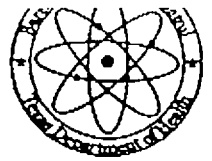


TEXAS DEPARTMENT OF HEALTH



BUREAU OF RADIATION CONTROL
1100 West 49th Street
AUSTIN, TEXAS 78756-3189
LICENSING, REGISTRATION & STANDARDS
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FROM: Cindy Cardwell

DIVISION: LRB

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Responses to Questions 42 and 43

Question 42. Definitions

"Byproduct material - Byproduct material is defined as:

(A) any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material; and

(B) the tailings or wastes produced by or resulting from the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes." (25 Texas Administrative Code (TAC) §289.201(b)(15))

"Disposal - Isolation or removal of radioactive wastes from mankind and his environment. The term does not include emissions and discharges under rules of the agency." (25 TAC §289.254(b)(3))

"Effluent" - No definition in rule

"Release limits" - No definition in rule

"Transfer" - No definition in rule

***"Radioactive waste - Any discarded or unwanted radioactive material, unless exempted by agency rule or any radioactive material that would require processing before it could be put to a beneficial reuse. The term does not include byproduct material as defined in paragraph (15)(B) of this subsection, or uranium ore, naturally occurring radioactive material (NORM) waste, or oil and gas NORM waste." (25 TAC §289.201(b)(82))

***"Low-level radioactive waste (LLRW) - Radioactive material that meets the following criteria:

(A) LLRW is radioactive material that is:

(i) discarded or unwanted and is not exempt by rule adopted under the Texas Radiation Control Act (Act), Health and Safety Code, §401.106;

(ii) waste, as that term is defined in 10 CFR Part 61.2; and

(iii) subject to:

(I) concentration limits established in 10 CFR Part 61.55, or

compatible rules adopted by the agency or the Texas Natural Resource Conservation Commission (TNRCC), as applicable; and

(II) disposal criteria established in 10 CFR, or established by the agency or TNRCC, as applicable.

(B) LLRW does not include:

- (i) high-level radioactive waste as defined by 10 CFR 60.2;
- (ii) spent nuclear fuel as defined by 10 CFR 72.3;
- (iii) byproduct material defined in the Act, Health and Safety Code, §401.003(3)(B);
- (iv) naturally occurring radioactive material (NORM) waste that is not oil and gas NORM waste; or
- (v) oil and gas NORM waste.

**Proposed for deletion; Proposed 11/99, Adopted 2/00

***Proposed new definition; Proposed 11/99, Adopted 2/00

Question 43. Release Standards in §289.202

(ccc) Vacating premises.

(1) Each licensee, registrant, or person possessing non-exempt sources of radiation shall, no less than 30 days before vacating or relinquishing possession or control of premises, notify the agency, in writing, of the intent to vacate.

(2) The licensee or person possessing non-exempt radioactive material shall decommission the premises to a degree consistent with subsequent use as an unrestricted area and in accordance with the requirements of subsections (ddd) and (eee) of this section.

(3) Notwithstanding the limits set forth in subsections (ddd) and (eee) of this section, contamination levels must be maintained in unrestricted areas so that no individual member of the public will receive an effective dose equivalent in excess of 100 mrem (1 mSv) above background per year.

(4) No licensee shall vacate a facility or land, or release a facility or land for unrestricted use, until the annual total effective dose equivalent to a member of the public resulting from radioactive material remaining from licensed activities (excluding radium and

its decay products) does not exceed 25 mrem (0.25 mSv) per year above background. The concentration for radium in soil shall be equivalent to or below the limits in subsection (eee) of this section. Notwithstanding the limits in this paragraph, each licensee shall make every reasonable effort to maintain any contamination of soil or vegetation ALARA. The licensee shall conduct all necessary radiation surveys and modeling and shall provide reports and documentation to demonstrate that the requirements for release for unrestricted use have been met. The Agency may require the licensee to provide any other information necessary to demonstrate that the facilities and land are suitable for release for unrestricted use.

(ddd) Soil contamination limits.

(1) No licensee shall possess, receive, use, or transfer radioactive material in such a manner as to cause contamination of soil in unrestricted areas, to the extent that the contamination exceeds, on a dry weight basis, the concentration limits specified in:

(A) subsection (ggg)(8) of this section; or

(B) the effluent concentrations in Table III of subsection (ggg)(2) of this section, with the units changed from microcuries per milliliter to microcuries per gram, for radionuclides not specified in subsection (ggg)(8) of this section or paragraph (3) of this subsection.

(2) Where combinations of radionuclides are involved, the sum of the ratios between the concentrations present and the limits specified in paragraph (1) of this subsection shall not exceed one.

(3) Except for the requirements in §289.127 of this title and notwithstanding the limits imposed by paragraph (1) of this subsection, the concentration of radium-226 or radium-228 in soil averaged over any 100 square meters (m^2) shall not exceed the background level by more than:

(A) 5 picocuries per gram (pCi/g) (0.185 becquerel per gram (Bq/g)), averaged over the first 15 cm of soil below the surface; and

(B) 15 pCi/g (0.555 Bq/g), averaged over 15 cm thick layers of soil more than 15 cm below the surface.

(4) 5 pCi/g (0.185 Bq/g), based on dry weight, for radium-226 or radium-228 in vegetation; and

(5) the following limits, based on dry weight, averaged over any 100 m² of area for natural uranium with no daughters present:

(A) 30 pCi/g (1.11 Bq/g), averaged over the top 15 cm of soil below the surface; and

(B) 150 pCi/g (5.55 Bq/g), average concentration at depths greater than 15 centimeters below the surface so that no individual member of the public will receive an effective dose equivalent in excess of 100 mrem (1 mSv) per year.

(eee) Surface contamination limits for facilities and equipment.

(1) Prior to vacating any facility or releasing areas or equipment for unrestricted use, each licensee shall ensure that radioactive contamination has been removed to ALARA levels. In no case shall the licensee vacate a facility or release areas or equipment for unrestricted use until radioactive surface contamination levels are below the limits specified in subsection (ggg)(6) of this section.

(2) In addition to meeting the surface contamination limits of paragraph (1) of this subsection, porous materials (e.g., concrete), that are to be released for unrestricted use, shall be evaluated to determine whether radioactive materials have penetrated to the interior of the material. If radioactive contamination has penetrated into the material, analysis of the average concentration, in pCi/g, shall be made. The material may be released for unrestricted use if the radionuclide concentrations do not exceed the limits specified for soil in subsection (ddd) of this section.

(fff) Exemption of specific wastes.

(1) A licensee may discard the following licensed material without regard to its radioactivity:

(A) 0.05 microcurie (μ Ci) (1.85 kilobecquerels (kBq)), or less, of hydrogen-3, carbon-14, or iodine-125 per gram of medium used for liquid scintillation counting or *in vitro* clinical or *in vitro* laboratory testing; and

(B) 0.05 μ Ci (1.85 kBq), or less, of hydrogen-3, carbon-14, or iodine-125, per gram of animal tissue, averaged over the weight of the entire animal.

(2) A licensee shall not discard tissue in accordance with paragraph (1)(B) of this subsection in a manner that would permit its use either as food for humans or as animal feed.

(3) The licensee shall maintain records in accordance with subsection (tt) of this section.

(4) Any licensee may, upon agency approval of procedures required in paragraph (6) of this subsection, discard licensed material included in subsection (ggg)(7) of

this section, provided that it does not exceed the concentration and total curie limits contained therein, in a Type I municipal solid waste site as defined in the Municipal Solid Waste Regulations of the authorized regulatory agency (31 TAC Chapter 330), unless such licensed material also contains hazardous waste, as defined in Section 3(15) of the Solid Waste Disposal Act, Health and Safety Code, Chapter 361. Any licensed material included in subsection (ggg)(7) of this section and which is a hazardous waste as defined in the Solid Waste Disposal Act may be discarded at a facility authorized to manage hazardous waste by the authorized regulatory agency.

(5) Each licensee who discards material described in paragraphs (1) or (4) of this subsection shall:

(A) make surveys adequate to assure that the limits of paragraphs (1) or (4) of this subsection are not exceeded; and

(B) remove or otherwise obliterate or obscure all labels, tags, or other markings that would indicate that the material or its contents is radioactive.

(6) Prior to authorizations in accordance with paragraph (4) of this subsection, a licensee shall submit procedures to the agency for:

(A) the physical delivery of the material to the disposal site;

(B) surveys to be performed for compliance with paragraph (5)(A) of this subsection;

(C) maintaining secure packaging during transportation to the site; and

(D) maintaining records of any discards made under paragraph (4) of this subsection.

(7) Nothing in this section relieves the licensee of maintaining records showing the receipt, transfer, and discard of such radioactive material as specified in §289.201(d) of this title.

(8) Nothing in this section relieves the licensee from complying with other applicable federal, state, and local regulations governing any other toxic or hazardous property of these materials.

(ggg) Appendices

(6) Acceptable surface contamination levels.

| NUCLIDE ^a | AVERAGE ^{b,c} | MAXIMUM ^{b,d} | REMOVABLE ^{b,c} |
|---|--|---|--|
| U-nat, U-235, U-238, and associated decay products except Ra-226, Th-230, Ac-227, and Pa-231 | 5,000 dpm alpha/ 100 cm ² | 15,000 dpm alpha/ 100 cm ² | 1,000 dpm alpha/ 100 cm ² |
| Transuranics, Ra-223, Ra-224, Ra-226, Ra-228, Th-nat, Th-228, Th-230, Th-232, U-232, Pa-231, Ac-227, Sr-90, I-129 | 1,000 dpm/100 cm ² | 3,000 dpm/100 cm ² | 200 dpm/100 cm ² |
| Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above. | 5,000 dpm beta, gamma/100 cm ² | 15,000 dpm beta, gamma/100 cm ² | 1,000 dpm beta, gamma/100 cm ² |

- ^a Where surface contamination by both alpha and beta-gamma emitting nuclides exists, the limits established for alpha and beta-gamma emitting nuclides should apply independently.
- ^b As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.
- ^c Measurements of average contamination level should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each object.
- ^d The maximum contamination level applies to an area of not more than 100 cm².

- e The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.
- f The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 centimeter and 1.0 mrad/hr at 1 centimeter, respectively, measured through not more than 7 mg/cm² of total absorber.

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(7) Concentration and activity limits of nuclides for disposal in a Type I municipal solid waste site or a hazardous waste facility (for use in subsection (fff) of this section).

| Nuclides | Concentrations Limit (Ci/m ³) | Annual Generator Disposal Limit (Ci/yr) |
|----------|--|--|
| F-18 | 3×10^{-1} | 8 |
| Si-31 | $1 \times 10^{+2}$ | $3 \times 10^{+3}$ |
| Na-24 | 9×10^{-4} | 2×10^{-2} |
| P-32 | 2 | $5 \times 10^{+1}$ |
| P-33 | 10 | $3 \times 10^{+2}$ |
| S-35 | 9 | $2 \times 10^{+2}$ |
| Ar-41 | 3×10^{-1} | 8 |
| K-42 | 2×10^{-2} | 5×10^{-1} |
| Ca-45 | 4 | $1 \times 10^{+2}$ |
| Ca-47 | 2×10^{-2} | 5×10^{-1} |
| Sc-46 | 2×10^{-3} | 5×10^{-2} |
| Cr-51 | 6×10^{-1} | $2 \times 10^{+1}$ |
| Fe-59 | 5×10^{-3} | 1×10^{-1} |
| Co-57 | 6×10^{-2} | 2 |
| Co-58 | 1×10^{-2} | 3×10^{-1} |
| Zn-65 | 7×10^{-3} | 2×10^{-1} |
| Ga-67 | 3×10^{-1} | 8 |
| Se-75 | 5×10^{-2} | 1 |
| Br-82 | 2×10^{-3} | 5×10^{-2} |
| Rb-86 | 4×10^{-2} | 1 |
| Sr-85 | 2×10^{-2} | 5×10^{-1} |
| Sr-89 | 8 | $2 \times 10^{+2}$ |
| Y-90 | 4 | $1 \times 10^{+2}$ |
| Y-91 | 4×10^{-1} | 10 |
| Zr-95 | 8×10^{-3} | 2×10^{-1} |
| Nb-95 | 8×10^{-3} | 2×10^{-1} |
| Mo-99 | 5×10^{-2} | 1 |
| Tc-99m | 1 | $3 \times 10^{+1}$ |
| Rh-106 | 1 | $3 \times 10^{+1}$ |
| Ag-110m | 2×10^{-3} | 5×10^{-2} |
| Cd-115m | 2×10^{-1} | 5 |
| In-111 | 9×10^{-2} | 2 |

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| Nuclides | Concentrations | Annual Generator Disposal |
|----------|----------------------------|---------------------------|
| | Limit (Ci/m ³) | Limit (Ci/yr) |
| In-113m | 9 | 2 x 10 ⁺² |
| Sn-113 | 6 x 10 ⁻² | 2 |
| Sn-119 | 2 x 10 ⁺¹ | 5 x 10 ⁺² |
| Sb-124 | 2 x 10 ⁻³ | 5 x 10 ⁻² |
| Te-129 | 2 x 10 ⁻¹ | 5 |
| I-123 | 4 x 10 ⁻¹ | 1 x 10 ⁺¹ |
| I-125 | 7 x 10 ⁻¹ | 2 x 10 ⁺¹ |
| I-131 | 4 x 10 ⁻² | 1 |
| I-133 | 2 x 10 ⁻² | 5 x 10 ⁻¹ |
| Xe-127 | 8 x 10 ⁻² | 2 |
| Xe-133 | 1 | 3 x 10 ⁺¹ |
| Ba-140 | 2 x 10 ⁻³ | 5 x 10 ⁻² |
| La-140 | 2 x 10 ⁻³ | 5 x 10 ⁻² |
| Ce-141 | 4 x 10 ⁻¹ | 1 x 10 ⁺¹ |
| Ce-144 | 1 x 10 ⁻³ | 3 x 10 ⁻² |
| Pr-143 | 6 | 2 x 10 ⁺² |
| Nd-147 | 7 x 10 ⁻² | 2 |
| Yb-169 | 6 x 10 ⁻² | 2 |
| Ir-192 | 1 x 10 ⁻² | 3 x 10 ⁻¹ |
| Au-198 | 3 x 10 ⁻² | 8 x 10 ⁻¹ |
| Hg-197 | 8 x 10 ⁻¹ | 2 x 10 ⁺¹ |
| Tl-201 | 4 x 10 ⁻¹ | 1 x 10 ⁺¹ |
| Hg-203 | 1 x 10 ⁻¹ | 3 |

NOTE: In any case where there is a mixture in waste of more than one radionuclide, the limiting values for purposes of this paragraph shall be determined as follows:

For each radionuclide in the mixture, calculate the ratio between the quantity present in the mixture and the limit established in this paragraph for the specific radionuclide when not in a mixture. The sum of such ratios for all the radionuclides in the mixture may not exceed "1" (i.e., "unity").

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Examples: If radionuclides a, b, and c are present in concentrations C_a , C_b , and C_c , and if the applicable concentrations are CL_a , CL_b , and CL_c respectively, then the concentrations shall be limited so that the following relationship exists:

$$(C_a/CL_a) + (C_b/CL_b) + (C_c/CL_c) \leq 1$$

If the total curies for radionuclides a, b, and c are represented A_a , A_b , and A_c , and the annual curie limit for each radionuclide is AL_a , AL_b , and AL_c , then the generator is limited to the following:

$$(A_a/AL_a) + (A_b/AL_b) + (A_c/AL_c) \leq 1$$

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(8) Soil contamination limits for selected radionuclides (for use in subsection (ddd) of this section).

| Isotope | Concentration Limits (pCi/g) |
|----------------|------------------------------------|
| Americium-241 | 6 |
| Antimony-125 | 100 |
| Bismuth-207 | 60 |
| Cadmium-109 | 200 |
| Carbon-14 | 800 |
| Cesium-137 | 40 |
| Cobalt-60 | 300 |
| Europium-152 | 80 |
| Europium-154 | 20 |
| Europium-155 | 200 |
| Hydrogen-3 | 3,000 |
| Iodine-125 | 200 |
| Iodine-129 | 200 |
| Iodine-131 | 60 |
| Iridium-192 | 40 |
| Iron-55 | 2,000 |
| Nickel-63 | 700 |
| Plutonium-238 | 6 |
| Plutonium-239 | 6 |
| Plutonium-240 | 6 |
| Promethium-147 | 200 |

* It must be emphasized that every effort must be made to reduce contamination to background levels and that the limits in this table only apply when it is technically or economically impractical to do so.

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| | |
|-----------------|-----|
| Scandium-46 | 40 |
| Sodium-22 | 30 |
| Strontium-90 | 40 |
| Technetium-99 | 200 |
| Thallium-204 | 60 |
| Thorium-230 | 6 |
| Thorium-232 | 8 |
| Uranium-234 | 6 |
| Uranium-238 | 8 |
| Uranium-natural | 30 |

Question 43. Release Standards in §289.251

****(c) Exemptions for source material.

(1) Any person is exempt from this section and §289.252 of this title if that person receives, possesses, uses, or transfers source material in any chemical mixture, compound, solution, or alloy in which the source material is by weight less than 1/20 of 1% (0.05%) of the mixture, compound, solution, or alloy.

****This exemptions allows disposal of FUSRAP materials in a hazardous or solid waste disposal facility.