and regulate accelerator produced radioactive material as byproduct and not as low-level radioactive waste to maintain compatibility with the NRC requirements. The third category of new byproduct material is any discrete source of naturally occurring radioactive material, other than source material, that the NRC determines would pose a threat similar to the threat posed by a discrete source of radium-226 to the public health and safety or the common defense and security and before, on, or after August 8, 2005, is extracted or converted after extraction for use in a commercial, medical, or research activity. In its October 1, 2007 publication of adopted rules, the NRC announced that it was not adding any new discrete sources of naturally occurring radioactive material under this classification. To date, the NRC has not added a new category of radioactive material to be classified as byproduct under this provision. The commission adopts a definition to add this category of byproduct material to maintain compatibility with NRC requirements but there are no types of radioactive material that will be classified as byproduct material under this provision at this time.

National Source Tracking System (71 FR 65685, effective February 6, 2007)

After the terrorist attacks in the United States on September 11, 2001, the NRC conducted a comprehensive review of nuclear material security requirements with particular focus of radioactive material of concern, including cobalt-60, cesium-137, iridium-192, and americium-241, as well as other radionuclides with the potential to be used in a radiological dispersal device or a radiological exposure device in the absence of proper security and control measures. The NRC's adopted rules created a national tracking system of sealed sources to provide greater source accountability and increased controls by licensees. The NRC rules require licensees to report information on the manufacture, transfer, receipt, disassembly, and disposal of nationally tracked sealed sources. A sealed source consists of radioactive material that is sealed in a capsule or is closely bonded to a non-radioactive substrate to prevent leakage or escape of the radioactive material. A nationally tracked sealed source is a sealed source containing a quantity of radioactive material equal to or greater than the Category 2 levels listed in the new Appendix E to 10 CFR Part 20. The commission adopts requirements of the National Source Tracking System in NRC regulations to maintain compatibility as an Agreement State program.

Occupational Dose Records, Labeling Containers, and the Total Effective Dose Equivalent (72 FR 68043 effective February 15, 2008)

The NRC implemented a regulatory review to reduce unnecessary regulatory burden on NRC and Agreement State licensees without affecting the level of protection for either the health and safety of workers and the public or for the environment. The NRC revised the requirements regarding the information that a licensee must make available to workers. A licensee must provide an annual report to each individual monitored of the dose received in that monitoring year if the individual's occupational dose report exceeds 1 millisievert (100 millirem) or to any individual that requests the report. A licensee is not required to provide unsolicited annual dose reports to those individuals whose annual dose does not exceed these limits. Also, the NRC's final rules revise the definition of "total effective dose equivalent" to mean the sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures). The revised definition will allow licensees to substitute effective dose equivalent for deep-dose equivalent for external exposures. Another aspect of the NRC rulemaking is to remove provisions in 10 CFR §20.2104(a)(2) that requires licensees to attempt to obtain the records of cumulative occupational radiation dose for each worker requiring monitoring because previous NRC rule changes removed requirements using cumulative lifetime dose under 10 CFR Part 20 except for cases involving planned special exposures. The previous NRC revisions make it unnecessary for licensees to attempt to obtain lifetime exposures for workers who are not participating in a planned special exposure. The NRC explains that the rule does not affect the level of protection for either the health and safety of workers and the public or for the environment because the requirements to determine an individual's occupational radiation dose received during the current year or cumulative radiation dose prior to permitting a planned special exposure are not changed. The commission adopts conforming changes in the rules to maintain compatibility with the NRC regulations.

NRC Order Imposing Increased Controls, EA-05-090 (71 FR 72128, published December 1, 2005)

In response to efforts to assess security risks posed by uncontrolled sources, the NRC issued an order on November 14, 2005 to impose requirements for the control of high-risk radioactive materials to prevent inadvertent and intentional unauthorized access, primarily due to the potential health and safety hazards posed by the uncontrolled material. The order identifies certain radionuclides of concern and establishes control measures for licensees to secure those materials. As part of the order, each Agreement State is required to issue legally binding requirements to put essentially identical measures in place for licensees under state regulatory jurisdiction. Because the NRC order was effective immediately for security concerns, the commission has already imposed the requirements of the NRC order on licensees and now adopts rules to implement the controls required by the NRC order.

The rulemaking also amends the fees charged for facilities regulated under Chapter 336, Subchapter L. The adopted fees shall recover for the state the actual expenses arising from the regulatory activities associated with licenses for commercial disposal of by-product material. This is consistent with other cost recovery rules already adopted by the commission. The rulemaking also amends the annual license fees to fund the Radiation and Perpetual Care Account.

Section by Section Discussion

Subchapter A, General Provisions

The commission adopts the amendment to §336.1 by removing §336.1(g). Accelerator-produced radioactive material is now regulated as byproduct material and not included as low-level radioactive waste in accordance with the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material* (72 FR 55864, effective November 30, 2007).

The commission adopts the amendment to §336.2 to make it compatible with 10 CFR Part 20. The definitions of "Accelerator-produced radioactive material" and "Byproduct material" are adopted for consistency with 10 CFR §20.1003. A new definition of "Discrete source" is adopted for consistency with 10 CFR §20.1003. These definitions are adopted to implement the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material* (72 FR 55864, effective November 30, 2007). The definition of "Low-level radioactive waste" is adopted to update the agency name of the "Texas Department of Health" to the "Texas Department of State Health Services." The definition of "Low-level radioactive waste" is adopted to exclude the new classes of byproduct material in adopted §336.2(16)(C) - (E) and to implement the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material* (72 FR 55864, effective November 30, 2007). A new definition of "Nationally tracked source" is adopted to implement the NRC rulemaking *National Source Tracking System* (71 FR 65685, effective February 6, 2007). The definition of "Naturally occurring radioactive material (NORM) waste" is adopted to update the agency name of the "Texas

Department of Health" to the "Texas Department of State Health Services." A new definition of "Particle accelerator" is adopted for consistency with 10 CFR §20.1003. This definition is adopted to implement the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material* (72 FR 55864, effective November 30, 2007). In response to comment, the definition of “particle accelerator” is revised to use the exact language used by the NRC in defining “particle accelerator.” The definition of "Total effective dose equivalent (TEDE)" is adopted for consistency with 10 CFR §20.1003. This definition is adopted to implement the NRC rulemaking *Occupational Dose Records, Labeling Containers, and the Total Effective Dose Equivalent* (72 FR 68043, effective February 15, 2008). A new definition of "Waste" is adopted for consistency with 10 CFR §20.1003 and §61.2. This definition is adopted to implement the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material* (72 FR 55864, effective November 30, 2007).

Congress enacted the Energy Policy Act of 2005 which expanded the definition of "byproduct material" under Section 11(e) of the Atomic Energy Act. The NRC adopted rules in 2007 to implement the new definition. Consistent with the expanded federal definition, "byproduct material" is adopted to include: any discrete source of radium-226 that is produced, extracted, or converted after extraction, for use for a commercial, medical, or research activity; any material that has been made radioactive by use of a particle accelerator and is produced, extracted, or converted for use for a commercial, medical, or research activity; and any discrete source of naturally occurring radioactive material, other than source material, that is extracted or converted after extraction for use in a commercial, medical, or research activity and that the NRC, in consultation with the Administrator of the United States Environmental Protection Agency (EPA), the United States Secretary of Energy, the United States Secretary of Homeland Security, and the head of any other appropriate Federal agency, determines would pose a threat similar to the threat posed by a discrete source of radium-226 to the public health and safety or the common defense and security. The commission notes that the expanded definition of byproduct material in Subchapter A does not expand or change the types of material licensed for disposal under Chapter 336, Subchapter L. Chapter 336, Subchapter L, relating to the licensing of source material and by-product material disposal facilities, addresses the requirements for the disposal of by-product material as defined in that subchapter and is limited to byproduct material as defined in the Atomic Energy Act, Section 11(e)(2) and §336.2(16)(B) as the tailings and waste produced by or resulting from the extraction or concentration of uranium or thorium from ore primarily for its source material content. Except for the reclassification of accelerator produced radioactive materials as byproduct material discussed in the proposed amendment to §336.1, the definitions in §336.2 are adopted to maintain compatibility with federal regulations and do not change existing requirements for disposal of radioactive material under Chapter 336. A licensee that was authorized to store and process naturally occurring radioactive materials under Chapter 336, Subchapter M would be authorized to accept the same material now classified as byproduct material under the revised definitions.

Subchapter B, Radioactive Substance Fees

The commission adopts amended §336.103 to reflect current procedures and provide clarification for invoicing and payment of annual fees for commercial facilities regulated under Chapter 336, Subchapter H. The adopted amendment to §336.103(c) clarifies that the commission will invoice quarterly for reimbursement of actual costs incurred from regulatory activities associated with the license. The current practice of quarterly invoicing for actual expenses allows the commission's staff to plan and budget regulatory activities efficiently and avoids problems that a single yearly invoice would create across fiscal years and biennial appropriations cycles. Cost recovery for expenses related to radioactive material licensing activities is authorized in state statute. Texas Health and Safety Code (THSC), §401.412(d) provides the commission may assess and collect an annual fee for each license and registration and for each application in an amount sufficient to recover its reasonable costs to administer its authority.

The commission adopts amended §336.105 to revise application fees charged for commercial facilities regulated under Chapter 336, Subchapter L. The adopted fees shall recover for the state the actual expenses arising from the regulatory activities associated with licenses for commercial disposal of by-product material. Cost recovery for expenses related to radioactive material licenses are authorized in state statute. THSC, §401.301(g) provides the commission may assess and collect additional fees from the applicant to recover the costs the commission incurs for administrative review, technical review, and hearings on the application. THSC, §401.412(d) provides the commission may assess and collect an annual fee for each license and registration and for each application in an amount sufficient to recover its reasonable costs to administer its authority.

The commission adopts amended §336.105(a)(4) for applications for new, amended, or renewal of commercial by-product material disposal licenses issued under Chapter 336, Subchapter L. The adopted amendment adds §336.105(a)(4)(A) to require a supplemental fee to recover the actual costs incurred by the commission for review of the application and any hearings associated with an application for commercial by-product material disposal. The adopted amendment also adds §336.105(a)(4)(B) to provide that the executive director invoice for reimbursement of the amount of the costs incurred quarterly. Agency practice of quarterly invoicing for actual expenses allows the commission's staff to plan and budget regulatory activities efficiently and avoids problems that a single yearly invoice would create across fiscal years and biennial appropriations cycles. Payment shall be made within 30 days following the date of the invoice. The adopted amendment implements THSC, §401.301(g) to provide for cost recovery for commercial by-product material disposal license applications.

The commission adopts amended §336.105(b)(4) for annual fees for commercial by-product material disposal licenses issued under Chapter 336, Subchapter L. Currently the $60,929.50 annual fee specified in §336.105(b)(4) is not sufficient to cover the costs incurred by the commission for expenses arising from the regulatory activities associated with commercial by-product material disposal licensing. The adopted amendment adds §336.105(b)(4)(A) to require a supplemental license fee sufficient to recover the actual costs incurred by the commission. This fee shall recover for the state the actual expenses arising from the regulatory activities associated with the license in accordance with THSC, §401.412(d). The adopted amendment also adds §336.105(b)(4)(B) to provide that the executive director shall invoice for the amount of the costs incurred quarterly. Licensees paying the fee on a quarterly basis would not be subject to the October 31 payment deadline in §336.107. Agency practice of quarterly invoicing for actual expenses allows the commission's staff to plan and budget regulatory activities efficiently and avoids problems that a single yearly invoice would create across fiscal years and biennial appropriations cycles. Payment shall be made within 30 days following the date of the invoice. The adopted amendment implements THSC, §401.412(d) to provide for cost recovery for annual fees associated with commercial by-product material disposal licenses.

The commission adopts amended §336.105(h) to add a citation to §336.103 and to clarify the requirements for payment of fees. The adopted amendment implements THSC, §401.301 to fund the perpetual care account. Licenses issued under Subchapter H will be required to pay the annual fee when necessary. Currently, no licensees will be assessed with this fee since the perpetual care account is sufficiently funded under the limitations imposed in THSC, §401.301(e).

Subchapter C, General Licensing Requirements

The commission adopts amended §336.210 to add radium-226 in alphabetical order to the Release Fractions Table in §336.210(e). This amendment is adopted for consistency with 10 CFR §30.72 and to implement the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material* (72 FR 55864, effective November 30, 2007). This adopted amendment adds radium-226 to the list of radioactive material that must be considered in the emergency planning provided in radioactive materials license applications.

Subchapter D, Standards for Protection Against Radiation

The commission adopts amended §336.305(c) to revise the method used to demonstrate compliance with the occupational dose limits. This amendment is adopted for consistency with 10 CFR §20.2008 and to implement the NRC rulemaking *Occupational Dose Records, Labeling Containers, and the Total Effective Dose Equivalent* (72 FR 68043 and 72233, effective February 15, 2008). The adopted amendment provides that when external exposure is determined by measurement with an external personal monitoring device, the deep-dose equivalent must be used in place of the effective dose equivalent, unless the effective dose equivalent is determined by a dosimetry method approved by the executive director.

The commission adopts amended §336.309(a) to revise the requirements for determining prior occupational dose. The adopted rule removes the requirement to attempt to obtain records of lifetime cumulative occupational radiation dose. Section 336.309(f) is adopted to require the licensee to retain dose records until the executive director terminates each pertinent license requiring this record. This amendment is adopted for consistency with 10 CFR §20.2104 and to implement the NRC rulemaking *Occupational Dose Records, Labeling Containers, and the Total Effective Dose Equivalent* (72 FR 68043 and 72233, effective February 15, 2008).

The commission adopts amended §336.331 to update the agency name of the "Texas Department of Health" to the "Texas Department of State Health Services." The commission adopts §336.331(i) to require shipping manifests for disposal of byproduct material as defined in proposed §336.2(16)(C) - (E). This amendment is adopted for consistency with 10 CFR §20.2006 and to implement the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material* (72 FR 55864, effective November 30, 2007).

The commission adopts new §336.351 to implement the requirements of the National Source Tracking System. The National Source Tracking System is the NRC's program for accounting for certain sealed sources by requiring licensees to report information on the manufacture, transfer, receipt, disassembly, and disposal of nationally tracked sealed sources. New §336.351 is adopted for consistency with 10 CFR §20.2207 and to implement the NRC rulemaking *National Source Tracking System* (71 FR 65685, effective February 6, 2007). In response to comment, §336.351(a), (a)(6), and (a)(7) are revised to correct a clerical error for cross-references to paragraphs (1) - (5) instead of paragraphs (1) - (6). In response to comment, §336.351(a)(2) is revised to remove the sentence stating that certain domestic transactions where the source remains in possession of the licensee are not subject to reporting requirements because this type of possession of sources is not under TCEQ's jurisdiction.

The commission adopts new §336.357 to implement the requirements in NRC's Order Imposing Increased Controls, EA-05-090. New §336.357 is adopted for consistency with 10 CFR §20.1801, and to implement the NRC's Order Imposing Increased Controls, EA-05-090 (71 FR 65685, published December 1, 2005). The adopted rule adds requirements for the control and access of certain radioactive materials possessed by a licensee to implement the security measures required by the NRC's order and are consistent with the Texas Department of State Health Services requirements in 25 TAC

§289.252(ii). In response to comment, §336.357(3)(D) and §336.357(4)(E) are revised to require reporting of actual or attempted theft, sabotage, or diversion of radioactive material or missing or stolen shipments of radioactive material to the Texas emergency operations contact rather that the NRC contact. Section 336.357(6) has been revised to include reference to paragraph (4). In response to comment, §336.357(9) is revised to authorize inspection by the executive director of the TCEQ rather than referring generally to the "agency."

The commission adopts amended §336.359. The figure in §336.359(d) is revised to include the elements "Nitrogen" and "Oxygen." This amendment is adopted for consistency with 10 CFR Part 20, Appendix B and to implement the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material* (72 FR 55864, effective November 30, 2007). In response to comment, the superscript "1" has been included to indicate a footnote and within the text of the footnote, the word “material” was inserted after "airborne."

Subchapter E, Notices, Instructions, and Reports to Workers and Inspections

The commission adopts amended §336.405 to update requirements for notifications to workers. Section 336.405(b) is adopted to require a licensee to provide an annual report to an individual if their occupational dose exceeds 1 millisieverts (100 millirem) or the individual requests his or her annual dose report. This amendment is adopted for consistency with 10 CFR §19.13 and to implement the NRC rulemaking *Occupational Dose Records, Labeling Containers, and the Total Effective Dose Equivalent* (72 FR 68043 and 72233, effective February 15, 2008).

Final Draft Regulatory Impact Analysis

The commission adopts the rulemaking under the regulatory analysis requirements of Texas Government Code, §2001.0225, and determined that the rulemaking is not subject to §2001.0225 because it does not meet the definition of a "major environmental rule" as defined in the statute. "Major environmental rule" means a rule the specific intent of which is to protect the environment or reduce risks to human health from environmental exposure and that may adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, or the public health and safety of the state or a sector of the state. The adopted rules in Chapter 336 are not anticipated to adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, or the public health and safety of the state or a sector of the state because there are no significant requirements imposed on radioactive material licensees. The commission adopts these rules for purpose of maintaining consistency with NRC regulations by providing new and revised definitions; revising occupational dose, exposure and reporting requirements; and providing reporting requirements for national tracked sources. The rules also revise fee requirements to implement THSC, §401.301(g) to authorize the assessment of additional application fees to recover the commission's cost for administrative and technical review and hearings for a license application.

Furthermore, the rulemaking does not meet any of the four applicability requirements listed in Texas Government Code, §2001.0225(a). Texas Government Code, §2001.0225 only applies to a major environmental rule, the result of which is to: 1) exceed a standard set by federal law, unless the rule is specifically required by state law; 2) exceed an express requirement of state law, unless the rule is specifically required by federal law; 3) exceed a requirement of a delegation agreement or contract between the state and an agency or representative of the federal government to implement a state and federal program; or 4) adopt a rule solely under the general powers of the agency instead of under a specific state law. The rulemaking does not exceed a standard set by federal law, an express requirement of state law, a requirement of a delegation agreement, nor adopt a rule solely under the general powers of the agency.

The Texas Radiation Control Act, THSC, Chapter 401, authorizes the commission to regulate commercial radioactive waste processing and the disposal of most radioactive material in Texas. THSC, §§401.051, 401.103, and 401.104 authorize the commission to adopt rules for the control of sources or radiation and the licensing of the disposal of radioactive materials. In addition, the state of Texas is an "Agreement State," authorized by the NRC to administer a radiation control program under the Atomic Energy Act.

NRC requirements must be implemented by the commission to preserve the status as an Agreement State. These rules do not exceed the standards set by federal law. The rulemaking implements changes in NRC definitions, NRC occupational dose requirements, NRC security requirements, and NRC requirements for reporting of national tracked sources.

These rules do not exceed an express requirement of state law. The Texas Radiation Control Act, THSC, Chapter 401, establishes general requirements for the licensing and disposal of radioactive materials. The Texas Radiation Control Act in THSC, §401.001 specifically establishes the policy to maintain compatibility with federal standards and regulatory programs.

The commission has also determined that these rules do not exceed a requirement of a delegation agreement or contract between the state and an agency of the federal government. The State of Texas has been designated as an "Agreement State" by the NRC under the authority of the Atomic Energy Act. The Atomic Energy Act requires that the NRC find that the state radiation control program is compatible with the NRC's requirements for the regulation of radioactive materials and is adequate to protect health and safety. The commission determined that these rules do not exceed the NRC's requirements nor exceed the requirements for retaining status as an Agreement State.

The commission also determined that these rules are adopted under specific authority of the Texas Radiation Control Act, THSC, Chapter 401. THSC, §§401.051, 401.103, and 401.104 authorize the commission to adopt rules for the control of sources or radiation and the licensing of the disposal of radioactive materials.

The commission invited public comment regarding the draft regulatory impact analysis determination during the public comment period. Comments were not received on the draft regulatory impact analysis determination.

Takings Impact Assessment

The commission evaluated these rules and performed a preliminary assessment of whether the Private Real Property Rights Preservation Act, Texas Government Code, Chapter 2007 is applicable. The commission's preliminary assessment is that Texas Government Code, Chapter 2007 does not apply to these rules because this is an action that is reasonably taken to fulfill an obligation mandated by federal law, which is exempt under Texas Government Code, §2007.003(b)(4). The State of Texas has received authorization as an Agreement State from the NRC to administer a radiation control program under the Atomic Energy Act. The Atomic Energy Act requires the NRC to find that the state's program is compatible with NRC requirements for the regulation of radioactive materials and is protective of health and safety. This rulemaking will provide consistency with federal regulations.

Nevertheless, the commission further evaluated these rules and performed a preliminary assessment of whether these rules constitute a taking under Texas Government Code, Chapter 2007. The following is a summary of that evaluation and preliminary assessment. The primary purpose of these rules is to implement changes to federal requirements for the regulation and licensing of radioactive material. The rules would substantially advance this purpose by implementing new federal definitions of by-product material; revising occupational dose, exposure, and reporting requirements; providing security controls; and providing reporting requirements for national tracked sources.

Promulgation and enforcement of these rules would be neither a statutory nor a constitutional taking of private real property. The rules do not affect a landowner's rights in private real property because this rulemaking does not burden (constitutionally), nor restrict or limit, the owner's right to property and reduce its value by 25% or more beyond which would otherwise exist in the absence of the rules. The rules primarily implement requirements in federal law relating to revised definitions; revised occupational dose, exposure, and reporting requirements; added security requirements; and reporting requirements for national tracked sources. The rules do not affect private real property.

Consistency with the Coastal Management Program

The commission reviewed this rulemaking action and determined that the rules are neither identified in, nor will they affect, any action/authorization identified in Coastal Coordination Act Implementation Rules in 31 TAC §505.11, relating to Actions and Rules Subject to the Texas Coastal Management Program (CMP). Therefore, the rulemaking action is not subject to the CMP.

The commission invited public comment regarding the consistency with the CMP during the public comment period. Comments were not received on the CMP.

Public Comment

The commission held a public hearing on August 30, 2011. The comment period closed on September 6, 2011. The commission received comments from the NRC, the Office of Public Interest Council (OPIC) of the TCEQ, the Uranium Committee of the Texas Mining and Reclamation Association (TMRA), and Waste Control Specialists, LLC (WCS).

Response to Comments

NRC commented that the regulation in §336.351(a) refers to the wrong paragraphs for the transaction reports. The language should be revised to "as specified in paragraphs

(1) - (5) of this subsection" and not paragraphs (1) - (6).

The proposed rule had a clerical error referring to the incorrect paragraphs in §336.351(a). The commission agrees with this comment and has amended §336.351(a) to refer to paragraphs (1) - (5) in response to this comment.

NRC commented that the regulation in §336.351(a)(6) refers to the wrong paragraphs for the transaction reports. The language should be revised to "reports discussed in paragraphs (1) - (5) of this subsection" and not paragraphs (1) - (6).

The proposed rule had a clerical error referring to the incorrect paragraphs in §336.351(a)(6). The commission agrees with this comment and has amended §336.351(a)(6) to refer to paragraphs (1) - (5) in response to this comment.

NRC commented that the regulation in §336.351(a)(7) refers to the wrong paragraphs for the transaction reports. The language should be revised to "reports identified by paragraphs (1) - (5) of this subsection" and not paragraphs (1) - (6).

The proposed rule had a clerical error referring to the incorrect paragraphs

in §336.351(a)(7). The commission agrees with this comment and has amended §336.351(a)(7) to refer to paragraphs (1) - (5) in response to this comment.

NRC commented that the Texas regulations in §336.357(2) do not contain condition 1.c. from the NRC's Increased Controls (IC) Orders. The Texas regulations repeat the text from §336.357(3)(E). Texas needs to add IC 1.c. in order to meet Compatibility Category B designation assigned to the provision.

In order to provide the NRC sufficient time to review the commission's rule revisions, staff provided the NRC an earlier version of the proposed rule revisions. Section 336.357(2)(D) was revised prior to publication in the *Texas Register* to include this provision from the NRC's IC Order and is identical with NRC condition IC 1.c. No change was made in response to this comment.

NRC commented that the Texas regulations in §336.357(2) do not contain paragraph (2)(E) which should contain condition 1.d. from the IC Orders. Texas needs to add IC 1.d. in order to meet Compatibility Category B designation assigned to the provision.

In order to provide the NRC sufficient time to review the commission's rule

revisions, staff provided the NRC an earlier version of the proposed rule revisions. Paragraph (2)(E) was inadvertently omitted from the version provided to the NRC. Section 336.357(2)(E) was revised prior to publication in the *Texas Register* to include this provision from the NRC's IC Order and is identical with NRC condition IC 1.d. No change was made in response to this comment.

NRC commented that the Texas regulations in §336.357(3)(D) have the licensee notifying the NRC Operations Center after initiating response to actual or attempted theft, sabotage, or diversion of the material. The licensee should call the Texas equivalent to the NRC Operations Center. Texas needs to revise the regulations so the calls go to Texas instead of the NRC in order to meet Compatibility Category B designation assigned to the provision.

The commission agrees with this comment and has amended §336.357(3)(D) in response to this comment. Actual or attempted theft, sabotage, or diversion of radioactive material or devices should be reported to the Office of Compliance and Enforcement 24-hour Emergency Response at 800-832-8224.

NRC commented that the Texas regulations in §336.357(4)(E) have the licensee notifying the NRC Operations Center if a shipment is determined to be lost, stolen, or missing. The licensee should call the Texas equivalent to the NRC Operations Center.

The commission agrees with this comment and has amended §336.357(4)(E) in response to this comment. A lost, stolen, or missing shipment of licensed material shall immediately be reported to the Office of Compliance and Enforcement 24-hour Emergency Response at 800-832-8224.

NRC commented that the Texas regulations in §336.357(5)(A) have the licensee notify the NRC Office of Nuclear Material Safety and Safeguards if it plans to ship a category 1 shipment for the first time. While this is consistent with the IC Order, the responsibility for this activity no longer resides with the Office of Nuclear Material Safety and Safeguards. The notification should now go to the NRC Director, Office of Federal and State Materials and Environmental Management Programs.

The commission agrees with this comment and has amended §336.357(5)(A) in response to this comment.

NRC commented that the Texas regulations in §336.357(6) do not include the reference to IC 3.a. which is the Texas equivalent to paragraph (4.) The wording should be ". . .

requirements of paragraphs (4) and (5) of this . . ." or ". . . requirements of paragraphs (4) and (5)(A) and (B) of this . . .."

The commission agrees with this comment and has amended §336.357(6) in response to this comment.

NRC commented that the Texas regulations in §336.357(9)(B) refer to paragraph (2)(E) which does not exist. However, once Texas adds IC condition 1.c. and 1.d., the reference would be correct, assuming that 1.d. becomes (2)(E).

In order to provide the NRC sufficient time to review the commission's rule revisions, staff provided the NRC an earlier version of the proposed rule revisions. Section 336.357(2)(E) was inadvertently omitted in the draft rule sent to NRC for review, but was added later and published with the proposal. The cross-references are now inconsistent with the NRC's IC Order. No change was made in response to this comment.

NRC commented that Texas did not include the footnote citation "1" on the term Submersion under Nitrogen and Oxygen entries in §336.359(d). Footnote 1 on Submersion is incomplete and the word "material" needs to be inserted after "airborne" at the end of the footnote.

The superscript "1" was inadvertently omitted at proposal in §336.359(d) and the text of the footnote omitted the word "material." The commission agrees with this comment and has amended §336.359(d) in response to this comment.

OPIC commented that the definition of byproduct material at §336.2(16)(A) should reflect the language used in the federal regulation by adding the term “yielded.”

The commission respectfully does not agree with this comment. Section 336.2(16)(A) was not proposed for change and the current language mirrors state statute in THSC, §401.003(3)(A). This definition has been determined to be compatible by NRC. No change was made in response to this comment.

OPIC commented that the definition of byproduct material at §336.2(16)(D) should have a comma instead of a semi-colon after the word "accelerator."

The commission agrees with this comment and has amended §336.2(16)(D) in response to this comment.

OPIC commented that the definition of particle accelerator at §336.2(92) should reflect the language used in the federal regulation by using the phrase "discharging the resultant particulate" rather than "designed to discharge the resultant particulate."

The commission agrees with this comment and has amended §336.2(92) to use the phrase "discharging the resultant particulate" in response to this comment.

OPIC requested clarification if the dosimetry method referenced in §336.305(c) requires NRC approval.

NRC ceded its authority to the TCEQ under the Agreement State program and reviews TCEQ rules for compatibility with federal regulations. NRC approval is not required for the dosimetry method referenced in §336.305(c). No change was made in response to this comment.

OPIC commented that specific requirements for the shipping manifest referenced in §336.331(i) and contained in 10 CFR Part 20, Appendix G should be incorporated into the commission rule.

The commission respectfully does not agree with this comment. The NRC

shipping manifest is incorporated by reference in commission rules. No change was made in response to this comment.

OPIC commented that the cross-reference to "paragraphs (1) - (6) of this subsection" in §336.351(a), (a)(6) and (a)(7) should read "paragraphs (1) - (5) of this subsection" throughout.

The commission agrees with this comment and has amended §336.351(a), (a)(6), and (7) in response to this comment.

OPIC commented that proposed §336.351(a)(2) includes an exemption for domestic transactions in which the nationally tracked source remains in the possession of the licensee. OPIC is unable to determine the source of this exemption in the federal regulations and asked the commission to identify the basis for this exemption.

The language proposed in §336.351(a)(2) was based on similar language adopted by the Texas Department of State Health Services to implement the NRC National Source Tracking System. However, upon reflection, the licenses authorized by the TCEQ do not regulate the possession, use, and transport of sources at various sites throughout the state under the control of the same licensee. Therefore, the provision is not applicable to TCEQ

requirements. The sentence, “Domestic transactions in which the nationally tracked source remains in the possession of the licensee do not require a report to the National Source Tracking System” has been removed from the adopted rule in §336.351(a)(2).

OPIC commented the numbering scheme for §336.357 should be revised to move the introduction to subsection (a), with corresponding paragraphs (1) and (2). Proposed paragraphs (1) and (2) flow from the language of the proposed introduction: "Licensees . . . shall: (1) control access . . .." However, proposed paragraphs (3) - (11) do not flow from the proposed introduction: "Licensees . . . shall: (3) Each licensee shall have a documented program . . .." Proposed paragraphs (3) - (11) will become subsections (b) - (j) and the numbering will adjust accordingly.

The commission respectfully does not agree with this comment. The numbering sequence for §336.357 is consistent with Texas Register formatting requirements. No change was made in response to this comment.

OPIC commented that the phrase "of concern" should be deleted in §336.357(1) and should read: "control access at all times to radioactive material in quantities of concern and devices containing such radioactive material (devices) in accordance . . .."

The commission agrees with this comment and has amended §336.357(1) to remove the phrase "of concern" in response to this comment.

OPIC commented that §336.357(2) needs to add language mirroring IC 1.c. and 1.d. (see 10 CFR 72130 (Attachment B)). Cross-references throughout the section will need to be adjusted accordingly.

The commission respectfully does not agree with this comment. Section 336.357(2)(D) is identical with NRC condition IC 1.c. Section 336.357(2)(E) is identical with NRC condition IC 1.d. No change was made in response to this comment.

OPIC commented that the modifier "in use or in storage" in the first sentence of §336.357(3) should be removed. This limitation is not in the federal regulation and is either redundant or unnecessarily limits the subsections applicability.

The commission respectfully does not agree with this comment. The language in §336.357(3) is consistent with NRC condition IC 2. which addresses the control of licensed material in use or storage. No change was

made in response to this comment.

OPIC commented to add a comma between "Safeguards" and "United States" in the first sentence in §336.357(5)(A).

The commission agrees with this comment and has amended §336.357(5)(A) to include a comma in response to this comment.

OPIC suggests to either remove "for inspection by the agency" or clarify whether the term "agency" refers to the commission or NRC or both in §336.357(9).

The commission agrees with this comment and has amended §336.357(9) in response to this comment. Specifically, the term "agency" has been changed to "executive director" to clarify this requirement is within the jurisdiction of the TCEQ.

OPIC commented §336.359(d) should be amended for consistency with the federal regulation. Specifically, the table should include a footnote 1 on the term "Submersion" as it relates to Nitrogen and Oxygen. Footnote 1 on should read: "'Submersion' means that values given are for submersion in a hemispherical semi-infinite cloud of airborne material."

The commission agrees with this comment and has amended §336.359(d) in response to this comment.

OPIC commented that the rule package inconsistently includes the name of cross-referenced rules in §336.405(b) and (c)(1)(A). The name of the rule section, e.g. "(relating to Records of Individual Monitoring Results)", is included in some sections and removed in others. This inconsistency may appear elsewhere in the proposal.

The commission respectfully does not agree with this comment. The section titles cross-referenced in §336.405(b) are correct as written. According to Texas Register formatting requirements, the cross-referenced section titles do not need to be repeated within the same section. No change was made in response to this comment.

TMRA commented that the proposed revisions to Chapter 336, and specifically the proposed language added to §336.105(a)(4) and (b)(4) do not apply to the activities engaged in by uranium mining companies and operators. TMRA asks for confirmation of this understanding.

The revisions of rules in Subchapters A, C, D, and E of Chapter 336

generally apply to all licensees and persons regulated by the TCEQ, including licensees authorized to recover uranium under Subchapter L of Chapter 336. The specific revisions in §336.105(a)(4) and (b)(4) for recovery of commission costs in excess of the application fee or annual fee only apply to commercial by-product disposal licenses issued under Subchapter L of Chapter 336. No change was made in response to this comment.

WCS commented that §336.103 and §336.105 should be amended to establish the amount of the annual fee by rule. WCS stated that an annual amount established in the rules is consistent with WCS's interpretation of statutory provisions in THSC, Chapter 401. WCS stated that an annual fee amount is necessary for their business planning. WCS commented that the commission should be required to prove additional costs exceeding the set annual fee amount.

The commission notes that establishing the amount for the annual fee assessed for a license issued under Subchapter H of Chapter 336 was beyond the scope of this rulemaking. The objective of this rulemaking was to revise these rules to implement the agency's practice to require quarterly payment of the annual fee to recover the commission's expenses in administering the license. The commission may consider future

rulemaking to establish a specific amount for the fee as suggested in the comment.

The commission is tasked with difficulties in implementing the statutory requirements that the annual fee be set in rule *and* be sufficient to recover the commission's costs. The current requirement has been in effect in the commission's rules since January 2004. The cost recovery provision in the rules was implemented to avoid generating too much or too little from a set fee. This provides complete program funding and ensures the licensee does not pay more than the actual cost to review. Because the facility licensed under Subchapter H has not been operational, the commission has not been able to anticipate routine activities at the site on which to budget anticipated costs. The commission has incurred costs for the review of the construction of the site, review of pre-operational license requirements, and review of amendment applications since the initial license was issued. These costs of the commission are based on decisions and activities under the licensee's control. The commission does expect that once the facility becomes operational, the activities at the site may become more routine and the commission can be in a better position to anticipate and plan for its costs for administering the license. Thus, the commission may be able to revisit this issue in the near future.

The annual fee of $69,929.50 for a license that authorizes the commercial disposal of by-product material is established in §336.105(b)(4) and the cost recovery provisions in §336.105(b)(4)(A) and (B) apply only if the annual fee is not sufficient to recover the costs incurred by the commission.

WCS commented that all payments under §336.103 and §336.105 should be annual, not quarterly.

Texas Water Code, §5.701(a)(1) provides that "Notwithstanding other provisions, the commission by rule may establish due dates, schedules, and procedures for assessment, collection, and remittance of fees due the commission to ensure the cost-effective administration of revenue collection and cash management programs." The revisions to §336.103 and §336.105 implement the commission's current practice of quarterly invoicing for actual expenses. The current practice of quarterly invoicing for actual expenses allows the commission's staff to plan and budget regulatory activities efficiently and avoids problems that a single yearly invoice would create across fiscal years and biennial appropriations cycles. Quarterly payment of the annual fee also avoids program funding gaps should the licensee remit a late annual payment as has previously occurred.

The collection of quarterly payment of the annual licensing fee is also consistent with the commission's collection of five percent of the license holder's gross receipts on a quarterly basis under §336.103(f). Should the commission experience lower and more predictable costs in administering the license, the commission may be amenable to revising the rules in the future to establish a yearly payment of the annual fee. No change was made in response to this comment.

WCS commented that §336.105(g) can be deleted from the rule as all of the fees subject to the subsection have expired.

The commission did not propose changes to §336.105(g) and does intend to delete this provision that reconciled the Texas Department of State Health Service's practice of biennial licensing fees with the commission's annual licensing fees when regulatory programs were transferred from the Texas Department of State Health Service to TCEQ. The commission will consider removing this provision in a future rulemaking.

SUBCHAPTER A: GENERAL PROVISIONS

§336.1, §336.2

Statutory Authority

The amendments are adopted under the Texas Radiation Control Act, Texas Health and Safety Code (THSC), Chapter 401; THSC, §401.011, which provides the commission authority to regulate and license the disposal of radioactive substances, the commercial processing and storage of radioactive substances, and the recovery and processing of source material; §401.051, which authorizes the commission to adopt rules and guidelines relating to control of sources of radiation; §401.103, which authorizes the commission to adopt rules and guidelines that provide for licensing and registration for the control of sources of radiation; §401.104, which requires the commission to provide rules for licensing for the disposal of radioactive substances; §401.201, which provides authority to the commission to regulate the disposal of low-level radioactive waste; §401.301, which authorizes the commission to set fees by rule; and §401.412, which provides authority to the commission to regulate licenses for the disposal of radioactive substances. The adopted amendments are also authorized by Texas Water Code, §5.103, which provides the commission with the authority to adopt rules necessary to carry out its powers and duties under the water code and other laws of the state.

The adopted amendments implement THSC, Chapter 401, including §§401.011, 401.051, 401.057, 401.059, 401.103, 401.104, 401.151, 401.201, 401.301, and 401.412.

§336.1. Scope and General Provisions.

(a) Except as otherwise specifically provided, the rules in this chapter apply to all persons who dispose of radioactive substances; all persons who recover or process source material; and all persons who receive radioactive substances from other persons for storage or processing.

(1) However, nothing in these rules shall apply to any person to the extent that person is subject to regulation by the United States Nuclear Regulatory Commission (NRC) or to radioactive material in the possession of federal agencies.

(2) Any United States Department of Energy contractor or subcontractor or any NRC contractor or subcontractor of the following categories operating within the state, is exempt from the rules in this chapter, with the exception of any applicable fee set forth in Subchapter B of this chapter (relating to Radioactive Substance Fees), to the extent that such contractor or subcontractor under his contract receives, possesses, uses, transfers, or acquires sources of radiation:

(A) prime contractors performing work for the United States Department of Energy at a United States government-owned or controlled site, including the transportation of radioactive material to or from the site and the performance of contract services during temporary interruptions of transportation;

(B) prime contractors of the United States Department of Energy performing research in or development, manufacture, storage, testing, or transportation of atomic weapons or components thereof;

(C) prime contractors of the United States Department of Energy using or operating nuclear reactors or other nuclear devices in a United States government-owned vehicle or vessel; and

(D) any other prime contractor or subcontractor of the United States Department of Energy or the NRC when the state and the NRC jointly determine that:

(i) the exemption of the prime contractor or subcontractor is authorized by law; and

(ii) under the terms of the contract or subcontract, there is adequate assurance that the work thereunder can be accomplished without undue risk to the public health and safety or the environment.

(3) Radioactive material that is physically received from the federal government by a non-federal facility is subject to state jurisdiction except as provided in paragraph (2) of this subsection.

(4) The rules of this chapter do not apply to transportation of radioactive materials. This provision does not exempt a transporter from other applicable requirements.

(5) The rules in this chapter do not apply to the disposal of radiation machines as defined in this subchapter or electronic devices that produce non-ionizing radiation.

(b) Regulation by the State of Texas of source material, by-product material, and special nuclear material in quantities not sufficient to form a critical mass is subject to the provisions of the agreement between the State of Texas and the NRC and to 10 Code of Federal Regulations Part 150 (10 CFR Part 150) (Exemptions and Continued Regulatory Authority in Agreement States and in Offshore Waters Under Section 274).

(A copy of the Texas agreement, "Articles of Agreement between the United States Nuclear Regulatory Commission and the State of Texas for Discontinuance of Certain Commission Regulatory Authority and Responsibility Within the State Pursuant to Section 274 of the Atomic Energy Act of 1954, as Amended" (Agreement), may be obtained from this commission.) Under the Agreement and 10 CFR Part 150, the NRC retains certain regulatory authorities over source material, by-product material, and special nuclear material in the State of Texas. Persons in the State of Texas are not exempt from the regulatory requirements of the NRC with respect to these retained authorities.

(c) No person may receive, possess, use, transfer, or dispose of radioactive material, which is subject to the rules in this chapter, in such a manner that the standards for protection against radiation prescribed in these rules are exceeded.

(d) Each person licensed by the commission under this chapter shall confine possession, use, and disposal of licensed radioactive material to the locations and purposes authorized in the license.

(e) No person may cause or allow the release of radioactive material, which is subject to the rules in this chapter, to the environment in violation of this chapter or of any rule, license, or order of the Texas Commission on Environmental Quality (commission).

(f) No person shall:

(1) dispose of low-level radioactive waste on site, except as authorized under §336.501(b) of this title (relating to Scope and General Provisions);

(2) receive low-level radioactive waste from other persons for the purpose of disposal, except for a person specifically licensed for the disposal of low-level radioactive waste;

(3) dispose of radioactive materials other than low-level radioactive waste, except for diffuse naturally occurring radioactive material waste having concentrations of less than 2,000 picocuries per gram (pCi/g) radium-226 or radium-228;

(4) dispose of radioactive materials from other persons other than low-level radioactive waste, except for naturally occurring radioactive material waste in accordance with Subchapter K of this chapter (relating to Commercial Disposal of Naturally Occurring Radioactive Material Waste from Public Water Systems);

(5) recover or process source material, except in accordance with Subchapter L of this chapter (relating to Licensing of Source Material Recovery and By-Product Material Disposal Facilities);

(6) store, process, or dispose of by-product material, except in accordance with Subchapter L of this chapter; or

(7) receive radioactive substances from other persons for storage or processing, except in accordance with Subchapter M of this chapter (relating to Licensing of Radioactive Substances Processing and Storage Facilities).

[(g) For the purpose of this chapter, any time the term "low-level radioactive waste" is used, the provision also applies to accelerator-produced radioactive material.]

§336.2. Definitions.

The following words and terms, when used in this chapter, shall have the following meanings, or as described in Chapter 3 of this title (relating to Definitions), unless the context clearly indicates otherwise. Additional definitions used only in a certain subchapter will be found in that subchapter.

(1) **Absorbed dose**--The energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the gray (Gy).

(2) **Accelerator-produced radioactive material**--Any material made radioactive by [exposing it to the radiation from] a particle accelerator.

(3) **Activity**--The rate of disintegration (transformation) or decay of radioactive material. The units of activity are the curie (Ci) and the becquerel (Bq).

(4) **Adult**--An individual 18 or more years of age.

(5) **Agreement state**--Any state with which the United States Nuclear Regulatory Commission (NRC) or the Atomic Energy Commission has entered into an effective agreement under the Atomic Energy Act of 1954, §274b, as amended through October 24, 1992 (Public Law 102-486).

(6) **Airborne radioactive material**--Any radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases.

(7) **Airborne radioactivity area**--A room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations:

(A) in excess of the derived air concentrations (DACs) specified in §336.359, Appendix B, Table I, Column 1, of this title (relating to Appendix B. Annual Limits on Intake (ALI) and Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sanitary Sewerage); or

(B) to a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6% of the ALI or 12 DAC-hours.

(8) **Air-purifying respirator--**A respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

(9) **Annual limit on intake (ALI)--**The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the "reference man" that would result in a committed effective dose equivalent of 5 rems (0.05 sievert) or a committed dose equivalent of 50 rems (0.5 sievert) to any individual organ or tissue. ALI values for intake by ingestion and by inhalation of selected

radionuclides are given in Table I, Columns 1 and 2, of §336.359, Appendix B, of this title.

(10) **As low as is reasonably achievable (ALARA)**--Making every reasonable effort to maintain exposures to radiation as far below the dose limits in this chapter as is practical, consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to the state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of ionizing radiation and licensed radioactive materials in the public interest.

(11) **Assigned protection factor (APF)**--The expected workplace level of respiratory protection that would be provided by a properly functioning respirator or a class of respirators to properly fitted and trained users. Operationally, the inhaled concentration can be estimated by dividing the ambient airborne concentration by the APF.

(12) **Atmosphere-supplying respirator**--A respirator that supplies the respirator user with breathing air from a source independent of the ambient

atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

(13) **Background radiation**--Radiation from cosmic sources; non-technologically enhanced naturally-occurring radioactive material, including radon (except as a decay product of source or special nuclear material) and global fallout as it exists in the environment from the testing of nuclear explosive devices or from past nuclear accidents such as Chernobyl that contribute to background radiation and are not under the control of the licensee. "Background radiation" does not include radiation from radioactive materials regulated by the commission, Texas Department of State Health Services, NRC, or an Agreement State.

(14) **Becquerel (Bq)**--See §336.4 of this title (relating to Units of Radioactivity).

(15) **Bioassay**--The determination of kinds, quantities, or concentrations, and, in some cases, the locations of radioactive material in the human body, whether by direct measurement (in vivo counting) or by analysis and evaluation of materials excreted or removed from the human body. For purposes of the rules in this chapter, "radiobioassay" is an equivalent term.

(16) **Byproduct material**--

(A) A radioactive material, other than special nuclear material, that is produced in or made radioactive by exposure to radiation incident to the process of producing or using special nuclear material; [or]

(B) The tailings or wastes produced by or resulting from the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes, and other tailings having similar radiological characteristics. Underground ore bodies depleted by these solution extraction processes do not constitute "byproduct material" within this definition; [.]

(C) Any discrete source of radium-226 that is produced, extracted, or converted after extraction, for use for a commercial, medical, or research activity;

(D) Any material that has been made radioactive by use of a particle accelerator,~~;~~ and is produced, extracted, or converted for use for a commercial, medical, or research activity; and

(E) Any discrete source of naturally occurring radioactive material, other than source material, that is extracted or converted after extraction for use in a

<u>commercial, medical, or research activity and that the NRC, in consultation with the Administrator of the United States Environmental Protection Agency (EPA), the United States Secretary of Energy, the United States Secretary of Homeland Security, and the head of any other appropriate Federal agency, determines would pose a threat similar to the threat posed by a discrete source of radium-226 to the public health and safety or the common defense and security.</u>

(17) **CFR--**Code of Federal Regulations.

(18) **Class--**A classification scheme for inhaled material according to its rate of clearance from the pulmonary region of the lung. Materials are classified as D, W, or Y, which applies to a range of clearance half-times: for Class D (Days) of less than ten days, for Class W (Weeks) from 10 to 100 days, and for Class Y (Years) of greater than 100 days. For purposes of the rules in this chapter, "lung class" and "inhalation class" are equivalent terms.

(19) **Collective dose--**The sum of the individual doses received in a given period of time by a specified population from exposure to a specified source of radiation.

(20) **Committed dose equivalent ($H_{T,50}$) (CDE)--**The dose equivalent to organs or tissues of reference (T) that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

(21) **Committed effective dose equivalent ($H_{E,50}$) (CEDE)--**The sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to each of these organs or tissues.

(22) **Compact--**The Texas Low-Level Radioactive Waste Disposal Compact established under Texas Health and Safety Code, §403.006 and Texas Low-Level Radioactive Waste Disposal Compact Consent Act, Public Law Number 105-236 (1998).

(23) **Compact waste--**Low-level radioactive waste that:

(A) is generated in a host state or a party state; or

(B) is not generated in a host state or a party state, but has been approved for importation to this state by the compact commission under §3.05 of the compact established under Texas Health and Safety Code, §403.006.

(24) **Compact waste disposal facility--**The low-level radioactive waste land disposal facility licensed by the commission under Subchapter H of this chapter

(relating to Licensing Requirements for Near-Surface Land Disposal of Low-Level Radioactive Waste) for the disposal of compact waste.

(25) **Constraint (dose constraint)**--A value above which specified licensee actions are required.

(26) **Critical group**--The group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances.

(27) **Curie (Ci)**--See §336.4 of this title.

(28) **Declared pregnant woman**--A woman who has voluntarily informed the licensee, in writing, of her pregnancy and the estimated date of conception. The declaration remains in effect until the declared pregnant woman withdraws the declaration in writing or is no longer pregnant.

(29) **Decommission**--To remove (as a facility) safely from service and reduce residual radioactivity to a level that permits:

(A) release of the property for unrestricted use and termination of license; or

(B) release of the property under restricted conditions and termination of the license.

(30) **Deep-dose equivalent (H_d) (which applies to external whole-body exposure)**--The dose equivalent at a tissue depth of one centimeter (1,000 milligrams/square centimeter).

(31) **Demand respirator**--An atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

(32) **Depleted uranium**--The source material uranium in which the isotope uranium-235 is less than 0.711%, by weight, of the total uranium present. Depleted uranium does not include special nuclear material.

(33) **Derived air concentration (DAC)**--The concentration of a given radionuclide in air which, if breathed by the "reference man" for a working year of 2,000 hours under conditions of light work (inhalation rate of 1.2 cubic meters of air/hour), results in an intake of one ALI. DAC values are given in Table I, Column 3, of §336.359, Appendix B, of this title.

(34) **Derived air concentration-hour (DAC-hour)**--The product of the concentration of radioactive material in air (expressed as a fraction or multiple of the derived air concentration for each radionuclide) and the time of exposure to that radionuclide, in hours. A licensee shall take 2,000 DAC-hours to represent one ALI, equivalent to a committed effective dose equivalent of 5 rems (0.05 sievert).

(35) **Discrete source**--A radionuclide that has been processed so that its concentration within a material has been purposely increased for use for commercial, medical, or research activities.

(36) [(35)] **Disposal**--With regard to low-level radioactive waste, the isolation or removal of low-level radioactive waste from mankind and mankind's environment without intent to retrieve that low-level radioactive waste later.

(37) [(36)] **Disposable respirator**--A respirator for which maintenance is not intended and that is designed to be discarded after excessive breathing resistance, sorbent exhaustion, physical damage, or end-of-service-life renders it unsuitable for use. Examples of this type of respirator are a disposable half-mask respirator or a disposable escape-only self-contained breathing apparatus (SCBA).

(38) [(37)] **Distinguishable from background**--The detectable concentration of a radionuclide is statistically different from the background concentration of that radionuclide in the vicinity of the site or, in the case of structures, in similar materials using adequate measurement technology, survey, and statistical techniques.

(39) [(38)] **Dose**--A generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, total organ dose equivalent, or total effective dose equivalent. For purposes of the rules in this chapter, "radiation dose" is an equivalent term.

(40) [(39)] **Dose equivalent (H_T)**--The product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and sievert (Sv).

(41) [(40)] **Dose limits**--The permissible upper bounds of radiation doses established in accordance with the rules in this chapter. For purposes of the rules in this chapter, "limits" is an equivalent term.

(42) [(41)] **Dosimetry processor**--An individual or organization that processes and evaluates individual monitoring devices in order to determine the radiation dose delivered to the monitoring devices.

(43) [(42)] **Effective dose equivalent (H_E)--**The sum of the products of the dose equivalent to each organ or tissue (H_T) and the weighting factor (w_T) applicable to each of the body organs or tis sues that are irradiated.

(44) [(43)] **Embryo/fetus--**The developing human organism from conception until the time of birth.

(45) [(44)] **Entrance or access point--**Any opening through which an individual or extremity of an individual could gain access to radiation areas or to licensed radioactive materials. This includes portals of sufficient size to permit human access, irrespective of their intended use.

(46) [(45)] **Exposure--**Being exposed to ionizing radiation or to radioactive material.

(47) [(46)] **Exposure rate--**The exposure per unit of time.

(48) [(47)] **External dose--**That portion of the dose equivalent received from any source of radiation outside the body.

(49) [(48)] **Extremity--**Hand, elbow, arm below the elbow, foot, knee, and leg below the knee. The arm above the elbow and the leg above the knee are considered part of the whole body.

(50) [(49)] **Federal facility waste--**Low-level radioactive waste that is the responsibility of the federal government under the Low-Level Radioactive Waste Policy Act, as amended by the Low-Level Radioactive Waste Policy Amendments Act of 1985 (42 United States Code, §2021b - 2021j). Excluded from this definition is low-level radioactive waste that is classified as greater than Class C in §336.362 of this title (relating to Appendix E. Classification and Characteristics of Low-Level Radioactive Waste).

(51) [(50)] **Federal facility waste disposal facility--**A low-level radioactive waste land disposal facility for the disposal of federal facility waste licensed under Subchapters H and J of this chapter.

(52) [(51)] **Filtering facepiece (dust mask)--**A negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium, not equipped with elastomeric sealing surfaces and adjustable straps.

(53) [(52)] **Fit factor--**A quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

(54) [(53)] **Fit test--**The use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual.

(55) [(54)] **General license--**An authorization granted by an agency under its rules which is effective without the filing of an application with that agency or the issuance of a licensing document to the particular person.

(56) [(55)] **Generally applicable environmental radiation standards--**Standards issued by the EPA under the authority of the Atomic Energy Act of 1954, as amended through October 4, 1996, that impose limits on radiation exposures or levels, or concentrations or quantities of radioactive material, in the general environment outside the boundaries of locations under the control of persons possessing or using radioactive material.

(57) [(56)] **Gray (Gy)--**See §336.3 of this title (relating to Units of Radiation Exposure and Dose).

(58) [(57)] **Hazardous waste**--Hazardous waste as defined in §335.1 of this title (relating to Definitions).

(59) [(58)] **Helmet**--A rigid respiratory inlet covering that also provides head protection against impact and penetration.

(60) [(59)] **High radiation area**--An area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving a dose equivalent in excess of 0.1 rem (1 millisievert) in one hour at 30 centimeters from the radiation source or 30 centimeters from any surface that the radiation penetrates.

(61) [(60)] **Hood**--A respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

(62) [(61)] **Host state**--A party state in which a compact facility is located or is being developed. The State of Texas is the host state under the Texas Low-Level Radioactive Waste Disposal Compact, §2.01, established under Texas Health and Safety Code, §403.006.

(63) [(62)] **Individual**--Any human being.

(64) [(63)] **Individual monitoring**--The assessment of:

(A) dose equivalent by the use of individual monitoring devices; or

(B) committed effective dose equivalent by bioassay or by determination of the time-weighted air concentrations to which an individual has been exposed, that is, DAC-hours; or

(C) dose equivalent by the use of survey data.

(65) [(64)] **Individual monitoring devices**--Devices designed to be worn by a single individual for the assessment of dose equivalent such as film badges, thermoluminescence dosimeters (TLDs), pocket ionization chambers, and personal ("lapel") air sampling devices.

(66) [(65)] **Inhalation class**--See "Class."

(67) [(66)] **Inspection**--An official examination and/or observation including, but not limited to, records, tests, surveys, and monitoring to determine compliance with the Texas Radiation Control Act (TRCA) and rules, orders, and license conditions of the commission.

(68) [(67)] **Internal dose**--That portion of the dose equivalent received from radioactive material taken into the body.

(69) [(68)] **Land disposal facility**--The land, buildings and structures, and equipment which are intended to be used for the disposal of low-level radioactive wastes into the subsurface of the land. For purposes of this chapter, a "geologic repository" as defined in 10 CFR §60.2 as amended through October 27, 1988 (53 FR 43421) (relating to Definitions - high-level radioactive wastes in geologic repositories) is not considered a "land disposal facility."

(70) [(69)] **Lens dose equivalent (LDE)**--The external exposure of the lens of the eye and is taken as the dose equivalent at a tissue depth of 0.3 centimeter (300 mg/cm^2).

(71) [(70)] **License**--See "Specific license."

(72) [(71)] **Licensed material**--Radioactive material received, possessed, used, processed, transferred, or disposed of under a license issued by the commission.

(73) [(72)] **Licensee**--Any person who holds a license issued by the commission in accordance with the Texas Health and Safety Code, Chapter 401 (Radioactive Materials and Other Sources of Radiation) and the rules in this chapter.

For purposes of the rules in this chapter, "radioactive material licensee" is an equivalent term. Unless stated otherwise, "licensee" as used in the rules of this chapter means the holder of a "specific license."

(74) [(73)] **Licensing state--**Any state with rules equivalent to the Suggested State Regulations for Control of Radiation relating to, and having an effective program for, the regulatory control of naturally occurring or accelerator-produced radioactive material (NARM) and which has been designated as such by the Conference of Radiation Control Program Directors, Inc.

(75) [(74)] **Loose-fitting facepiece--**A respiratory inlet covering that is designed to form a partial seal with the face.

(76) [(75)] **Lost or missing licensed radioactive material--**Licensed material whose location is unknown. This definition includes material that has been shipped but has not reached its planned destination and whose location cannot be readily traced in the transportation system.

(77) [(76)] **Low-level radioactive waste--**

(A) Except as provided by subparagraph (B) of this paragraph, low-level radioactive waste means radioactive material that:

(i) is discarded or unwanted and is not exempt by a Texas Department of State Health Services rule adopted under the Texas Health and Safety Code, §401.106;

(ii) is waste, as that term is defined by 10 CFR §61.2; and

(iii) is subject to:

(I) concentration limits established under this chapter; and

(II) disposal criteria established under this chapter.

(B) Low-level radioactive waste does not include:

(i) high-level radioactive waste defined by 10 CFR §60.2;

(ii) spent nuclear fuel as defined by 10 CFR §72.3;

(iii) transuranic waste as defined in this section;

(iv) byproduct material as defined by paragraph (16)(B) - (E) of this section;

(v) naturally occurring radioactive material (NORM) waste; or

(vi) oil and gas NORM waste.

(C) When used in this section, the references to 10 CFR sections mean those CFR sections as they existed on September 1, 1999, as required by Texas Health and Safety Code, §401.005.

(78) [(77)] **Lung class**--See "Class."

(79) [(78)] **Member of the public**--Any individual except when that individual is receiving an occupational dose.

(80) [(79)] **Minor**--An individual less than 18 years of age.

(81) [(80)] **Mixed waste**--A combination of hazardous waste, as defined in [30 TAC] §335.1 of this title (relating to Definitions) and low-level radioactive waste. The term includes compact waste and federal facility waste containing hazardous waste.

(82) [(81)] **Monitoring**--The measurement of radiation levels, radioactive material concentrations, surface area activities, or quantities of radioactive material and the use of the results of these measurements to evaluate potential exposures and doses. For purposes of the rules in this chapter, "radiation monitoring" and "radiation protection monitoring" are equivalent terms.

(83) **Nationally tracked source**--A sealed source containing a quantity equal to or greater than Category 1 or Category 2 levels of any radioactive material listed in §336.351 of this title (relating to Reports of Transactions Involving Nationally Tracked Sources). In this context a sealed source is defined as radioactive material that is sealed in a capsule or closely bonded, in a solid form and which is not exempt from regulatory control. It does not mean material encapsulated solely for disposal, or nuclear material contained in any fuel assembly, subassembly, fuel rod, or fuel pellet. Category 1 nationally tracked sources are those containing radioactive material at a quantity equal to or greater than the Category 1 threshold. Category 2 nationally tracked sources are those containing radioactive material at a quantity equal to or greater than the Category 2 threshold but less than the Category 1 threshold.

(84) [(82)] **Naturally occurring or accelerator-produced radioactive material (NARM)--**Any naturally occurring or accelerator-produced radioactive material except source material or special nuclear material.

(85) [(83)] **Naturally occurring radioactive material (NORM) waste--**Solid, liquid, or gaseous material or combination of materials, excluding source material, special nuclear material, and byproduct material, that:

(A) in its natural physical state spontaneously emits radiation;

(B) is discarded or unwanted; and

(C) is not exempt under rules of the Texas Department of State Health Services adopted under Texas Health and Safety Code, §401.106.

(86) [(84)] **Near-surface disposal facility--**A land disposal facility in which low-level radioactive waste is disposed of in or within the upper 30 meters of the earth's surface.

(87) [(85)] **Negative pressure respirator (tight fitting)--**A respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

(88) [(86)] **Nonstochastic effect--**A health effect, the severity of which varies with the dose and for which a threshold is believed to exist. Radiation-induced cataract formation is an example of a nonstochastic effect. For purposes of the rules in this chapter, "deterministic effect" is an equivalent term.

(89) [(87)] **Occupational dose--**The dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation and/or to radioactive material from licensed and unlicensed sources of radiation, whether in the possession of the licensee or other person. Occupational dose does not include dose received from background radiation, as a patient from medical practices, from voluntary participation in medical research programs, or as a member of the public.

(90) (88) **Oil and gas naturally occurring radioactive material (NORM) waste--**Naturally occurring radioactive material (NORM) waste that constitutes, is contained in, or has contaminated oil and gas waste as that term is defined in the Texas Natural Resources Code, §91.1011.

(91) [(89)] **On-site--**The same or geographically contiguous property that may be divided by public or private rights-of-way, provided the entrance and exit between the properties is at a cross-roads intersection, and access is by crossing, as

opposed to going along, the right-of-way. Noncontiguous properties owned by the same person but connected by a right-of-way that the property owner controls and to which the public does not have access, is also considered on-site property.

(92) **Particle accelerator**--Any machine capable of accelerating electrons, protons, deuterons, or other charged particles in a vacuum and discharging ~~designed to discharge~~ the resultant particulate or other associated radiation at energies usually in excess of 1 million electron volts (MeV).

(93) [(90)] **Party state**--Any state that has become a party to the compact in accordance with Article VII of the Texas Low-Level Radioactive Waste Disposal Compact, established under Texas Health and Safety Code, §403.006.

(94) [(91)] **Perpetual care account**--The radiation and perpetual care account as defined in this section.

(95) [(92)] **Personnel monitoring equipment**--See "Individual monitoring devices."

(96) [(93)] **Planned special exposure**--An infrequent exposure to radiation, separate from and in addition to the annual occupational dose limits.

(97) [(94)] **Positive pressure respirator**--A respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

(98) [(95)] **Powered air-purifying respirator (PAPR)**--An air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

(99) [(96)] **Pressure demand respirator**--A positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

(100) [(97)] **Principal activities**--Activities authorized by the license which are essential to achieving the purpose(s) for which the license is issued or amended. Storage during which no licensed material is accessed for use or disposal and activities incidental to decontamination or decommissioning are not principal activities.

(101) [(98)] **Public dose**--The dose received by a member of the public from exposure to radiation and/or radioactive material released by a licensee, or to any other source of radiation under the control of the licensee. It does not include occupational dose or doses received from background radiation, as a patient from medical practices, or from voluntary participation in medical research programs.

(102) [(99)] **Qualitative fit test (QLFT)--**A pass/fail test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

(103) [(100)] **Quality factor (Q)--**The modifying factor listed in Table I or II of §336.3 of this title that is used to derive dose equivalent from absorbed dose.

(104) [(101)] **Quantitative fit test (QNFT)--**An assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

(105) [(102)] **Quarter (Calendar quarter)--**A period of time equal to one-fourth of the year observed by the licensee (approximately 13 consecutive weeks), providing that the beginning of the first quarter in a year coincides with the starting date of the year and that no day is omitted or duplicated in consecutive quarters.

(106) [(103)] **Rad--**See §336.3 of this title.

(107) [(104)] **Radiation--**Alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. For purposes of the rules in this chapter, "ionizing radiation" is an

equivalent term. Radiation, as used in this chapter, does not include non-ionizing radiation, such as radio- or microwaves or visible, infrared, or ultraviolet light.

(108) [(105)] **Radiation and Perpetual Care Account**--An account in the general revenue fund established for the purposes specified in the Texas Health and Safety Code, §401.305.

(109) [(106)] **Radiation area**--Any area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 millisievert) in one hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates.

(110) [(107)] **Radiation machine**--Any device capable of producing ionizing radiation except those devices with radioactive material as the only source of radiation.

(111) [(108)] **Radioactive material**--A naturally-occurring or artificially-produced solid, liquid, or gas that emits radiation spontaneously.

(112) [(109)] **Radioactive substance**--Includes byproduct material, radioactive material, low-level radioactive waste, source material, special nuclear material, source of radiation, and NORM waste, excluding oil and gas NORM waste.

(113) [(110)] **Radioactivity**--The disintegration of unstable atomic nuclei with the emission of radiation.

(114) [(111)] **Radiobioassay**--See "Bioassay."

(115) [(112)] **Reference man**--A hypothetical aggregation of human physical and physiological characteristics determined by international consensus. These characteristics shall be used by researchers and public health workers to standardize results of experiments and to relate biological insult to a common base. A description of "reference man" is contained in the International Commission on Radiological Protection report, ICRP Publication 23, "Report of the Task Group on Reference Man."

(116) [(113)] **Rem**--See §336.3 of this title.

(117) [(114)] **Residual radioactivity**--Radioactivity in structures, materials, soils, groundwater, and other media at a site resulting from activities under the licensee's control. This includes radioactivity from all licensed and unlicensed sources used by the licensee, but excludes background radiation. It also includes radioactive materials remaining at the site as a result of routine or accidental releases of radioactive material at the site and previous burials at the site, even if those burials were made in accordance with the provisions of 10 CFR Part 20.

(118) [(115)] **Respiratory protection equipment--**An apparatus, such as a respirator, used to reduce an individual's intake of airborne radioactive materials. For purposes of the rules in this chapter, "respiratory protective device" is an equivalent term.

(119) [(116)] **Restricted area--**An area, access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. Restricted area does not include areas used as residential quarters, but separate rooms in a residential building shall be set apart as a restricted area.

(120) [(117)] **Roentgen (R)--**See §336.3 of this title.

(121) [(118)] **Sanitary sewerage--**A system of public sewers for carrying off waste water and refuse, but excluding sewage treatment facilities, septic tanks, and leach fields owned or operated by the licensee.

(122) [(119)] **Sealed source--**Radioactive material that is permanently bonded or fixed in a capsule or matrix designed to prevent release and dispersal of the radioactive material under the most severe conditions that are likely to be encountered in normal use and handling.

(123) [(120)] **Self-contained breathing apparatus (SCBA)--**An atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

(124) [(121)] **Shallow-dose equivalent (H_s) (which applies to the external exposure of the skin of the whole body or the skin of an extremity)--**The dose equivalent at a tissue depth of 0.007 centimeter (seven milligrams/square centimeter).

(125) [(122)] **SI--**The abbreviation for the International System of Units.

(126) [(123)] **Sievert (Sv)--**See §336.3 of this title.

(127) [(124)] **Site boundary--**That line beyond which the land or property is not owned, leased, or otherwise controlled by the licensee.

(128) [(125)] **Source material--**

(A) Uranium or thorium, or any combination thereof, in any physical or chemical form; or

(B) ores that contain, by weight, 0.05% or more of uranium, thorium, or any combination thereof. Source material does not include special nuclear material.

(129) [(126)] **Special form radioactive material--**Radioactive material which is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule and which has at least one dimension not less than five millimeters and which satisfies the test requirements of 10 CFR §71.75 as amended through September 28, 1995 (60 FR 50264) (Transportation of License Material).

(130) [(127)] **Special nuclear material--**

(A) Plutonium, uranium-233, uranium enriched in the isotope 233 or in the isotope 235, and any other material that the NRC, under the provisions of the Atomic Energy Act of 1954, §51, as amended through November 2, 1994 (Public Law 103-437), determines to be special nuclear material, but does not include source material; or

(B) any material artificially enriched by any of the foregoing, but does not include source material.

(131) [(128)] **Special nuclear material in quantities not sufficient to form a critical mass--**Uranium enriched in the isotope 235 in quantities not exceeding 350 grams of contained uranium-235; uranium-233 in quantities not exceeding 200 grams; plutonium in quantities not exceeding 200 grams; or any combination of these in accordance with the following formula: For each kind of special nuclear material, determine the ratio between the quantity of that special nuclear material and the quantity specified above for the same kind of special nuclear material. The sum of such ratios for all of the kinds of special nuclear material in combination shall not exceed 1. For example, the following quantities in combination would not exceed the limitation: (175 grams contained U-235/350 grams) + (50 grams U-233/200 grams) + (50 grams Pu/200 grams) = 1.

(132) [(129)] **Specific license--**A licensing document issued by an agency upon an application filed under its rules. For purposes of the rules in this chapter, "radioactive material license" is an equivalent term. Unless stated otherwise, "license" as used in this chapter means a "specific license."

(133) [(130)] **State--**The State of Texas.

(134) [(131)] **Stochastic effect--**A health effect that occurs randomly and for which the probability of the effect occurring, rather than its severity, is assumed to

be a linear function of dose without threshold. Hereditary effects and cancer incidence are examples of stochastic effects. For purposes of the rules in this chapter, "probabilistic effect" is an equivalent term.

(135) [(132)] **Supplied-air respirator (SAR) or airline respirator--**An atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

(136) [(133)] **Survey--**An evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, and/or presence of radioactive materials or other sources of radiation. When appropriate, this evaluation includes, but is not limited to, physical examination of the location of radioactive material and measurements or calculations of levels of radiation or concentrations or quantities of radioactive material present.

(137) [(134)] **Termination--**As applied to a license, a release by the commission of the obligations and authorizations of the licensee under the terms of the license. It does not relieve a person of duties and responsibilities imposed by law.

(138) [(135)] **Tight-fitting facepiece--**A respiratory inlet covering that forms a complete seal with the face.

(139) [(136)] **Total effective dose equivalent (TEDE)--**The sum of the effective dose [deep-dose] equivalent for external exposures and the committed effective dose equivalent for internal exposures.

(140) [(137)] **Total organ dose equivalent (TODE)--**The sum of the deep-dose equivalent and the committed dose equivalent to the organ receiving the highest dose as described in §336.346(a)(6) of this title (relating to Records of Individual Monitoring Results).

(141) [(138)] **Transuranic waste--**For the purposes of this chapter, wastes containing alpha emitting transuranic radionuclides with a half-life greater than five years at concentrations greater than 100 nanocuries/gram.

(142) [(139)] **Type A quantity (for packaging)--**A quantity of radioactive material, the aggregate radioactivity of which does not exceed A_1 for special form radioactive material or A_2 for normal form radioactive material, where A_1 and A_2 are given in or shall be determined by procedures in Appendix A to 10 CFR Part 71 as amended through September 28, 1995 (60 FR 50264) (Packaging and Transportation of Radioactive Material).

(143) [(140)] **Type B quantity (for packaging)--**A quantity of radioactive material greater than a Type A quantity.

(144) [(141)] **Unrefined and unprocessed ore**--Ore in its natural form before any processing, such as grinding, roasting, beneficiating, or refining.

(145) [(142)] **Unrestricted area**--Any area that is not a restricted area.

(146) [(143)] **User seal check (fit check)**--An action conducted by the respirator user to determine if the respirator is properly seated to the face. Examples include negative pressure check, positive pressure check, irritant smoke check, or isoamyl acetate check.

(147) [(144)] **Very high radiation area**--An area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving an absorbed dose in excess of 500 rads (five grays) in one hour at one meter from a source of radiation or one meter from any surface that the radiation penetrates.

(148) [(145)] **Violation**--An infringement of any provision of the Texas Radiation Control Act (TRCA) or of any rule, order, or license condition of the commission issued under the TRCA or this chapter.

(149) **Waste**--Low-level radioactive wastes containing source, special nuclear, or byproduct material that are acceptable for disposal in a land disposal facility. For the purposes of this definition, low-level radioactive waste means radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in paragraph (16)(B) - (E) of this section.

(150) [(146)] **Week**--Seven consecutive days starting on Sunday.

(151) [(147)] **Weighting factor (w_T) for an organ or tissue (T)**--The proportion of the risk of stochastic effects resulting from irradiation of that organ or tissue to the total risk of stochastic effects when the whole body is irradiated uniformly. For calculating the effective dose equivalent, the values of w_T are:

Figure: 30 TAC §336.2(151)

[Figure: 30 TAC §336.2(147)]

Organ Dose Weighting Factors

Organ or Tissue	W_T
Gonads	0.25

Breast	0.15
Red bone marrow	0.12
Lung	0.12
Thyroid	0.03
Bone surfaces	0.03
Remainder	0.30[1]
Whole body	1.00[2]

1. The value 0.30 results from 0.06 for each of five remainder organs, excluding the skin and the lens of the eye, that receive the highest doses.

2. For the purpose of weighting the external whole body dose (for adding it to the internal dose) a single weighting factor, w_T =1.0, has been specified. The use of other weighting factors for external exposure will be approved on a case-by-case basis until such time as specific guidance is issued.

(152) [(148)] **Whole body**--For purposes of external exposure, head, trunk including male gonads, arms above the elbow, or legs above the knee.

(153) [(149)] **Worker**--An individual engaged in activities under a license issued by the commission and controlled by a licensee, but does not include the licensee.

(154) [(150)] **Working level (WL)**--Any combination of short-lived radon daughters in one liter of air that will result in the ultimate emission of 1.3 x 10^5 MeV [million electron volts (MeV)] of potential alpha particle energy. The short-lived radon daughters are: for radon-222: polonium-218, lead-214, bismuth-214, and polonium-214; and for radon-220: polonium-216, lead-212, bismuth-212, and polonium-212.

(155) [(151)] **Working level month (WLM)**--An exposure to one working level for 170 hours (2,000 working hours per year divided by 12 months per year is approximately equal to 170 hours per month).

(156) [(152)] Year--The period of time beginning in January used to determine compliance with the provisions of the rules in this chapter. The licensee shall change the starting date of the year used to determine compliance by the licensee provided that the change is made at the beginning of the year and that no day is omitted or duplicated in consecutive years.

SUBCHAPTER B: RADIOACTIVE SUBSTANCE FEES

§336.103, §336.105

Statutory Authority

The amendments are adopted under the Texas Radiation Control Act, Texas Health and Safety Code (THSC), Chapter 401; THSC, §401.011,which provides the commission authority to regulate and license the disposal of radioactive substances, the commercial processing and storage of radioactive substances, and the recovery and processing of source material; §401.051, which authorizes the commission to adopt rules and guidelines relating to control of sources of radiation; §401.103, which authorizes the commission to adopt rules and guidelines that provide for licensing and registration for the control of sources of radiation; §401.104, which requires the commission to provide rules for licensing for the disposal of radioactive substances; §401.201, which provides authority to the commission to regulate the disposal of low-level radioactive waste; §401.301, which authorizes the commission to set fees by rule; and §401.412, which provides authority to the commission to regulate licenses for the disposal of radioactive substances. The adopted amendments are also authorized by Texas Water Code, §5.103, which provides the commission with the authority to adopt rules necessary to carry out its powers and duties under the water code and other laws of the state.

The adopted amendments implement THSC, Chapter 401, including §§401.011, 401.051, 401.057, 401.059, 401.103, 401.104, 401.151, 401.201, 401.301, and 401.412.

§336.103. Schedule of Fees for Subchapter H Licenses.

(a) An application for a low-level radioactive waste disposal site license under Subchapter H of this chapter (relating to Licensing Requirements for Near-Surface Land Disposal of Low-Level Radioactive Waste) shall be accompanied by a nonrefundable application processing fee of $500,000. If the commission's costs in processing an application under Subchapter H of this chapter exceed the $500,000 application processing fee, the commission may assess and collect additional fees from the applicant to recover the costs. Recoverable costs include costs incurred by the commission for administrative review, technical review, and hearings associated with the application.

(b) An applicant shall submit an annual fee for the actual costs incurred by the commission for hearings associated with an application for a low-level radioactive waste disposal site under Subchapter H of this chapter. The executive director shall send an invoice for the amount of the costs incurred during the period September 1 through August 31 of each year. Payment shall be made within 30 days following the date of the invoice.

(c) A holder of a license for a low-level radioactive waste disposal site issued under Subchapter H of this chapter shall submit an annual license fee for the services received. This fee shall recover for the state the actual expenses arising from the regulatory activities associated with the license. This fee shall include reimbursement for the salary and other expenses of the resident inspectors as provided by §336.743 of this title (relating to Resident Inspector). The executive director shall [send an] invoice for the amount of the costs incurred <u>quarterly</u> [during the period September 1 through August 31 of each year]. Payment shall be made within 30 days following the date of the invoice.

(d) An application for a major amendment of a license issued under Subchapter H of this chapter must be accompanied by an application fee of $50,000.

(e) An application for renewal of a license issued under Subchapter H of this chapter must be accompanied by an application fee of $300,000.

(f) The compact waste disposal facility license holder shall remit to the commission 5% of the gross receipts from compact waste received at the compact waste disposal facility and any federal facility waste received at the federal facility waste disposal facility. Payment shall be made within 30 days of the end of each quarter. The end of each quarter is the last day of the months of November, February, May, and August.

(g) The compact waste disposal facility license holder shall remit directly to the host county 5% of the gross receipts from compact waste received at the compact waste disposal facility and any federal facility waste received at the federal facility waste disposal facility as required in Texas Health and Safety Code, §401.244. Payment shall be made within 30 days of the end of each quarter. The end of each quarter is the last day of the months of November, February, May, and August.

§336.105. Schedule of Fees for Other Licenses.

(a) Each application for a license under Subchapter F of this chapter (relating to Licensing of Alternative Methods of Disposal of Radioactive Material), Subchapter G of this chapter (relating to Decommissioning Standards), Subchapter K of this chapter (relating to Commercial Disposal of Naturally Occurring Radioactive Material Waste from Public Water Systems), Subchapter L of this chapter (relating to Licensing of Source Material Recovery and By-product Material Disposal Facilities), or Subchapter M of this chapter (relating to Licensing of Radioactive Substances Processing and Storage Facilities) must be accompanied by an application fee as follows:

(1) facilities regulated under Subchapter F of this chapter: $50,000;

(2) facilities regulated under Subchapter G of this chapter: $10,000;

(3) facilities regulated under Subchapter K of this chapter: $50,000;

(4) facilities regulated under Subchapter L of this chapter: $463,096 for conventional mining; $322,633 for in situ mining; $325,910 for heap leach; and $374,729 for disposal only; or

(A) if the application fee is not sufficient to cover costs incurred by the commission, then the applicant shall submit a supplemental fee to recover the actual costs incurred by the commission for review of the application and any hearings associated with an application for commercial by-product material disposal under Subchapter L of this chapter in accordance with Texas Health and Safety Code, §401.301(g);

(B) the executive director shall invoice for the amount of the costs incurred quarterly. Payment shall be made within 30 days following the date of the invoice;

(5) facilities regulated under Subchapter M of this chapter: $3,830 for Waste Processing - Class I Exempt; $39,959 for Waste Processing - Class I; $94,661 for Waste Processing - Class II; and $273,800 for Waste Processing - Class III.

(b) An annual license fee shall be paid for each license issued under Subchapter F, Subchapter G, Subchapter K, Subchapter L, and Subchapter M of this chapter. The amount of each annual fee is as follows:

(1) facilities regulated under Subchapter F of this chapter: $25,000;

(2) facilities regulated under Subchapter G of this chapter: $8,400;

(3) facilities regulated under Subchapter K of this chapter: $25,000;

(4) facilities regulated under Subchapter L of this chapter that are operational: $60,929.50; <u>or</u>

<u>(A) if the annual fee is not sufficient to cover costs incurred by the commission, a holder of a license for commercial by-product material disposal issued under Subchapter L of this chapter shall submit a supplemental license fee sufficient to recover the actual costs incurred by the commission. This fee shall recover for the state</u>

the actual expenses arising from the regulatory activities associated with the license in accordance with Texas Health and Safety Code, §401.412(d);

(B) the executive director shall invoice for the amount of the costs incurred quarterly. Payment shall be made within 30 days following the date of the invoice;

(5) facilities regulated under Subchapter L of this chapter that are in closure: $60,929.50;

(6) facilities regulated under Subchapter L of this chapter that are in post-closure: $52,011.50 for conventional mining; $26,006 for in situ mining; and $52,011.50 for disposal only;

(7) facilities regulated under Subchapter L of this chapter, if additional noncontiguous source material recovery facility sites are authorized under the same license, the annual fee shall be increased by 25% for each additional site and 50% for sites in closure;

(8) facilities regulated under Subchapter L of this chapter, if an authorization for disposal of by-product material is added to a license, the annual fee shall be increased by 25%;

(9) facilities regulated under Subchapter L of this chapter, the following one-time fees apply if added after an environmental assessment has been completed on a facility:

(A) $28,658 for in situ wellfield on noncontiguous property;

(B) $71,651 for in situ satellite;

(C) $11,235 for wellfield on contiguous property;

(D) $50,756 for non-vacuum dryer; or

(E) $71, 651 for disposal (including processing, if applicable) of by-product material; or

(10) facilities regulated under Subchapter M of this chapter: $3,830 for Waste Processing - Class I Exempt; $39,959 for Waste Processing - Class I; $94,661 for Waste Processing - Class II; and $273,800 for Waste Processing - Class III.

(c) An application for a major amendment of a license issued under Subchapter F, Subchapter G, Subchapter K, Subchapter L, or Subchapter M of this chapter must be accompanied by an application fee of $10,000.

(d) An application for renewal of a license issued under Subchapter F, Subchapter G, Subchapter K, Subchapter L, or Subchapter M of this chapter must be accompanied by an application fee of $35,000.

(e) Upon permanent cessation of all disposal activities and approval of the final decommissioning plan, holders of licenses issued under Subchapter F, Subchapter K, Subchapter L, or Subchapter M of this chapter shall use the applicable fee schedule for subsections (b) and (c) of this section.

(f) For any application for a license issued under this chapter, the commission may assess and collect additional fees from the applicant to recover costs. Recoverable costs include costs incurred by the commission for administrative review, technical review, and hearings associated with the application. The executive director shall send an invoice for the amount of the costs incurred during the period September 1 through August 31 of each year. Payment shall be made within 30 days following the date of the invoice.

(g) If a licensee remitted a biennial licensing fee to the Texas Department of State Health Services during the one year period prior to June 17, 2007, the licensee is not subject to an annual fee under subsection (b) of this section until the expiration of the second year for which the biennial fee was paid.

(h) The commission may charge an additional 5% of annual fee assessed under subsection (b) of this section <u>and §336.103 of this title (relating to Schedule of Fees for Subchapter H Licenses)</u>. The fee is non-refundable and will be deposited to the perpetual care account.

<u>(1) The fees collected by the agency in accordance with this subsection shall be deposited to the credit of the Radiation and Perpetual Care Account, until the fees collectively total $500,000.</u>

<u>(2) If the balance of fees collected in accordance with this subsection is subsequently reduced to $350,000 or less, the agency shall reinstitute assessment of the fee until the balance reaches $500,000.</u>

(i) The holder of a license authorizing disposal of a radioactive substance from other persons shall remit to the commission 5% of the holder's gross receipts received from disposal operations under a license. Payment shall be made within 30 days of the end of each quarter. The end of each quarter is the last day of the months of November, February, May, and August. This subsection does not apply to the disposal of compact waste or federal facility waste.

(j) The holder of a license authorizing disposal of a radioactive substance from other persons shall remit directly to the host county 5% of the gross receipts disposal operations under a license as required in Texas Health and Safety Code, §401.271(2). Payment shall be made within 30 days of the end of each quarter. The end of each quarter is the last day of the months of November, February, May, and August. This subsection does not apply to the disposal of compact waste or federal facility waste.

SUBCHAPTER C: GENERAL LICENSING REQUIREMENTS

§336.210

Statutory Authority

The amendment is adopted under the Texas Radiation Control Act, Texas Health and Safety Code (THSC), Chapter 401; THSC, §401.011, which provides the commission authority to regulate and license the disposal of radioactive substances, the commercial processing and storage of radioactive substances, and the recovery and processing of source material; §401.051, which authorizes the commission to adopt rules and guidelines relating to control of sources of radiation; §401.103, which authorizes the commission to adopt rules and guidelines that provide for licensing and registration for the control of sources of radiation; §401.104, which requires the commission to provide rules for licensing for the disposal of radioactive substances; §401.201, which provides authority to the commission to regulate the disposal of low-level radioactive waste; §401.301, which authorizes the commission to set fees by rule; and §401.412, which provides authority to the commission to regulate licenses for the disposal of radioactive substances. The adopted amendment is also authorized by Texas Water Code, §5.103, which provides the commission with the authority to adopt rules necessary to carry out its powers and duties under the water code and other laws of the state.

The adopted amendment implements THSC, Chapter 401, including §§401.011,

§401.051, §401.057, §401.059, §401.103, §401.104, §401.151, §401.201, §401.301, and §401.412.

§336.210. Emergency Plan for Responding to a Release.

(a) A new or renewal application for each specific license to possess radioactive materials in unsealed form, on foils or plated sources, or sealed in glass in excess of the quantities in subsection (e) of this section shall contain either:

(1) an evaluation showing that the maximum dose to a person off-site due to a release of radioactive material would not exceed 1 rem effective dose equivalent or 5 rems to the thyroid; or

(2) an emergency plan for responding to a release of radioactive material.

(b) One or more of the following factors may be used to support an evaluation submitted in accordance with subsection (a)(1) of this section:

(1) the radioactive material is physically separated so that only a portion could be involved in an accident;

(2) all or part of the radioactive material is not subject to release during an accident because of the way it is stored or packaged;

(3) the release fraction in the respirable size range would be lower than the release fraction in subsection (e) of this section due to the chemical or physical form of the material;

(4) the solubility of the radioactive material would reduce the dose received;

(5) facility design or engineered safety features in the facility would cause the release fraction to be lower than that in subsection (e) of this section;

(6) operating restrictions or procedures would prevent a release fraction as large as that in subsection (e) of this section; or

(7) other factors appropriate for the specific facility.

(c) An emergency plan for responding to a release of radioactive material submitted in accordance with subsection (a)(1) of this section shall include the following information.

(1) Facility description. A brief description of the licensee's facility and area near the site.

(2) Types of accidents. An identification of each type of radioactive materials accident for which protective actions may be needed.

(3) Classification of accidents. A classification system for classifying accidents as alerts or site area emergencies.

(4) Detection of accidents. Identification of the means of detecting each type of accident in a timely manner.

(5) Mitigation of consequences. A brief description of the means and equipment for mitigating the consequences of each type of accident, including those provided to protect workers onsite, and a description of the program for maintaining the equipment.

(6) Assessment of releases. A brief description of the methods and equipment to assess releases of radioactive materials.

(7) Responsibilities. A brief description of the responsibilities of licensee personnel should an accident occur, including identification of personnel responsible for

promptly notifying off-site response organizations and the agency; also, responsibilities for developing, maintaining, and updating the plan.

(8) Notification and coordination. A commitment to and a brief description of the means to promptly notify off-site response organizations and request off-site assistance, including medical assistance for the treatment of contaminated injured onsite workers when appropriate. A control point shall be established. The notification and coordination shall be planned so that unavailability of some personnel, parts of the facility, and some equipment will not prevent the notification and coordination. The licensee shall also commit to notify the agency immediately after notification of the appropriate off-site response organizations and not later than one hour after the licensee declares an emergency. These reporting requirements do not supersede or release licensees from complying with the requirements in accordance with the Emergency Planning and Community Right-to-Know-Act of 1986, Title III, Publication L. 99-499 or other state or federal reporting requirements.

(9) Information to be communicated. A brief description of the types of information on facility status, radioactive releases, and recommended protective actions, if necessary, to be given to off-site response organizations and to the agency.

(10) Training. A brief description of the frequency, performance objectives, and plans for the training that the licensee will provide workers on how to respond to an emergency, including any special instructions and orientation tours the licensee would offer to fire, police, medical, and other emergency personnel. The training shall familiarize personnel with site-specific emergency procedures. Also, the training shall thoroughly prepare site personnel for their responsibilities in the event of accident scenarios postulated as most probable for the specific site, including the use of team training for such scenarios.

(11) Safe shutdown. A brief description of the means of restoring the facility to a safe condition after an accident.

(12) Exercises. Provisions for conducting quarterly communications checks with off-site response organizations at intervals not to exceed three months and biennial onsite exercises to test response to simulated emergencies. Communications checks with off-site response organizations shall include the check and update of all necessary telephone numbers. The licensee shall invite off-site response organizations to participate in the biennial exercises. Participation of off-site response organizations in biennial exercises, although recommended, is not required. Exercises shall use accident scenarios postulated as most probable for the specific site and the scenarios shall not be known to most exercise participants. The licensee shall critique each exercise using

individuals not having direct implementation responsibility for the plan. Critiques of exercises shall evaluate the appropriateness of the plan, emergency procedures, facilities, equipment, training of personnel, and overall effectiveness of the response. Deficiencies found by the critiques shall be corrected.

(13) Hazardous chemicals. A certification that the applicant has met its responsibilities in accordance with the Emergency Planning and Community Right-to-Know Act of 1986, Title III, Publication L. 99-499, if applicable to the applicant's activities at the proposed place of use of the radioactive material.

(d) The licensee shall allow the off-site response organizations expected to respond in case of an accident 60 days to comment on the licensee's emergency plan before submitting it to the agency. The licensee shall provide any comments received within the 60 days to the agency with the emergency plan.

(e) The following indicates release fractions for radioactive material.

Figure: 30 TAC §336.210(e)

[Figure: 30 TAC §336.210(e)]

Radioactive Material*	**Release Fraction**	**Quantity (curies)**	**Radioactive Material***	**Release Fraction**	**Quantity (curies)**	**Radioactive Material***	**Release Fraction**	**Quantity (curies)**

Ac-228 (89)	0.001	4,000	In-114m (49)	0.01	1,000	V-48 (23)	0.01	7,000
Am-241 (95)	0.001	2	Ir-192 (77)	0.001	40,000	Xe-133 (54)	1.0	900,000
Am-242 (95)	0.001	2	Fe-55 (26)	0.01	40,000	Y-91 (39)	0.01	2,000
Am-243 (95)	0.001	2	Fe-59 (26)	0.01	7,000	Zn-65 (30)	0.01	5,000
Sb-124 (51)	0.01	4,000	Kr-85 (36)	1.0	6,000,000	Zr-93 (40)	0.01	400
Sb-126 (51)	0.01	6,000	Pb-210 (82)	0.01	8	Zr-95 (40)	0.01	5,000
Ba-133 (56)	0.01	10,000	Mn-56 (25)	0.01	60,000	Any other beta-gamma emitter [β-emitter]		
Ba-140 (56)	0.01	30,000	Hg-203 (80)	0.01	10,000		0.01	10,000
Bi-207 (83)	0.01	5,000	Mo-99 (42)	0.01	30,000	Mixed fission products		
Bi-210 (83)	0.01	600	Np-237 (93)	0.001	>2		0.01	1,000
Cd-109 (48)	0.01	1,000	Ni-63 (28)	0.01	20,000	Mixed corrosion products		
Cd-113 (48)	0.01	80	Nb-94 (41)	0.01	300			
Ca-45 (20)	0.01	20,000	P-32 (15)	0.5	100		0.01	10,000
Cf-252 (98)	0.001	9(20mg)	P-33 (15)	0.5	1,000	Contaminated equipment, beta-gamma [β-]		
C-14 (6)**	0.01	50,000	Po-210 (84)	0.01	10			
Ce-141 (58)	0.01	10,000	K-42 (19)	0.01	9,000		0.001	10,000
Ce-144 (58)	0.01	300	Pm-145 (61)	0.01	4,000	Irradiated material, any form other than solid non-combustible		
Cs-134 (55)	0.01	2,000	Pm-147 (61)	0.01	4,000			
Cs-137 (55)	0.01	2,000	Ra-226 (88)	0.001	100			
Cl-36 (17)	0.5	100	Ru-106 (44)	0.01	200			
Cr-51 (24)	0.01	300,000	Sm-151 (62)	0.01	4,000			
Co-60 (27)	0.001	5,000	Sc-46 (21)	0.01	3,000		0.01	1,000
Cu-64 (29)	0.01	200,000	Se-75 (34)	0.01	10,000	Irradiated material, solid non-		
Cm-242 (96)	0.001	60	Ag110m (47)	0.01	1,000		0.001	10,000

Cm-243 (96)	0.001	3	Na-22 (11)	0.01	9,000	combustible		
Cm-244 (96)	0.001	4	Na-24 (11)	0.01	10,000			
Cm-245 (96)	0.001	2	Sr-89 (38)	0.01	3,000	Mixed radioactive waste, <u>beta-gamma</u> [β-]		
Eu-152 (63)	0.01	500	Sr-90 (38)	0.01	90			
Eu-154 (63)	0.01	400	Sr-35 (16)	0.5	900		0.01	1,000
Eu-155 (63)	0.01	3,000	Tc-99 (43)	0.01	10,000	Packaged <u>mixed</u> waste, <u>beta-gamma</u> [β-]***		
Ge-68 (32)	0.01	2,000	Tc-99m (43)	0.01	400,000			
Gd-153 (64)	0.01	5,000	Te-127m(52)	0.01	5,000		0.001	10,000
Au-198 (79)	0.01	30,000	Te-129m(52)	0.01	5,000	Any other <u>alpha emitter</u> [α-emitter]		
Hf-172 (72)	0.01	400	Tb-160 (65)	0.01	4,000		0.001	2
Hf-181 (72)	0.01	7,000	Tm-170 (69)	0.01	4,000	Contaminated equipment, <u>alpha</u> [α]		
Ho-166 (67)	0.01	100	Sn-113 (50)	0.01	10,000		0.0001	20
H-3 (1)	0.5	20,000	Sn-123 (50)	0.01	3,000	Packaged waste<u>, alpha</u>***		
I-125 (53)	0.5	10	Sn-126 (50)	0.01	1,000		0.0001	20
I-131 (53)	0.5	10	Ti-144 (22)	0.01	100			

* For combinations of <u>radioactive materials</u> [radionuclides], consideration of the need for an emergency plan is required if the sum of the ratios of the quantity of each <u>radioactive material</u> [radionuclide] authorized to the quantity listed for that <u>material</u> [radionuclide] in this paragraph exceeds one.

**<u>Non-carbon dioxide</u> [Non CO] forms only.

***Waste packaged in Type B containers does not require an emergency plan.

SUBCHAPTER D: STANDARDS FOR PROTECTION AGAINST RADIATION

§§336.305, 336.309, 336.331, 336.351, 336.357, 336.359

Statutory Authority

The amendments and new sections are adopted under the Texas Radiation Control Act, Texas Health and Safety Code (THSC), Chapter 401; THSC, §401.011,which provides the commission authority to regulate and license the disposal of radioactive substances, the commercial processing and storage of radioactive substances, and the recovery and processing of source material; §401.051, which authorizes the commission to adopt rules and guidelines relating to control of sources of radiation; §401.103, which authorizes the commission to adopt rules and guidelines that provide for licensing and registration for the control of sources of radiation; §401.104, which requires the commission to provide rules for licensing for the disposal of radioactive substances; §401.201, which provides authority to the commission to regulate the disposal of low-level radioactive waste; §401.301, which authorizes the commission to set fees by rule; and §401.412, which provides authority to the commission to regulate licenses for the disposal of radioactive substances. The adopted amendments and new sections are also authorized by Texas Water Code, §5.103, which provides the commission with the authority to adopt rules necessary to carry out its powers and duties under the water code and other laws of the state.

The adopted amendments and new sections implement THSC, Chapter 401, including §§401.011, 401.051, 401.057, 401.059, 401.103, 401.104, 401.151, 401.201, 401.301, and 401.412.

§336.305. Occupational Dose Limits for Adults.

(a) The licensee shall control the occupational dose to individual adults, except for planned special exposures under §336.310 of this title (relating to Planned Special Exposures), to the following dose limits:

(1) an annual limit, which is the more limiting of:

(A) the total effective dose equivalent being equal to 5 rems (0.05 sievert); or

(B) the sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 50 rems (0.5 sievert).

(2) the annual limits to the lens of the eye, to the skin of the whole body, and to the skin of the extremities, which are:

(A) a lens dose equivalent of 15 rems (0.15 sievert), and

(B) a shallow-dose equivalent of 50 rems (0.5 sievert) to the skin of the whole body or to the skin of any extremity.

(b) Doses received in excess of the annual limits, including doses received during accidents, emergencies, and planned special exposures, shall be subtracted from the limits for planned special exposures that the individual may receive during the current year and during the individual's lifetime. See §336.310(5)(A) and (B) of this title [(relating to Planned Special Exposures)].

(c) <u>When the external exposure is determined by measurement with an external personal monitoring device, the deep-dose equivalent must be used in place of the effective dose equivalent, unless the effective dose equivalent is determined by a dosimetry method approved by the executive director.</u> The assigned deep-dose equivalent must be for the part of the body receiving the highest exposure. The assigned [and] shallow-dose equivalent must be the dose averaged over the contiguous ten square centimeters of skin [for the part of the body] receiving the highest exposure. The deep-dose equivalent, lens dose equivalent, and shallow-dose equivalent may be assessed from surveys or other radiation measurements for the purpose of demonstrating compliance with the occupational dose limits, if the individual monitoring device was not in the region of highest potential exposure or the results of individual monitoring are unavailable.

(d) Derived air concentration (DAC) and annual limit on intake (ALI) values are specified in Table I of §336.359, Appendix B, of this title (relating to Appendix B. Annual Limits on Intake (ALI) and Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sanitary Sewerage) and may be used to determine the individual's dose and to demonstrate compliance with the occupational dose limits. See §336.346 of this title (relating to Records of Individual Monitoring Results).

(e) In addition to the annual dose limits, the licensee shall limit the soluble uranium intake by an individual to 10 milligrams in a week in consideration of chemical toxicity. See note 3 of §336.359, Appendix B, of this title [(relating to Annual Limits on Intake (ALI) and Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sanitary Sewerage)].

(f) The licensee shall reduce the dose that an individual may be allowed to receive in the current year by the amount of occupational dose received while employed by any other person. See §336.309(e) of this title (relating to Determination of Prior Occupational Dose).

§336.309. Determination of Prior Occupational Dose.

(a) For each individual who is likely to receive in a year an occupational dose requiring monitoring under §336.316 of this title (relating to Conditions Requiring Individual Monitoring of External and Internal Occupational Dose), the licensee shall [:]

[(1)] determine the occupational radiation dose received during the current year [; and]

[(2) attempt to obtain the records of lifetime cumulative occupational radiation dose].

(b) Before permitting an individual to participate in a planned special exposure, the licensee shall determine:

(1) the internal and external doses from all previous planned special exposures; and

(2) all doses in excess of the limits, including doses received during accidents and emergencies, received during the lifetime of the individual.

(c) In complying with the requirements of subsection (a) or (b) of this section, a licensee may:

(1) accept, as a record of the occupational dose that the individual received during the current year, a written signed statement from the individual, or from the individual's most recent employer for work involving radiation exposure, that discloses the nature and the amount of any occupational dose that the individual received during the current year; and

(2) accept, as the record of lifetime cumulative radiation dose, an up-to-date form "Cumulative Occupational Exposure History" (see §336.367, Appendix J of this title (relating to Appendix J. Cumulative Occupational Exposure History)) or equivalent, signed by the individual and countersigned by an appropriate official of the most recent employer for work involving radiation exposure, or the individual's current employer, if the individual is not employed by the licensee; and

(3) obtain reports of the individual's dose equivalent from the most recent employer for work involving radiation exposure, or the individual's current employer, if

the individual is not employed by the licensee, by telephone, telegram, electronic media, or letter. The licensee shall request a written verification of the dose data if the authenticity of the transmitted report cannot be established.

(d) The licensee shall record individual exposure histories.

(1) The licensee shall record the exposure history of each individual, as required by subsection (a) or (b) of this section, on form "Cumulative Occupational Exposure History" (see §336.367, Appendix J of this title) or other clear and legible record which includes all of the information required on that form. The form or record shall show each period in which the individual received occupational exposure to radiation or radioactive material and shall be signed by the individual who received the exposure. For each period for which the licensee obtains reports, the licensee shall use the dose shown in the report in preparing form "Cumulative Occupational Exposure History" (see §336.367, Appendix J of this title) or equivalent. For any period for which the licensee does not obtain a report, the licensee shall place a notation on form "Cumulative Occupational Exposure History" (see §336.367, Appendix J of this title) or equivalent indicating the periods of time for which data are not available.

(2) Licensees are not required to separate historical dose, obtained and recorded before January 1, 1994, into external dose equivalent(s) and internal

committed dose equivalent(s). Further, occupational exposure histories obtained and recorded on form "Cumulative Occupational Exposure History" (see §336.367, Appendix J of this title) or equivalent before January 1, 1994, would not have included effective dose equivalent but may be used in the absence of specific information on the intake of radionuclides by the individual.

(e) If the licensee is unable to obtain a complete record of an individual's current and previously accumulated occupational dose, the licensee shall assume:

(1) in establishing administrative controls under §336.305(f) of this title (relating to Occupational Dose Limits for Adults) for the current year, that the allowable dose limit for the individual is reduced by 1.25 rems (12.5 millisieverts) for each quarter for which records are unavailable and that the individual was engaged in activities that could have resulted in occupational radiation exposure; and

(2) that the individual is not available for planned special exposures.

<u>(f) The licensee shall retain the records on form "Cumulative Occupational Exposure History" (see §336.367, Appendix J of this title) or equivalent until the executive director terminates each pertinent license requiring this record. The licensee shall retain records used in preparing form "Cumulative Occupational Exposure</u>

History" (see §336.367, Appendix J of this title) for three years after the record is made. This includes records required under the standards for protection against radiation in effect prior to January 1, 1994.

§336.331. Transfer of Radioactive Material.

(a) The licensee shall not transfer source material, byproduct material, or other licensed radioactive material except as authorized under the rules in this subchapter.

(b) Except as otherwise provided in the license and subject to the provisions of subsections (c) and (d) of this section, a licensee shall transfer source material, byproduct material, or other licensed radioactive material:

(1) to the agency (A licensee shall transfer material to the agency only after receiving prior approval from the agency. If the material to be transferred is special nuclear material, the quantity must not be sufficient to form a critical mass.);

(2) to the United States Department of Energy;

(3) to any person exempt from licensing requirements by the Texas Department of State Health Services (DSHS) [(TDH)] under the Texas Health and

Safety Code, §401.106(a), the rules in this chapter, or exempt from the licensing requirements of the United States Nuclear Regulatory Commission (NRC) or an Agreement State, to the extent permitted by those exemptions;

(4) to any person authorized to receive this material under terms of a specific or a general license or its equivalent issued by the commission, DSHS [TDH], NRC, or any Agreement State, or to any person authorized to receive this material by the federal government; or

(5) as otherwise authorized by the commission in writing by DSHS [TDH], any Agreement State, or the federal government.

(c) Before transferring source material, byproduct material, or other radioactive material to a specific licensee of the commission, DSHS [TDH], NRC, or an Agreement State or to a general licensee who is required to register with DSHS [TDH], NRC, or an Agreement State prior to receipt of the source material, byproduct material, or other radioactive material, the licensee transferring the material shall verify that the transferee's license authorizes the receipt of the type, form, and quantity of radioactive material to be transferred.

(d) The following methods for the verification required by subsection (c) of this section are acceptable.

(1) The transferor shall possess and have read a current copy of the transferee's specific license or certificate of registration.

(2) The transferor may possess a written certification by the transferee that the transferee is authorized by the license or certificate of registration to receive the type, form, and quantity of radioactive material to be transferred, specifying the license or certificate of registration number, issuing agency, and expiration date.

(3) For emergency shipments, the transferor may accept oral certification by the transferee that the transferee is authorized by license or certificate of registration to receive the type, form, and quantity of radioactive material to be transferred, specifying the license or certificate of registration number, issuing agency, and expiration date, provided that the oral certification is confirmed in writing within ten days.

(4) The transferor may obtain other sources of information compiled by a reporting service from official records of the commission, DSHS [TDH], NRC, or an

Agreement State as to the identity of licensees and registrants and the scope and expiration dates of licenses and registrations.

(5) When none of the methods of verification described in paragraphs (1) - (4) of this subsection are readily available or when a transferor desires to verify that information received by one of these methods is correct or up-to-date, the transferor may obtain and record confirmation from the commission, DSHS [TDH], NRC, or an Agreement State that the transferee is licensed to receive the source material, byproduct material, or other radioactive material.

(e) Transportation of radioactive material shall also be subject to applicable rules of the United States Department of Transportation, United States Postal Service, NRC, or DSHS [TDH].

(f) The licensee shall keep records showing the transfer of any source material, byproduct material, or other radioactive material.

(g) Transfer of low-level radioactive waste by a waste generator, waste collector, or waste processor who ships this waste either directly, or indirectly through a collector or processor, to a licensed land disposal facility shall also be subject to applicable rules of DSHS [TDH]. A commission licensee who transfers low-level radioactive waste for disposal at a licensed land disposal facility shall also be subject to applicable rules of DSHS [TDH] with respect to transfers.

(h) A licensed land disposal facility operator shall use and comply with the requirements of §336.363 of this title (relating to Appendix F. Requirements for Receipt of Low-Level Radioactive Waste for Disposal at Licensed Land Disposal Facilities and Uniform Manifests).

(i) Any licensee shipping byproduct material, as defined in §336.2(16)(C) - (E) of this title (relating to Definitions) concerning the definition of byproduct material, intended for ultimate disposal must document the information required on the shipping manifest and transfer this recorded manifest information to the intended consignee.

§336.351. Reports of Transactions Involving Nationally Tracked Sources.

(a) Each licensee who manufactures, transfers, receives, disassembles, or disposes of a nationally tracked source shall complete and submit to the United States Nuclear Regulatory Commission (NRC) a National Source Tracking Transaction Report as specified in paragraphs (1) - (6)~~(5)~~ of this subsection for each type of transaction.

(1) Each licensee who manufactures a nationally tracked source shall complete and submit to NRC a National Source Tracking Transaction Report. The report must include the following information:

(A) the name, address, and license number of the reporting licensee;

(B) the name of the individual preparing the report;

(C) the manufacturer, model, and serial number of the source;

(D) the radioactive material in the source;

(E) the initial source strength in becquerels (curies) at the time of manufacture; and

(F) the manufacture date of the source.

(2) Each licensee that transfers a nationally tracked source to another person shall complete and submit to NRC a National Source Tracking Transaction Report. ~~Domestic transactions in which the nationally tracked source remains in the~~

~~possession of the licensee do not require a report to the National Source Tracking System.~~ The report shall include the following information:

(A) the name, address, and license number of the reporting licensee;

(B) the name of the individual preparing the report;

(C) the name and license number of the recipient facility and the shipping address;

(D) the manufacturer, model, and serial number of the source or, if not available, other information to uniquely identify the source;

(E) the radioactive material in the source;

(F) the initial or current source strength in becquerels (curies);

(G) the date for which the source strength is reported;

(H) the shipping date;

(I) the estimated arrival date; and

(J) for nationally tracked sources transferred as waste under a Uniform Low-Level Radioactive Waste Manifest, the waste manifest number and the container identification of the container with the nationally tracked source.

(3) Each licensee that receives a nationally tracked source shall complete and submit to NRC a National Source Tracking Transaction Report. The report shall include the following information:

(A) the name, address, and license number of the reporting licensee;

(B) the name of the individual preparing the report;

(C) the name, address, and license number of the person that provided the source;

(D) the manufacturer, model, and serial number of the source or, if not available, other information to uniquely identify the source;

(E) the radioactive material in the source;

(F) the initial or current source strength in becquerels (curies);

(G) the date for which the source strength is reported;

(H) the date of receipt; and

(I) for material received under a Uniform Low-Level Radioactive Waste Manifest, the waste manifest number and the container identification with the nationally tracked source.

(4) Each licensee that disassembles a nationally tracked source shall complete and submit to NRC a National Source Tracking Transaction Report. The report shall include the following information:

(A) the name, address, and license number of the reporting licensee;

(B) the name of the individual preparing the report;

(C) the manufacturer, model, and serial number of the source or, if not available, other information to uniquely identify the source;

(D) the radioactive material in the source;

(E) the initial or current source strength in becquerels (curies);

(F) the date for which the source strength is reported; and

(G) the disassemble date of the source.

(5) Each licensee who disposes of a nationally tracked source shall complete and submit to NRC a National Source Tracking Transaction Report. The report shall include the following information:

(A) the name, address, and license number of the reporting licensee;

(B) the name of the individual preparing the report;

(C) the waste manifest number;

(D) the container identification with the nationally tracked source;

(E) the date of disposal; and

(F) the method of disposal.

(6) The reports discussed in paragraphs (1) - (6)~~(5)~~ of this subsection shall be submitted to NRC by the close of the next business day after the transaction. A single report may be submitted for multiple sources and transactions. The reports shall be submitted to the National Source Tracking System by using the following:

(A) the on-line National Source Tracking System;

(B) electronically using a computer-readable format;

(C) by facsimile;

(D) by mail to the address on the National Source Tracking Transaction Report Form (NRC Form 748); or

(E) by telephone with follow-up by facsimile or mail.

(7) Each licensee shall correct any error in previously filed reports or file a new report for any missed transaction within five business days of the discovery of the error or missed transaction. Such errors may be detected by a variety of methods such as administrative reviews or by physical inventories required by regulation. In addition, each licensee shall reconcile the inventory of nationally tracked sources possessed by the licensee against that licensee's data in the National Source Tracking System. The reconciliation shall be conducted during the month of January in each year. The reconciliation process shall include resolving any discrepancies between the National Source Tracking System and the actual inventory by filing the reports identified by paragraphs (1) - (6)~~(5)~~ of this subsection. By January 31 of each year, each licensee shall submit to the National Source Tracking System confirmation that the data in the National Source Tracking System is correct.

(8) Each licensee that possesses Category 1 or Category 2 nationally tracked sources listed in subsection (b) of this section shall report its initial inventory of Category 1 or Category 2 nationally tracked sources to the National Source Tracking System by January 31, 2009. The information may be submitted to NRC by using any of

the methods identified by paragraph (6)(A) - (E) of this subsection. The initial inventory report shall include the following information:

(A) the name, address, and license number of the reporting licensee;

(B) the name of the individual preparing the report;

(C) the manufacturer, model, and serial number of each nationally tracked source or, if not available, other information to uniquely identify the source;

(D) the radioactive material in the sealed source;

(E) the initial or current source strength in becquerels (curies); and

(F) the date for which the source strength is reported.

(b) Nationally tracked source thresholds. The Terabecquerel (TBq) values are the regulatory standards. The curie values specified are obtained by converting from the TBq value. The curie values are provided for practical usefulness only and are rounded after conversion. The following table contains nationally tracked source thresholds.

Figure: 30 TAC §336.351(b)

Nationally Tracked Sources Threshold				
Radioactive Material	Category 1 (TBq)	Category 1 (Ci)	Category 2 (TBq)	Category 2 (Ci)
Actinium-227	20	540	0.2	5.4
Americium-241	60	1,600	0.6	16.0
Americium-241/Be	60	1,600	0.6	16.0
Californium-252	20	540	0.2	5.4
Cobalt-60	30	810	0.3	8.1
Curium-244	50	1,400	0.5	14.0
Cesium-137	100	2,700	1.0	27.0
Gadolinium-153	1,000	27,000	10.0	270.0
Iridium-192	80	2,200	0.8	22.0
Plutonium-238	60	1,600	0.6	16.0
Plutonium-239/Be	60	1,600	0.6	16.0
Polonium-210	60	1,600	0.6	16.0
Promethium-147	40,000	1,100,000	400.0	11,000.0
Radium-226	40	1,100	0.4	11.0
Selenium-75	200	5,400	2.0	54.0
Strontium-90	1,000	27,000	10.0	270.0
Thorium-228	20	540	0.2	5.4
Thorium-229	20	540	0.2	5.4
Thulium-170	20,000	540,000	200.0	5,400.0
Ytterbium-169	300	8,100	3.0	81.0

TBq - Terabecquerel

Ci - Curie

§336.357. Increased Controls for Licensees that Possess Sources Containing Radioactive Material Quantities of Concern.

Licensees possessing sources containing radioactive material, at any given time, in quantities greater than or equal to the quantities of concern listed in paragraph (11) of this section shall:

(1) control access at all times to radioactive material in quantities of concern and devices containing such radioactive material (devices) ~~in quantities~~ in accordance with paragraph (11) of this section; and

(2) limit access to such radioactive material and devices to only approved individuals who require access to perform their duties.

(A) The licensee shall allow only trustworthy and reliable individuals, approved in writing by the licensee, to have unescorted access to radioactive material quantities of concern and devices.

(B) The licensee shall approve for unescorted access only those individuals with job duties that require access to such radioactive material and devices. Personnel who require access to such radioactive material and devices to perform a job duty, but who are not approved by the licensee for unescorted access, must be escorted by an approved individual.

(C) For individuals employed by the licensee for three years or less, and for non-licensee personnel, such as physicians, physicists, house-keeping personnel, and security personnel under contract, trustworthiness and reliability shall be determined, at a minimum, by verifying employment history, education, and personal references. The licensee shall also, to the extent possible, obtain independent information to corroborate that provided by the employee (i.e., seeking references not supplied by the individual). For individuals employed by the licensee for longer than three years, trustworthiness and reliability shall be determined, at a minimum, by a review of the employees' employment history with the licensee.

(D) Service providers shall be escorted unless determined to be trustworthy and reliable by an NRC required background investigation as an employee of a manufacturing and distribution licensee. Written verification attesting to or certifying the person's trustworthiness and reliability shall be obtained from the manufacturing and distribution licensee providing the service.

(E) The licensee shall document the basis for concluding that there is reasonable assurance that an individual granted unescorted access is trustworthy and reliable, and does not constitute an unreasonable risk for unauthorized use of radioactive material quantities of concern. The licensee shall maintain a list of persons approved for unescorted access to such radioactive material and devices by the licensee.

(3) Each licensee shall have a documented program to monitor and immediately detect, assess, and respond to unauthorized access to radioactive material quantities of concern and devices in use or in storage. Enhanced monitoring shall be provided during periods of source delivery or shipment, where the delivery or shipment exceeds 100 times the values listed in paragraph (11) of this section.

(A) The licensee shall respond immediately to any actual or attempted theft, sabotage, or diversion of such radioactive material or of the devices.

The response shall include requesting assistance from a Local Law Enforcement Agency (LLEA).

(B) The licensee shall have a pre-arranged plan with LLEA for assistance in response to an actual or attempted theft, sabotage, or diversion of such radioactive material or of the devices which is consistent in scope and timing with a realistic potential vulnerability of the sources containing such radioactive material. The pre-arranged plan shall be updated when changes to the facility design or operation affect the potential vulnerability of the sources.

(C) The licensee shall have a dependable means to transmit information between, and among, the various components used to detect and identify an unauthorized intrusion, to inform the assessor, and to summon the appropriate responder.

(D) After initiating appropriate response to any actual or attempted theft, sabotage, or diversion of radioactive material or of the devices, the licensee shall, as promptly as possible, notify the Office of Compliance and Enforcement 24-hour Emergency Response at 800-832-8224 ~~United States Nuclear Regulatory Commission (NRC) Operations Center at (301) 816-5100~~.

(E) The licensee shall maintain documentation describing each instance of unauthorized access and any necessary corrective actions to prevent future instances of unauthorized access.

(4) In order to ensure the safe handling, use, and control of licensed material in transportation for domestic highway and rail shipments by a carrier other than the licensee, for quantities that equal or exceed but are less than 100 times those listed in paragraph (11) of this section, per consignment, the licensee shall:

(A) use carriers which:

(i) use package tracking systems;

(ii) implement methods to assure trustworthiness and reliability of drivers;

(iii) maintain constant control and/or surveillance during transit; and

(iv) have the capability for immediate communication to summon appropriate response or assistance;

(B) verify and document that the carrier employs the measures in subparagraph (A) of this paragraph;

(C) contact the recipient to coordinate the expected arrival time of the shipment;

(D) confirm receipt of the shipment; and

(E) initiate an investigation to determine the location of the licensed material if the shipment does not arrive on or about the expected arrival time. When, through the course of the investigation, it is determined the shipment has become lost, stolen, or is missing, the licensee shall immediately notify the Office of Compliance and Enforcement 24-hour Emergency Response at 800-832-8224 ~~NRC Operations Center at (301) 816-5700~~. If, after 24 hours of investigating, the location of the material still cannot be determined, the radioactive material shall be deemed missing and the licensee shall immediately notify the Office of Compliance and Enforcement 24-hour Emergency Response at 800-832-8224 ~~NRC Operations Center at (301) 816-5700~~.

(5) For domestic highway and rail shipments, prior to shipping licensed radioactive material that exceeds 100 times the quantities in paragraph (11) of this section per consignment, the licensee shall:

(A) Notify the United States Nuclear Regulatory Commission (NRC) ~~NRC~~ Director, Office of Federal and State Materials and Environmental Management Programs, ~~Office of Nuclear Safety and Safeguards~~ United States Nuclear Regulatory Commission, Washington, DC 20555, in writing, at least 90 days prior to the anticipated date of shipment. The NRC will issue the Order to implement the Additional Security Measures (ASMs) for the transportation of Radioactive Material Quantities of Concern (RAM QC). The licensee shall not ship this material until the ASMs for the transportation of RAM QC are implemented or the licensee is notified otherwise, in writing, by the NRC.

(B) Once the licensee has implemented the ASMs for the transportation of RAM QC, the notification requirements in subparagraph (A) of this paragraph shall not apply to future shipments of licensed radioactive material that exceeds 100 times the quantities listed in paragraph (11) of this section. The licensee shall implement the ASMs for the transportation of RAM QC.

(6) If a licensee employs an Manufacturer/Distributor (M&D) licensee to take possession at the licensee's location of the licensed radioactive material and ship it under its M&D license, the requirements of paragraphs (4) ~~paragraph~~ and (5)(A) and (B) of this section shall not apply.

(7) If the licensee is to receive radioactive material greater than or equal to the quantities in paragraph (11) of this section, per consignment, the licensee shall coordinate with the originator to:

(A) establish an expected time of delivery; and

(B) confirm receipt of transferred radioactive material. If the material is not received at the expected time of delivery, notify the originator and assist in any investigation.

(8) Each licensee who possesses mobile or portable devices containing radioactive material in quantities greater than or equal to the values listed in paragraph (11) of this section, shall:

(A) For portable devices, have two independent physical controls that form tangible barriers to secure the material from unauthorized removal when the device is not under direct control and constant surveillance by the licensee.

(B) For mobile devices:

(i) that are only moved outside of the facility (e.g., on a trailer), have two independent physical controls that form tangible barriers to secure the material from unauthorized removal when the device is not under direct control and constant surveillance by the licensee.

(ii) that are only moved inside a facility, have a physical control that forms a tangible barrier to secure the material from unauthorized movement or removal when the device is not under direct control and constant surveillance by the licensee.

(C) For devices in or on a vehicle or trailer, licensees shall also utilize a method to disable the vehicle or trailer when not under direct control and constant surveillance by the licensee.

(9) The licensee shall retain documentation required by these increased controls for inspection by the executive director ~~agency~~ for three years after they are no longer effective.

(A) The licensee shall retain documentation regarding the trustworthiness and reliability of individual employees for three years after the individual's employment ends.

(B) Each time the licensee revises the list of approved persons required by paragraph (2)(E) of this section, or the documented program required by paragraph (3) of this section, the licensee shall retain the previous documentation for three years after the revision.

(C) The licensee shall retain documentation on each radioactive material carrier for three years after the licensee discontinues use of that particular carrier.

(D) The licensee shall retain documentation on shipment coordination, notifications, and investigations for three years after the shipment or investigation is completed.

(E) After the license is terminated or amended to reduce possession limits below the quantities of concern, the licensee shall retain all documentation required by these increased controls for three years.

(10) Detailed information generated by the licensee that describes the physical protection of radioactive material quantities of concern, is sensitive information and shall be protected from unauthorized disclosure.

(A) The licensee shall control access to its physical protection information to those persons who have an established need to know the information, and are considered to be trustworthy and reliable.

(B) The licensee shall develop, maintain, and implement policies and procedures for controlling access to, and for proper handling and protection against unauthorized disclosure of, its physical protection information for radioactive material covered by these requirements. The policies and procedures shall include the following:

(i) general performance requirement that each person who produces, receives, or acquires the licensee's sensitive information, protect the information from unauthorized disclosure;

(ii) protection of sensitive information during use, storage, and transit;

(iii) preparation, identification or marking, and transmission;

(iv) access controls;

(v) destruction of documents;

(vi) use of automatic data processing systems; and

(vii) removal from the licensee's sensitive information category.

(11) Radionuclide quantities of concern. The following methods shall be used to determine which sources of radioactive material require increased controls:

(A) include any single source equal to or greater than the quantity of concern;

(B) include multiple collocated sources of the same radionuclide when the combined quantity equals or exceeds the quantity of concern;

(C) for combinations of radionuclides, include multiple collocated sources of different radionuclides when the aggregate quantities satisfy the following unity rule: ((amount of radionuclide A) / (quantity of concern of radionuclide A)) + ((amount of radionuclide B) / (quantity of concern of radionuclide B)) + etc...> 1; and

(D) The following table contains quantities of radioactive materials to be used in determining a quantity of concern.

Figure: 30 TAC §336.357(11)(D)

Radionuclides of Concern		
Radionuclide	Quantity of Concern[1] (TBq)	Quantity of Concern[2] (Ci)
Am-241	0.6	16
Am-241/Be	0.6	16
Cf-252	0.2	5.4
Cm-244	0.5	14
Co-60	0.3	8.1

Radionuclides of Concern		
Radionuclide	Quantity of Concern[1] (TBq)	Quantity of Concern[2] (Ci)
Cs-137	1	27
Gd-153	10	270
Ir-192	0.8	22
Pm-147	400	11,000
Pu-238	0.6	16
Pu-239/Be	0.6	16
Ra-226	0.4	11
Se-75	2	54
Sr-90 (Y-90)	10	270
Tm-170	200	5,400
Yb-169	3	81
Combinations of radioactive materials listed above[3]	See footnote below[4]	

[1]The aggregate activity of multiple, collocated sources of the same radionuclide should be included when the total activity equals or exceeds the quantity of concern.

[2] The primary values used for compliance with this Order are terabecquerel (TBq). The curie (Ci) values are rounded to two significant figures for informational purposes only.

[3] Radioactive materials are to be considered aggregated or collocated if breaching a common physical security barrier (e.g., a locked door at the entrance to a storage room) would allow access to the radioactive material or devices containing the radioactive material. When transporting or storing sources on vehicles and/or trailers, the sources are automatically considered collocated.

[4] If several radionuclides are aggregated, the sum of the ratios of the activity of each source, i of radionuclide, n, A(i,n), to the quantity of concern for radionuclide n, Q(n), listed for that radionuclide equals or exceeds one. ((aggregated source activity for radionuclide A) /(quantity of concern for radionuclide A)) + ((aggregated source activity for radionuclide B) /(quantity of concern for radionuclide B)) + etc...>1

§336.359. Appendix B. Annual Limits on Intake (ALI) and Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sanitary Sewerage.

(a) Introduction. For each radionuclide, Table I indicates the chemical form that is to be used for selecting the appropriate ALI or DAC value. The ALIs and DACs for inhalation are given for an aerosol with an activity median aerodynamic diameter (AMAD) of 1 micrometer and for three classes (D,W,Y) of radioactive material, which refer to their retention (approximately days, weeks, or years) in the pulmonary region of the lung. This classification applies to a range of clearance half-times for D of less than 10 days, for W from 10 to 100 days, and for Y greater than 100 days.

(1) The class (D, W, or Y) given in the column headed "Class" applies only to the inhalation ALIs and DACs given in Table I, Columns 2 and 3. Table II provides concentration limits for airborne and liquid effluents released to the general environment. Table III provides concentration limits for discharges to sanitary sewerage.

(2) The values in Tables I, II, and III are presented in the computer "E" notation. In this notation, a value of 6E-02 represents a value of 6×10^{-2} or 0.06, 6E+2 represents 6×10^{2} or 600, and 6E+0 represents 6×10^{0} or 6. Values are given in units of microcuries (μCi) or microcuries per milliliter (μCi/ml), as indicated.

(b) Table I, "Occupational Values". Note that the columns in Table I of this appendix captioned "Oral Ingestion ALI," "Inhalation ALI," and "DAC," are applicable to occupational exposure to radioactive material.

(1) The ALIs in this appendix are the annual intakes of a given radionuclide by "reference man" that would result in either a committed effective dose equivalent of 5 rems (0.05 sievert) (stochastic ALI) or a committed dose equivalent of 50 rems (0.5 sievert) to an organ or tissue (non-stochastic ALI). The stochastic ALIs were derived to result in a risk, due to irradiation of organs and tissues, comparable to the risk associated with deep dose equivalent to the whole body of 5 rems (0.05 sievert). The derivation includes multiplying the committed dose equivalent to an organ or tissue by a weighting factor, w_T . This weighting factor is the proportion of the risk of stochastic effects resulting from irradiation of the organ or tissue, T, to the total risk of stochastic effects when the whole body is irradiated uniformly. The values of w_T are listed under the definition of "weighting factor" in §336.2 of this title (relating to Definitions). The

non-stochastic ALIs were derived to avoid non-stochastic effects, such as prompt damage to tissue or reduction in organ function.

(2) A value of $w_T = 0.06$ is applicable to each of the five organs or tissues in the "remainder" category receiving the highest dose equivalents, and the dose equivalents of all other remaining tissues may be disregarded. The following parts of the GI tract--stomach, small intestine, upper large intestine, and lower large intestine--are to be treated as four separate organs.

(3) Note that the dose equivalents for an extremity, skin, and lens of the eye are not considered in computing the committed effective dose equivalent but are subject to limits that must be met separately. When an ALI is defined by the stochastic dose limit, this value alone is given.

(4) When an ALI is determined by the non-stochastic dose limit to an organ, the organ or tissue to which the limit applies is shown, and the ALI for the stochastic limit is shown in parentheses. The following abbreviated organ or tissue designations are used:

(A) LLI wall = lower large intestine wall;

(B) St wall = stomach wall;

(C) Blad wall = bladder wall; and

(D) Bone surf = bone surface.

(5) The use of the ALIs listed first, the more limiting of the stochastic and non-stochastic ALIs, will ensure that non-stochastic effects are avoided and that the risk of stochastic effects is limited to an acceptably low value. If, in a particular situation involving a radionuclide for which the non-stochastic ALI is limiting, use of that non-stochastic ALI is considered unduly conservative, the licensee may use the stochastic ALI to determine the committed effective dose equivalent. However, the licensee shall also ensure that the 50-rem (0.5 sievert) dose equivalent limit for any organ or tissue is not exceeded by the sum of the external deep dose equivalent plus the internal committed dose equivalent to that organ (not the effective dose). For the case where there is no external dose contribution, this would be demonstrated if the sum of the fractions of the nonstochastic ALIs (ALI_{ns}) that contribute to the committed dose equivalent to the organ receiving the highest dose does not exceed 1 (i.e., Sigma (intake in µCi of each radionuclide/ALI_{ns}) $\leq$ 1.0). If there is an external deep-dose equivalent contribution of H_d , then this sum must be less than 1 - (H_d /50), instead of $\leq$ 1.0.

(6) The DAC values are derived limits intended to control chronic occupational exposures. The relationship between the DAC and the ALI is given by:

Figure: 30 TAC §336.359(b)(6)

$$\text{DAC} = \text{ALI(in } \mu\text{Ci)}/(2000 \text{ hours per working year x } 60 \text{ minutes/hour x } 2 \times 10^4 \text{ ml per minute)} = (\text{ALI}/2.4 \times 10^9)\ \mu\text{Ci/ml},$$

where 2×10^4 ml is the volume of air breathed per minute at work by "reference man" under working conditions of light work.

(7) The DAC values relate to one of two modes of exposure: either external submersion or the internal committed dose equivalents resulting from inhalation of radioactive materials. The DAC values based upon submersion are for immersion in a semi-infinite cloud of uniform concentration and apply to each radionuclide separately.

(8) The ALI and DAC values include contributions to exposure by the single radionuclide named and any in-growth of daughter radionuclides produced in the body by decay of the parent. However, intakes that include both the parent and daughter radionuclides shall be treated by the general method appropriate for mixtures.

(9) The values of ALI and DAC do not apply directly when the individual both ingests and inhales a radionuclide, when the individual is exposed to a mixture of radionuclides by either inhalation or ingestion or both, or when the individual is exposed to both internal and external irradiation (see §336.306 of this title (relating to Compliance with Requirements for Summation of External and Internal Doses)). When an individual is exposed to radioactive materials which fall under several of the translocation classifications of the same radionuclide (i.e., Class D, Class W, or Class Y), the exposure may be evaluated as if it were a mixture of different radionuclides.

(10) It shall be noted that the classification of a compound as Class D, W, or Y is based on the chemical form of the compound and does not take into account the radiological half-life of different radionuclides. For this reason, values are given for Class D, W, and Y compounds, even for very short-lived radionuclides.

(c) Table II, "Effluent Concentrations". The columns in Table II of this appendix captioned "Effluent Concentrations," "Air," and "Water" are applicable to the assessment and control of dose to the public, particularly in the implementation of the provisions of §336.314 of this title (relating to Compliance with Dose Limits for Individual Members of the Public). The concentration values given in Columns 1 and 2 of Table II are equivalent to the radionuclide concentrations which, if inhaled or ingested continuously over the course of a year, would produce a total effective dose equivalent of 0.05 rem (0.5 millisievert).

(1) Consideration of non-stochastic limits has not been included in deriving the air and water effluent concentration limits because non-stochastic effects are presumed not to occur at or below the dose levels established for individual members of the public. For radionuclides, where the non-stochastic limit was governing in deriving the occupational DAC, the stochastic ALI was used in deriving the corresponding airborne effluent limit in Table II. For this reason, the DAC and airborne effluent limits are not always proportional.

(2) The air concentration values listed in Table II, Column 1, were derived by one of two methods. For those radionuclides for which the stochastic limit is governing, the occupational stochastic inhalation ALI was divided by 2.4×10^9 ml, relating the inhalation ALI to the DAC and then divided by a factor of 300. The factor of 300 is composed of a factor of 50 to relate the 5-rem (0.05 sievert) annual occupational dose limit to the 0.1 rem (1 millisievert) limit for members of the public, a factor of 3 to adjust for the difference in exposure time and the inhalation rate for a worker and that for members of the public; and a factor of 2 to adjust the occupational values (derived for adults) so that they are applicable to other age groups.

(3) For those radionuclides for which submersion (external dose) is limiting, the occupational DAC in Table I, Column 3, was divided by 219. The factor of 219 is composed of a factor of 50 and a factor of 4.38 relating occupational exposure for 2,000 hours/year to full-time exposure (8,760 hours/year). Note that an additional factor of 2 for age considerations is not warranted in the submersion case.

(4) The water concentrations were derived by taking the most restrictive occupational stochastic oral ingestion ALI and dividing by 7.3×10^7 ml. The factor of 7.3×10^7 ml is composed of the factors of 50 and 2 and a factor of 7.3×10^5 ml which is the annual water intake of "reference man."

(5) Note 6 of this appendix provides groupings of radionuclides that are applicable to unknown mixtures of radionuclides. These groupings, including occupational inhalation ALIs and DACs, air and water effluent concentrations, and releases to sewerage, require demonstrating that the most limiting radionuclides in successive classes are absent. The limit for the unknown mixture is defined when the presence of one of the listed radionuclides cannot be definitely excluded either from knowledge of the radionuclide composition of the source or from actual measurements.

(d) Table III, "releases to sewers." The monthly average concentrations for release to sanitary sewerage are applicable to the provisions in §336.215 of this title (relating to

Disposal by Release into Sanitary Sewerage). The concentration values were derived by taking the most restrictive occupational stochastic oral ingestion ALI and dividing by 7.3 x 10^{6} ml. The factor of 7.3 x 10^{6} ml is composed of a factor of 7.3 x 10^{5} ml, the annual water intake by "reference man," and a factor of 10, such that the concentrations, if the sewage released by the licensee were the only source of water ingested by a "reference man" during a year, would result in a committed effective dose equivalent of 0.5 rem (5 millisieverts).

Figure: 30 TAC §336.359(d)

~~Figure: 30 TAC §336.359(d)~~

(*figure attached*)

SUBCHAPTER E: NOTICES, INSTRUCTIONS, AND REPORTS TO WORKERS AND INSPECTIONS

§336.405

Statutory Authority

The amendment is adopted under the Texas Radiation Control Act, Texas Health and Safety Code (THSC), Chapter 401; THSC, §401.011,which provides the commission authority to regulate and license the disposal of radioactive substances, the commercial processing and storage of radioactive substances, and the recovery and processing of source material; §401.051, which authorizes the commission to adopt rules and guidelines relating to control of sources of radiation; §401.103, which authorizes the commission to adopt rules and guidelines that provide for licensing and registration for the control of sources of radiation; §401.104, which requires the commission to provide rules for licensing for the disposal of radioactive substances; §401.201, which provides authority to the commission to regulate the disposal of low-level radioactive waste; §401.301, which authorizes the commission to set fees by rule;and§401.412, which provides authority to the commission to regulate licenses for the disposal of radioactive substances. The adopted amendment is also authorized by Texas Water Code, §5.103, which provides the commission with the authority to adopt rules necessary to carry out its powers and duties under the water code and other laws of the state.

The adopted amendment implements THSC, Chapter 401, including §§401.011, 401.051, 401.057, 401.059, 401.103 401.104, 401.151, 401.201, 401.301, and 401.412.

§336.405. Notifications and Reports to Individuals.

(a) Radiation exposure data for an individual and the results of any measurements, analyses, and calculations of radioactive material deposited or retained in the body of an individual shall be reported to the individual as specified in this section. The information reported shall include data and results obtained under commission rules, orders, or license conditions, as shown in records maintained by the licensee under commission rules. Each notification and report shall be in writing; shall include appropriate identifying data such as the name of the licensee, the name of the individual, and the individual's social security number; shall include the individual's exposure information; and shall contain the statement "This report is furnished to you under the provisions of 30 Texas Administrative Code, Chapter 336, Subchapter E. You shall preserve this report for further reference."

(b) Each licensee shall <u>make dose information available to workers</u> [advise each worker annually of the worker's dose] as shown in records maintained by the licensee under §336.346 of this title (relating to Records of Individual Monitoring Results). <u>The licensee shall provide an annual report to each individual monitored under §336.316 of</u>

this title (relating to Conditions Requiring Individual Monitoring of External and Internal Occupational Dose) of the dose received in that monitoring year if:

(1) the individual's occupational dose exceeds 1 millisievert (mSv) (100 millirem (mrem)) total effective dose equivalent or 1 mSv (100 mrem) to any individual organ or tissue; or

(2) the individual requests his or her annual dose report in writing.

(c) A former worker may request a report of the worker's exposure to radiation and/or radioactive material from the licensee.

(1) At the request of a worker formerly engaged in licensed activities controlled by the licensee, each licensee shall furnish to the worker a report of the worker's exposure to radiation and/or to radioactive material:

(A) as shown in records maintained by the licensee under §336.346 of this title [(relating to Records of Individual Monitoring Results)] for each year the worker was required to be monitored under the provisions of §336.316 of this title [(relating to Conditions Requiring Individual Monitoring of External and Internal Occupational Dose)]; and

(B) for each year the worker was required to be monitored under the monitoring requirements in effect before January 1, 1994.

(2) This report must be furnished within 30 days from the time the request is made or within 30 days after the exposure of the individual has been determined by the licensee, whichever is later. This report must cover the period of time that the worker's activities involved exposure to radiation from radioactive materials licensed by the commission and must include the dates and locations of licensed activities in which the worker participated during this period.

(d) When a licensee is required under §336.335 of this title (relating to Reporting Requirements for Incidents), §336.352 of this title (relating to Reports of Exposures, Radiation Levels, and Concentrations of Radioactive Material Exceeding the Limits), §336.353 of this title (relating to Reports of Planned Special Exposures), or §336.355 of this title (relating to Reports of Individual Monitoring) to report to the executive director any exposure of an individual to radiation or radioactive material, the licensee shall also provide the individual a report of that individual's exposure data. This report must be transmitted at a time not later than the transmittal to the executive director.

(e) At the request of a worker who is terminating employment with the licensee that involved exposure to radiation or radioactive materials, during the current year, each licensee shall provide at termination to each worker, or to the worker's designee, a written report regarding the radiation dose received by that worker from operations of the licensee during the current year or fraction thereof. If the most recent individual monitoring results are not available at that time, a written estimate of the dose shall be provided together with a clear indication that this is an estimate.

Figure: 30 TAC §336.359(d)

Name	Symbol	Atomic Number	Name	Symbol	Atomic Number
Actinium	Ac	89	Mercury	Hg	80
Aluminum	Al	13	Molybdenum	Mo	42
Americium	Am	95	Neodymium	Nd	60
Antimony	Sb	51	Neptunium	Np	93
Argon	Ar	18	Nickel	Ni	28
Arsenic	As	33	Niobium	Nb	41
Astatine	At	85	<u>Nitrogen</u>	<u>N</u>	<u>7</u>
Barium	Ba	56	Osmium	Os	76
Berkelium	Bk	97	<u>Oxygen</u>	<u>O</u>	<u>8</u>
Beryllium	Be	4	Palladium	Pd	46
Bismuth	Bi	83	Phosphorus	P	15
Bromine	Br	35	Platinum	Pt	78
Cadmium	Cd	48	Plutonium	Pu	94
Calcium	Ca	20	Polonium	Po	84
Californium	Cf	98	Potassium	K	19
Carbon	C	6	Praseodymium	Pr	59
Cerium	Ce	58	Promethium	Pm	61
Cesium	Cs	55	Protactinium	Pa	91
Chlorine	Cl	17	Radium	Ra	88
Chromium	Cr	24	Radon	Rn	86
Cobalt	Co	27	Rhodium	Rh	45
Copper	Cu	29	Rubidium	Rb	37
Curium	Cm	96	Ruthenium	Ru	44
Dysprosium	Dy	66	Samarium	Sm	62
Einsteinium	Es	99	Scandium	Sc	21
Erbium	Er	68	Selenium	Se	34
Europium	Eu	63	Silicon	Si	14
Fermium	Fm	100	Silver	Ag	47
Fluorine	F	9	Sodium	Na	11
Francium	Fr	87	Strontium	Sr	38
Gadolinium	Gd	64	Sulfur	S	16
Gallium	Ga	31	Tantalum	Ta	73
Germanium	Ge	32	Technetium	Tc	43
Gold	Au	79	Tellurium	Te	52
Hafnium	Hf	72	Terbium	Tb	65

Figure: 30 TAC §336.359(d)

Holmium	Ho	67	Thallium	Tl	81
Hydrogen	H	1	Thorium	Th	90
Indium	In	49	Thulium	Tm	69
Iodine	I	53	Tin	Sn	50
Iridium	Ir	77	Titanium	Ti	22
Iron	Fe	26	Tungsten	W	74
Krypton	Kr	36	Uranium	U	92
Lanthanum	La	57	Vanadium	V	23
Lead	Pb	82	Xenon	Xe	54
Lutetium	Lu	71	Ytterbium	Yb	70
Magnesium	Mg	12	Yttrium	Y	39
Manganese	Mn	25	Zinc	Zn	30
Mendelevium	Md	101	Zirconium	Zr	40

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Occupational Values Col. 2 Inhalation ALI (µCi)	Table I Occupational Values Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Effluent Concentrations Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
1	Hydrogen-3	Water, DAC includes skin absorption	8E+4	8E+4	2E-5	1E-7	1E-3	1E-2
		Gas (HT or T_2) Submersion[1]: Use above values as HT and T_2 oxidize in air and in the body to HTO.						
4	Beryllium-7	W, all compounds except those given for Y	4E+4	2E+4	9E-6	3E-8	6E-4	6E-3
		Y, oxides, halides, and nitrates	-	2E+4	8E-6	3E-8	-	-
4	Beryllium-10	W, see ^{7}Be	1E+3	2E+2	6E-8	2E-10	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{7}Be	-	1E+1	6E-9	2E-11	-	-
6	Carbon-11[2]	Monoxide	-	1E+6	5E-4	2E-6	-	-
		Dioxide	-	6E+5	3E-4	9E-7	-	-
		Compounds	4E+5	4E+5	2E-4	6E-7	6E-3	6E-2
6	Carbon-14	Monoxide	-	2E+6	7E-4	2E-6	-	-
		Dioxide	-	2E+5	9E-5	3E-7	-	-
		Compounds	2E+3	2E+3	1E-6	3E-9	3E-5	3E-4
7	Nitrogen-13[2]	Submersion[1]	-	-	4E-6	2E-8	-	-
8	Oxygen-15[2]	Submersion[1]	-	-	4E-6	2E-8	-	-
9	Fluorine-18[2]	D, fluorides of H, Li, Na, K, RB, Cs, and Fr	5E+4	7E+4	3E-5	1E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
		W, fluorides of Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, As, Sb, Bi, Fe, Ru, Os, Co, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, V, Nb, Ta, Mn, Tc, and Re	-	9E+4	4E-5	1E-7	-	-
		Y, lanthanum fluoride	-	8E+4	3E-5	1E-7	-	-
11	Sodium-22	D, all compounds	4E+2	6E+2	3E-7	9E-10	6E-6	6E-5
11	Sodium-24	D, all compounds	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
12	Magnesium-28	D, all compounds except those given for W	7E+2	2E+3	7E-7	2E-9	9E-6	9E-5
		W, oxides, hydroxides, carbides, halides, and nitrates	-	1E+3	5E-7	2E-9	-	-
13	Aluminum-26	D, all compounds except those given for W	4E+2	6E+1	3E-8	9E-11	6E-6	6E-5
		W, oxides, hydroxides, carbides, halides, and nitrates	-	9E+1	4E-8	1E-10	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
14	Silicon-31	D, all compounds except those given for W and Y	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
		W, oxides, hydroxides, carbides, and nitrates	-	3E+4	1E-5	5E-8	-	-
		Y, aluminosilicate glass	-	3E+4	1E-5	4E-8	-	-
14	Silicon-32	D, see ^{31}Si	2E+3	2E+2	1E-7	3E-10	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
		W, see ^{31}Si	-	1E+2	5E-8	2E-10	-	-
		Y, see ^{31}Si	-	5E+0	2E-9	7E-12	-	-
15	Phosphorus-32	D, all compounds except phosphates given for W	6E+2	9E+2	4E-7	1E-9	9E-6	9E-5
		W, phosphates of Zn^{2+}, S^{3+}, Mg^{2+}, Fe^{3+}, Bi^{3+}, and lanthanides	-	4E+2	2E-7	5E-10	-	-
15	Phosphorus-33	D, see ^{32}P	6E+3	8E+3	4E-6	1E-8	8E-5	8E-4
		W, see ^{32}P	-	3E+3	1E-6	4E-9	-	-
16	Sulfur-35	Vapor	-	1E+4	6E-6	2E-8	-	-
		D, sulfides and sulfates except those given for W	1E+4	2E+4	7E-6	2E-8	-	-
			LLI wall (8E+3)	-	-	-	1E-4	1E-3
		W, elemental sulfur, sulfides of Sr, Ba, Ge, Sn, Pb, As, Sb, Bi, Cu, Ag, Au, Zn, Cd, Hg, W, and Mo. Sulfates of Ca, Sr, Ba, Ra, As, Sb, and Bi	6E+3 -	2E+3	9E-7	3E-9	-	-
17	Chlorine-36	D, chlorides of H, Li, Na, K, Rb, Cs, and	2E+3	2E+3	1E-6	3E-9	2E-5	2E-4
		W, chlorides of lanthanides, Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, Ge, Sn, Pb, As, Sb, Bi, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, Mn, Tc, and Re	-	2E+2	1E-7	3E-10	-	-

Figure: 30 TAC §336.359(d)

			Table I Occupational Values			**Table II** Effluent Concentrations		**Table III** Release to Sewers
			Col. 1 Oral Ingestion	Col. 2 Inhalation	Col. 3 Inhalation	Col. 1	Col. 2	Montly Average
Atomic No.	**Radionuclide**	**Class**	ALI (µCi)	ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	Concentrations (µCi/ml)
17	Chlorine-38[2]	D, see ^{36}Cl	2E+4	4E+4	2E-5	6E-8	-	-
			St wall (5E+4)	-	-	-	3E-4	3E-3
		W, see ^{36}Cl	-	5E+4	2E-5	6E-8	-	-
17	Chlorine-39[2]	D, see ^{36}Cl	2E+4	5E+4	2E-5	7E-8	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ^{36}Cl	-	6E+4	2E-5	8E-8	-	-
18	Argon-37	Submersion[1]	-	-	1E+0	6E-3	-	-
18	Argon-39	Submersion[1]	-	-	2E-4	8E-7	-	-
18	Argon-41	Submersion[1]	-	-	3E-6	1E-8	-	-
19	Potassium-40	D, all compounds	3E+2	4E+2	2E-7	6E-10	4E-6	4E-5
19	Potassium-42	D, all compounds	5E+3	5E+3	2E-6	7E-9	6E-5	6E-4
19	Potassium-43	D, all compounds	6E+3	9E+3	4E-6	1E-8	9E-5	9E-4
19	Potassium-44[2]	D, all compounds	2E+4	7E+4	3E-5	9E-8	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
19	Potassium-45[2]	D, all compounds	3E+4	1E+5	5E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
20	Calcium-41	W, all compounds	3E+3	4E+3	2E-6	-	-	-
			Bone surf (4E+3)	Bone surf (4E+3)	-	5E-9	6E-5	6E-4
20	Calcium-45	W, all compounds	2E+3	8E+2	4E-7	1E-9	2E-5	2E-4
20	Calcium-47	W, all compounds	8E+2	9E+2	4E-7	1E-9	1E-5	1E-4
21	Scandium-43	Y, all compounds	7E+3	2E+4	9E-6	3E-8	1E-4	1E-3
21	Scandium-44m	Y, all compounds	5E+2	7E+2	3E-7	1E-9	7E-6	7E-5
21	Scandium-44	Y, all compounds	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
21	Scandium-46	Y, all compounds	9E+2	2E+2	1E-7	3E-10	1E-5	1E-4
21	Scandium-47	Y, all compounds	2E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
21	Scandium-48	Y, all compounds	8E+2	1E+3	6E-7	2E-9	1E-5	1E-4
21	Scandium-49[2]	Y, all compounds	2E+4	5E+4	2E-5	8E-8	3E-4	3E-3
22	Titanium-44	D, all compounds except those given for W and Y	3E+2	1E+1	5E-9	2E-11	4E-6	4E-5
		W, oxides, hydroxides, carbides, halides, and nitrates nitrates	-	3E+1	1E-8	4E-11	-	-
		Y, SrTi0	-	6E+0	2E-9	8E-12	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
22	Titanium-45	D, see ^{44}Ti	9E+3	3E+4	1E-5	3E-8	1E-4	1E-3
		W, see ^{44}Ti	-	4E+4	1E-5	5E-8	-	-
		Y, see ^{44}Ti	-	3E+4	1E-5	4E-8	-	-
23	Vanadium-47[2]	D, all compounds except those given for W	3E+4	8E+4	3E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, oxides, hydroxides, carbides, and halides	-	1E+5	4E-5	1E-7	-	-
23	Vanadium-48	D, see ^{47}V	6E+2	1E+3	5E-7	2E-9	9E-6	9E-5
		W, see ^{47}V	-	6E+2	3E-7	9E-10	-	-
23	Vanadium-49	D, see ^{47}V	7E+4	3E+4	1E-5	-	-	-
			LLI wall (9E+4)	Bone surf (3E+4)	-	5E-8	1E-3	1E-2
		W, see ^{47}V	-	2E+4	8E-6	2E-8	-	-
24	Chromium-48	D, all compounds except those given for W and Y	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
		W, halides and nitrates	-	7E+3	3E-6	1E-8	-	-
		Y, oxides and hydroxides	-	7E+3	3E-6	1E-8	-	-
24	Chromium-49[2]	D, see ^{48}Cr	3E+4	8E+4	4E-5	1E-7	4E-4	4E-3
		W, see ^{48}Cr	-	1E+5	4E-5	1E-7	-	-
		Y, see ^{48}Cr	-	9E+4	4E-5	1E-7	-	-
24	Chromium-51	D, see ^{48}Cr	4E+4	5E+4	2E-5	6E-8	5E-4	5E-3
		W, see ^{48}Cr	-	2E+4	1E-5	3E-8	-	-
		Y, see ^{48}Cr	-	2E+4	8E-6	3E-8	-	-
25	Manganese-51[2]	D, all compounds except those given for W	2E+4	5E+4	2E-5	7E-8	3E-4	3E-3
		W, oxides, hydroxides, halides, and nitrates	-	6E+4	3E-5	8E-8	-	-
25	Manganese-52m[2]	D, see ^{51}Mn	3E+4	9E+4	4E-5	1E-7	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ^{51}Mn	-	1E+5	4E-5	1E-7	-	-
25	Manganese-52	D, see ^{51}Mn	7E+2	1E+3	5E-7	2E-9	1E-5	1E-4
		W, see ^{51}Mn	-	9E+2	4E-7	1E-9	-	-

Figure: 30 TAC §336.359(d)

			Table I Occupational Values			Table II Effluent Concentrations		Table III Release to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
			Oral Ingestion	Inhalation				Montly Average
Atomic No.	**Radionuclide**	**Class**	ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentrations (μCi/ml)
25	Manganese-53	D, see ^{51}Mn	5E+4	1E+4	5E-6	-	7E-4	7E-3
				Bone surf (2E+4)	-	3E-8	-	-
		W, see ^{51}Mn	-	1E+4	5E-6	2E-8	-	-
25	Manganese-54	D, see ^{51}Mn	2E+3	9E+2	4E-7	1E-9	3E-5	3E-4
		W, see ^{51}Mn	-	8E+2	3E-7	1E-9	-	-
25	Manganese-56	D, see ^{51}Mn	5E+3	2E+4	6E-6	2E-8	7E-5	7E-4
		W, see ^{51}Mn	-	2E+4	9E-6	3E-8	-	-
26	Iron-52	D, all compounds except those given for W	9E+2	3E+3	1E-6	4E-9	1E-5	1E-4
		W, oxides, hydroxides, and halides	-	2E+3	1E-6	3E-9	-	-
26	Iron-55	D, see ^{52}Fe	9E+3	2E+3	8E-7	3E-9	1E-4	1E-3
		W, see ^{52}Fe	-	4E+3	2E-6	6E-9	-	-
26	Iron-59	D, see ^{52}Fe	8E+2	3E+2	1E-7	5E-10	1E-5	1E-4
		W, see ^{52}Fe	-	5E+2	2E-7	7E-10	-	-
26	Iron-60	D, see ^{52}Fe	3E+1	6E+0	3E-9	9E-12	4E-7	4E-6
		W, see ^{52}Fe	-	2E+1	8E-9	3E-11	-	-
27	Cobalt-55	W, all compounds except those given for Y	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		Y, oxides, hydroxides,halides, and nitrates	-	3E+3	1E-6	4E-9	-	-
27	Cobalt-56	W, see ^{55}Co	5E+2	3E+2	1E-7	4E-10	6E-6	6E-5
		Y, see ^{55}Co	4E+2	2E+2	8E-8	3E-10	-	-
27	Cobalt-57	W, see ^{55}Co	8E+3	3E+3	1E-6	4E-9	6E-5	6E-4
		Y, see ^{55}Co	4E+3	7E+2	3E-7	9E-10	-	-
27	Cobalt-58m	W, see ^{55}Co	6E+4	9E+4	4E-5	1E-7	8E-4	8E-3
		Y, see ^{55}Co	-	6E+4	3E-5	9E-8	-	-
27	Cobalt-58	W, see ^{55}Co	2E+3	1E+3	5E-7	2E-9	2E-5	2E-4
		Y, see ^{55}Co	1E+3	7E+2	3E-7	1E-9	-	-
27	Cobalt-60m[2]	W, see ^{55}Co	1E+6	4E+6	2E-3	6E-6	-	-
			St wall (1E+6)	-	-	-	2E-2	2E-1
		Y, see ^{55}Co	-	3E+6	1E-3	4E-6	-	-
27	Cobalt-60	W, see ^{55}Co	5E+2	2E+2	7E-8	2E-10	3E-6	3E-5
		Y, see ^{55}Co	2E+2	3E+1	1E-8	5E-11	-	-
27	Cobalt-61[2]	W, see ^{55}Co	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		Y, see ^{55}Co	2E+4	6E+4	2E-5	8E-8	-	-
27	Cobalt-62m[2]	W, see ^{55}Co	4E+4	2E+5	7E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
		Y, see ^{55}Co	-	2E+5	6E-5	2E-7	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
28	Nickel-56	D, all compounds except those given for W	1E+3	2E+3	8E-7	3E-9	2E-5	2E-4
		W, oxides, hydroxides, and carbides	-	1E+3	5E-7	2E-9	-	-
		Vapor	-	1E+3	5E-7	2E-9	-	-
28	Nickel-57	D, see ^{56}Ni	2E+3	5E+3	2E-6	7E-9	2E-5	2E-4
		W, see ^{56}Ni	-	3E+3	1E-6	4E-9	-	-
		Vapor	-	6E+3	3E-6	9E-9	-	-
28	Nickel-59	D, see ^{56}Ni	2E+4	4E+3	2E-6	5E-9	3E-4	3E-3
		W, see ^{56}Ni	-	7E+3	3E-6	1E-8	-	-
		Vapor	-	2E+3	8E-7	3E-9	-	-
28	Nickel-63	D, see ^{56}Ni	9E+3	2E+3	7E-7	2E-9	1E-4	1E-3
		W, see ^{56}Ni	-	3E+3	1E-6	4E-9	-	-
		Vapor	-	8E+2	3E-7	1E-9	-	-
28	Nickel-65	D, see ^{56}Ni	8E+3	2E+4	1E-5	3E-8	1E-4	1E-3
		W, see ^{56}Ni	-	3E+4	1E-5	4E-8	-	-
		Vapor	-	2E+4	7E-6	2E-8	-	-
28	Nickel-66	D, see ^{56}Ni	4E+2	2E+3	7E-7	2E-9	-	-
			LLI wall (5E+2)	-	-	-	6E-6	6E-5
		W, see ^{56}Ni	-	6E+2	3E-7	9E-10	-	-
		Vapor	-	3E+3	1E-6	4E-9	-	-
29	Copper-60[2]	D, all compounds except those given for W and Y	3E+4	9E+4	4E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, sulfides, halides, and nitrates	-	1E+5	5E-5	2E-7	-	-
		Y, oxides and hydroxides	-	1E+5	4E-5	1E-7	-	-
29	Copper-61	D, see ^{60}Cu	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ^{60}Cu	-	4E+4	2E-5	6E-8	-	-
		Y, see ^{60}Cu	-	4E+4	1E-5	5E-8	-	-
29	Copper-64	D, see ^{60}Cu	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ^{60}Cu	-	2E+4	1E-5	3E-8	-	-
		Y, see ^{60}Cu	-	2E+4	9E-6	3E-8	-	-
29	Copper-67	D, see ^{60}Cu	5E+3	8E+3	3E-6	1E-8	6E-5	6E-4
		W, see ^{60}Cu	-	5E+3	2E-6	7E-9	-	-
		Y, see ^{60}Cu	-	5E+3	2E-6	6E-9	-	-
30	Zinc-62	Y, all compounds	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
30	Zinc-63[2]	Y, all compounds	2E+4	7E+4	3E-5	9E-8	-	-
			St wall (3E+4)	-	-	-	3E-4	3E-3
30	Zinc-65	Y, all compounds	4E+2	3E+2	1E-7	4E-10	5E-6	5E-5
30	Zinc-69m	Y, all compounds	4E+3	7E+3	3E-6	1E-8	6E-5	6E-4

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Occupational Values Col. 2 Inhalation ALI (µCi)	Table I Occupational Values Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Effluent Concentrations Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
30	Zinc-69[2]	Y, all compounds	6E+4	1E+5	6E-5	2E-7	8E-4	8E-3
30	Zinc-71m	Y, all compounds	6E+3	2E+4	7E-6	2E-8	8E-5	8E-4
30	Zinc-72	Y, all compounds	1E+3	1E+3	5E-7	2E-9	1E-5	1E-4
31	Gallium-65[2]	D, all compounds except those given for W	5E+4	2E+5	7E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	9E-4	9E-3
		W, oxides, hydroxides, carbides, halides, and nitrates	-	2E+5	8E-5	3E-7	-	-
31	Gallium-66	D, see ^{65}Ga	1E+3	4E+3	1E-6	5E-9	1E-5	1E-4
		W, see ^{65}Ga	-	3E+3	1E-6	4E-9	-	-
31	Gallium-67	D, see ^{65}Ga	7E+3	1E+4	6E-6	2E-8	1E-4	1E-3
		W, see ^{65}Ga	-	1E+4	4E-6	1E-8	-	-
31	Gallium-68[2]	D, see ^{65}Ga	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{65}Ga	-	5E+4	2E-5	7E-8	-	-
31	Gallium-70[2]	D, see ^{65}Ga	5E+4	2E+5	7E-5	2E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
		W, see ^{65}Ga	-	2E+5	8E-5	3E-7	-	-
31	Gallium-72	D, see ^{65}Ga	1E+3	4E+3	1E-6	5E-9	2E-5	2E-4
		W, see ^{65}Ga	-	3E+3	1E-6	4E-9	-	-
31	Gallium-73	D, see ^{65}Ga	5E+3	2E+4	6E-6	2E-8	7E-5	7E-4
		W, see ^{65}Ga	-	2E+4	6E-6	2E-8	-	-
32	Germanium-66	D, all compounds except those given for W	2E+4	3E+4	1E-5	4E-8	3E-4	3E-3
		W, oxides, sulfides, and halides	-	2E+4	8E-6	3E-8	-	-
32	Germanium-67[2]	D, see ^{66}Ge	3E+4	9E+4	4E-5	1E-7	-	-
			St wall (4E+4)	-	-	-	6E-4	6E-3
		W, see ^{66}Ge	-	1E+5	4E-5	1E-7	-	-
32	Germanium-68	D, see ^{66}Ge	5E+3	4E+3	2E-6	5E-9	6E-5	6E-4
		W, see ^{66}Ge	-	1E+2	4E-8	1E-10	-	-
32	Germanium-69	D, see ^{66}Ge	1E+4	2E+4	6E-6	2E-8	2E-4	2E-3
		W, see ^{66}Ge	-	8E+3	3E-6	1E-8	-	-
32	Germanium-71	D, see ^{66}Ge	5E+5	4E+5	2E-4	6E-7	7E-3	7E-2
		W, see ^{66}Ge	-	4E+4	2E-5	6E-8	-	-
32	Germanium-75[2]	D, see ^{66}Ge	4E+4	8E+4	3E-5	1E-7	-	-
			St wall (7E+4)	-	-	-	9E-4	9E-3
		W, see ^{66}Ge	-	8E+4	4E-5	1E-7	-	-
32	Germanium-77	D, see ^{66}Ge	9E+3	1E+4	4E-6	1E-8	1E-4	1E-3
		W, see ^{66}Ge	-	6E+3	2E-6	8E-9	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
32	Germanium-78[2]	D, see ^{66}Ge	2E+4	2E+4	9E-6	3E-8	-	-
			St wall (2E+4)	-	-	-	3E-4	3E-3
		W, see ^{66}Ge	-	2E+4	9E-6	3E-8	-	-
33	Arsenic-69[2]	W, all compounds	3E+4	1E+5	5E-5	2E-7	-	-
			St wall (4E+4)	-	-	-	6E-4	6E-3
33	Arsenic-70[2]	W, all compounds	1E+4	5E+4	2E-5	7E-8	2E-4	2E-3
33	Arsenic-71	W, all compounds	4E+3	5E+3	2E-6	6E-9	5E-5	5E-4
33	Arsenic-72	W, all compounds	9E+2	1E+3	6E-7	2E-9	1E-5	1E-4
33	Arsenic-73	W, all compounds	8E+3	2E+3	7E-7	2E-9	1E-4	1E-3
33	Arsenic-74	W, all compounds	1E+3	8E+2	3E-7	1E-9	2E-5	2E-4
33	Arsenic-76	W, all compounds	1E+3	1E+3	6E-7	2E-9	1E-5	1E-4
33	Arsenic-77	W, all compounds	4E+3	5E+3	2E-6	7E-9	-	-
			LLI wall (5E+3)	-	-	-	6E-5	6E-4
33	Arsenic-78[2]	W, all compounds	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3
34	Selenium-70[2]	D, all compounds except those given for W	2E+4	4E+4	2E-5	5E-8	1E-4	1E-3
		W, oxides, hydroxides, carbides, and elemental Se	1E+4	4E+4	2E-5	6E-8	-	-
34	Selenium-73m[2]	D, see ^{70}Se	6E+4	2E+5	6E-5	2E-7	4E-4	4E-3
		W, see ^{70}Se	3E+4	1E+5	6E-5	2E-7	-	-
34	Selenium-73	D, see ^{70}Se	3E+3	1E+4	5E-6	2E-8	4E-5	4E-4
		W, see ^{70}Se	-	2E+4	7E-6	2E-8	-	-
34	Selenium-75	D, see ^{70}Se	5E+2	7E+2	3E-7	1E-9	7E-6	7E-5
		W, see ^{70}Se	-	6E+2	3E-7	8E-10	-	-
34	Selenium-79	D, see ^{70}Se	6E+2	8E+2	3E-7	1E-9	8E-6	8E-5
		W, see ^{70}Se	-	6E+2	2E-7	8E-10	-	-
34	Selenium-81m[2]	D, see ^{70}Se	4E+4	7E+4	3E-5	9E-8	3E-4	3E-3
		W, see ^{70}Se	2E+4	7E+4	3E-5	1E-7	-	-
34	Selenium-81[2]	D, see ^{70}Se	6E+4	2E+5	9E-5	3E-7	-	-
			St wall (8E+4)	-	-	-	1E-3	1E-2
		W, see ^{70}Se	-	2E+5	1E-4	3E-7	-	-
34	Selenium-83[2]	D, see ^{70}Se	4E+4	1E+5	5E-5	2E-7	4E-4	4E-3
		W, see ^{70}Se	3E+4	1E+5	5E-5	2E-7	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
35	Bromine-74m[2]	D, bromides of H, Li, Na, K, Rb, Cs, and Fr	1E+4	4E+4	2E-5	5E-8	-	-
			St wall (2E+4)	-	-	-	3E-4	3E-3
		W, bromides of lanthanides, Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, Ge, Sn, Pb, As, Sb, Bi, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, Hf, V, Nb, Ta, Mn, Tc, and Re	-	4E+4	2E-5	6E-8	-	-
35	Bromine-74[2]	D, see ^{74m}Br	2E+4	7E+4	3E-5	1E-7	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ^{74m}Br	-	8E+4	4E-5	1E-7	-	-
35	Bromine-75[2]	D, see ^{74m}Br	3E+4	5E+4	2E-5	7E-8	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ^{74m}Br	-	5E+4	2E-5	7E-8	-	-
35	Bromine-76	D, see ^{74m}Br	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
		W, see ^{74m}Br	-	4E+3	2E-6	6E-9	-	-
35	Bromine-77	D, see ^{74m}Br	2E+4	2E+4	1E-5	3E-8	2E-4	2E-3
		W, see ^{74m}Br	-	2E+4	8E-6	3E-8	-	-
35	Bromine-80m	D, see ^{74m}Br	2E+4	2E+4	7E-6	2E-8	3E-4	3E-3
		W, see ^{74m}Br	-	1E+4	6E-6	2E-8	-	-
35	Bromine-80[2]	D, see ^{74m}Br	5E+4	2E+5	8E-5	3E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
		W, see ^{74m}Br	-	2E+5	9E-5	3E-7	-	-
35	Bromine-82	D, see ^{74m}Br	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
		W, see ^{74m}Br	-	4E+3	2E-6	5E-9	-	-
35	Bromine-83	D, see ^{74m}Br	5E+4	6E+4	3E-5	9E-8	-	-
			St wall (7E+4)	-	-	-	9E-4	9E-3
		W, see ^{74m}Br	-	6E+4	3E-5	9E-8	-	-
35	Bromine-84[2]	D, see ^{74m}Br	2E+4	6E+4	2E-5	8E-8	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, see ^{74m}Br	-	6E+4	3E-5	9E-8	-	-
36	Krypton-74[2]	Submersion[1]	-	-	3E-6	1E-8	-	-
36	Krypton-76	Submersion[1]	-	-	9E-6	4E-8	-	-
36	Krypton-77[2]	Submersion[1]	-	-	4E-6	2E-8	-	-
36	Krypton-79	Submersion[1]	-	-	2E-5	7E-8	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
36	Krypton-81	Submersion[1]	-	-	7E-4	3E-6	-	-
36	Krypton-83m[2]	Submersion[1]	-	-	1E-2	5E-5	-	-
36	Krypton-85m	Submersion[1]	-	-	2E-5	1E-7	-	-
36	Krypton-85	Submersion[1]	-	-	1E-4	7E-7	-	-
36	Krypton-87[2]	Submersion[1]	-	-	5E-6	2E-8	-	-
36	Krypton-88	Submersion[1]	-	-	2E-6	9E-9	-	-
37	Rubidium-79[2]	D, all compounds	4E+4	1E+5	5E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
37	Rubidium-81m[2]	D, all compounds	2E+5	3E+5	1E-4	5E-7	-	-
			St wall (3E+5)	-	-	-	4E-3	4E-2
37	Rubidium-81	D, all compounds	4E+4	5E+4	2E-5	7E-8	5E-4	5E-3
37	Rubidium-82m	D, all compounds	1E+4	2E+4	7E-6	2E-8	2E-4	2E-3
37	Rubidium-83	D, all compounds	6E+2	1E+3	4E-7	1E-9	9E-6	9E-5
37	Rubidium-84	D, all compounds	5E+2	8E+2	3E-7	1E-9	7E-6	7E-5
37	Rubidium-86	D, all compounds	5E+2	8E+2	3E-7	1E-9	7E-6	7E-5
37	Rubidium-87	D, all compounds	1E+3	2E+3	6E-7	2E-9	1E-5	1E-4
37	Rubidium-88[2]	D, all compounds	2E+4	6E+4	3E-5	9E-8	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
37	Rubidium-89[2]	D, all compounds	4E+4	1E+5	6E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	9E-4	9E-3
38	Strontium-80[2]	D, all soluble compounds except SrTiO	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		Y, all insoluble compounds and SrTi0	-	1E+4	5E-6	2E-8	-	-
38	Strontium-81[2]	D, see ^{80}Sr	3E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		Y, see ^{80}Sr	2E+4	8E+4	3E-5	1E-7	-	-
38	Strontium-82	D, see ^{80}Sr	3E+2	4E+2	2E-7	6E-10	-	-
			LLI wall (2E+2)	-	-	-	3E-6	3E-5
		Y, see ^{80}Sr	2E+2	9E+1	4E-8	1E-10	-	-
38	Strontium-83	D, see ^{80}Sr	3E+3	7E+3	3E-6	1E-8	3E-5	3E-4
		Y, see ^{80}Sr	2E+3	4E+3	1E-6	5E-9	-	-
38	Strontium-85m[2]	D, see ^{80}Sr	2E+5	6E+5	3E-4	9E-7	3E-3	3E-2
		Y, see ^{80}Sr	-	8E+5	4E-4	1E-6	-	-
38	Strontium-85	D, see ^{80}Sr	3E+3	3E+3	1E-6	4E-9	4E-5	4E-4
		Y, see ^{80}Sr	-	2E+3	6E-7	2E-9	-	-
38	Strontium-87m	D, see ^{80}Sr	5E+4	1E+5	5E-5	2E-7	6E-4	6E-3
		Y, see ^{80}Sr	4E+4	2E+5	6E-5	2E-7	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
38	Strontium-89	D, see ^{80}Sr	6E+2	8E+2	4E-7	1E-9	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
		Y, see ^{80}Sr	5E+2	1E+2	6E-8	2E-10	-	-
38	Strontium-90	D, see ^{80}Sr	3E+1	2E+1	8E-9	-	-	-
			Bone surf (4E+1)	Bone surf (2E+1)	-	3E-11	5E-7	5E-6
		Y, see ^{80}Sr	-	4E+0	2E-9	6E-12	-	-
38	Strontium-91	D, see ^{80}Sr	2E+3	6E+3	2E-6	8E-9	2E-5	2E-4
		Y, see ^{80}Sr	-	4E+3	1E-6	5E-9	-	-
38	Strontium-92	D, see ^{80}Sr	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		Y, see ^{80}Sr	-	7E+3	3E-6	9E-9	-	-
39	Yttrium-86m[2]	W, all compounds except those given for Y	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
		Y, oxides and hydroxides	-	5E+4	2E-5	8E-8	-	-
39	Yttrium-86	W, see ^{86m}Y	1E+3	3E+3	1E-6	5E-9	2E-5	2E-4
		Y, see ^{86m}Y	-	3E+3	1E-6	5E-9	-	-
39	Yttrium-87	W, see ^{86m}Y	2E+3	3E+3	1E-6	5E-9	3E-5	3E-4
		Y, see ^{86m}Y	-	3E+3	1E-6	5E-9	-	-
39	Yttrium-88	W, see ^{86m}Y	1E+3	3E+2	1E-7	3E-10	1E-5	1E-4
		Y, see ^{86m}Y	-	2E+2	1E-7	3E-10	-	-
39	Yttrium-90m	W, see ^{86m}Y	8E+3	1E+4	5E-6	2E-8	1E-4	1E-3
		Y, see ^{86m}Y	-	1E+4	5E-6	2E-8	-	-
39	Yttrium-90	W, see ^{86m}Y	4E+2	7E+2	3E-7	9E-10	-	-
			LLI wall (5E+2)	-	-	-	7E-6	7E-5
		Y, see ^{86m}Y	-	6E+2	3E-7	9E-10	-	-
39	Yttrium-91m[2]	W, see ^{86m}Y	1E+5	2E+5	1E-4	3E-7	2E-3	2E-2
		Y, see ^{86m}Y	-	2E+5	7E-5	2E-7	-	-
39	Yttrium-91	W, see ^{86m}Y	5E+2	2E+2	7E-8	2E-10	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
		Y, see ^{86m}Y	-	1E+2	5E-8	2E-10	-	-
39	Yttrium-92	W, see ^{86m}Y	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		Y, see ^{86m}Y	-	8E+3	3E-6	1E-8	-	-
39	Yttrium-93	W, see ^{86m}Y	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		Y, see ^{86m}Y	-	2E+3	1E-6	3E-9	-	-
39	Yttrium-94[2]	W, see ^{86m}Y	2E+4	8E+4	3E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		Y, see ^{86m}Y	-	8E+4	3E-5	1E-7	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
39	Yttrium-95[2]	W, see ^{86m}Y	4E+4	2E+5	6E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
		Y, see ^{86m}Y	-	1E+5	6E-5	2E-7	-	-
40	Zirconium-86	D, all compounds except those given for W and Y	1E+3	4E+3	2E-6	6E-9	2E-5	2E-4
		W, oxides, hydroxides, halides, and nitrates	-	3E+3	1E-6	4E-9	-	-
		Y, carbide	-	2E+3	1E-6	3E-9	-	-
40	Zirconium-88	D, see ^{86}Zr	4E+3	2E+2	9E-8	3E-10	5E-5	5E-4
		W, see ^{86}Zr	-	5E+2	2E-7	7E-10	-	-
		Y, see ^{86}Zr	-	3E+2	1E-7	4E-10	-	-
40	Zirconium-89	D, see ^{86}Zr	2E+3	4E+3	1E-6	5E-9	2E-5	2E-4
		W, see ^{86}Zr	-	2E+3	1E-6	3E-9	-	-
		Y, see ^{86}Zr	-	2E+3	1E-6	3E-9	-	-
40	Zirconium-93	D, see ^{86}Zr	1E+3	6E+0	3E-9	-	-	-
			Bone surf (3E+3)	Bone surf (2E+1)	-	2E-11	4E-5	4E-4
		W, see ^{86}Zr	-	2E+1	1E-8	-	-	-
			-	Bone surf (6E+1)	-	9E-11	-	-
		Y, see ^{86}Zr	-	6E+1	2E-8	-	-	-
			-	Bone surf (7E+1)	-	9E-11	-	-
40	Zirconium-95	D, see ^{86}Zr	1E+3	1E+2	5E-8	-	2E-5	2E-4
			-	Bone surf (3E+2)	-	4E-10	-	-
		W, see ^{86}Zr	-	4E+2	2E-7	5E-10	-	-
		Y, see ^{86}Zr	-	3E+2	1E-7	4E-10	-	-
40	Zirconium-97	D, see ^{86}Zr	6E+2	2E+3	8E-7	3E-9	9E-6	9E-5
		W, see ^{86}Zr	-	1E+3	6E-7	2E-9	-	-
		Y, see ^{86}Zr	-	1E+3	5E-7	2E-9	-	-
41	Niobium-88[2]	W, all compounds except those given for Y	5E+4	2E+5	9E-5	3E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
		Y, oxides and hydroxides	-	2E+5	9E-5	3E-7	-	-
41	Niobium-89[2] (66 min)	W, see ^{88}Nb	1E+4	4E+4	2E-5	6E-8	1E-4	1E-3
		Y, see ^{88}Nb	-	4E+4	2E-5	5E-8	-	-
41	Niobium-89 (122 min)	W, see ^{88}Nb	5E+3	2E+4	8E-6	3E-8	7E-5	7E-4
		Y, see ^{88}Nb	-	2E+4	6E-6	2E-8	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
41	Niobium-90	W, see ^{88}Nb	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
		Y, see ^{88}Nb	-	2E+3	1E-6	3E-9	-	-
41	Niobium-93m	W, see ^{88}Nb	9E+3	2E+3	8E-7	3E-9	-	-
			LLI wall (1E+4)	-	-	-	2E-4	2E-3
		Y, see ^{88}Nb	-	2E+2	7E-8	2E-10	-	-
41	Niobium-94	W, see ^{88}Nb	9E+2	2E+2	8E-8	3E-10	1E-5	1E-4
		Y, see ^{88}Nb	-	2E+1	6E-9	2E-11	-	-
41	Niobium-95m	W, see ^{88}Nb	2E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
		Y, see ^{88}Nb	-	2E+3	9E-7	3E-9	-	-
41	Niobium-95	W, see ^{88}Nb	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
		Y, see ^{88}Nb	-	1E+3	5E-7	2E-9	-	-
41	Niobium-96	W, see ^{88}Nb	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		Y, see ^{88}Nb	-	2E+3	1E-6	3E-9	-	-
41	Niobium-97[2]	W, see ^{88}Nb	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		Y, see ^{88}Nb	-	7E+4	3E-5	1E-7	-	-
41	Niobium-98[2]	W, see ^{88}Nb	1E+4	5E+4	2E-5	8E-8	2E-4	2E-3
		Y, see ^{88}Nb	-	5E+4	2E-5	7E-8	-	-
42	Molybdenum-90	D, all compounds except those given for Y	4E+3	7E+3	3E-6	1E-8	3E-5	3E-4
		Y, oxides, hydroxides, and MoS	2E+3	5E+3	2E-6	6E-9	-	-
42	Molybdenum-93m	D, see ^{90}Mo	9E+3	2E+4	7E-6	2E-8	6E-5	6E-4
		Y, see ^{90}Mo	4E+3	1E+4	6E-6	2E-8	-	-
42	Molybdenum-93	D, see ^{90}Mo	4E+3	5E+3	2E-6	8E-9	5E-5	5E-4
		Y, see ^{90}Mo	2E+4	2E+2	8E-8	2E-10	-	-
42	Molybdenum-99	D, see ^{90}Mo	2E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{90}Mo	1E+3	1E+3	6E-7	2E-9	-	-
42	Molybdenum-101[2]	D, see ^{90}Mo	4E+4	1E+5	6E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
		Y, see ^{90}Mo	-	1E+5	6E-5	2E-7	-	-
43	Technetium-93m[2]	D, all compounds except those given for W	7E+4	2E+5	6E-5	2E-7	1E-3	1E-2
		W, oxides, hydroxides, halides, and nitrates	-	3E+5	1E-4	4E-7	-	-
43	Technetium-93	D, see ^{93m}Tc	3E+4	7E+4	3E-5	1E-7	4E-4	4E-3
		W, see ^{93m}Tc	-	1E+5	4E-5	1E-7	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
43	Technetium-94m[2]	D, see ^{93m}Tc	2E+4	4E+4	2E-5	6E-8	3E-4	3E-3
		W, see ^{93m}Tc	-	6E+4	2E-5	8E-8	-	-
43	Technetium-94	D, see ^{93m}Tc	9E+3	2E+4	8E-6	3E-8	1E-4	1E-3
		W, see ^{93m}Tc	-	2E+4	1E-5	3E-8	-	-
43	Technetium-95m	D, see ^{93m}Tc	4E+3	5E+3	2E-6	8E-9	5E-5	5E-4
		W, see ^{93m}Tc	-	2E+3	8E-7	3E-9	-	-
43	Technetium-95	D, see ^{93m}Tc	1E+4	2E+4	9E-6	3E-8	1E-4	1E-3
		W, see ^{93m}Tc	-	2E+4	8E-6	3E-8	-	-
43	Technetium-96m[2]	D, see ^{93m}Tc	2E+5	3E+5	1E-4	4E-7	2E-3	2E-2
		W, see ^{93m}Tc	-	2E+5	1E-4	3E-7	-	-
43	Technetium-96	D, see ^{93m}Tc	2E+3	3E+3	1E-6	5E-9	3E-5	3E-4
		W, see ^{93m}Tc	-	2E+3	9E-7	3E-9	-	-
43	Technetium-97m	D, see ^{93m}Tc	5E+3	7E+3	3E-6	-	6E-5	6E-4
			-	St wall (7E+3)	-	1E-8	-	-
		W, see ^{93m}Tc	-	1E+3	5E-7	2E-9	-	-
43	Technetium-97	D, see ^{93m}Tc	4E+4	5E+4	2E-5	7E-8	5E-4	5E-3
		W, see ^{93m}Tc	-	6E+3	2E-6	8E-9	-	-
43	Technetium-98	D, see ^{93m}Tc	1E+3	2E+3	7E-7	2E-9	1E-5	1E-4
		W, see ^{93m}Tc	-	3E+2	1E-7	4E-10	-	-
43	Technetium-99m	D, see ^{93m}Tc	8E+4	2E+5	6E-5	2E-7	1E-3	1E-2
		W, see ^{93m}Tc	-	2E+5	1E-4	3E-7	-	-
43	Technetium-99	D, see ^{93m}Tc	4E+3	5E+3	2E-6	-	6E-5	6E-4
			-	St wall (6E+3)	-	8E-9	-	-
		W, see ^{93m}Tc	-	7E+2	3E-7	9E-10	-	-
43	Technetium-101[2]	D, see ^{93m}Tc	9E+4	3E+5	1E-4	5E-7	-	-
			St wall (1E+5)	-	-	-	2E-3	2E-2
		W, see ^{93m}Tc	-	4E+5	2E-4	5E-7	-	-
43	Technetium-104[2]	D, see ^{93m}Tc	2E+4	7E+4	3E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, see ^{93m}Tc	-	9E+4	4E-5	1E-7	-	-
44	Ruthenium-94[2]	D, all compounds except those given for W and Y	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, halides	-	6E+4	3E-5	9E-8	-	-
		Y, oxides and hydroxides	-	6E+4	2E-5	8E-8	-	-
44	Ruthenium-97	D, see ^{94}Ru	8E+3	2E+4	8E-6	3E-8	1E-4	1E-3
		W, see ^{94}Ru	-	1E+4	5E-6	2E-8	-	-
		Y, see ^{94}Ru	-	1E+4	5E-6	2E-8	-	-
44	Ruthenium-103	D, see ^{94}Ru	2E+3	2E+3	7E-7	2E-9	3E-5	3E-4
		W, see ^{94}Ru	-	1E+3	4E-7	1E-9	-	-
		Y, see ^{94}Ru	-	6E+2	3E-7	9E-10	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
44	Ruthenium-105	D, see ^{94}Ru	5E+3	1E+4	6E-6	2E-8	7E-5	7E-4
		W, see ^{94}Ru	-	1E+4	6E-6	2E-8	-	-
		Y, see ^{94}Ru	-	1E+4	5E-6	2E-8	-	-
44	Ruthenium-106	D, see ^{94}Ru	2E+2	9E+1	4E-8	1E-10	-	-
			LLI wall (2E+2)	-	-	-	3E-6	3E-5
		W, see ^{94}Ru	-	5E+1	2E-8	8E-11	-	-
		Y, see ^{94}Ru	-	1E+1	5E-9	2E-11	-	-
45	Rhodium-99m	D, all compounds except those given for W and Y	2E+4	6E+4	2E-5	8E-8	2E-4	2E-3
		W, halides	-	8E+4	3E-5	1E-7	-	-
		Y, oxides and hydroxides	-	7E+4	3E-5	9E-8	-	-
45	Rhodium-99	D, see ^{99m}Rh	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
		W, see ^{99m}Rh	-	2E+3	9E-7	3E-9	-	-
		Y, see ^{99m}Rh	-	2E+3	8E-7	3E-9	-	-
45	Rhodium-100	D, see ^{99m}Rh	2E+3	5E+3	2E-6	7E-9	2E-5	2E-4
		W, see ^{99m}Rh	-	4E+3	2E-6	6E-9	-	-
		Y, see ^{99m}Rh	-	4E+3	2E-6	5E-9	-	-
45	Rhodium-101m	D, see ^{99m}Rh	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
		W, see ^{99m}Rh	-	8E+3	4E-6	1E-8	-	-
		Y, see ^{99m}Rh	-	8E+3	3E-6	1E-8	-	-
45	Rhodium-101	D, see ^{99m}Rh	2E+3	5E+2	2E-7	7E-10	3E-5	3E-4
		W, see ^{99m}Rh	-	8E+2	3E-7	1E-9	-	-
		Y, see ^{99m}Rh	-	2E+2	6E-8	2E-10	-	-
45	Rhodium-102m	D, see ^{99m}Rh	1E+3	5E+2	2E-7	7E-10	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		W, see ^{99m}Rh	-	4E+2	2E-7	5E-10	-	-
		Y, see ^{99m}Rh	-	1E+2	5E-8	2E-10	-	-
45	Rhodium-102	D, see ^{99m}Rh	6E+2	9E+1	4E-8	1E-10	8E-6	8E-5
		W, see ^{99m}Rh	-	2E+2	7E-8	2E-10	-	-
		Y, see ^{99m}Rh	-	6E+1	2E-8	8E-11	-	-
45	Rhodium-103m[2]	D, see ^{99m}Rh	4E+5	1E+6	5E-4	2E-6	6E-3	6E-2
		W, see ^{99m}Rh	-	1E+6	5E-4	2E-6	-	-
		Y, see ^{99m}Rh	-	1E+6	5E-4	2E-6	-	-
45	Rhodium-105	D, see ^{99m}Rh	4E+3	1E+4	5E-6	2E-8	-	-
			LLI wall (4E+3)	-	-	-	5E-5	5E-4
		W, see ^{99m}Rh	-	6E+3	3E-6	9E-9	-	-
		Y, see ^{99m}Rh	-	6E+3	2E-6	8E-9	-	-
45	Rhodium-106m	D, see ^{99m}Rh	8E+3	3E+4	1E-5	4E-8	1E-4	1E-3
		W, see ^{99m}Rh	-	4E+4	2E-5	5E-8	-	-
		Y, see ^{99m}Rh	-	4E+4	1E-5	5E-8	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
45	Rhodium-107[2]	D, see ^{99m}Rh	7E+4	2E+5	1E-4	3E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
		W, see ^{99m}Rh	-	3E+5	1E-4	4E-7	-	-
		Y, see ^{99m}Rh	-	3E+5	1E-4	3E-7	-	-
46	Palladium-100	D, all compounds except those given for W and Y	1E+3	1E+3	6E-7	2E-9	2E-5	2E-4
		W, nitrates	-	1E+3	5E-7	2E-9	-	-
		Y, oxides and hydroxides	-	1E+3	6E-7	2E-9	-	-
46	Palladium-101	D, see ^{100}Pd	1E+4	3E+4	1E-5	5E-8	2E-4	2E-3
		W, see ^{100}Pd	-	3E+4	1E-5	5E-8	-	-
		Y, see ^{100}Pd	-	3E+4	1E-5	4E-8	-	-
46	Palladium-103	D, see ^{100}Pd	6E+3	6E+3	3E-6	9E-9	-	-
			LLI wall (7E+3)	-	-	-	1E-4	1E-3
		W, see ^{100}Pd	-	4E+3	2E-6	6E-9	-	-
		Y, see ^{100}Pd	-	4E+3	1E-6	5E-9	-	-
46	Palladium-107	D, see ^{100}Pd	3E+4	2E+4	9E-6	-	-	-
			LLI wall (4E+4)	Kidneys (2E+4)	-	3E-8	5E-4	5E-3
		W, see ^{100}Pd	-	7E+3	3E-6	1E-8	-	-
		Y, see ^{100}Pd	-	4E+2	2E-7	6E-10	-	-
46	Palladium-109	D, see ^{100}Pd	2E+3	6E+3	3E-6	9E-9	3E-5	3E-4
		W, see ^{100}Pd	-	5E+3	2E-6	8E-9	-	-
		Y, see ^{100}Pd	-	5E+3	2E-6	6E-9	-	-
47	Silver-102[2]	D, all compounds except those given for W and Y	5E+4	2E+5	8E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	9E-4	9E-3
		W, nitrates and sulfides	-	2E+5	9E-5	3E-7	-	-
		Y, oxides and hydroxides	-	2E+5	8E-5	3E-7	-	-
47	Silver-103[2]	D, see ^{102}Ag	4E+4	1E+5	4E-5	1E-7	5E-4	5E-3
		W, see ^{102}Ag	-	1E+5	5E-5	2E-7	-	-
		Y, see ^{102}Ag	-	1E+5	5E-5	2E-7	-	-
47	Silver-104m[2]	D, see ^{102}Ag	3E+4	9E+4	4E-5	1E-7	4E-4	4E-3
		W, see ^{102}Ag	-	1E+5	5E-5	2E-7	-	-
		Y, see ^{102}Ag	-	1E+5	5E-5	2E-7	-	-
47	Silver-104[2]	D, see ^{102}Ag	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
		W, see ^{102}Ag	-	1E+5	6E-5	2E-7	-	-
		Y, see ^{102}Ag	-	1E+5	6E-5	2E-7	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
47	Silver-105	D, see ^{102}Ag	3E+3	1E+3	4E-7	1E-9	4E-5	4E-4
		W, see ^{102}Ag	-	2E+3	7E-7	2E-9	-	-
		Y, see ^{102}Ag	-	2E+3	7E-7	2E-9	-	-
47	Silver-106m	D, see ^{102}Ag	8E+2	7E+2	3E-7	1E-9	1E-5	1E-4
		W, see ^{102}Ag	-	9E+2	4E-7	1E-9	-	-
		Y, see ^{102}Ag	-	9E+2	4E-7	1E-9	-	-
47	Silver-106[2]	D, see ^{102}Ag	6E+4	2E+5	8E-5	3E-7	-	-
			St. wall (6E+4)	-	-	-	9E-4	9E-3
		W, see ^{102}Ag	-	2E+5	9E-5	3E-7	-	-
		Y, see ^{102}Ag	-	2E+5	8E-5	3E-7	-	-
47	Silver-108m	D, see ^{102}Ag	6E+2	2E+2	8E-8	3E-10	9E-6	9E-5
		W, see ^{102}Ag	-	3E+2	1E-7	4E-10	-	-
		Y, see ^{102}Ag	-	2E+1	1E-8	3E-11	-	-
47	Silver-110m	D, see ^{102}Ag	5E+2	1E+2	5E-8	2E-10	6E-6	6E-5
		W, see ^{102}Ag	-	2E+2	8E-8	3E-10	-	-
		Y, see ^{102}Ag	-	9E+1	4E-8	1E-10	-	-
47	Silver-111	D, see ^{102}Ag	9E+2	2E+3	6E-7	-	-	-
			LLI wall (1E+3)	Liver (2E+3)	-	2E-9	2E-5	2E-4
		W, see ^{102}Ag	-	9E+2	4E-7	1E-9	-	-
		Y, see ^{102}Ag	-	9E+2	4E-7	1E-9	-	-
47	Silver-112	D, see ^{102}Ag	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
		W, see ^{102}Ag	-	1E+4	4E-6	1E-8	-	-
		Y, see ^{102}Ag	-	9E+3	4E-6	1E-8	-	-
47	Silver-115[2]	D, see ^{102}Ag	3E+4	9E+4	4E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, see ^{102}Ag	-	9E+4	4E-5	1E-7	-	-
		Y, see ^{102}Ag	-	8E+4	3E-5	1E-7	-	-
48	Cadmium-104[2]	D, all compounds except those given for W and Y	2E+4	7E+4	3E-5	9E-8	3E-4	3E-3
		W, sulfides, halides, and nitrates	-	1E+5	5E-5	2E-7	-	-
		Y, oxides and hydroxides	-	1E+5	5E-5	2E-7	-	-
48	Cadmium-107	D, see ^{104}Cd	2E+4	5E+4	2E-5	8E-8	3E-4	3E-3
		W, see ^{104}Cd	-	6E+4	2E-5	8E-8	-	-
		Y, see ^{104}Cd	-	5E+4	2E-5	7E-8	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
48	Cadmium-109	D, see ^{104}Cd	3E+2	4E+1	1E-8	-	-	-
			Kidneys (4E+2)	Kidneys (5E+1)	-	7E-11	6E-6	6E-5
		W, see ^{104}Cd	-	1E+2	5E-8	-	-	-
			-	Kidneys (1E+2)	-	2E-10	-	-
		Y, see ^{104}Cd	-	1E+2	5E-8	2E-10	-	-
48	Cadmium-113m	D, see ^{104}Cd	2E+1	2E+0	1E-9	-	-	-
			Kidneys (4E+1)	Kidneys (4E+0)	-	5E-12	5E-7	5E-6
		W, see ^{104}Cd	-	8E+0	4E-9	-	-	-
			-	Kidneys (1E+1)	-	2E-11	-	-
		Y, see ^{104}Cd	-	1E+1	5E-9	2E-11	-	-
48	Cadmium-113	D, see ^{104}Cd	2E+1	2E+0	9E-10	-	-	-
			Kidneys (3E+1)	Kidneys (3E+0)	-	5E-12	4E-7	4E-6
		W, see ^{104}Cd	-	8E+0	3E-9	-	-	-
			-	Kidneys (1E+1)	-	2E-11	-	-
		Y, see ^{104}Cd	-	1E+1	6E-9	2E-11	-	-
48	Cadmium-115m	D, see ^{104}Cd	3E+2	5E+1	2E-8	-	4E-6	4E-5
			-	Kidneys (8E+1)	-	1E-10	-	-
		W, see ^{104}Cd	-	1E+2	5E-8	2E-10	-	-
		Y, see ^{104}Cd	-	1E+2	6E-8	2E-10	-	-
48	Cadmium-115	D, see ^{104}Cd	9E+2	1E+3	6E-7	2E-9	-	-
			LLI wall (1E+3)	-	-	-	1E-5	1E-4
		W, see ^{104}Cd	-	1E+3	5E-7	2E-9	-	-
		Y, see ^{104}Cd	-	1E+3	6E-7	2E-9	-	-
48	Cadmium-117m	D, see ^{104}Cd	5E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		W, see ^{104}Cd	-	2E+4	7E-6	2E-8	-	-
		Y, see ^{104}Cd	-	1E+4	6E-6	2E-8	-	-
48	Cadmium-117	D, see ^{104}Cd	5E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		W, see ^{104}Cd	-	2E+4	7E-6	2E-8	-	-
		Y, see ^{104}Cd	-	1E+4	6E-6	2E-8	-	-
49	Indium-109	D, all compounds except those given for W	2E+4	4E+4	2E-5	6E-8	3E-4	3E-3
		W, oxides, hydroxides, halides, and nitrates	-	6E+4	3E-5	9E-8	-	-
49	Indium-110[2] (69.1 min)	D, see ^{109}In	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{109}In	-	6E+4	2E-5	8E-8	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
49	Indium-110 (4.9 h)	D, see ^{109}In	5E+3	2E+4	7E-6	2E-8	7E-5	7E-4
		W, see ^{109}In	-	2E+4	8E-6	3E-8	-	-
49	Indium-111	D, see ^{109}In	4E+3	6E+3	3E-6	9E-9	6E-5	6E-4
		W, see ^{109}In	-	6E+3	3E-6	9E-9	-	-
49	Indium-112[2]	D, see ^{109}In	2E+5	6E+5	3E-4	9E-7	2E-3	2E-2
		W, see ^{109}In	-	7E+5	3E-4	1E-6	-	-
49	Indium-113m[2]	D, see ^{109}In	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
		W, see ^{109}In	-	2E+5	8E-5	3E-7	-	-
49	Indium-114m	D, see ^{109}In	3E+2	6E+1	3E-8	9E-11	-	-
			LLI wall (4E+2)	-	-	-	5E-6	5E-5
		W, see ^{109}In	-	1E+2	4E-8	1E-10	-	-
49	Indium-115m	D, see ^{109}In	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{109}In	-	5E+4	2E-5	7E-8	-	-
49	Indium-115	D, see ^{109}In	4E+1	1E+0	6E-10	2E-12	5E-7	5E-6
		W, see ^{109}In	-	5E+0	2E-9	8E-12	-	-
49	Indium-116m[2]	D, see ^{109}In	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		W, see ^{109}In	-	1E+5	5E-5	2E-7	-	-
49	Indium-117m[2]	D, see ^{109}In	1E+4	3E+4	1E-5	5E-8	2E-4	2E-3
		W, see ^{109}In	-	4E+4	2E-5	6E-8	-	-
49	Indium-117[2]	D, see ^{109}In	6E+4	2E+5	7E-5	2E-7	8E-4	8E-3
		W, see ^{109}In	-	2E+5	9E-5	3E-7	-	-
49	Indium-119m[2]	D, see ^{109}In	4E+4	1E+5	5E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
		W, see ^{109}In	-	1E+5	6E-5	2E-7	-	-
50	Tin-110	D, all compounds except those given for W	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
		W, sulfides, oxides, hydroxides, halides, nitrates, and stannic phosphate	-	1E+4	5E-6	2E-8	-	-
50	Tin-111[2]	D, see ^{110}Sn	7E+4	2E+5	9E-5	3E-7	1E-3	1E-2
		W, see ^{110}Sn	-	3E+5	1E-4	4E-7	-	-
50	Tin-113	D, see ^{110}Sn	2E+3	1E+3	5E-7	2E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
		W, see ^{110}Sn	-	5E+2	2E-7	8E-10	-	-
50	Tin-117m	D, see ^{110}Sn	2E+3	1E+3	5E-7	-	-	-
			LLI wall (2E+3)	Bone surf (2E+3)	-	3E-9	3E-5	3E-4
		W, see ^{110}Sn	-	1E+3	6E-7	2E-9	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
50	Tin-119m	D, see ^{110}Sn	3E+3	2E+3	1E-6	3E-9	-	-
			LLI wall (4E+3)	-	-	-	6E-5	6E-4
		W, see ^{110}Sn	-	1E+3	4E-7	1E-9	-	-
50	Tin-121m	D, see ^{110}Sn	3E+3	9E+2	4E-7	1E-9	-	-
			LLI wall (4E+3)	-	-	-	5E-5	5E-4
		W, see ^{110}Sn	-	5E+2	2E-7	8E-10	-	-
50	Tin-121	D, see ^{110}Sn	6E+3	2E+4	6E-6	2E-8	-	-
			LLI wall (6E+3)	-	-	-	8E-5	8E-4
		W, see ^{110}Sn	-	1E+4	5E-6	2E-8	-	-
50	Tin-123m[2]	D, see ^{110}Sn	5E+4	1E+5	5E-5	2E-7	7E-4	7E-3
		W, see ^{110}Sn	-	1E+5	6E-5	2E-7	-	-
50	Tin-123	D, see ^{110}Sn	5E+2	6E+2	3E-7	9E-10	-	-
			LLI wall (6E+2)	-	-	-	9E-6	9E-5
		W, see ^{110}Sn	-	2E+2	7E-8	2E-10	-	-
50	Tin-125	D, see ^{110}Sn	4E+2	9E+2	4E-7	1E-9	-	-
			LLI wall (5E+2)	-	-	-	6E-6	6E-5
		W, see ^{110}Sn	-	4E+2	1E-7	5E-10	-	-
50	Tin-126	D, see ^{110}Sn	3E+2	6E+1	2E-8	8E-11	4E-6	4E-5
		W, see ^{110}Sn	-	7E+1	3E-8	9E-11	-	-
50	Tin-127	D, see ^{110}Sn	7E+3	2E+4	8E-6	3E-8	9E-5	9E-4
		W, see ^{110}Sn	-	2E+4	8E-6	3E-8	-	-
50	Tin-128[2]	D, see ^{110}Sn	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
		W, see ^{110}Sn	-	4E+4	1E-5	5E-8	-	-
51	Antimony-115[2]	D, all compounds except those given for W	8E+4	2E+5	1E-4	3E-7	1E-3	1E-2
		W, oxides, hydroxides, halides, sulfides, sulfates, and nitrates	-	3E+5	1E-4	4E-7	-	-
51	Antimony-116m[2]	D, see ^{115}Sb	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
		W, see ^{115}Sb	-	1E+5	6E-5	2E-7	-	-
51	Antimony-116[2]	D, see ^{115}Sb	7E+4	3E+5	1E-4	4E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
		W, see ^{115}Sb	-	3E+5	1E-4	5E-7	-	-
51	Antimony-117	D, see ^{115}Sb	7E+4	2E+5	9E-5	3E-7	9E-4	9E-3
		W, see ^{115}Sb	-	3E+5	1E-4	4E-7	-	-
51	Antimony-118m	D, see ^{115}Sb	6E+3	2E+4	8E-6	3E-8	7E-5	7E-4
		W, see ^{115}Sb	5E+3	2E+4	9E-6	3E-8	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
51	Antimony-119	D, see ^{115}Sb	2E+4	5E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{115}Sb	2E+4	3E+4	1E-5	4E-8	-	-
51	Antimony-120[2] (16 min)	D, see ^{115}Sb	1E+5	4E+5	2E-4	6E-7	-	-
			St wall (2E+5)	-	-	-	2E-3	2E-2
		W, see ^{115}Sb	-	5E+5	2E-4	7E-7	-	-
51	Antimony-120 (5.76 d)	D, see ^{115}Sb	1E+3	2E+3	9E-7	3E-9	1E-5	1E-4
		W, see ^{115}Sb	9E+2	1E+3	5E-7	2E-9	-	-
51	Antimony-122	D, see ^{115}Sb	8E+2	2E+3	1E-6	3E-9	-	-
			LLI wall (8E+2)	-	-	-	1E-5	1E-4
		W, see ^{115}Sb	7E+2	1E+3	4E-7	2E-9	-	-
51	Antimony-124m[2]	D, see ^{115}Sb	3E+5	8E+5	4E-4	1E-6	3E-3	3E-2
		W, see ^{115}Sb	2E+5	6E+5	2E-4	8E-7	-	-
51	Antimony-124	D, see ^{115}Sb	6E+2	9E+2	4E-7	1E-9	7E-6	7E-5
		W, see ^{115}Sb	5E+2	2E+2	1E-7	3E-10	-	-
51	Antimony-125	D, see ^{115}Sb	2E+3	2E+3	1E-6	3E-9	3E-5	3E-4
		W, see ^{115}Sb	-	5E+2	2E-7	7E-10	-	-
51	Antimony-126m[2]	D, see ^{115}Sb	5E+4	2E+5	8E-5	3E-7	-	-
			St wall (7E+4)	-	-	-	9E-4	9E-3
		W, see ^{115}Sb	-	2E+5	8E-5	3E-7	-	-
51	Antimony-126	D, see ^{115}Sb	6E+2	1E+3	5E-7	2E-9	7E-6	7E-5
		W, see ^{115}Sb	5E+2	5E+2	2E-7	7E-10	-	-
51	Antimony-127	D, see ^{115}Sb	8E+2	2E+3	9E-7	3E-9	-	-
			LLI wall (8E+2)	-	-	-	1E-5	1E-4
		W, see ^{115}Sb	7E+2	9E+2	4E-7	1E-9	-	-
51	Antimony-128[2] (10.4 min)	D, see ^{115}Sb	8E+4	4E+5	2E-4	5E-7	-	-
			St wall (1E+5)	-	-	-	1E-3	1E-2
		W, see ^{115}Sb	-	4E+5	2E-4	6E-7	-	-
51	Antimony-128 (9.01 h)	D, see ^{115}Sb	1E+3	4E+3	2E-6	6E-9	2E-5	2E-4
		W, see ^{115}Sb	-	3E+3	1E-6	5E-9	-	-
51	Antimony-129	D, see ^{115}Sb	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		W, see ^{115}Sb	-	9E+3	4E-6	1E-8	-	-
51	Antimony-130[2]	D, see ^{115}Sb	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		W, see ^{115}Sb	-	8E+4	3E-5	1E-7	-	-
51	Antimony-131[2]	D, see ^{115}Sb	1E+4	2E+4	1E-5	-	-	-
			Thyroid (2E+4)	Thyroid (4E+4)	-	6E-8	2E-4	2E-3
		W, see ^{115}Sb	-	2E+4	1E-5		-	-
			-	Thyroid (4E+4)	-	6E-8	-	-

Figure: 30 TAC §336.359(d)

			Table I Occupational Values			Table II Effluent Concentrations		Table III Release to Sewers
			Col. 1 Oral Ingestion	Col. 2 Inhalation	Col. 3 Inhalation	Col. 1	Col. 2	Montly Average
Atomic No.	Radionuclide	Class	ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentrations (μCi/ml)
52	Tellurium-116	D, all compounds except those given for W	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3
		W, oxides, hydroxides, and nitrates	-	3E+4	1E-5	4E-8	-	-
52	Tellurium-121m	D, see ^{116}Te	5E+2	2E+2	8E-8	-	-	-
			Bone surf (7E+2)	Bone surf (4E+2)	-	5E-10	1E-5	1E-4
		W, see ^{116}Te	-	4E+2	2E-7	6E-10	-	-
52	Tellurium-121	D, see ^{116}Te	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
		W, see ^{116}Te	-	3E+3	1E-6	4E-9	-	-
52	Tellurium-123m	D, see ^{116}Te	6E+2	2E+2	9E-8	-	-	-
			Bone surf (1E+3)	Bone surf (5E+2)	-	8E-10	1E-5	1E-4
		W, see ^{116}Te	-	5E+2	2E-7	8E-10	-	-
52	Tellurium-123	D, see ^{116}Te	5E+2	2E+2	8E-8	-	-	-
			Bone surf (1E+3)	Bone surf (5E+2)	-	7E-10	2E-5	2E-4
		W, see ^{116}Te	-	4E+2	2E-7	-	-	-
			-	Bone surf (1E+3)	-	2E-9	-	-
52	Tellurium-125m	D, see ^{116}Te	1E+3	4E+2	2E-7	-	-	-
			Bone surf (1E+3)	Bone surf (1E+3)	-	1E-9	2E-5	2E-4
		W, see ^{116}Te	-	7E+2	3E-7	1E-9	-	-
52	Tellurium-127m	D, see ^{116}Te	6E+2	3E+2	1E-7	-	9E-6	9E-5
			-	Bone surf (4E+2)	-	6E-10	-	-
		W, see ^{116}Te	-	3E+2	1E-7	4E-10	-	-
52	Tellurium-127	D, see ^{116}Te	7E+3	2E+4	9E-6	3E-8	1E-4	1E-3
		W, see ^{116}Te	-	2E+4	7E-6	2E-8	-	-
52	Tellurium-129m	D, see ^{116}Te	5E+2	6E+2	3E-7	9E-10	7E-6	7E-5
		W, see ^{116}Te	-	2E+2	1E-7	3E-10	-	-
52	Tellurium-129[2]	D, see ^{116}Te	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
		W, see ^{116}Te	-	7E+4	3E-5	1E-7	-	-
52	Tellurium-131m	D, see ^{116}Te	3E+2	4E+2	2E-7	-	-	-
			Thyroid (6E+2)	Thyroid (1E+3)	-	2E-9	8E-6	8E-5
		W, see ^{116}Te	-	4E+2	2E-7	-	-	-
			-	Thyroid (9E+2)	-	1E-9	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
52	Tellurium-131[2]	D, see ^{116}Te	3E+3	5E+3	2E-6	-	-	-
			Thyroid (6E+3)	Thyroid (1E+4)	-	2E-8	8E-5	8E-4
		W, see ^{116}Te	-	5E+3	2E-6	-	-	-
			-	Thyroid (1E+4)	-	2E-8	-	-
52	Tellurium-132	D, see ^{116}Te	2E+2	2E+2	9E-8	-	-	-
			Thyroid (7E+2)	Thyroid (8E+2)	-	1E-9	9E-6	9E-5
		W, see ^{116}Te	-	2E+2	9E-8	-	-	-
			-	Thyroid (6E+2)	-	9E-10	-	-
52	Tellurium-133m[2]	D, see ^{116}Te	3E+3	5E+3	2E-6	-	-	-
			Thyroid (6E+3)	Thyroid (1E+4)	-	2E-8	9E-5	9E-4
		W, see ^{116}Te	-	5E+3	2E-6	-	-	-
			-	Thyroid (1E+4)	-	2E-8	-	-
52	Tellurium-133[2]	D, see ^{116}Te	1E+4	2E+4	9E-6	-	-	-
			Thyroid (3E+4)	Thyroid (6E+4)	-	8E-8	4E-4	4E-3
		W, see ^{116}Te	-	2E+4	9E-6	-	-	-
			-	Thyroid (6E+4)	-	8E-8	-	-
52	Tellurium-134[2]	D, see ^{116}Te	2E+4	2E+4	1E-5	-	-	-
			Thyroid (2E+4)	Thyroid (5E+4)	-	7E-8	3E-4	3E-3
		W, see ^{116}Te	-	2E+4	1E-5	-	-	-
			-	Thyroid (5E+4)	-	7E-8	-	-
53	Iodine-120m[2]	D, all compounds	1E+4	2E+4	9E-6	3E-8	-	-
			Thyroid (2E+4)	-	-	-	2E-4	2E-3
53	Iodine-120[2]	D, all compounds	4E+3	9E+3	4E-6	-	-	-
			Thyroid (8E+3)	Thyroid (2E+4)	-	2E-8	1E-4	1E-3
53	Iodine-121	D, all compounds	1E+4	2E+4	8E-6	-	-	-
			Thyroid (3E+3)	Thyroid (5E+4)	-	7E-8	4E-4	4E-3
53	Iodine-123	D, all compounds	3E+3	6E+3	3E-6	-	-	-
			Thyroid (1E+4)	Thyroid (2E+4)	-	2E-8	1E-4	1E-3
53	Iodine-124	D, all compounds	5E+1	8E+1	3E-8	-	-	-
			Thyroid (2E+2)	Thyroid (3E+2)	-	4E-10	2E-6	2E-5

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values, Col. 1 Oral Ingestion ALI (µCi)	Table I Occupational Values, Col. 2 Inhalation ALI (µCi)	Table I Occupational Values, Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations, Col. 1 Air (µCi/ml)	Table II Effluent Concentrations, Col. 2 Water (µCi/ml)	Table III Release to Sewers, Montly Average Concentrations (µCi/ml)
53	Iodine-125	D, all compounds	4E+1	6E+1	3E-8	-	-	-
			Thyroid (1E+2)	Thyroid (2E+2)	-	3E-10	2E-6	2E-5
53	Iodine-126	D, all compounds	2E+1	4E+1	1E-8	-	-	-
			Thyroid (7E+1)	Thyroid (1E+2)	-	2E-10	1E-6	1E-5
53	Iodine-128[2]	D, all compounds	4E+4	1E+5	5E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
53	Iodine-129	D, all compounds	5E+0	9E+0	4E-9	-	-	-
			Thyroid (2E+1)	Thyroid (3E+1)	-	4E-11	2E-7	2E-6
53	Iodine-130	D, all compounds	4E+2	7E+2	3E-7	-	-	-
			Thyroid (1E+3)	Thyroid (2E+3)	-	3E-9	2E-5	2E-4
53	Iodine-131	D, all compounds	3E+1	5E+1	2E-8	-	-	-
			Thyroid (9E+1)	Thyroid (2E+2)	-	2E-10	1E-6	1E-5
53	Iodine-132m[2]	D, all compounds	4E+3	8E+3	4E-6	-	-	-
			Thyroid (1E+4)	Thyroid (2E+4)	-	3E-8	1E-4	1E-3
53	Iodine-132	D, all compounds	4E+3	8E+3	3E-6	-	-	-
			Thyroid (9E+3)	Thyroid (1E+4)	-	2E-8	1E-4	1E-3
53	Iodine-133	D, all compounds	1E+2	3E+2	1E-7	-	-	-
			Thyroid (5E+2)	Thyroid (9E+2)	-	1E-9	7E-6	7E-5
53	Iodine-134[2]	D, all compounds	2E+4	5E+4	2E-5	6E-8	-	-
			Thyroid (3E+4)	-	-	-	4E-4	4E-3
53	Iodine-135	D, all compounds	8E+2	2E+3	7E-7	-	-	-
			Thyroid (3E+3)	Thyroid (4E+3)	-	6E-9	3E-5	3E-4
54	Xenon-120[2]	Submersion[1]	-	-	1E-5	4E-8	-	-
54	Xenon-121[2]	Submersion[1]	-	-	2E-6	1E-8	-	-
54	Xenon-122	Submersion[1]	-	-	7E-5	3E-7	-	-
54	Xenon-123	Submersion[1]	-	-	6E-6	3E-8	-	-
54	Xenon-125	Submersion[1]	-	-	2E-5	7E-8	-	-
54	Xenon-127	Submersion[1]	-	-	1E-5	6E-8	-	-
54	Xenon-129m	Submersion[1]	-	-	2E-4	9E-7	-	-
54	Xenon-131m	Submersion[1]	-	-	4E-4	2E-6	-	-
54	Xenon-133m	Submersion[1]	-	-	1E-4	6E-7	-	-
54	Xenon-133	Submersion[1]	-	-	1E-4	5E-7	-	-
54	Xenon-135m[2]	Submersion[1]	-	-	9E-6	4E-8	-	-
54	Xenon-135	Submersion[1]	-	-	1E-5	7E-8	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
54	Xenon-138[2]	Submersion[1]	-	-	4E-6	2E-8	-	-
55	Cesium-125[2]	D, all compounds	5E+4	1E+5	6E-5	2E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
55	Cesium-127	D, all compounds	6E+4	9E+4	4E-5	1E-7	9E-4	9E-3
55	Cesium-129	D, all compounds	2E+4	3E+4	1E-5	5E-8	3E-4	3E-3
55	Cesium-130[2]	D, all compounds	6E+4	2E+5	8E-5	3E-7	-	-
			St wall (1E+5)	-	-	-	1E-3	1E-2
55	Cesium-131	D, all compounds	2E+4	3E+4	1E-5	4E-8	3E-4	3E-3
55	Cesium-132	D, all compounds	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
55	Cesium-134m	D, all compounds	1E+5	1E+5	6E-5	2E-7	-	-
			St wall (1E+5)	-	-	-	2E-3	2E-2
55	Cesium-134	D, all compounds	7E+1	1E+2	4E-8	2E-10	9E-7	9E-6
55	Cesium-135m[2]	D, all compounds	1E+5	2E+5	8E-5	3E-7	1E-3	1E-2
55	Cesium-135	D, all compounds	7E+2	1E+3	5E-7	2E-9	1E-5	1E-4
55	Cesium-136	D, all compounds	4E+2	7E+2	3E-7	9E-10	6E-6	6E-5
55	Cesium-137	D, all compounds	1E+2	2E+2	6E-8	2E-10	1E-6	1E-5
55	Cesium-138[2]	D, all compounds	2E+4	6E+4	2E-5	8E-8	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
56	Barium-126[2]	D, all compounds	6E+3	2E+4	6E-6	2E-8	8E-5	8E-4
56	Barium-128	D, all compounds	5E+2	2E+3	7E-7	2E-9	7E-6	7E-5
56	Barium-131m[2]	D, all compounds	4E+5	1E+6	6E-4	2E-6	-	-
			St wall (5E+5)	-	-	-	7E-3	7E-2
56	Barium-131	D, all compounds	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
56	Barium-133m	D, all compounds	2E+3	9E+3	4E-6	1E-8	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
56	Barium-133	D, all compounds	2E+3	7E+2	3E-7	9E-10	2E-5	2E-4
56	Barium-135m	D, all compounds	3E+3	1E+4	5E-6	2E-8	4E-5	4E-4
56	Barium-139[2]	D, all compounds	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
56	Barium-140	D, all compounds	5E+2	1E+3	6E-7	2E-9	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
56	Barium-141[2]	D, all compounds	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
56	Barium-142[2]	D, all compounds	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
57	Lanthanum-131[2]	D, all compounds except those given for W	5E+4	1E+5	5E-5	2E-7	6E-4	6E-3
		W, oxides and hydroxides	-	2E+5	7E-5	2E-7	-	-
57	Lanthanum-132	D, see ^{131}La	3E+3	1E+4	4E-6	1E-8	4E-5	4E-4
		W, see ^{131}La	-	1E+4	5E-6	2E-8	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
57	Lanthanum-135	D, see ^{131}La	4E+4	1E+5	4E-5	1E-7	5E-4	5E-3
		W, see ^{131}La	-	9E+4	4E-5	1E-7	-	-
57	Lanthanum-137	D, see ^{131}La	1E+4	6E+1	3E-8	-	2E-4	2E-3
			-	Liver (7E+1)	-	1E-10	-	-
		W, see ^{131}La	-	3E+2	1E-7	-	-	-
			-	Liver (3E+2)	-	4E-10	-	-
57	Lanthanum-138	D, see ^{131}La	9E+2	4E+0	1E-9	5E-12	1E-5	1E-4
		W, see ^{131}La	-	1E+1	6E-9	2E-11	-	-
57	Lanthanum-140	D, see ^{131}La	6E+2	1E+3	6E-7	2E-9	9E-6	9E-5
		W, see ^{131}La	-	1E+3	5E-7	2E-9	-	-
57	Lanthanum-141	D, see ^{131}La	4E+3	9E+3	4E-6	1E-8	5E-5	5E-4
		W, see ^{131}La	-	1E+4	5E-6	2E-8	-	-
57	Lanthanum-142[2]	D, see ^{131}La	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3
		W, see ^{131}La	-	3E+4	1E-5	5E-8	-	-
57	Lanthanum-143[2]	D, see ^{131}La	4E+4	1E+5	4E-5	1E-7	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ^{131}La	-	9E+4	4E-5	1E-7	-	-
58	Cerium-134	W, all compounds except those given for Y	5E+2	7E+2	3E-7	1E-9	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
		Y, oxides, hydroxides, and fluorides	-	7E+2	3E-7	9E-10	-	-
58	Cerium-135	W, see ^{134}Ce	2E+3	4E+3	2E-6	5E-9	2E-5	2E-4
		Y, see ^{134}Ce	-	4E+3	1E-6	5E-9	-	-
58	Cerium-137m	W, see ^{134}Ce	2E+3	4E+3	2E-6	6E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
		Y, see ^{134}Ce	-	4E+3	2E-6	5E-9	-	-
58	Cerium-137	W, see ^{134}Ce	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
		Y, see ^{134}Ce	-	1E+5	5E-5	2E-7	-	-
58	Cerium-139	W, see ^{134}Ce	5E+3	8E+2	3E-7	1E-9	7E-5	7E-4
		Y, see ^{134}Ce	-	7E+2	3E-7	9E-10	-	-
58	Cerium-141	W, see ^{134}Ce	2E+3	7E+2	3E-7	1E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
		Y, see ^{134}Ce	-	6E+2	2E-7	8E-10	-	-
58	Cerium-143	W, see ^{134}Ce	1E+3	2E+3	8E-7	3E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{134}Ce	-	2E+3	7E-7	2E-9	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
58	Cerium-144	W, see ^{134}Ce	2E+2	3E+1	1E-8	4E-11	-	-
			LLI wall (3E+2)	-	-	-	3E-6	3E-5
		Y, see ^{134}Ce	-	1E+1	6E-9	2E-11	-	-
59	Praseodymium-136[2]	W, all compounds	5E+4	2E+5	1E-4	3E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
		Y, oxides, hydroxides, carbides, and fluorides	-	2E+5	9E-5	3E-7	-	-
59	Praseodymium-137[2]	W, see ^{136}Pr	4E+4	2E+5	6E-5	2E-7	5E-4	5E-3
		Y, see ^{136}Pr	-	1E+5	6E-5	2E-7	-	-
59	Praseodymium-138m	W, see ^{136}Pr	1E+4	5E+4	2E-5	8E-8	1E-4	1E-3
		Y, see ^{136}Pr	-	4E+4	2E-5	6E-8	-	-
59	Praseodymium-139	W, see ^{136}Pr	4E+4	1E+5	5E-5	2E-7	6E-4	6E-3
		Y, see ^{136}Pr	-	1E+5	5E-5	2E-7	-	-
59	Praseodymium-142m[2]	W, see ^{136}Pr	8E+4	2E+5	7E-5	2E-7	1E-3	1E-2
		Y, see ^{136}Pr	-	1E+5	6E-5	2E-7	-	-
59	Praseodymium-142	W, see ^{136}Pr	1E+3	2E+3	9E-7	3E-9	1E-5	1E-4
		Y, see ^{136}Pr	-	2E+3	8E-7	3E-9	-	-
59	Praseodymium-143	W, see ^{136}Pr	9E+2	8E+2	3E-7	1E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{136}Pr	-	7E+2	3E-7	9E-10	-	-
59	Praseodymium-144[2]	W, see ^{136}Pr	3E+4	1E+5	5E-5	2E-7	-	-
			St wall (4E+4)	-	-	-	6E-4	6E-3
		Y, see ^{136}Pr	-	1E+5	5E-5	2E-7	-	-
59	Praseodymium-145	W, see ^{136}Pr	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		Y, see ^{136}Pr	-	8E+3	3E-6	1E-8	-	-
59	Praseodymium-147[2]	W, see ^{136}Pr	5E+4	2E+5	8E-5	3E-7	-	-
			St wall (8E+4)	-	-	-	1E-3	1E-2
		Y, see ^{136}Pr	-	2E+5	8E-5	3E-7	-	-
60	Neodymium-136[2]	W, all compounds except those given for Y	1E+4	6E+4	2E-5	8E-8	2E-4	2E-3
		Y, oxides, hydroxides, carbides, and fluorides	-	5E+4	2E-5	8E-8	-	-
60	Neodymium-138	W, see ^{136}Nd	2E+3	6E+3	3E-6	9E-9	3E-5	3E-4
		Y, see ^{136}Nd	-	5E+3	2E-6	7E-9	-	-
60	Neodymium-139m	W, see ^{136}Nd	5E+3	2E+4	7E-6	2E-8	7E-5	7E-4
		Y, see ^{136}Nd	-	1E+4	6E-6	2E-8	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
60	Neodymium-139[2]	W, see ^{136}Nd	9E+4	3E+5	1E-4	5E-7	1E-3	1E-2
		Y, see ^{136}Nd	-	3E+5	1E-4	4E-7	-	-
60	Neodymium-141	W, see ^{136}Nd	2E+5	7E+5	3E-4	1E-6	2E-3	2E-2
		Y, see ^{136}Nd	-	6E+5	3E-4	9E-7	-	-
60	Neodymium-147	W, see ^{136}Nd	1E+3	9E+2	4E-7	1E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{136}Nd	-	8E+2	4E-7	1E-9	-	-
60	Neodymium-149[2]	W, see ^{136}Nd	1E+4	3E+4	1E-5	4E-8	1E-4	1E-3
		Y, see ^{136}Nd	-	2E+4	1E-5	3E-8	-	-
60	Neodymium-151[2]	W, see ^{136}Nd	7E+4	2E+5	8E-5	3E-7	9E-4	9E-3
		Y, see ^{136}Nd	-	2E+5	8E-5	3E-7	-	-
61	Promethium-141[2]	W, all compounds except those given for Y	5E+4	2E+5	8E-5	3E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
		Y, oxides, hydroxides, carbides, and fluorides	-	2E+5	7E-5	2E-7	-	-
61	Promethium-143	W, see ^{141}Pm	5E+3	6E+2	2E-7	8E-10	7E-5	7E-4
		Y, see ^{141}Pm	-	7E+2	3E-7	1E-9	-	-
61	Promethium-144	W, see ^{141}Pm	1E+3	1E+2	5E-8	2E-10	2E-5	2E-4
		Y, see ^{141}Pm	-	1E+2	5E-8	2E-10	-	-
61	Promethium-145	W, see ^{141}Pm	1E+4	2E+2	7E-8	-	1E-4	1E-3
			-	Bone surf (2E+2)	-	3E-10	-	-
		Y, see ^{141}Pm	-	2E+2	8E-8	3E-10	-	-
61	Promethium-146	W, see ^{141}Pm	2E+3	5E+1	2E-8	7E-11	2E-5	2E-4
		Y, see ^{141}Pm	-	4E+1	2E-8	6E-11	-	-
61	Promethium-147	W, see ^{141}Pm	4E+3	1E+2	5E-8	-	-	-
			LLI wall (5E+3)	Bone surf (2E+2)	-	3E-10	7E-5	7E-4
		Y, see ^{141}Pm	-	1E+2	6E-8	2E-10	-	-
61	Promethium-148m	W, see ^{141}Pm	7E+2	3E+2	1E-7	4E-10	1E-5	1E-4
		Y, see ^{141}Pm	-	3E+2	1E-7	5E-10	-	-
61	Promethium-148	W, see ^{141}Pm	4E+2	5E+2	2E-7	8E-10	-	-
			LLI wall (5E+2)	-	-	-	7E-6	7E-5
		Y, see ^{141}Pm	-	5E+2	2E-7	7E-10	-	-
61	Promethium-149	W, see ^{141}Pm	1E+3	2E+3	8E-7	3E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{141}Pm	-	2E+3	8E-7	2E-9	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
61	Promethium-150	W, see ^{141}Pm	5E+3	2E+4	8E-6	3E-8	7E-5	7E-4
		Y, see ^{141}Pm	-	2E+4	7E-6	2E-8	-	-
61	Promethium-151	W, see ^{141}Pm	2E+3	4E+3	1E-6	5E-9	2E-5	2E-4
		Y, see ^{141}Pm	-	3E+3	1E-6	4E-9	-	-
62	Samarium-141m[2]	W, all compounds	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3
62	Samarium-141[2]	W, all compounds	5E+4	2E+5	8E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
62	Samarium-142[2]	W, all compounds	8E+3	3E+4	1E-5	4E-8	1E-4	1E-3
62	Samarium-145	W, all compounds	6E+3	5E+2	2E-7	7E-10	8E-5	8E-4
62	Samarium-146	W, all compounds	1E+1	4E-2	1E-11	-	-	-
			Bone surf (3E+1)	Bone surf (6E-2)	-	9E-14	3E-7	3E-6
62	Samarium-147	W, all compounds	2E+1	4E-2	2E-11	-	-	-
			Bone surf (3E+1)	Bone surf (7E-2)	-	1E-13	4E-7	4E-6
62	Samarium-151	W, all compounds	1E+4	1E+2	4E-8	-	-	-
			LLI wall (1E-4)	Bone surf (2E+2)	-	2E-10	2E-4	2E-3
62	Samarium-153	W, all compounds	2E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
62	Samarium-155[2]	W, all compounds	6E+4	2E+5	9E-5	3E-7	-	-
			St wall (8E+4)	-	-	-	1E-3	1E-2
62	Samarium-156	W, all compounds	5E+3	9E+3	4E-6	1E-8	7E-5	7E-4
63	Europium-145	W, all compounds	2E+3	2E+3	8E-7	3E-9	2E-5	2E-4
63	Europium-146	W, all compounds	1E+3	1E+3	5E-7	2E-9	1E-5	1E-4
63	Europium-147	W, all compounds	3E+3	2E+3	7E-7	2E-9	4E-5	4E-4
63	Europium-148	W, all compounds	1E+3	4E+2	1E-7	5E-10	1E-5	1E-4
63	Europium-149	W, all compounds	1E+4	3E+3	1E-6	4E-9	2E-4	2E-3
63	Europium-150 (12.62 h)	W, all compounds	3E+3	8E+3	4E-6	1E-8	4E-5	4E-4
63	Europium-150 (34.2 y)	W, all compounds	8E+2	2E+1	8E-9	3E-11	1E-5	1E-4
63	Europium-152m	W, all compounds	3E+3	6E+3	3E-6	9E-9	4E-5	4E-4
63	Europium-152	W, all compounds	8E+2	2E+1	1E-8	3E-11	1E-5	1E-4
63	Europium-154	W, all compounds	5E+2	2E+1	8E-9	3E-11	7E-6	7E-5
63	Europium-155	W, all compounds	4E+3	9E+1	4E-8	-	5E-5	5E-4
			-	Bone surf (1E+2)	-	2E-10	-	-
63	Europium-156	W, all compounds	6E+2	5E+2	2E-7	6E-10	8E-6	8E-5
63	Europium-157	W, all compounds	2E+3	5E+3	2E-6	7E-9	3E-5	3E-4
63	Europium-158[2]	W, all compounds	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
64	Gadolinium-145[2]	D, all compounds except those given for W	5E+4	2E+5	6E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	6E-4	6E-3
		W, oxides, hydroxides, and fluorides	-	2E+5	7E-5	2E-7	-	-
64	Gadolinium-146	D, see ^{145}Gd	1E+3	1E+2	5E-8	2E-10	2E-5	2E-4
		W, see ^{145}Gd	-	3E+2	1E-7	4E-10	-	-
64	Gadolinium-147	D, see ^{145}Gd	2E+3	4E+3	2E-6	6E-9	3E-5	3E-4
		W, see ^{145}Gd	-	4E+3	1E-6	5E-9	-	-
64	Gadolinium-148	D, see ^{145}Gd	1E+1	8E+3	3E-12	-	-	-
			Bone surf (2E+1)	Bone surf (2E+2)	-	2E-14	3E-7	3E-6
		W, see ^{145}Gd	-	3E-2	1E-11	-	-	-
			-	Bone surf (6E-2)	-	8E-14	-	-
64	Gadolinium-149	D, see ^{145}Gd	3E+3	2E+3	9E-7	3E-9	4E-5	4E-4
		W, see ^{145}Gd	-	2E+3	1E-6	3E-9	-	-
64	Gadolinium-151	D, see ^{145}Gd	6E+3	4E+2	2E-7	-	9E-5	9E-4
			-	Bone surf (6E+2)	-	9E-10	-	-
		W, see ^{145}Gd	-	1E+3	5E-7	2E-9	-	-
64	Gadolinium-152	D, see ^{145}Gd	2E+1	1E-2	4E-12	-	-	-
			Bone surf (3E+1)	Bone surf (2E-2)	-	3E-14	4E-7	4E-6
		W, see ^{145}Gd	-	4E-2	2E-11	-	-	-
			-	Bone surf (8E-2)	-	1E-13	-	-
64	Gadolinium-153	D, see ^{145}Gd	5E+3	1E+2	6E-8	-	6E-5	6E-4
			-	Bone surf (2E+2)	-	3E-10	-	-
		W, see ^{145}Gd	-	6E+2	2E-7	8E-10	-	-
64	Gadolinium-159	D, see ^{145}Gd	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
		W, see ^{145}Gd	-	6E+3	2E-6	8E-9	-	-
65	Terbium-147[2]	W, all compounds	9E+3	3E+4	1E-5	5E-8	1E-4	1E-3
65	Terbium-149	W, all compounds	5E+3	7E+2	3E-7	1E-9	7E-5	7E-4
65	Terbium-150	W, all compounds	5E+3	2E+4	9E-6	3E-8	7E-5	7E-4
65	Terbium-151	W, all compounds	4E+3	9E+3	4E-6	1E-8	5E-5	5E-4
65	Terbium-153	W, all compounds	5E+3	7E+3	3E-6	1E-8	7E-5	7E-4
65	Terbium-154	W, all compounds	2E+3	4E+3	2E-6	6E-9	2E-5	2E-4
65	Terbium-155	W, all compounds	6E+3	8E+3	3E-6	1E-8	8E-5	8E-4
65	Terbium-156m (5.0 h)	W, all compounds	2E+4	3E+4	1E-5	4E-8	2E-4	2E-3

Figure: 30 TAC §336.359(d)

			Table I Occupational Values			Table II Effluent Concentrations		Table III Release to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
			Oral Ingestion	Inhalation				Montly Average
Atomic No.	**Radionuclide**	**Class**	ALI (µCi)	ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	Concentrations (µCi/ml)
65	Terbium-156m (24.4 h)	W, all compounds	7E+3	8E+3	3E-6	1E-8	1E-4	1E-3
65	Terbium-156	W, all compounds	1E+3	1E+3	6E-7	2E-9	1E-5	1E-4
65	Terbium-157	W, all compounds	5E+4	3E+2	1E-7	-	-	-
			LLI wall (5E+4)	Bone surf (6E+2)	-	8E-10	7E-4	7E-3
65	Terbium-158	W, all compounds	1E+3	2E+1	8E-9	3E-11	2E-5	2E-4
65	Terbium-160	W, all compounds	8E+2	2E+2	9E-8	3E-10	1E-5	1E-4
65	Terbium-161	W, all compounds	2E+3	2E+3	7E-7	2E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
66	Dysprosium-155	W, all compounds	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
66	Dysprosium-157	W, all compounds	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
66	Dysprosium-159	W, all compounds	1E+4	2E+3	1E-6	3E-9	2E-4	2E-3
66	Dysprosium-165	W, all compounds	1E+4	5E+4	2E-5	6E-8	2E-4	2E-3
66	Dysprosium-166	W, all compounds	6E+2	7E+2	3E-7	1E-9	-	-
			LLI wall (8E+2)	-	-	-	1E-5	1E-4
67	Holmium-155[2]	W, all compounds	4E+4	2E+5	6E-5	2E-7	6E-4	6E-3
67	Holmium-157[2]	W, all compounds	3E+5	1E+6	6E-4	2E-6	4E-3	4E-2
67	Holmium-159[2]	W, all compounds	2E+5	1E+6	4E-4	1E-6	3E-3	3E-2
67	Holmium-161	W, all compounds	1E+5	4E+5	2E-4	6E-7	1E-3	1E-2
67	Holmium-162m[2]	W, all compounds	5E+4	3E+5	1E-4	4E-7	7E-4	7E-3
67	Holmium-162[2]	W, all compounds	5E+5	2E+6	1E-3	3E-6	-	-
			St wall (8E+5)	-	-	-	1E-2	1E-1
67	Holmium-164m[2]	W, all compounds	1E+5	3E+5	1E-4	4E-7	1E-3	1E-2
67	Holmium-164[2]	W, all compounds	2E+5	6E+5	3E-4	9E-7	-	-
			St wall (2E+5)	-	-	-	3E-3	3E-2
67	Holmium-166m	W, all compounds	6E+2	7E+0	3E-9	9E-12	9E-6	9E-5
67	Holmium-166	W, all compounds	9E+2	2E+3	7E-7	2E-9	-	-
			LLI wall (9E+2)	-	-	-	1E-5	1E-4
67	Holmium-167	W, all compounds	2E+4	6E+4	2E-5	8E-8	2E-4	2E-3
68	Erbium-161	W, all compounds	2E+4	6E+4	3E-5	9E-8	2E-4	2E-3
68	Erbium-165	W, all compounds	6E+4	2E+5	8E-5	3E-7	9E-4	9E-3
68	Erbium-169	W, all compounds	3E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (4E+3)	-	-	-	5E-5	5E-4
68	Erbium-171	W, all compounds	4E+3	1E+4	4E-6	1E-8	5E-5	5E-4
68	Erbium-172	W, all compounds	1E+3	1E+3	6E-7	2E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
69	Thulium-162[2]	W, all compounds	7E+4	3E+5	1E-4	4E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
69	Thulium-166	W, all compounds	4E+3	1E+4	6E-6	2E-8	6E-5	6E-4
69	Thulium-167	W, all compounds	2E+3	2E+3	8E-7	3E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
69	Thulium-170	W, all compounds	8E+2	2E+2	9E-8	3E-10	-	-
			LLI wall (1E+3)	-	-	-	1E-5	1E-4
69	Thulium-171	W, all compounds	1E+4	3E+2	1E-7	-	-	-
			LLI wall (1E+4)	Bone surf (6E+2)	-	8E-10	2E-4	2E-3
69	Thulium-172	W, all compounds	7E+2	1E+3	5E-7	2E-9	-	-
			LLI wall (8E+2)	-	-	-	1E-5	1E-4
69	Thulium-173	W, all compounds	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
69	Thulium-175[2]	W, all compounds	7E+4	3E+5	1E-4	4E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
70	Ytterbium-162[2]	W, all compounds except those given for Y	7E+4	3E+5	1E-4	4E-7	1E-3	1E-2
		Y, oxides, hydroxides, and fluorides	-	3E+5	1E-4	4E-7	-	-
70	Ytterbium-166	W, see ^{162}Yb	1E+3	2E+3	8E-7	3E-9	2E-5	2E-4
		Y, see ^{162}Yb	-	2E+3	8E-7	3E-9	-	-
70	Ytterbium-167[2]	W, see ^{162}Yb	3E+5	8E+5	3E-4	1E-6	4E-3	4E-2
		Y, see ^{162}Yb	-	7E+5	3E-4	1E-6	-	-
70	Ytterbium-169	W, see ^{162}Yb	2E+3	8E+2	4E-7	1E-9	2E-5	2E-4
		Y, see ^{162}Yb	-	7E+2	3E-7	1E-9	-	-
70	Ytterbium-175	W, see ^{162}Yb	3E+3	4E+3	1E-6	5E-9	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
		Y, see ^{162}Yb	-	3E+3	1E-6	5E-9	-	-
70	Ytterbium-177[2]	W, see ^{162}Yb	2E+4	5E+4	2E-5	7E-8	2E-4	2E-3
		Y, see ^{162}Yb	-	5E+4	2E-5	6E-8	-	-
70	Ytterbium-178[2]	W, see ^{162}Yb	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		Y, see ^{162}Yb	-	4E+4	2E-5	5E-8	-	-
71	Lutetium-169	W, all compounds except those given for Y	3E+3	4E+3	2E-6	6E-9	3E-5	3E-4
		Y, oxides, hydroxides, and fluorides	-	4E+3	2E-6	6E-9	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
71	Lutetium-170	W, see ^{169}Lu	1E+3	2E+3	9E-7	3E-9	2E-5	2E-4
		Y, see ^{169}Lu	-	2E+3	8E-7	3E-9	-	-
71	Lutetium-171	W, see ^{169}Lu	2E+3	2E+3	8E-7	3E-9	3E-5	3E-4
		Y, see ^{169}Lu	-	2E+3	8E-7	3E-9	-	-
71	Lutetium-172	W, see ^{169}Lu	1E+3	1E+3	5E-7	2E-9	1E-5	1E-4
		Y, see ^{169}Lu	-	1E+3	5E-7	2E-9	-	-
71	Lutetium-173	W, see ^{169}Lu	5E+3	3E+2	1E-7	-	7E-5	7E-4
			-	Bone surf (5E+2)	-	6E-10	-	-
		Y, see ^{169}Lu	-	3E+2	1E-7	4E-10	-	-
71	Lutetium-174m	W, see ^{169}Lu	2E+3	2E+2	1E-7	-	-	-
			LLI wall (3E+3)	Bone surf (3E+2)	-	5E-10	4E-5	4E-4
		Y, see ^{169}Lu	-	2E+2	9E-8	3E-10	-	-
71	Lutetium-174	W, see ^{169}Lu	5E+3	1E+2	5E-8	-	7E-5	7E-4
			-	Bone surf (2E+2)	-	3E-10	-	-
		Y, see ^{169}Lu	-	2E+2	6E-8	2E-10	-	-
71	Lutetium-176m	W, see ^{169}Lu	8E+3	3E+4	1E-5	3E-8	1E-4	1E-3
		Y, see ^{169}Lu	-	2E+4	9E-6	3E-8	-	-
71	Lutetium-176	W, see ^{169}Lu	7E+2	5E+0	2E-9	-	1E-5	1E-4
			-	Bone surf (1E+1)	-	2E-11	-	-
		Y, see ^{169}Lu	-	8E+0	3E-9	1E-11	-	-
71	Lutetium-177m	W, see ^{169}Lu	7E+2	1E+2	5E-8	-	1E-5	1E-4
			-	Bone surf (1E+2)	-	2E-10	-	-
		Y, see ^{169}Lu	-	8E+1	3E-8	1E-10	-	-
71	Lutetium-177	W, see ^{169}Lu	2E+3	2E+3	9E-7	3E-9	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
		Y, see ^{169}Lu	-	2E+3	9E-7	3E-9	-	-
71	Lutetium-178m[2]	W, see ^{169}Lu	5E+4	2E+5	8E-5	3E-7	-	-
			St. wall (6E+4)	-	-	-	8E-4	8E-3
		Y, see ^{169}Lu	-	2E+5	7E-5	2E-7	-	-
71	Lutetium-178[2]	W, see ^{169}Lu	4E+4	1E+5	5E-5	2E-7	-	-
			St. wall (4E+4)	-	-	-	6E-4	6E-3
		Y, see ^{169}Lu	-	1E+5	5E-5	2E-7	-	-
71	Lutetium-179	W, see ^{169}Lu	6E+3	2E+4	8E-6	3E-8	9E-5	9E-4
		Y, see ^{169}Lu	-	2E+4	6E-6	3E-8	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
72	Hafnium-170	D, all compounds except those given for W	3E+3	6E+3	2E-6	8E-9	4E-5	4E-4
		W, oxides, hydroxides, carbides, and nitrates	-	5E+3	2E-6	6E-9	-	-
72	Hafnium-172	D, see ^{170}Hf	1E+3	9E+0	4E-9	-	2E-5	2E-4
			-	Bone surf (2E+1)	-	3E-11	-	-
		W, see ^{170}Hf	-	4E+1	2E-8	-	-	-
			-	Bone surf (6E+1)	-	8E-11	-	-
72	Hafnium-173	D, see ^{170}Hf	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
		W, see ^{170}Hf	-	1E+4	5E-6	2E-8	-	-
72	Hafnium-175	D, see ^{170}Hf	3E+3	9E+2	4E-7	-	4E-5	4E-4
			-	Bone surf (1E+3)	-	1E-9	-	-
		W, see ^{170}Hf	-	1E+3	5E-7	2E-9	-	-
72	Hafnium-177m[2]	D, see ^{170}Hf	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
		W, see ^{170}Hf	-	9E+4	4E-5	1E-7	-	-
72	Hafnium-178m	D, see ^{170}Hf	3E+2	1E+0	5E-10	-	3E-6	3E-5
			-	Bone surf (2E+0)	-	3E-12	-	-
		W, see ^{170}Hf	-	5E+0	2E-9	-	-	-
			-	Bone surf (9E+0)	-	1E-11	-	-
72	Hafnium-179m	D, see ^{170}Hf	1E+3	3E+2	1E-7	-	1E-5	1E-4
			-	Bone surf (6E+2)	-	8E-10	-	-
		W, see ^{170}Hf	-	6E+2	3E-7	8E-10	-	-
72	Hafnium-180m	D, see ^{170}Hf	7E+3	2E+4	9E-6	3E-8	1E-4	1E-3
		W, see ^{170}Hf	-	3E+4	1E-5	4E-8	-	-
72	Hafnium-181	D, see ^{170}Hf	1E+3	2E+2	7E-8	-	2E-5	2E-4
			-	Bone surf (4E+2)	-	6E-10	-	-
		W, see ^{170}Hf	-	4E+2	2E-7	6E-10	-	-
72	Hafnium-182m[2]	D, see ^{170}Hf	4E+4	9E+4	4E-5	1E-7	5E-4	5E-3
		W, see ^{170}Hf	-	1E+5	6E-5	2E-7	-	-
72	Hafnium-182	D, see ^{170}Hf	2E+2	8E-1	3E-10	-	-	-
			Bone surf (4E+2)	Bone surf (2E+0)	-	2E-12	5E-6	5E-5
		W, see ^{170}Hf	-	3E+0	1E-9	-	-	-
			-	Bone surf (7E+0)	-	1E-11	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
72	Hafnium-183[2]	D, see ^{170}Hf	2E+4	5E+4	2E-5	6E-8	3E-4	3E-3
		W, see ^{170}Hf	-	6E+4	2E-5	8E-8	-	-
72	Hafnium-184	D, see ^{170}Hf	2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
		W, see ^{170}Hf	-	6E+3	3E-6	9E-9	-	-
73	Tantalum-172[2]	W, all compounds except those given for Y	4E+4	1E+5	5E-5	2E-7	5E-4	5E-3
		Y, elemental Ta, oxides, hydroxides, halides, carbides, nitrates, and nitrides	-	1E+5	4E-5	1E-7	-	-
73	Tantalum-173	W, see ^{172}Ta	7E+3	2E+4	8E-6	3E-8	9E-5	9E-4
		Y, see ^{172}Ta	-	2E+4	7E-6	2E-8	-	-
73	Tantalum-174[2]	W, see ^{172}Ta	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3
		Y, see ^{172}Ta	-	9E+4	4E-5	1E-7	-	-
73	Tantalum-175	W, see ^{172}Ta	6E+3	2E+4	7E-6	2E-8	8E-5	8E-4
		Y, see ^{172}Ta	-	1E+4	6E-6	2E-8	-	-
73	Tantalum-176	W, see ^{172}Ta	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
		Y, see ^{172}Ta	-	1E+4	5E-6	2E-8	-	-
73	Tantalum-177	W, see ^{172}Ta	1E+4	2E+4	8E-6	3E-8	2E-4	2E-3
		Y, see ^{172}Ta	-	2E+4	7E-6	2E-8	-	-
73	Tantalum-178	W, see ^{172}Ta	2E+4	9E+4	4E-5	1E-7	2E-4	2E-3
		Y, see ^{172}Ta	-	7E+4	3E-5	1E-7	-	-
73	Tantalum-179	W, see ^{172}Ta	2E+4	5E+3	2E-6	8E-9	3E-4	3E-3
		Y, see ^{172}Ta	-	9E+2	4E-7	1E-9	-	-
73	Tantalum-180m	W, see ^{172}Ta	2E+4	7E+4	3E-5	9E-8	3E-4	3E-3
		Y, see ^{172}Ta	-	6E+4	2E-5	8E-8	-	-
73	Tantalum-180	W, see ^{172}Ta	1E+3	4E+2	2E-7	6E-10	2E-5	2E-4
		Y, see ^{172}Ta	-	2E+1	1E-8	3E-11	-	-
73	Tantalum-182m[2]	W, see ^{172}Ta	2E+5	5E+5	2E-4	8E-7	-	-
			St wall (2E+5)	-	-	-	3E-3	3E-2
		Y, see ^{172}Ta	-	4E+5	2E-4	6E-7	-	-
73	Tantalum-182	W, see ^{172}Ta	8E+2	3E+2	1E-7	5E-10	1E-5	1E-4
		Y, see ^{172}Ta	-	1E+2	6E-8	2E-10	-	-
73	Tantalum-183	W, see ^{172}Ta	9E+2	1E+3	5E-7	2E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{172}Ta	-	1E+3	4E-7	1E-9	-	-
73	Tantalum-184	W, see ^{172}Ta	2E+3	5E+3	2E-6	8E-9	3E-5	3E-4
		Y, see ^{172}Ta	-	5E+3	2E-6	7E-9	-	-
73	Tantalum-185[2]	W, see ^{172}Ta	3E+4	7E+4	3E-5	1E-7	4E-4	4E-3
		Y, see ^{172}Ta	-	6E+4	3E-5	9E-8	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
73	Tantalum-186[2]	W, see ^{172}Ta	5E+4	2E+5	1E-4	3E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
		Y, see ^{172}Ta	-	2E+5	9E-5	3E-7	-	-
74	Tungsten-176	D, all compounds	1E+4	5E+4	2E-5	7E-8	1E-4	1E-3
74	Tungsten-177	D, all compounds	2E+4	9E+4	4E-5	1E-7	3E-4	3E-3
74	Tungsten-178	D, all compounds	5E+3	2E+4	8E-6	3E-8	7E-5	7E-4
74	Tungsten-179[2]	D, all compounds	5E+5	2E+6	7E-4	2E-6	7E-3	7E-2
74	Tungsten-181	D, all compounds	2E+4	3E+4	1E-5	5E-8	2E-4	2E-3
74	Tungsten-185	D, all compounds	2E+3	7E+3	3E-6	9E-9	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
74	Tungsten-187	D, all compounds	2E+3	9E+3	4E-6	1E-8	3E-5	3E-4
74	Tungsten-188	D, all compounds	4E+2	1E+3	5E-7	2E-9	-	-
			LLI wall (5E+2)	-	-	-	7E-6	7E-5
75	Rhenium-177[2]	D, all compounds except those given for W	9E+4	3E+5	1E-4	4E-7	-	-
			St wall (1E+5)	-	-	-	2E-3	2E-2
		W, oxides, hydroxides, and nitrates	-	4E+5	1E-4	5E-7	-	-
75	Rhenium-178[2]	D, see ^{177}Re	7E+4	3E+5	1E-4	4E-7	-	-
			St wall (1E+5)	-	-	-	1E-3	1E-2
		W, see ^{177}Re	-	3E+5	1E-4	4E-7	-	-
75	Rhenium-181	D, see ^{177}Re	5E+3	9E+3	4E-6	1E-8	7E-5	7E-4
		W, see ^{177}Re	-	9E+3	4E-6	1E-8	-	-
75	Rhenium-182 (12.7 h)	D, see ^{177}Re	7E+3	1E+4	5E-6	2E-8	9E-5	9E-4
		W, see ^{177}Re	-	2E+4	6E-6	2E-8	-	-
75	Rhenium-182 (64.0 h)	D, see ^{177}Re	1E+3	2E+3	1E-6	3E-9	2E-5	2E-4
		W, see ^{177}Re	-	2E+3	9E-7	3E-9	-	-
75	Rhenium-184m	D, see ^{177}Re	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
		W, see ^{177}Re	-	4E+2	2E-7	6E-10	-	-
75	Rhenium-184	D, see ^{177}Re	2E+3	4E+3	1E-6	5E-9	3E-5	3E-4
		W, see ^{177}Re	-	1E+3	6E-7	2E-9	-	-
75	Rhenium-186m	D, see ^{177}Re	1E+3	2E+3	7E-7	-	-	-
			St wall (2E+3)	St wall (2E+3)	-	3E-9	2E-5	2E-4
		W, see ^{177}Re	-	2E+2	6E-8	2E-10	-	-
75	Rhenium-186	D, see ^{177}Re	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
		W, see ^{177}Re	-	2E+3	7E-7	2E-9	-	-

Figure: 30 TAC §336.359(d)

			Table I Occupational Values			**Table II** Effluent Concentrations		**Table III** Release to Sewers
			Col. 1 Oral Ingestion	Col. 2 Inhalation	Col. 3 Inhalation	Col. 1	Col. 2	Montly Average
Atomic No.	**Radionuclide**	**Class**	ALI (µCi)	ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	Concentrations (µCi/ml)
75	Rhenium-187	D, see ^{177}Re	6E+5	8E+5	4E-4	-	8E-3	8E-2
			-	St wall (9E+5)	-	1E-6	-	-
		W, see ^{177}Re	-	1E+5	4E-5	1E-7	-	-
75	Rhenium-188m[2]	D, see ^{177}Re	8E+4	1E+5	6E-5	2E-7	1E-3	1E-2
		W, see ^{177}Re	-	1E+5	6E-5	2E-7	-	-
75	Rhenium-188	D, see ^{177}Re	2E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		W, see ^{177}Re	-	3E+3	1E-6	4E-9	-	-
75	Rhenium-189	D, see ^{177}Re	3E+3	5E+3	2E-6	7E-9	4E-5	4E-4
		W, see ^{177}Re	-	4E+3	2E-6	6E-9	-	-
76	Osmium-180[2]	D, all compounds except those given for W and Y	1E+5	4E+5	2E-4	5E-7	1E-3	1E-2
		W, halides and nitrates	-	5E+5	2E-4	7E-7	-	-
		Y, oxides and hydroxides	-	5E+5	2E-4	6E-7	-	-
76	Osmium-181[2]	D, see ^{180}Os	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{180}Os	-	5E+4	2E-5	6E-8	-	-
		Y, see ^{180}Os	-	4E+4	2E-5	6E-8	-	-
76	Osmium-182	D, see ^{180}Os	2E+3	6E+3	2E-6	8E-9	3E-5	3E-4
		W, see ^{180}Os	-	4E+3	2E-6	6E-9	-	-
		Y, see ^{180}Os	-	4E+3	2E-6	6E-9	-	-
76	Osmium-185	D, see ^{180}Os	2E+3	5E+2	2E-7	7E-10	3E-5	3E-4
		W, see ^{180}Os	-	8E+2	3E-7	1E-9	-	-
		Y, see ^{180}Os	-	8E+2	3E-7	1E-9	-	-
76	Osmium-189m	D, see ^{180}Os	8E+4	2E+5	1E-4	3E-7	1E-3	1E-2
		W, see ^{180}Os	-	2E+5	9E-5	3E-7	-	-
		Y, see ^{180}Os	-	2E+5	7E-5	2E-7	-	-
76	Osmium-191m	D, see ^{180}Os	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ^{180}Os	-	2E+4	8E-6	3E-8	-	-
		Y, see ^{180}Os	-	2E+4	7E-6	2E-8	-	-
76	Osmium-191	D, see ^{180}Os	2E+3	2E+3	9E-7	3E-9	-	-
			LLI wall (3E+3)	-	-	-	3E-5	3E-4
		W, see ^{180}Os	-	2E+3	7E-7	2E-9	-	-
		Y, see ^{180}Os	-	1E+3	6E-7	2E-9	-	-
76	Osmium-193	D, see ^{180}Os	2E+3	5E+3	2E-6	6E-9	-	-
			LLI wall (2E+3)	-	-	-	2E-5	2E-4
		W, see ^{180}Os	-	3E+3	1E-6	4E-9	-	-
		Y, see ^{180}Os	-	3E+3	1E-6	4E-9	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Occupational Values Col. 2 Inhalation ALI (µCi)	Table I Occupational Values Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Effluent Concentrations Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
76	Osmium-194	D, see ^{180}Os	4E+2	4E+1	2E-8	6E-11	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
		W, see ^{180}Os	-	6E+1	2E-8	8E-11	-	-
		Y, see ^{180}Os	-	8E+0	3E-9	1E-11	-	-
77	Iridium-182[2]	D, all compounds except those given for W and Y	4E+4	1E+5	6E-5	2E-7	-	-
			St wall (4E+4)	-	-	-	6E-4	6E-3
		W, halides, nitrates, and metallic iridium	-	2E+5	6E-5	2E-7	-	-
		Y, oxides and hydroxides	-	1E+5	5E-5	2E-7	-	-
77	Iridium-184	D, see ^{182}Ir	8E+3	2E+4	1E-5	3E-8	1E-4	1E-3
		W, see ^{182}Ir	-	3E+4	1E-5	5E-8	-	-
		Y, see ^{182}Ir	-	3E+4	1E-5	4E-8	-	-
77	Iridium-185	D, see ^{182}Ir	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
		W, see ^{182}Ir	-	1E+4	5E-6	2E-8	-	-
		Y, see ^{182}Ir	-	1E+4	4E-6	1E-8	-	-
77	Iridium-186	D, see ^{182}Ir	2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
		W, see ^{182}Ir	-	6E+3	3E-6	9E-9	-	-
		Y, see ^{182}Ir	-	6E+3	2E-6	8E-9	-	-
77	Iridium-187	D, see ^{182}Ir	1E+4	3E+4	1E-5	5E-8	1E-4	1E-3
		W, see ^{182}Ir	-	3E+4	1E-5	4E-8	-	-
		Y, see ^{182}Ir	-	3E+4	1E-5	4E-8	-	-
77	Iridium-188	D, see ^{182}Ir	2E+3	5E+3	2E-6	6E-9	3E-5	3E-4
		W, see ^{182}Ir	-	4E+3	1E-6	5E-9	-	-
		Y, see ^{182}Ir	-	3E+3	1E-6	5E-9	-	-
77	Iridium-189	D, see ^{182}Ir	5E+3	5E+3	2E-6	7E-9	-	-
			LLI wall (5E+3)	-	-	-	7E-5	7E-4
		W, see ^{182}Ir	-	4E+3	2E-6	5E-9	-	-
		Y, see ^{182}Ir	-	4E+3	1E-6	5E-9	-	-
77	Iridium-190m[2]	D, see ^{182}Ir	2E+5	2E+5	8E-5	3E-7	2E-3	2E-2
		W, see ^{182}Ir	-	2E+5	9E-5	3E-7	-	-
		Y, see ^{182}Ir	-	2E+5	8E-5	3E-7	-	-
77	Iridium-190	D, see ^{182}Ir	1E+3	9E+2	4E-7	1E-9	1E-5	1E-4
		W, see ^{182}Ir	-	1E+3	4E-7	1E-9	-	-
		Y, see ^{182}Ir	-	9E+2	4E-7	1E-9	-	-
77	Iridium-192m	D, see ^{182}Ir	3E+3	9E+1	4E-8	1E-10	4E-5	4E-4
		W, see ^{182}Ir	-	2E+2	9E-8	3E-10	-	-
		Y, see ^{182}Ir	-	2E+1	6E-9	2E-11	-	-
77	Iridium-192	D, see ^{182}Ir	9E+2	3E+2	1E-7	4E-10	1E-5	1E-4
		W, see ^{182}Ir	-	4E+2	2E-7	6E-10	-	-
		Y, see ^{182}Ir	-	2E+2	9E-8	3E-10	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	**Table I** Occupational Values Col. 1 Oral Ingestion ALI (μCi)	**Table I** Col. 2 Inhalation ALI (μCi)	**Table I** Col. 3 Inhalation DAC (μCi/ml)	**Table II** Effluent Concentrations Col. 1 Air (μCi/ml)	**Table II** Col. 2 Water (μCi/ml)	**Table III** Release to Sewers Montly Average Concentrations (μCi/ml)
77	Iridium-194m	D, see ^{182}Ir	6E+2	9E+1	4E-8	1E-10	9E-6	9E-5
		W, see ^{182}Ir	-	2E+2	7E-8	2E-10	-	-
		Y, see ^{182}Ir	-	1E+2	4E-8	1E-10	-	-
77	Iridium-194	D, see ^{182}Ir	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
		W, see ^{182}Ir	-	2E+3	9E-7	3E-9	-	-
		Y, see ^{182}Ir	-	2E+3	8E-7	3E-9	-	-
77	Iridium-195m	D, see ^{182}Ir	8E+3	2E+4	1E-5	3E-8	1E-4	1E-3
		W, see ^{182}Ir	-	3E+4	1E-5	4E-8	-	-
		Y, see ^{182}Ir	-	2E+4	9E-6	3E-8	-	-
77	Iridium-195	D, see ^{182}Ir	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{182}Ir	-	5E+4	2E-5	7E-8	-	-
		Y, see ^{182}Ir	-	4E+4	2E-5	6E-8	-	-
78	Platinum-186	D, all compounds	1E+4	4E+4	2E-5	5E-8	2E-4	2E-3
78	Platinum-188	D, all compounds	2E+3	2E+3	7E-7	2E-9	2E-5	2E-4
78	Platinum-189	D, all compounds	1E+4	3E+4	1E-5	4E-8	1E-4	1E-3
78	Platinum-191	D, all compounds	4E+3	8E+3	4E-6	1E-8	5E-5	5E-4
78	Platinum-193m	D, all compounds	3E+3	6E+3	3E-6	8E-9	-	-
			LLI wall (3E+4)	-	-	-	4E-5	4E-4
78	Platinum-193	D, all compounds	4E+4	2E+4	1E-5	3E-8	-	-
			LLI wall (5E+4)	-	-	-	6E-4	6E-3
78	Platinum-195m	D, all compounds	2E+3	4E+3	2E-6	6E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
78	Platinum-197m[2]	D, all compounds	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
78	Platinum-197	D, all compounds	3E+3	1E+4	4E-6	1E-8	4E-5	4E-4
78	Platinum-199[2]	D, all compounds	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
78	Platinum-200	D, all compounds	1E+3	3E+3	1E-6	5E-9	2E-5	2E-4
79	Gold-193	D, all compounds except those given for W and Y	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
		W, halides and nitrates	-	2E+4	9E-6	3E-8	-	-
		Y, oxides and hydroxides	-	2E+4	8E-6	3E-8	-	-
79	Gold-194	D, see ^{193}Au	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
		W, see ^{193}Au	-	5E+3	2E-6	8E-9	-	-
		Y, see ^{193}Au	-	5E+3	2E-6	7E-9	-	-
79	Gold-195	D, see ^{193}Au	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
		W, see ^{193}Au	-	1E+3	6E-7	2E-9	-	-
		Y, see ^{193}Au	-	4E+2	2E-7	6E-10	-	-
79	Gold-198m	D, see ^{193}Au	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
		W, see ^{193}Au	-	1E+3	5E-7	2E-9	-	-
		Y, see ^{193}Au	-	1E+3	5E-7	2E-9	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Occupational Values Col. 2 Inhalation ALI (μCi)	Table I Occupational Values Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Effluent Concentrations Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
79	Gold-198	D, see ^{193}Au	1E+3	4E+3	2E-6	5E-9	2E-5	2E-4
		W, see ^{193}Au	-	2E+3	8E-7	3E-9	-	-
		Y, see ^{193}Au	-	2E+3	7E-7	2E-9	-	-
79	Gold-199	D, see ^{193}Au	3E+3	9E+3	4E-6	1E-8	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
		W, see ^{193}Au	-	4E+3	2E-6	6E-9	-	-
		Y, see ^{193}Au	-	4E+3	2E-6	5E-9	-	-
79	Gold-200m	D, see ^{193}Au	1E+3	4E+3	1E-6	5E-9	2E-5	2E-4
		W, see ^{193}Au	-	3E+3	1E-6	4E-9	-	-
		Y, see ^{193}Au	-	2E+4	1E-6	3E-9	-	-
79	Gold-200[2]	D, see ^{193}Au	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
		W, see ^{193}Au	-	8E+4	3E-5	1E-7	-	-
		Y, see ^{193}Au	-	7E+4	3E-5	1E-7	-	-
79	Gold-201[2]	D, see ^{193}Au	7E+4	2E+5	9E-5	3E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
		W, see ^{193}Au	-	2E+5	1E-4	3E-7	-	-
		Y, see ^{193}Au	-	2E+5	9E-5	3E-7	-	-
80	Mercury-193m	Vapor	-	8E+3	4E-6	1E-8	-	-
		Organic D	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		D, sulfates	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		W, oxides, hydroxides, halides, nitrates, and sulfides	-	8E+3	3E-6	1E-8	-	-
80	Mercury-193	Vapor	-	3E+4	1E-5	4E-8	-	-
		Organic D	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		D, see ^{193m}Hg	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{193m}Hg	-	4E+4	2E-5	6E-8	-	-
80	Mercury-194	Vapor	-	3E+1	1E-8	4E-11	-	-
		Organic D	2E+1	3E+1	1E-8	4E-11	2E-7	2E-6
		D, see ^{193m}Hg	8E+2	4E+1	2E-8	6E-11	1E-5	1E-4
		W, see ^{193m}Hg	-	1E+2	5E-8	2E-10	-	-
80	Mercury-195m	Vapor	-	4E+3	2E-6	6E-9	-	-
		Organic D	3E+3	6E+3	3E-6	8E-9	4E-5	4E-4
		D, see ^{193m}Hg	2E+3	5E+3	2E-6	7E-9	3E-5	3E-4
		W, see ^{193m}Hg	-	4E+3	2E-6	5E-9	-	-
80	Mercury-195	Vapor	-	3E+4	1E-5	4E-8	-	-
		Organic D	2E+4	5E+4	2E-5	6E-8	2E-4	2E-3
		D, see ^{193m}Hg	1E+4	4E+4	1E-5	5E-8	2E-4	2E-3
		W, see ^{193m}Hg	-	3E+4	1E-5	5E-8	-	-
80	Mercury-197m	Vapor	-	5E+3	2E-6	7E-9	-	-
		Organic D	4E+3	9E+3	4E-6	1E-8	5E-5	5E-4
		D, see ^{193m}Hg	3E+3	7E+3	3E-6	1E-8	4E-5	4E-4
		W, see ^{193m}Hg	-	5E+3	2E-6	7E-9	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
80	Mercury-197	Vapor	-	8E+3	4E-6	1E-8	-	-
		Organic D	7E+3	1E+4	6E-6	2E-8	9E-5	9E-4
		D, see ^{193m}Hg	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
		W, see ^{193m}Hg	-	9E+3	4E-6	1E-8	-	-
80	Mercury-199m[2]	Vapor	-	8E+4	3E-5	1E-7	-	-
		Organic D	6E+4	2E+5	7E-5	2E-7	-	-
			St wall (1E+5)	-	-	-	1E-3	1E-2
		D, see ^{193m}Hg	6E+4	1E+5	6E-5	2E-7	8E-4	8E-3
		W, see ^{193m}Hg	-	2E+5	7E-5	2E-7	-	-
80	Mercury-203	Vapor	-	8E+2	4E-7	1E-9	-	-
		Organic D	5E+2	8E+2	3E-7	1E-9	7E-6	7E-5
		D, see ^{193m}Hg	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
		W, see ^{193m}Hg	-	1E+3	5E-7	2E-9	-	-
81	Thallium-194m[2]	D, all compounds	5E+4	2E+5	6E-5	2E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
81	Thallium-194[2]	D, all compounds	3E+5	6E+5	2E-4	8E-7	-	-
			St wall (3E+5)	-	-	-	4E-3	4E-2
81	Thallium-195[2]	D, all compounds	6E+4	1E+5	5E-5	2E-7	9E-4	9E-3
81	Thallium-197	D, all compounds	7E+4	1E+5	5E-5	2E-7	1E-3	1E-2
81	Thallium-198m[2]	D, all compounds	3E+4	5E+4	2E-5	8E-8	4E-4	4E-3
81	Thallium-198	D, all compounds	2E+4	3E+4	1E-5	5E-8	3E-4	3E-3
81	Thallium-199	D, all compounds	6E+4	8E+4	4E-5	1E-7	9E-4	9E-3
81	Thallium-200	D, all compounds	8E+3	1E+4	5E-6	2E-8	1E-4	1E-3
81	Thallium-201	D, all compounds	2E+4	2E+4	9E-6	3E-8	2E-4	2E-3
81	Thallium-202	D, all compounds	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
81	Thallium-204	D, all compounds	2E+3	2E+3	9E-7	3E-9	2E-5	2E-4
82	Lead-195m[2]	D, all compounds	6E+4	2E+5	8E-5	3E-7	8E-4	8E-3
82	Lead-198	D, all compounds	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
82	Lead-199[2]	D, all compounds	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
82	Lead-200	D, all compounds	3E+3	6E+3	3E-6	9E-9	4E-5	4E-4
82	Lead-201	D, all compounds	7E+3	2E+4	8E-6	3E-8	1E-4	1E-3
82	Lead-202m	D, all compounds	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
82	Lead-202	D, all compounds	1E+2	5E+1	2E-8	7E-11	2E-6	2E-5
82	Lead-203	D, all compounds	5E+3	9E+3	4E-6	1E-8	7E-5	7E-4
82	Lead-205	D, all compounds	4E+3	1E+3	6E-7	2E-9	5E-5	5E-4
82	Lead-209	D, all compounds	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
82	Lead-210	D, all compounds	6E-1	2E-1	1E-10	-	-	-
			Bone surf (1E+0)	Bone surf (4E-1)	-	6E-13	1E-8	1E-7
82	Lead-211[2]	D, all compounds	1E+4	6E+2	3E-7	9E-10	2E-4	2E-3

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
82	Lead-212	D, all compounds	8E+1	3E+1	1E-8	5E-11	-	-
			Bone surf (1E+2)	-	-	-	2E-6	2E-5
82	Lead-214[2]	D, all compounds	9E+3	8E+2	3E-7	1E-9	1E-4	1E-3
83	Bismuth-200[2]	D, nitrates	3E+4	8E+4	4E-5	1E-7	4E-4	4E-3
		W, all other compounds	-	1E+5	4E-5	1E-7	-	-
83	Bismuth-201[2]	D, see ^{200}Bi	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ^{200}Bi	-	4E+4	2E-5	5E-8	-	-
83	Bismuth-202[2]	D, see ^{200}Bi	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{200}Bi	-	8E+4	3E-5	1E-7	-	-
83	Bismuth-203	D, see ^{200}Bi	2E+3	7E+3	3E-6	9E-9	3E-5	3E-4
		W, see ^{200}Bi	-	6E+3	3E-6	9E-9	-	-
83	Bismuth-205	D, see ^{200}Bi	1E+3	3E+3	1E-6	3E-9	2E-5	2E-4
		W, see ^{200}Bi	-	1E+3	5E-7	2E-9	-	-
83	Bismuth-206	D, see ^{200}Bi	6E+2	1E+3	6E-7	2E-9	9E-6	9E-5
		W, see ^{200}Bi	-	9E+2	4E-7	1E-9	-	-
83	Bismuth-207	D, see ^{200}Bi	1E+3	2E+3	7E-7	2E-9	1E-5	1E-4
		W, see ^{200}Bi	-	4E+2	1E-7	5E-10	-	-
83	Bismuth-210m	D, see ^{200}Bi	4E+1	5E+0	2E-9	-	-	-
			Kidneys (6E+1)	Kidneys (6E+0)	-	9E-12	8E-7	8E-6
		W, see ^{200}Bi	-	7E-1	3E-10	9E-13	-	-
83	Bismuth-210	D, see ^{200}Bi	8E+2	2E+2	1E-7	-	1E-5	1E-4
			- -	Kidneys (4E+2)	-	5E-10	-	-
		W, see ^{200}Bi	-	3E+1	1E-8	4E-11	-	-
83	Bismuth-212[2]	D, see ^{200}Bi	5E+3	2E+2	1E-7	3E-10	7E-5	7E-4
		W, see ^{200}Bi	-	3E+2	1E-7	4E-10	-	-
83	Bismuth-213[2]	D, see ^{200}Bi	7E+3	3E+2	1E-7	4E-10	1E-4	1E-3
		W, see ^{200}Bi	-	4E+2	1E-7	5E-10	-	-
83	Bismuth-214[2]	D, see ^{200}Bi	2E+4	8E+2	3E-7	1E-9	-	-
			St wall (2E+4)	-	-	-	3E-4	3E-3
		W, see ^{200}Bi	-	9E-2	4E-7	1E-9	-	-
84	Polonium-203[2]	D, all compounds except those given for W	3E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		W, oxides, hydroxides, and nitrates	-	9E+4	4E-5	1E-7	-	-
84	Polonium-205[2]	D, see ^{203}Po	2E+4	4E+4	2E-5	5E-8	3E-4	3E-3
		W, see ^{203}Po	-	7E+4	3E-5	1E-7	-	-
84	Polonium-207	D, see ^{203}Po	8E+3	3E+4	1E-5	3E-8	1E-4	1E-3
		W, see ^{203}Po	-	3E+4	1E-5	4E-8	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
84	Polonium-210	D, see ^{203}Po	3E+0	6E-1	3E-10	9E-13	4E-8	4E-7
		W, see ^{203}Po	-	6E-1	3E-10	9E-13	-	-
85	Astatine-207[2]	D, halides	6E+3	3E+3	1E-6	4E-9	8E-5	8E-4
		W	-	2E+3	9E-7	3E-9	-	-
85	Astatine-211	D, halides	1E+2	8E+1	3E-8	1E-10	2E-6	2E-5
		W	-	5E+1	2E-8	8E-11	-	-
86	Radon-220	With daughters removed	-	2E+4	7E-6	2E-8	-	-
		With daughters present	-	2E+1 (or 12 working level months)	9E-9 (or 1.0 working level)	3E-11	-	-
86	Radon-222	With daughters removed	-	1E+4	4E-6	1E-8	-	-
		With daughters present	-	1E+2 (or 4 working level months)	3E-8 (or 0.33 working level)	1E-10	-	-
87	Francium-222[2]	D, all compounds	2E+3	5E+2	2E-7	6E-10	3E-5	3E-4
87	Francium-223[2]	D, all compounds	6E+2	8E+2	3E-7	1E-9	8E-6	8E-5
88	Radium-223	W, all compounds	5E+0	7E-1	3E-10	9E-13	-	-
			Bone surf (9E+0)	-	-	-	1E-7	1E-6
88	Radium-224	W, all compounds	8E+0	2E+0	7E-10	2E-12	-	-
			Bone surf (2E+1)	-	-	-	2E-7	2E-6
88	Radium-225	W, all compounds	8E+0	7E-1	3E-10	9E-13	-	-
			Bone surf (2E+1)	-	-	-	2E-7	2E-6
88	Radium-226	W, all compounds	2E+0	6E-1	3E-10	9E-13	-	-
			Bone surf (5E+0)	-	-	-	6E-8	6E-7
88	Radium-227[2]	W, all compounds	2E+4	1E+4	6E-6	-	-	-
			Bone surf (2E+4)	Bone surf (2E+4)	-	3E-8	3E-4	3E-3
88	Radium-228	W, all compounds	2E+0	1E+0	5E-10	2E-12	-	-
			Bone surf (4E+0)	-	-	-	6E-8	6E-7

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Occupational Values Col. 2 Inhalation ALI (µCi)	Table I Occupational Values Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Effluent Concentrations Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
89	Actinium-224	D, all compounds except those given for W and Y	2E+3	3E+1	1E-8	-	-	-
			LLI wall (2E+3)	Bone surf (4E+1)	-	5E-11	3E-5	3E-4
		W, halides and nitrates	-	5E+1	2E-8	7E-11	-	-
		Y, oxides and hydroxides	-	5E+1	2E-8	6E-11	-	-
89	Actinium-225	D, see ^{224}Ac	5E+1	3E-1	1E-10	-	-	-
			LLI wall (5E+1)	Bone surf (5E-1)	-	7E-13	7E-7	7E-6
		W, see ^{224}Ac	-	6E-1	3E-10	9E-13	-	-
		Y, see ^{224}Ac	-	6E-1	3E-10	9E-13	-	-
89	Actinium-226	D, see ^{224}Ac	1E+2	3E+0	1E-9	-	-	-
			LLI wall (1E+2)	Bone surf (4E+0)	-	5E-12	2E-6	2E-5
		W, see ^{224}Ac	-	5E+0	2E-9	7E-12	-	-
		Y, see ^{224}Ac	-	5E+0	2E-9	6E-12	-	-
89	Actinium-227	D, see ^{224}Ac	2E-1	4E-4	2E-13	-	-	-
			Bone surf (4E-1)	Bone surf (8E-4)	-	1E-15	5E-9	5E-8
		W, see ^{224}Ac	-	2E-3	7E-13	-	-	-
			-	Bone surf (3E-3)	-	4E-15	-	-
		Y, see ^{224}Ac	-	4E-3	2E-12	6E-15	-	-
89	Actinium-228	D, see ^{224}Ac	2E+3	9E+0	4E-9	-	3E-5	3E-4
			-	Bone surf (2E+1)	-	2E-11	-	-
		W, see ^{224}Ac	-	4E+1	2E-8	-	-	-
			-	Bone surf (6E+1)	-	8E-11	-	-
		Y, see ^{224}Ac	-	4E+1	2E-8	6E-11	-	-
90	Thorium-226[2]	W, all compounds except those given for Y	5E+3	2E+2	6E-8	2E-10	-	-
			St wall (5E+3)	-	-	-	7E-5	7E-4
		Y, oxides and hydroxides	-	1E+2	6E-8	2E-10	-	-
90	Thorium-227	W, see ^{226}Th	1E+2	3E-1	1E-10	5E-13	2E-6	2E-5
		Y, see ^{226}Th	-	3E-1	1E-10	5E-13	-	-
90	Thorium-228	W, see ^{226}Th	6E+0	1E-2	4E-12	-	-	-
			Bone surf (1E+1)	Bone surf (2E-2)	-	3E-14	2E-7	2E-6
		Y, see ^{226}Th	-	2E-2	7E-12	2E-14	-	-

Figure: 30 TAC §336.359(d)

			Table I Occupational Values			Table II Effluent Concentrations		Table III Release to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
			Oral Ingestion	Inhalation				Montly Average
Atomic No.	Radionuclide	Class	ALI (µCi)	ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	Concentrations (µCi/ml)
90	Thorium-229	W, see ^{226}Th	6E-1	9E-4	4E-13	-	-	-
			Bone surf (1E+0)	Bone surf (2E-3)	-	3E-15	2E-8	2E-7
		Y, see ^{226}Th	-	2E-3	1E-12	-	-	-
			-	Bone surf (3E-3)	-	4E-15	-	-
90	Thorium-230	W, see ^{226}Th	4E+0	6E-3	3E-12	-	-	-
			Bone surf (9E+0)	Bone surf (2E-2)	-	2E-14	1E-7	1E-6
		Y, see ^{226}Th	-	2E-2	6E-12	-	-	-
			-	Bone surf (2E-2)	-	3E-14	-	-
90	Thorium-231	W, see ^{226}Th	4E+3	6E+3	3E-6	9E-9	5E-5	5E-4
		Y, see ^{226}Th	-	6E+3	3E-6	9E-9	-	-
90	Thorium-232	W, see ^{226}Th	7E-1	1E-3	5E-13	-	-	-
			Bone surf (2E+0)	Bone surf (3E-3)	-	4E-15	3E-8	3E-7
		Y, see ^{226}Th	-	3E-3	1E-12	-	-	-
			-	Bone surf (4E-3)	-	6E-15	-	-
90	Thorium-234	W, see ^{226}Th	3E+2	2E+2	8E-8	3E-10	-	-
			LLI wall (4E+2)	-	-	-	5E-6	5E-5
		Y, see ^{226}Th	-	2E+2	6E-8	2E-10	-	-
91	Protactinium-227[2]	W, all compounds except those given for Y	4E+3	1E+2	5E-8	2E-10	5E-5	5E-4
		Y, oxides and hydroxides	-	1E+2	4E-8	1E-10	-	-
91	Protactinium-228	W, see ^{227}Pa	1E+3	1E+1	5E-9	-	2E-5	2E-4
			-	Bone surf (2E+1)	-	3E-11	-	-
		Y, see ^{227}Pa	-	1E+1	5E-9	2E-11	-	-
91	Protactinium-230	W, see ^{227}Pa	6E+2	5E+0	2E-9	7E-12	-	-
			Bone surf (9E+2)	-	-	-	1E-5	1E-4
		Y, see ^{227}Pa	-	4E+0	1E-9	5E-12	-	-
91	Protactinium-231	W, see ^{227}Pa	2E-1	2E-3	6E-13	-	-	-
			Bone surf (5E-1)	Bone surf (4E-3)	-	6E-15	6E-9	6E-8
		Y, see ^{227}Pa	-	4E-3	2E-12	-	-	-
			-	Bone surf (6E-3)	-	8E-15	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values, Col. 1 Oral Ingestion ALI (µCi)	Table I Occupational Values, Col. 2 Inhalation ALI (µCi)	Table I Occupational Values, Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations, Col. 1 Air (µCi/ml)	Table II Effluent Concentrations, Col. 2 Water (µCi/ml)	Table III Release to Sewers, Montly Average Concentrations (µCi/ml)
91	Protactinium-232	W, see ^{227}Pa	1E+3	2E+1	9E-9	-	2E-5	2E-4
			-	Bone surf (6E+1)	-	8E-11	-	-
		Y, see ^{227}Pa	-	6E+1	2E-8	-	-	-
			-	Bone surf (7E+1)	-	1E-10	-	-
91	Protactinium-233	W, see ^{227}Pa	1E+3	7E+2	3E-7	1E-9	-	-
			LLI wall (2E+3)	-	-	-	2E-5	2E-4
		Y, see ^{227}Pa	-	6E+2	2E-7	8E-10	-	-
91	Protactinium-234	W, see ^{227}Pa	2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
		Y, see ^{227}Pa	-	7E+3	3E-6	9E-9	-	-
92	Uranium-230	D, UF, UOF, UO(NO)	4E+0	4E-1	2E-10	-	-	-
			Bone surf (6E+0)	Bone surf (6E-1)	-	8E-13	8E-8	8E-7
		W, UO, UF, UCl	-	4E-1	1E-10	5E-13	-	-
		Y, UO, UO	-	3E-1	1E-10	4E-13	-	-
92	Uranium-231	D, see ^{230}U	5E+3	8E+3	3E-6	1E-8	-	-
			LLI wall (4E+3)	-	-	-	6E-5	6E-4
		W, see ^{230}U	-	6E+3	2E-6	8E-9	-	-
		Y, see ^{230}U	-	5E+3	2E-6	6E-9	-	-
92	Uranium-232	D, see ^{230}U	2E+0	2E-1	9E-11	-	-	-
			Bone surf (4E+0)	Bone surf (4E-1)	-	6E-13	6E-8	6E-7
		W, see ^{230}U	-	4E-1	2E-10	5E-13	-	-
		Y, see ^{230}U	-	8E-3	3E-12	1E-14	-	-
92	Uranium-233	D, see ^{230}U	1E+1	1E+0	5E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ^{230}U	-	7E-1	3E-10	1E-12	-	-
		Y, see ^{230}U	-	4E-2	2E-11	5E-14	-	-
92	Uranium-234[3]	D, see ^{230}U	1E+1	1E+0	5E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ^{230}U	-	7E-1	3E-10	1E-12	-	-
		Y, see ^{230}U	-	4E-2	2E-11	5E-14	-	-
92	Uranium-235[3]	D, see ^{230}U	1E+1	1E+0	6E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ^{230}U	-	8E-1	3E-10	1E-12	-	-
		Y, see ^{230}U	-	4E-2	2E-11	6E-14	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
92	Uranium-236	D, see ^{230}U	1E+1	1E+0	5E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ^{230}U	-	8E-1	3E-10	1E-12	-	-
		Y, see ^{230}U	-	4E-2	2E-11	6E-14	-	-
92	Uranium-237	D, see ^{230}U	2E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
		W, see ^{230}U	-	2E+3	7E-7	2E-9	-	-
		Y, see ^{230}U	-	2E+3	6E-7	2E-9	-	-
92	Uranium-238[3]	D, see ^{230}U	1E+1	1E+0	6E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ^{230}U	-	-	3E-10	1E-12	-	-
		Y, see ^{230}U	-	4E-2	2E-11	6E-14	-	-
92	Uranium-239[2]	D, see ^{230}U	7E+4	2E+5	8E-5	3E-7	9E-4	9E-3
		W, see ^{230}U	-	2E+5	7E-5	2E-7	-	-
		Y, see ^{230}U	-	2E+5	6E-5	2E-7	-	-
92	Uranium-240	D, see ^{230}U	1E+3	4E+3	2E-6	5E-9	2E-5	2E-4
		W, see ^{230}U	-	3E+3	1E-6	4E-9	-	-
		Y, see ^{230}U	-	2E+3	1E-6	3E-9	-	-
92	Uranium-natural[3]	D, see ^{230}U	1E+1	1E+0	5E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ^{230}U	-	8E-1	3E-10	9E-13	-	-
		Y, see ^{230}U	-	5E-2	2E-11	9E-14	-	-
93	Neptunium-232[2]	W, all compounds	1E+5	2E+3	7E-7	-	2E-3	2E-2
			-	Bone surf (5E+2)	-	6E-9	-	-
93	Neptunium-233[2]	W, all compounds	8E+5	3E+6	1E-3	4E-6	1E-2	1E-1
93	Neptunium-234	W, all compounds	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
93	Neptunium-235	W, all compounds	2E+4	8E+2	3E-7	-	-	-
			LLI wall (2E+4)	Bone surf (1E+3)	-	2E-9	3E-4	3E-3
93	Neptunium-236 (1.15E+5 y)	W, all compounds	3E+0	2E-2	9E-12	-	-	-
			Bone surf (6E+0)	Bone surf (5E-2)	-	8E-14	9E-8	9E-7
93	Neptunium-236 (22.5 h)	W, all compounds	3E+3	3E+1	1E-8	-	-	-
			Bone surf (4E+3)	Bone surf (7E+1)	-	1E-10	5E-5	5E-4
93	Neptunium-237	W, all compounds	5E-1	4E-3	2E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	1E-14	2E-8	2E-7

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
93	Neptunium-238	W, all compounds	1E+3	6E+1	3E-8	-	2E-5	2E-4
			-	Bone surf (2E+2)	-	2E-10	-	-
93	Neptunium-239	W, all compounds	2E+3	2E+3	9E-7	3E-9	-	-
			LLI wall (2E+3)	-	-	-	2E-5	2E-4
93	Neptunium-240[2]	W, all compounds	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
94	Plutonium-234	W, all compounds except PuO	8E+3	2E+2	9E-8	3E-10	1E-4	1E-3
		Y, PuO	-	2E+2	8E-8	3E-10	-	-
94	Plutonium-235[2]	W, see ^{234}Pu	9E+5	3E+6	1E-3	4E-6	1E-2	1E-1
		Y, see ^{234}Pu	-	3E+6	1E-3	3E-6	-	-
94	Plutonium-236	W, see ^{234}Pu	2E+0	2E-2	8E-12	-	-	-
			Bone surf (4E+0)	Bone surf (4E-2)	-	5E-14	6E-8	6E-7
		Y, see ^{234}Pu	-	4E-2	2E-11	6E-14	-	-
94	Plutonium-237	W, see ^{234}Pu	1E+4	3E+3	1E-6	5E-9	2E-4	2E-3
		Y, see ^{234}Pu	-	3E+3	1E-6	4E-9	-	-
94	Plutonium-238	W, see ^{234}Pu	9E-1	7E-3	3E-12	-	-	-
			Bone surf (2E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
		Y, see ^{234}Pu	-	2E-2	8E-12	2E-14	-	-
94	Plutonium-239	W, see ^{234}Pu	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
		Y, see ^{234}Pu	-	2E-2	7E-12	-	-	-
			-	Bone surf (2E-2)	-	2E-14	-	-
94	Plutonium-240	W, see ^{234}Pu	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
		Y, see ^{234}Pu	-	2E-2	7E-12	-	-	-
			-	Bone surf (2E-2)	-	2E-14	-	-
94	Plutonium-241	W, see ^{234}Pu	4E+1	3E-1	1E-10	-	-	-
			Bone surf (7E+1)	Bone surf (6E-1)	-	8E-13	1E-6	1E-5
		Y, see ^{234}Pu	-	8E-1	3E-10	-	-	-
			-	Bone surf (1E+0)	-	1E-12	-	-
94	Plutonium-242	W, see ^{234}Pu	8E-1	7E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
		Y, see ^{234}Pu	-	2E-2	7E-12	-	-	-
			-	Bone surf (2E-2)	-	2E-14	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
94	Plutonium-243	W, see ^{234}Pu	2E+4	4E+4	2E-5	5E-8	2E-4	2E-3
		Y, see ^{234}Pu	-	4E+4	2E-5	5E-8	-	-
94	Plutonium-244	W, see ^{234}Pu	8E-1	7E-3	3E-12	-	-	-
			Bone surf (2E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
		Y, see ^{234}Pu	-	2E-2	7E-12	-	-	-
			-	Bone surf (2E-2)	-	2E-14	-	-
94	Plutonium-245	W, see ^{234}Pu	2E+3	5E+3	2E-6	6E-9	3E-5	3E-4
		Y, see ^{234}Pu	-	4E+3	2E-6	6E-9	-	-
94	Plutonium-246	W, see ^{234}Pu	4E+2	3E+2	1E-7	4E-10	-	-
			LLI wall (4E+2)	-	-	-	6E-6	6E-5
		Y, see ^{234}Pu	-	3E+2	1E-7	4E-10	-	-
95	Americium-237[2]	W, all compounds	8E+4	3E+5	1E-4	4E-7	1E-3	1E-2
95	Americium-238[2]	W, all compounds	4E+4	3E+3	1E-6	-	5E-4	5E-3
			-	Bone surf (6E+3)	-	9E-9	-	-
95	Americium-239	W, all compounds	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
95	Americium-240	W, all compounds	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
95	Americium-241	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
95	Americium-242m	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
95	Americium-242	W, all compounds	4E+3	8E+1	4E-8	-	5E-5	5E-4
			-	Bone surf (9E+1)	-	1E-10	-	-
95	Americium-243	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
95	Americium-244m[2]	W, all compounds	6E+4	4E+3	2E-6	-	-	-
			St wall (8E+4)	Bone surf (7E+3)	-	1E-8	1E-3	1E-2
95	Americium-244	W, all compounds	3E+3	2E+2	8E-8	-	4E-5	4E-4
			-	Bone surf (3E+2)	-	4E-10	-	-
95	Americium-245	W, all compounds	3E+4	8E+4	3E-5	1E-7	4E-4	4E-3
95	Americium-246m[2]	W, all compounds	5E+4	2E+5	8E-5	3E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
95	Americium-246[2]	W, all compounds	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3
96	Curium-238	W, all compounds	2E+4	1E+3	5E-7	2E-9	2E-4	2E-3

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Montly Average Concentrations (μCi/ml)
96	Curium-240	W, all compounds	6E+1	6E-1	2E-10	-	-	-
			Bone surf (8E+1)	Bone surf (6E-1)	-	9E-13	1E-6	1E-5
96	Curium-241	W, all compounds	1E+3	3E+1	1E-8	-	2E-5	2E-4
			-	Bone surf (4E+1)	-	5E-11	-	-
96	Curium-242	W, all compounds	3E+1	3E-1	1E-10	-	-	-
			Bone surf (5E+1)	Bone surf (3E-1)	-	4E-13	7E-7	7E-6
96	Curium-243	W, all compounds	1E+0	9E-3	4E-12	-	-	-
			Bone surf (2E+0)	Bone surf (2E-2)	-	2E-14	3E-8	3E-7
96	Curium-244	W, all compounds	1E+0	1E-2	5E-12	-	-	-
			Bone surf (3E+0)	Bone surf (2E-2)	-	3E-14	3E-8	3E-7
96	Curium-245	W, all compounds	7E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
96	Curium-246	W, all compounds	7E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
96	Curium-247	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
96	Curium-248	W, all compounds	2E-1	2E-3	7E-13	-	-	-
			Bone surf (4E-1)	Bone surf (3E-3)	-	4E-15	5E-9	5E-8
96	Curium-249[2]	W, all compounds	5E+4	2E+4	7E-6	-	7E-4	7E-3
			-	Bone surf (3E+4)	-	4E-8	-	-
96	Curium-250	W, all compounds	4E-2	3E-4	1E-13	-	-	-
			Bone surf (6E-2)	Bone surf (5E-4)	-	8E-16	9E-10	9E-9
97	Berkelium-245	W, all compounds	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
97	Berkelium-246	W, all compounds	3E+3	3E+3	1E-6	4E-9	4E-5	4E-4
97	Berkelium-247	W, all compounds	5E-1	4E-3	2E-12	-	-	-
			Bone surf (1E+0)	Bone surf (9E-3)	-	1E-14	2E-8	2E-7
97	Berkelium-249	W, all compounds	2E+2	2E+0	7E-10	-	-	-
			Bone surf (5E+2)	Bone surf (4E+0)	-	5E-12	6E-6	6E-5
97	Berkelium-250	W, all compounds	9E+3	3E+2	1E-7	-	1E-4	1E-3
			-	Bone surf (7E+2)	-	1E-9	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Release to Sewers
			Col. 1 Oral Ingestion ALI (µCi)	Col. 2 Inhalation ALI (µCi)	Col. 3 Inhalation DAC (µCi/ml)	Col. 1 Air (µCi/ml)	Col. 2 Water (µCi/ml)	Montly Average Concentrations (µCi/ml)
98	Californium-244[2]	W, all compounds except those given for Y	3E+4	6E+2	2E-7	8E-10	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		Y, oxides and hydroxides	-	6E+2	2E-7	8E-10	-	-
98	Californium-246	W, see ^{244}Cf	4E+2	9E+0	4E-9	1E-11	5E-6	5E-5
		Y, see ^{244}Cf	-	9E+0	4E-9	1E-11	-	-
98	Californium-248	W, see ^{244}Cf	8E+0	6E-2	3E-11	-	-	-
			Bone surf (2E+1)	Bone surf (1E-1)	-	2E-13	2E-7	2E-6
		Y, see ^{244}Cf	-	1E-1	4E-11	1E-13	-	-
98	Californium-249	W, see ^{244}Cf	5E-1	4E-3	2E-12	-	-	-
			Bone surf (1E+0)	Bone surf (9E-3)	-	1E-14	2E-8	2E-7
		Y, see ^{244}Cf	-	1E-2	4E-12	-	-	-
			-	Bone surf (1E-2)	-	2E-14	-	-
98	Californium-250	W, see ^{244}Cf	1E+0	9E-3	4E-12	-	-	
			Bone surf (2E+0)	Bone surf (2E-2)	-	3E-14	3E-8	3E-7
		Y, see ^{244}Cf	-	3E-2	1E-11	4E-14	-	-
98	Californium-251	W, see ^{244}Cf	5E-1	4E-3	2E-12	-	-	-
			Bone surf (1E+0)	Bone surf (9E-3)	-	1E-14	2E-8	2E-7
		Y, see ^{244}Cf	-	1E-2	4E-12	-	-	-
			-	Bone surf (1E-2)	-	2E-14	-	-
98	Californium-252	W, see ^{244}Cf	2E+0	2E-2	8E-12	-	-	-
			Bone surf (5E+0)	Bone surf (4E-2)	-	5E-14	7E-8	7E-7
		Y, see ^{244}Cf	-	3E-2	1E-11	5E-14	-	-
98	Californium-253	W, see ^{244}Cf	2E+2	2E+0	8E-10	3E-12	-	-
			Bone surf (4E+2)	-	-	-	5E-6	5E-5
		Y, see ^{244}Cf	-	2E+0	7E-10	2E-12	-	-
98	Californium-254	W, see ^{244}Cf	2E+0	2E-2	9E-12	3E-14	3E-8	3E-7
		Y, see ^{244}Cf	-	2E-2	7E-12	2E-14	-	-
99	Einsteinium-250	W, all compounds	4E+4	5E+2	2E-7	-	6E-4	6E-3
			-	Bone surf (1E+3)	-	2E-9	-	-
99	Einsteinium-251	W, all compounds	7E+3	9E+2	4E-7	-	1E-4	1E-3
			-	Bone surf (1E+3)	-	2E-9	-	-
99	Einsteinium-253	W, all compounds	2E+2	1E+0	6E-10	2E-12	2E-6	2E-5

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	**Table I** Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 Inhalation DAC (μCi/ml)	**Table II** Effluent Concentrations Col. 1 Air (μCi/ml)	Col. 2 Water (μCi/ml)	**Table III** Release to Sewers Montly Average Concentrations (μCi/ml)
99	Einsteinium-254m	W, all compounds	3E+2	1E+1	4E-9	1E-11	-	-
			Bone surf (3E+2)	-	-	-	4E-6	4E-5
99	Einsteinium-254	W, all compounds	8E+0	7E-2	3E-11	-	-	-
			Bone surf (2E+1)	Bone surf (1E-1)	-	2E-13	2E-7	2E-6
100	Fermium-252	W, all compounds	5E+2	1E+1	5E-9	2E-11	6E-6	6E-5
100	Fermium-253	W, all compounds	1E+3	1E+1	4E-9	1E-11	1E-5	1E-4
100	Fermium-254	W, all compounds	3E+3	9E+1	4E-8	1E-10	4E-5	4E-4
100	Fermium-255	W, all compounds	5E+2	2E+1	9E-9	3E-11	7E-6	7E-5
100	Fermium-257	W, all compounds	2E+1	2E-1	7E-11	-	-	-
			Bone surf (4E+1)	Bone surf (2E-1)	-	3E-13	5E-7	5E-6
101	Mendelevium-257	W, all compounds	7E+3	8E+1	4E-8	-	1E-4	1E-3
			-	Bone surf (9E+1)	-	1E-10	-	-
101	Mendelevium-258	W, all compounds	3E+1	2E-1	1E-10	-	-	-
			Bone surf (5E+1)	Bone surf (3E-1)	-	5E-13	6E-7	6E-6
-	Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life less than 2 hours	Submersion[1]	-	2E+2	1E-7	1E-9	-	-
-	Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life greater than 2 hours	. . . .	-	2E-1	1E-10	1E-12	1E-8	1E-7

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
-	Any single radionuclide not listed above that decays by alpha emission or spontaneous fission, or any mixture for which either the identity or the concentration of any radionuclide in the mixture is not known	. . . .	-	4E-4	2E-13	1E-15	2E-9	2E-8

FOOTNOTES:

[1] "Submersion" means that values given are for submersion in a hemispherical semi-infinite cloud of airborne material

[2] These radionuclides have radiological half-lives of less than 2 hours. The total effective dose equivalent received during operations with these radionuclides might include a significant contribution from external exposure. The DAC values for all radionuclides, other than those designated Class "Submersion," are based upon the committed effective dose equivalent due to the intake of the radionuclide into the body and do NOT include potentially significant contributions to dose equivalent from external exposures. The licensee may substitute 1E-7 µCi/ml for the listed DAC to account for the submersion dose prospectively, but should use individual monitoring devices or other radiation measuring instruments that measure external exposure to demonstrate compliance with the limits.

[3] For soluble mixtures of U-238, U-234, and U-235 in air, chemical toxicity may be the limiting factor. If the percent by weight (enrichment) of U-235 is not greater than 5, the concentration value for a 40-hour workweek is 0.2 milligrams uranium per cubic meter of air average. For any enrichment, the product of the average concentration and time of exposure during a 40-hour workweek shall not exceed 8E-3 (SA) µCi-hr/ml, where SA is the specific activity of the uranium inhaled. The specific activity for natural uranium is 6.77E-7 curies per gram U. The specific activity for other mixtures of U-238, U-235, and U-234, if not known, shall be:

SA = 3.6E-7 curies/gram U U-depleted

SA = [0.4 + 0.38 (enrichment) + 0.0034 (enrichment)^2] E-6 , enrichment $\geq$ 0.72

where enrichment is the percentage by weight of U-235, expressed as percent.

NOTE:

1 If the identity of each radionuclide in a mixture is known but the concentration of one or more of the radionuclides in the mixture is not known, the DAC for the mixture shall be the most restrictive DAC of any radionuclide in the mixture.

2 If the identity of each radionuclide in the mixture is not known, but it is known that certain radionuclides specified in this appendix are not present in the mixture, the inhalation ALI, DAC, and effluent and sewage concentrations for the mixture are the lowest values specified in this appendix for any radionuclide that is not known to be absent from the mixture; or

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
If it is known that Ac-227-D and Cm-250-W are not present			-	7E-4	3E-13	-	-	-
If, in addition, it is known that Ac-227-W,Y, Th-229-W,Y, Th-230-W, Th-232-W,Y, Pa-231-W,Y, Np-237-W, Pu-239-W, Pu-240-W, Pu-242-W, Am-241-W, Am-242m-W, Am-243-W, Cm-245-W, Cm-246-W, Cm-247-W, Cm-248-W, Bk-247-W, Cf-249-W, and Cf-251-W are not present			-	7E-3	3E-12	-	-	-
If, in addition, it is known that Sm-146-W, Sm-147-W, Gd-148-D,W, Gd-152-D,W, Th-228-W,Y, Th-230-Y, U-232-Y, U-233-Y, U-234-Y, U-235-Y, U-236-Y, U-238-Y, Np-236-W, Pu-236-W,Y, Pu-238-W,Y, Pu-239-Y, Pu-240-Y, Pu-242-Y, Pu-244-W,Y, Cm-243-W, Cm-244-W, Cf-248-W, Cf-249-Y, Cf-250-W,Y, Cf-251-Y, Cf-252-W,Y, and Cf-254-W,Y are not present			-	7E-2	3E-11	-	-	-
If, in addition, it is known that Pb-210-D, Bi-210m-W, Po-210-D,W, Ra-223-W, Ra-225-W, Ra-226-W, Ac-225-D,W,Y, Th-227-W,Y, U-230-D,W,Y, U-232-D,W, Pu-241-W, Cm-240-W, Cm-242-W, Cf-248-Y, Es-254-W, Fm-257-W, and Md-258-W are not present			-	7E-1	3E-10	-	-	-
If, in addition, it is known that Si-32-Y, Ti-44-Y, Fe-60-D, Sr-90-Y, Zr-93-D, Cd-113m-D, Cd-113-D, In-115-D,W, La-138-D, Lu-176-W, Hf-178m-D,W, Hf-182-D,W, Bi-210m-D, Ra-224-W, Ra-228-W, Ac-226-D,W,Y, Pa-230-W,Y, U-233-D,W, U-234-D,W, U-235-D,W, U-236-D,W, U-238-D,W, Pu-241-Y, Bk-249-W, Cf-253-W,Y, and Es-253-W are not present			-	7E+0	3E-9	-	-	-
If it is known that Ac-227-D,W,Y, Th-229-W,Y, Th-232-W,Y, Pa-231-W,Y, Cm-248-W, and Cm-250-W are not present			-	-	-	1E-14	-	-
If, in addition, it is known that Sm-146-W, Gd-148-D,W, Gd-152-D, Th-228-W,Y, Th-230-W,Y, U-232-Y, U-233-Y, U-234-Y, U-235-Y, U-236-Y, U-238-Y, U-Nat-Y, Np-236-W, Np-237-W, Pu-236-W,Y, Pu-238-W,Y, Pu-239-W,Y, Pu-240-W,Y, Pu-242-W,Y, Pu-244-W,Y, Am-241-W, Am-242m-W, Am-243-W, Cm-243-W, Cm-244-W, Cm-245-W, Cm-246-W, Cm-247-W, Bk-247-W, Cf-249-W,Y, Cf-250-W,Y, Cf-251-W,Y, Cf-252-W,Y, and Cf-254-W,Y are not present			-	-	-	1E-13	-	-

Figure: 30 TAC §336.359(d)

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Montly Average Concentrations (µCi/ml)
If, in addition, it is known that Sm-147-W, Gd-152-W, Pb-210-D, Bi-210m-W, Po-210-D,W, Ra-223-W, Ra-225-W, Ra-226-W, Ac-225-D,W,Y, Th-227-W,Y, U-230-D,W,Y, U-232-D,W, U-Nat-W, Pu-241-W, Cm-240-W, Cm-242-W, Cf-248-W,Y, Es-254-W, Fm-257-W, and Md-258-W are not present			-	-	-	1E-12	-	-
If, in addition it is known that Fe-60, Sr-90, Cd-113m, Cd-113, In-115, I-129, Cs-134, Sm-145, Sm-147, Gd-148, Gd-152, Hg-194 (organic), Bi-210m, Ra-223, Ra-224, Ra-225, Ac-225, Th-228, Th-230, U-233, U-234, U-235, U-236, U-238, U-Nat, Cm-242, Cf-248, Es-254, Fm-257, and Md-258 are not present			-	-	-	-	1E-6	1E-5

3 If a mixture of radionuclides consists of uranium and its daughters in ore dust (10 µm AMAD particle distribution assumed) prior to chemical separation of the uranium from the ore, the following values may be used for the DAC of the mixture: 6E-11 µCi of gross alpha activity from uranium-238, uranium-234, thorium-230, and radium-226 per milliliter of air; 3E-11 µCi of natural uranium per milliliter of air; or 45 micrograms of natural uranium per cubic meter of air.

4 If the identity and concentration of each radionuclide in a mixture are known, the limiting values should be derived as follows: determine, for each radionuclide in the mixture, the ratio between the concentration present in the mixture and the concentration otherwise established in this subsection for the specific radionuclide when not in a mixture. The sum of such ratios for all of the radionuclides in the mixture may not exceed "1" (i.e., "unity").

Example: If radionuclides "A," "B," and "C" are present in concentrations C_A, C_B, and C_C, and if the applicable DACs are DAC_A, DAC_B, and DAC_C, respectively, then the concentrations shall be limited so that the following relationship exists:

$$\frac{C_A}{DAC_A} + \frac{C_B}{DAC_B} + \frac{C_C}{DAC_C} \leq 1$$

ORDER ADOPTING NEW AND AMENDED RULES

Docket No. 2011-0755-RUL

On January 11, 2012, the Texas Commission on Environmental Quality (Commission) adopted new and amended rules in 30 TAC Chapter 336, concerning Radioactive Substance Rules. The proposed rules were published for comment in the August 5, 2011, issue of the Texas Register (36 TexReg 4920).

IT IS THEREFORE ORDERED BY THE COMMISSION that the new and amended rules are hereby adopted. The Commission further authorizes staff to make any non-substantive revisions to the rules necessary to comply with Texas Register requirements. The adopted rules and the preamble to the adopted rules are incorporated by reference in this Order as if set forth at length verbatim in this Order.

This Order constitutes the Order of the Commission required by the Administrative Procedure Act, Government Code, § 2001.033.

If any portion of this Order is for any reason held to be invalid by a court of competent jurisdiction, the invalidity of any portion shall not affect the validity of the remaining portions.

Issued date:

TEXAS COMMISSION ON
ENVIRONMENTAL QUALITY

Bryan W. Shaw, Ph.D., Chairman

Health and Safety Code, Chapters 691 and 692A [~~692~~]. The board also exercises jurisdiction over individuals, corporations, associations, institutions, research organizations, or other legal entities authorized to receive whole bodies under Chapters 691 and 692A [~~or 692~~].

(2) The board lacks jurisdiction over:

(A) - (B) (No change.)

(C) individuals in possession of parts or skeletal material or specimens described in subparagraphs (A) and (B) of this paragraph.

§477.2. Institutional Requirements.

(a) Institution accreditation. Institutions applying to be authorized to receive and hold bodies, or parts thereof, must show evidence of accreditation by the accrediting board for that profession. This applies to tissue banks authorized to receive donations under the Health and Safety Code Chapter 692A.

(b) - (c) (No change.)

§477.4. Transport, Importation and Exportation of Bodies.

(a) Transport of Bodies. The transfer and transport of bodies from one institution to another, or for export from the state, shall be done in an appropriate, secured vehicle operated by a licensed funeral establishment, ambulance service, member institution, or public carrier. A label with the statement "CONTENTS DERIVED FROM DONATED HUMAN TISSUE" shall be affixed to the container in which the body or anatomical specimen is transported. Violations may result in revocation of authorization to receive and hold bodies.

(b) (No change.)

(c) Exportation. No body under the jurisdiction of the board including donations to tissue banks authorized by Health and Safety Code, Chapter 692A, shall be shipped out of the State of Texas, unless permission in writing for such shipment has been granted by the board acting through its secretary-treasurer. If the secretary-treasurer is an employee of the institution that is to make the shipment, secondary approval must be given by the chair.

(1) The board may grant approval of exportation of a body if it or its secretary-treasurer or chair determines that:

(A) a written request has been received from an institution that is in the approved categories described in §479.1(a) of this title (relating [~~subsection (a) of Section 479.1 relating~~] to [~~"~~]Institutions Authorized to Receive and Hold Bodies)[~~"~~] that describes the need for the body and the facilities available for holding the body.

(B) - (C) (No change.)

(2) (No change.)

(d) - (e) (No change.)

§477.7. Board Forms.

(a) (No change.)

(b) Yearly cadaver procurement and use report. Each institution which has received, directly or by transfer, and/or used a body during the prior year shall complete, sign and file with the secretary-treasurer the yearly cadaver procurement and use report prescribed by the board. This report shall be filed not later than August 31 of each year for the prior annual period August 1 through July 31.Tissue banks receiving donations as authorized by Health and Safety Code Chapter 692A will file a cadaver procurement and transfer form as prescribed by the board.

(c) (No change.)

§477.8. Forms for Recording of Willed and Donated Bodies.

(a) Member institutions operating a willed body program, and institutions or individuals receiving donated bodies, including those authorized under Health and Safety Code, Chapter 692A, shall prepare separate forms for pre-death wills under Health and Safety Code, Chapter 691 and post-death donations under the Anatomical Gift Act, Health and Safety Code, Chapter 692A [~~692~~]. A copy of such forms shall be deposited, as a sample, with the secretary-treasurer.

(b) All Chapter 691 will forms and Chapter 692A [~~692~~] donation forms shall incorporate the following: "Complaints or inquiries regarding a willed or donated body should be directed to the secretary-treasurer of the Anatomical Board of the State of Texas. The name and address of this individual may be obtained from the institution to which the body was delivered."

This agency hereby certifies that the proposal has been reviewed by legal counsel and found to be within the agency's legal authority to adopt.

Filed with the Office of the Secretary of State on July 18, 2011.

TRD-201102716
Len Cleary, Ph.D.
Secretary-Treasurer
Anatomical Board of the State of Texas
Earliest possible date of adoption: September 4, 2011
For further information, please call: (713) 500-5631

♦ ♦ ♦

TITLE 30. ENVIRONMENTAL QUALITY

PART 1. TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

CHAPTER 336. RADIOACTIVE SUBSTANCE RULES

The Texas Commission on Environmental Quality (TCEQ, agency, or commission) proposes amendments to §§336.1, 336.2, 336.103, 336.105, 336.210, 336.305, 336.309, 336.331, 336.359, and 336.405. The commission also proposes new §336.351 and §336.357.

Background and Summary of the Factual Basis for the Proposed Rules

The changes proposed to this chapter will revise the commission's radiation control rules to ensure compatibility with regulations promulgated by the United States Nuclear Regulatory Commission (NRC). Compatibility of the commission's rules with the federal program is necessary to preserve the status of Texas as an Agreement State under Title 10 Code of Federal Regulations (CFR) Part 150 and under the "Articles of Agreement between the United States Atomic Energy Commission and the State of Texas for Discontinuance of Certain Commission Regulatory Authority and Responsibility Within the State Pursuant to Section 274 of the Atomic Energy Act of 1954, as Amended." Rules which are designated by NRC as compatibility items must be adopted by an Agreement State within three years of the effective date of the NRC rules, in most cases. Specific changes to the rules that involve incorporation of NRC rules are explained in the Section by Section Discussion of this preamble. These rules along with their *Federal Register* publication dates and effective dates are listed as follows:

Requirements for Expanded Definition of Byproduct Material (72 FR 55864, effective November 30, 2007).

The federal Energy Policy Act of 2005 expanded the Atomic Energy Act of 1954 definition of "byproduct material" to include any discrete source of radium-226, any material made radioactive by use of a particle accelerator, and discrete source material that the NRC determines would pose a similar threat to public health, safety or the common defense and security as radium-226, that are extracted or converted after extraction for use for a commercial, medical or research activity. The expansion of this definition placed the added materials under the NRC's regulatory authority. The federal Energy Policy Act of 2005 directed the NRC to issue regulations to implement the new definition of byproduct material. The NRC published its adopted regulations in the *Federal Register* on October 1, 2007 (72 FR 55864). The NRC explained that the new categories of byproduct material are not considered to be low-level radioactive waste. The first category of new material that is now classified as byproduct material is any discrete source of radium-226 that is produced, extracted, or converted after extraction before, on or after August 8, 2005 for use for a commercial, medical, or research activity. Radium is a chemically reactive, silvery white radioactive metallic element with an atomic number of 88 and symbol of Ra. Radium-226, the most abundant and most stable isotope of radium, emits alpha particles and gamma radiation and decays into radon gas. Because of radium's properties, especially its ability to stimulate luminescence, industries used radium in the early twentieth century in various consumer products, such as glow-in-the-dark watch and clock faces and other instruments that were made to be visible at night. Most of these uses were discontinued for health and safety reasons. In more recent times, radium sources were used in industrial radiography, industrial smoke detectors, or industrial gauges that measure properties such as moisture and density. In the NRC's rules, only "discrete" sources of radium-226 are covered under the new definition. The NRC explains that discrete sources are radionuclides that have been processed so that the concentration within the material has been purposely increased for use for commercial, medical, or research activities. The NRC determined that Energy Policy Act of 2005 gave the NRC authority over discrete sources of radium-226 but not over diffuse sources of radium-226, such as radium-226 as it occurs in nature or over other processes where radium-226 may be unintentionally concentrated. Scale from pipes, fly ash from coal power plants, phosphate fertilizers, or residuals from the treatment of water to meet drinking water standards are not considered to be discrete sources of radium-226 and therefore are not covered under the NRC's new definition of byproduct material. Although certain byproduct materials were added to the NRC's regulatory authority, the materials were already subject to state licensing requirements. The State of Texas and the commission already regulated discrete and diffuse sources of radium-226 as naturally-occurring radioactive material waste prior to the Energy Policy Act of 2005 definitional changes. Consequently, the commission's implementation of the NRC's rules does not change the state requirements for how discrete sources of radium-226 may be disposed. The second category of new byproduct material under the NRC regulation is any material that has been made radioactive by use of a particle accelerator and is produced, extracted, or converted after extraction before, on, or after August 8, 2005 for use for a commercial, medical, or research activity. A particle accelerator is a device that imparts kinetic energy to subatomic particles by increasing their speed through electromagnetic interactions. Particle accelerators are used to produce radioactive material by directing a beam of high-speed particles at a target composed of a specifically selected element, which is usually not radioactive. Usually the nuclide produced is radioactive and is created for the use of its radiological properties. The NRC explains that the majority of accelerator-produced radioactive material is created for use in medicine. Prior to the NRC's regulations, the commission rule in §336.1(g) included accelerator-produced radioactive material within the term "low-level radioactive waste." Because the Energy Policy Act and the NRC regulations now define materials that are made radioactive by use of a particle accelerator as byproduct material and that the newly added material is not considered to be low-level radioactive waste, the commission must revise current §336.1(g) and regulate accelerator produced radioactive material as byproduct and not as low-level radioactive waste to maintain compatibility with the NRC requirements. The third category of new byproduct material is any discrete source of naturally occurring radioactive material, other than source material, that the NRC determines would pose a threat similar to the threat posed by a discrete source of radium-226 to the public health and safety or the common defense and security and before, on, or after August 8, 2005, is extracted or converted after extraction for use in a commercial, medical, or research activity. In its October 1, 2007 publication of adopted rules, the NRC announced that it was not adding any new discrete sources of naturally occurring radioactive material under this classification. To date, the NRC has not added a new category of radioactive material to be classified as byproduct under this provision. The commission proposes to add this category of byproduct material to maintain compatibility with NRC requirements but there are no types of radioactive material that will be classified as byproduct material under this provision at this time.

National Source Tracking System (71 FR 65685, effective February 6, 2007).

After the terrorist attacks in the United States on September 11, 2001, the NRC conducted a comprehensive review of nuclear material security requirements with particular focus of radioactive material of concern, including cobalt-60, cesium-137, iridium-192, and americium-241, as well as other radionuclides with the potential to be used in a radiological dispersal device or a radiological exposure device in the absence of proper security and control measures. The NRC's adopted rules create a national tracking system of sealed sources to provide greater source accountability and increased controls by licensees. The NRC rules require licensees to report information on the manufacture, transfer, receipt, disassembly, and disposal of nationally tracked sealed sources. A sealed source consists of radioactive material that is sealed in a capsule or is closely bonded to a non-radioactive substrate to prevent leakage or escape of the radioactive material. A nationally tracked sealed source is a sealed source containing a quantity of radioactive material equal to or greater than the Category 2 levels listed in the new Appendix E to 10 CFR Part 20. The commission proposes requirements of the National Source Tracking System in NRC regulations to maintain compatibility as an Agreement State program.

Occupational Dose Records, Labeling Containers, and the Total Effective Dose Equivalent (72 FR 68043 effective February 15, 2008).

The NRC implemented a regulatory review to reduce unnecessary regulatory burden on NRC and Agreement State licensees without affecting the level of protection for either the health and safety of workers and the public or for the environment. The NRC revised the requirements regarding the information that a licensee must make available to workers. A licensee must provide an annual report to each individual monitored of the dose received in that monitoring year if the individual's occupational dose report exceeds 1 millisievert (100 millirem) or to any individual that requests the report. A licensee is not required to provide unsolicited annual dose reports to those individuals whose annual dose does not exceed these limits. Also, the NRC's final rules revise the definition of "total effective dose equivalent" to mean the sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures). The revised definition will allow licensees to substitute effective dose equivalent for deep-dose equivalent for external exposures. Another aspect of the NRC rulemaking is to remove provisions in 10 CFR §20.2104(a)(2) that requires licensees to attempt to obtain the records of cumulative occupational radiation dose for each worker requiring monitoring because previous NRC rule changes removed requirements using cumulative lifetime dose under 10 CFR Part 20 except for cases involving planned special exposures. The previous NRC revisions make it unnecessary for licensees to attempt to obtain lifetime exposures for workers who are not participating in a planned special exposure. The NRC explains that the rule does not affect the level of protection for either the health and safety of workers and the public or for the environment because the requirements to determine an individual's occupational radiation dose received during the current year or cumulative radiation dose prior to permitting a planned special exposure are not changed. The commission proposes changes in the rules to maintain compatibility with the NRC regulations.

NRC Order Imposing Increased Controls, EA-05-090 (71 FR 72128, published December 1, 2005).

In response to efforts to assess security risks posed by uncontrolled sources, the NRC issued an order on November 14, 2005 to impose requirements for the control of high-risk radioactive materials to prevent inadvertent and intentional unauthorized access, primarily due to the potential health and safety hazards posed by the uncontrolled material. The order identifies certain radionuclides of concern and establishes control measures for licensees to secure those materials. As part of the order, each Agreement State is required to issue legally binding requirements to put essentially identical measures in place for licensees under state regulatory jurisdiction. Because the NRC order was effective immediately for security concerns, the commission has already imposed the requirements of the NRC order on licensees and now proposes rules to implement the controls required by the NRC order.

The rulemaking will also amend the fees charged for facilities regulated under Chapter 336, Subchapter L. The proposed fees shall recover for the state the actual expenses arising from the regulatory activities associated with licenses for commercial disposal of by-product material. This is consistent with other cost recovery rules already adopted by the commission. The rulemaking will also amend the annual license fees to fund the Radiation and Perpetual Care Account.

Section by Section Discussion

Subchapter A, General Provisions

The commission proposes to amend §336.1 by removing §336.1(g). Accelerator-produced radioactive material is now regulated as byproduct material and not included as low-level radioactive waste in accordance with the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material (72 FR 55864, effective November 30, 2007).*

The commission proposes to amend §336.2 to make it compatible with 10 CFR Part 20. The definitions of "Accelerator-produced radioactive material" and "Byproduct material" are proposed to be amended for consistency with 10 CFR §20.1003. A new definition of "Discrete source" is proposed for consistency with 10 CFR §20.1003. These definitions are proposed to implement the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material* (72 FR 55864, effective November 30, 2007). The definition of "Low-level radioactive waste" is proposed to be revised to update the agency name of the "Texas Department of Health" to the "Texas Department of State Health Services." The definition of "Low-level radioactive waste" is also proposed to be amended to exclude the new classes of byproduct material in proposed §336.2(16)(C) - (E) and to implement the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material* (72 FR 55864, effective November 30, 2007). A new definition of "Nationally tracked source" is proposed to implement the NRC rulemaking *National Source Tracking System* (71 FR 65685, effective February 6, 2007). The definition of "Naturally occurring radioactive material (NORM) waste" is proposed to be revised to update the agency name of the "Texas Department of Health" to the "Texas Department of State Health Services." A new definition of "Particle accelerator" is proposed for consistency with 10 CFR §20.1003. This definition is proposed to implement the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material* (72 FR 55864, effective November 30, 2007). The definition of "Total effective dose equivalent (TEDE)" is proposed to be amended for consistency with 10 CFR §20.1003. This definition is proposed to implement the NRC rulemaking *Occupational Dose Records, Labeling Containers, and the Total Effective Dose Equivalent* (72 FR 68043, effective February 15, 2008). A new definition of "Waste" is proposed for consistency with 10 CFR §20.1003 and §61.2. This definition is proposed to implement the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material* (72 FR 55864, effective November 30, 2007).

Congress enacted the Energy Policy Act of 2005 which expanded the definition of "byproduct material" under Section 11(e) of the Atomic Energy Act. The NRC adopted rules in 2007 to implement the new definition. Consistent with the expanded federal definition, "byproduct material" is proposed to be defined to include: any discrete source of radium-226 that is produced, extracted, or converted after extraction, for use for a commercial, medical, or research activity; any material that has been made radioactive by use of a particle accelerator and is produced, extracted, or converted for use for a commercial, medical, or research activity; and any discrete source of naturally occurring radioactive material, other than source material, that is extracted or converted after extraction for use in a commercial, medical, or research activity and that the NRC, in consultation with the Administrator of the United States Environmental Protection Agency (EPA), the United States Secretary of Energy, the United States Secretary of Homeland Security, and the head of any other appropriate Federal agency, determines would pose a threat similar to the threat posed by a discrete source of radium-226 to the public health and safety or the common defense and security. The commission notes that the expanded definition of byproduct material in Subchapter A does not expand or change the types of material licensed for disposal under Chapter 336, Subchapter L. Chapter 336, Subchapter L, relating to the licensing of source material and by-product material disposal facilities, addresses the requirements for the disposal of by-product material as defined in that subchapter and is limited to byproduct material as defined in the Atomic Energy Act, Section 11(e)(2) and §336.2(16)(B) as the tailings and waste produced by or resulting from the extraction or concentration of uranium or thorium from ore primarily for its source material content. Except for the reclassification of accelerator produced radioactive materials as byproduct material discussed in the proposed amendment to §336.1, the definitions in §336.2 are proposed to maintain compatibility with federal regulations and do not change existing requirements for disposal of radioactive material under Chapter 336. A licensee that was authorized to store and process NORM materials under Chapter 336, Subchapter M would be authorized to accept the same material now classified as byproduct material under the revised definitions.

Subchapter B, Radioactive Substance Fees

The commission proposes to amend §336.103 to reflect current procedures and provide clarification for invoicing and payment of annual fees for commercial facilities regulated under Chapter 336, Subchapter H. The proposed amendment to §336.103(c) clarifies that the commission will invoice quarterly for reimbursement of actual costs incurred from regulatory activities associated with the license. The current practice of quarterly invoicing for actual expenses allows the commission's staff to plan and budget regulatory activities efficiently and avoids problems that a single yearly invoice would create across fiscal years and biennial appropriations cycles. Cost recovery for expenses related to radioactive material licensing activities is authorized in state statute. Texas Health and Safety Code (THSC), §401.412(d) provides the commission may assess and collect an annual fee for each license and registration and for each application in an amount sufficient to recover its reasonable costs to administer its authority.

The commission proposes to amend §336.105 to revise application fees charged for commercial facilities regulated under Chapter 336, Subchapter L. The proposed fees shall recover for the state the actual expenses arising from the regulatory activities associated with licenses for commercial disposal of by-product material. Cost recovery for expenses related to radioactive material licenses are authorized in state statute. THSC, §401.301(g) provides the commission may assess and collect additional fees from the applicant to recover the costs the commission incurs for administrative review, technical review, and hearings on the application. THSC, §401.412(d) provides the commission may assess and collect an annual fee for each license and registration and for each application in an amount sufficient to recover its reasonable costs to administer its authority.

The commission proposes to amend §336.105(a)(4) for applications for new, amended, or renewal commercial by-product material disposal licenses issued under Chapter 336, Subchapter L. The proposed amendment adds §336.105(a)(4)(A) to require a supplemental fee to recover the actual costs incurred by the commission for review of the application and any hearings associated with an application for commercial by-product material disposal. The proposed amendment also adds §336.105(a)(4)(B) to provide that the executive director invoice for reimbursement of the amount of the costs incurred quarterly. Agency practice of quarterly invoicing for actual expenses allows the commission's staff to plan and budget regulatory activities efficiently and avoids problems that a single yearly invoice would create across fiscal years and biennial appropriations cycles. Payment shall be made within 30 days following the date of the invoice. The proposed amendment implements THSC, §401.301(g) to provide for cost recovery for commercial by-product material disposal license applications.

The commission proposes to amend §336.105(b)(4) for annual fees for commercial by-product material disposal licenses issued under Chapter 336, Subchapter L. Currently the $60,929.50 annual fee specified in §336.105(b)(4) is not sufficient to cover the costs incurred by the commission for expenses arising from the regulatory activities associated with commercial by-product material disposal licensing. The proposed amendment adds §336.105(b)(4)(A) to require a supplemental license fee sufficient to recover the actual costs incurred by the commission. This fee shall recover for the state the actual expenses arising from the regulatory activities associated with the license in accordance with THSC, §401.412(d). The proposed amendment also adds §336.105(b)(4)(B) to provide that the executive director shall invoice for the amount of the costs incurred quarterly. Agency practice of quarterly invoicing for actual expenses allows the commission's staff to plan and budget regulatory activities efficiently and avoids problems that a single yearly invoice would create across fiscal years and biennial appropriations cycles. Payment shall be made within 30 days following the date of the invoice. The proposed amendment implements THSC, §401.412(d) to provide for cost recovery for annual fees associated with commercial by-product material disposal licenses.

The commission proposes to amend §336.105(h) to add a citation to §336.103 and to clarify the requirements for payment of fees. The proposed amendment implements THSC, §401.301 to fund the perpetual care account. Licenses issued under Subchapter H will be required to pay the annual fee when necessary. Currently, no licensees will be assessed with this fee since the perpetual care account is sufficiently funded under the limitations imposed in THSC, §401.301(e).

Subchapter C, General Licensing Requirements

The commission proposes to amend §336.210 to add radium-226 in alphabetical order to the Release Fractions Table in §336.210(e). This amendment is proposed for consistency with 10 CFR §30.72 and to implement the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material* (72 FR 55864, effective November 30, 2007). This proposed amendment adds radium-226 to the list of radioactive material that must be considered in the emergency planning provided in radioactive materials license applications.

Subchapter D, Standards for Protection Against Radiation

The commission proposes to amend §336.305(c) to revise the method used to demonstrate compliance with the occupational dose limits. This amendment is proposed for consistency with 10 CFR §20.2008 and to implement the NRC rulemaking *Occupational Dose Records, Labeling Containers, and the Total Effective Dose Equivalent* (72 FR 68043 and 72233, effective February 15, 2008). The proposed amendment provides that when external exposure is determined by measurement with an external personal monitoring device, the deep-dose equivalent must be used in place of the effective dose equivalent, unless the effective dose equivalent is determined by a dosimetry method approved by the executive director.

The commission proposes to amend §336.309(a) to revise the requirements for determining prior occupational dose. The proposed rule removes the requirement to attempt to obtain records of lifetime cumulative occupational radiation dose. Section 336.309(f) is proposed to require the licensee to retain dose records until the executive director terminates each pertinent license requiring this record. This amendment is proposed for consistency with 10 CFR §20.2104 and to implement the NRC rulemaking *Occupational Dose Records, Labeling Containers, and the Total Effective Dose Equivalent* (72 FR 68043 and 72233, effective February 15, 2008).

The commission proposes to amend §336.331 to update the agency name of the "Texas Department of Health" to the "Texas Department of State Health Services." The commission proposes §336.331(i) to require shipping manifests for disposal of byproduct material as defined in proposed §336.2(16)(C) - (E). This amendment is proposed for consistency with 10 CFR §20.2006 and to implement the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material* (72 FR 55864, effective November 30, 2007).

The commission proposes new §336.351 to implement the requirements of the National Source Tracking System. The National Source Tracking System is the NRC's program for accounting for certain sealed sources by requiring licensees to report information on the manufacture, transfer, receipt, disassembly, and disposal of nationally tracked sealed sources. New §336.351 is proposed for consistency with 10 CFR §20.2207 and to implement the NRC rulemaking *National Source Tracking System* (71 FR 65685, effective February 6, 2007).

The commission proposes new §336.357 to implement the requirements in NRC's Order Imposing Increased Controls, EA-05-090. New §336.357 is proposed for consistency with 10 CFR §20.1801, and to implement the NRC's Order Imposing Increased Controls, EA-05-090 (71 FR 65685, published December 1, 2005). The proposed rule adds requirements for the control and access of certain radioactive materials possessed by a licensee to implement the security measures required by the NRC's order and are consistent with the Texas Department of State Health Services requirements in 25 TAC §289.252(ii).

The commission proposes to amend §336.359. Figure 2 in §336.359(d) is revised to include the elements "Nitrogen" and "Oxygen." This amendment is proposed for consistency with 10 CFR Part 20, Appendix B and to implement the NRC rulemaking *Requirements for Expanded Definition of Byproduct Material (72 FR 55864, effective November 30, 2007).*

Subchapter E, Notices, Instructions, and Reports to Workers and Inspections

The commission proposes to amend §336.405 to update requirements for notifications to workers. Section 336.405(b) is proposed to be amended to require a licensee to provide an annual report to an individual if their occupational dose exceeds 1 millisieverts (100 millirem) or the individual requests his or her annual dose report. This amendment is proposed for consistency with 10 CFR §19.13 and to implement the NRC rulemaking *Occupational Dose Records, Labeling Containers, and the Total Effective Dose Equivalent* (72 FR 68043 and 72233, effective February 15, 2008).

Fiscal Note: Costs to State and Local Government

Nina Chamness, Analyst, Strategic Planning and Assessment, has determined that, for the first five-year period the proposed rules are in effect, fiscal implications are anticipated for the agency but not for other units of state or local government as a result of administration or enforcement of the proposed rules.

The proposed rules will amend Chapter 336 to ensure that the agency's radiation control rules are compatible with regulations promulgated by the NRC. The proposed rules are necessary to maintain the status of the state as an Agreement State authorized to administer a portion of the radiation control program under the Atomic Energy Act. The proposed adoption of federal rule language is not expected to significantly impact the current practices and procedures used by licensees to comply with state and federal regulations.

The proposed rules allow the agency to recover the actual costs incurred by the commission for the review of an application and any hearings associated with an application for commercial by-product material disposal facilities regulated under Chapter 336, Subchapter L. The proposed rules will also allow the agency to recover the actual costs associated with regulatory activities for commercial radioactive by-product disposal licensees (an annual license fee). The application fee is currently $374,729. Annual license fees are currently $60,929 per year. Agency use of any revenue collected above these amounts would be subject to the legislature increasing the agency's appropriation authority.

For both of the proposed fee changes, the executive director would be required to send an invoice for the amount of the costs incurred during the period of September 1 through August 31 of each year. Payment would have to be made within 30 days following the date of the invoice.

The proposed rules also provide for the funding of the Radiation and Perpetual Care Account (Account 5096). The revenue in Account 5096 is funded by non-refundable fees equal to 5% of the total fee for each specific license under the jurisdiction of the agency. The maximum balance of fees collected in the Radiation and Perpetual Care Account is $500,000. If the balance in the account is reduced to $350,000 or less due to decommissioning or remediation activities, the agency is to reinstitute the assessment of the non-refundable fee until the balance of fees collected totals $500,000.

The proposed rules are not expected to have a significant impact on local government or other state agencies since these types of governmental entities do not typically engage in the commercial disposal of radioactive by-product material.

Public Benefits And Costs

Nina Chamness also determined that for each year of the first five years the proposed rules are in effect, the public benefit anticipated from the changes seen in the proposed rules will be consistency with federal regulations and the ability of the agency to recover actual costs arising from regulatory activities associated with the regulation of the commercial disposal of radioactive by-product material.

The proposed rules are not expected to have an impact on individuals. Fiscal implications may be anticipated for those commercial by-product material disposal businesses regulated under Chapter 336, Subchapter L. At this time, no new license applications are anticipated for these types of facilities. However, for future license applicants, any additional costs above the current application fee of $374,729 will depend upon the actual costs incurred by the commission for the review of an application and any hearings associated with the application.

The proposed rules also provide for the funding of the Radiation and Perpetual Care Account (Account 5096). If the balance of fees collected in Account 5096 is $350,000 or less, a business would be required to pay a non-refundable fee equal to 5% of the total fee for each specific license under the jurisdiction of the agency until the balance of fees collected in the account totals $500,000. A business applying for a new license would not be required to pay a non-refundable fee to Account 5096 if the balance is over $350,000 at the time of application. At this time the balance in Account 5096 is at the maximum allowed balance.

At this time, there is one large business in the state that has a license for the commercial disposal of radioactive by-product material. There may be costs for this license holder resulting from the proposed requirement to submit an annual license fee sufficient to recover the actual costs incurred by the commission for the actual expenses arising from the regulatory activities associated with the license. Those costs will depend upon the agency's cost to regulate these activities. If these regulatory activities cost more than $60,929 per year, the Radioactive Materials Division would send an invoice for the amount of the additional costs incurred during the period of September 1 through August 31 of each year. Payment would have to be made within 30 days following the date of the invoice. At this time the Radioactive Materials Division is not able to project whether those regulatory costs would exceed $60,929 each year.

Small Business and Micro-Business Assessment

No adverse fiscal implications are anticipated for small or micro-businesses under the proposed rules. Small businesses do not typically engage in the commercial disposal of radioactive by-product material.

Small Business Regulatory Flexibility Analysis

The commission has reviewed this proposed rulemaking and determined that a small business regulatory flexibility analysis is not required because the proposed rules are required to protect the environment and comply with federal regulations. In addition, the proposed rules are not expected to affect a small or micro-business in a material way for the first five years that the proposed rules are in effect.

Local Employment Impact Statement

The commission has reviewed this proposed rulemaking and determined that a local employment impact statement is not required because the proposed rules do not adversely affect a local economy in a material way for the first five years that the proposed rules are in effect.

Draft Regulatory Impact Analysis Determination

The commission reviewed the proposed rulemaking in light of the regulatory analysis requirements of Texas Government Code, §2001.0225, and determined that the rulemaking is not subject to §2001.0225 because it does not meet the definition of a "major environmental rule" as defined in the act. "Major environmental rule" means a rule the specific intent of which is to protect the environment or reduce risks to human health from environmental exposure and that may adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, or the public health and safety of the state or a sector of the state. The proposed rules are not anticipated to adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, or the public health and safety of the state or a sector of the state because there are no significant requirements imposed on radioactive material licensees. The commission proposes these rules for purpose of maintaining consistency with NRC regulations by providing new and revised definitions; revising occupational dose, exposure, and reporting requirements; and providing reporting requirements for national tracked sources. The proposed rules also revise fee requirements to implement THSC, §401.301(g) to authorize the assessment of additional application fees to recover the commission's cost for administrative and technical review and hearings for a license application.

Furthermore, the proposed rulemaking does not meet any of the four applicability requirements listed in Texas Government Code, §2001.0225(a). Texas Government Code, §2001.0225 only applies to a major environmental rule, the result of which is to: 1) exceed a standard set by federal law, unless the rule is specifically required by state law; 2) exceed an express requirement of state law, unless the rule is specifically required by federal law; 3) exceed a requirement of a delegation agreement or contract between the state and an agency or representative of the federal government to implement a state and federal program; or 4) adopt a rule solely under the general powers of the agency instead of under a specific state law. The proposed rulemaking does not exceed a standard set by federal law, an express requirement of state law, a requirement of a delegation agreement, nor adopt a rule solely under the general powers of the agency.

The Texas Radiation Control Act, THSC, Chapter 401, authorizes the commission to regulate commercial radioactive waste processing and the disposal of most radioactive material in Texas. THSC, §§401.051, 401.103, and 401.104 authorize the commission to adopt rules for the control of sources or radiation and the licensing of the disposal of radioactive materials. In addition, the State of Texas is an Agreement State, authorized by the NRC to administer a radiation control program under the Atomic Energy Act. NRC requirements must be implemented by the commission to preserve the status as an Agreement State. The proposed rules do not exceed the standards set by federal law. The proposed rulemaking implements changes in NRC definitions, NRC occupational dose requirements, NRC security requirements, and NRC requirements for reporting of national tracked sources.

The proposed rules do not exceed an express requirement of state law. The Texas Radiation Control Act, THSC, Chapter 401 establishes general requirements for the licensing and disposal of radioactive materials. The Texas Radiation Control Act in THSC, §401.001 specifically establishes the policy to maintain compatibility with federal standards and regulatory programs.

The commission has also determined that the proposed rules do not exceed a requirement of a delegation agreement or contract between the state and an agency of the federal government. The State of Texas has been designated as an Agreement State by the NRC under the authority of the Atomic Energy Act. The Atomic Energy Act requires that the NRC find that the state radiation control program is compatible with the NRC's requirements for the regulation of radioactive materials and is adequate to protect health and safety. The commission determined that the proposed rules do not exceed the NRC's requirements nor exceed the requirements for retaining status as an Agreement State.

The commission also determined that these rules are proposed under specific authority of the Texas Radiation Control Act, THSC, Chapter 401. THSC, §§401.051, 401.103, and 401.104 authorize the commission to adopt rules for the control of sources or radiation and the licensing of the disposal of radioactive materials.

The commission invites public comment of the draft regulatory impact analysis determination.

Takings Impact Assessment

The commission evaluated these proposed rules and performed a preliminary assessment of whether Texas Government Code, Chapter 2007 is applicable. The commission's preliminary assessment indicates that Texas Government Code, Chapter 2007 does not apply to these proposed rules because this is an action that is reasonably taken to fulfill an obligation mandated by federal law, which is exempt under Texas Government Code, §2007.003(b)(4). The State of Texas has received authorization as an Agreement State from the NRC to administer a radiation control program under the Atomic Energy Act. The Atomic Energy Act requires the NRC to find that the state's program is compatible with NRC requirements for the regulation of radioactive materials and is protective of health and safety. The proposed rulemaking will provide consistency with federal regulations.

Nevertheless, the commission further evaluated these proposed rules and performed a preliminary assessment of whether these proposed rules constitute a taking under Texas Government Code, Chapter 2007. The following is a summary of that evaluation and preliminary assessment. The primary purpose of these proposed rules is to implement changes to federal requirements for the regulation and licensing of radioactive material. The proposed rules would substantially advance this purpose by implementing new federal definitions of by-product material; revising occupational dose, exposure, and reporting requirements; providing security controls, and providing reporting requirements for national tracked sources.

Promulgation and enforcement of these proposed rules would be neither a statutory nor a constitutional taking of private real property. The proposed rules do not affect a landowner's rights in private real property because this rulemaking does not burden (constitutionally), nor restrict or limit, the owner's right to property and reduce its value by 25% or more beyond which would otherwise exist in the absence of the rules. The proposed rules primarily implement requirements in federal law relating to revised definitions; revise occupational dose, exposure, and reporting requirements; provide security requirements; and provide reporting requirements for national tracked sources. The proposed rules do not affect private real property.

Consistency with the Coastal Management Program

The commission reviewed this proposed rulemaking action and determined that the proposed rules are neither identified in, nor will they affect, any action/authorization identified in Coastal Coordination Act Implementation Rules in 31 TAC §505.11, relating to Actions and Rules Subject to the Texas Coastal Management Program (CMP). Therefore, the proposed rulemaking action is not subject to the CMP.

Written comments on the consistency of this rulemaking may be submitted to the contact person at the address listed under the Submittal of Comments section of this preamble.

Announcement of Hearing

The commission will hold a public hearing on this proposal in Austin on August 30, 2011 at 10:00 in Building E, Room 201S, at the commission's central office located at 12100 Park 35 Circle. The hearing is structured for the receipt of oral or written comments by interested persons. Individuals may present oral statements when called upon in order of registration. Open discussion will not be permitted during the hearing; however, commission staff members will be available to discuss the proposal 30 minutes prior to the hearing.

Persons who have special communication or other accommodation needs who are planning to attend the hearing should contact Sandy Wong, Office of Legal Services at (512) 239-1802. Requests should be made as far in advance as possible.

Submittal of Comments

Written comments may be submitted to Michael Parrish, MC 205, Office of Legal Services, Texas Commission on Environmental Quality, P.O. Box 13087, Austin, Texas 78711-3087, or faxed to (512) 239-4808. Electronic comments may be submitted at: *http://www5.tceq.texas.gov/rules/ecomments/*. File size restrictions may apply to comments being submitted via the eComments system. All comments should reference Rule Project Number 2011-011-336-PR. The comment period closes September 6, 2011. Copies of the proposed rulemaking can be obtained from the commission's Web site at *http://www.tceq.texas.gov/nav/rules/propose_adopt.html.* For further information, please contact Devane Clarke, Radioactive Materials Division, (512) 239-5604.

SUBCHAPTER A. GENERAL PROVISIONS

30 TAC §336.1, §336.2

Statutory Authority

The amendments are proposed under the Texas Radiation Control Act, Texas Health and Safety Code (THSC), Chapter 401; THSC, §401.011, which provides the commission authority to regulate and license the disposal of radioactive substances, the commercial processing and storage of radioactive substances, and the recovery and processing of source material; §401.051, which authorizes the commission to adopt rules and guidelines relating to control of sources of radiation; §401.103, which authorizes the commission to adopt rules and guidelines that provide for licensing and registration for the control of sources of radiation; §401.104, which requires the commission to provide rules for licensing for the disposal of radioactive substances; §401.201, which provides authority to the commission to regulate the disposal of low-level radioactive waste; §401.301, which authorizes the commission to set fees by rule; and §401.412, which provides authority to the commission to regulate licenses for the disposal of radioactive substances. The proposed amendments are also authorized by Texas Water Code, §5.103, which provides the commission with the authority to adopt rules necessary to carry out its powers and duties under the water code and other laws of the state.

The proposed amendments implement THSC, Chapter 401, including §§401.011, 401.051, 401.057, 401.059, 401.103, 401.104, 401.151, 401.201, 401.301, and 401.412.

§336.1. Scope and General Provisions.

(a) Except as otherwise specifically provided, the rules in this chapter apply to all persons who dispose of radioactive substances; all persons who recover or process source material; and all persons who receive radioactive substances from other persons for storage or processing.

(1) However, nothing in these rules shall apply to any person to the extent that person is subject to regulation by the United States Nuclear Regulatory Commission (NRC) or to radioactive material in the possession of federal agencies.

(2) Any United States Department of Energy contractor or subcontractor or any NRC contractor or subcontractor of the following

categories operating within the state, is exempt from the rules in this chapter, with the exception of any applicable fee set forth in Subchapter B of this chapter (relating to Radioactive Substance Fees), to the extent that such contractor or subcontractor under his contract receives, possesses, uses, transfers, or acquires sources of radiation:

(A) prime contractors performing work for the United States Department of Energy at a United States government-owned or controlled site, including the transportation of radioactive material to or from the site and the performance of contract services during temporary interruptions of transportation;

(B) prime contractors of the United States Department of Energy performing research in or development, manufacture, storage, testing, or transportation of atomic weapons or components thereof;

(C) prime contractors of the United States Department of Energy using or operating nuclear reactors or other nuclear devices in a United States government-owned vehicle or vessel; and

(D) any other prime contractor or subcontractor of the United States Department of Energy or the NRC when the state and the NRC jointly determine that:

(i) the exemption of the prime contractor or subcontractor is authorized by law; and

(ii) under the terms of the contract or subcontract, there is adequate assurance that the work thereunder can be accomplished without undue risk to the public health and safety or the environment.

(3) Radioactive material that is physically received from the federal government by a non-federal facility is subject to state jurisdiction except as provided in paragraph (2) of this subsection.

(4) The rules of this chapter do not apply to transportation of radioactive materials. This provision does not exempt a transporter from other applicable requirements.

(5) The rules in this chapter do not apply to the disposal of radiation machines as defined in this subchapter or electronic devices that produce non-ionizing radiation.

(b) Regulation by the State of Texas of source material, by-product material, and special nuclear material in quantities not sufficient to form a critical mass is subject to the provisions of the agreement between the State of Texas and the NRC and to 10 Code of Federal Regulations Part 150 (10 CFR Part 150) (Exemptions and Continued Regulatory Authority in Agreement States and in Offshore Waters Under Section 274). (A copy of the Texas agreement, "Articles of Agreement between the United States Nuclear Regulatory Commission and the State of Texas for Discontinuance of Certain Commission Regulatory Authority and Responsibility Within the State Pursuant to Section 274 of the Atomic Energy Act of 1954, as Amended" (Agreement), may be obtained from this commission.) Under the Agreement and 10 CFR Part 150, the NRC retains certain regulatory authorities over source material, by-product material, and special nuclear material in the State of Texas. Persons in the State of Texas are not exempt from the regulatory requirements of the NRC with respect to these retained authorities.

(c) No person may receive, possess, use, transfer, or dispose of radioactive material, which is subject to the rules in this chapter, in such a manner that the standards for protection against radiation prescribed in these rules are exceeded.

(d) Each person licensed by the commission under this chapter shall confine possession, use, and disposal of licensed radioactive material to the locations and purposes authorized in the license.

(e) No person may cause or allow the release of radioactive material, which is subject to the rules in this chapter, to the environment in violation of this chapter or of any rule, license, or order of the Texas Commission on Environmental Quality (commission).

(f) No person shall:

(1) dispose of low-level radioactive waste on site, except as authorized under §336.501(b) of this title (relating to Scope and General Provisions);

(2) receive low-level radioactive waste from other persons for the purpose of disposal, except for a person specifically licensed for the disposal of low-level radioactive waste;

(3) dispose of radioactive materials other than low-level radioactive waste, except for diffuse naturally occurring radioactive material waste having concentrations of less than 2,000 picocuries per gram (pCi/g) radium-226 or radium-228;

(4) dispose of radioactive materials from other persons other than low-level radioactive waste, except for naturally occurring radioactive material waste in accordance with Subchapter K of this chapter (relating to Commercial Disposal of Naturally Occurring Radioactive Material Waste from Public Water Systems);

(5) recover or process source material, except in accordance with Subchapter L of this chapter (relating to Licensing of Source Material Recovery and By-Product Material Disposal Facilities);

(6) store, process, or dispose of by-product material, except in accordance with Subchapter L of this chapter; or

(7) receive radioactive substances from other persons for storage or processing, except in accordance with Subchapter M of this chapter (relating to Licensing of Radioactive Substances Processing and Storage Facilities).

[~~(g) For the purpose of this chapter, any time the term "low-level radioactive waste" is used, the provision also applies to accelerator-produced radioactive material.~~]

§336.2. Definitions.

The following words and terms, when used in this chapter, shall have the following meanings, or as described in Chapter 3 of this title (relating to Definitions), unless the context clearly indicates otherwise. Additional definitions used only in a certain subchapter will be found in that subchapter.

(1) Absorbed dose--The energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the gray (Gy).

(2) Accelerator-produced radioactive material--Any material made radioactive by [~~exposing it to the radiation from~~] a particle accelerator.

(3) Activity--The rate of disintegration (transformation) or decay of radioactive material. The units of activity are the curie (Ci) and the becquerel (Bq).

(4) Adult--An individual 18 or more years of age.

(5) Agreement state--Any state with which the United States Nuclear Regulatory Commission (NRC) or the Atomic Energy Commission has entered into an effective agreement under the Atomic

Energy Act of 1954, §274b, as amended through October 24, 1992 (Public Law 102-486).

(6) Airborne radioactive material--Any radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases.

(7) Airborne radioactivity area--A room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations:

(A) in excess of the derived air concentrations (DACs) specified in §336.359, Appendix B, Table I, Column 1, of this title (relating to Appendix B. Annual Limits on Intake (ALI) and Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sanitary Sewerage); or

(B) to a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6% of the ALI or 12 DAC-hours.

(8) Air-purifying respirator--A respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

(9) Annual limit on intake (ALI)--The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the "reference man" that would result in a committed effective dose equivalent of 5 rems (0.05 sievert) or a committed dose equivalent of 50 rems (0.5 sievert) to any individual organ or tissue. ALI values for intake by ingestion and by inhalation of selected radionuclides are given in Table I, Columns 1 and 2, of §336.359, Appendix B, of this title.

(10) As low as is reasonably achievable (ALARA)--Making every reasonable effort to maintain exposures to radiation as far below the dose limits in this chapter as is practical, consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to the state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of ionizing radiation and licensed radioactive materials in the public interest.

(11) Assigned protection factor (APF)--The expected workplace level of respiratory protection that would be provided by a properly functioning respirator or a class of respirators to properly fitted and trained users. Operationally, the inhaled concentration can be estimated by dividing the ambient airborne concentration by the APF.

(12) Atmosphere-supplying respirator--A respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

(13) Background radiation--Radiation from cosmic sources; non-technologically enhanced naturally-occurring radioactive material, including radon (except as a decay product of source or special nuclear material) and global fallout as it exists in the environment from the testing of nuclear explosive devices or from past nuclear accidents such as Chernobyl that contribute to background radiation and are not under the control of the licensee. "Background radiation" does not include radiation from radioactive materials regulated by the commission, Texas Department of State Health Services, NRC, or an Agreement State.

(14) Becquerel (Bq)--See §336.4 of this title (relating to Units of Radioactivity).

(15) Bioassay--The determination of kinds, quantities, or concentrations, and, in some cases, the locations of radioactive material in the human body, whether by direct measurement (in vivo counting) or by analysis and evaluation of materials excreted or removed from the human body. For purposes of the rules in this chapter, "radiobioassay" is an equivalent term.

(16) Byproduct material--

(A) A radioactive material, other than special nuclear material, that is produced in or made radioactive by exposure to radiation incident to the process of producing or using special nuclear material; [~~or~~]

(B) The tailings or wastes produced by or resulting from the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes, and other tailings having similar radiological characteristics. Underground ore bodies depleted by these solution extraction processes do not constitute "byproduct material" within this definition; [~~.~~]

(C) Any discrete source of radium-226 that is produced, extracted, or converted after extraction, for use for a commercial, medical, or research activity;

(D) Any material that has been made radioactive by use of a particle accelerator; and is produced, extracted, or converted for use for a commercial, medical, or research activity; and

(E) Any discrete source of naturally occurring radioactive material, other than source material, that is extracted or converted after extraction for use in a commercial, medical, or research activity and that the NRC, in consultation with the Administrator of the United States Environmental Protection Agency (EPA), the United States Secretary of Energy, the United States Secretary of Homeland Security, and the head of any other appropriate Federal agency, determines would pose a threat similar to the threat posed by a discrete source of radium-226 to the public health and safety or the common defense and security.

(17) CFR--Code of Federal Regulations.

(18) Class--A classification scheme for inhaled material according to its rate of clearance from the pulmonary region of the lung. Materials are classified as D, W, or Y, which applies to a range of clearance half-times: for Class D (Days) of less than ten days, for Class W (Weeks) from 10 to 100 days, and for Class Y (Years) of greater than 100 days. For purposes of the rules in this chapter, "lung class" and "inhalation class" are equivalent terms.

(19) Collective dose--The sum of the individual doses received in a given period of time by a specified population from exposure to a specified source of radiation.

(20) Committed dose equivalent ($H_{T,50}$) (CDE)--The dose equivalent to organs or tissues of reference (T) that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

(21) Committed effective dose equivalent ($H_{E,50}$) (CEDE)--The sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to each of these organs or tissues.

(22) Compact--The Texas Low-Level Radioactive Waste Disposal Compact established under Texas Health and Safety Code,

§403.006 and Texas Low-Level Radioactive Waste Disposal Compact Consent Act, Public Law Number 105-236 (1998).

(23) Compact waste--Low-level radioactive waste that:

(A) is generated in a host state or a party state; or

(B) is not generated in a host state or a party state, but has been approved for importation to this state by the compact commission under §3.05 of the compact established under Texas Health and Safety Code, §403.006.

(24) Compact waste disposal facility--The low-level radioactive waste land disposal facility licensed by the commission under Subchapter H of this chapter (relating to Licensing Requirements for Near-Surface Land Disposal of Low-Level Radioactive Waste) for the disposal of compact waste.

(25) Constraint (dose constraint)--A value above which specified licensee actions are required.

(26) Critical group--The group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances.

(27) Curie (Ci)--See §336.4 of this title.

(28) Declared pregnant woman--A woman who has voluntarily informed the licensee, in writing, of her pregnancy and the estimated date of conception. The declaration remains in effect until the declared pregnant woman withdraws the declaration in writing or is no longer pregnant.

(29) Decommission--To remove (as a facility) safely from service and reduce residual radioactivity to a level that permits:

(A) release of the property for unrestricted use and termination of license; or

(B) release of the property under restricted conditions and termination of the license.

(30) Deep-dose equivalent (H_d) (which applies to external whole-body exposure)--The dose equivalent at a tissue depth of one centimeter (1,000 milligrams/square centimeter).

(31) Demand respirator--An atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

(32) Depleted uranium--The source material uranium in which the isotope uranium-235 is less than 0.711%, by weight, of the total uranium present. Depleted uranium does not include special nuclear material.

(33) Derived air concentration (DAC)--The concentration of a given radionuclide in air which, if breathed by the "reference man" for a working year of 2,000 hours under conditions of light work (inhalation rate of 1.2 cubic meters of air/hour), results in an intake of one ALI. DAC values are given in Table I, Column 3, of §336.359, Appendix B, of this title.

(34) Derived air concentration-hour (DAC-hour)--The product of the concentration of radioactive material in air (expressed as a fraction or multiple of the derived air concentration for each radionuclide) and the time of exposure to that radionuclide, in hours. A licensee shall take 2,000 DAC-hours to represent one ALI, equivalent to a committed effective dose equivalent of 5 rems (0.05 sievert).

(35) Discrete source--A radionuclide that has been processed so that its concentration within a material has been purposely increased for use for commercial, medical, or research activities.

(36) [~~(35)~~] Disposal--With regard to low-level radioactive waste, the isolation or removal of low-level radioactive waste from mankind and mankind's environment without intent to retrieve that low-level radioactive waste later.

(37) [~~(36)~~] Disposable respirator--A respirator for which maintenance is not intended and that is designed to be discarded after excessive breathing resistance, sorbent exhaustion, physical damage, or end-of-service-life renders it unsuitable for use. Examples of this type of respirator are a disposable half-mask respirator or a disposable escape-only self-contained breathing apparatus (SCBA).

(38) [~~(37)~~] Distinguishable from background--The detectable concentration of a radionuclide is statistically different from the background concentration of that radionuclide in the vicinity of the site or, in the case of structures, in similar materials using adequate measurement technology, survey, and statistical techniques.

(39) [~~(38)~~] Dose--A generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, total organ dose equivalent, or total effective dose equivalent. For purposes of the rules in this chapter, "radiation dose" is an equivalent term.

(40) [~~(39)~~] Dose equivalent (H_T)--The product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and sievert (Sv).

(41) [~~(40)~~] Dose limits--The permissible upper bounds of radiation doses established in accordance with the rules in this chapter. For purposes of the rules in this chapter, "limits" is an equivalent term.

(42) [~~(41)~~] Dosimetry processor--An individual or organization that processes and evaluates individual monitoring devices in order to determine the radiation dose delivered to the monitoring devices.

(43) [~~(42)~~] Effective dose equivalent (H_E)--The sum of the products of the dose equivalent to each organ or tissue (H_T) and the weighting factor (w_T) applicable to each of the body organs or tissues that are irradiated.

(44) [~~(43)~~] Embryo/fetus--The developing human organism from conception until the time of birth.

(45) [~~(44)~~] Entrance or access point--Any opening through which an individual or extremity of an individual could gain access to radiation areas or to licensed radioactive materials. This includes portals of sufficient size to permit human access, irrespective of their intended use.

(46) [~~(45)~~] Exposure--Being exposed to ionizing radiation or to radioactive material.

(47) [~~(46)~~] Exposure rate--The exposure per unit of time.

(48) [~~(47)~~] External dose--That portion of the dose equivalent received from any source of radiation outside the body.

(49) [~~(48)~~] Extremity--Hand, elbow, arm below the elbow, foot, knee, and leg below the knee. The arm above the elbow and the leg above the knee are considered part of the whole body.

(50) [~~(49)~~] Federal facility waste--Low-level radioactive waste that is the responsibility of the federal government under the Low-Level Radioactive Waste Policy Act, as amended by the Low-Level Radioactive Waste Policy Amendments Act of 1985 (42 United States Code, §2021b - 2021j). Excluded from this definition is low-level radioactive waste that is classified as greater than Class

C in §336.362 of this title (relating to Appendix E. Classification and Characteristics of Low-Level Radioactive Waste).

(51) [~~(50)~~] Federal facility waste disposal facility--A low-level radioactive waste land disposal facility for the disposal of federal facility waste licensed under Subchapters H and J of this chapter.

(52) [~~(51)~~] Filtering facepiece (dust mask)--A negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium, not equipped with elastomeric sealing surfaces and adjustable straps.

(53) [~~(52)~~] Fit factor--A quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

(54) [~~(53)~~] Fit test--The use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual.

(55) [~~(54)~~] General license--An authorization granted by an agency under its rules which is effective without the filing of an application with that agency or the issuance of a licensing document to the particular person.

(56) [~~(55)~~] Generally applicable environmental radiation standards--Standards issued by the EPA under the authority of the Atomic Energy Act of 1954, as amended through October 4, 1996, that impose limits on radiation exposures or levels, or concentrations or quantities of radioactive material, in the general environment outside the boundaries of locations under the control of persons possessing or using radioactive material.

(57) [~~(56)~~] Gray (Gy)--See §336.3 of this title (relating to Units of Radiation Exposure and Dose).

(58) [~~(57)~~] Hazardous waste--Hazardous waste as defined in §335.1 of this title (relating to Definitions).

(59) [~~(58)~~] Helmet--A rigid respiratory inlet covering that also provides head protection against impact and penetration.

(60) [~~(59)~~] High radiation area--An area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving a dose equivalent in excess of 0.1 rem (1 millisievert) in one hour at 30 centimeters from the radiation source or 30 centimeters from any surface that the radiation penetrates.

(61) [~~(60)~~] Hood--A respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

(62) [~~(61)~~] Host state--A party state in which a compact facility is located or is being developed. The State of Texas is the host state under the Texas Low-Level Radioactive Waste Disposal Compact, §2.01, established under Texas Health and Safety Code, §403.006.

(63) [~~(62)~~] Individual--Any human being.

(64) [~~(63)~~] Individual monitoring--The assessment of:

(A) dose equivalent by the use of individual monitoring devices; or

(B) committed effective dose equivalent by bioassay or by determination of the time-weighted air concentrations to which an individual has been exposed, that is, DAC-hours; or

(C) dose equivalent by the use of survey data.

(65) [~~(64)~~] Individual monitoring devices--Devices designed to be worn by a single individual for the assessment of dose equivalent such as film badges, thermoluminescence dosimeters (TLDs), pocket ionization chambers, and personal ("lapel") air sampling devices.

(66) [~~(65)~~] Inhalation class--See "Class."

(67) [~~(66)~~] Inspection--An official examination and/or observation including, but not limited to, records, tests, surveys, and monitoring to determine compliance with the Texas Radiation Control Act (TRCA) and rules, orders, and license conditions of the commission.

(68) [~~(67)~~] Internal dose--That portion of the dose equivalent received from radioactive material taken into the body.

(69) [~~(68)~~] Land disposal facility--The land, buildings and structures, and equipment which are intended to be used for the disposal of low-level radioactive wastes into the subsurface of the land. For purposes of this chapter, a "geologic repository" as defined in 10 CFR §60.2 as amended through October 27, 1988 (53 FR 43421) (relating to Definitions - high-level radioactive wastes in geologic repositories) is not considered a "land disposal facility."

(70) [~~(69)~~] Lens dose equivalent (LDE)--The external exposure of the lens of the eye and is taken as the dose equivalent at a tissue depth of 0.3 centimeter (300 mg/cm^2).

(71) [~~(70)~~] License--See "Specific license."

(72) [~~(71)~~] Licensed material--Radioactive material received, possessed, used, processed, transferred, or disposed of under a license issued by the commission.

(73) [~~(72)~~] Licensee--Any person who holds a license issued by the commission in accordance with the Texas Health and Safety Code, Chapter 401 (Radioactive Materials and Other Sources of Radiation) and the rules in this chapter. For purposes of the rules in this chapter, "radioactive material licensee" is an equivalent term. Unless stated otherwise, "licensee" as used in the rules of this chapter means the holder of a "specific license."

(74) [~~(73)~~] Licensing state--Any state with rules equivalent to the Suggested State Regulations for Control of Radiation relating to, and having an effective program for, the regulatory control of naturally occurring or accelerator-produced radioactive material (NARM) and which has been designated as such by the Conference of Radiation Control Program Directors, Inc.

(75) [~~(74)~~] Loose-fitting facepiece--A respiratory inlet covering that is designed to form a partial seal with the face.

(76) [~~(75)~~] Lost or missing licensed radioactive material--Licensed material whose location is unknown. This definition includes material that has been shipped but has not reached its planned destination and whose location cannot be readily traced in the transportation system.

(77) [~~(76)~~] Low-level radioactive waste--

(A) Except as provided by subparagraph (B) of this paragraph, low-level radioactive waste means radioactive material that:

(i) is discarded or unwanted and is not exempt by a Texas Department of State Health Services rule adopted under the Texas Health and Safety Code, §401.106;

(ii) is waste, as that term is defined by 10 CFR §61.2; and

(iii) is subject to:

(I) concentration limits established under this chapter; and

(II) disposal criteria established under this chapter.

(B) Low-level radioactive waste does not include:

(i) high-level radioactive waste defined by 10 CFR §60.2;

(ii) spent nuclear fuel as defined by 10 CFR §72.3;

(iii) transuranic waste as defined in this section;

(iv) byproduct material as defined by paragraph (16)(B) - (E) of this section;

(v) naturally occurring radioactive material (NORM) waste; or

(vi) oil and gas NORM waste.

(C) When used in this section, the references to 10 CFR sections mean those CFR sections as they existed on September 1, 1999, as required by Texas Health and Safety Code, §401.005.

(78) [~~(77)~~] Lung class--See "Class."

(79) [~~(78)~~] Member of the public--Any individual except when that individual is receiving an occupational dose.

(80) [~~(79)~~] Minor--An individual less than 18 years of age.

(81) [~~(80)~~] Mixed waste--A combination of hazardous waste, as defined in [~~30 TAC~~] §335.1 of this title (relating to Definitions) and low-level radioactive waste. The term includes compact waste and federal facility waste containing hazardous waste.

(82) [~~(81)~~] Monitoring--The measurement of radiation levels, radioactive material concentrations, surface area activities, or quantities of radioactive material and the use of the results of these measurements to evaluate potential exposures and doses. For purposes of the rules in this chapter, "radiation monitoring" and "radiation protection monitoring" are equivalent terms.

(83) Nationally tracked source--A sealed source containing a quantity equal to or greater than Category 1 or Category 2 levels of any radioactive material listed in §336.351 of this title (relating to Reports of Transactions Involving Nationally Tracked Sources). In this context a sealed source is defined as radioactive material that is sealed in a capsule or closely bonded, in a solid form and which is not exempt from regulatory control. It does not mean material encapsulated solely for disposal, or nuclear material contained in any fuel assembly, subassembly, fuel rod, or fuel pellet. Category 1 nationally tracked sources are those containing radioactive material at a quantity equal to or greater than the Category 1 threshold. Category 2 nationally tracked sources are those containing radioactive material at a quantity equal to or greater than the Category 2 threshold but less than the Category 1 threshold.

(84) [~~(82)~~] Naturally occurring or accelerator-produced radioactive material (NARM)--Any naturally occurring or accelerator-produced radioactive material except source material or special nuclear material.

(85) [~~(83)~~] Naturally occurring radioactive material (NORM) waste--Solid, liquid, or gaseous material or combination of materials, excluding source material, special nuclear material, and byproduct material, that:

(A) in its natural physical state spontaneously emits radiation;

(B) is discarded or unwanted; and

(C) is not exempt under rules of the Texas Department of State Health Services adopted under Texas Health and Safety Code, §401.106.

(86) [~~(84)~~] Near-surface disposal facility--A land disposal facility in which low-level radioactive waste is disposed of in or within the upper 30 meters of the earth's surface.

(87) [~~(85)~~] Negative pressure respirator (tight fitting)--A respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

(88) [~~(86)~~] Nonstochastic effect--A health effect, the severity of which varies with the dose and for which a threshold is believed to exist. Radiation-induced cataract formation is an example of a nonstochastic effect. For purposes of the rules in this chapter, "deterministic effect" is an equivalent term.

(89) [~~(87)~~] Occupational dose--The dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation and/or to radioactive material from licensed and unlicensed sources of radiation, whether in the possession of the licensee or other person. Occupational dose does not include dose received from background radiation, as a patient from medical practices, from voluntary participation in medical research programs, or as a member of the public.

(90) [~~(88)~~] Oil and gas naturally occurring radioactive material (NORM) waste--Naturally occurring radioactive material (NORM) waste that constitutes, is contained in, or has contaminated oil and gas waste as that term is defined in the Texas Natural Resources Code, §91.1011.

(91) [~~(89)~~] On-site--The same or geographically contiguous property that may be divided by public or private rights-of-way, provided the entrance and exit between the properties is at a cross-roads intersection, and access is by crossing, as opposed to going along, the right-of-way. Noncontiguous properties owned by the same person but connected by a right-of-way that the property owner controls and to which the public does not have access, is also considered on-site property.

(92) Particle accelerator--Any machine capable of accelerating electrons, protons, deuterons, or other charged particles in a vacuum and designed to discharge the resultant particulate or other associated radiation at energies usually in excess of 1 million electron volts (MeV).

(93) [~~(90)~~] Party state--Any state that has become a party to the compact in accordance with Article VII of the Texas Low-Level Radioactive Waste Disposal Compact, established under Texas Health and Safety Code, §403.006.

(94) [~~(91)~~] Perpetual care account--The radiation and perpetual care account as defined in this section.

(95) [~~(92)~~] Personnel monitoring equipment--See "Individual monitoring devices."

(96) [~~(93)~~] Planned special exposure--An infrequent exposure to radiation, separate from and in addition to the annual occupational dose limits.

(97) [~~(94)~~] Positive pressure respirator--A respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

(98) [~~(95)~~] Powered air-purifying respirator (PAPR)--An air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

(99) [~~(96)~~] Pressure demand respirator--A positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

(100) [~~(97)~~] Principal activities--Activities authorized by the license which are essential to achieving the purpose(s) for which the license is issued or amended. Storage during which no licensed material is accessed for use or disposal and activities incidental to decontamination or decommissioning are not principal activities.

(101) [~~(98)~~] Public dose--The dose received by a member of the public from exposure to radiation and/or radioactive material released by a licensee, or to any other source of radiation under the control of the licensee. It does not include occupational dose or doses received from background radiation, as a patient from medical practices, or from voluntary participation in medical research programs.

(102) [~~(99)~~] Qualitative fit test (QLFT)--A pass/fail test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

(103) [~~(100)~~] Quality factor (Q)--The modifying factor listed in Table I or II of §336.3 of this title that is used to derive dose equivalent from absorbed dose.

(104) [~~(101)~~] Quantitative fit test (QNFT)--An assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

(105) [~~(102)~~] Quarter (Calendar quarter)--A period of time equal to one-fourth of the year observed by the licensee (approximately 13 consecutive weeks), providing that the beginning of the first quarter in a year coincides with the starting date of the year and that no day is omitted or duplicated in consecutive quarters.

(106) [~~(103)~~] Rad--See §336.3 of this title.

(107) [~~(104)~~] Radiation--Alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. For purposes of the rules in this chapter, "ionizing radiation" is an equivalent term. Radiation, as used in this chapter, does not include non-ionizing radiation, such as radio- or microwaves or visible, infrared, or ultraviolet light.

(108) [~~(105)~~] Radiation and Perpetual Care Account--An account in the general revenue fund established for the purposes specified in the Texas Health and Safety Code, §401.305.

(109) [~~(106)~~] Radiation area--Any area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 millisievert) in one hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates.

(110) [~~(107)~~] Radiation machine--Any device capable of producing ionizing radiation except those devices with radioactive material as the only source of radiation.

(111) [~~(108)~~] Radioactive material--A naturally-occurring or artificially-produced solid, liquid, or gas that emits radiation spontaneously.

(112) [~~(109)~~] Radioactive substance--Includes byproduct material, radioactive material, low-level radioactive waste, source material, special nuclear material, source of radiation, and NORM waste, excluding oil and gas NORM waste.

(113) [~~(110)~~] Radioactivity--The disintegration of unstable atomic nuclei with the emission of radiation.

(114) [~~(111)~~] Radiobioassay--See "Bioassay."

(115) [~~(112)~~] Reference man--A hypothetical aggregation of human physical and physiological characteristics determined by international consensus. These characteristics shall be used by researchers and public health workers to standardize results of experiments and to relate biological insult to a common base. A description of "reference man" is contained in the International Commission on Radiological Protection report, ICRP Publication 23, "Report of the Task Group on Reference Man."

(116) [~~(113)~~] Rem--See §336.3 of this title.

(117) [~~(114)~~] Residual radioactivity--Radioactivity in structures, materials, soils, groundwater, and other media at a site resulting from activities under the licensee's control. This includes radioactivity from all licensed and unlicensed sources used by the licensee, but excludes background radiation. It also includes radioactive materials remaining at the site as a result of routine or accidental releases of radioactive material at the site and previous burials at the site, even if those burials were made in accordance with the provisions of 10 CFR Part 20.

(118) [~~(115)~~] Respiratory protection equipment--An apparatus, such as a respirator, used to reduce an individual's intake of airborne radioactive materials. For purposes of the rules in this chapter, "respiratory protective device" is an equivalent term.

(119) [~~(116)~~] Restricted area--An area, access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. Restricted area does not include areas used as residential quarters, but separate rooms in a residential building shall be set apart as a restricted area.

(120) [~~(117)~~] Roentgen (R)--See §336.3 of this title.

(121) [~~(118)~~] Sanitary sewerage--A system of public sewers for carrying off waste water and refuse, but excluding sewage treatment facilities, septic tanks, and leach fields owned or operated by the licensee.

(122) [~~(119)~~] Sealed source--Radioactive material that is permanently bonded or fixed in a capsule or matrix designed to prevent release and dispersal of the radioactive material under the most severe conditions that are likely to be encountered in normal use and handling.

(123) [~~(120)~~] Self-contained breathing apparatus (SCBA)--An atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

(124) [~~(121)~~] Shallow-dose equivalent (H_s) (which applies to the external exposure of the skin of the whole body or the skin of an extremity)--The dose equivalent at a tissue depth of 0.007 centimeter (seven milligrams/square centimeter).

(125) [~~(122)~~] SI--The abbreviation for the International System of Units.

(126) [~~(123)~~] Sievert (Sv)--See §336.3 of this title.

(127) [~~(124)~~] Site boundary--That line beyond which the land or property is not owned, leased, or otherwise controlled by the licensee.

(128) [~~(125)~~] Source material--

(A) Uranium or thorium, or any combination thereof, in any physical or chemical form; or

(B) ores that contain, by weight, 0.05% or more of uranium, thorium, or any combination thereof. Source material does not include special nuclear material.

(129) [~~(126)~~] Special form radioactive material--Radioactive material which is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule and which has at least one dimension not less than five millimeters and which satisfies the test requirements of 10 CFR §71.75 as amended through September 28, 1995 (60 FR 50264) (Transportation of License Material).

(130) [~~(127)~~] Special nuclear material--

(A) Plutonium, uranium-233, uranium enriched in the isotope 233 or in the isotope 235, and any other material that the NRC, under the provisions of the Atomic Energy Act of 1954, §51, as amended through November 2, 1994 (Public Law 103-437), determines to be special nuclear material, but does not include source material; or

(B) any material artificially enriched by any of the foregoing, but does not include source material.

(131) [~~(128)~~] Special nuclear material in quantities not sufficient to form a critical mass--Uranium enriched in the isotope 235 in quantities not exceeding 350 grams of contained uranium-235; uranium-233 in quantities not exceeding 200 grams; plutonium in quantities not exceeding 200 grams; or any combination of these in accordance with the following formula: For each kind of special nuclear material, determine the ratio between the quantity of that special nuclear material and the quantity specified above for the same kind of special nuclear material. The sum of such ratios for all of the kinds of special nuclear material in combination shall not exceed 1. For example, the following quantities in combination would not exceed the limitation: (175 grams contained U-235/350 grams) + (50 grams U-233/200 grams) + (50 grams Pu/200 grams) = 1.

(132) [~~(129)~~] Specific license--A licensing document issued by an agency upon an application filed under its rules. For purposes of the rules in this chapter, "radioactive material license" is an equivalent term. Unless stated otherwise, "license" as used in this chapter means a "specific license."

(133) [~~(130)~~] State--The State of Texas.

(134) [~~(131)~~] Stochastic effect--A health effect that occurs randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without threshold. Hereditary effects and cancer incidence are examples of stochastic effects. For purposes of the rules in this chapter, "probabilistic effect" is an equivalent term.

(135) [~~(132)~~] Supplied-air respirator (SAR) or airline respirator--An atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

(136) [~~(133)~~] Survey--An evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, and/or presence of radioactive materials or other sources of radiation. When appropriate, this evaluation includes, but is not limited to, physical examination of the location of radioactive material and measurements or calculations of levels of radiation or concentrations or quantities of radioactive material present.

(137) [~~(134)~~] Termination--As applied to a license, a release by the commission of the obligations and authorizations of the licensee under the terms of the license. It does not relieve a person of duties and responsibilities imposed by law.

(138) [~~(135)~~] Tight-fitting facepiece--A respiratory inlet covering that forms a complete seal with the face.

(139) [~~(136)~~] Total effective dose equivalent (TEDE)--The sum of the effective dose [~~deep-dose~~] equivalent for external exposures and the committed effective dose equivalent for internal exposures.

(140) [~~(137)~~] Total organ dose equivalent (TODE)--The sum of the deep-dose equivalent and the committed dose equivalent to the organ receiving the highest dose as described in §336.346(a)(6) of this title (relating to Records of Individual Monitoring Results).

(141) [~~(138)~~] Transuranic waste--For the purposes of this chapter, wastes containing alpha emitting transuranic radionuclides with a half-life greater than five years at concentrations greater than 100 nanocuries/gram.

(142) [~~(139)~~] Type A quantity (for packaging)--A quantity of radioactive material, the aggregate radioactivity of which does not exceed A_1 for special form radioactive material or A_2 for normal form radioactive material, where A_1 and A_2 are given in or shall be determined by procedures in Appendix A to 10 CFR Part 71 as amended through September 28, 1995 (60 FR 50264) (Packaging and Transportation of Radioactive Material).

(143) [~~(140)~~] Type B quantity (for packaging)--A quantity of radioactive material greater than a Type A quantity.

(144) [~~(141)~~] Unrefined and unprocessed ore--Ore in its natural form before any processing, such as grinding, roasting, beneficiating, or refining.

(145) [~~(142)~~] Unrestricted area--Any area that is not a restricted area.

(146) [~~(143)~~] User seal check (fit check)--An action conducted by the respirator user to determine if the respirator is properly seated to the face. Examples include negative pressure check, positive pressure check, irritant smoke check, or isoamyl acetate check.

(147) [~~(144)~~] Very high radiation area--An area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving an absorbed dose in excess of 500 rads (five grays) in one hour at one meter from a source of radiation or one meter from any surface that the radiation penetrates.

(148) [~~(145)~~] Violation--An infringement of any provision of the Texas Radiation Control Act (TRCA) or of any rule, order, or license condition of the commission issued under the TRCA or this chapter.

(149) Waste--Low-level radioactive wastes containing source, special nuclear, or byproduct material that are acceptable for disposal in a land disposal facility. For the purposes of this definition, low-level radioactive waste means radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in paragraph (16)(B) - (E) of this section.

(150) [~~(146)~~] Week--Seven consecutive days starting on Sunday.

(151) [~~(147)~~] Weighting factor (w_T) for an organ or tissue (T)--The proportion of the risk of stochastic effects resulting from irradiation of that organ or tissue to the total risk of stochastic effects when the whole body is irradiated uniformly. For calculating the effective dose equivalent, the values of w_T are:
Figure: 30 TAC §336.2(151)

[Figure: ~~30 TAC §336.2(147)~~]

(152) [~~(148)~~] Whole body--For purposes of external exposure, head, trunk including male gonads, arms above the elbow, or legs above the knee.

(153) [~~(149)~~] Worker--An individual engaged in activities under a license issued by the commission and controlled by a licensee, but does not include the licensee.

(154) [~~(150)~~] Working level (WL)--Any combination of short-lived radon daughters in one liter of air that will result in the ultimate emission of 1.3 x 10^5 MeV [~~million electron volts (MeV)~~] of potential alpha particle energy. The short-lived radon daughters are: for radon-222: polonium-218, lead-214, bismuth-214, and polonium-214; and for radon-220: polonium-216, lead-212, bismuth-212, and polonium-212.

(155) [~~(151)~~] Working level month (WLM)--An exposure to one working level for 170 hours (2,000 working hours per year divided by 12 months per year is approximately equal to 170 hours per month).

(156) [~~(152)~~] Year--The period of time beginning in January used to determine compliance with the provisions of the rules in this chapter. The licensee shall change the starting date of the year used to determine compliance by the licensee provided that the change is made at the beginning of the year and that no day is omitted or duplicated in consecutive years.

This agency hereby certifies that the proposal has been reviewed by legal counsel and found to be within the agency's legal authority to adopt.

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SUBCHAPTER B. RADIOACTIVE SUBSTANCE FEES

30 TAC §336.103, §336.105

Statutory Authority

The amendments are proposed under the Texas Radiation Control Act, Texas Health and Safety Code (THSC), Chapter 401; THSC, §401.011, which provides the commission authority to regulate and license the disposal of radioactive substances, the commercial processing and storage of radioactive substances, and the recovery and processing of source material; §401.051, which authorizes the commission to adopt rules and guidelines relating to control of sources of radiation; §401.103, which authorizes the commission to adopt rules and guidelines that provide for licensing and registration for the control of sources of radiation; §401.104, which requires the commission to provide rules for licensing for the disposal of radioactive substances; §401.201, which provides authority to the commission to regulate the disposal of low-level radioactive waste; §401.301, which authorizes the commission to set fees by rule; and §401.412, which provides authority to the commission to regulate licenses for the disposal of radioactive substances. The proposed amendments are also authorized by Texas Water Code, §5.103, which provides the commission with the authority to adopt rules necessary to carry out its powers and duties under the water code and other laws of the state.

The proposed amendments implement THSC, Chapter 401, including §§401.011, 401.051, 401.057, 401.059, 401.103, 401.104, 401.151, 401.201, 401.301, and 401.412.

§336.103. Schedule of Fees for Subchapter H Licenses.

(a) An application for a low-level radioactive waste disposal site license under Subchapter H of this chapter (relating to Licensing Requirements for Near-Surface Land Disposal of Low-Level Radioactive Waste) shall be accompanied by a nonrefundable application processing fee of $500,000. If the commission's costs in processing an application under Subchapter H of this chapter exceed the $500,000 application processing fee, the commission may assess and collect additional fees from the applicant to recover the costs. Recoverable costs include costs incurred by the commission for administrative review, technical review, and hearings associated with the application.

(b) An applicant shall submit an annual fee for the actual costs incurred by the commission for hearings associated with an application for a low-level radioactive waste disposal site under Subchapter H of this chapter. The executive director shall send an invoice for the amount of the costs incurred during the period September 1 through August 31 of each year. Payment shall be made within 30 days following the date of the invoice.

(c) A holder of a license for a low-level radioactive waste disposal site issued under Subchapter H of this chapter shall submit an annual license fee for the services received. This fee shall recover for the state the actual expenses arising from the regulatory activities associated with the license. This fee shall include reimbursement for the salary and other expenses of the resident inspectors as provided by §336.743 of this title (relating to Resident Inspector). The executive director shall [~~send an~~] invoice for the amount of the costs incurred quarterly [~~during the period September 1 through August 31 of each year~~]. Payment shall be made within 30 days following the date of the invoice.

(d) An application for a major amendment of a license issued under Subchapter H of this chapter must be accompanied by an application fee of $50,000.

(e) An application for renewal of a license issued under Subchapter H of this chapter must be accompanied by an application fee of $300,000.

(f) The compact waste disposal facility license holder shall remit to the commission 5% of the gross receipts from compact waste received at the compact waste disposal facility and any federal facility waste received at the federal facility waste disposal facility. Payment shall be made within 30 days of the end of each quarter. The end of each quarter is the last day of the months of November, February, May, and August.

(g) The compact waste disposal facility license holder shall remit directly to the host county 5% of the gross receipts from compact waste received at the compact waste disposal facility and any federal facility waste received at the federal facility waste disposal facility as required in Texas Health and Safety Code, §401.244. Payment shall be made within 30 days of the end of each quarter. The end of each quarter is the last day of the months of November, February, May, and August.

§336.105. Schedule of Fees for Other Licenses.

(a) Each application for a license under Subchapter F of this chapter (relating to Licensing of Alternative Methods of Disposal of Radioactive Material), Subchapter G of this chapter (relating to Decommissioning Standards), Subchapter K of this chapter (relating to Commercial Disposal of Naturally Occurring Radioactive Material Waste from Public Water Systems), Subchapter L of this chapter (relating to Licensing of Source Material Recovery and By-product Material Disposal Facilities), or Subchapter M of this chapter (relating to Licensing of Radioactive Substances Processing and Storage Facilities) must be accompanied by an application fee as follows:

(1) facilities regulated under Subchapter F of this chapter: $50,000;

(2) facilities regulated under Subchapter G of this chapter: $10,000;

(3) facilities regulated under Subchapter K of this chapter: $50,000;

(4) facilities regulated under Subchapter L of this chapter: $463,096 for conventional mining; $322,633 for in situ mining; $325,910 for heap leach; and $374,729 for disposal only; or

(A) if the application fee is not sufficient to cover costs incurred by the commission, then the applicant shall submit a supplemental fee to recover the actual costs incurred by the commission for review of the application and any hearings associated with an application for commercial by-product material disposal under Subchapter L of this chapter in accordance with Texas Health and Safety Code, §401.301(g);

(B) the executive director shall invoice for the amount of the costs incurred quarterly. Payment shall be made within 30 days following the date of the invoice;

(5) facilities regulated under Subchapter M of this chapter: $3,830 for Waste Processing - Class I Exempt; $39,959 for Waste Processing - Class I; $94,661 for Waste Processing - Class II; and $273,800 for Waste Processing - Class III.

(b) An annual license fee shall be paid for each license issued under Subchapter F, Subchapter G, Subchapter K, Subchapter L, and Subchapter M of this chapter. The amount of each annual fee is as follows:

(1) facilities regulated under Subchapter F of this chapter: $25,000;

(2) facilities regulated under Subchapter G of this chapter: $8,400;

(3) facilities regulated under Subchapter K of this chapter: $25,000;

(4) facilities regulated under Subchapter L of this chapter that are operational: $60,929.50; or

(A) if the annual fee is not sufficient to cover costs incurred by the commission, a holder of a license for commercial by-product material disposal issued under Subchapter L of this chapter shall submit a supplemental license fee sufficient to recover the actual costs incurred by the commission. This fee shall recover for the state the actual expenses arising from the regulatory activities associated with the license in accordance with Texas Health and Safety Code, §401.412(d);

(B) the executive director shall invoice for the amount of the costs incurred quarterly. Payment shall be made within 30 days following the date of the invoice;

(5) facilities regulated under Subchapter L of this chapter that are in closure: $60,929.50;

(6) facilities regulated under Subchapter L of this chapter that are in post-closure: $52,011.50 for conventional mining; $26,006 for in situ mining; and $52,011.50 for disposal only;

(7) facilities regulated under Subchapter L of this chapter, if additional noncontiguous source material recovery facility sites are authorized under the same license, the annual fee shall be increased by 25% for each additional site and 50% for sites in closure;

(8) facilities regulated under Subchapter L of this chapter, if an authorization for disposal of by-product material is added to a license, the annual fee shall be increased by 25%;

(9) facilities regulated under Subchapter L of this chapter, the following one-time fees apply if added after an environmental assessment has been completed on a facility:

(A) $28,658 for in situ wellfield on noncontiguous property;

(B) $71,651 for in situ satellite;

(C) $11,235 for wellfield on contiguous property;

(D) $50,756 for non-vacuum dryer; or

(E) $71, 651 for disposal (including processing, if applicable) of by-product material; or

(10) facilities regulated under Subchapter M of this chapter: $3,830 for Waste Processing - Class I Exempt; $39,959 for Waste Processing - Class I; $94,661 for Waste Processing - Class II; and $273,800 for Waste Processing - Class III.

(c) An application for a major amendment of a license issued under Subchapter F, Subchapter G, Subchapter K, Subchapter L, or Subchapter M of this chapter must be accompanied by an application fee of $10,000.

(d) An application for renewal of a license issued under Subchapter F, Subchapter G, Subchapter K, Subchapter L, or Subchapter M of this chapter must be accompanied by an application fee of $35,000.

(e) Upon permanent cessation of all disposal activities and approval of the final decommissioning plan, holders of licenses issued under Subchapter F, Subchapter K, Subchapter L, or Subchapter M of this chapter shall use the applicable fee schedule for subsections (b) and (c) of this section.

(f) For any application for a license issued under this chapter, the commission may assess and collect additional fees from the applicant to recover costs. Recoverable costs include costs incurred by the commission for administrative review, technical review, and hearings associated with the application. The executive director shall send an invoice for the amount of the costs incurred during the period September 1 through August 31 of each year. Payment shall be made within 30 days following the date of the invoice.

(g) If a licensee remitted a biennial licensing fee to the Texas Department of State Health Services during the one year period prior to June 17, 2007, the licensee is not subject to an annual fee under subsection (b) of this section until the expiration of the second year for which the biennial fee was paid.

(h) The commission may charge an additional 5% of annual fee assessed under subsection (b) of this section and §336.103 of this title (relating to Schedule of Fees for Subchapter H Licenses). The fee is non-refundable and will be deposited to the perpetual care account.

(1) The fees collected by the agency in accordance with this subsection shall be deposited to the credit of the Radiation and Perpetual Care Account, until the fees collectively total $500,000.

(2) If the balance of fees collected in accordance with this subsection is subsequently reduced to $350,000 or less, the agency shall reinstitute assessment of the fee until the balance reaches $500,000.

(i) The holder of a license authorizing disposal of a radioactive substance from other persons shall remit to the commission 5% of the holder's gross receipts received from disposal operations under a license. Payment shall be made within 30 days of the end of each quarter. The end of each quarter is the last day of the months of November, February, May, and August. This subsection does not apply to the disposal of compact waste or federal facility waste.

(j) The holder of a license authorizing disposal of a radioactive substance from other persons shall remit directly to the host county 5% of the gross receipts disposal operations under a license as required in Texas Health and Safety Code, §401.271(2). Payment shall be made within 30 days of the end of each quarter. The end of each quarter is the last day of the months of November, February, May, and August. This subsection does not apply to the disposal of compact waste or federal facility waste.

This agency hereby certifies that the proposal has been reviewed by legal counsel and found to be within the agency's legal authority to adopt.

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SUBCHAPTER C. GENERAL LICENSING REQUIREMENTS

30 TAC §336.210

Statutory Authority

The amendment is proposed under the Texas Radiation Control Act, Texas Health and Safety Code (THSC), Chapter 401; THSC, §401.011, which provides the commission authority to regulate and license the disposal of radioactive substances, the commercial processing and storage of radioactive substances, and the recovery and processing of source material; §401.051, which authorizes the commission to adopt rules and guidelines relating to control of sources of radiation; §401.103, which authorizes the commission to adopt rules and guidelines that provide for licensing and registration for the control of sources of radiation; §401.104, which requires the commission to provide rules for licensing for the disposal of radioactive substances; §401.201, which provides authority to the commission to regulate the disposal of low-level radioactive waste; §401.301, which authorizes the commission to set fees by rule; and §401.412, which provides authority to the commission to regulate licenses for the disposal of radioactive substances. The proposed amendment is also authorized by Texas Water Code, §5.103, which provides the commission with the authority to adopt rules necessary to carry out its powers and duties under the water code and other laws of the state.

The proposed amendment implements THSC, Chapter 401, including §§401.011, 401.051, 401.057, 401.059, 401.103, 401.104, 401.151, 401.201, 401.301, and 401.412.

§336.210. Emergency Plan for Responding to a Release.

(a) A new or renewal application for each specific license to possess radioactive materials in unsealed form, on foils or plated sources, or sealed in glass in excess of the quantities in subsection (e) of this section shall contain either:

(1) an evaluation showing that the maximum dose to a person off-site due to a release of radioactive material would not exceed 1 rem effective dose equivalent or 5 rems to the thyroid; or

(2) an emergency plan for responding to a release of radioactive material.

(b) One or more of the following factors may be used to support an evaluation submitted in accordance with subsection (a)(1) of this section:

(1) the radioactive material is physically separated so that only a portion could be involved in an accident;

(2) all or part of the radioactive material is not subject to release during an accident because of the way it is stored or packaged;

(3) the release fraction in the respirable size range would be lower than the release fraction in subsection (e) of this section due to the chemical or physical form of the material;

(4) the solubility of the radioactive material would reduce the dose received;

(5) facility design or engineered safety features in the facility would cause the release fraction to be lower than that in subsection (e) of this section;

(6) operating restrictions or procedures would prevent a release fraction as large as that in subsection (e) of this section; or

(7) other factors appropriate for the specific facility.

(c) An emergency plan for responding to a release of radioactive material submitted in accordance with subsection (a)(1) of this section shall include the following information.

(1) Facility description. A brief description of the licensee's facility and area near the site.

(2) Types of accidents. An identification of each type of radioactive materials accident for which protective actions may be needed.

(3) Classification of accidents. A classification system for classifying accidents as alerts or site area emergencies.

(4) Detection of accidents. Identification of the means of detecting each type of accident in a timely manner.

(5) Mitigation of consequences. A brief description of the means and equipment for mitigating the consequences of each type of accident, including those provided to protect workers onsite, and a description of the program for maintaining the equipment.

(6) Assessment of releases. A brief description of the methods and equipment to assess releases of radioactive materials.

(7) Responsibilities. A brief description of the responsibilities of licensee personnel should an accident occur, including identification of personnel responsible for promptly notifying off-site response organizations and the agency; also, responsibilities for developing, maintaining, and updating the plan.

(8) Notification and coordination. A commitment to and a brief description of the means to promptly notify off-site response organizations and request off-site assistance, including medical assistance for the treatment of contaminated injured onsite workers when appropriate. A control point shall be established. The notification and coordination shall be planned so that unavailability of some personnel, parts of the facility, and some equipment will not prevent the notification and coordination. The licensee shall also commit to notify the agency immediately after notification of the appropriate off-site response organizations and not later than one hour after the licensee declares an emergency. These reporting requirements do not supersede or release licensees from complying with the requirements in accordance with the Emergency Planning and Community Right-to-Know-Act of 1986, Title III, Publication L. 99-499 or other state or federal reporting requirements.

(9) Information to be communicated. A brief description of the types of information on facility status, radioactive releases, and recommended protective actions, if necessary, to be given to off-site response organizations and to the agency.

(10) Training. A brief description of the frequency, performance objectives, and plans for the training that the licensee will provide workers on how to respond to an emergency, including any special instructions and orientation tours the licensee would offer to fire, police, medical, and other emergency personnel. The training shall familiarize personnel with site-specific emergency procedures. Also, the training shall thoroughly prepare site personnel for their responsibilities in the event of accident scenarios postulated as most probable for the specific site, including the use of team training for such scenarios.

(11) Safe shutdown. A brief description of the means of restoring the facility to a safe condition after an accident.

(12) Exercises. Provisions for conducting quarterly communications checks with off-site response organizations at intervals not to exceed three months and biennial onsite exercises to test response to simulated emergencies. Communications checks with off-site response organizations shall include the check and update of all necessary telephone numbers. The licensee shall invite off-site response organizations to participate in the biennial exercises. Participation of off-site response organizations in biennial exercises, although recommended, is not required. Exercises shall use accident scenarios postulated as most probable for the specific site and the scenarios shall not be known to most exercise participants. The licensee shall critique each exercise using individuals not having direct implementation responsibility for the plan. Critiques of exercises shall evaluate the appropriateness of the plan, emergency procedures, facilities, equipment, training of personnel, and overall effectiveness of the response. Deficiencies found by the critiques shall be corrected.

(13) Hazardous chemicals. A certification that the applicant has met its responsibilities in accordance with the Emergency Planning and Community Right-to-Know Act of 1986, Title III, Publication L. 99-499, if applicable to the applicant's activities at the proposed place of use of the radioactive material.

(d) The licensee shall allow the off-site response organizations expected to respond in case of an accident 60 days to comment on the licensee's emergency plan before submitting it to the agency. The licensee shall provide any comments received within the 60 days to the agency with the emergency plan.

(e) The following indicates release fractions for radioactive material.
Figure: 30 TAC §336.210(e)
[~~Figure: 30 TAC §336.210(e)~~]

This agency hereby certifies that the proposal has been reviewed by legal counsel and found to be within the agency's legal authority to adopt.

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SUBCHAPTER D. STANDARDS FOR PROTECTION AGAINST RADIATION

30 TAC §§336.305, 336.309, 336.331, 336.351, 336.357, 336.359

Statutory Authority

The amendments and new sections are proposed under the Texas Radiation Control Act, Texas Health and Safety Code (THSC), Chapter 401; THSC, §401.011, which provides the commission authority to regulate and license the disposal of radioactive substances, the commercial processing and storage of radioactive substances, and the recovery and processing of source material; §401.051, which authorizes the commission to adopt rules and guidelines relating to control of sources of radiation; §401.103, which authorizes the commission to adopt rules and guidelines that provide for licensing and registration for the control of sources of radiation; §401.104, which requires the commission to provide rules for licensing for the disposal of radioactive substances; §401.201, which provides authority to the commission to regulate the disposal of low-level radioactive waste; §401.301, which authorizes the commission to set fees by rule; and §401.412, which provides authority to the commission to regulate licenses for the disposal of radioactive substances. The proposed amendments and new sections are also authorized by Texas Water Code, §5.103, which provides the commission with the authority to adopt rules necessary to carry out its powers and duties under the water code and other laws of the state.

The proposed amendments and new sections implement THSC, Chapter 401, including §§401.011, 401.051, 401.057, 401.059, 401.103, 401.104, 401.151, 401.201, 401.301, and 401.412.

§336.305. Occupational Dose Limits for Adults.

(a) The licensee shall control the occupational dose to individual adults, except for planned special exposures under §336.310 of this title (relating to Planned Special Exposures), to the following dose limits:

(1) an annual limit, which is the more limiting of:

(A) the total effective dose equivalent being equal to 5 rems (0.05 sievert); or

(B) the sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 50 rems (0.5 sievert).

(2) the annual limits to the lens of the eye, to the skin of the whole body, and to the skin of the extremities, which are:

(A) a lens dose equivalent of 15 rems (0.15 sievert), and

(B) a shallow-dose equivalent of 50 rems (0.5 sievert) to the skin of the whole body or to the skin of any extremity.

(b) Doses received in excess of the annual limits, including doses received during accidents, emergencies, and planned special exposures, shall be subtracted from the limits for planned special exposures that the individual may receive during the current year and during the individual's lifetime. See §336.310(5)(A) and (B) of this title [~~(relating to Planned Special Exposures)~~].

(c) When the external exposure is determined by measurement with an external personal monitoring device, the deep-dose equivalent must be used in place of the effective dose equivalent, unless the effective dose equivalent is determined by a dosimetry method approved by the executive director. The assigned deep-dose equivalent must be for the part of the body receiving the highest exposure. The assigned [~~and~~] shallow-dose equivalent must be the dose averaged over the contiguous ten square centimeters of skin [~~for the part of the body~~] receiving the highest exposure. The deep-dose equivalent, lens dose equivalent, and shallow-dose equivalent may be assessed from surveys or other radiation measurements for the purpose of demonstrating compliance with the occupational dose limits, if the individual monitoring device was not in the region of highest potential exposure or the results of individual monitoring are unavailable.

(d) Derived air concentration (DAC) and annual limit on intake (ALI) values are specified in Table I of §336.359, Appendix B, of this title (relating to Appendix B. Annual Limits on Intake (ALI) and Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sanitary Sewerage) and may be used to determine the individual's dose and to demonstrate compliance with the occupational dose limits. See §336.346 of this title (relating to Records of Individual Monitoring Results).

(e) In addition to the annual dose limits, the licensee shall limit the soluble uranium intake by an individual to 10 milligrams in a week in consideration of chemical toxicity. See note 3 of §336.359, Appendix B, of this title [~~(relating to Annual Limits on Intake (ALI) and Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sanitary Sewerage)~~].

(f) The licensee shall reduce the dose that an individual may be allowed to receive in the current year by the amount of occupational dose received while employed by any other person. See §336.309(e) of this title (relating to Determination of Prior Occupational Dose).

§336.309. Determination of Prior Occupational Dose.

(a) For each individual who is likely to receive in a year an occupational dose requiring monitoring under §336.316 of this title (relating to Conditions Requiring Individual Monitoring of External and Internal Occupational Dose), the licensee shall[~~:~~]

[~~(1)~~] determine the occupational radiation dose received during the current year. [~~; and~~]

[~~(2) attempt to obtain the records of lifetime cumulative occupational radiation dose.~~]

(b) Before permitting an individual to participate in a planned special exposure, the licensee shall determine:

(1) the internal and external doses from all previous planned special exposures; and

(2) all doses in excess of the limits, including doses received during accidents and emergencies, received during the lifetime of the individual.

(c) In complying with the requirements of subsection (a) or (b) of this section, a licensee may:

(1) accept, as a record of the occupational dose that the individual received during the current year, a written signed statement from the individual, or from the individual's most recent employer for work involving radiation exposure, that discloses the nature and the amount of any occupational dose that the individual received during the current year; and

(2) accept, as the record of lifetime cumulative radiation dose, an up-to-date form "Cumulative Occupational Exposure History" (see §336.367, Appendix J of this title (relating to Appendix J. Cumulative Occupational Exposure History)) or equivalent, signed by the individual and countersigned by an appropriate official of the most recent employer for work involving radiation exposure, or the individual's current employer, if the individual is not employed by the licensee; and

(3) obtain reports of the individual's dose equivalent from the most recent employer for work involving radiation exposure, or the individual's current employer, if the individual is not employed by the licensee, by telephone, telegram, electronic media, or letter. The licensee shall request a written verification of the dose data if the authenticity of the transmitted report cannot be established.

(d) The licensee shall record individual exposure histories.

(1) The licensee shall record the exposure history of each individual, as required by subsection (a) or (b) of this section, on form "Cumulative Occupational Exposure History" (see §336.367, Appendix J of this title) or other clear and legible record which includes all of the information required on that form. The form or record shall show each period in which the individual received occupational exposure to radiation or radioactive material and shall be signed by the individual who received the exposure. For each period for which the licensee obtains reports, the licensee shall use the dose shown in the report in preparing form "Cumulative Occupational Exposure History" (see §336.367, Appendix J of this title) or equivalent. For any period for which the licensee does not obtain a report, the licensee shall place a notation on form "Cumulative Occupational Exposure History" (see §336.367, Appendix J of this title) or equivalent indicating the periods of time for which data are not available.

(2) Licensees are not required to separate historical dose, obtained and recorded before January 1, 1994, into external dose equivalent(s) and internal committed dose equivalent(s). Further, occupational exposure histories obtained and recorded on form "Cumulative Occupational Exposure History" (see §336.367, Appendix J of this title) or equivalent before January 1, 1994, would not have included effective dose equivalent but may be used in the absence of specific information on the intake of radionuclides by the individual.

(e) If the licensee is unable to obtain a complete record of an individual's current and previously accumulated occupational dose, the licensee shall assume:

(1) in establishing administrative controls under §336.305(f) of this title (relating to Occupational Dose Limits for Adults) for the current year, that the allowable dose limit for the individual is reduced by 1.25 rems (12.5 millisieverts) for each quarter for which records are unavailable and that the individual was engaged in activities that could have resulted in occupational radiation exposure; and

(2) that the individual is not available for planned special exposures.

(f) The licensee shall retain the records on form "Cumulative Occupational Exposure History" (see §336.367, Appendix J of this title) or equivalent until the executive director terminates each pertinent license requiring this record. The licensee shall retain records used in preparing form "Cumulative Occupational Exposure History" (see §336.367, Appendix J of this title) for three years after the record is made. This includes records required under the standards for protection against radiation in effect prior to January 1, 1994.

§336.331. Transfer of Radioactive Material.

(a) The licensee shall not transfer source material, byproduct material, or other licensed radioactive material except as authorized under the rules in this subchapter.

(b) Except as otherwise provided in the license and subject to the provisions of subsections (c) and (d) of this section, a licensee shall transfer source material, byproduct material, or other licensed radioactive material:

(1) to the agency (A licensee shall transfer material to the agency only after receiving prior approval from the agency. If the material to be transferred is special nuclear material, the quantity must not be sufficient to form a critical mass.);

(2) to the United States Department of Energy;

(3) to any person exempt from licensing requirements by the Texas Department of State Health Services (DSHS) [~~(TDH)~~] under the Texas Health and Safety Code, §401.106(a), the rules in this chapter, or exempt from the licensing requirements of the United States Nuclear Regulatory Commission (NRC) or an Agreement State, to the extent permitted by those exemptions;

(4) to any person authorized to receive this material under terms of a specific or a general license or its equivalent issued by the commission, DSHS [~~TDH~~], NRC, or any Agreement State, or to any person authorized to receive this material by the federal government; or

(5) as otherwise authorized by the commission in writing by DSHS [~~TDH~~], any Agreement State, or the federal government.

(c) Before transferring source material, byproduct material, or other radioactive material to a specific licensee of the commission, DSHS [~~TDH~~], NRC, or an Agreement State or to a general licensee who is required to register with DSHS [~~TDH~~], NRC, or an Agreement State prior to receipt of the source material, byproduct material, or other radioactive material, the licensee transferring the material shall verify that the transferee's license authorizes the receipt of the type, form, and quantity of radioactive material to be transferred.

(d) The following methods for the verification required by subsection (c) of this section are acceptable.

(1) The transferor shall possess and have read a current copy of the transferee's specific license or certificate of registration.

(2) The transferor may possess a written certification by the transferee that the transferee is authorized by the license or certificate of registration to receive the type, form, and quantity of radioactive material to be transferred, specifying the license or certificate of registration number, issuing agency, and expiration date.

(3) For emergency shipments, the transferor may accept oral certification by the transferee that the transferee is authorized by license or certificate of registration to receive the type, form, and quantity of radioactive material to be transferred, specifying the license or certificate of registration number, issuing agency, and expiration date, provided that the oral certification is confirmed in writing within ten days.

(4) The transferor may obtain other sources of information compiled by a reporting service from official records of the commission, DSHS [~~TDH~~], NRC, or an Agreement State as to the identity of licensees and registrants and the scope and expiration dates of licenses and registrations.

(5) When none of the methods of verification described in paragraphs (1) - (4) of this subsection are readily available or when a transferor desires to verify that information received by one of these methods is correct or up-to-date, the transferor may obtain and record confirmation from the commission, DSHS [~~TDH~~], NRC, or an Agreement State that the transferee is licensed to receive the source material, byproduct material, or other radioactive material.

(e) Transportation of radioactive material shall also be subject to applicable rules of the United States Department of Transportation, United States Postal Service, NRC, or DSHS [~~TDH~~].

(f) The licensee shall keep records showing the transfer of any source material, byproduct material, or other radioactive material.

(g) Transfer of low-level radioactive waste by a waste generator, waste collector, or waste processor who ships this waste either directly, or indirectly through a collector or processor, to a licensed land disposal facility shall also be subject to applicable rules of DSHS [~~TDH~~]. A commission licensee who transfers low-level radioactive waste for disposal at a licensed land disposal facility shall also be subject to applicable rules of DSHS [~~TDH~~] with respect to transfers.

(h) A licensed land disposal facility operator shall use and comply with the requirements of §336.363 of this title (relating to Appendix F. Requirements for Receipt of Low-Level Radioactive Waste for Disposal at Licensed Land Disposal Facilities and Uniform Manifests).

(i) Any licensee shipping byproduct material, as defined in §336.2(16)(C) - (E) of this title (relating to Definitions) concerning the definition of byproduct material, intended for ultimate disposal must document the information required on the shipping manifest and transfer this recorded manifest information to the intended consignee.

§336.351. Reports of Transactions Involving Nationally Tracked Sources.

(a) Each licensee who manufactures, transfers, receives, disassembles, or disposes of a nationally tracked source shall complete and submit to the United States Nuclear Regulatory Commission (NRC) a National Source Tracking Transaction Report as specified in paragraphs (1) - (6) of this subsection for each type of transaction.

(1) Each licensee who manufactures a nationally tracked source shall complete and submit to NRC a National Source Tracking Transaction Report. The report must include the following information:

(A) the name, address, and license number of the reporting licensee;

(B) the name of the individual preparing the report;

(C) the manufacturer, model, and serial number of the source;

(D) the radioactive material in the source;

(E) the initial source strength in becquerels (curies) at the time of manufacture; and

(F) the manufacture date of the source.

(2) Each licensee that transfers a nationally tracked source to another person shall complete and submit to NRC a National Source Tracking Transaction Report. Domestic transactions in which the na-

tionally tracked source remains in the possession of the licensee do not require a report to the National Source Tracking System. The report shall include the following information:

(A) the name, address, and license number of the reporting licensee;

(B) the name of the individual preparing the report;

(C) the name and license number of the recipient facility and the shipping address;

(D) the manufacturer, model, and serial number of the source or, if not available, other information to uniquely identify the source;

(E) the radioactive material in the source;

(F) the initial or current source strength in becquerels (curies);

(G) the date for which the source strength is reported;

(H) the shipping date;

(I) the estimated arrival date; and

(J) for nationally tracked sources transferred as waste under a Uniform Low-Level Radioactive Waste Manifest, the waste manifest number and the container identification of the container with the nationally tracked source.

(3) Each licensee that receives a nationally tracked source shall complete and submit to NRC a National Source Tracking Transaction Report. The report shall include the following information:

(A) the name, address, and license number of the reporting licensee;

(B) the name of the individual preparing the report;

(C) the name, address, and license number of the person that provided the source;

(D) the manufacturer, model, and serial number of the source or, if not available, other information to uniquely identify the source;

(E) the radioactive material in the source;

(F) the initial or current source strength in becquerels (curies);

(G) the date for which the source strength is reported;

(H) the date of receipt; and

(I) for material received under a Uniform Low-Level Radioactive Waste Manifest, the waste manifest number and the container identification with the nationally tracked source.

(4) Each licensee that disassembles a nationally tracked source shall complete and submit to NRC a National Source Tracking Transaction Report. The report shall include the following information:

(A) the name, address, and license number of the reporting licensee;

(B) the name of the individual preparing the report;

(C) the manufacturer, model, and serial number of the source or, if not available, other information to uniquely identify the source;

(D) the radioactive material in the source;

(E) the initial or current source strength in becquerels (curies);

(F) the date for which the source strength is reported; and

(G) the disassemble date of the source.

(5) Each licensee who disposes of a nationally tracked source shall complete and submit to NRC a National Source Tracking Transaction Report. The report shall include the following information:

(A) the name, address, and license number of the reporting licensee;

(B) the name of the individual preparing the report;

(C) the waste manifest number;

(D) the container identification with the nationally tracked source;

(E) the date of disposal; and

(F) the method of disposal.

(6) The reports discussed in paragraphs (1) - (6) of this subsection shall be submitted to NRC by the close of the next business day after the transaction. A single report may be submitted for multiple sources and transactions. The reports shall be submitted to the National Source Tracking System by using the following:

(A) the on-line National Source Tracking System;

(B) electronically using a computer-readable format;

(C) by facsimile;

(D) by mail to the address on the National Source Tracking Transaction Report Form (NRC Form 748); or

(E) by telephone with follow-up by facsimile or mail.

(7) Each licensee shall correct any error in previously filed reports or file a new report for any missed transaction within five business days of the discovery of the error or missed transaction. Such errors may be detected by a variety of methods such as administrative reviews or by physical inventories required by regulation. In addition, each licensee shall reconcile the inventory of nationally tracked sources possessed by the licensee against that licensee's data in the National Source Tracking System. The reconciliation shall be conducted during the month of January in each year. The reconciliation process shall include resolving any discrepancies between the National Source Tracking System and the actual inventory by filing the reports identified by paragraphs (1) - (6) of this subsection. By January 31 of each year, each licensee shall submit to the National Source Tracking System confirmation that the data in the National Source Tracking System is correct.

(8) Each licensee that possesses Category 1 or Category 2 nationally tracked sources listed in subsection (b) of this section shall report its initial inventory of Category 1 or Category 2 nationally tracked sources to the National Source Tracking System by January 31, 2009. The information may be submitted to NRC by using any of the methods identified by paragraph (6)(A) - (E) of this subsection. The initial inventory report shall include the following information:

(A) the name, address, and license number of the reporting licensee;

(B) the name of the individual preparing the report;

(C) the manufacturer, model, and serial number of each nationally tracked source or, if not available, other information to uniquely identify the source;

(D) the radioactive material in the sealed source;

(E) the initial or current source strength in becquerels (curies); and

(F) the date for which the source strength is reported.

(b) Nationally tracked source thresholds. The Terabecquerel (TBq) values are the regulatory standards. The curie values specified are obtained by converting from the TBq value. The curie values are provided for practical usefulness only and are rounded after conversion. The following table contains nationally tracked source thresholds.
Figure: 30 TAC §336.351(b)

§336.357. Increased Controls for Licensees that Possess Sources Containing Radioactive Material Quantities of Concern.

Licensees possessing sources containing radioactive material, at any given time, in quantities greater than or equal to the quantities of concern listed in paragraph (11) of this section shall:

(1) control access at all times to radioactive material and devices containing such radioactive material (devices) in quantities in accordance with paragraph (11) of this section; and

(2) limit access to such radioactive material and devices to only approved individuals who require access to perform their duties.

(A) The licensee shall allow only trustworthy and reliable individuals, approved in writing by the licensee, to have unescorted access to radioactive material quantities of concern and devices.

(B) The licensee shall approve for unescorted access only those individuals with job duties that require access to such radioactive material and devices. Personnel who require access to such radioactive material and devices to perform a job duty, but who are not approved by the licensee for unescorted access, must be escorted by an approved individual.

(C) For individuals employed by the licensee for three years or less, and for non-licensee personnel, such as physicians, physicists, house-keeping personnel, and security personnel under contract, trustworthiness and reliability shall be determined, at a minimum, by verifying employment history, education, and personal references. The licensee shall also, to the extent possible, obtain independent information to corroborate that provided by the employee (i.e., seeking references not supplied by the individual). For individuals employed by the licensee for longer than three years, trustworthiness and reliability shall be determined, at a minimum, by a review of the employees' employment history with the licensee.

(D) Service providers shall be escorted unless determined to be trustworthy and reliable by an NRC required background investigation as an employee of a manufacturing and distribution licensee. Written verification attesting to or certifying the person's trustworthiness and reliability shall be obtained from the manufacturing and distribution licensee providing the service.

(E) The licensee shall document the basis for concluding that there is reasonable assurance that an individual granted unescorted access is trustworthy and reliable, and does not constitute an unreasonable risk for unauthorized use of radioactive material quantities of concern. The licensee shall maintain a list of persons approved for unescorted access to such radioactive material and devices by the licensee.

(3) Each licensee shall have a documented program to monitor and immediately detect, assess, and respond to unauthorized access to radioactive material quantities of concern and devices in use or in storage. Enhanced monitoring shall be provided during periods of source delivery or shipment, where the delivery or shipment exceeds 100 times the values listed in paragraph (11) of this section.

(A) The licensee shall respond immediately to any actual or attempted theft, sabotage, or diversion of such radioactive material or of the devices. The response shall include requesting assistance from a Local Law Enforcement Agency (LLEA).

(B) The licensee shall have a pre-arranged plan with LLEA for assistance in response to an actual or attempted theft, sabotage, or diversion of such radioactive material or of the devices which is consistent in scope and timing with a realistic potential vulnerability of the sources containing such radioactive material. The pre-arranged plan shall be updated when changes to the facility design or operation affect the potential vulnerability of the sources.

(C) The licensee shall have a dependable means to transmit information between, and among, the various components used to detect and identify an unauthorized intrusion, to inform the assessor, and to summon the appropriate responder.

(D) After initiating appropriate response to any actual or attempted theft, sabotage, or diversion of radioactive material or of the devices, the licensee shall, as promptly as possible, notify the United States Nuclear Regulatory Commission (NRC) Operations Center at (301) 816-5100.

(E) The licensee shall maintain documentation describing each instance of unauthorized access and any necessary corrective actions to prevent future instances of unauthorized access.

(4) In order to ensure the safe handling, use, and control of licensed material in transportation for domestic highway and rail shipments by a carrier other than the licensee, for quantities that equal or exceed but are less than 100 times those listed in paragraph (11) of this section, per consignment, the licensee shall:

(A) use carriers which:

(i) use package tracking systems;

(ii) implement methods to assure trustworthiness and reliability of drivers;

(iii) maintain constant control and/or surveillance during transit; and

(iv) have the capability for immediate communication to summon appropriate response or assistance;

(B) verify and document that the carrier employs the measures in subparagraph (A) of this paragraph;

(C) contact the recipient to coordinate the expected arrival time of the shipment;

(D) confirm receipt of the shipment; and

(E) initiate an investigation to determine the location of the licensed material if the shipment does not arrive on or about the expected arrival time. When, through the course of the investigation, it is determined the shipment has become lost, stolen, or is missing, the licensee shall immediately notify the NRC Operations Center at (301) 816-5100. If, after 24 hours of investigating, the location of the material still cannot be determined, the radioactive material shall be deemed missing and the licensee shall immediately notify the NRC Operations Center at (301) 816-5100.

(5) For domestic highway and rail shipments, prior to shipping licensed radioactive material that exceeds 100 times the quantities in paragraph (11) of this section per consignment, the licensee shall:

(A) Notify the NRC Director, Office of Nuclear Material Safety and Safeguards United States Nuclear Regulatory Commission, Washington, DC 20555, in writing, at least 90 days prior to the anticipated date of shipment. The NRC will issue the Order to implement the Additional Security Measures (ASMs) for the transportation of Radioactive Material Quantities of Concern (RAM QC). The licensee shall not ship this material until the ASMs for the transportation of RAM QC are implemented or the licensee is notified otherwise, in writing, by the NRC.

(B) Once the licensee has implemented the ASMs for the transportation of RAM QC, the notification requirements in subparagraph (A) of this paragraph shall not apply to future shipments of licensed radioactive material that exceeds 100 times the quantities listed in paragraph (11) of this section. The licensee shall implement the ASMs for the transportation of RAM QC.

(6) If a licensee employs an Manufacturer/Distributor (M&D) licensee to take possession at the licensee's location of the licensed radioactive material and ship it under its M&D license, the requirements of paragraph (5)(A) and (B) of this section shall not apply.

(7) If the licensee is to receive radioactive material greater than or equal to the quantities in paragraph (11) of this section, per consignment, the licensee shall coordinate with the originator to:

(A) establish an expected time of delivery; and

(B) confirm receipt of transferred radioactive material. If the material is not received at the expected time of delivery, notify the originator and assist in any investigation.

(8) Each licensee who possesses mobile or portable devices containing radioactive material in quantities greater than or equal to the values listed in paragraph (11) of this section, shall:

(A) For portable devices, have two independent physical controls that form tangible barriers to secure the material from unauthorized removal when the device is not under direct control and constant surveillance by the licensee.

(B) For mobile devices:

(i) that are only moved outside of the facility (e.g., on a trailer), have two independent physical controls that form tangible barriers to secure the material from unauthorized removal when the device is not under direct control and constant surveillance by the licensee.

(ii) that are only moved inside a facility, have a physical control that forms a tangible barrier to secure the material from unauthorized movement or removal when the device is not under direct control and constant surveillance by the licensee.

(C) For devices in or on a vehicle or trailer, licensees shall also utilize a method to disable the vehicle or trailer when not under direct control and constant surveillance by the licensee.

(9) The licensee shall retain documentation required by these increased controls for inspection by the agency for three years after they are no longer effective.

(A) The licensee shall retain documentation regarding the trustworthiness and reliability of individual employees for three years after the individual's employment ends.

(B) Each time the licensee revises the list of approved persons required by paragraph (2)(E) of this section, or the documented program required by paragraph (3) of this section, the licensee shall retain the previous documentation for three years after the revision.

(C) The licensee shall retain documentation on each radioactive material carrier for three years after the licensee discontinues use of that particular carrier.

(D) The licensee shall retain documentation on shipment coordination, notifications, and investigations for three years after the shipment or investigation is completed.

(E) After the license is terminated or amended to reduce possession limits below the quantities of concern, the licensee shall retain all documentation required by these increased controls for three years.

(10) Detailed information generated by the licensee that describes the physical protection of radioactive material quantities of concern, is sensitive information and shall be protected from unauthorized disclosure.

(A) The licensee shall control access to its physical protection information to those persons who have an established need to know the information, and are considered to be trustworthy and reliable.

(B) The licensee shall develop, maintain, and implement policies and procedures for controlling access to, and for proper handling and protection against unauthorized disclosure of, its physical protection information for radioactive material covered by these requirements. The policies and procedures shall include the following:

(i) general performance requirement that each person who produces, receives, or acquires the licensee's sensitive information, protect the information from unauthorized disclosure;

(ii) protection of sensitive information during use, storage, and transit;

(iii) preparation, identification or marking, and transmission;

(iv) access controls;

(v) destruction of documents;

(vi) use of automatic data processing systems; and

(vii) removal from the licensee's sensitive information category.

(11) Radionuclide quantities of concern. The following methods shall be used to determine which sources of radioactive material require increased controls:

(A) include any single source equal to or greater than the quantity of concern;

(B) include multiple collocated sources of the same radionuclide when the combined quantity equals or exceeds the quantity of concern;

(C) for combinations of radionuclides, include multiple collocated sources of different radionuclides when the aggregate quantities satisfy the following unity rule: ((amount of radionuclide A) / (quantity of concern of radionuclide A)) + ((amount of radionuclide B) / (quantity of concern of radionuclide B)) + etc...> 1; and

(D) The following table contains quantities of radioactive materials to be used in determining a quantity of concern.
Figure: 30 TAC §336.357(11)(D)

§336.359. Appendix B. Annual Limits on Intake (ALI) and Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sanitary Sewerage.

(a) Introduction. For each radionuclide, Table I indicates the chemical form that is to be used for selecting the appropriate ALI or DAC value. The ALIs and DACs for inhalation are given for an aerosol with an activity median aerodynamic diameter (AMAD) of 1 micrometer and for three classes (D,W,Y) of radioactive material, which refer to their retention (approximately days, weeks, or years) in the pulmonary region of the lung. This classification applies to a range of clearance half-times for D of less than 10 days, for W from 10 to 100 days, and for Y greater than 100 days.

(1) The class (D, W, or Y) given in the column headed "Class" applies only to the inhalation ALIs and DACs given in Table I, Columns 2 and 3. Table II provides concentration limits for airborne and liquid effluents released to the general environment. Table III provides concentration limits for discharges to sanitary sewerage.

(2) The values in Tables I, II, and III are presented in the computer "E" notation. In this notation, a value of 6E-02 represents a value of 6×10^{-2} or 0.06, 6E+2 represents 6×10^{2} or 600, and 6E+0 represents 6×10^{0} or 6. Values are given in units of microcuries (μCi) or microcuries per milliliter (μCi/ml), as indicated.

(b) Table I, "Occupational Values". Note that the columns in Table I of this appendix captioned "Oral Ingestion ALI," "Inhalation ALI," and "DAC," are applicable to occupational exposure to radioactive material.

(1) The ALIs in this appendix are the annual intakes of a given radionuclide by "reference man" that would result in either a committed effective dose equivalent of 5 rems (0.05 sievert) (stochastic ALI) or a committed dose equivalent of 50 rems (0.5 sievert) to an organ or tissue (non-stochastic ALI). The stochastic ALIs were derived to result in a risk, due to irradiation of organs and tissues, comparable to the risk associated with deep dose equivalent to the whole body of 5 rems (0.05 sievert). The derivation includes multiplying the committed dose equivalent to an organ or tissue by a weighting factor, w_T. This weighting factor is the proportion of the risk of stochastic effects resulting from irradiation of the organ or tissue, T, to the total risk of stochastic effects when the whole body is irradiated uniformly. The values of w_T are listed under the definition of "weighting factor" in §336.2 of this title (relating to Definitions). The non-stochastic ALIs were derived to avoid non-stochastic effects, such as prompt damage to tissue or reduction in organ function.

(2) A value of $w_T = 0.06$ is applicable to each of the five organs or tissues in the "remainder" category receiving the highest dose equivalents, and the dose equivalents of all other remaining tissues may be disregarded. The following parts of the GI tract--stomach, small intestine, upper large intestine, and lower large intestine--are to be treated as four separate organs.

(3) Note that the dose equivalents for an extremity, skin, and lens of the eye are not considered in computing the committed effective dose equivalent but are subject to limits that must be met separately. When an ALI is defined by the stochastic dose limit, this value alone is given.

(4) When an ALI is determined by the non-stochastic dose limit to an organ, the organ or tissue to which the limit applies is shown, and the ALI for the stochastic limit is shown in parentheses. The following abbreviated organ or tissue designations are used:

(A) LLI wall = lower large intestine wall;

(B) St wall = stomach wall;

(C) Blad wall = bladder wall; and

(D) Bone surf = bone surface.

(5) The use of the ALIs listed first, the more limiting of the stochastic and non-stochastic ALIs, will ensure that non-stochastic effects are avoided and that the risk of stochastic effects is limited to an acceptably low value. If, in a particular situation involving a radionuclide for which the non-stochastic ALI is limiting, use of that non-stochastic ALI is considered unduly conservative, the licensee may use the stochastic ALI to determine the committed effective dose equivalent. However, the licensee shall also ensure that the 50-rem (0.5 sievert) dose equivalent limit for any organ or tissue is not exceeded by the sum of the external deep dose equivalent plus the internal committed dose equivalent to that organ (not the effective dose). For the case where there is no external dose contribution, this would be demonstrated if the sum of the fractions of the nonstochastic ALIs (ALI_{ns}) that contribute to the committed dose equivalent to the organ receiving the highest dose does not exceed 1 (i.e., Sigma (intake in μCi of each radionuclide/ALI_{ns}) ≤ 1.0). If there is an external deep-dose equivalent contribution of H_d, then this sum must be less than 1 - (H_d/50), instead of ≤ 1.0.

(6) The DAC values are derived limits intended to control chronic occupational exposures. The relationship between the DAC and the ALI is given by:

Figure: 30 TAC §336.359(b)(6) (No change.)

(7) The DAC values relate to one of two modes of exposure: either external submersion or the internal committed dose equivalents resulting from inhalation of radioactive materials. The DAC values based upon submersion are for immersion in a semi-infinite cloud of uniform concentration and apply to each radionuclide separately.

(8) The ALI and DAC values include contributions to exposure by the single radionuclide named and any in-growth of daughter radionuclides produced in the body by decay of the parent. However, intakes that include both the parent and daughter radionuclides shall be treated by the general method appropriate for mixtures.

(9) The values of ALI and DAC do not apply directly when the individual both ingests and inhales a radionuclide, when the individual is exposed to a mixture of radionuclides by either inhalation or ingestion or both, or when the individual is exposed to both internal and external irradiation (see §336.306 of this title (relating to Compliance with Requirements for Summation of External and Internal Doses)). When an individual is exposed to radioactive materials which fall under several of the translocation classifications of the same radionuclide (i.e., Class D, Class W, or Class Y), the exposure may be evaluated as if it were a mixture of different radionuclides.

(10) It shall be noted that the classification of a compound as Class D, W, or Y is based on the chemical form of the compound and does not take into account the radiological half-life of different radionuclides. For this reason, values are given for Class D, W, and Y compounds, even for very short-lived radionuclides.

(c) Table II, "Effluent Concentrations". The columns in Table II of this appendix captioned "Effluent Concentrations," "Air," and "Water" are applicable to the assessment and control of dose to the public, particularly in the implementation of the provisions of §336.314 of this title (relating to Compliance with Dose Limits for Individual Members of the Public). The concentration values given in Columns 1 and 2 of Table II are equivalent to the radionuclide concentrations which, if inhaled or ingested continuously over the course of a year, would produce a total effective dose equivalent of 0.05 rem (0.5 millisievert).

(1) Consideration of non-stochastic limits has not been included in deriving the air and water effluent concentration limits be-

cause non-stochastic effects are presumed not to occur at or below the dose levels established for individual members of the public. For radionuclides, where the non-stochastic limit was governing in deriving the occupational DAC, the stochastic ALI was used in deriving the corresponding airborne effluent limit in Table II. For this reason, the DAC and airborne effluent limits are not always proportional.

(2) The air concentration values listed in Table II, Column 1, were derived by one of two methods. For those radionuclides for which the stochastic limit is governing, the occupational stochastic inhalation ALI was divided by 2.4 x 10^9 ml, relating the inhalation ALI to the DAC and then divided by a factor of 300. The factor of 300 is composed of a factor of 50 to relate the 5-rem (0.05 sievert) annual occupational dose limit to the 0.1 rem (1 millisievert) limit for members of the public, a factor of 3 to adjust for the difference in exposure time and the inhalation rate for a worker and that for members of the public; and a factor of 2 to adjust the occupational values (derived for adults) so that they are applicable to other age groups.

(3) For those radionuclides for which submersion (external dose) is limiting, the occupational DAC in Table I, Column 3, was divided by 219. The factor of 219 is composed of a factor of 50 and a factor of 4.38 relating occupational exposure for 2,000 hours/year to full-time exposure (8,760 hours/year). Note that an additional factor of 2 for age considerations is not warranted in the submersion case.

(4) The water concentrations were derived by taking the most restrictive occupational stochastic oral ingestion ALI and dividing by 7.3 x 10^7 ml. The factor of 7.3 x 10^7 ml is composed of the factors of 50 and 2 and a factor of 7.3 x 10^5 ml which is the annual water intake of "reference man."

(5) Note 6 of this appendix provides groupings of radionuclides that are applicable to unknown mixtures of radionuclides. These groupings, including occupational inhalation ALIs and DACs, air and water effluent concentrations, and releases to sewerage, require demonstrating that the most limiting radionuclides in successive classes are absent. The limit for the unknown mixture is defined when the presence of one of the listed radionuclides cannot be definitely excluded either from knowledge of the radionuclide composition of the source or from actual measurements.

(d) Table III, "releases to sewers." The monthly average concentrations for release to sanitary sewerage are applicable to the provisions in §336.215 of this title (relating to Disposal by Release into Sanitary Sewerage). The concentration values were derived by taking the most restrictive occupational stochastic oral ingestion ALI and dividing by 7.3 x 10^6 ml. The factor of 7.3 x 10^6 ml is composed of a factor of 7.3 x 10^5 ml, the annual water intake by "reference man," and a factor of 10, such that the concentrations, if the sewage released by the licensee were the only source of water ingested by a "reference man" during a year, would result in a committed effective dose equivalent of 0.5 rem (5 millisieverts).

Figure: 30 TAC §336.359(d)

[~~Figure: 30 TAC §336.359(d)~~]

This agency hereby certifies that the proposal has been reviewed by legal counsel and found to be within the agency's legal authority to adopt.

Filed with the Office of the Secretary of State on July 22, 2011.

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Robert Martinez
Director, Environmental Law Division
Texas Commission on Environmental Quality
Earliest possible date of adoption: September 4, 2011
For further information, please call: (512) 239-2548

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SUBCHAPTER E. NOTICES, INSTRUCTIONS, AND REPORTS TO WORKERS AND INSPECTIONS

30 TAC §336.405

Statutory Authority

The amendment is proposed under the Texas Radiation Control Act, Texas Health and Safety Code (THSC), Chapter 401; THSC, §401.011, which provides the commission authority to regulate and license the disposal of radioactive substances, the commercial processing and storage of radioactive substances, and the recovery and processing of source material; §401.051, which authorizes the commission to adopt rules and guidelines relating to control of sources of radiation; §401.103, which authorizes the commission to adopt rules and guidelines that provide for licensing and registration for the control of sources of radiation; §401.104, which requires the commission to provide rules for licensing for the disposal of radioactive substances; §401.201, which provides authority to the commission to regulate the disposal of low-level radioactive waste; §401.301, which authorizes the commission to set fees by rule; and §401.412, which provides authority to the commission to regulate licenses for the disposal of radioactive substances. The proposed amendment is also authorized by Texas Water Code, §5.103, which provides the commission with the authority to adopt rules necessary to carry out its powers and duties under the water code and other laws of the state.

The proposed amendment implements THSC, Chapter 401, including §§401.011, 401.051, 401.057, 401.059, 401.103 401.104, 401.151, 401.201, 401.301, and 401.412.

§336.405. Notifications and Reports to Individuals.

(a) Radiation exposure data for an individual and the results of any measurements, analyses, and calculations of radioactive material deposited or retained in the body of an individual shall be reported to the individual as specified in this section. The information reported shall include data and results obtained under commission rules, orders, or license conditions, as shown in records maintained by the licensee under commission rules. Each notification and report shall be in writing; shall include appropriate identifying data such as the name of the licensee, the name of the individual, and the individual's social security number; shall include the individual's exposure information; and shall contain the statement "This report is furnished to you under the provisions of 30 Texas Administrative Code, Chapter 336, Subchapter E. You shall preserve this report for further reference."

(b) Each licensee shall make dose information available to workers [~~advise each worker annually of the worker's dose~~] as shown in records maintained by the licensee under §336.346 of this title (relating to Records of Individual Monitoring Results). The licensee shall provide an annual report to each individual monitored under §336.316 of this title (relating to Conditions Requiring Individual Monitoring of External and Internal Occupational Dose) of the dose received in that monitoring year if:

(1) the individual's occupational dose exceeds 1 millisievert (mSv) (100 millirem (mrem)) total effective dose equivalent or 1 mSv (100 mrem) to any individual organ or tissue; or

(2) the individual requests his or her annual dose report in writing.

(c) A former worker may request a report of the worker's exposure to radiation and/or radioactive material from the licensee.

(1) At the request of a worker formerly engaged in licensed activities controlled by the licensee, each licensee shall furnish to the worker a report of the worker's exposure to radiation and/or to radioactive material:

(A) as shown in records maintained by the licensee under §336.346 of this title [~~(relating to Records of Individual Monitoring Results)~~] for each year the worker was required to be monitored under the provisions of §336.316 of this title [~~(relating to Conditions Requiring Individual Monitoring of External and Internal Occupational Dose)~~]; and

(B) for each year the worker was required to be monitored under the monitoring requirements in effect before January 1, 1994.

(2) This report must be furnished within 30 days from the time the request is made or within 30 days after the exposure of the individual has been determined by the licensee, whichever is later. This report must cover the period of time that the worker's activities involved exposure to radiation from radioactive materials licensed by the commission and must include the dates and locations of licensed activities in which the worker participated during this period.

(d) When a licensee is required under §336.335 of this title (relating to Reporting Requirements for Incidents), §336.352 of this title (relating to Reports of Exposures, Radiation Levels, and Concentrations of Radioactive Material Exceeding the Limits), §336.353 of this title (relating to Reports of Planned Special Exposures), or §336.355 of this title (relating to Reports of Individual Monitoring) to report to the executive director any exposure of an individual to radiation or radioactive material, the licensee shall also provide the individual a report of that individual's exposure data. This report must be transmitted at a time not later than the transmittal to the executive director.

(e) At the request of a worker who is terminating employment with the licensee that involved exposure to radiation or radioactive materials, during the current year, each licensee shall provide at termination to each worker, or to the worker's designee, a written report regarding the radiation dose received by that worker from operations of the licensee during the current year or fraction thereof. If the most recent individual monitoring results are not available at that time, a written estimate of the dose shall be provided together with a clear indication that this is an estimate.

This agency hereby certifies that the proposal has been reviewed by legal counsel and found to be within the agency's legal authority to adopt.

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TITLE 34. PUBLIC FINANCE

PART 6. TEXAS MUNICIPAL RETIREMENT SYSTEM

CHAPTER 127. MISCELLANEOUS RULES

34 TAC §127.3

The Board of Trustees ("Board") of the Texas Municipal Retirement System ("TMRS") proposes an amendment to 34 TAC §127.3, concerning the Board's authority to adopt rules to limit the annual benefit payable under Title 8, Subtitle G of the Texas Government Code (the "TMRS Act") to the extent necessary to conform with applicable limitations on benefit payments set forth in §415 of the Internal Revenue Code ("IRC") as the IRC applies from time to time to TMRS. IRC §415 establishes maximum limitations on benefits paid under a qualified plan. Texas Government Code §854.007 of the TMRS Act provides that if the amount of a benefit payment under the TMRS Act would exceed the limitations provided by IRC §415, and its amendments and regulations promulgated thereunder, then TMRS shall reduce the amount of the benefit to comply with IRC §415. Texas Government Code §855.608 further provides that benefits payable under the TMRS Act that would otherwise be limited under IRC §415 and Texas Government Code §854.007 shall be paid out of an excess benefit arrangement created for this purpose.

The proposed amendment amends §127.3 to correct a scrivener's error in subsection (a) and to add a new subsection (b) to specifically state certain rules applicable when testing benefits for IRC §415 limits, including: (i) providing that the §415 limit applicable to a member's benefit will be increased from time to time to reflect the adjusted §415 dollar limit established by the Secretary of the Treasury from time to time; (ii) specifying that increases in the §415 dollar limit will apply after a member's separation from service; (iii) clarifying that benefits will comply with the adjusted §415 limits in each year during which payments are made; (iv) providing that, for benefits commencing prior to age 62 or after age 65, the applicable §415 limit will be adjusted to the extent, if any, required by the Treasury Regulations and subject to other applicable IRC §415 rules; and (v) specifying that for §415 testing purposes: the limitation year is the calendar year, the stability period is one calendar year, and the look-back period will be the month of September each year. The amendment further provides that, in the event a member participates in another qualified defined benefit plan maintained by his/her employer, and if the benefits provided under all the plans would exceed the §415 limit, then the benefits under such other plans will be reduced first in order to avoid exceeding the §415 limit and reduced under the TMRS system only to the extent necessary to avoid exceeding the limit.

The proposed amendment of §127.3 implements the authority granted to the Board in Texas Government Code §855.607 to adopt rules that modify the plan to the extent the Board considers necessary for the retirement system to be considered a qualified plan. Pursuant to §855.607, rules adopted by the Board relating to plan qualifications issues are considered a part of the plan. On February 25, 2011, the Board approved the publication of the rule amendment proposal for comment.

David Gavia, Executive Director of TMRS, has determined that for the first five-year period the amendment is in effect there will

Figure: 30 TAC §336.2(151)

Organ Dose Weighting Factors

Organ or Tissue	W_T
Gonads	0.25
Breast	0.15
Red bone marrow	0.12
Lung	0.12
Thyroid	0.03
Bone surfaces	0.03
Remainder	0.30[1]
Whole body	1.00[2]

1. The value 0.30 results from 0.06 for each of five remainder organs, excluding the skin and the lens of the eye, that receive the highest doses.

2. For the purpose of weighting the external whole body dose (for adding it to the internal dose) a single weighting factor, w_T =1.0, has been specified. The use of other weighting factors for external exposure will be approved on a case-by-case basis until such time as specific guidance is issued.

Figure: 30 TAC §336.210(e)

Radioactive Material*	Release Fraction	Quantity (curies)	Radioactive Material*	Release Fraction	Quantity (curies)	Radioactive Material*	Release Fraction	Quantity (curies)
Ac-228 (89)	0.001	4,000	In-114m (49)	0.01	1,000	V-48 (23)	0.01	7,000
Am-241 (95)	0.001	2	Ir-192 (77)	0.001	40,000	Xe-133 (54)	1.0	900,000
Am-242 (95)	0.001	2	Fe-55 (26)	0.01	40,000	Y-91 (39)	0.01	2,000
Am-243 (95)	0.001	2	Fe-59 (26)	0.01	7,000	Zn-65 (30)	0.01	5,000
Sb-124 (51)	0.01	4,000	Kr-85 (36)	1.0	6,000,000	Zr-93 (40)	0.01	400
Sb-126 (51)	0.01	6,000	Pb-210 (82)	0.01	8	Zr-95 (40)	0.01	5,000
Ba-133 (56)	0.01	10,000	Mn-56 (25)	0.01	60,000	Any other beta-gamma emitter	0.01	10,000
Ba-140 (56)	0.01	30,000	Hg-203 (80)	0.01	10,000			
Bi-207 (83)	0.01	5,000	Mo-99 (42)	0.01	30,000	Mixed fission products	0.01	1,000
Bi-210 (83)	0.01	600	Np-237 (93)	0.001	>2			
Cd-109 (48)	0.01	1,000	Ni-63 (28)	0.01	20,000	Mixed corrosion products	0.01	10,000
Cd-113 (48)	0.01	80	Nb-94 (41)	0.01	300			
Ca-45 (20)	0.01	20,000	P-32 (15)	0.5	100			
Cf-252 (98)	0.001	9(20mg)	P-33 (15)	0.5	1,000	Contaminated equipment, beta-gamma	0.001	10,000
C-14 (6)**	0.01	50,000	Po-210 (84)	0.01	10			
Ce-141 (58)	0.01	10,000	K-42 (19)	0.01	9,000			
Ce-144 (58)	0.01	300	Pm-145 (61)	0.01	4,000	Irradiated material, any form other than solid non-combustible	0.01	1,000
Cs-134 (55)	0.01	2,000	Pm-147 (61)	0.01	4,000			
Cs-137 (55)	0.01	2,000	Ra-226 (88)	0.001	100			
Cl-36 (17)	0.5	100	Ru-106 (44)	0.01	200			
Cr-51 (24)	0.01	300,000	Sm-151 (62)	0.01	4,000			
Co-60 (27)	0.001	5,000	Sc-46 (21)	0.01	3,000			
Cu-64 (29)	0.01	200,000	Se-75 (34)	0.01	10,000	Irradiated material, solid non-combustible	0.001	10,000
Cm-242 (96)	0.001	60	Ag110m (47)	0.01	1,000			
Cm-243 (96)	0.001	3	Na-22 (11)	0.01	9,000			

Cm-244 (96)	0.001	4	Na-24 (11)	0.01	10,000			
Cm-245 (96)	0.001	2	Sr-89 (38)	0.01	3,000	Mixed radioactive waste, beta-gamma	0.01	1,000
Eu-152 (63)	0.01	500	Sr-90 (38)	0.01	90			
Eu-154 (63)	0.01	400	Sr-35 (16)	0.5	900			
Eu-155 (63)	0.01	3,000	Tc-99 (43)	0.01	10,000	Packaged mixed waste, beta-gamma***	0.001	10,000
Ge-68 (32)	0.01	2,000	Tc-99m (43)	0.01	400,000			
Gd-153 (64)	0.01	5,000	Te-127m(52)	0.01	5,000			
Au-198 (79)	0.01	30,000	Te-129m(52)	0.01	5,000	Any other alpha emitter	0.001	2
Hf-172 (72)	0.01	400	Tb-160 (65)	0.01	4,000			
Hf-181 (72)	0.01	7,000	Tm-170 (69)	0.01	4,000	Contaminated equipment, alpha	0.0001	20
Ho-166 (67)	0.01	100	Sn-113 (50)	0.01	10,000			
H-3 (1)	0.5	20,000	Sn-123 (50)	0.01	3,000	Packaged waste, alpha***	0.0001	20
I-125 (53)	0.5	10	Sn-126 (50)	0.01	1,000			
I-131 (53)	0.5	10	Ti-144 (22)	0.01	100			

* For combinations of radioactive materials, consideration of the need for an emergency plan is required if the sum of the ratios of the quantity of each radioactive material authorized to the quantity listed for that material in this paragraph exceeds one.

**Non-carbon dioxide forms only.

***Waste packaged in Type B containers does not require an emergency plan.

Figure: 30 TAC §336.351(b)

Nationally Tracked Sources Threshold

Radioactive Material	Category 1 (TBq)	Category 1 (Ci)	Category 2 (TBq)	Category 2 (Ci)
Actinium-227	20	540	0.2	5.4
Americium-241	60	1,600	0.6	16.0
Americium-241/Be	60	1,600	0.6	16.0
Californium-252	20	540	0.2	5.4
Cobalt-60	30	810	0.3	8.1
Curium-244	50	1,400	0.5	14.0
Cesium-137	100	2,700	1.0	27.0
Gadolinium-153	1,000	27,000	10.0	270.0
Iridium-192	80	2,200	0.8	22.0
Plutonium-238	60	1,600	0.6	16.0
Plutonium-239/Be	60	1,600	0.6	16.0
Polonium-210	60	1,600	0.6	16.0
Promethium-147	40,000	1,100,000	400.0	11,000.0
Radium-226	40	1,100	0.4	11.0
Selenium-75	200	5,400	2.0	54.0
Strontium-90	1,000	27,000	10.0	270.0
Thorium-228	20	540	0.2	5.4
Thorium-229	20	540	0.2	5.4
Thulium-170	20,000	540,000	200.0	5,400.0
Ytterbium-169	300	8,100	3.0	81.0

TBq - Terabecquerel
Ci - Curie

Figure: 30 TAC §336.357(11)(D)

Radionuclides of Concern

Radionuclide	Quantity of Concern[1] (TBq)	Quantity of Concern[2] (Ci)
Am-241	0.6	16
Am-241/Be	0.6	16
Cf-252	0.2	5.4
Cm-244	0.5	14
Co-60	0.3	8.1
Cs-137	1	27
Gd-153	10	270
Ir-192	0.8	22
Pm-147	400	11,000
Pu-238	0.6	16
Pu-239/Be	0.6	16
Ra-226	0.4	11
Se-75	2	54
Sr-90 (Y-90)	10	270
Tm-170	200	5,400
Yb-169	3	81
Combinations of radioactive materials listed above[3]	See footnote below[4]	

[1]The aggregate activity of multiple, collocated sources of the same radionuclide should be included when the total activity equals or exceeds the quantity of concern.

[2]The primary values used for compliance with this Order are terabecquerel (TBq). The curie (Ci) values are rounded to two significant figures for informational purposes only.

[3]Radioactive materials are to be considered aggregated or collocated if breaching a common physical security barrier (e.g., a locked door at the entrance to a storage room) would allow access to the radioactive material or devices containing the radioactive material. When transporting or storing sources on vehicles and/or trailers, the sources are automatically considered collocated.

[4]If several radionuclides are aggregated, the sum of the ratios of the activity of each source, i of radionuclide, n, A(i,n), to the quantity of concern for radionuclide n, Q(n), listed for that radionuclide equals or exceeds one. ((aggregated source activity for radionuclide A) /(quantity of concern for radionuclide A)) + ((aggregated source activity for radionuclide B) /(quantity of conoern for radionuclide B)) + etc...>1

Figure: 30 TAC §336.359(d)

Name	Symbol	Atomic Number	Name	Symbol	Atomic Number
Actinium	Ac	89	Mercury	Hg	80
Aluminum	Al	13	Molybdenum	Mo	42
Americium	Am	95	Neodymium	Nd	60
Antimony	Sb	51	Neptunium	Np	93
Argon	Ar	18	Nickel	Ni	28
Arsenic	As	33	Niobium	Nb	41
Astatine	At	85	Nitrogen	N	7
Barium	Ba	56	Osmium	Os	76
Berkelium	Bk	97	Oxygen	O	8
Beryllium	Be	4	Palladium	Pd	46
Bismuth	Bi	83	Phosphorus	P	15
Bromine	Br	35	Platinum	Pt	78
Cadmium	Cd	48	Plutonium	Pu	94
Calcium	Ca	20	Polonium	Po	84
Californium	Cf	98	Potassium	K	19
Carbon	C	6	Praseodymium	Pr	59
Cerium	Ce	58	Promethium	Pm	61
Cesium	Cs	55	Protactinium	Pa	91
Chlorine	Cl	17	Radium	Ra	88
Chromium	Cr	24	Radon	Rn	86
Cobalt	Co	27	Rhodium	Rh	45
Copper	Cu	29	Rubidium	Rb	37
Curium	Cm	96	Ruthenium	Ru	44
Dysprosium	Dy	66	Samarium	Sm	62
Einsteinium	Es	99	Scandium	Sc	21
Erbium	Er	68	Selenium	Se	34
Europium	Eu	63	Silicon	Si	14
Fermium	Fm	100	Silver	Ag	47
Fluorine	F	9	Sodium	Na	11
Francium	Fr	87	Strontium	Sr	38
Gadolinium	Gd	64	Sulfur	S	16
Gallium	Ga	31	Tantalum	Ta	73
Germanium	Ge	32	Technetium	Tc	43
Gold	Au	79	Tellurium	Te	52
Hafnium	Hf	72	Terbium	Tb	65

Holmium	Ho	67	Thallium	Tl	81
Hydrogen	H	1	Thorium	Th	90
Indium	In	49	Thulium	Tm	69
Iodine	I	53	Tin	Sn	50
Iridium	Ir	77	Titanium	Ti	22
Iron	Fe	26	Tungsten	W	74
Krypton	Kr	36	Uranium	U	92
Lanthanum	La	57	Vanadium	V	23
Lead	Pb	82	Xenon	Xe	54
Lutetium	Lu	71	Ytterbium	Yb	70
Magnesium	Mg	12	Yttrium	Y	39
Manganese	Mn	25	Zinc	Zn	30
Mendelevium	Md	101	Zirconium	Zr	40

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
1	Hydrogen-3	Water, DAC includes skin absorption	8E+4	8E+4	2E-5	1E-7	1E-3	1E-2
		Gas (HT or T_2) Submersion[1]: Use above values as HT and T_2 oxidize in air and in the body to HTO.						
4	Beryllium-7	W, all compounds except those given for Y	4E+4	2E+4	9E-6	3E-8	6E-4	6E-3
		Y, oxides, halides, and nitrates	-	2E+4	8E-6	3E-8	-	-
4	Beryllium-10	W, see ^{7}Be	1E+3	2E+2	6E-8	2E-10	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{7}Be	-	1E+1	6E-9	2E-11	-	-
6	Carbon-11[2]	Monoxide	-	1E+6	5E-4	2E-6	-	-
		Dioxide	-	6E+5	3E-4	9E-7	-	-
		Compounds	4E+5	4E+5	2E-4	6E-7	6E-3	6E-2
6	Carbon-14	Monoxide	-	2E+6	7E-4	2E-6	-	-
		Dioxide	-	2E+5	9E-5	3E-7	-	-
		Compounds	2E+3	2E+3	1E-6	3E-9	3E-5	3E-4
7	Nitrogen-13[2]	Submersion	-	-	4E-6	2E-8	-	-
8	Oxygen-15[2]	Submersion	-	-	4E-6	2E-8	-	-
9	Fluorine-18[2]	D, fluorides of H, Li, Na, K, RB, Cs, and Fr	5E+4	7E+4	3E-5	1E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
		W, fluorides of Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, As, Sb, Bi, Fe, Ru, Os, Co, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, V, Nb, Ta, Mn, Tc, and Re	-	9E+4	4E-5	1E-7	-	-
		Y, lanthanum fluoride	-	8E+4	3E-5	1E-7	-	-
11	Sodium-22	D, all compounds	4E+2	6E+2	3E-7	9E-10	6E-6	6E-5
11	Sodium-24	D, all compounds	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
12	Magnesium-28	D, all compounds except those given for W	7E+2	2E+3	7E-7	2E-9	9E-6	9E-5
		W, oxides, hydroxides, carbides, halides, and nitrates	-	1E+3	5E-7	2E-9	-	-
13	Aluminum-26	D, all compounds except those given for W	4E+2	6E+1	3E-8	9E-11	6E-6	6E-5
		W, oxides, hydroxides, carbides, halides, and nitrates	-	9E+1	4E-8	1E-10	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
14	Silicon-31	D, all compounds except those given for W and Y	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
		W, oxides, hydroxides, carbides, and nitrates	-	3E+4	1E-5	5E-8	-	-
		Y, aluminosilicate glass	-	3E+4	1E-5	4E-8	-	-
14	Silicon-32	D, see ^{31}Si	2E+3	2E+2	1E-7	3E-10	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
		W, see ^{31}Si	-	1E+2	5E-8	2E-10	-	-
		Y, see ^{31}Si	-	5E+0	2E-9	7E-12	-	-
15	Phosphorus-32	D, all compounds except phosphates given for W	6E+2	9E+2	4E-7	1E-9	9E-6	9E-5
		W, phosphates of Zn^{2+},S^{3+}, Mg^{2+}, Fe^{3+}, Bi^{3+}, and lanthanides	-	4E+2	2E-7	5E-10	-	-
15	Phosphorus-33	D, see ^{32}P	6E+3	8E+3	4E-6	1E-8	8E-5	8E-4
		W, see ^{32}P	-	3E+3	1E-6	4E-9	-	-
16	Sulfur-35	Vapor	-	1E+4	6E-6	2E-8	-	-
		D, sulfides and sulfates except those given for W	1E+4	2E+4	7E-6	2E-8	-	-
			LLI wall (8E+3)	-	-	-	1E-4	1E-3
		W, elemental sulfur, sulfides of Sr, Ba, Ge, Sn, Pb, As, Sb, Bi, Cu, Ag, Au, Zn, Cd, Hg, W, and Mo. Sulfates of Ca, Sr, Ba, Ra, As, Sb, and Bi	6E+3 -	2E+3	9E-7	3E-9	-	-
17	Chlorine-36	D, chlorides of H, Li, Na, K, Rb, Cs, and	2E+3	2E+3	1E-6	3E-9	2E-5	2E-4
		W, chlorides of lanthanides, Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, Ge, Sn, Pb, As, Sb, Bi, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, Mn, Tc, and Re	-	2E+2	1E-7	3E-10	-	-

			Table I Occupational Values			Table II Effluent Concentrations		Table III Release to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
			Oral Ingestion	Inhalation				Monthly Average
Atomic No.	Radionuclide	Class	ALI (µCi)	ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	Concentrations (µCi/ml)
17	Chlorine-38[2]	D, see ^{36}Cl	2E+4	4E+4	2E-5	6E-8	-	-
			St wall (5E+4)	-	-	-	3E-4	3E-3
		W, see ^{36}Cl	-	5E+4	2E-5	6E-8	-	-
17	Chlorine-39[2]	D, see ^{36}Cl	2E+4	5E+4	2E-5	7E-8	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ^{36}Cl	-	6E+4	2E-5	8E-8	-	-
18	Argon-37	Submersion[1]	-	-	1E+0	6E-3	-	-
18	Argon-39	Submersion[1]	-	-	2E-4	8E-7	-	-
18	Argon-41	Submersion[1]	-	-	3E-6	1E-8	-	-
19	Potassium-40	D, all compounds	3E+2	4E+2	2E-7	6E-10	4E-6	4E-5
19	Potassium-42	D, all compounds	5E+3	5E+3	2E-6	7E-9	6E-5	6E-4
19	Potassium-43	D, all compounds	6E+3	9E+3	4E-6	1E-8	9E-5	9E-4
19	Potassium-44[2]	D, all compounds	2E+4	7E+4	3E-5	9E-8	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
19	Potassium-45[2]	D, all compounds	3E+4	1E+5	5E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
20	Calcium-41	W, all compounds	3E+3	4E+3	2E-6	-	-	-
			Bone surf (4E+3)	Bone surf (4E+3)	-	5E-9	6E-5	6E-4
20	Calcium-45	W, all compounds	2E+3	8E+2	4E-7	1E-9	2E-5	2E-4
20	Calcium-47	W, all compounds	8E+2	9E+2	4E-7	1E-9	1E-5	1E-4
21	Scandium-43	Y, all compounds	7E+3	2E+4	9E-6	3E-8	1E-4	1E-3
21	Scandium-44m	Y, all compounds	5E+2	7E+2	3E-7	1E-9	7E-6	7E-5
21	Scandium-44	Y, all compounds	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
21	Scandium-46	Y, all compounds	9E+2	2E+2	1E-7	3E-10	1E-5	1E-4
21	Scandium-47	Y, all compounds	2E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
21	Scandium-48	Y, all compounds	8E+2	1E+3	6E-7	2E-9	1E-5	1E-4
21	Scandium-49[2]	Y, all compounds	2E+4	5E+4	2E-5	8E-8	3E-4	3E-3

22	Titanium-44	D, all compounds except those given for W and Y	3E+2	1E+1	5E-9	2E-11	4E-6	4E-5
		W, oxides, hydroxides, carbides, halides, and nitrates nitrates	-	3E+1	1E-8	4E-11	-	-
		Y, SrTi0	-	6E+0	2E-9	8E-12	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
22	Titanium-45	D, see ^{44}Ti	9E+3	3E+4	1E-5	3E-8	1E-4	1E-3
		W, see ^{44}Ti	-	4E+4	1E-5	5E-8	-	-
		Y, see ^{44}Ti	-	3E+4	1E-5	4E-8	-	-
23	Vanadium-47[2]	D, all compounds except those given for W	3E+4	8E+4	3E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, oxides, hydroxides, carbides, and halides	-	1E+5	4E-5	1E-7	-	-
23	Vanadium-48	D, see ^{47}V	6E+2	1E+3	5E-7	2E-9	9E-6	9E-5
		W, see ^{47}V	-	6E+2	3E-7	9E-10	-	-
23	Vanadium-49	D, see ^{47}V	7E+4	3E+4	1E-5	-	-	-
			LLI wall (9E+4)	Bone surf (3E+4)	-	5E-8	1E-3	1E-2
		W, see ^{47}V	-	2E+4	8E-6	2E-8	-	-
24	Chromium-48	D, all compounds except those given for W and Y	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
		W, halides and nitrates	-	7E+3	3E-6	1E-8	-	-
		Y, oxides and hydroxides	-	7E+3	3E-6	1E-8	-	-
24	Chromium-49[2]	D, see ^{48}Cr	3E+4	8E+4	4E-5	1E-7	4E-4	4E-3
		W, see ^{48}Cr	-	1E+5	4E-5	1E-7	-	-
		Y, see ^{48}Cr	-	9E+4	4E-5	1E-7	-	-
24	Chromium-51	D, see ^{48}Cr	4E+4	5E+4	2E-5	6E-8	5E-4	5E-3
		W, see ^{48}Cr	-	2E+4	1E-5	3E-8	-	-
		Y, see ^{48}Cr	-	2E+4	8E-6	3E-8	-	-
25	Manganese-51[2]	D, all compounds except those given for W	2E+4	5E+4	2E-5	7E-8	3E-4	3E-3
		W, oxides, hydroxides, halides, and nitrates	-	6E+4	3E-5	8E-8	-	-
25	Manganese-52m[2]	D, see ^{51}Mn	3E+4	9E+4	4E-5	1E-7	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ^{51}Mn	-	1E+5	4E-5	1E-7	-	-
25	Manganese-52	D, see ^{51}Mn	7E+2	1E+3	5E-7	2E-9	1E-5	1E-4
		W, see ^{51}Mn	-	9E+2	4E-7	1E-9	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
25	Manganese-53	D, see ^{51}Mn	5E+4	1E+4	5E-6	-	7E-4	7E-3
				Bone surf (2E+4)	-	3E-8	-	-
		W, see ^{51}Mn	-	1E+4	5E-6	2E-8	-	-
25	Manganese-54	D, see ^{51}Mn	2E+3	9E+2	4E-7	1E-9	3E-5	3E-4
		W, see ^{51}Mn	-	8E+2	3E-7	1E-9	-	-
25	Manganese-56	D, see ^{51}Mn	5E+3	2E+4	6E-6	2E-8	7E-5	7E-4
		W, see ^{51}Mn	-	2E+4	9E-6	3E-8	-	-
26	Iron-52	D, all compounds except those given for W	9E+2	3E+3	1E-6	4E-9	1E-5	1E-4
		W, oxides, hydroxides, and halides	-	2E+3	1E-6	3E-9	-	-
26	Iron-55	D, see ^{52}Fe	9E+3	2E+3	8E-7	3E-9	1E-4	1E-3
		W, see ^{52}Fe	-	4E+3	2E-6	6E-9	-	-
26	Iron-59	D, see ^{52}Fe	8E+2	3E+2	1E-7	5E-10	1E-5	1E-4
		W, see ^{52}Fe	-	5E+2	2E-7	7E-10	-	-
26	Iron-60	D, see ^{52}Fe	3E+1	6E+0	3E-9	9E-12	4E-7	4E-6
		W, see ^{52}Fe	-	2E+1	8E-9	3E-11	-	-
27	Cobalt-55	W, all compounds except those given for Y	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		Y, oxides, hydroxides,halides, and nitrates	-	3E+3	1E-6	4E-9	-	-
27	Cobalt-56	W, see ^{55}Co	5E+2	3E+2	1E-7	4E-10	6E-6	6E-5
		Y, see ^{55}Co	4E+2	2E+2	8E-8	3E-10	-	-
27	Cobalt-57	W, see ^{55}Co	8E+3	3E+3	1E-6	4E-9	6E-5	6E-4
		Y, see ^{55}Co	4E+3	7E+2	3E-7	9E-10	-	-
27	Cobalt-58m	W, see ^{55}Co	6E+4	9E+4	4E-5	1E-7	8E-4	8E-3
		Y, see ^{55}Co	-	6E+4	3E-5	9E-8	-	-
27	Cobalt-58	W, see ^{55}Co	2E+3	1E+3	5E-7	2E-9	2E-5	2E-4
		Y, see ^{55}Co	1E+3	7E+2	3E-7	1E-9	-	-
27	Cobalt-60m[2]	W, see ^{55}Co	1E+6	4E+6	2E-3	6E-6	-	-
			St wall (1E+6)	-	-	-	2E-2	2E-1
		Y, see ^{55}Co	-	3E+6	1E-3	4E-6	-	-
27	Cobalt-60	W, see ^{55}Co	5E+2	2E+2	7E-8	2E-10	3E-6	3E-5
		Y, see ^{55}Co	2E+2	3E+1	1E-8	5E-11	-	-
27	Cobalt-61[2]	W, see ^{55}Co	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		Y, see ^{55}Co	2E+4	6E+4	2E-5	8E-8	-	-
27	Cobalt-62m[2]	W, see ^{55}Co	4E+4	2E+5	7E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
		Y, see ^{55}Co	-	2E+5	6E-5	2E-7	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
28	Nickel-56	D, all compounds except those given for W	1E+3	2E+3	8E-7	3E-9	2E-5	2E-4
		W, oxides, hydroxides, and carbides	-	1E+3	5E-7	2E-9	-	-
		Vapor	-	1E+3	5E-7	2E-9	-	-
28	Nickel-57	D, see ^{56}Ni	2E+3	5E+3	2E-6	7E-9	2E-5	2E-4
		W, see ^{56}Ni	-	3E+3	1E-6	4E-9	-	-
		Vapor	-	6E+3	3E-6	9E-9	-	-
28	Nickel-59	D, see ^{56}Ni	2E+4	4E+3	2E-6	5E-9	3E-4	3E-3
		W, see ^{56}Ni	-	7E+3	3E-6	1E-8	-	-
		Vapor	-	2E+3	8E-7	3E-9	-	-
28	Nickel-63	D, see ^{56}Ni	9E+3	2E+3	7E-7	2E-9	1E-4	1E-3
		W, see ^{56}Ni	-	3E+3	1E-6	4E-9	-	-
		Vapor	-	8E+2	3E-7	1E-9	-	-
28	Nickel-65	D, see ^{56}Ni	8E+3	2E+4	1E-5	3E-8	1E-4	1E-3
		W, see ^{56}Ni	-	3E+4	1E-5	4E-8	-	-
		Vapor	-	2E+4	7E-6	2E-8	-	-
28	Nickel-66	D, see ^{56}Ni	4E+2	2E+3	7E-7	2E-9	-	-
			LLI wall (5E+2)	-	-	-	6E-6	6E-5
		W, see ^{56}Ni	-	6E+2	3E-7	9E-10	-	-
		Vapor	-	3E+3	1E-6	4E-9	-	-
29	Copper-60[2]	D, all compounds except those given for W and Y	3E+4	9E+4	4E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, sulfides, halides, and nitrates	-	1E+5	5E-5	2E-7	-	-
		Y, oxides and hydroxides	-	1E+5	4E-5	1E-7	-	-
29	Copper-61	D, see ^{60}Cu	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ^{60}Cu	-	4E+4	2E-5	6E-8	-	-
		Y, see ^{60}Cu	-	4E+4	1E-5	5E-8	-	-
29	Copper-64	D, see ^{60}Cu	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ^{60}Cu	-	2E+4	1E-5	3E-8	-	-
		Y, see ^{60}Cu	-	2E+4	9E-6	3E-8	-	-
29	Copper-67	D, see ^{60}Cu	5E+3	8E+3	3E-6	1E-8	6E-5	6E-4
		W, see ^{60}Cu	-	5E+3	2E-6	7E-9	-	-
		Y, see ^{60}Cu	-	5E+3	2E-6	6E-9	-	-
30	Zinc-62	Y, all compounds	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
30	Zinc-63[2]	Y, all compounds	2E+4	7E+4	3E-5	9E-8	-	-
			St wall (3E+4)	-	-	-	3E-4	3E-3
30	Zinc-65	Y, all compounds	4E+2	3E+2	1E-7	4E-10	5E-6	5E-5
30	Zinc-69m	Y, all compounds	4E+3	7E+3	3E-6	1E-8	6E-5	6E-4

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
30	Zinc-69[2]	Y, all compounds	6E+4	1E+5	6E-5	2E-7	8E-4	8E-3
30	Zinc-71m	Y, all compounds	6E+3	2E+4	7E-6	2E-8	8E-5	8E-4
30	Zinc-72	Y, all compounds	1E+3	1E+3	5E-7	2E-9	1E-5	1E-4
31	Gallium-65[2]	D, all compounds except those given for W	5E+4	2E+5	7E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	9E-4	9E-3
		W, oxides, hydroxides, carbides, halides, and nitrates	-	2E+5	8E-5	3E-7	-	-
31	Gallium-66	D, see ^{65}Ga	1E+3	4E+3	1E-6	5E-9	1E-5	1E-4
		W, see ^{65}Ga	-	3E+3	1E-6	4E-9	-	-
31	Gallium-67	D, see ^{65}Ga	7E+3	1E+4	6E-6	2E-8	1E-4	1E-3
		W, see ^{65}Ga	-	1E+4	4E-6	1E-8	-	-
31	Gallium-68[2]	D, see ^{65}Ga	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{65}Ga	-	5E+4	2E-5	7E-8	-	-
31	Gallium-70[2]	D, see ^{65}Ga	5E+4	2E+5	7E-5	2E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
		W, see ^{65}Ga	-	2E+5	8E-5	3E-7	-	-
31	Gallium-72	D, see ^{65}Ga	1E+3	4E+3	1E-6	5E-9	2E-5	2E-4
		W, see ^{65}Ga	-	3E+3	1E-6	4E-9	-	-
31	Gallium-73	D, see ^{65}Ga	5E+3	2E+4	6E-6	2E-8	7E-5	7E-4
		W, see ^{65}Ga	-	2E+4	6E-6	2E-8	-	-
32	Germanium-66	D, all compounds except those given for W	2E+4	3E+4	1E-5	4E-8	3E-4	3E-3
		W, oxides, sulfides, and halides	-	2E+4	8E-6	3E-8	-	-
32	Germanium-67[2]	D, see ^{66}Ge	3E+4	9E+4	4E-5	1E-7	-	-
			St wall (4E+4)	-	-	-	6E-4	6E-3
		W, see ^{66}Ge	-	1E+5	4E-5	1E-7	-	-
32	Germanium-68	D, see ^{66}Ge	5E+3	4E+3	2E-6	5E-9	6E-5	6E-4
		W, see ^{66}Ge	-	1E+2	4E-8	1E-10	-	-
32	Germanium-69	D, see ^{66}Ge	1E+4	2E+4	6E-6	2E-8	2E-4	2E-3
		W, see ^{66}Ge	-	8E+3	3E-6	1E-8	-	-
32	Germanium-71	D, see ^{66}Ge	5E+5	4E+5	2E-4	6E-7	7E-3	7E-2
		W, see ^{66}Ge	-	4E+4	2E-5	6E-8	-	-
32	Germanium-75[2]	D, see ^{66}Ge	4E+4	8E+4	3E-5	1E-7	-	-
			St wall (7E+4)	-	-	-	9E-4	9E-3
		W, see ^{66}Ge	-	8E+4	4E-5	1E-7	-	-
32	Germanium-77	D, see ^{66}Ge	9E+3	1E+4	4E-6	1E-8	1E-4	1E-3
		W, see ^{66}Ge	-	6E+3	2E-6	8E-9	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
32	Germanium-78[2]	D, see ^{66}Ge	2E+4	2E+4	9E-6	3E-8	-	-
			St wall (2E+4)	-	-	-	3E-4	3E-3
		W, see ^{66}Ge	-	2E+4	9E-6	3E-8	-	-
33	Arsenic-69[2]	W, all compounds	3E+4	1E+5	5E-5	2E-7	-	-
			St wall (4E+4)	-	-	-	6E-4	6E-3
33	Arsenic-70[2]	W, all compounds	1E+4	5E+4	2E-5	7E-8	2E-4	2E-3
33	Arsenic-71	W, all compounds	4E+3	5E+3	2E-6	6E-9	5E-5	5E-4
33	Arsenic-72	W, all compounds	9E+2	1E+3	6E-7	2E-9	1E-5	1E-4
33	Arsenic-73	W, all compounds	8E+3	2E+3	7E-7	2E-9	1E-4	1E-3
33	Arsenic-74	W, all compounds	1E+3	8E+2	3E-7	1E-9	2E-5	2E-4
33	Arsenic-76	W, all compounds	1E+3	1E+3	6E-7	2E-9	1E-5	1E-4
33	Arsenic-77	W, all compounds	4E+3	5E+3	2E-6	7E-9	-	-
			LLI wall (5E+3)	-	-	-	6E-5	6E-4
33	Arsenic-78[2]	W, all compounds	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3
34	Selenium-70[2]	D, all compounds except those given for W	2E+4	4E+4	2E-5	5E-8	1E-4	1E-3
		W, oxides, hydroxides, carbides, and elemental Se	1E+4	4E+4	2E-5	6E-8	-	-
34	Selenium-73m[2]	D, see ^{70}Se	6E+4	2E+5	6E-5	2E-7	4E-4	4E-3
		W, see ^{70}Se	3E+4	1E+5	6E-5	2E-7	-	-
34	Selenium-73	D, see ^{70}Se	3E+3	1E+4	5E-6	2E-8	4E-5	4E-4
		W, see ^{70}Se	-	2E+4	7E-6	2E-8	-	-
34	Selenium-75	D, see ^{70}Se	5E+2	7E+2	3E-7	1E-9	7E-6	7E-5
		W, see ^{70}Se	-	6E+2	3E-7	8E-10	-	-
34	Selenium-79	D, see ^{70}Se	6E+2	8E+2	3E-7	1E-9	8E-6	8E-5
		W, see ^{70}Se	-	6E+2	2E-7	8E-10	-	-
34	Selenium-81m[2]	D, see ^{70}Se	4E+4	7E+4	3E-5	9E-8	3E-4	3E-3
		W, see ^{70}Se	2E+4	7E+4	3E-5	1E-7	-	-
34	Selenium-81[2]	D, see ^{70}Se	6E+4	2E+5	9E-5	3E-7	-	-
			St wall (8E+4)	-	-	-	1E-3	1E-2
		W, see ^{70}Se	-	2E+5	1E-4	3E-7	-	-
34	Selenium-83[2]	D, see ^{70}Se	4E+4	1E+5	5E-5	2E-7	4E-4	4E-3
		W, see ^{70}Se	3E+4	1E+5	5E-5	2E-7	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
35	Bromine-74m[2]	D, bromides of H, Li, Na, K, Rb, Cs, and Fr	1E+4	4E+4	2E-5	5E-8	-	-
			St wall (2E+4)	-	-	-	3E-4	3E-3
		W, bromides of lanthanides, Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, Ge, Sn, Pb, As, Sb, Bi, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, Hf, V, Nb, Ta, Mn, Tc, and Re	-	4E+4	2E-5	6E-8	-	-
35	Bromine-74[2]	D, see ^{74m}Br	2E+4	7E+4	3E-5	1E-7	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ^{74m}Br	-	8E+4	4E-5	1E-7	-	-
35	Bromine-75[2]	D, see ^{74m}Br	3E+4	5E+4	2E-5	7E-8	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ^{74m}Br	-	5E+4	2E-5	7E-8	-	-
35	Bromine-76	D, see ^{74m}Br	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
		W, see ^{74m}Br	-	4E+3	2E-6	6E-9	-	-
35	Bromine-77	D, see ^{74m}Br	2E+4	2E+4	1E-5	3E-8	2E-4	2E-3
		W, see ^{74m}Br	-	2E+4	8E-6	3E-8	-	-
35	Bromine-80m	D, see ^{74m}Br	2E+4	2E+4	7E-6	2E-8	3E-4	3E-3
		W, see ^{74m}Br	-	1E+4	6E-6	2E-8	-	-
35	Bromine-80[2]	D, see ^{74m}Br	5E+4	2E+5	8E-5	3E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
		W, see ^{74m}Br	-	2E+5	9E-5	3E-7	-	-
35	Bromine-82	D, see ^{74m}Br	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
		W, see ^{74m}Br	-	4E+3	2E-6	5E-9	-	-
35	Bromine-83	D, see ^{74m}Br	5E+4	6E+4	3E-5	9E-8	-	-
			St wall (7E+4)	-	-	-	9E-4	9E-3
		W, see ^{74m}Br	-	6E+4	3E-5	9E-8	-	-
35	Bromine-84[2]	D, see ^{74m}Br	2E+4	6E+4	2E-5	8E-8	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, see ^{74m}Br	-	6E+4	3E-5	9E-8	-	-
36	Krypton-74[2]	Submersion[1]	-	-	3E-6	1E-8	-	-
36	Krypton-76	Submersion[1]	-	-	9E-6	4E-8	-	-
36	Krypton-77[2]	Submersion[1]	-	-	4E-6	2E-8	-	-
36	Krypton-79	Submersion[1]	-	-	2E-5	7E-8	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
36	Krypton-81	Submersion[1]	-	-	7E-4	3E-6	-	-
36	Krypton-83m[2]	Submersion[1]	-	-	1E-2	5E-5	-	-
36	Krypton-85m	Submersion[1]	-	-	2E-5	1E-7	-	-
36	Krypton-85	Submersion[1]	-	-	1E-4	7E-7	-	-
36	Krypton-87[2]	Submersion[1]	-	-	5E-6	2E-8	-	-
36	Krypton-88	Submersion[1]	-	-	2E-6	9E-9	-	-
37	Rubidium-79[2]	D, all compounds	4E+4	1E+5	5E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
37	Rubidium-81m[2]	D, all compounds	2E+5	3E+5	1E-4	5E-7	-	-
			St wall (3E+5)	-	-	-	4E-3	4E-2
37	Rubidium-81	D, all compounds	4E+4	5E+4	2E-5	7E-8	5E-4	5E-3
37	Rubidium-82m	D, all compounds	1E+4	2E+4	7E-6	2E-8	2E-4	2E-3
37	Rubidium-83	D, all compounds	6E+2	1E+3	4E-7	1E-9	9E-6	9E-5
37	Rubidium-84	D, all compounds	5E+2	8E+2	3E-7	1E-9	7E-6	7E-5
37	Rubidium-86	D, all compounds	5E+2	8E+2	3E-7	1E-9	7E-6	7E-5
37	Rubidium-87	D, all compounds	1E+3	2E+3	6E-7	2E-9	1E-5	1E-4
37	Rubidium-88[2]	D, all compounds	2E+4	6E+4	3E-5	9E-8	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
37	Rubidium-89[2]	D, all compounds	4E+4	1E+5	6E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	9E-4	9E-3
38	Strontium-80[2]	D, all soluble compounds except SrTiO	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		Y, all insoluble compounds and SrTi0	-	1E+4	5E-6	2E-8	-	-
38	Strontium-81[2]	D, see ^{80}Sr	3E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		Y, see ^{80}Sr	2E+4	8E+4	3E-5	1E-7	-	-
38	Strontium-82	D, see ^{80}Sr	3E+2	4E+2	2E-7	6E-10	-	-
			LLI wall (2E+2)	-	-	-	3E-6	3E-5
		Y, see ^{80}Sr	2E+2	9E+1	4E-8	1E-10	-	-
38	Strontium-83	D, see ^{80}Sr	3E+3	7E+3	3E-6	1E-8	3E-5	3E-4
		Y, see ^{80}Sr	2E+3	4E+3	1E-6	5E-9	-	-
38	Strontium-85m[2]	D, see ^{80}Sr	2E+5	6E+5	3E-4	9E-7	3E-3	3E-2
		Y, see ^{80}Sr	-	8E+5	4E-4	1E-6	-	-
38	Strontium-85	D, see ^{80}Sr	3E+3	3E+3	1E-6	4E-9	4E-5	4E-4
		Y, see ^{80}Sr	-	2E+3	6E-7	2E-9	-	-
38	Strontium-87m	D, see ^{80}Sr	5E+4	1E+5	5E-5	2E-7	6E-4	6E-3
		Y, see ^{80}Sr	4E+4	2E+5	6E-5	2E-7	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
38	Strontium-89	D, see ^{80}Sr	6E+2	8E+2	4E-7	1E-9	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
		Y, see ^{80}Sr	5E+2	1E+2	6E-8	2E-10	-	-
38	Strontium-90	D, see ^{80}Sr	3E+1	2E+1	8E-9	-	-	-
			Bone surf (4E+1)	Bone surf (2E+1)	-	3E-11	5E-7	5E-6
		Y, see ^{80}Sr	-	4E+0	2E-9	6E-12	-	-
38	Strontium-91	D, see ^{80}Sr	2E+3	6E+3	2E-6	8E-9	2E-5	2E-4
		Y, see ^{80}Sr	-	4E+3	1E-6	5E-9	-	-
38	Strontium-92	D, see ^{80}Sr	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		Y, see ^{80}Sr	-	7E+3	3E-6	9E-9	-	-
39	Yttrium-86m[2]	W, all compounds except those given for Y	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
		Y, oxides and hydroxides	-	5E+4	2E-5	8E-8	-	-
39	Yttrium-86	W, see ^{86m}Y	1E+3	3E+3	1E-6	5E-9	2E-5	2E-4
		Y, see ^{86m}Y	-	3E+3	1E-6	5E-9	-	-
39	Yttrium-87	W, see ^{86m}Y	2E+3	3E+3	1E-6	5E-9	3E-5	3E-4
		Y, see ^{86m}Y	-	3E+3	1E-6	5E-9	-	-
39	Yttrium-88	W, see ^{86m}Y	1E+3	3E+2	1E-7	3E-10	1E-5	1E-4
		Y, see ^{86m}Y	-	2E+2	1E-7	3E-10	-	-
39	Yttrium-90m	W, see ^{86m}Y	8E+3	1E+4	5E-6	2E-8	1E-4	1E-3
		Y, see ^{86m}Y	-	1E+4	5E-6	2E-8	-	-
39	Yttrium-90	W, see ^{86m}Y	4E+2	7E+2	3E-7	9E-10	-	-
			LLI wall (5E+2)	-	-	-	7E-6	7E-5
		Y, see ^{86m}Y	-	6E+2	3E-7	9E-10	-	-
39	Yttrium-91m[2]	W, see ^{86m}Y	1E+5	2E+5	1E-4	3E-7	2E-3	2E-2
		Y, see ^{86m}Y	-	2E+5	7E-5	2E-7	-	-
39	Yttrium-91	W, see ^{86m}Y	5E+2	2E+2	7E-8	2E-10	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
		Y, see ^{86m}Y	-	1E+2	5E-8	2E-10	-	-
39	Yttrium-92	W, see ^{86m}Y	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		Y, see ^{86m}Y	-	8E+3	3E-6	1E-8	-	-
39	Yttrium-93	W, see ^{86m}Y	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		Y, see ^{86m}Y	-	2E+3	1E-6	3E-9	-	-
39	Yttrium-94[2]	W, see ^{86m}Y	2E+4	8E+4	3E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		Y, see ^{86m}Y	-	8E+4	3E-5	1E-7	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
39	Yttrium-95[2]	W, see ^{86m}Y	4E+4	2E+5	6E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
		Y, see ^{86m}Y	-	1E+5	6E-5	2E-7	-	-
40	Zirconium-86	D, all compounds except those given for W and Y	1E+3	4E+3	2E-6	6E-9	2E-5	2E-4
		W, oxides, hydroxides, halides, and nitrates	-	3E+3	1E-6	4E-9	-	-
		Y, carbide	-	2E+3	1E-6	3E-9	-	-
40	Zirconium-88	D, see ^{86}Zr	4E+3	2E+2	9E-8	3E-10	5E-5	5E-4
		W, see ^{86}Zr	-	5E+2	2E-7	7E-10	-	-
		Y, see ^{86}Zr	-	3E+2	1E-7	4E-10	-	-
40	Zirconium-89	D, see ^{86}Zr	2E+3	4E+3	1E-6	5E-9	2E-5	2E-4
		W, see ^{86}Zr	-	2E+3	1E-6	3E-9	-	-
		Y, see ^{86}Zr	-	2E+3	1E-6	3E-9	-	-
40	Zirconium-93	D, see ^{86}Zr	1E+3	6E+0	3E-9	-	-	-
			Bone surf (3E+3)	Bone surf (2E+1)	-	2E-11	4E-5	4E-4
		W, see ^{86}Zr	-	2E+1	1E-8	-	-	-
			-	Bone surf (6E+1)	-	9E-11	-	-
		Y, see ^{86}Zr	-	6E+1	2E-8	-	-	-
			-	Bone surf (7E+1)	-	9E-11	-	-
40	Zirconium-95	D, see ^{86}Zr	1E+3	1E+2	5E-8	-	2E-5	2E-4
			-	Bone surf (3E+2)	-	4E-10	-	-
		W, see ^{86}Zr	-	4E+2	2E-7	5E-10	-	-
		Y, see ^{86}Zr	-	3E+2	1E-7	4E-10	-	-
40	Zirconium-97	D, see ^{86}Zr	6E+2	2E+3	8E-7	3E-9	9E-6	9E-5
		W, see ^{86}Zr	-	1E+3	6E-7	2E-9	-	-
		Y, see ^{86}Zr	-	1E+3	5E-7	2E-9	-	-
41	Niobium-88[2]	W, all compounds except those given for Y	5E+4	2E+5	9E-5	3E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
		Y, oxides and hydroxides	-	2E+5	9E-5	3E-7	-	-
41	Niobium-89[2] (66 min)	W, see ^{88}Nb	1E+4	4E+4	2E-5	6E-8	1E-4	1E-3
		Y, see ^{88}Nb	-	4E+4	2E-5	5E-8	-	-
41	Niobium-89 (122 min)	W, see ^{88}Nb	5E+3	2E+4	8E-6	3E-8	7E-5	7E-4
		Y, see ^{88}Nb	-	2E+4	6E-6	2E-8	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
41	Niobium-90	W, see ^{88}Nb	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
		Y, see ^{88}Nb	-	2E+3	1E-6	3E-9	-	-
41	Niobium-93m	W, see ^{88}Nb	9E+3	2E+3	8E-7	3E-9	-	-
			LLI wall (1E+4)	-	-	-	2E-4	2E-3
		Y, see ^{88}Nb	-	2E+2	7E-8	2E-10	-	-
41	Niobium-94	W, see ^{88}Nb	9E+2	2E+2	8E-8	3E-10	1E-5	1E-4
		Y, see ^{88}Nb	-	2E+1	6E-9	2E-11	-	-
41	Niobium-95m	W, see ^{88}Nb	2E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
		Y, see ^{88}Nb	-	2E+3	9E-7	3E-9	-	-
41	Niobium-95	W, see ^{88}Nb	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
		Y, see ^{88}Nb	-	1E+3	5E-7	2E-9	-	-
41	Niobium-96	W, see ^{88}Nb	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		Y, see ^{88}Nb	-	2E+3	1E-6	3E-9	-	-
41	Niobium-97[2]	W, see ^{88}Nb	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		Y, see ^{88}Nb	-	7E+4	3E-5	1E-7	-	-
41	Niobium-98[2]	W, see ^{88}Nb	1E+4	5E+4	2E-5	8E-8	2E-4	2E-3
		Y, see ^{88}Nb	-	5E+4	2E-5	7E-8	-	-
42	Molybdenum-90	D, all compounds except those given for Y	4E+3	7E+3	3E-6	1E-8	3E-5	3E-4
		Y, oxides, hydroxides, and MoS	2E+3	5E+3	2E-6	6E-9	-	-
42	Molybdenum-93m	D, see ^{90}Mo	9E+3	2E+4	7E-6	2E-8	6E-5	6E-4
		Y, see ^{90}Mo	4E+3	1E+4	6E-6	2E-8	-	-
42	Molybdenum-93	D, see ^{90}Mo	4E+3	5E+3	2E-6	8E-9	5E-5	5E-4
		Y, see ^{90}Mo	2E+4	2E+2	8E-8	2E-10	-	-
42	Molybdenum-99	D, see ^{90}Mo	2E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{90}Mo	1E+3	1E+3	6E-7	2E-9	-	-
42	Molybdenum-101[2]	D, see ^{90}Mo	4E+4	1E+5	6E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
		Y, see ^{90}Mo	-	1E+5	6E-5	2E-7	-	-
43	Technetium-93m[2]	D, all compounds except those given for W	7E+4	2E+5	6E-5	2E-7	1E-3	1E-2
		W, oxides, hydroxides, halides, and nitrates	-	3E+5	1E-4	4E-7	-	-
43	Technetium-93	D, see ^{93m}Tc	3E+4	7E+4	3E-5	1E-7	4E-4	4E-3
		W, see ^{93m}Tc	-	1E+5	4E-5	1E-7	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
43	Technetium-94m[2]	D, see ^{93m}Tc	2E+4	4E+4	2E-5	6E-8	3E-4	3E-3
		W, see ^{93m}Tc	-	6E+4	2E-5	8E-8	-	-
43	Technetium-94	D, see ^{93m}Tc	9E+3	2E+4	8E-6	3E-8	1E-4	1E-3
		W, see ^{93m}Tc	-	2E+4	1E-5	3E-8	-	-
43	Technetium-95m	D, see ^{93m}Tc	4E+3	5E+3	2E-6	8E-9	5E-5	5E-4
		W, see ^{93m}Tc	-	2E+3	8E-7	3E-9	-	-
43	Technetium-95	D, see ^{93m}Tc	1E+4	2E+4	9E-6	3E-8	1E-4	1E-3
		W, see ^{93m}Tc	-	2E+4	8E-6	3E-8	-	-
43	Technetium-96m[2]	D, see ^{93m}Tc	2E+5	3E+5	1E-4	4E-7	2E-3	2E-2
		W, see ^{93m}Tc	-	2E+5	1E-4	3E-7	-	-
43	Technetium-96	D, see ^{93m}Tc	2E+3	3E+3	1E-6	5E-9	3E-5	3E-4
		W, see ^{93m}Tc	-	2E+3	9E-7	3E-9	-	-
43	Technetium-97m	D, see ^{93m}Tc	5E+3	7E+3	3E-6	-	6E-5	6E-4
			-	St wall (7E+3)	-	1E-8	-	-
		W, see ^{93m}Tc	-	1E+3	5E-7	2E-9	-	-
43	Technetium-97	D, see ^{93m}Tc	4E+4	5E+4	2E-5	7E-8	5E-4	5E-3
		W, see ^{93m}Tc	-	6E+3	2E-6	8E-9	-	-
43	Technetium-98	D, see ^{93m}Tc	1E+3	2E+3	7E-7	2E-9	1E-5	1E-4
		W, see ^{93m}Tc	-	3E+2	1E-7	4E-10	-	-
43	Technetium-99m	D, see ^{93m}Tc	8E+4	2E+5	6E-5	2E-7	1E-3	1E-2
		W, see ^{93m}Tc	-	2E+5	1E-4	3E-7	-	-
43	Technetium-99	D, see ^{93m}Tc	4E+3	5E+3	2E-6	-	6E-5	6E-4
			-	St wall (6E+3)	-	8E-9	-	-
		W, see ^{93m}Tc	-	7E+2	3E-7	9E-10	-	-
43	Technetium-101[2]	D, see ^{93m}Tc	9E+4	3E+5	1E-4	5E-7	-	-
			St wall (1E+5)	-	-	-	2E-3	2E-2
		W, see ^{93m}Tc	-	4E+5	2E-4	5E-7	-	-
43	Technetium-104[2]	D, see ^{93m}Tc	2E+4	7E+4	3E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, see ^{93m}Tc	-	9E+4	4E-5	1E-7	-	-
44	Ruthenium-94[2]	D, all compounds except those given for W and Y	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, halides	-	6E+4	3E-5	9E-8	-	-
		Y, oxides and hydroxides	-	6E+4	2E-5	8E-8	-	-
44	Ruthenium-97	D, see ^{94}Ru	8E+3	2E+4	8E-6	3E-8	1E-4	1E-3
		W, see ^{94}Ru	-	1E+4	5E-6	2E-8	-	-
		Y, see ^{94}Ru	-	1E+4	5E-6	2E-8	-	-
44	Ruthenium-103	D, see ^{94}Ru	2E+3	2E+3	7E-7	2E-9	3E-5	3E-4
		W, see ^{94}Ru	-	1E+3	4E-7	1E-9	-	-
		Y, see ^{94}Ru	-	6E+2	3E-7	9E-10	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
44	Ruthenium-105	D, see ^{94}Ru	5E+3	1E+4	6E-6	2E-8	7E-5	7E-4
		W, see ^{94}Ru	-	1E+4	6E-6	2E-8	-	-
		Y, see ^{94}Ru	-	1E+4	5E-6	2E-8	-	-
44	Ruthenium-106	D, see ^{94}Ru	2E+2	9E+1	4E-8	1E-10	-	-
			LLI wall (2E+2)	-	-	-	3E-6	3E-5
		W, see ^{94}Ru	-	5E+1	2E-8	8E-11	-	-
		Y, see ^{94}Ru	-	1E+1	5E-9	2E-11	-	-
45	Rhodium-99m	D, all compounds except those given for W and Y	2E+4	6E+4	2E-5	8E-8	2E-4	2E-3
		W, halides	-	8E+4	3E-5	1E-7	-	-
		Y, oxides and hydroxides	-	7E+4	3E-5	9E-8	-	-
45	Rhodium-99	D, see ^{99m}Rh	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
		W, see ^{99m}Rh	-	2E+3	9E-7	3E-9	-	-
		Y, see ^{99m}Rh	-	2E+3	8E-7	3E-9	-	-
45	Rhodium-100	D, see ^{99m}Rh	2E+3	5E+3	2E-6	7E-9	2E-5	2E-4
		W, see ^{99m}Rh	-	4E+3	2E-6	6E-9	-	-
		Y, see ^{99m}Rh	-	4E+3	2E-6	5E-9	-	-
45	Rhodium-101m	D, see ^{99m}Rh	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
		W, see ^{99m}Rh	-	8E+3	4E-6	1E-8	-	-
		Y, see ^{99m}Rh	-	8E+3	3E-6	1E-8	-	-
45	Rhodium-101	D, see ^{99m}Rh	2E+3	5E+2	2E-7	7E-10	3E-5	3E-4
		W, see ^{99m}Rh	-	8E+2	3E-7	1E-9	-	-
		Y, see ^{99m}Rh	-	2E+2	6E-8	2E-10	-	-
45	Rhodium-102m	D, see ^{99m}Rh	1E+3	5E+2	2E-7	7E-10	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		W, see ^{99m}Rh	-	4E+2	2E-7	5E-10	-	-
		Y, see ^{99m}Rh	-	1E+2	5E-8	2E-10	-	-
45	Rhodium-102	D, see ^{99m}Rh	6E+2	9E+1	4E-8	1E-10	8E-6	8E-5
		W, see ^{99m}Rh	-	2E+2	7E-8	2E-10	-	-
		Y, see ^{99m}Rh	-	6E+1	2E-8	8E-11	-	-
45	Rhodium-103m[2]	D, see ^{99m}Rh	4E+5	1E+6	5E-4	2E-6	6E-3	6E-2
		W, see ^{99m}Rh	-	1E+6	5E-4	2E-6	-	-
		Y, see ^{99m}Rh	-	1E+6	5E-4	2E-6	-	-
45	Rhodium-105	D, see ^{99m}Rh	4E+3	1E+4	5E-6	2E-8	-	-
			LLI wall (4E+3)	-	-	-	5E-5	5E-4
		W, see ^{99m}Rh	-	6E+3	3E-6	9E-9	-	-
		Y, see ^{99m}Rh	-	6E+3	2E-6	8E-9	-	-
45	Rhodium-106m	D, see ^{99m}Rh	8E+3	3E+4	1E-5	4E-8	1E-4	1E-3
		W, see ^{99m}Rh	-	4E+4	2E-5	5E-8	-	-
		Y, see ^{99m}Rh	-	4E+4	1E-5	5E-8	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
45	Rhodium-107[2]	D, see ^{99m}Rh	7E+4	2E+5	1E-4	3E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
		W, see ^{99m}Rh	-	3E+5	1E-4	4E-7	-	-
		Y, see ^{99m}Rh	-	3E+5	1E-4	3E-7	-	-
46	Palladium-100	D, all compounds except those given for W and Y	1E+3	1E+3	6E-7	2E-9	2E-5	2E-4
		W, nitrates	-	1E+3	5E-7	2E-9	-	-
		Y, oxides and hydroxides	-	1E+3	6E-7	2E-9	-	-
46	Palladium-101	D, see ^{100}Pd	1E+4	3E+4	1E-5	5E-8	2E-4	2E-3
		W, see ^{100}Pd	-	3E+4	1E-5	5E-8	-	-
		Y, see ^{100}Pd	-	3E+4	1E-5	4E-8	-	-
46	Palladium-103	D, see ^{100}Pd	6E+3	6E+3	3E-6	9E-9	-	-
			LLI wall (7E+3)	-	-	-	1E-4	1E-3
		W, see ^{100}Pd	-	4E+3	2E-6	6E-9	-	-
		Y, see ^{100}Pd	-	4E+3	1E-6	5E-9	-	-
46	Palladium-107	D, see ^{100}Pd	3E+4	2E+4	9E-6	-	-	-
			LLI wall (4E+4)	Kidneys (2E+4)	-	3E-8	5E-4	5E-3
		W, see ^{100}Pd	-	7E+3	3E-6	1E-8	-	-
		Y, see ^{100}Pd	-	4E+2	2E-7	6E-10	-	-
46	Palladium-109	D, see ^{100}Pd	2E+3	6E+3	3E-6	9E-9	3E-5	3E-4
		W, see ^{100}Pd	-	5E+3	2E-6	8E-9	-	-
		Y, see ^{100}Pd	-	5E+3	2E-6	6E-9	-	-
47	Silver-102[2]	D, all compounds except those given for W and Y	5E+4	2E+5	8E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	9E-4	9E-3
		W, nitrates and sulfides	-	2E+5	9E-5	3E-7	-	-
		Y, oxides and hydroxides	-	2E+5	8E-5	3E-7	-	-
47	Silver-103[2]	D, see ^{102}Ag	4E+4	1E+5	4E-5	1E-7	5E-4	5E-3
		W, see ^{102}Ag	-	1E+5	5E-5	2E-7	-	-
		Y, see ^{102}Ag	-	1E+5	5E-5	2E-7	-	-
47	Silver-104m[2]	D, see ^{102}Ag	3E+4	9E+4	4E-5	1E-7	4E-4	4E-3
		W, see ^{102}Ag	-	1E+5	5E-5	2E-7	-	-
		Y, see ^{102}Ag	-	1E+5	5E-5	2E-7	-	-
47	Silver-104[2]	D, see ^{102}Ag	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
		W, see ^{102}Ag	-	1E+5	6E-5	2E-7	-	-
		Y, see ^{102}Ag	-	1E+5	6E-5	2E-7	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
47	Silver-105	D, see ^{102}Ag	3E+3	1E+3	4E-7	1E-9	4E-5	4E-4
		W, see ^{102}Ag	-	2E+3	7E-7	2E-9	-	-
		Y, see ^{102}Ag	-	2E+3	7E-7	2E-9	-	-
47	Silver-106m	D, see ^{102}Ag	8E+2	7E+2	3E-7	1E-9	1E-5	1E-4
		W, see ^{102}Ag	-	9E+2	4E-7	1E-9	-	-
		Y, see ^{102}Ag	-	9E+2	4E-7	1E-9	-	-
47	Silver-106[2]	D, see ^{102}Ag	6E+4	2E+5	8E-5	3E-7	-	-
			St. wall (6E+4)	-	-	-	9E-4	9E-3
		W, see ^{102}Ag	-	2E+5	9E-5	3E-7	-	-
		Y, see ^{102}Ag	-	2E+5	8E-5	3E-7	-	-
47	Silver-108m	D, see ^{102}Ag	6E+2	2E+2	8E-8	3E-10	9E-6	9E-5
		W, see ^{102}Ag	-	3E+2	1E-7	4E-10	-	-
		Y, see ^{102}Ag	-	2E+1	1E-8	3E-11	-	-
47	Silver-110m	D, see ^{102}Ag	5E+2	1E+2	5E-8	2E-10	6E-6	6E-5
		W, see ^{102}Ag	-	2E+2	8E-8	3E-10	-	-
		Y, see ^{102}Ag	-	9E+1	4E-8	1E-10	-	-
47	Silver-111	D, see ^{102}Ag	9E+2	2E+3	6E-7	-	-	-
			LLI wall (1E+3)	Liver (2E+3)	-	2E-9	2E-5	2E-4
		W, see ^{102}Ag	-	9E+2	4E-7	1E-9	-	-
		Y, see ^{102}Ag	-	9E+2	4E-7	1E-9	-	-
47	Silver-112	D, see ^{102}Ag	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
		W, see ^{102}Ag	-	1E+4	4E-6	1E-8	-	-
		Y, see ^{102}Ag	-	9E+3	4E-6	1E-8	-	-
47	Silver-115[2]	D, see ^{102}Ag	3E+4	9E+4	4E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, see ^{102}Ag	-	9E+4	4E-5	1E-7	-	-
		Y, see ^{102}Ag	-	8E+4	3E-5	1E-7	-	-
48	Cadmium-104[2]	D, all compounds except those given for W and Y	2E+4	7E+4	3E-5	9E-8	3E-4	3E-3
		W, sulfides, halides, and nitrates	-	1E+5	5E-5	2E-7	-	-
		Y, oxides and hydroxides	-	1E+5	5E-5	2E-7	-	-
48	Cadmium-107	D, see ^{104}Cd	2E+4	5E+4	2E-5	8E-8	3E-4	3E-3
		W, see ^{104}Cd	-	6E+4	2E-5	8E-8	-	-
		Y, see ^{104}Cd	-	5E+4	2E-5	7E-8	-	-

			Table I Occupational Values			Table II Effluent Concentrations		Table III Release to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
			Oral Ingestion	Inhalation				Monthly Average
Atomic No.	Radionuclide	Class	ALI (µCi)	ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	Concentrations (µCi/ml)
48	Cadmium-109	D, see ^{104}Cd	3E+2	4E+1	1E-8	-	-	-
			Kidneys (4E+2)	Kidneys (5E+1)	-	7E-11	6E-6	6E-5
		W, see ^{104}Cd	-	1E+2	5E-8	-	-	-
			-	Kidneys (1E+2)	-	2E-10	-	-
		Y, see ^{104}Cd	-	1E+2	5E-8	2E-10	-	-
48	Cadmium-113m	D, see ^{104}Cd	2E+1	2E+0	1E-9	-	-	-
			Kidneys (4E+1)	Kidneys (4E+0)	-	5E-12	5E-7	5E-6
		W, see ^{104}Cd	-	8E+0	4E-9	-	-	-
			-	Kidneys (1E+1)	-	2E-11	-	-
		Y, see ^{104}Cd	-	1E+1	5E-9	2E-11	-	-
48	Cadmium-113	D, see ^{104}Cd	2E+1	2E+0	9E-10	-	-	-
			Kidneys (3E+1)	Kidneys (3E+0)	-	5E-12	4E-7	4E-6
		W, see ^{104}Cd	-	8E+0	3E-9	-	-	-
			-	Kidneys (1E+1)	-	2E-11	-	-
		Y, see ^{104}Cd	-	1E+1	6E-9	2E-11	-	-
48	Cadmium-115m	D, see ^{104}Cd	3E+2	5E+1	2E-8	-	4E-6	4E-5
			-	Kidneys (8E+1)	-	1E-10	-	-
		W, see ^{104}Cd	-	1E+2	5E-8	2E-10	-	-
		Y, see ^{104}Cd	-	1E+2	6E-8	2E-10	-	-
48	Cadmium-115	D, see ^{104}Cd	9E+2	1E+3	6E-7	2E-9	-	-
			LLI wall (1E+3)	-	-	-	1E-5	1E-4
		W, see ^{104}Cd	-	1E+3	5E-7	2E-9	-	-
		Y, see ^{104}Cd	-	1E+3	6E-7	2E-9	-	-
48	Cadmium-117m	D, see ^{104}Cd	5E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		W, see ^{104}Cd	-	2E+4	7E-6	2E-8	-	-
		Y, see ^{104}Cd	-	1E+4	6E-6	2E-8	-	-
48	Cadmium-117	D, see ^{104}Cd	5E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		W, see ^{104}Cd	-	2E+4	7E-6	2E-8	-	-
		Y, see ^{104}Cd	-	1E+4	6E-6	2E-8	-	-
49	Indium-109	D, all compounds except those given for W	2E+4	4E+4	2E-5	6E-8	3E-4	3E-3
		W, oxides, hydroxides, halides, and nitrates	-	6E+4	3E-5	9E-8	-	-
49	Indium-110[2] (69.1 min)	D, see ^{109}In	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{109}In	-	6E+4	2E-5	8E-8	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
49	Indium-110 (4.9 h)	D, see ^{109}In	5E+3	2E+4	7E-6	2E-8	7E-5	7E-4
		W, see ^{109}In	-	2E+4	8E-6	3E-8	-	-
49	Indium-111	D, see ^{109}In	4E+3	6E+3	3E-6	9E-9	6E-5	6E-4
		W, see ^{109}In	-	6E+3	3E-6	9E-9	-	-
49	Indium-112[2]	D, see ^{109}In	2E+5	6E+5	3E-4	9E-7	2E-3	2E-2
		W, see ^{109}In	-	7E+5	3E-4	1E-6	-	-
49	Indium-113m[2]	D, see ^{109}In	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
		W, see ^{109}In	-	2E+5	8E-5	3E-7	-	-
49	Indium-114m	D, see ^{109}In	3E+2	6E+1	3E-8	9E-11	-	-
			LLI wall (4E+2)	-	-	-	5E-6	5E-5
		W, see ^{109}In	-	1E+2	4E-8	1E-10	-	-
49	Indium-115m	D, see ^{109}In	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{109}In	-	5E+4	2E-5	7E-8	-	-
49	Indium-115	D, see ^{109}In	4E+1	1E+0	6E-10	2E-12	5E-7	5E-6
		W, see ^{109}In	-	5E+0	2E-9	8E-12	-	-
49	Indium-116m[2]	D, see ^{109}In	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		W, see ^{109}In	-	1E+5	5E-5	2E-7	-	-
49	Indium-117m[2]	D, see ^{109}In	1E+4	3E+4	1E-5	5E-8	2E-4	2E-3
		W, see ^{109}In	-	4E+4	2E-5	6E-8	-	-
49	Indium-117[2]	D, see ^{109}In	6E+4	2E+5	7E-5	2E-7	8E-4	8E-3
		W, see ^{109}In	-	2E+5	9E-5	3E-7	-	-
49	Indium-119m[2]	D, see ^{109}In	4E+4	1E+5	5E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
		W, see ^{109}In	-	1E+5	6E-5	2E-7	-	-
50	Tin-110	D, all compounds except those given for W	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
		W, sulfides, oxides, hydroxides, halides, nitrates, and stannic phosphate	-	1E+4	5E-6	2E-8	-	-
50	Tin-111[2]	D, see ^{110}Sn	7E+4	2E+5	9E-5	3E-7	1E-3	1E-2
		W, see ^{110}Sn	-	3E+5	1E-4	4E-7	-	-
50	Tin-113	D, see ^{110}Sn	2E+3	1E+3	5E-7	2E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
		W, see ^{110}Sn	-	5E+2	2E-7	8E-10	-	-
50	Tin-117m	D, see ^{110}Sn	2E+3	1E+3	5E-7	-	-	-
			LLI wall (2E+3)	Bone surf (2E+3)	-	3E-9	3E-5	3E-4
		W, see ^{110}Sn	-	1E+3	6E-7	2E-9	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
50	Tin-119m	D, see ^{110}Sn	3E+3	2E+3	1E-6	3E-9	-	-
			LLI wall (4E+3)	-	-	-	6E-5	6E-4
		W, see ^{110}Sn	-	1E+3	4E-7	1E-9	-	-
50	Tin-121m	D, see ^{110}Sn	3E+3	9E+2	4E-7	1E-9	-	-
			LLI wall (4E+3)	-	-	-	5E-5	5E-4
		W, see ^{110}Sn	-	5E+2	2E-7	8E-10	-	-
50	Tin-121	D, see ^{110}Sn	6E+3	2E+4	6E-6	2E-8	-	-
			LLI wall (6E+3)	-	-	-	8E-5	8E-4
		W, see ^{110}Sn	-	1E+4	5E-6	2E-8	-	-
50	Tin-123m[2]	D, see ^{110}Sn	5E+4	1E+5	5E-5	2E-7	7E-4	7E-3
		W, see ^{110}Sn	-	1E+5	6E-5	2E-7	-	-
50	Tin-123	D, see ^{110}Sn	5E+2	6E+2	3E-7	9E-10	-	-
			LLI wall (6E+2)	-	-	-	9E-6	9E-5
		W, see ^{110}Sn	-	2E+2	7E-8	2E-10	-	-
50	Tin-125	D, see ^{110}Sn	4E+2	9E+2	4E-7	1E-9	-	-
			LLI wall (5E+2)	-	-	-	6E-6	6E-5
		W, see ^{110}Sn	-	4E+2	1E-7	5E-10	-	-
50	Tin-126	D, see ^{110}Sn	3E+2	6E+1	2E-8	8E-11	4E-6	4E-5
		W, see ^{110}Sn	-	7E+1	3E-8	9E-11	-	-
50	Tin-127	D, see ^{110}Sn	7E+3	2E+4	8E-6	3E-8	9E-5	9E-4
		W, see ^{110}Sn	-	2E+4	8E-6	3E-8	-	-
50	Tin-128[2]	D, see ^{110}Sn	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
		W, see ^{110}Sn	-	4E+4	1E-5	5E-8	-	-
51	Antimony-115[2]	D, all compounds except those given for W	8E+4	2E+5	1E-4	3E-7	1E-3	1E-2
		W, oxides, hydroxides, halides, sulfides, sulfates, and nitrates	-	3E+5	1E-4	4E-7	-	-
51	Antimony-116m[2]	D, see ^{115}Sb	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
		W, see ^{115}Sb	-	1E+5	6E-5	2E-7	-	-
51	Antimony-116[2]	D, see ^{115}Sb	7E+4	3E+5	1E-4	4E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
		W, see ^{115}Sb	-	3E+5	1E-4	5E-7	-	-
51	Antimony-117	D, see ^{115}Sb	7E+4	2E+5	9E-5	3E-7	9E-4	9E-3
		W, see ^{115}Sb	-	3E+5	1E-4	4E-7	-	-
51	Antimony-118m	D, see ^{115}Sb	6E+3	2E+4	8E-6	3E-8	7E-5	7E-4
		W, see ^{115}Sb	5E+3	2E+4	9E-6	3E-8	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Occupational Values Col. 2 Inhalation ALI (μCi)	Table I Occupational Values Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Effluent Concentrations Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
51	Antimony-119	D, see ^{115}Sb	2E+4	5E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{115}Sb	2E+4	3E+4	1E-5	4E-8	-	-
51	Antimony-120[2] (16 min)	D, see ^{115}Sb	1E+5	4E+5	2E-4	6E-7	-	-
			St wall (2E+5)	-	-	-	2E-3	2E-2
		W, see ^{115}Sb	-	5E+5	2E-4	7E-7	-	-
51	Antimony-120 (5.76 d)	D, see ^{115}Sb	1E+3	2E+3	9E-7	3E-9	1E-5	1E-4
		W, see ^{115}Sb	9E+2	1E+3	5E-7	2E-9	-	-
51	Antimony-122	D, see ^{115}Sb	8E+2	2E+3	1E-6	3E-9	-	-
			LLI wall (8E+2)	-	-	-	1E-5	1E-4
		W, see ^{115}Sb	7E+2	1E+3	4E-7	2E-9	-	-
51	Antimony-124m[2]	D, see ^{115}Sb	3E+5	8E+5	4E-4	1E-6	3E-3	3E-2
		W, see ^{115}Sb	2E+5	6E+5	2E-4	8E-7	-	-
51	Antimony-124	D, see ^{115}Sb	6E+2	9E+2	4E-7	1E-9	7E-6	7E-5
		W, see ^{115}Sb	5E+2	2E+2	1E-7	3E-10	-	-
51	Antimony-125	D, see ^{115}Sb	2E+3	2E+3	1E-6	3E-9	3E-5	3E-4
		W, see ^{115}Sb	-	5E+2	2E-7	7E-10	-	-
51	Antimony-126m[2]	D, see ^{115}Sb	5E+4	2E+5	8E-5	3E-7	-	-
			St wall (7E+4)	-	-	-	9E-4	9E-3
		W, see ^{115}Sb	-	2E+5	8E-5	3E-7	-	-
51	Antimony-126	D, see ^{115}Sb	6E+2	1E+3	5E-7	2E-9	7E-6	7E-5
		W, see ^{115}Sb	5E+2	5E+2	2E-7	7E-10	-	-
51	Antimony-127	D, see ^{115}Sb	8E+2	2E+3	9E-7	3E-9	-	-
			LLI wall (8E+2)	-	-	-	1E-5	1E-4
		W, see ^{115}Sb	7E+2	9E+2	4E-7	1E-9	-	-
51	Antimony-128[2] (10.4 min)	D, see ^{115}Sb	8E+4	4E+5	2E-4	5E-7	-	-
			St wall (1E+5)	-	-	-	1E-3	1E-2
		W, see ^{115}Sb	-	4E+5	2E-4	6E-7	-	-
51	Antimony-128 (9.01 h)	D, see ^{115}Sb	1E+3	4E+3	2E-6	6E-9	2E-5	2E-4
		W, see ^{115}Sb	-	3E+3	1E-6	5E-9	-	-
51	Antimony-129	D, see ^{115}Sb	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		W, see ^{115}Sb	-	9E+3	4E-6	1E-8	-	-
51	Antimony-130[2]	D, see ^{115}Sb	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		W, see ^{115}Sb	-	8E+4	3E-5	1E-7	-	-
51	Antimony-131[2]	D, see ^{115}Sb	1E+4	2E+4	1E-5	-	-	-
			Thyroid (2E+4)	Thyroid (4E+4)	-	6E-8	2E-4	2E-3
		W, see ^{115}Sb	-	2E+4	1E-5		-	-
			-	Thyroid (4E+4)	-	6E-8	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
52	Tellurium-116	D, all compounds except those given for W	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3
		W, oxides, hydroxides, and nitrates	-	3E+4	1E-5	4E-8	-	-
52	Tellurium-121m	D, see ^{116}Te	5E+2	2E+2	8E-8	-	-	-
			Bone surf (7E+2)	Bone surf (4E+2)	-	5E-10	1E-5	1E-4
		W, see ^{116}Te	-	4E+2	2E-7	6E-10	-	-
52	Tellurium-121	D, see ^{116}Te	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
		W, see ^{116}Te	-	3E+3	1E-6	4E-9	-	-
52	Tellurium-123m	D, see ^{116}Te	6E+2	2E+2	9E-8	-	-	-
			Bone surf (1E+3)	Bone surf (5E+2)	-	8E-10	1E-5	1E-4
		W, see ^{116}Te	-	5E+2	2E-7	8E-10	-	-
52	Tellurium-123	D, see ^{116}Te	5E+2	2E+2	8E-8	-	-	-
			Bone surf (1E+3)	Bone surf (5E+2)	-	7E-10	2E-5	2E-4
		W, see ^{116}Te	-	4E+2	2E-7	-	-	-
			-	Bone surf (1E+3)	-	2E-9	-	-
52	Tellurium-125m	D, see ^{116}Te	1E+3	4E+2	2E-7	-	-	-
			Bone surf (1E+3)	Bone surf (1E+3)	-	1E-9	2E-5	2E-4
		W, see ^{116}Te	-	7E+2	3E-7	1E-9	-	-
52	Tellurium-127m	D, see ^{116}Te	6E+2	3E+2	1E-7	-	9E-6	9E-5
			-	Bone surf (4E+2)	-	6E-10	-	-
		W, see ^{116}Te	-	3E+2	1E-7	4E-10	-	-
52	Tellurium-127	D, see ^{116}Te	7E+3	2E+4	9E-6	3E-8	1E-4	1E-3
		W, see ^{116}Te	-	2E+4	7E-6	2E-8	-	-
52	Tellurium-129m	D, see ^{116}Te	5E+2	6E+2	3E-7	9E-10	7E-6	7E-5
		W, see ^{116}Te	-	2E+2	1E-7	3E-10	-	-
52	Tellurium-129[2]	D, see ^{116}Te	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
		W, see ^{116}Te	-	7E+4	3E-5	1E-7	-	-
52	Tellurium-131m	D, see ^{116}Te	3E+2	4E+2	2E-7	-	-	-
			Thyroid (6E+2)	Thyroid (1E+3)	-	2E-9	8E-6	8E-5
		W, see ^{116}Te	-	4E+2	2E-7	-	-	-
			-	Thyroid (9E+2)	-	1E-9	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
52	Tellurium-131[2]	D, see ^{116}Te	3E+3	5E+3	2E-6	-	-	-
			Thyroid (6E+3)	Thyroid (1E+4)	-	2E-8	8E-5	8E-4
		W, see ^{116}Te	-	5E+3	2E-6	-	-	-
			-	Thyroid (1E+4)	-	2E-8	-	-
52	Tellurium-132	D, see ^{116}Te	2E+2	2E+2	9E-8	-	-	-
			Thyroid (7E+2)	Thyroid (8E+2)	-	1E-9	9E-6	9E-5
		W, see ^{116}Te	-	2E+2	9E-8	-	-	-
			-	Thyroid (6E+2)	-	9E-10	-	-
52	Tellurium-133m[2]	D, see ^{116}Te	3E+3	5E+3	2E-6	-	-	-
			Thyroid (6E+3)	Thyroid (1E+4)	-	2E-8	9E-5	9E-4
		W, see ^{116}Te	-	5E+3	2E-6	-	-	-
			-	Thyroid (1E+4)	-	2E-8	-	-
52	Tellurium-133[2]	D, see ^{116}Te	1E+4	2E+4	9E-6	-	-	-
			Thyroid (3E+4)	Thyroid (6E+4)	-	8E-8	4E-4	4E-3
		W, see ^{116}Te	-	2E+4	9E-6	-	-	-
			-	Thyroid (6E+4)	-	8E-8	-	-
52	Tellurium-134[2]	D, see ^{116}Te	2E+4	2E+4	1E-5	-	-	-
			Thyroid (2E+4)	Thyroid (5E+4)	-	7E-8	3E-4	3E-3
		W, see ^{116}Te	-	2E+4	1E-5	-	-	-
			-	Thyroid (5E+4)	-	7E-8	-	-
53	Iodine-120m[2]	D, all compounds	1E+4	2E+4	9E-6	3E-8	-	-
			Thyroid (2E+4)	-	-	-	2E-4	2E-3
53	Iodine-120[2]	D, all compounds	4E+3	9E+3	4E-6	-	-	-
			Thyroid (8E+3)	Thyroid (2E+4)	-	2E-8	1E-4	1E-3
53	Iodine-121	D, all compounds	1E+4	2E+4	8E-6	-	-	-
			Thyroid (3E+3)	Thyroid (5E+4)	-	7E-8	4E-4	4E-3
53	Iodine-123	D, all compounds	3E+3	6E+3	3E-6	-	-	-
			Thyroid (1E+4)	Thyroid (2E+4)	-	2E-8	1E-4	1E-3
53	Iodine-124	D, all compounds	5E+1	8E+1	3E-8	-	-	-
			Thyroid (2E+2)	Thyroid (3E+2)	-	4E-10	2E-6	2E-5

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
53	Iodine-125	D, all compounds	4E+1	6E+1	3E-8	-	-	-
			Thyroid (1E+2)	Thyroid (2E+2)	-	3E-10	2E-6	2E-5
53	Iodine-126	D, all compounds	2E+1	4E+1	1E-8	-	-	-
			Thyroid (7E+1)	Thyroid (1E+2)	-	2E-10	1E-6	1E-5
53	Iodine-128[2]	D, all compounds	4E+4	1E+5	5E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
53	Iodine-129	D, all compounds	5E+0	9E+0	4E-9	-	-	-
			Thyroid (2E+1)	Thyroid (3E+1)	-	4E-11	2E-7	2E-6
53	Iodine-130	D, all compounds	4E+2	7E+2	3E-7	-	-	-
			Thyroid (1E+3)	Thyroid (2E+3)	-	3E-9	2E-5	2E-4
53	Iodine-131	D, all compounds	3E+1	5E+1	2E-8	-	-	-
			Thyroid (9E+1)	Thyroid (2E+2)	-	2E-10	1E-6	1E-5
53	Iodine-132m[2]	D, all compounds	4E+3	8E+3	4E-6	-	-	-
			Thyroid (1E+4)	Thyroid (2E+4)	-	3E-8	1E-4	1E-3
53	Iodine-132	D, all compounds	4E+3	8E+3	3E-6	-	-	-
			Thyroid (9E+3)	Thyroid (1E+4)	-	2E-8	1E-4	1E-3
53	Iodine-133	D, all compounds	1E+2	3E+2	1E-7	-	-	-
			Thyroid (5E+2)	Thyroid (9E+2)	-	1E-9	7E-6	7E-5
53	Iodine-134[2]	D, all compounds	2E+4	5E+4	2E-5	6E-8	-	-
			Thyroid (3E+4)	-	-	-	4E-4	4E-3
53	Iodine-135	D, all compounds	8E+2	2E+3	7E-7	-	-	-
			Thyroid (3E+3)	Thyroid (4E+3)	-	6E-9	3E-5	3E-4
54	Xenon-120[2]	Submersion[1]	-	-	1E-5	4E-8	-	-
54	Xenon-121[2]	Submersion[1]	-	-	2E-6	1E-8	-	-
54	Xenon-122	Submersion[1]	-	-	7E-5	3E-7	-	-
54	Xenon-123	Submersion[1]	-	-	6E-6	3E-8	-	-
54	Xenon-125	Submersion[1]	-	-	2E-5	7E-8	-	-
54	Xenon-127	Submersion[1]	-	-	1E-5	6E-8	-	-
54	Xenon-129m	Submersion[1]	-	-	2E-4	9E-7	-	-
54	Xenon-131m	Submersion[1]	-	-	4E-4	2E-6	-	-
54	Xenon-133m	Submersion[1]	-	-	1E-4	6E-7	-	-
54	Xenon-133	Submersion[1]	-	-	1E-4	5E-7	-	-
54	Xenon-135m[2]	Submersion[1]	-	-	9E-6	4E-8	-	-
54	Xenon-135	Submersion[1]	-	-	1E-5	7E-8	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
54	Xenon-138[2]	Submersion[1]	-	-	4E-6	2E-8	-	-
55	Cesium-125[2]	D, all compounds	5E+4	1E+5	6E-5	2E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
55	Cesium-127	D, all compounds	6E+4	9E+4	4E-5	1E-7	9E-4	9E-3
55	Cesium-129	D, all compounds	2E+4	3E+4	1E-5	5E-8	3E-4	3E-3
55	Cesium-130[2]	D, all compounds	6E+4	2E+5	8E-5	3E-7	-	-
			St wall (1E+5)	-	-	-	1E-3	1E-2
55	Cesium-131	D, all compounds	2E+4	3E+4	1E-5	4E-8	3E-4	3E-3
55	Cesium-132	D, all compounds	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
55	Cesium-134m	D, all compounds	1E+5	1E+5	6E-5	2E-7	-	-
			St wall (1E+5)	-	-	-	2E-3	2E-2
55	Cesium-134	D, all compounds	7E+1	1E+2	4E-8	2E-10	9E-7	9E-6
55	Cesium-135m[2]	D, all compounds	1E+5	2E+5	8E-5	3E-7	1E-3	1E-2
55	Cesium-135	D, all compounds	7E+2	1E+3	5E-7	2E-9	1E-5	1E-4
55	Cesium-136	D, all compounds	4E+2	7E+2	3E-7	9E-10	6E-6	6E-5
55	Cesium-137	D, all compounds	1E+2	2E+2	6E-8	2E-10	1E-6	1E-5
55	Cesium-138[2]	D, all compounds	2E+4	6E+4	2E-5	8E-8	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
56	Barium-126[2]	D, all compounds	6E+3	2E+4	6E-6	2E-8	8E-5	8E-4
56	Barium-128	D, all compounds	5E+2	2E+3	7E-7	2E-9	7E-6	7E-5
56	Barium-131m[2]	D, all compounds	4E+5	1E+6	6E-4	2E-6	-	-
			St wall (5E+5)	-	-	-	7E-3	7E-2
56	Barium-131	D, all compounds	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
56	Barium-133m	D, all compounds	2E+3	9E+3	4E-6	1E-8	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
56	Barium-133	D, all compounds	2E+3	7E+2	3E-7	9E-10	2E-5	2E-4
56	Barium-135m	D, all compounds	3E+3	1E+4	5E-6	2E-8	4E-5	4E-4
56	Barium-139[2]	D, all compounds	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
56	Barium-140	D, all compounds	5E+2	1E+3	6E-7	2E-9	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
56	Barium-141[2]	D, all compounds	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
56	Barium-142[2]	D, all compounds	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
57	Lanthanum-131[2]	D, all compounds except those given for W	5E+4	1E+5	5E-5	2E-7	6E-4	6E-3
		W, oxides and hydroxides	-	2E+5	7E-5	2E-7	-	-
57	Lanthanum-132	D, see ^{131}La	3E+3	1E+4	4E-6	1E-8	4E-5	4E-4
		W, see ^{131}La	-	1E+4	5E-6	2E-8	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
57	Lanthanum-135	D, see ^{131}La	4E+4	1E+5	4E-5	1E-7	5E-4	5E-3
		W, see ^{131}La	-	9E+4	4E-5	1E-7	-	-
57	Lanthanum-137	D, see ^{131}La	1E+4	6E+1	3E-8	-	2E-4	2E-3
			-	Liver (7E+1)	-	1E-10	-	-
		W, see ^{131}La	-	3E+2	1E-7	-	-	-
			-	Liver (3E+2)	-	4E-10	-	-
57	Lanthanum-138	D, see ^{131}La	9E+2	4E+0	1E-9	5E-12	1E-5	1E-4
		W, see ^{131}La	-	1E+1	6E-9	2E-11	-	-
57	Lanthanum-140	D, see ^{131}La	6E+2	1E+3	6E-7	2E-9	9E-6	9E-5
		W, see ^{131}La	-	1E+3	5E-7	2E-9	-	-
57	Lanthanum-141	D, see ^{131}La	4E+3	9E+3	4E-6	1E-8	5E-5	5E-4
		W, see ^{131}La	-	1E+4	5E-6	2E-8	-	-
57	Lanthanum-142[2]	D, see ^{131}La	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3
		W, see ^{131}La	-	3E+4	1E-5	5E-8	-	-
57	Lanthanum-143[2]	D, see ^{131}La	4E+4	1E+5	4E-5	1E-7	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ^{131}La	-	9E+4	4E-5	1E-7	-	-
58	Cerium-134	W, all compounds except those given for Y	5E+2	7E+2	3E-7	1E-9	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
		Y, oxides, hydroxides, and fluorides	-	7E+2	3E-7	9E-10	-	-
58	Cerium-135	W, see ^{134}Ce	2E+3	4E+3	2E-6	5E-9	2E-5	2E-4
		Y, see ^{134}Ce	-	4E+3	1E-6	5E-9	-	-
58	Cerium-137m	W, see ^{134}Ce	2E+3	4E+3	2E-6	6E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
		Y, see ^{134}Ce	-	4E+3	2E-6	5E-9	-	-
58	Cerium-137	W, see ^{134}Ce	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
		Y, see ^{134}Ce	-	1E+5	5E-5	2E-7	-	-
58	Cerium-139	W, see ^{134}Ce	5E+3	8E+2	3E-7	1E-9	7E-5	7E-4
		Y, see ^{134}Ce	-	7E+2	3E-7	9E-10	-	-
58	Cerium-141	W, see ^{134}Ce	2E+3	7E+2	3E-7	1E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
		Y, see ^{134}Ce	-	6E+2	2E-7	8E-10	-	-
58	Cerium-143	W, see ^{134}Ce	1E+3	2E+3	8E-7	3E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{134}Ce	-	2E+3	7E-7	2E-9	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
58	Cerium-144	W, see ^{134}Ce	2E+2	3E+1	1E-8	4E-11	-	-
			LLI wall (3E+2)	-	-	-	3E-6	3E-5
		Y, see ^{134}Ce	-	1E+1	6E-9	2E-11	-	-
59	Praseodymium-136[2]	W, all compounds	5E+4	2E+5	1E-4	3E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
		Y, oxides, hydroxides, carbides, and fluorides	-	2E+5	9E-5	3E-7	-	-
59	Praseodymium-137[2]	W, see ^{136}Pr	4E+4	2E+5	6E-5	2E-7	5E-4	5E-3
		Y, see ^{136}Pr	-	1E+5	6E-5	2E-7	-	-
59	Praseodymium-138m	W, see ^{136}Pr	1E+4	5E+4	2E-5	8E-8	1E-4	1E-3
		Y, see ^{136}Pr	-	4E+4	2E-5	6E-8	-	-
59	Praseodymium-139	W, see ^{136}Pr	4E+4	1E+5	5E-5	2E-7	6E-4	6E-3
		Y, see ^{136}Pr	-	1E+5	5E-5	2E-7	-	-
59	Praseodymium-142m[2]	W, see ^{136}Pr	8E+4	2E+5	7E-5	2E-7	1E-3	1E-2
		Y, see ^{136}Pr	-	1E+5	6E-5	2E-7	-	-
59	Praseodymium-142	W, see ^{136}Pr	1E+3	2E+3	9E-7	3E-9	1E-5	1E-4
		Y, see ^{136}Pr	-	2E+3	8E-7	3E-9	-	-
59	Praseodymium-143	W, see ^{136}Pr	9E+2	8E+2	3E-7	1E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{136}Pr	-	7E+2	3E-7	9E-10	-	-
59	Praseodymium-144[2]	W, see ^{136}Pr	3E+4	1E+5	5E-5	2E-7	-	-
			St wall (4E+4)	-	-	-	6E-4	6E-3
		Y, see ^{136}Pr	-	1E+5	5E-5	2E-7	-	-
59	Praseodymium-145	W, see ^{136}Pr	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		Y, see ^{136}Pr	-	8E+3	3E-6	1E-8	-	-
59	Praseodymium-147[2]	W, see ^{136}Pr	5E+4	2E+5	8E-5	3E-7	-	-
			St wall (8E+4)	-	-	-	1E-3	1E-2
		Y, see ^{136}Pr	-	2E+5	8E-5	3E-7	-	-
60	Neodymium-136[2]	W, all compounds except those given for Y	1E+4	6E+4	2E-5	8E-8	2E-4	2E-3
		Y, oxides, hydroxides, carbides, and fluorides	-	5E+4	2E-5	8E-8	-	-
60	Neodymium-138	W, see ^{136}Nd	2E+3	6E+3	3E-6	9E-9	3E-5	3E-4
		Y, see ^{136}Nd	-	5E+3	2E-6	7E-9	-	-
60	Neodymium-139m	W, see ^{136}Nd	5E+3	2E+4	7E-6	2E-8	7E-5	7E-4
		Y, see ^{136}Nd	-	1E+4	6E-6	2E-8	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
60	Neodymium-139[2]	W, see ^{136}Nd	9E+4	3E+5	1E-4	5E-7	1E-3	1E-2
		Y, see ^{136}Nd	-	3E+5	1E-4	4E-7	-	-
60	Neodymium-141	W, see ^{136}Nd	2E+5	7E+5	3E-4	1E-6	2E-3	2E-2
		Y, see ^{136}Nd	-	6E+5	3E-4	9E-7	-	-
60	Neodymium-147	W, see ^{136}Nd	1E+3	9E+2	4E-7	1E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{136}Nd	-	8E+2	4E-7	1E-9	-	-
60	Neodymium-149[2]	W, see ^{136}Nd	1E+4	3E+4	1E-5	4E-8	1E-4	1E-3
		Y, see ^{136}Nd	-	2E+4	1E-5	3E-8	-	-
60	Neodymium-151[2]	W, see ^{136}Nd	7E+4	2E+5	8E-5	3E-7	9E-4	9E-3
		Y, see ^{136}Nd	-	2E+5	8E-5	3E-7	-	-
61	Promethium-141[2]	W, all compounds except those given for Y	5E+4	2E+5	8E-5	3E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
		Y, oxides, hydroxides, carbides, and fluorides	-	2E+5	7E-5	2E-7	-	-
61	Promethium-143	W, see ^{141}Pm	5E+3	6E+2	2E-7	8E-10	7E-5	7E-4
		Y, see ^{141}Pm	-	7E+2	3E-7	1E-9	-	-
61	Promethium-144	W, see ^{141}Pm	1E+3	1E+2	5E-8	2E-10	2E-5	2E-4
		Y, see ^{141}Pm	-	1E+2	5E-8	2E-10	-	-
61	Promethium-145	W, see ^{141}Pm	1E+4	2E+2	7E-8	-	1E-4	1E-3
			-	Bone surf (2E+2)	-	3E-10	-	-
		Y, see ^{141}Pm	-	2E+2	8E-8	3E-10	-	-
61	Promethium-146	W, see ^{141}Pm	2E+3	5E+1	2E-8	7E-11	2E-5	2E-4
		Y, see ^{141}Pm	-	4E+1	2E-8	6E-11	-	-
61	Promethium-147	W, see ^{141}Pm	4E+3	1E+2	5E-8	-	-	-
			LLI wall (5E+3)	Bone surf (2E+2)	-	3E-10	7E-5	7E-4
		Y, see ^{141}Pm	-	1E+2	6E-8	2E-10	-	-
61	Promethium-148m	W, see ^{141}Pm	7E+2	3E+2	1E-7	4E-10	1E-5	1E-4
		Y, see ^{141}Pm	-	3E+2	1E-7	5E-10	-	-
61	Promethium-148	W, see ^{141}Pm	4E+2	5E+2	2E-7	8E-10	-	-
			LLI wall (5E+2)	-	-	-	7E-6	7E-5
		Y, see ^{141}Pm	-	5E+2	2E-7	7E-10	-	-
61	Promethium-149	W, see ^{141}Pm	1E+3	2E+3	8E-7	3E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{141}Pm	-	2E+3	8E-7	2E-9	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
61	Promethium-150	W, see ^{141}Pm	5E+3	2E+4	8E-6	3E-8	7E-5	7E-4
		Y, see ^{141}Pm	-	2E+4	7E-6	2E-8	-	-
61	Promethium-151	W, see ^{141}Pm	2E+3	4E+3	1E-6	5E-9	2E-5	2E-4
		Y, see ^{141}Pm	-	3E+3	1E-6	4E-9	-	-
62	Samarium-141m[2]	W, all compounds	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3
62	Samarium-141[2]	W, all compounds	5E+4	2E+5	8E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
62	Samarium-142[2]	W, all compounds	8E+3	3E+4	1E-5	4E-8	1E-4	1E-3
62	Samarium-145	W, all compounds	6E+3	5E+2	2E-7	7E-10	8E-5	8E-4
62	Samarium-146	W, all compounds	1E+1	4E-2	1E-11	-	-	-
			Bone surf (3E+1)	Bone surf (6E-2)	-	9E-14	3E-7	3E-6
62	Samarium-147	W, all compounds	2E+1	4E-2	2E-11	-	-	-
			Bone surf (3E+1)	Bone surf (7E-2)	-	1E-13	4E-7	4E-6
62	Samarium-151	W, all compounds	1E+4	1E+2	4E-8	-	-	-
			LLI wall (1E-4)	Bone surf (2E+2)	-	2E-10	2E-4	2E-3
62	Samarium-153	W, all compounds	2E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
62	Samarium-155[2]	W, all compounds	6E+4	2E+5	9E-5	3E-7	-	-
			St wall (8E+4)	-	-	-	1E-3	1E-2
62	Samarium-156	W, all compounds	5E+3	9E+3	4E-6	1E-8	7E-5	7E-4
63	Europium-145	W, all compounds	2E+3	2E+3	8E-7	3E-9	2E-5	2E-4
63	Europium-146	W, all compounds	1E+3	1E+3	5E-7	2E-9	1E-5	1E-4
63	Europium-147	W, all compounds	3E+3	2E+3	7E-7	2E-9	4E-5	4E-4
63	Europium-148	W, all compounds	1E+3	4E+2	1E-7	5E-10	1E-5	1E-4
63	Europium-149	W, all compounds	1E+4	3E+3	1E-6	4E-9	2E-4	2E-3
63	Europium-150 (12.62 h)	W, all compounds	3E+3	8E+3	4E-6	1E-8	4E-5	4E-4
63	Europium-150 (34.2 y)	W, all compounds	8E+2	2E+1	8E-9	3E-11	1E-5	1E-4
63	Europium-152m	W, all compounds	3E+3	6E+3	3E-6	9E-9	4E-5	4E-4
63	Europium-152	W, all compounds	8E+2	2E+1	1E-8	3E-11	1E-5	1E-4
63	Europium-154	W, all compounds	5E+2	2E+1	8E-9	3E-11	7E-6	7E-5
63	Europium-155	W, all compounds	4E+3	9E+1	4E-8	-	5E-5	5E-4
			-	Bone surf (1E+2)	-	2E-10	-	-
63	Europium-156	W, all compounds	6E+2	5E+2	2E-7	6E-10	8E-6	8E-5
63	Europium-157	W, all compounds	2E+3	5E+3	2E-6	7E-9	3E-5	3E-4
63	Europium-158[2]	W, all compounds	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	 Col. 2 Inhalation ALI (µCi)	 Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	 Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
64	Gadolinium-145[2]	D, all compounds except those given for W	5E+4	2E+5	6E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	6E-4	6E-3
		W, oxides, hydroxides, and fluorides	-	2E+5	7E-5	2E-7	-	-
64	Gadolinium-146	D, see ^{145}Gd	1E+3	1E+2	5E-8	2E-10	2E-5	2E-4
		W, see ^{145}Gd	-	3E+2	1E-7	4E-10	-	-
64	Gadolinium-147	D, see ^{145}Gd	2E+3	4E+3	2E-6	6E-9	3E-5	3E-4
		W, see ^{145}Gd	-	4E+3	1E-6	5E-9	-	-
64	Gadolinium-148	D, see ^{145}Gd	1E+1	8E+3	3E-12	-	-	-
			Bone surf (2E+1)	Bone surf (2E+2)	-	2E-14	3E-7	3E-6
		W, see ^{145}Gd	-	3E-2	1E-11	-	-	-
			-	Bone surf (6E-2)	-	8E-14	-	-
64	Gadolinium-149	D, see ^{145}Gd	3E+3	2E+3	9E-7	3E-9	4E-5	4E-4
		W, see ^{145}Gd	-	2E+3	1E-6	3E-9	-	-
64	Gadolinium-151	D, see ^{145}Gd	6E+3	4E+2	2E-7	-	9E-5	9E-4
			-	Bone surf (6E+2)	-	9E-10	-	-
		W, see ^{145}Gd	-	1E+3	5E-7	2E-9	-	-
64	Gadolinium-152	D, see ^{145}Gd	2E+1	1E-2	4E-12	-	-	-
			Bone surf (3E+1)	Bone surf (2E-2)	-	3E-14	4E-7	4E-6
		W, see ^{145}Gd	-	4E-2	2E-11	-	-	-
			-	Bone surf (8E-2)	-	1E-13	-	-
64	Gadolinium-153	D, see ^{145}Gd	5E+3	1E+2	6E-8	-	6E-5	6E-4
			-	Bone surf (2E+2)	-	3E-10	-	-
		W, see ^{145}Gd	-	6E+2	2E-7	8E-10	-	-
64	Gadolinium-159	D, see ^{145}Gd	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
		W, see ^{145}Gd	-	6E+3	2E-6	8E-9	-	-
65	Terbium-147[2]	W, all compounds	9E+3	3E+4	1E-5	5E-8	1E-4	1E-3
65	Terbium-149	W, all compounds	5E+3	7E+2	3E-7	1E-9	7E-5	7E-4
65	Terbium-150	W, all compounds	5E+3	2E+4	9E-6	3E-8	7E-5	7E-4
65	Terbium-151	W, all compounds	4E+3	9E+3	4E-6	1E-8	5E-5	5E-4
65	Terbium-153	W, all compounds	5E+3	7E+3	3E-6	1E-8	7E-5	7E-4
65	Terbium-154	W, all compounds	2E+3	4E+3	2E-6	6E-9	2E-5	2E-4
65	Terbium-155	W, all compounds	6E+3	8E+3	3E-6	1E-8	8E-5	8E-4
65	Terbium-156m (5.0 h)	W, all compounds	2E+4	3E+4	1E-5	4E-8	2E-4	2E-3

Atomic No.	Radionuclide	Class	**Table I** Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 Inhalation DAC (μCi/ml)	**Table II** Effluent Concentrations Col. 1 Air (μCi/ml)	Col. 2 Water (μCi/ml)	**Table III** Release to Sewers Monthly Average Concentrations (μCi/ml)
65	Terbium-156m (24.4 h)	W, all compounds	7E+3	8E+3	3E-6	1E-8	1E-4	1E-3
65	Terbium-156	W, all compounds	1E+3	1E+3	6E-7	2E-9	1E-5	1E-4
65	Terbium-157	W, all compounds	5E+4	3E+2	1E-7	-	-	-
			LLI wall (5E+4)	Bone surf (6E+2)	-	8E-10	7E-4	7E-3
65	Terbium-158	W, all compounds	1E+3	2E+1	8E-9	3E-11	2E-5	2E-4
65	Terbium-160	W, all compounds	8E+2	2E+2	9E-8	3E-10	1E-5	1E-4
65	Terbium-161	W, all compounds	2E+3	2E+3	7E-7	2E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
66	Dysprosium-155	W, all compounds	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
66	Dysprosium-157	W, all compounds	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
66	Dysprosium-159	W, all compounds	1E+4	2E+3	1E-6	3E-9	2E-4	2E-3
66	Dysprosium-165	W, all compounds	1E+4	5E+4	2E-5	6E-8	2E-4	2E-3
66	Dysprosium-166	W, all compounds	6E+2	7E+2	3E-7	1E-9	-	-
			LLI wall (8E+2)	-	-	-	1E-5	1E-4
67	Holmium-155[2]	W, all compounds	4E+4	2E+5	6E-5	2E-7	6E-4	6E-3
67	Holmium-157[2]	W, all compounds	3E+5	1E+6	6E-4	2E-6	4E-3	4E-2
67	Holmium-159[2]	W, all compounds	2E+5	1E+6	4E-4	1E-6	3E-3	3E-2
67	Holmium-161	W, all compounds	1E+5	4E+5	2E-4	6E-7	1E-3	1E-2
67	Holmium-162m[2]	W, all compounds	5E+4	3E+5	1E-4	4E-7	7E-4	7E-3
67	Holmium-162[2]	W, all compounds	5E+5	2E+6	1E-3	3E-6	-	-
			St wall (8E+5)	-	-	-	1E-2	1E-1
67	Holmium-164m[2]	W, all compounds	1E+5	3E+5	1E-4	4E-7	1E-3	1E-2
67	Holmium-164[2]	W, all compounds	2E+5	6E+5	3E-4	9E-7	-	-
			St wall (2E+5)	-	-	-	3E-3	3E-2
67	Holmium-166m	W, all compounds	6E+2	7E+0	3E-9	9E-12	9E-6	9E-5
67	Holmium-166	W, all compounds	9E+2	2E+3	7E-7	2E-9	-	-
			LLI wall (9E+2)	-	-	-	1E-5	1E-4
67	Holmium-167	W, all compounds	2E+4	6E+4	2E-5	8E-8	2E-4	2E-3
68	Erbium-161	W, all compounds	2E+4	6E+4	3E-5	9E-8	2E-4	2E-3
68	Erbium-165	W, all compounds	6E+4	2E+5	8E-5	3E-7	9E-4	9E-3
68	Erbium-169	W, all compounds	3E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (4E+3)	-	-	-	5E-5	5E-4
68	Erbium-171	W, all compounds	4E+3	1E+4	4E-6	1E-8	5E-5	5E-4
68	Erbium-172	W, all compounds	1E+3	1E+3	6E-7	2E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4

			Table I Occupational Values			Table II Effluent Concentrations		Table III Release to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
			Oral Ingestion	Inhalation				Monthly Average
Atomic No.	Radionuclide	Class	ALI (µCi)	ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	Concentrations (µCi/ml)
69	Thulium-162[2]	W, all compounds	7E+4	3E+5	1E-4	4E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
69	Thulium-166	W, all compounds	4E+3	1E+4	6E-6	2E-8	6E-5	6E-4
69	Thulium-167	W, all compounds	2E+3	2E+3	8E-7	3E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
69	Thulium-170	W, all compounds	8E+2	2E+2	9E-8	3E-10	-	-
			LLI wall (1E+3)	-	-	-	1E-5	1E-4
69	Thulium-171	W, all compounds	1E+4	3E+2	1E-7	-	-	-
			LLI wall (1E+4)	Bone surf (6E+2)	-	8E-10	2E-4	2E-3
69	Thulium-172	W, all compounds	7E+2	1E+3	5E-7	2E-9	-	-
			LLI wall (8E+2)	-	-	-	1E-5	1E-4
69	Thulium-173	W, all compounds	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
69	Thulium-175[2]	W, all compounds	7E+4	3E+5	1E-4	4E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
70	Ytterbium-162[2]	W, all compounds except those given for Y	7E+4	3E+5	1E-4	4E-7	1E-3	1E-2
		Y, oxides, hydroxides, and fluorides	-	3E+5	1E-4	4E-7	-	-
70	Ytterbium-166	W, see ^{162}Yb	1E+3	2E+3	8E-7	3E-9	2E-5	2E-4
		Y, see ^{162}Yb	-	2E+3	8E-7	3E-9	-	-
70	Ytterbium-167[2]	W, see ^{162}Yb	3E+5	8E+5	3E-4	1E-6	4E-3	4E-2
		Y, see ^{162}Yb	-	7E+5	3E-4	1E-6	-	-
70	Ytterbium-169	W, see ^{162}Yb	2E+3	8E+2	4E-7	1E-9	2E-5	2E-4
		Y, see ^{162}Yb	-	7E+2	3E-7	1E-9	-	-
70	Ytterbium-175	W, see ^{162}Yb	3E+3	4E+3	1E-6	5E-9	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
		Y, see ^{162}Yb	-	3E+3	1E-6	5E-9	-	-
70	Ytterbium-177[2]	W, see ^{162}Yb	2E+4	5E+4	2E-5	7E-8	2E-4	2E-3
		Y, see ^{162}Yb	-	5E+4	2E-5	6E-8	-	-
70	Ytterbium-178[2]	W, see ^{162}Yb	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		Y, see ^{162}Yb	-	4E+4	2E-5	5E-8	-	-
71	Lutetium-169	W, all compounds except those given for Y	3E+3	4E+3	2E-6	6E-9	3E-5	3E-4
		Y, oxides, hydroxides, and fluorides	-	4E+3	2E-6	6E-9	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Release to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (µCi)	ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	Concentrations (µCi/ml)
71	Lutetium-170	W, see ^{169}Lu	1E+3	2E+3	9E-7	3E-9	2E-5	2E-4
		Y, see ^{169}Lu	-	2E+3	8E-7	3E-9	-	-
71	Lutetium-171	W, see ^{169}Lu	2E+3	2E+3	8E-7	3E-9	3E-5	3E-4
		Y, see ^{169}Lu	-	2E+3	8E-7	3E-9	-	-
71	Lutetium-172	W, see ^{169}Lu	1E+3	1E+3	5E-7	2E-9	1E-5	1E-4
		Y, see ^{169}Lu	-	1E+3	5E-7	2E-9	-	-
71	Lutetium-173	W, see ^{169}Lu	5E+3	3E+2	1E-7	-	7E-5	7E-4
			-	Bone surf (5E+2)	-	6E-10	-	-
		Y, see ^{169}Lu	-	3E+2	1E-7	4E-10	-	-
71	Lutetium-174m	W, see ^{169}Lu	2E+3	2E+2	1E-7	-	-	-
			LLI wall (3E+3)	Bone surf (3E+2)	-	5E-10	4E-5	4E-4
		Y, see ^{169}Lu	-	2E+2	9E-8	3E-10	-	-
71	Lutetium-174	W, see ^{169}Lu	5E+3	1E+2	5E-8	-	7E-5	7E-4
			-	Bone surf (2E+2)	-	3E-10	-	-
		Y, see ^{169}Lu	-	2E+2	6E-8	2E-10	-	-
71	Lutetium-176m	W, see ^{169}Lu	8E+3	3E+4	1E-5	3E-8	1E-4	1E-3
		Y, see ^{169}Lu	-	2E+4	9E-6	3E-8	-	-
71	Lutetium-176	W, see ^{169}Lu	7E+2	5E+0	2E-9	-	1E-5	1E-4
			-	Bone surf (1E+1)	-	2E-11	-	-
		Y, see ^{169}Lu	-	8E+0	3E-9	1E-11	-	-
71	Lutetium-177m	W, see ^{169}Lu	7E+2	1E+2	5E-8	-	1E-5	1E-4
			-	Bone surf (1E+2)	-	2E-10	-	-
		Y, see ^{169}Lu	-	8E+1	3E-8	1E-10	-	-
71	Lutetium-177	W, see ^{169}Lu	2E+3	2E+3	9E-7	3E-9	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
		Y, see ^{169}Lu	-	2E+3	9E-7	3E-9	-	-
71	Lutetium-178m[2]	W, see ^{169}Lu	5E+4	2E+5	8E-5	3E-7	-	-
			St. wall (6E+4)	-	-	-	8E-4	8E-3
		Y, see ^{169}Lu	-	2E+5	7E-5	2E-7	-	-
71	Lutetium-178[2]	W, see ^{169}Lu	4E+4	1E+5	5E-5	2E-7	-	-
			St. wall (4E+4)	-	-	-	6E-4	6E-3
		Y, see ^{169}Lu	-	1E+5	5E-5	2E-7	-	-
71	Lutetium-179	W, see ^{169}Lu	6E+3	2E+4	8E-6	3E-8	9E-5	9E-4
		Y, see ^{169}Lu	-	2E+4	6E-6	3E-8	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
72	Hafnium-170	D, all compounds except those given for W	3E+3	6E+3	2E-6	8E-9	4E-5	4E-4
		W, oxides, hydroxides, carbides, and nitrates	-	5E+3	2E-6	6E-9	-	-
72	Hafnium-172	D, see ^{170}Hf	1E+3	9E+0	4E-9	-	2E-5	2E-4
			-	Bone surf (2E+1)	-	3E-11	-	-
		W, see ^{170}Hf	-	4E+1	2E-8	-	-	-
			-	Bone surf (6E+1)	-	8E-11	-	-
72	Hafnium-173	D, see ^{170}Hf	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
		W, see ^{170}Hf	-	1E+4	5E-6	2E-8	-	-
72	Hafnium-175	D, see ^{170}Hf	3E+3	9E+2	4E-7	-	4E-5	4E-4
			-	Bone surf (1E+3)	-	1E-9	-	-
		W, see ^{170}Hf	-	1E+3	5E-7	2E-9	-	-
72	Hafnium-177m[2]	D, see ^{170}Hf	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
		W, see ^{170}Hf	-	9E+4	4E-5	1E-7	-	-
72	Hafnium-178m	D, see ^{170}Hf	3E+2	1E+0	5E-10	-	3E-6	3E-5
			-	Bone surf (2E+0)	-	3E-12	-	-
		W, see ^{170}Hf	-	5E+0	2E-9	-	-	-
			-	Bone surf (9E+0)	-	1E-11	-	-
72	Hafnium-179m	D, see ^{170}Hf	1E+3	3E+2	1E-7	-	1E-5	1E-4
			-	Bone surf (6E+2)	-	8E-10	-	-
		W, see ^{170}Hf	-	6E+2	3E-7	8E-10	-	-
72	Hafnium-180m	D, see ^{170}Hf	7E+3	2E+4	9E-6	3E-8	1E-4	1E-3
		W, see ^{170}Hf	-	3E+4	1E-5	4E-8	-	-
72	Hafnium-181	D, see ^{170}Hf	1E+3	2E+2	7E-8	-	2E-5	2E-4
			-	Bone surf (4E+2)	-	6E-10	-	-
		W, see ^{170}Hf	-	4E+2	2E-7	6E-10	-	-
72	Hafnium-182m[2]	D, see ^{170}Hf	4E+4	9E+4	4E-5	1E-7	5E-4	5E-3
		W, see ^{170}Hf	-	1E+5	6E-5	2E-7	-	-
72	Hafnium-182	D, see ^{170}Hf	2E+2	8E-1	3E-10	-	-	-
			Bone surf (4E+2)	Bone surf (2E+0)	-	2E-12	5E-6	5E-5
		W, see ^{170}Hf	-	3E+0	1E-9	-	-	-
			-	Bone surf (7E+0)	-	1E-11	-	-

			Table I Occupational Values			Table II Effluent Concentrations		Table III Release to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
			Oral Ingestion	Inhalation				Monthly Average
Atomic No.	Radionuclide	Class	ALI (µCi)	ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	Concentrations (µCi/ml)
72	Hafnium-183[2]	D, see ^{170}Hf	2E+4	5E+4	2E-5	6E-8	3E-4	3E-3
		W, see ^{170}Hf	-	6E+4	2E-5	8E-8	-	-
72	Hafnium-184	D, see ^{170}Hf	2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
		W, see ^{170}Hf	-	6E+3	3E-6	9E-9	-	-
73	Tantalum-172[2]	W, all compounds except those given for Y	4E+4	1E+5	5E-5	2E-7	5E-4	5E-3
		Y, elemental Ta, oxides, hydroxides, halides, carbides, nitrates, and nitrides	-	1E+5	4E-5	1E-7	-	-
73	Tantalum-173	W, see ^{172}Ta	7E+3	2E+4	8E-6	3E-8	9E-5	9E-4
		Y, see ^{172}Ta	-	2E+4	7E-6	2E-8	-	-
73	Tantalum-174[2]	W, see ^{172}Ta	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3
		Y, see ^{172}Ta	-	9E+4	4E-5	1E-7	-	-
73	Tantalum-175	W, see ^{172}Ta	6E+3	2E+4	7E-6	2E-8	8E-5	8E-4
		Y, see ^{172}Ta	-	1E+4	6E-6	2E-8	-	-
73	Tantalum-176	W, see ^{172}Ta	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
		Y, see ^{172}Ta	-	1E+4	5E-6	2E-8	-	-
73	Tantalum-177	W, see ^{172}Ta	1E+4	2E+4	8E-6	3E-8	2E-4	2E-3
		Y, see ^{172}Ta	-	2E+4	7E-6	2E-8	-	-
73	Tantalum-178	W, see ^{172}Ta	2E+4	9E+4	4E-5	1E-7	2E-4	2E-3
		Y, see ^{172}Ta	-	7E+4	3E-5	1E-7	-	-
73	Tantalum-179	W, see ^{172}Ta	2E+4	5E+3	2E-6	8E-9	3E-4	3E-3
		Y, see ^{172}Ta	-	9E+2	4E-7	1E-9	-	-
73	Tantalum-180m	W, see ^{172}Ta	2E+4	7E+4	3E-5	9E-8	3E-4	3E-3
		Y, see ^{172}Ta	-	6E+4	2E-5	8E-8	-	-
73	Tantalum-180	W, see ^{172}Ta	1E+3	4E+2	2E-7	6E-10	2E-5	2E-4
		Y, see ^{172}Ta	-	2E+1	1E-8	3E-11	-	-
73	Tantalum-182m[2]	W, see ^{172}Ta	2E+5	5E+5	2E-4	8E-7	-	-
			St wall (2E+5)	-	-	-	3E-3	3E-2
		Y, see ^{172}Ta	-	4E+5	2E-4	6E-7	-	-
73	Tantalum-182	W, see ^{172}Ta	8E+2	3E+2	1E-7	5E-10	1E-5	1E-4
		Y, see ^{172}Ta	-	1E+2	6E-8	2E-10	-	-
73	Tantalum-183	W, see ^{172}Ta	9E+2	1E+3	5E-7	2E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ^{172}Ta	-	1E+3	4E-7	1E-9	-	-
73	Tantalum-184	W, see ^{172}Ta	2E+3	5E+3	2E-6	8E-9	3E-5	3E-4
		Y, see ^{172}Ta	-	5E+3	2E-6	7E-9	-	-
73	Tantalum-185[2]	W, see ^{172}Ta	3E+4	7E+4	3E-5	1E-7	4E-4	4E-3
		Y, see ^{172}Ta	-	6E+4	3E-5	9E-8	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
73	Tantalum-186[2]	W, see ^{172}Ta	5E+4	2E+5	1E-4	3E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
		Y, see ^{172}Ta	-	2E+5	9E-5	3E-7	-	-
74	Tungsten-176	D, all compounds	1E+4	5E+4	2E-5	7E-8	1E-4	1E-3
74	Tungsten-177	D, all compounds	2E+4	9E+4	4E-5	1E-7	3E-4	3E-3
74	Tungsten-178	D, all compounds	5E+3	2E+4	8E-6	3E-8	7E-5	7E-4
74	Tungsten-179[2]	D, all compounds	5E+5	2E+6	7E-4	2E-6	7E-3	7E-2
74	Tungsten-181	D, all compounds	2E+4	3E+4	1E-5	5E-8	2E-4	2E-3
74	Tungsten-185	D, all compounds	2E+3	7E+3	3E-6	9E-9	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
74	Tungsten-187	D, all compounds	2E+3	9E+3	4E-6	1E-8	3E-5	3E-4
74	Tungsten-188	D, all compounds	4E+2	1E+3	5E-7	2E-9	-	-
			LLI wall (5E+2)	-	-	-	7E-6	7E-5
75	Rhenium-177[2]	D, all compounds except those given for W	9E+4	3E+5	1E-4	4E-7	-	-
			St wall (1E+5)	-	-	-	2E-3	2E-2
		W, oxides, hydroxides, and nitrates	-	4E+5	1E-4	5E-7	-	-
75	Rhenium-178[2]	D, see ^{177}Re	7E+4	3E+5	1E-4	4E-7	-	-
			St wall (1E+5)	-	-	-	1E-3	1E-2
		W, see ^{177}Re	-	3E+5	1E-4	4E-7	-	-
75	Rhenium-181	D, see ^{177}Re	5E+3	9E+3	4E-6	1E-8	7E-5	7E-4
		W, see ^{177}Re	-	9E+3	4E-6	1E-8	-	-
75	Rhenium-182 (12.7 h)	D, see ^{177}Re	7E+3	1E+4	5E-6	2E-8	9E-5	9E-4
		W, see ^{177}Re	-	2E+4	6E-6	2E-8	-	-
75	Rhenium-182 (64.0 h)	D, see ^{177}Re	1E+3	2E+3	1E-6	3E-9	2E-5	2E-4
		W, see ^{177}Re	-	2E+3	9E-7	3E-9	-	-
75	Rhenium-184m	D, see ^{177}Re	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
		W, see ^{177}Re	-	4E+2	2E-7	6E-10	-	-
75	Rhenium-184	D, see ^{177}Re	2E+3	4E+3	1E-6	5E-9	3E-5	3E-4
		W, see ^{177}Re	-	1E+3	6E-7	2E-9	-	-
75	Rhenium-186m	D, see ^{177}Re	1E+3	2E+3	7E-7	-	-	-
			St wall (2E+3)	St wall (2E+3)	-	3E-9	2E-5	2E-4
		W, see ^{177}Re	-	2E+2	6E-8	2E-10	-	-
75	Rhenium-186	D, see ^{177}Re	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
		W, see ^{177}Re	-	2E+3	7E-7	2E-9	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
75	Rhenium-187	D, see ^{177}Re	6E+5	8E+5	4E-4	-	8E-3	8E-2
			-	St wall (9E+5)	-	1E-6	-	-
		W, see ^{177}Re	-	1E+5	4E-5	1E-7	-	-
75	Rhenium-188m[2]	D, see ^{177}Re	8E+4	1E+5	6E-5	2E-7	1E-3	1E-2
		W, see ^{177}Re	-	1E+5	6E-5	2E-7	-	-
75	Rhenium-188	D, see ^{177}Re	2E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		W, see ^{177}Re	-	3E+3	1E-6	4E-9	-	-
75	Rhenium-189	D, see ^{177}Re	3E+3	5E+3	2E-6	7E-9	4E-5	4E-4
		W, see ^{177}Re	-	4E+3	2E-6	6E-9	-	-
76	Osmium-180[2]	D, all compounds except those given for W and Y	1E+5	4E+5	2E-4	5E-7	1E-3	1E-2
		W, halides and nitrates	-	5E+5	2E-4	7E-7	-	-
		Y, oxides and hydroxides	-	5E+5	2E-4	6E-7	-	-
76	Osmium-181[2]	D, see ^{180}Os	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{180}Os	-	5E+4	2E-5	6E-8	-	-
		Y, see ^{180}Os	-	4E+4	2E-5	6E-8	-	-
76	Osmium-182	D, see ^{180}Os	2E+3	6E+3	2E-6	8E-9	3E-5	3E-4
		W, see ^{180}Os	-	4E+3	2E-6	6E-9	-	-
		Y, see ^{180}Os	-	4E+3	2E-6	6E-9	-	-
76	Osmium-185	D, see ^{180}Os	2E+3	5E+2	2E-7	7E-10	3E-5	3E-4
		W, see ^{180}Os	-	8E+2	3E-7	1E-9	-	-
		Y, see ^{180}Os	-	8E+2	3E-7	1E-9	-	-
76	Osmium-189m	D, see ^{180}Os	8E+4	2E+5	1E-4	3E-7	1E-3	1E-2
		W, see ^{180}Os	-	2E+5	9E-5	3E-7	-	-
		Y, see ^{180}Os	-	2E+5	7E-5	2E-7	-	-
76	Osmium-191m	D, see ^{180}Os	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ^{180}Os	-	2E+4	8E-6	3E-8	-	-
		Y, see ^{180}Os	-	2E+4	7E-6	2E-8	-	-
76	Osmium-191	D, see ^{180}Os	2E+3	2E+3	9E-7	3E-9	-	-
			LLI wall (3E+3)	-	-	-	3E-5	3E-4
		W, see ^{180}Os	-	2E+3	7E-7	2E-9	-	-
		Y, see ^{180}Os	-	1E+3	6E-7	2E-9	-	-
76	Osmium-193	D, see ^{180}Os	2E+3	5E+3	2E-6	6E-9	-	-
			LLI wall (2E+3)	-	-	-	2E-5	2E-4
		W, see ^{180}Os	-	3E+3	1E-6	4E-9	-	-
		Y, see ^{180}Os	-	3E+3	1E-6	4E-9	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
76	Osmium-194	D, see ^{180}Os	4E+2	4E+1	2E-8	6E-11	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
		W, see ^{180}Os	-	6E+1	2E-8	8E-11	-	-
		Y, see ^{180}Os	-	8E+0	3E-9	1E-11	-	-
77	Iridium-182[2]	D, all compounds except those given for W and Y	4E+4	1E+5	6E-5	2E-7	-	-
			St wall (4E+4)	-	-	-	6E-4	6E-3
		W, halides, nitrates, and metallic iridium	-	2E+5	6E-5	2E-7	-	-
		Y, oxides and hydroxides	-	1E+5	5E-5	2E-7	-	-
77	Iridium-184	D, see ^{182}Ir	8E+3	2E+4	1E-5	3E-8	1E-4	1E-3
		W, see ^{182}Ir	-	3E+4	1E-5	5E-8	-	-
		Y, see ^{182}Ir	-	3E+4	1E-5	4E-8	-	-
77	Iridium-185	D, see ^{182}Ir	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
		W, see ^{182}Ir	-	1E+4	5E-6	2E-8	-	-
		Y, see ^{182}Ir	-	1E+4	4E-6	1E-8	-	-
77	Iridium-186	D, see ^{182}Ir	2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
		W, see ^{182}Ir	-	6E+3	3E-6	9E-9	-	-
		Y, see ^{182}Ir	-	6E+3	2E-6	8E-9	-	-
77	Iridium-187	D, see ^{182}Ir	1E+4	3E+4	1E-5	5E-8	1E-4	1E-3
		W, see ^{182}Ir	-	3E+4	1E-5	4E-8	-	-
		Y, see ^{182}Ir	-	3E+4	1E-5	4E-8	-	-
77	Iridium-188	D, see ^{182}Ir	2E+3	5E+3	2E-6	6E-9	3E-5	3E-4
		W, see ^{182}Ir	-	4E+3	1E-6	5E-9	-	-
		Y, see ^{182}Ir	-	3E+3	1E-6	5E-9	-	-
77	Iridium-189	D, see ^{182}Ir	5E+3	5E+3	2E-6	7E-9	-	-
			LLI wall (5E+3)	-	-	-	7E-5	7E-4
		W, see ^{182}Ir	-	4E+3	2E-6	5E-9	-	-
		Y, see ^{182}Ir	-	4E+3	1E-6	5E-9	-	-
77	Iridium-190m[2]	D, see ^{182}Ir	2E+5	2E+5	8E-5	3E-7	2E-3	2E-2
		W, see ^{182}Ir	-	2E+5	9E-5	3E-7	-	-
		Y, see ^{182}Ir	-	2E+5	8E-5	3E-7	-	-
77	Iridium-190	D, see ^{182}Ir	1E+3	9E+2	4E-7	1E-9	1E-5	1E-4
		W, see ^{182}Ir	-	1E+3	4E-7	1E-9	-	-
		Y, see ^{182}Ir	-	9E+2	4E-7	1E-9	-	-
77	Iridium-192m	D, see ^{182}Ir	3E+3	9E+1	4E-8	1E-10	4E-5	4E-4
		W, see ^{182}Ir	-	2E+2	9E-8	3E-10	-	-
		Y, see ^{182}Ir	-	2E+1	6E-9	2E-11	-	-
77	Iridium-192	D, see ^{182}Ir	9E+2	3E+2	1E-7	4E-10	1E-5	1E-4
		W, see ^{182}Ir	-	4E+2	2E-7	6E-10	-	-
		Y, see ^{182}Ir	-	2E+2	9E-8	3E-10	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
77	Iridium-194m	D, see ^{182}Ir	6E+2	9E+1	4E-8	1E-10	9E-6	9E-5
		W, see ^{182}Ir	-	2E+2	7E-8	2E-10	-	-
		Y, see ^{182}Ir	-	1E+2	4E-8	1E-10	-	-
77	Iridium-194	D, see ^{182}Ir	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
		W, see ^{182}Ir	-	2E+3	9E-7	3E-9	-	-
		Y, see ^{182}Ir	-	2E+3	8E-7	3E-9	-	-
77	Iridium-195m	D, see ^{182}Ir	8E+3	2E+4	1E-5	3E-8	1E-4	1E-3
		W, see ^{182}Ir	-	3E+4	1E-5	4E-8	-	-
		Y, see ^{182}Ir	-	2E+4	9E-6	3E-8	-	-
77	Iridium-195	D, see ^{182}Ir	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{182}Ir	-	5E+4	2E-5	7E-8	-	-
		Y, see ^{182}Ir	-	4E+4	2E-5	6E-8	-	-
78	Platinum-186	D, all compounds	1E+4	4E+4	2E-5	5E-8	2E-4	2E-3
78	Platinum-188	D, all compounds	2E+3	2E+3	7E-7	2E-9	2E-5	2E-4
78	Platinum-189	D, all compounds	1E+4	3E+4	1E-5	4E-8	1E-4	1E-3
78	Platinum-191	D, all compounds	4E+3	8E+3	4E-6	1E-8	5E-5	5E-4
78	Platinum-193m	D, all compounds	3E+3	6E+3	3E-6	8E-9	-	-
			LLI wall (3E+4)	-	-	-	4E-5	4E-4
78	Platinum-193	D, all compounds	4E+4	2E+4	1E-5	3E-8	-	-
			LLI wall (5E+4)	-	-	-	6E-4	6E-3
78	Platinum-195m	D, all compounds	2E+3	4E+3	2E-6	6E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
78	Platinum-197m[2]	D, all compounds	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
78	Platinum-197	D, all compounds	3E+3	1E+4	4E-6	1E-8	4E-5	4E-4
78	Platinum-199[2]	D, all compounds	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
78	Platinum-200	D, all compounds	1E+3	3E+3	1E-6	5E-9	2E-5	2E-4
79	Gold-193	D, all compounds except those given for W and Y	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
		W, halides and nitrates	-	2E+4	9E-6	3E-8	-	-
		Y, oxides and hydroxides	-	2E+4	8E-6	3E-8	-	-
79	Gold-194	D, see ^{193}Au	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
		W, see ^{193}Au	-	5E+3	2E-6	8E-9	-	-
		Y, see ^{193}Au	-	5E+3	2E-6	7E-9	-	-
79	Gold-195	D, see ^{193}Au	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
		W, see ^{193}Au	-	1E+3	6E-7	2E-9	-	-
		Y, see ^{193}Au	-	4E+2	2E-7	6E-10	-	-
79	Gold-198m	D, see ^{193}Au	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
		W, see ^{193}Au	-	1E+3	5E-7	2E-9	-	-
		Y, see ^{193}Au	-	1E+3	5E-7	2E-9	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
79	Gold-198	D, see ^{193}Au	1E+3	4E+3	2E-6	5E-9	2E-5	2E-4
		W, see ^{193}Au	-	2E+3	8E-7	3E-9	-	-
		Y, see ^{193}Au	-	2E+3	7E-7	2E-9	-	-
79	Gold-199	D, see ^{193}Au	3E+3	9E+3	4E-6	1E-8	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
		W, see ^{193}Au	-	4E+3	2E-6	6E-9	-	-
		Y, see ^{193}Au	-	4E+3	2E-6	5E-9	-	-
79	Gold-200m	D, see ^{193}Au	1E+3	4E+3	1E-6	5E-9	2E-5	2E-4
		W, see ^{193}Au	-	3E+3	1E-6	4E-9	-	-
		Y, see ^{193}Au	-	2E+4	1E-6	3E-9	-	-
79	Gold-200[2]	D, see ^{193}Au	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
		W, see ^{193}Au	-	8E+4	3E-5	1E-7	-	-
		Y, see ^{193}Au	-	7E+4	3E-5	1E-7	-	-
79	Gold-201[2]	D, see ^{193}Au	7E+4	2E+5	9E-5	3E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
		W, see ^{193}Au	-	2E+5	1E-4	3E-7	-	-
		Y, see ^{193}Au	-	2E+5	9E-5	3E-7	-	-
80	Mercury-193m	Vapor	-	8E+3	4E-6	1E-8	-	-
		Organic D	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		D, sulfates	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		W, oxides, hydroxides, halides, nitrates, and sulfides	-	8E+3	3E-6	1E-8	-	-
80	Mercury-193	Vapor	-	3E+4	1E-5	4E-8	-	-
		Organic D	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		D, see ^{193m}Hg	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{193m}Hg	-	4E+4	2E-5	6E-8	-	-
80	Mercury-194	Vapor	-	3E+1	1E-8	4E-11	-	-
		Organic D	2E+1	3E+1	1E-8	4E-11	2E-7	2E-6
		D, see ^{193m}Hg	8E+2	4E+1	2E-8	6E-11	1E-5	1E-4
		W, see ^{193m}Hg	-	1E+2	5E-8	2E-10	-	-
80	Mercury-195m	Vapor	-	4E+3	2E-6	6E-9	-	-
		Organic D	3E+3	6E+3	3E-6	8E-9	4E-5	4E-4
		D, see ^{193m}Hg	2E+3	5E+3	2E-6	7E-9	3E-5	3E-4
		W, see ^{193m}Hg	-	4E+3	2E-6	5E-9	-	-
80	Mercury-195	Vapor	-	3E+4	1E-5	4E-8	-	-
		Organic D	2E+4	5E+4	2E-5	6E-8	2E-4	2E-3
		D, see ^{193m}Hg	1E+4	4E+4	1E-5	5E-8	2E-4	2E-3
		W, see ^{193m}Hg	-	3E+4	1E-5	5E-8	-	-
80	Mercury-197m	Vapor	-	5E+3	2E-6	7E-9	-	-
		Organic D	4E+3	9E+3	4E-6	1E-8	5E-5	5E-4
		D, see ^{193m}Hg	3E+3	7E+3	3E-6	1E-8	4E-5	4E-4
		W, see ^{193m}Hg	-	5E+3	2E-6	7E-9	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
80	Mercury-197	Vapor	-	8E+3	4E-6	1E-8	-	-
		Organic D	7E+3	1E+4	6E-6	2E-8	9E-5	9E-4
		D, see ^{193m}Hg	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
		W, see ^{193m}Hg	-	9E+3	4E-6	1E-8	-	-
80	Mercury-199m[2]	Vapor	-	8E+4	3E-5	1E-7	-	-
		Organic D	6E+4	2E+5	7E-5	2E-7	-	-
			St wall (1E+5)	-	-	-	1E-3	1E-2
		D, see ^{193m}Hg	6E+4	1E+5	6E-5	2E-7	8E-4	8E-3
		W, see ^{193m}Hg	-	2E+5	7E-5	2E-7	-	-
80	Mercury-203	Vapor	-	8E+2	4E-7	1E-9	-	-
		Organic D	5E+2	8E+2	3E-7	1E-9	7E-6	7E-5
		D, see ^{193m}Hg	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
		W, see ^{193m}Hg	-	1E+3	5E-7	2E-9	-	-
81	Thallium-194m[2]	D, all compounds	5E+4	2E+5	6E-5	2E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
81	Thallium-194[2]	D, all compounds	3E+5	6E+5	2E-4	8E-7	-	-
			St wall (3E+5)	-	-	-	4E-3	4E-2
81	Thallium-195[2]	D, all compounds	6E+4	1E+5	5E-5	2E-7	9E-4	9E-3
81	Thallium-197	D, all compounds	7E+4	1E+5	5E-5	2E-7	1E-3	1E-2
81	Thallium-198m[2]	D, all compounds	3E+4	5E+4	2E-5	8E-8	4E-4	4E-3
81	Thallium-198	D, all compounds	2E+4	3E+4	1E-5	5E-8	3E-4	3E-3
81	Thallium-199	D, all compounds	6E+4	8E+4	4E-5	1E-7	9E-4	9E-3
81	Thallium-200	D, all compounds	8E+3	1E+4	5E-6	2E-8	1E-4	1E-3
81	Thallium-201	D, all compounds	2E+4	2E+4	9E-6	3E-8	2E-4	2E-3
81	Thallium-202	D, all compounds	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
81	Thallium-204	D, all compounds	2E+3	2E+3	9E-7	3E-9	2E-5	2E-4
82	Lead-195m[2]	D, all compounds	6E+4	2E+5	8E-5	3E-7	8E-4	8E-3
82	Lead-198	D, all compounds	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
82	Lead-199[2]	D, all compounds	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
82	Lead-200	D, all compounds	3E+3	6E+3	3E-6	9E-9	4E-5	4E-4
82	Lead-201	D, all compounds	7E+3	2E+4	8E-6	3E-8	1E-4	1E-3
82	Lead-202m	D, all compounds	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
82	Lead-202	D, all compounds	1E+2	5E+1	2E-8	7E-11	2E-6	2E-5
82	Lead-203	D, all compounds	5E+3	9E+3	4E-6	1E-8	7E-5	7E-4
82	Lead-205	D, all compounds	4E+3	1E+3	6E-7	2E-9	5E-5	5E-4
82	Lead-209	D, all compounds	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
82	Lead-210	D, all compounds	6E-1	2E-1	1E-10	-	-	-
			Bone surf (1E+0)	Bone surf (4E-1)	-	6E-13	1E-8	1E-7
82	Lead-211[2]	D, all compounds	1E+4	6E+2	3E-7	9E-10	2E-4	2E-3

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
82	Lead-212	D, all compounds	8E+1	3E+1	1E-8	5E-11	-	-
			Bone surf (1E+2)	-	-	-	2E-6	2E-5
82	Lead-214[2]	D, all compounds	9E+3	8E+2	3E-7	1E-9	1E-4	1E-3
83	Bismuth-200[2]	D, nitrates	3E+4	8E+4	4E-5	1E-7	4E-4	4E-3
		W, all other compounds	-	1E+5	4E-5	1E-7	-	-
83	Bismuth-201[2]	D, see ^{200}Bi	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ^{200}Bi	-	4E+4	2E-5	5E-8	-	-
83	Bismuth-202[2]	D, see ^{200}Bi	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{200}Bi	-	8E+4	3E-5	1E-7	-	-
83	Bismuth-203	D, see ^{200}Bi	2E+3	7E+3	3E-6	9E-9	3E-5	3E-4
		W, see ^{200}Bi	-	6E+3	3E-6	9E-9	-	-
83	Bismuth-205	D, see ^{200}Bi	1E+3	3E+3	1E-6	3E-9	2E-5	2E-4
		W, see ^{200}Bi	-	1E+3	5E-7	2E-9	-	-
83	Bismuth-206	D, see ^{200}Bi	6E+2	1E+3	6E-7	2E-9	9E-6	9E-5
		W, see ^{200}Bi	-	9E+2	4E-7	1E-9	-	-
83	Bismuth-207	D, see ^{200}Bi	1E+3	2E+3	7E-7	2E-9	1E-5	1E-4
		W, see ^{200}Bi	-	4E+2	1E-7	5E-10	-	-
83	Bismuth-210m	D, see ^{200}Bi	4E+1	5E+0	2E-9	-	-	-
			Kidneys (6E+1)	Kidneys (6E+0)	-	9E-12	8E-7	8E-6
		W, see ^{200}Bi	-	7E-1	3E-10	9E-13	-	-
83	Bismuth-210	D, see ^{200}Bi	8E+2	2E+2	1E-7	-	1E-5	1E-4
			-					
			-	Kidneys (4E+2)	-	5E-10	-	-
		W, see ^{200}Bi	-	3E+1	1E-8	4E-11	-	-
83	Bismuth-212[2]	D, see ^{200}Bi	5E+3	2E+2	1E-7	3E-10	7E-5	7E-4
		W, see ^{200}Bi	-	3E+2	1E-7	4E-10	-	-
83	Bismuth-213[2]	D, see ^{200}Bi	7E+3	3E+2	1E-7	4E-10	1E-4	1E-3
		W, see ^{200}Bi	-	4E+2	1E-7	5E-10	-	-
83	Bismuth-214[2]	D, see ^{200}Bi	2E+4	8E+2	3E-7	1E-9	-	-
			St wall (2E+4)	-	-	-	3E-4	3E-3
		W, see ^{200}Bi	-	9E-2	4E-7	1E-9	-	-
84	Polonium-203[2]	D, all compounds except those given for W	3E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		W, oxides, hydroxides, and nitrates	-	9E+4	4E-5	1E-7	-	-
84	Polonium-205[2]	D, see ^{203}Po	2E+4	4E+4	2E-5	5E-8	3E-4	3E-3
		W, see ^{203}Po	-	7E+4	3E-5	1E-7	-	-
84	Polonium-207	D, see ^{203}Po	8E+3	3E+4	1E-5	3E-8	1E-4	1E-3
		W, see ^{203}Po	-	3E+4	1E-5	4E-8	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
84	Polonium-210	D, see ^{203}Po	3E+0	6E-1	3E-10	9E-13	4E-8	4E-7
		W, see ^{203}Po	-	6E-1	3E-10	9E-13	-	-
85	Astatine-207[2]	D, halides	6E+3	3E+3	1E-6	4E-9	8E-5	8E-4
		W	-	2E+3	9E-7	3E-9	-	-
85	Astatine-211	D, halides	1E+2	8E+1	3E-8	1E-10	2E-6	2E-5
		W	-	5E+1	2E-8	8E-11	-	-
86	Radon-220	With daughters removed	-	2E+4	7E-6	2E-8	-	-
		With daughters present	-	2E+1 (or 12 working level months)	9E-9 (or 1.0 working level)	3E-11	-	-
86	Radon-222	With daughters removed	-	1E+4	4E-6	1E-8	-	-
		With daughters present	-	1E+2 (or 4 working level months)	3E-8 (or 0.33 working level)	1E-10	-	-
87	Francium-222[2]	D, all compounds	2E+3	5E+2	2E-7	6E-10	3E-5	3E-4
87	Francium-223[2]	D, all compounds	6E+2	8E+2	3E-7	1E-9	8E-6	8E-5
88	Radium-223	W, all compounds	5E+0	7E-1	3E-10	9E-13	-	-
			Bone surf (9E+0)	-	-	-	1E-7	1E-6
88	Radium-224	W, all compounds	8E+0	2E+0	7E-10	2E-12	-	-
			Bone surf (2E+1)	-	-	-	2E-7	2E-6
88	Radium-225	W, all compounds	8E+0	7E-1	3E-10	9E-13	-	-
			Bone surf (2E+1)	-	-	-	2E-7	2E-6
88	Radium-226	W, all compounds	2E+0	6E-1	3E-10	9E-13	-	-
			Bone surf (5E+0)	-	-	-	6E-8	6E-7
88	Radium-227[2]	W, all compounds	2E+4	1E+4	6E-6	-	-	-
			Bone surf (2E+4)	Bone surf (2E+4)	-	3E-8	3E-4	3E-3
88	Radium-228	W, all compounds	2E+0	1E+0	5E-10	2E-12	-	-
			Bone surf (4E+0)	-	-	-	6E-8	6E-7

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
89	Actinium-224	D, all compounds except those given for W and Y	2E+3	3E+1	1E-8	-	-	-
			LLI wall (2E+3)	Bone surf (4E+1)	-	5E-11	3E-5	3E-4
		W, halides and nitrates	-	5E+1	2E-8	7E-11	-	-
		Y, oxides and hydroxides	-	5E+1	2E-8	6E-11	-	-
89	Actinium-225	D, see ^{224}Ac	5E+1	3E-1	1E-10	-	-	-
			LLI wall (5E+1)	Bone surf (5E-1)	-	7E-13	7E-7	7E-6
		W, see ^{224}Ac	-	6E-1	3E-10	9E-13	-	-
		Y, see ^{224}Ac	-	6E-1	3E-10	9E-13	-	-
89	Actinium-226	D, see ^{224}Ac	1E+2	3E+0	1E-9	-	-	-
			LLI wall (1E+2)	Bone surf (4E+0)	-	5E-12	2E-6	2E-5
		W, see ^{224}Ac	-	5E+0	2E-9	7E-12	-	-
		Y, see ^{224}Ac	-	5E+0	2E-9	6E-12	-	-
89	Actinium-227	D, see ^{224}Ac	2E-1	4E-4	2E-13	-	-	-
			Bone surf (4E-1)	Bone surf (8E-4)	-	1E-15	5E-9	5E-8
		W, see ^{224}Ac	-	2E-3	7E-13	-	-	-
			-	Bone surf (3E-3)	-	4E-15	-	-
		Y, see ^{224}Ac	-	4E-3	2E-12	6E-15	-	-
89	Actinium-228	D, see ^{224}Ac	2E+3	9E+0	4E-9	-	3E-5	3E-4
			-	Bone surf (2E+1)	-	2E-11	-	-
		W, see ^{224}Ac	-	4E+1	2E-8	-	-	-
			-	Bone surf (6E+1)	-	8E-11	-	-
		Y, see ^{224}Ac	-	4E+1	2E-8	6E-11	-	-
90	Thorium-226[2]	W, all compounds except those given for Y	5E+3	2E+2	6E-8	2E-10	-	-
			St wall (5E+3)	-	-	-	7E-5	7E-4
		Y, oxides and hydroxides	-	1E+2	6E-8	2E-10	-	-
90	Thorium-227	W, see ^{226}Th	1E+2	3E-1	1E-10	5E-13	2E-6	2E-5
		Y, see ^{226}Th	-	3E-1	1E-10	5E-13	-	-
90	Thorium-228	W, see ^{226}Th	6E+0	1E-2	4E-12	-	-	-
			Bone surf (1E+1)	Bone surf (2E-2)	-	3E-14	2E-7	2E-6
		Y, see ^{226}Th	-	2E-2	7E-12	2E-14	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
90	Thorium-229	W, see ^{226}Th	6E-1	9E-4	4E-13	-	-	-
			Bone surf (1E+0)	Bone surf (2E-3)	-	3E-15	2E-8	2E-7
		Y, see ^{226}Th	-	2E-3	1E-12	-	-	-
			-	Bone surf (3E-3)	-	4E-15	-	-
90	Thorium-230	W, see ^{226}Th	4E+0	6E-3	3E-12	-	-	-
			Bone surf (9E+0)	Bone surf (2E-2)	-	2E-14	1E-7	1E-6
		Y, see ^{226}Th	-	2E-2	6E-12	-	-	-
			-	Bone surf (2E-2)	-	3E-14	-	-
90	Thorium-231	W, see ^{226}Th	4E+3	6E+3	3E-6	9E-9	5E-5	5E-4
		Y, see ^{226}Th	-	6E+3	3E-6	9E-9	-	-
90	Thorium-232	W, see ^{226}Th	7E-1	1E-3	5E-13	-	-	-
			Bone surf (2E+0)	Bone surf (3E-3)	-	4E-15	3E-8	3E-7
		Y, see ^{226}Th	-	3E-3	1E-12	-	-	-
			-	Bone surf (4E-3)	-	6E-15	-	-
90	Thorium-234	W, see ^{226}Th	3E+2	2E+2	8E-8	3E-10	-	-
			LLI wall (4E+2)	-	-	-	5E-6	5E-5
		Y, see ^{226}Th	-	2E+2	6E-8	2E-10	-	-
91	Protactinium-227[2]	W, all compounds except those given for Y	4E+3	1E+2	5E-8	2E-10	5E-5	5E-4
		Y, oxides and hydroxides	-	1E+2	4E-8	1E-10	-	-
91	Protactinium-228	W, see ^{227}Pa	1E+3	1E+1	5E-9	-	2E-5	2E-4
			-	Bone surf (2E+1)	-	3E-11	-	-
		Y, see ^{227}Pa	-	1E+1	5E-9	2E-11	-	-
91	Protactinium-230	W, see ^{227}Pa	6E+2	5E+0	2E-9	7E-12	-	-
			Bone surf (9E+2)	-	-	-	1E-5	1E-4
		Y, see ^{227}Pa	-	4E+0	1E-9	5E-12	-	-
91	Protactinium-231	W, see ^{227}Pa	2E-1	2E-3	6E-13	-	-	-
			Bone surf (5E-1)	Bone surf (4E-3)	-	6E-15	6E-9	6E-8
		Y, see ^{227}Pa	-	4E-3	2E-12	-	-	-
			-	Bone surf (6E-3)	-	8E-15	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values: Col. 1 Oral Ingestion ALI (μCi)	Table I: Col. 2 Inhalation ALI (μCi)	Table I: Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations: Col. 1 Air (μCi/ml)	Table II: Col. 2 Water (μCi/ml)	Table III Release to Sewers: Monthly Average Concentrations (μCi/ml)
91	Protactinium-232	W, see ^{227}Pa	1E+3	2E+1	9E-9	-	2E-5	2E-4
			-	Bone surf (6E+1)	-	8E-11	-	-
		Y, see ^{227}Pa	-	6E+1	2E-8	-	-	-
			-	Bone surf (7E+1)	-	1E-10	-	-
91	Protactinium-233	W, see ^{227}Pa	1E+3	7E+2	3E-7	1E-9	-	-
			LLI wall (2E+3)	-	-	-	2E-5	2E-4
		Y, see ^{227}Pa	-	6E+2	2E-7	8E-10	-	-
91	Protactinium-234	W, see ^{227}Pa	2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
		Y, see ^{227}Pa	-	7E+3	3E-6	9E-9	-	-
92	Uranium-230	D, UF, UOF, UO(NO)	4E+0	4E-1	2E-10	-	-	-
			Bone surf (6E+0)	Bone surf (6E-1)	-	8E-13	8E-8	8E-7
		W, UO, UF, UCl	-	4E-1	1E-10	5E-13	-	-
		Y, UO, UO	-	3E-1	1E-10	4E-13	-	-
92	Uranium-231	D, see ^{230}U	5E+3	8E+3	3E-6	1E-8	-	-
			LLI wall (4E+3)	-	-	-	6E-5	6E-4
		W, see ^{230}U	-	6E+3	2E-6	8E-9	-	-
		Y, see ^{230}U	-	5E+3	2E-6	6E-9	-	-
92	Uranium-232	D, see ^{230}U	2E+0	2E-1	9E-11	-	-	-
			Bone surf (4E+0)	Bone surf (4E-1)	-	6E-13	6E-8	6E-7
		W, see ^{230}U	-	4E-1	2E-10	5E-13	-	-
		Y, see ^{230}U	-	8E-3	3E-12	1E-14	-	-
92	Uranium-233	D, see ^{230}U	1E+1	1E+0	5E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ^{230}U	-	7E-1	3E-10	1E-12	-	-
		Y, see ^{230}U	-	4E-2	2E-11	5E-14	-	-
92	Uranium-234[3]	D, see ^{230}U	1E+1	1E+0	5E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ^{230}U	-	7E-1	3E-10	1E-12	-	-
		Y, see ^{230}U	-	4E-2	2E-11	5E-14	-	-
92	Uranium-235[3]	D, see ^{230}U	1E+1	1E+0	6E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ^{230}U	-	8E-1	3E-10	1E-12	-	-
		Y, see ^{230}U	-	4E-2	2E-11	6E-14	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
92	Uranium-236	D, see ^{230}U	1E+1	1E+0	5E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ^{230}U	-	8E-1	3E-10	1E-12	-	-
		Y, see ^{230}U	-	4E-2	2E-11	6E-14	-	-
92	Uranium-237	D, see ^{230}U	2E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
		W, see ^{230}U	-	2E+3	7E-7	2E-9	-	-
		Y, see ^{230}U	-	2E+3	6E-7	2E-9	-	-
92	Uranium-238[3]	D, see ^{230}U	1E+1	1E+0	6E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ^{230}U	-	-	3E-10	1E-12	-	-
		Y, see ^{230}U	-	4E-2	2E-11	6E-14	-	-
92	Uranium-239[2]	D, see ^{230}U	7E+4	2E+5	8E-5	3E-7	9E-4	9E-3
		W, see ^{230}U	-	2E+5	7E-5	2E-7	-	-
		Y, see ^{230}U	-	2E+5	6E-5	2E-7	-	-
92	Uranium-240	D, see ^{230}U	1E+3	4E+3	2E-6	5E-9	2E-5	2E-4
		W, see ^{230}U	-	3E+3	1E-6	4E-9	-	-
		Y, see ^{230}U	-	2E+3	1E-6	3E-9	-	-
92	Uranium-natural[3]	D, see ^{230}U	1E+1	1E+0	5E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ^{230}U	-	8E-1	3E-10	9E-13	-	-
		Y, see ^{230}U	-	5E-2	2E-11	9E-14	-	-
93	Neptunium-232[2]	W, all compounds	1E+5	2E+3	7E-7	-	2E-3	2E-2
			-	Bone surf (5E+2)	-	6E-9	-	-
93	Neptunium-233[2]	W, all compounds	8E+5	3E+6	1E-3	4E-6	1E-2	1E-1
93	Neptunium-234	W, all compounds	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
93	Neptunium-235	W, all compounds	2E+4	8E+2	3E-7	-	-	-
			LLI wall (2E+4)	Bone surf (1E+3)	-	2E-9	3E-4	3E-3
93	Neptunium-236 (1.15E+5 y)	W, all compounds	3E+0	2E-2	9E-12	-	-	-
			Bone surf (6E+0)	Bone surf (5E-2)	-	8E-14	9E-8	9E-7
93	Neptunium-236 (22.5 h)	W, all compounds	3E+3	3E+1	1E-8	-	-	-
			Bone surf (4E+3)	Bone surf (7E+1)	-	1E-10	5E-5	5E-4
93	Neptunium-237	W, all compounds	5E-1	4E-3	2E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	1E-14	2E-8	2E-7

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Col. 2 Inhalation ALI (µCi)	Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
93	Neptunium-238	W, all compounds	1E+3	6E+1	3E-8	-	2E-5	2E-4
			-	Bone surf (2E+2)	-	2E-10	-	-
93	Neptunium-239	W, all compounds	2E+3	2E+3	9E-7	3E-9	-	-
			LLI wall (2E+3)	-	-	-	2E-5	2E-4
93	Neptunium-240[2]	W, all compounds	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
94	Plutonium-234	W, all compounds except PuO	8E+3	2E+2	9E-8	3E-10	1E-4	1E-3
		Y, PuO	-	2E+2	8E-8	3E-10	-	-
94	Plutonium-235[2]	W, see ^{234}Pu	9E+5	3E+6	1E-3	4E-6	1E-2	1E-1
		Y, see ^{234}Pu	-	3E+6	1E-3	3E-6	-	-
94	Plutonium-236	W, see ^{234}Pu	2E+0	2E-2	8E-12	-	-	-
			Bone surf (4E+0)	Bone surf (4E-2)	-	5E-14	6E-8	6E-7
		Y, see ^{234}Pu	-	4E-2	2E-11	6E-14	-	-
94	Plutonium-237	W, see ^{234}Pu	1E+4	3E+3	1E-6	5E-9	2E-4	2E-3
		Y, see ^{234}Pu	-	3E+3	1E-6	4E-9	-	-
94	Plutonium-238	W, see ^{234}Pu	9E-1	7E-3	3E-12	-	-	-
			Bone surf (2E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
		Y, see ^{234}Pu	-	2E-2	8E-12	2E-14	-	-
94	Plutonium-239	W, see ^{234}Pu	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
		Y, see ^{234}Pu	-	2E-2	7E-12	-	-	-
			-	Bone surf (2E-2)	-	2E-14	-	-
94	Plutonium-240	W, see ^{234}Pu	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
		Y, see ^{234}Pu	-	2E-2	7E-12	-	-	-
			-	Bone surf (2E-2)	-	2E-14	-	-
94	Plutonium-241	W, see ^{234}Pu	4E+1	3E-1	1E-10	-	-	-
			Bone surf (7E+1)	Bone surf (6E-1)	-	8E-13	1E-6	1E-5
		Y, see ^{234}Pu	-	8E-1	3E-10	-	-	-
			-	Bone surf (1E+0)	-	1E-12	-	-
94	Plutonium-242	W, see ^{234}Pu	8E-1	7E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
		Y, see ^{234}Pu	-	2E-2	7E-12	-	-	-
			-	Bone surf (2E-2)	-	2E-14	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
94	Plutonium-243	W, see ^{234}Pu	2E+4	4E+4	2E-5	5E-8	2E-4	2E-3
		Y, see ^{234}Pu	-	4E+4	2E-5	5E-8	-	-
94	Plutonium-244	W, see ^{234}Pu	8E-1	7E-3	3E-12	-	-	-
			Bone surf (2E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
		Y, see ^{234}Pu	-	2E-2	7E-12	-	-	-
			-	Bone surf (2E-2)	-	2E-14	-	-
94	Plutonium-245	W, see ^{234}Pu	2E+3	5E+3	2E-6	6E-9	3E-5	3E-4
		Y, see ^{234}Pu	-	4E+3	2E-6	6E-9	-	-
94	Plutonium-246	W, see ^{234}Pu	4E+2	3E+2	1E-7	4E-10	-	-
			LLI wall (4E+2)	-	-	-	6E-6	6E-5
		Y, see ^{234}Pu	-	3E+2	1E-7	4E-10	-	-
95	Americium-237[2]	W, all compounds	8E+4	3E+5	1E-4	4E-7	1E-3	1E-2
95	Americium-238[2]	W, all compounds	4E+4	3E+3	1E-6	-	5E-4	5E-3
			-	Bone surf (6E+3)	-	9E-9	-	-
95	Americium-239	W, all compounds	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
95	Americium-240	W, all compounds	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
95	Americium-241	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
95	Americium-242m	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
95	Americium-242	W, all compounds	4E+3	8E+1	4E-8	-	5E-5	5E-4
			-	Bone surf (9E+1)	-	1E-10	-	-
95	Americium-243	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
95	Americium-244m[2]	W, all compounds	6E+4	4E+3	2E-6	-	-	-
			St wall (8E+4)	Bone surf (7E+3)	-	1E-8	1E-3	1E-2
95	Americium-244	W, all compounds	3E+3	2E+2	8E-8	-	4E-5	4E-4
			-	Bone surf (3E+2)	-	4E-10	-	-
95	Americium-245	W, all compounds	3E+4	8E+4	3E-5	1E-7	4E-4	4E-3
95	Americium-246m[2]	W, all compounds	5E+4	2E+5	8E-5	3E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
95	Americium-246[2]	W, all compounds	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3
96	Curium-238	W, all compounds	2E+4	1E+3	5E-7	2E-9	2E-4	2E-3

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Occupational Values Col. 2 Inhalation ALI (μCi)	Table I Occupational Values Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Effluent Concentrations Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
96	Curium-240	W, all compounds	6E+1	6E-1	2E-10	-	-	-
			Bone surf (8E+1)	Bone surf (6E-1)	-	9E-13	1E-6	1E-5
96	Curium-241	W, all compounds	1E+3	3E+1	1E-8	-	2E-5	2E-4
			-	Bone surf (4E+1)	-	5E-11	-	-
96	Curium-242	W, all compounds	3E+1	3E-1	1E-10	-	-	-
			Bone surf (5E+1)	Bone surf (3E-1)	-	4E-13	7E-7	7E-6
96	Curium-243	W, all compounds	1E+0	9E-3	4E-12	-	-	-
			Bone surf (2E+0)	Bone surf (2E-2)	-	2E-14	3E-8	3E-7
96	Curium-244	W, all compounds	1E+0	1E-2	5E-12	-	-	-
			Bone surf (3E+0)	Bone surf (2E-2)	-	3E-14	3E-8	3E-7
96	Curium-245	W, all compounds	7E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
96	Curium-246	W, all compounds	7E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
96	Curium-247	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
96	Curium-248	W, all compounds	2E-1	2E-3	7E-13	-	-	-
			Bone surf (4E-1)	Bone surf (3E-3)	-	4E-15	5E-9	5E-8
96	Curium-249[2]	W, all compounds	5E+4	2E+4	7E-6	-	7E-4	7E-3
			-	Bone surf (3E+4)	-	4E-8	-	-
96	Curium-250	W, all compounds	4E-2	3E-4	1E-13	-	-	-
			Bone surf (6E-2)	Bone surf (5E-4)	-	8E-16	9E-10	9E-9
97	Berkelium-245	W, all compounds	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
97	Berkelium-246	W, all compounds	3E+3	3E+3	1E-6	4E-9	4E-5	4E-4
97	Berkelium-247	W, all compounds	5E-1	4E-3	2E-12	-	-	-
			Bone surf (1E+0)	Bone surf (9E-3)	-	1E-14	2E-8	2E-7
97	Berkelium-249	W, all compounds	2E+2	2E+0	7E-10	-	-	-
			Bone surf (5E+2)	Bone surf (4E+0)	-	5E-12	6E-6	6E-5
97	Berkelium-250	W, all compounds	9E+3	3E+2	1E-7	-	1E-4	1E-3
			-	Bone surf (7E+2)	-	1E-9	-	-

			Table I Occupational Values			Table II Effluent Concentrations		Table III Release to Sewers
			Col. 1 Oral Ingestion	Col. 2 Inhalation	Col. 3 Inhalation	Col. 1	Col. 2	Monthly Average Concentrations
Atomic No.	**Radionuclide**	**Class**	ALI (µCi)	ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	(µCi/ml)
98	Californium-244[2]	W, all compounds except those given for Y	3E+4	6E+2	2E-7	8E-10	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		Y, oxides and hydroxides	-	6E+2	2E-7	8E-10	-	-
98	Californium-246	W, see ^{244}Cf	4E+2	9E+0	4E-9	1E-11	5E-6	5E-5
		Y, see ^{244}Cf	-	9E+0	4E-9	1E-11	-	-
98	Californium-248	W, see ^{244}Cf	8E+0	6E-2	3E-11	-	-	-
			Bone surf (2E+1)	Bone surf (1E-1)	-	2E-13	2E-7	2E-6
		Y, see ^{244}Cf	-	1E-1	4E-11	1E-13	-	-
98	Californium-249	W, see ^{244}Cf	5E-1	4E-3	2E-12	-	-	-
			Bone surf (1E+0)	Bone surf (9E-3)	-	1E-14	2E-8	2E-7
		Y, see ^{244}Cf	-	1E-2	4E-12	-	-	-
			-	Bone surf (1E-2)	-	2E-14	-	-
98	Californium-250	W, see ^{244}Cf	1E+0	9E-3	4E-12	-	-	
			Bone surf (2E+0)	Bone surf (2E-2)	-	3E-14	3E-8	3E-7
		Y, see ^{244}Cf	-	3E-2	1E-11	4E-14	-	-
98	Californium-251	W, see ^{244}Cf	5E-1	4E-3	2E-12	-	-	-
			Bone surf (1E+0)	Bone surf (9E-3)	-	1E-14	2E-8	2E-7
		Y, see ^{244}Cf	-	1E-2	4E-12	-	-	-
			-	Bone surf (1E-2)	-	2E-14	-	-
98	Californium-252	W, see ^{244}Cf	2E+0	2E-2	8E-12	-	-	-
			Bone surf (5E+0)	Bone surf (4E-2)	-	5E-14	7E-8	7E-7
		Y, see ^{244}Cf	-	3E-2	1E-11	5E-14	-	-
98	Californium-253	W, see ^{244}Cf	2E+2	2E+0	8E-10	3E-12	-	-
			Bone surf (4E+2)	-	-	-	5E-6	5E-5
		Y, see ^{244}Cf	-	2E+0	7E-10	2E-12	-	-
98	Californium-254	W, see ^{244}Cf	2E+0	2E-2	9E-12	3E-14	3E-8	3E-7
		Y, see ^{244}Cf	-	2E-2	7E-12	2E-14	-	-
99	Einsteinium-250	W, all compounds	4E+4	5E+2	2E-7	-	6E-4	6E-3
			-	Bone surf (1E+3)	-	2E-9	-	-
99	Einsteinium-251	W, all compounds	7E+3	9E+2	4E-7	-	1E-4	1E-3
			-	Bone surf (1E+3)	-	2E-9	-	-
99	Einsteinium-253	W, all compounds	2E+2	1E+0	6E-10	2E-12	2E-6	2E-5

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
99	Einsteinium-254m	W, all compounds	3E+2	1E+1	4E-9	1E-11	-	-
			Bone surf (3E+2)	-	-	-	4E-6	4E-5
99	Einsteinium-254	W, all compounds	8E+0	7E-2	3E-11	-	-	-
			Bone surf (2E+1)	Bone surf (1E-1)	-	2E-13	2E-7	2E-6
100	Fermium-252	W, all compounds	5E+2	1E+1	5E-9	2E-11	6E-6	6E-5
100	Fermium-253	W, all compounds	1E+3	1E+1	4E-9	1E-11	1E-5	1E-4
100	Fermium-254	W, all compounds	3E+3	9E+1	4E-8	1E-10	4E-5	4E-4
100	Fermium-255	W, all compounds	5E+2	2E+1	9E-9	3E-11	7E-6	7E-5
100	Fermium-257	W, all compounds	2E+1	2E-1	7E-11	-	-	-
			Bone surf (4E+1)	Bone surf (2E-1)	-	3E-13	5E-7	5E-6
101	Mendelevium-257	W, all compounds	7E+3	8E+1	4E-8	-	1E-4	1E-3
			-	Bone surf (9E+1)	-	1E-10	-	-
101	Mendelevium-258	W, all compounds	3E+1	2E-1	1E-10	-	-	-
			Bone surf (5E+1)	Bone surf (3E-1)	-	5E-13	6E-7	6E-6
-	Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life less than 2 hours	Submersion[1]	-	2E+2	1E-7	1E-9	-	-
-	Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life greater than 2 hours	. . . .	-	2E-1	1E-10	1E-12	1E-8	1E-7

Atomic No.	Radionuclide	Class	Table I Occupational Values: Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations: Col. 1 Air (μCi/ml)	Col. 2 Water (μCi/ml)	Table III Release to Sewers: Monthly Average Concentrations (μCi/ml)
-	Any single radionuclide not listed above that decays by alpha emission or spontaneous fission, or any mixture for which either the identity or the concentration of any radionuclide in the mixture is not known	. . . .	-	4E-4	2E-13	1E-15	2E-9	2E-8

FOOTNOTES:

[1] "Submersion" means that values given are for submersion in a hemispherical semi-infinite cloud of airborne

[2] These radionuclides have radiological half-lives of less than 2 hours. The total effective dose equivalent received during operations with these radionuclides might include a significant contribution from external exposure. The DAC values for all radionuclides, other than those designated Class "Submersion," are based upon the committed effective dose equivalent due to the intake of the radionuclide into the body and do NOT include potentially significant contributions to dose equivalent from external exposures. The licensee may substitute 1E-7 μCi/ml for the listed DAC to account for the submersion dose prospectively, but should use individual monitoring devices or other radiation measuring instruments that measure external exposure to demonstrate compliance with the limits.

[3] For soluble mixtures of U-238, U-234, and U-235 in air, chemical toxicity may be the limiting factor. If the percent by weight (enrichment) of U-235 is not greater than 5, the concentration value for a 40-hour workweek is 0.2 milligrams uranium per cubic meter of air average. For any enrichment, the product of the average concentration and time of exposure during a 40-hour workweek shall not exceed 8E-3 (SA) μCi-hr/ml, where SA is the specific activity of the uranium inhaled. The specific activity for natural uranium is 6.77E-7 curies per gram U. The specific activity for other mixtures of U-238, U-235, and U-234, if not known, shall be:

SA = 3.6E-7 curies/gram U   U-depleted

SA = [0.4 + 0.38 (enrichment) + 0.0034 (enrichment)^2] E-6 , enrichment $\geq$ 0.72

where enrichment is the percentage by weight of U-235, expressed as percent.

NOTE:

1 If the identity of each radionuclide in a mixture is known but the concentration of one or more of the radionuclides in the mixture is not known, the DAC for the mixture shall be the most restrictive DAC of any radionuclide in the mixture.

2 If the identity of each radionuclide in the mixture is not known, but it is known that certain radionuclides specified in this appendix are not present in the mixture, the inhalation ALI, DAC, and effluent and sewage concentrations for the mixture are the lowest values specified in this appendix for any radionuclide that is not known to be absent from the mixture; or

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi)	Table I Col. 2 Inhalation ALI (μCi)	Table I Col. 3 Inhalation DAC (μCi/ml)	Table II Effluent Concentrations Col. 1 Air (μCi/ml)	Table II Col. 2 Water (μCi/ml)	Table III Release to Sewers Monthly Average Concentrations (μCi/ml)
If it is known that Ac-227-D and Cm-250-W are not present			-	7E-4	3E-13	-	-	-
If, in addition, it is known that Ac-227-W,Y, Th-229-W,Y, Th-230-W, Th-232-W,Y, Pa-231-W,Y, Np-237-W, Pu-239-W, Pu-240-W, Pu-242-W, Am-241-W, Am-242m-W, Am-243-W, Cm-245-W, Cm-246-W, Cm-247-W, Cm-248-W, Bk-247-W, Cf-249-W, and Cf-251-W are not present			-	7E-3	3E-12	-	-	-
If, in addition, it is known that Sm-146-W, Sm-147-W, Gd-148-D,W, Gd-152-D,W, Th-228-W,Y, Th-230-Y, U-232-Y, U-233-Y, U-234-Y, U-235-Y, U-236-Y, U-238-Y, Np-236-W, Pu-236-W,Y, Pu-238-W,Y, Pu-239-Y, Pu-240-Y, Pu-242-Y, Pu-244-W,Y, Cm-243-W, Cm-244-W, Cf-248-W, Cf-249-Y, Cf-250-W,Y, Cf-251-Y, Cf-252-W,Y, and Cf-254-W,Y are not present			-	7E-2	3E-11	-	-	-
If, in addition, it is known that Pb-210-D, Bi-210m-W, Po-210-D,W, Ra-223-W, Ra-225-W, Ra-226-W, Ac-225-D,W,Y, Th-227-W,Y, U-230-D,W,Y, U-232-D,W, Pu-241-W, Cm-240-W, Cm-242-W, Cf-248-Y, Es-254-W, Fm-257-W, and Md-258-W are not present			-	7E-1	3E-10	-	-	-
If, in addition, it is known that Si-32-Y, Ti-44-Y, Fe-60-D, Sr-90-Y, Zr-93-D, Cd-113m-D, Cd-113-D, In-115-D,W, La-138-D, Lu-176-W, Hf-178m-D,W, Hf-182-D,W, Bi-210m-D, Ra-224-W, Ra-228-W, Ac-226-D,W,Y, Pa-230-W,Y, U-233-D,W, U-234-D,W, U-235-D,W, U-236-D,W, U-238-D,W, Pu-241-Y, Bk-249-W, Cf-253-W,Y, and Es-253-W are not present			-	7E+0	3E-9	-	-	-
If it is known that Ac-227-D,W,Y, Th-229-W,Y, Th-232-W,Y, Pa-231-W,Y, Cm-248-W, and Cm-250-W are not present			-	-	-	1E-14	-	-
If, in addition, it is known that Sm-146-W, Gd-148-D,W, Gd-152-D, Th-228-W,Y, Th-230-W,Y, U-232-Y, U-233-Y, U-234-Y, U-235-Y, U-236-Y, U-238-Y, U-Nat-Y, Np-236-W, Np-237-W, Pu-236-W,Y, Pu-238-W,Y, Pu-239-W,Y, Pu-240-W,Y, Pu-242-W,Y, Pu-244-W,Y, Am-241-W, Am-242m-W, Am-243-W, Cm-243-W, Cm-244-W, Cm-245-W, Cm-246-W, Cm-247-W, Bk-247-W, Cf-249-W,Y, Cf-250-W,Y, Cf-251-W,Y, Cf-252-W,Y, and Cf-254-W,Y are not present			-	-	-	1E-13	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Col. 2 Inhalation ALI (µCi)	Table I Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Col. 2 Water (µCi/ml)	Table III Release to Sewers Monthly Average Concentrations (µCi/ml)
If, in addition, it is known that Sm-147-W, Gd-152-W, Pb-210-D, Bi-210m-W, Po-210-D,W, Ra-223-W, Ra-225-W, Ra-226-W, Ac-225-D,W,Y, Th-227-W,Y, U-230-D,W,Y, U-232-D,W, U-Nat-W, Pu-241-W, Cm-240-W, Cm-242-W, Cf-248-W,Y, Es-254-W, Fm-257-W, and Md-258-W are not present			-	-	-	1E-12	-	-
If, in addition it is known that Fe-60, Sr-90, Cd-113m, Cd-113, In-115, I-129, Cs-134, Sm-145, Sm-147, Gd-148, Gd-152, Hg-194 (organic), Bi-210m, Ra-223, Ra-224, Ra-225, Ac-225, Th-228, Th-230, U-233, U-234, U-235, U-236, U-238, U-Nat, Cm-242, Cf-248, Es-254, Fm-257, and Md-258 are not present			-	-	-	-	1E-6	1E-5

3 If a mixture of radionuclides consists of uranium and its daughters in ore dust (10 µm AMAD particle distribution assumed) prior to chemical separation of the uranium from the ore, the following values may be used for the DAC of the mixture: 6E-11 µCi of gross alpha activity from uranium-238, uranium-234, thorium-230, and radium-226 per milliliter of air; 3E-11 µCi of natural uranium per milliliter of air; or 45 micrograms of natural uranium per cubic meter of air.

4 If the identity and concentration of each radionuclide in a mixture are known, the limiting values should be derived as follows: determine, for each radionuclide in the mixture, the ratio between the concentration present in the mixture and the concentration otherwise established in this subsection for the specific radionuclide when not in a mixture. The sum of such ratios for all of the radionuclides in the mixture may not exceed "1" (i.e., "unity").

Example: If radionuclides "A," "B," and "C" are present in concentrations C_A, C_B, and C_C, and if the applicable DACs are DAC_A, DAC_B, and DAC_C, respectively, then the concentrations shall be limited so that the following relationship exists:

$$\frac{C_A}{DAC_A} + \frac{C_B}{DAC_B} + \frac{C_C}{DAC_C} \leq 1$$