



To: Tom O'Brien, OSP, USNRC

8 November 1999

Subject: Response to Request for Technical Information from NRC (SP-89-074) from Nebraska

From: John Fassell, CHP, Acting Program Manager, Low-Level Radioactive Waste Program

Nebraska's response to question 42 includes definitions of the following terms: waste, disposal, byproduct material. These definitions are drawn from Nebraska Title 180 "Regulations for the Control of Radiation - Ionizing" or from the "Revised Statutes of Nebraska (1943) Article 35 Radiation Control Act

"Waste" means those low-level radioactive wastes that are acceptable for disposal in a management facility. For the purposes of this definition, low-level waste has the same meaning as in the Low-Level Radioactive Waste Policy Act, P.L. 96-573, as amended by P.L. 99-240, effective January 15, 1986; that is, radioactive waste (a) not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in Section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste) and (b) classified as low-level radioactive waste consistent with existing law and in accordance with (a) by the U.S. Nuclear Regulatory Commission.

"Disposal" means the permanent isolation of radioactive wastes from the biosphere inhabited by man and his food chain by emplacement in a management facility.

"Byproduct material" means:

(1) 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

(2) The tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including discrete surface wastes resulting from uranium or thorium solution extraction processes. Underground ore bodies depleted by solution extraction operations do not constitute byproduct material.

The remaining requested definitions (effluent, transfer and release limits) are not specifically denoted in our radiological health regulations. However, the Nebraska Department of Environmental Quality (NDEQ) maintains a set of regulations pertaining to the choosing of sites for a low-level radioactive waste disposal facility known as Title 194 of the Nebraska Administrative Code (194 NAC). The remaining definitions are also not present in that document.

The nearest regulatory document to one containing applicable definitions for these terms is one under NDEQ purview known as Title 121 "Effluent Guidelines and Controls". Note that this document is not intended for specific application to radioactive materials but more for generic hazardous materials concerns. With regard to the particular issue at hand it incorporates by reference all of 40 CFR Part 421 and 471, dealing with nonferrous metals manufacturing and forming. In this document the following definitions exist: effluent limitation. This definition is intended for use with discharges into water.

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"Effluent limitation" shall mean any restriction established by the Director (of NDEQ) on quantities, rates, and concentrations of chemical, physical, biological and other constituents which are discharged from point sources other than new sources into waters of the State.

The Nebraska response to question 43 dealing with Nebraska's radiological criteria for unrestricted release of solid materials is found within Title 180 NAC 1-004. Since your question deals specifically with solid materials Section 4.37D and following is the applicable area. Unlike almost all of the rest of Title 180 NAC which follows 10CFR rather closely, this area is modeled on Texas law dealing with disposal of radioactive materials in a city or county landfill.

I have included a copy of our sections dealing with this matter. Particular points of note are:

- (a) It is intended for disposal use in those city or county landfills authorized to receive radioactive material.
- (b) Surveys must be performed to verify the actual limits are not exceeded.
- (c) There are limits for both the volumetric concentration (no specific surficial limit beyond those normally applicable which would qualify the material as surface contaminated object low-level radioactive waste) and the total disposal quantity for a given generator.
- (d) Prior to disposal, procedures must be submitted to Nebraska HHS Regulation and Licensure that cover the delivery, physical emplacement and the covering of the material, compliance surveys, maintaining secure packaging during transport, record maintenance, landfill operator's agreement to such a disposal, etc.
- (e) This section is intended for waste disposal, not recycling.
- (f) In any case Tc-99 is not one of isotopes spelled out in Appendix 4-G. The isotopes specified are generally under one year in half life and Tc-99 has a half-life of 213,000 years.

All of this paints a dim picture for the issue at hand, however our regulations also contain some parallels to the NRC regulations in two areas that may apply. Our 180NAC1-004.14 basically states that licensees should conduct operations so that TEDE to the public remains below 100 mrem/year exclusive of background, medical administration, exposure to medically radioactive individuals, voluntary participation in medical research programs and sanitary sewer releases. There is the additional requirement that the dose not exceed 2 mrem/hour but since the most conservative exposure scenarios that you would want to do a performance assessment for would probably involve 24 hour/day exposures the 100 mrem annual limit would probably be the limit of concern.

Of course such an evaluation would need to be done in accordance with ALARA principles and could be subject to other limitations imposed by the State of Tennessee or the EPA (40CFR requirements).

The other relevant regulations area that parallels the NRC is Section 004.34 which covers alternate disposal procedure methods approval. This section mostly implements the approval process also covered in Section 4.14. The problem here lies in that "disposal's" definition includes a reference to emplacement in a management facility which would not be free release.

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004.13C The dose to an embryo/fetus shall be taken as the sum of:

004.13C1 The deep dose equivalent to the declared pregnant woman; and

004.13C2 The dose to the embryo/fetus from radionuclides in the embryo/fetus and radionuclides in the declared pregnant woman.

004.13D If by the time the woman declares pregnancy to the licensee or registrant, the dose to the embryo/fetus has exceeded 4.5 mSv (0.45 rem), the licensee or registrant shall be deemed to be in compliance with 004.13A if the additional dose to the embryo/fetus does not exceed 0.50 mSv (0.05 rem) during the remainder of the pregnancy.

RADIATION DOSE LIMITS FOR INDIVIDUAL MEMBERS OF THE PUBLIC

004.14 Dose Limits for Individual Members of the Public.

004.14A Each licensee or registrant shall conduct operations so that:

004.14A1 The total effective dose equivalent to individual members of the public from the licensed or registered operation does not exceed 1 mSv (0.1 rem) in a year, exclusive of the dose contributions from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released in accordance with Subsection 007.30, from voluntary participation in medical research programs, and from the licensee's or registrant's disposal of radioactive material into sanitary sewerage in accordance with 004.35, and

004.14A2 The dose in any unrestricted area from external sources, exclusive of the dose contributions from patients administered radioactive material and released in accordance with Subsection 007.30, does not exceed 0.02 mSv (0.002 rem) in any one hour.

004.14B If the licensee or registrant permits members of the public to have access to restricted areas, the limits for members of the public continue to apply to those individuals.

004.14C A licensee, registrant, or an applicant for a license or registration may apply for prior Agency authorization to operate up to an annual dose limit for an individual member of the public of 5 mSv (0.5 rem). This application shall include the following information:

004.14C1 Demonstration of the need for and the expected duration of operations in excess of the limit in 004.14A; and

004.14C2 The licensee's or registrant's program to assess and control dose within the 5 mSv (0.5 rem) annual limit; and

004.14C3 The procedures to be followed to maintain the dose ALARA.

004.14D In addition to the requirements of Section 004, a licensee or registrant subject to the provisions of the U.S. Environmental Protection Agency's generally applicable environmental radiation standards in 40 CFR 190 shall comply with those standards.

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004.14E The Agency may impose additional restrictions on radiation levels in unrestricted areas and on the total quantity of radionuclides that a licensee or registrant may release in effluents in order to restrict the collective dose.

004.15 Compliance with Dose Limits for Individual Members of the Public.

004.15A The licensee or registrant shall make or cause to be made surveys of radiation levels in unrestricted areas and radioactive materials in effluents released to unrestricted areas to demonstrate compliance with the dose limits for individual members of the public in 004.14.

004.15B A licensee or registrant shall show compliance with the annual dose limit in 004.14 by:

004.15B1 Demonstrating by measurement or calculation that the total effective dose equivalent to the individual likely to receive the highest dose from the licensed or registered operation does not exceed the annual dose limit; or

004.15B2 Demonstrating that:

004.15B2a The annual average concentrations of radioactive material released in gaseous and liquid effluents at the boundary of the unrestricted area do not exceed the values specified in Table II of Appendix 004-B; and

004.15B2b If an individual were continuously present in an unrestricted area, the dose from external sources would not exceed 0.02 mSv (0.002 rem) in an hour and 0.5 mSv (0.05 rem) in a year.

004.15C Upon approval from the Agency, the licensee or registrant may adjust the effluent concentration values in Appendix 004-B, Table II, for members of the public, to take into account the actual physical and chemical characteristics of the effluents, such as, aerosol size distribution, solubility, density, radioactive decay equilibrium, and chemical form.

004.16 Reserved.

SURVEYS AND MONITORING

004.17 General.

004.17A Each licensee or registrant shall make, or cause to be made, surveys that:

004.17A1 Are necessary for the licensee or registrant to comply with Section 004; and

004.17A2 Are necessary under the circumstances to evaluate:

004.17A2a Radiation levels; and

004.17A2b Concentrations or quantities of radioactive material; and

004.17A2c The potential radiological hazards that could be present.

004.17B The licensee or registrant shall ensure that instruments and equipment used for quantitative radiation measurements (e.g., dose rate and effluent monitoring) are calibrated at

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004.32B3 Monitor all packages known to contain radioactive material for radioactive contamination and radiation levels if there is evidence of degradation of package integrity, such as packages that are crushed, wet, or damaged.

004.32C The licensee shall perform the monitoring required by 004.32B as soon as practical after receipt of the package, but not later than 3 hours after the package is received at the licensee's or registrant's facility if it is received during the licensee's or registrant's normal working hours, or not later than 3 hours from the beginning of the next working day if it is received after working hours.

004.32D The licensee shall immediately notify the final delivery carrier and, by telephone and telegram, mailgram, or facsimile, the Agency when:

004.32D1 Removable radioactive surface contamination exceeds the limits of Part 013.15H of these regulations; or

004.32D2 External radiation levels exceed the limits of Parts 013.15I and J of these regulations.

004.32E Each licensee shall:

004.32E1 Establish, maintain, and retain written procedures for safely opening packages in which radioactive material is received; and

004.32E2 Ensure that the procedures are followed and that due consideration is given to special instructions for the type of package being opened.

004.32F Licensees transferring special form sources in vehicles owned or operated by the licensee to and from a work site are exempt from the contamination monitoring requirements of 004.32B, but are not exempt from the monitoring requirement in 004.32B for measuring radiation levels that ensures that the source is still properly lodged in its shield.

WASTE DISPOSAL

004.33 General Requirements.

004.33A A licensee shall dispose of licensed material only:

004.33A1 By transfer to an authorized recipient as provided in 004.38 or in Sections 003, 012, or 019 of these regulations, or to the U.S. Department of Energy; or

004.33A2 By decay in storage; or

004.33A3 By release in effluents within the limits in 004.14; or

004.33A4 As authorized pursuant to 004.34, 004.35, 004.36, or 004.37.

004.33B A person shall be specifically licensed to receive waste containing licensed material from other persons for:

004.33B1 Treatment prior to disposal; or

004.33B2 Treatment or disposal by incineration; or

004.33B3 Decay in storage; or

004.33B4 Management at a facility licensed pursuant to Section 012 of these regulations; or

004.33B5 Storage until transferred to a storage or disposal facility authorized to receive the waste.

004.34 Method for Obtaining Approval of Proposed Disposal Procedures. A licensee or applicant for a license may apply to the Agency for approval of proposed procedures, not otherwise authorized in these regulations, to dispose of licensed material generated in the licensee's operations. Each application shall include:

004.34A A description of the waste containing licensed or registered material to be disposed of, including the physical and chemical properties that have an impact on risk evaluation, and the proposed manner and conditions of waste disposal; and

004.34B An analysis and evaluation of pertinent information on the nature of the environment; and

004.34C The nature and location of other potentially affected facilities; and

004.34D Analyses and procedures to ensure that doses are maintained ALARA and within the dose limits in Section 004.

004.35 Disposal by Release Into Sanitary Sewerage.

004.35A A licensee may discharge licensed material into sanitary sewerage if each of the following conditions is satisfied:

004.35A1 The material is readily soluble, or is readily dispersible biological material, in water; and

004.35A2 The quantity of licensed radioactive material that the licensee releases into the sewer in 1 month divided by the average monthly volume of water released into the sewer by the licensee does not exceed the concentration listed in Table III of Appendix 004-B; and

004.35A3 If more than one radionuclide is released, the following conditions must also be satisfied:

004.35A3a The licensee shall determine the fraction of the limit in Table III of Appendix 004-B represented by discharges into sanitary sewerage by dividing the actual monthly average concentration of each radionuclide released by the licensee or registrant into the sewer by the concentration of that radionuclide listed in Table III of Appendix 004-B; and

004.35A3b The sum of the fractions for each radionuclide required by 004.35A3a does not exceed unity; and

004.35A4 The total quantity of licensed radioactive material that the licensee releases into the sanitary sewerage system in a year does not exceed 185 GBq (5 Ci) of hydrogen-3, 37 GBq (1 Ci) of carbon-14, and 37 GBq (1 Ci) of all other radioactive materials combined.

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004.35B Excreta from individuals undergoing medical diagnosis or therapy with radioactive material are not subject to the limitations contained in 004.35A.

004.36 Treatment or Disposal by Incineration. A licensee may treat or dispose of licensed material by incineration only in the amounts and forms specified in 004.37 or as specifically approved by the Agency pursuant to 004.34.

004.37 Disposal of Specific Wastes.

004.37A A licensee may dispose of the following licensed material as if it were not radioactive:

004.37A1 1.85 kBq (0.05 μ Ci), or less, of Hydrogen-3, Carbon-14 or Iodine-125 per gram of medium used for liquid scintillation counting; and

004.37A2 1.85 kBq (0.05 μ Ci), or less, of Hydrogen-3, or Carbon-14 or Iodine-125 per gram of animal tissue, averaged over the weight of the entire animal.

004.37B A licensee shall not dispose of tissue pursuant to 004.37A2 in a manner that would permit its use either as food for humans or as animal feed.

004.37C The licensee shall maintain records in accordance with 004.48.

004.37D Any licensee may, upon Agency approval of procedures required in 004.37F, dispose of radioactive material included in Appendix 004-G, provided that it does not exceed the concentration and total curie limits contained therein. Any radioactive material included in Appendix 004-G may be disposed of at a city or county landfill facility authorized to receive the radioactive material.

004.37E Each licensee who disposes of radioactive material described in 004.37A or D shall:

004.37E1 Make surveys adequate to assure that the limits of 004.37A or D are not exceeded; and

004.37E2 Remove or otherwise obliterate all labels, tags, or other markings which would indicate that the material or its contents is radioactive.

004.37E Prior to the initiation of disposals authorized by 004.37D, a licensee shall submit procedures to the Agency for:

004.37E1 The physical delivery of the material to the disposal site, the physical placing of the material in the disposal location and that the material is properly covered;

004.37E2 Surveys to be performed for compliance with 004.37E1;

004.37E3 Maintaining secure packaging during transportation to the site;

004.37E4 Maintaining records of disposals made under 004.37D; and

004.37E5 Written authorization by the landfill operator agreeing to such disposal.

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004.37G Nothing in this section, however, relieves the licensee of maintaining records showing the receipt, transfer, and disposal of such radioactive material as specified pursuant to 001.04 of these regulations.

004.37H Nothing in this section relieves the licensee from complying with other applicable federal, state or local regulations governing any other toxic or hazardous property of these materials.

004.37I Radioactive material disposed of under this section is not subject to the requirements of Section 013 of these regulations.

004.38 Transfer for Disposal and Manifests.

004.38A The requirements of this section and Appendix 004-D are designed to:

004.38A1 Control transfers of low-level radioactive waste by any waste generator, waste collector, or waste processor license, as defined in this section, who ships low-level waste either directly, or indirectly through a waste collector or waste processor, to a licensed low-level waste land disposal facility (as defined in Section 012 of these regulations);

004.38A2 Establish a manifest tracking system; and

004.38A3 Supplement existing requirements concerning transfers and recordkeeping for those wastes.

004.38B All affected licensees must use Appendix 004-D and comply with subpart 004.38B2 of this section.

004.38B1 Each shipment of radioactive waste intended for disposal at a licensed low-level radioactive waste disposal facility must be accompanied by a shipment manifest as specified in Section I of Appendix 004-D.

004.38B2 Any licensee shipping radioactive waste intended for ultimate disposal at a licensed land disposal facility must document the information required on the Agency's Uniform Low-Level Radioactive Waste Manifest and transfer this recorded manifest information to the intended consignee in accordance with Appendix 004-D of this section.

004.38C Each shipment manifest must include a certification by waste generator as specified in Section II of Appendix 004-D.

004.38D Each person involved in the transfer for disposal and disposal of waste, including the waste generator, waste collector, waste processor, and disposal facility operator, shall comply with the requirements specified in Section III of Appendix 004-D.

004.39 Compliance with Environmental and Health Protection Regulations. Nothing in Subsections 004.33, 004.34, 004.35, 004.36, 004.37, or 004.38 relieves the licensee from complying with other applicable Federal, State, and local regulations governing any other toxic or hazardous properties of materials that may be disposed of pursuant to Subsections 004.33, 004.34, 004.35, 004.36, 004.37, or 004.38.

APPENDIX 004-G

CONCENTRATION AND ACTIVITY LIMITS OF NUCLIDES FOR DISPOSAL IN A CITY OR COUNTY LANDFILL DISPOSAL FACILITY

(For use in 004.37)

Nuclides Concentration Limit (Ci/m³) Annual Generator Disposal Limit (Ci/yr)

F-18	3E-1	8
SI-31	1E-2	3E+3
Na-24	8E-4	2E-2
P-32	2	6E+1
P-33	10	3E+2
S-35	8	2E+2
Ar-41	3E-1	8
K-42	2E-2	6E-1
Ca-45	4	1E+2
Ca-47	2E-2	6E-1
Sc-46	2E-3	6E-2
Cr-51	6E-1	2E+1
Fe-59	6E-3	1E-1
Co-57	6E-2	2
Co-58	1E-2	3E-1
Zn-65	7E-3	2E-1
Ga-67	3E-1	8
Ge-75	6E-2	1
Br-82	2E-3	6E-2
Rb-86	4E-2	1
Br-85	2E-2	6E-1
Br-89	8	2E+2
Y-90	4	1E+2
Y-91	4E-1	10
Zr-95	8E-3	2E-1
Nb-95	8E-3	2E-1

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Nuclides	Concentration Limit (Cl/m ³)	Annual Generator Disposal Limit (Cl/yr)
Mo-99	5E-2	1
Tc-99m	1	3E+1
Rh-106	1	3E+1
Ag-110m	2E-3	5E-2
Cd-115m	2E-1	5
In-111	0E-2	2
In-113m	0	2E+2
Sn-113	6E-2	2
Sn-119	2E+1	5E+2
Sb-124	2E-3	5E-2
Te-120	2E-1	5
I-123	4E-1	1E+1
I-125	7E-1	2E+1
I-131	4E-2	1
I-133	2E-2	5E-1
Xe-127	8E-2	2
Xe-133	1	3E+1
Ba-140	2E-3	5E-2
La-140	2E-3	5E-2
Ce-141	4E-1	1E+1
Ce-144	1E-3	3E-2
Pr-143	6	2E+2
Nd-147	7E-2	2
Yb-169	6E-2	2
Ir-192	1E-2	3E-1
Au-198	3E-2	8E-1
Hg-197	8E-1	2E+1
Tl	4E-1	1E+1
Hg-203	1E-1	3

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NOTE: In any case where there is a mixture in waste of more than one radionuclide, the limiting values for purposes of this Appendix 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 Appendix 004-G 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").

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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