Fermilab
ES&H Section

ENVIRONMENTAL PROTECTION NOTE No. 27

Standards on Concentrations of Tritium in Environmental Water

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1. Introduction

There are several sets of "standards" on concentrations of tritium in water that one encounters. This topic is somewhat complex and needs to be reviewed in the context of current conditions on the Fermilab site and the implementation of DOE Order 458.1, "Environmental Protection of the Public and the Environment". The intent of this document is to summarize the applicability of these limits to situations encountered at Fermilab pertaining to tritium. Quotations from various standards and regulations are shaded in gray. In this document direct quotations from official sources are presented followed by explanatory commentary.

2. Executive Summary

The DOE O458.1 implemented Derived Concentration Standard (DCS) value of 1900 pCi/ml for tritium along with the tabulated values therein of other radionuclides is the applicable standard for surface water discharges. The standards applicable to discharges to sanitary sewers set forth in DOE O458.1 for tritium are a concentration of 9500 pCi/ml augmented by an annual limit of 5 Ci total activity. The EPA drinking water standard, 20 pCi/ml, is a reference value that is not directly applicable since the surface waters do not directly comprise a drinking water supply. The Order places specific obligations on the DOE Field Element Manager (here DOE-FSO) to communicate with operators of sewage treatment facilities used by DOE.

3. DOE ORDER 458.1 "RADIATION PROTECTION OF THE PUBLIC AND THE ENVIRONMENT"

This Order was first issued February 2, 2011. The present version was issued June 6, 2011 and was incorporated into the FRA Contract September 2011. This Order superseded its predecessor, DOE O5400.5, with the same title that had been in place since 1990 with somewhat different content. Important excerpts from DOE O458.1 are provided pertinent to the subject of this note. The citations of O458.1 are specifically referenced to DOE O458.1 Cng 2 06-06-11 (June 6, 2011).

DOE O458.1 Page 1: Introductory Material:

1. PURPOSE.
a. To establish requirements to protect the public and the environment against undue risk from radiation associated with radiological activities conducted under the control of the Department of Energy (DOE) pursuant to the Atomic Energy Act of 1954, as amended (AEA).

DOE O458.1 Pages 3-4: Section 4 - Public Dose Limits:

4.b. Public Dose Limit.
(1) DOE radiological activities, including remedial actions and activities using Technologically Enhanced Naturally Occurring Radioactive Material (TENORM),

must be conducted so that exposure of members of the public to ionizing radiation will:

(a) Not cause a total effective dose (TED) exceeding 100 mrem (1mSv) in a year, an equivalent dose to the lens of the eye exceeding 1500 mrem (15 mSv) in a year, or an equivalent dose to the skin or extremities exceeding 5000 mrem (50 mSv) in a year, from all sources of ionizing radiation and exposure pathways that could contribute significantly to the total dose excepting:

1 Dose from radon and its decay products in air [Radon is regulated separately e.g., under Paragraphs 4.f. and 4.h.(1)(d) in this Order and under Title 40 Code of Federal Regulations (CFR) Part 61, Subparts Q and T];

2 Dose received by patients from medical sources of radiation, and by volunteers in medical research programs;

3 Dose from background radiation;

4 Dose from occupational exposure under NRC or Agreement State license or to general employees regulated under 10 CFR Part 835, and

(b) Comply with ALARA requirements in paragraph 4.d. of this Order.

(2) The public dose limit applies to members of the public located off DOE sites and on DOE sites outside of controlled areas, and to those exposed to residual radioactive material subsequent to any remedial action or clearance of property.

This section gives the dose limits for total effective dose (TED) (i.e., “whole body”) and equivalent doses to certain specified human organs. Doses due to radon, medical exposures, natural background, and occupational doses regulated separate by NRC licensees and by DOE are expressly not included.

A brief word should be made about the calculation of “doses”. In radiation protection regulations and standards such as this Order and 10 CFR 835, a Federal Regulation that covers occupational radiation protection for DOE and its facilities, dose to human beings is regulated in terms of radiation protection quantities such as TED and equivalent dose that are connected by specific radiation protection models with the main physical quantity that can actually be measured, absorbed dose, that is given by the energy deposited in a given tissue per unit mass. While absorbed dose is defined precisely, the radiation protection system that connects absorbed dose with the radiation protection quantities have been redefined by international institutions, most prominently the International Commission on Radiation Protection (ICRP) on several occasions over last half-century.

The adoption of recent modifications to the radiation protection system issued by the ICRP is, in fact a principal reason for the new DOE Order. The revisions were also made to match similar changes in 10 CFR 835 issued in 2007. Other U. S. entities such as the Environmental Protection Agency, the Nuclear Regulatory Commission, and individual states have not yet completely made these changes and their schedule for doing so is not precisely defined. In practical work, the impact of the choice of radiation protection system is usually relatively small.

DOE O458.1 - Pages 8-9: Section 4 - Requirements for Liquid Discharges

4.g. Control and Management of Radionuclides from DOE Activities in Liquid Discharges. Operators of DOE facilities discharging or releasing liquids containing radionuclides from DOE activities must:

(1) Characterize planned and unplanned releases of liquids containing radionuclides from DOE activities, consistent with the potential for on- and off-site impacts, and provide an assessment of radiological consequences as necessary to demonstrate compliance with the requirements of this Order.
(2) Comply with the ALARA process requirements in paragraph 4.d. of this Order.
(3) Conduct activities to ensure that liquid releases containing radionuclides from DOE activities are managed in a manner that protects ground water resources now and in the future, based on use and value considerations.
(4) Conduct activities to ensure that liquid discharges containing radionuclides from DOE activities do not exceed an annual average (at the point of discharge) of either of the following:
(a) 5 pCi (0.2 Bq) per gram above background of settleable solids for alpha-emitting radionuclides.
(b) 50 pCi (2 Bq) per gram above background of settleable solids for beta-emitting radionuclides.
(5) Except for tritium and sanitary sewers, apply Best Available Technology (BAT) if at the point of discharge:
(a) The annual average concentration of a given radionuclide is greater than the DOE-approved *Derived Concentration Technical Standard*, DOE-STD-1196-2011, (DCS) value for water, or for multiple radionuclides, the composite DCS must be the sum of the fractional DCS values derived from DOE-approved DCS values,
(b) The discharge contributes greater than 10 mrem (0.1 mSv) annual TED *[total effective dose]* to members of the public, or
(c) The collective dose from all DOE sources is greater than 100 person-rem (1 person-Sv) and the liquid discharge contributes 50 percent or more of this collective dose.
(6) Control releases of tritium in a manner that has been established by application of the ALARA process.
(7) Conduct radiological activities to ensure that radionuclides from DOE activities contained in liquid effluents do not cause private or public drinking water systems to exceed the drinking water maximum contamination limits in 40 CFR Part 141, *National Primary Drinking Water Regulations*.

The above section pertains to liquid discharges and references a separate document, DOE-STD-1196-2011 (initial issue, April 2011) that lists Derived Concentration Standards (DCSs) for nearly all radionuclides. The DCS values replace the Derived Concentration Guides (DCGs) specified in the predecessor Order to O458.1, DOE O5400.5.

The DCS value for tritium in water specified in this Standard is 1900 pCi/ml and replaced the previously published DCG value of 2000 pCi/ml found in DOE O5400.5. The definition of DCS, as did the DCG before it, connects the use of water containing one

DCS of radioactivity continually throughout the year (or likewise with air) with a resultant effective dose of 100 mrem as determined by DOE using methodology set forth by the International Commission on Radiation Protection (ICRP). If multiple radionuclides are involved, the applicable standard is that the sum of the ratios of the individual concentrations to the individual DCS values for each radionuclide shall be less than 1.0.

The reason that the DCS values differ from those of the formerly-used DCGs is due to the adoption of a more recent ICRP methodology for determining the doses. In fact, a motivation for this new Order was to render the calculation of doses to members of the public to be consistent with that instituted for occupational workers at DOE facilities in amendments made to 10 CFR 835 in 2007.

It should be noted that all limits of this type are based on "dose in a year", not the instantaneous rate of dose delivery in mrem/yr. Thus, "continuous exposure" would normally mean the time-averaged exposure over a one year period. This is the basis for limits on discharges to surface waters such as the Fermilab pond system and the creeks.

It is important to note that BAT is not required to be applied to tritium because there is no known large-scale method of removing tritium such as, for example, filtering. While the wording of the Order clearly states in the above excerpt that tritium discharges should be controlled using an ALARA process, the DCS provides a generally-accepted guideline for concentrations in its discharge given the correlation with effective dose.

DOE O458.1 - Pages 10-11: Section 4 - Requirements for Discharges to Sanitary Systems

4.g.(8) Control discharges into sanitary sewers in accordance with the following requirements:

(a) Except for excreta from patients and medical research volunteers treated with radioactive material, discharges of liquids containing radionuclides from DOE activities into non-Federally owned sanitary sewers are prohibited unless:

1 The material is readily soluble (or readily dispersed biological materials) in water;

2 Such discharges comply with ALARA process requirements;

3 BAT is applied to discharges of liquid releases containing radionuclides from DOE activities if the average monthly concentration level at the point of discharge into the sanitary sewer is greater than five times the DOE-approved DCS values for ingestion except for tritium which is addressed under paragraph 4.g.(6);

4 Releases do not result in an annual discharge (above background) into sanitary sewers in excess of 5 Ci (185 GBq) of tritium; 1 Ci (37 GBq) carbon-14 or 1 Ci (37 GBq) of all other radionuclides combined;

5 DOE operations are conducted to minimize long-term buildup of radionuclides in the sewage treatment plants that may create handling and disposal issues or interfere with plant operations;

6 Operators of sewage treatment plants are informed of DOE practices and processes to radiologically control and clear discharges, and are notified of unusual discharges to sanitary sewers;

7 The DOE Field Element Manager provides a report that describes and summarizes such discharges to sanitary sewers to appropriate local officials at least annually; and

8 Existing agreements, contracts, statements of understanding or other formal arrangements with other agencies concerning the discharge of liquids containing radionuclides from DOE activities to sanitary sewers are not violated.

This section continues to reference concentrations in sewer discharges of individual radionuclides to the DCS values. In sewer discharges 5 times the DCS value is the reference standard. Speculating a bit here, perhaps the higher limit is allowable in sewers because of assumptions concerning further dilution, etc. Again, the DCS standards *per se* are not applicable to discharges of tritium that are, citing the 4.g.(6) of the previous excerpt, to be managed ALARA. Again, using the DCS values as a guide, 5 times this value would be 9500 pCi/ml.

In addition to this concentration-based standard, specific annual limits have been placed on the total activity in the discharges of certain radionuclides to sewers, specifically 5 Ci for tritium. These explicit limits on activity, not concentration, did not appear in the predecessor Order 5400.5. These explicit limits are identical to those applicable to U. S. Nuclear Regulatory Commission licensees as will be discussed below.

This section of the Order places specific obligations on the DOE Field Element Manager (here DOE-FSO) to communicate with operators of sewage treatment facilities used by DOE.

The remainder of this section addresses the utilization of sewage systems owned by the Federal government and prohibits the use of soil columns. Neither circumstance is applicable to Fermilab.

4. REGULATIONS OF THE U. S. NUCLEAR REGULATORY COMMISSION (NRC) IN CHAPTER 10, CODE OF REGULATIONS, PART 20, "STANDARDS FOR PROTECTION AGAINST RADIATION"

The following excerpt of the NRC Regulations was taken from the NRC website on at: http://www.nrc.gov/reading-rm/doc-collections/cfr/part020/part020-1002.html. (Accessed August 7, 2012.):

§ 20.1002 Scope.

The regulations in this part apply to persons licensed by the Commission to receive, possess, use, transfer, or dispose of byproduct, source, or special nuclear material or to operate a production or utilization facility under Parts 30 through 36, 39, 40, 50, 60, 61, 63, 70, or 72 of this chapter, and in accordance with 10 CFR 76.60 to persons required to obtain a certificate of compliance or an approved compliance plan under part 76 of this chapter. The limits in this part do not apply to doses due to background radiation, to exposure of patients to radiation for the purpose of medical diagnosis or therapy, to exposure from individuals administered radioactive material and released under § 35.75, or to exposure from voluntary participation in medical research programs.

This makes it clear that these regulations apply to NRC licensees. Neither DOE nor its prime contractors are subject to licensing by NRC. Therefore, NRC standards and requirements really serve the sole purpose of providing points of comparison with comparable DOE requirements.

The following excerpt of the NRC Regulations was taken from the NRC website at: http://www.nrc.gov/reading-rm/doc-collections/cfr/part020/part020-1301.html. (Accessed August 7, 2012.):

§ 20.1301 Dose limits for individual members of the public.

(a) Each licensee shall conduct operations so that —

(1) The total effective dose equivalent to individual members of the public from the licensed operation does not exceed 0.1 rem (1 mSv) in a year, exclusive of the dose contributions from background radiation, from any administration the individual has received, from exposure to individuals administered radioactive material and released under § 35.75, from voluntary participation in medical research programs, and from the licensee's disposal of radioactive material into sanitary sewerage in accordance with § 20.2003, and…

Thus NRC applies the same numerical limit of 100 mrem in a year to individual members of the public as does DOE. The most straightforward interpretation of this is that the 100 mrem would include the contributions of all pathways excluding medical and natural background sources.

All of these NRC standards are taken from the NRC Regulations 10 CFR 20 and apply to all NRC licensees, "Agreement State" licenses issued by individual states in conformance with their "Agreement" with the NRC, and to the operators of nuclear reactors licensed directly by the NRC. Illinois is a NRC Agreement State. These Regulations thus apply to many educational and medical institutions as well as the nuclear power plants. Such Regulations have been promulgated only after being subject to the public comment period applicable to all Federal Regulations.

The following excerpt of the NRC Regulations was taken from the NRC website at: http://www.nrc.gov/reading-rm/doc-collections/cfr/part020/part020-1302.html. (Accessed August 7, 2012.)

§ 20.1302 Compliance with dose limits for individual members of the public.

(a) The licensee shall make or cause to be made, as appropriate, surveys of radiation levels in unrestricted and controlled areas and radioactive materials in effluents released to unrestricted and controlled areas to demonstrate compliance with the dose limits for individual members of the public in § 20.1301.

(b) A licensee shall show compliance with the annual dose limit in § 20.1301 by--

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

(2) Demonstrating that--

(i) 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 2 of appendix B to part 20; …

This allows the licensee to demonstrate that the dose to individual members of the public is less than 100 mrem in a year by two means; a direct calculation of dose or by demonstrating that the concentrations are less, averaged annually, than those specified in the referenced table. The latter method is probably more straightforward than is the former.

The preamble to Table 2 of Appendx B states that its entries (i.e., for tritium the value of 1000 pCi/ml) are equivalent to the radionuclide concentration which, if ingested continuously over the course of a year would produce a total effective dose equivalent of 50 mrem. Apparently NRC defined its tables to allow "headroom" for doses from other sources to keep the dose to users of such water at half the primary limit of 100 mrem in a year. The methodology is that of ICRP Report 30, an older ICRP methodology than that now used by DOE in both O458.1 and in 10 CFR 835. Thus the standard of 1000 pCi/ml is, indeed, exactly half of that of the DCG set forth in the now obsolete DOE O5400.5 and only slightly more than half of the DCS value of 1900 pCi/ml. It is my understanding that NRC has initiated a process of revising 10 CFR 20 to incorporate the new ICRP recommendations, a process that is likely to last multiple years as such a change will undoubtedly result in a large number of comments both by licensees and members of the general public.

The following excerpt of the NRC Regulations was taken from the NRC website at: http://www.nrc.gov/reading-rm/doc-collections/cfr/part020/part020-2003.html. (Accessed August 7, 2012.):

§ 20.2003 Disposal by release into sanitary sewerage.

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

(1) The material is readily soluble (or is readily dispersible biological material) in water; and

(2) The quantity of licensed or other 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 3 of appendix B to part 20; and

(3) If more than one radionuclide is released, the following conditions must also be satisfied:

(i) The licensee shall determine the fraction of the limit in table 3 of appendix B to part 20 represented by discharges into sanitary sewerage by dividing the actual monthly average concentration of each radionuclide released by the licensee into the sewer by the concentration of that radionuclide listed in table 3 of appendix B to part 20; and

(ii) The sum of the fractions for each radionuclide required by paragraph (a)(3)(i) of this section does not exceed unity; and

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

This provides the conditions for sewer disposal by NRC licensees. For tritium, the cited tabulated value is 10,000 pCi/ml, identical to the older DOE O5400.5 DCG value multipled by 5 and very close to the 9500 pCi/ml inferred from the DOE O458.1 implemented DCS. No correlation with a specific dose value is mentioned in this section of the Regulation. Note, however, that this requirement does impose specific limits on the total activity discharged into sewer systems for specified radionuclides, notably 5 Curies for tritium. In DOE O458.1, identical limits, heretofore not in place, on total activities have been adopted by DOE.

5. REGULATIONS OF THE U. S. ENVIRONMENTAL PROTECTION AGENCY (USEPA) IN CHAPTER 40, CODE OF REGULATIONS

The following excerpts, with commentary added below each, were downloaded from the Electronic Code of Federal Regulations posted by the National Archives and Records Administration at: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=%2Findex.tpl. (Accessed August 7, 2012.)

PART 141—NATIONAL PRIMARY DRINKING WATER REGULATIONS

§ 141.1 Applicability.

This part establishes primary drinking water regulations pursuant to section 1412 of the Public Health Service Act, as amended by the Safe Drinking Water Act (Pub. L. 93–523); and related regulations applicable to public water systems.

§ 141.2 Definitions.

…Community water system means a public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

Gross beta particle activity means the total radioactivity due to beta particle emission as inferred from measurements on a dry sample…

The latter definition may be useful below in connection with the discussion of Illinois Environmental Protection Regulations in Section 4, below. Clearly gross beta particle cannot be applicable to tritiated water because it references "dry" samples.

§ 141.3 Coverage.

This part shall apply to each public water system, unless the public water system meets all of the following conditions:

(a) Consists only of distribution and storage facilities (and does not have any collection and treatment facilities);

(b) Obtains all of its water from, but is not owned or operated by, a public water system to which such regulations apply:

(c) Does not sell water to any person; and

(d) Is not a carrier which conveys passengers in interstate commerce.

§ 141.25 Analytical methods for radioactivity.

…(2) To determine compliance with §141.66(d) the detection limits shall not exceed the concentrations listed in Table C to this paragraph.

Table C—Detection Limits for Man-made Beta Particle and Photon Emitters

Radionuclide	Detection limit
Tritium	1,000 pCi/liter
Strontium–89	10 pCi/liter
Strontium–90	2 pCi/liter
Iodine–131	1 pCi/liter
Cesium–134	10 pCi/liter
Gross beta	4 pCi/liter
Other radionuclides	1/10 of the applicable limit.

This section provides the criteria of "how good" one must be able to measure radionuclides in water. Note these are in pCi/liter so one must divide by 1000 to get the same criteria in pCi/ml, units commonly used here at Fermilab.

§ 141.66 Maximum contaminant levels for radionuclides.

(d) *MCL for beta particle and photon radioactivity.* (1) The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water must not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year (mrem/year).

(2) Except for the radionuclides listed in table A, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents must be calculated on the basis of 2 liter per day drinking water intake using the 168 hour data list in "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure," NBS (National Bureau of Standards) Handbook 69 as amended August 1963, U.S. Department of Commerce. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies of this document are available from the National Technical Information Service, NTIS ADA 280 282, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161. The toll-free number is 800–553–6847. Copies may be inspected at EPA's Drinking Water Docket, 401 M Street, SW., Washington, DC 20460; or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202–741–6030, or go to: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.* If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 mrem/year.

Table A—Average Annual Concentrations Assumed To Produce: a Total Body or Organ Dose of 4 mrem/yr

1. Radionuclide	Critical organ	pCi per liter
2. Tritium	Total body	20,000
3. Strontium-90	Bone Marrow	8

…

This is the drinking water standard. It is a reference point because our surface waters are not a community water system as defined above. Some major points need to be highlighted here:

- This is where the 20 pCi/ml limit as a specific limit for tritium in drinking water is set forth.

- Compliance with this standard in community water systems is based on an annual average, not a one-time excursion.

- It is tied to a user who gets all of his drinking water from the source in question and intakes it at the standard rate of 2 liters/day.

- It is based on a specific NBS standard, issued in 1963 which, though now widely regarded as obsolete, remains incorporated into the regulation. The 2 liters/day remains the reference intake rate used but the radiation protection system has changed considerably. For example, to get to the EPA limit 4 mrem in a year from drinking water containing tritium, one could logically multiply the DOE DCS value of 1900 pCi/ml, deemed by DOE to lead to 100 mrem in a year (see discussion of DOE O458.1 above), by a factor of 4/100 and get a value of 76 pCi/ml. During public comment on these standards sometime during the 1990's, it is recalled that EPA was made aware of these issues but chose to retain the generally more conservative standards based on the 1963 radiation protection system.

6. REGULATIONS OF THE ILLINOIS POLLUTION CONTROL BOARD FOUND IN ILLINOIS ADMINISTRATIVE CODE (IAC) TITLE 35, "ENVIRONMENTAL PROTECTION SUBTITLE C: WATER POLLUTION, CHAPTER I POLLUTION CONTROL BOARD"

The following excerpts, with commentary added below each, were downloaded website of the Illinois Pollution Control Board at:
http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.asp.
(Accessed August 7, 2012.):

Part 301 Introduction

…Section 301.340 Pollutant *[definition]*

Pollutant: Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water…

This definition is relevant because it includes "radioactive materials" in the list of defined pollutants that is cited in Section 302.

Part 302 Water Quality Standards

…Section 302.101 Scope and Applicability

a) This Part contains schedules of water quality standards which are applicable throughout the State as designated in 35 Ill. Adm. Code 303. Site specific water quality standards are found with the water use designations in 35 Ill. Adm. Code 303.

b) Subpart B contains general use water quality standards which must be met in waters of the State for which there is no specific designation (35 Ill. Adm. Code 303.201)…

Section 302.105 Antidegradation

The purpose of this Section is to protect existing uses of all waters of the State of Illinois, maintain the quality of waters with quality that is better than water quality standards, and prevent unnecessary deterioration of waters of the State.

a) Existing Uses

Uses actually attained in a surface water body or water body segment on or after November 28, 1975, whether or not they are included in the water quality standards, must be maintained and protected. Examples of degradation of existing uses of the waters of the State include:

1) an action that would result in the deterioration of the existing aquatic community, such as a shift from a community of predominantly pollutant-sensitive species to pollutant-tolerant species or a loss of species diversity;

2) an action that would result in a loss of a resident or indigenous species whose presence is necessary to sustain commercial or recreational activities; or

3) an action that would preclude continued use of a surface water body or water body segment for a public water supply or for recreational or commercial fishing, swimming, paddling or boating…

This section defines "degradation" in Illinois surface waters. At the present or foreseeable levels of tritium concentrations, such degradation is improbable.

SUBPART B: GENERAL USE WATER QUALITY STANDARDS

Section 302.201 Scope and Applicability

Subpart B contains general use water quality standards which must be met in waters of the State for which there is no specific designation (Section 303.201).

This introduces the standards of various pollutants of which radioactivity is only one type.

Section 302.207 Radioactivity

a) Gross beta (STORET[1] number 03501) concentration shall not exceed 100 picocuries per liter (pCi/liter).

b) Concentrations of radium 226 (STORET number 09501) and strontium 90 (STORET number 13501) shall not exceed 1 and 2 picocuries per liter respectively…

I could find no definition of "gross beta" within the IAC Regulations and no other mention of radioactivity. Normally one uses this term for "unknown radionuclides" where the dose due to beta radiation is measurable and not for situations in which the radionuclide is identified. For "unknowns" the standards for "gross beta" are thus understandably stringent. Furthermore, appealing to the Federal definition of "gross beta" quoted above at 40 CFR § 141.2, cannot apply to tritium in water since it refers to dry samples. Also in the Table C excerpted from 40 CFR § 141.25 above, the vastly lower limit for "gross beta" as compared with that given for tritium.

Section 303.201 General Use Waters

Except as otherwise specifically provided, all waters of the State must meet the general use standards of Subpart B of Part 302.

This is included to further clarify the coverage of these IAC Regulations and perhaps the intent of Section 302.101. It would appear that all natural waterways are included.

[1] STORET is an identification number for referencing monitoring data for specific contaminants in the U. S. EPA's data repository of the same name. More information can obtained at: http://www.epa.gov/storet/. (Accessed August 7, 2012.)

7. ACKNOWLEDGEMENTS

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