

221

RECORD #221

TITLE: Lower Limit of Detection (LLD) For Potentially Contaminated
Oil

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MEMORANDUM FOR: Douglas M. Collins, Chief, Emergency Preparedness
and Radiological Protection Branch, DRSS, Reg. II

FROM: Frank J. Congel, Chief
Radiological Assessment Branch, DSI

SUBJECT: LOWER LIMIT OF DETECTION (LLD) FOR POTENTIALLY
CONTAMINATED OIL

Your memorandum to me, dated September 10, 1984, requested that we develop guidelines for acceptable surveys of potentially contaminated oils for use by licensees. You referred to IE Circular 81-07 (and "many regulatory guides") as espousing the use of operational state-of-the-art measurements for release of materials. Circular 81-07 did not establish criteria for releasing radioactively contaminated materials from restricted areas for unrestricted use. The regulations applicable to nuclear power reactor licensees do not provide for release of materials that are known to be radioactively contaminated at any level. Authorization for disposal of specific radioactively contaminated materials may be requested as specified in 10 CFR 20.302. The intent of that circular was to provide guidance on acceptable limits of detection of portable survey equipment, thus defining "how hard you have to look" for the case in which no release of radioactive material is authorized. The other case, not addressed in that circular, is the case in which some release is authorized, e.g., pursuant to 10 CFR 20.302. Both cases are discussed below.

For the case in which no release of radioactive material is authorized, the appropriate LLD value is the "operational state of the art" value used for laboratory measurements of environmental samples. This is the LLD value given in the standard RETS for environmental samples (e.g., 15 pCi/L, or 1.5 E-8 uCi/ml for Co-58, Co-60 and Cs-134). We note, parenthetically, that LLDs of this magnitude must have been used by licensees for previous measurements of oils since the petition for rulemaking published September 28, 1984 (49FR 36653; PRM-20-15) states that measured radioactivity levels for major sources of waste oil at BWRs and PWRs typically are in the 1 E-7 to 1 E-6 micro-curie/ml range.

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For the case in which disposal of radioactively contaminated oil has been authorized by the NRC, pursuant to 10 CFR 20.302, the necessary LLD value need only be sufficiently low to ensure that the particular limits are not exceeded. Thus, these LLDs may be substantially above the technical specification environmental LLD values if the NRC authorized release limits correspond to radioactivity concentrations substantially above these levels. Because the release limits authorized pursuant to 10 CFR 20.302 are established on a case-by-case basis, the corresponding LLD-values that are necessary to ensure that the release limits are not exceeded will vary accordingly.

You should be aware that there are a number of on-going activities that are related to the questions discussed here. One is the petition for rulemaking mentioned above concerning the disposal of radioactively contaminated oil. Another is a forthcoming request from IE, NRR, and NMSS that RES take the lead in developing an agency position regarding the lower threshold of licensed material contamination of solid materials which require disposition as licensed material. Finally, RAB in response to a request from and discussions with IE, is developing guidance on 10 CFR 20.302 applications which will include criteria for residual radioactivity contamination levels that will be approved by the NRC. This 20.302 guidance will be issued in an IE Information Notice which may include the preceding guidance on detection limits for oils.

Original signed by
F. J. Congel

Frank J. Congel, Chief
Radiological Assessment Branch
Division of Systems Integration

Enclosures:

- 1. Federal Register Notice, dtd Sept. 28, 1984

- cc: R. Bernero
D. Muller
R. Bellamy, RI
K. Paperiello, RIII
R. Hall, RIV
F. Wenslawski, RV
L. J. Cunningham, IE
J. Buchanan, IE
W. A. Mills
D. Harmon

OFFICE	DSI:RAB	DSI:RAB	IE:	IE:	IE:ORPB	DSI:RP
SURNAME	EBrangan:cm	FJCongel	JBuchanan	LJ Cunningham	PF Maskee	DM Muller
DATE	1/28/85	1/24/85	1/22/85	1/25/85	1/17/85	1/16/85

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decaying into innocuous levels.

2. By limiting the wastes that can be buried under this proposal to materials that have no attraction for human contact, the risk of potential salvage of contaminated articles is eliminated.

3. The biological and chemical characteristics of the specified wastes rule out inputs to human food chains.

4. The low concentrations permitted for the proposed methods of disposal would preclude significant exposures to personnel involved in the collection and transportation of the wastes. Because of this, there would be no restrictions on handling of the waste and there would be no need for special containers or labels.

The petitioner concludes by stating that handling and disposal of the specified wastes in the manner proposed in the petition would reduce overall risk from flammable and toxic chemicals and from pathogenic organisms without significantly changing the risk from radiation exposure.

In order to help evaluate the merits of this petition, the NRC staff requests biomedical research institutions and other users of the short-lived radionuclides, in addition to their comments on the petition itself, to provide information on:

- (1) Their usual inventory of these short-lived radionuclides;
- (2) The amounts used and the activity, volume, and types of materials disposed of annually or monthly;
- (3) Estimates of the cost of packaging, storage, transportation, and disposal of this material; and
- (4) The costs of any alternative methods of disposal which have been examined. In particular, the amount of any cost savings resulting from methods of disposal which would become available if the petition were granted would be extremely helpful.

Dated at Washington, DC this 25th day of January, 1984.

For the Nuclear Regulatory Commission,
Samuel J. Chill,
Secretary of the Commission.

49 FR 36653
Published 8/19/84
Comment period expires 11/19/84.

10 CFR Part 20
(Docket No. PRM-20-15)

Edison Electric Institute (EEI) and
Utility Nuclear Waste Management
Group (UNWMC); Filing of Petition for
Rulemaking

AGENCY: Nuclear Regulatory
Commission

ACTION: Notice of receipt of petition for
rulemaking from Edison Electric

Institute (EEI) and Utility Nuclear Waste
Management Group (UNWMC).

SUMMARY: The Commission is publishing for public comment its notice of receipt of a petition for rulemaking dated July 31, 1984, which was filed with the Commission by Michael A. Beuser on behalf of EEI and UNWMC. The petition was docketed by the Commission on July 31, 1984, and has been assigned Docket No. PRM-20-15. The petitioners request that the Commission issue a regulation governing the disposal of low-level radioactively contaminated waste oil from nuclear power plants by establishing radionuclide concentrations in waste oil at which disposal may be carried out without regard to the radioactive material content of the waste.

DATE: Submit comments by November 19, 1984. Comments received after this date will be considered if it is practical to do so, but assurance of consideration cannot be given as to comments received on or before this date.

ADDRESSES: All persons who desire to submit written comments concerning the petition for rulemaking send their comments to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, DC 20555. Attention: Docketing and Service Branch.

For a copy of the petition write to the Division of Rules and Records, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555.

The petition, copies of comments, and the accompanying document to the petition may be inspected and copied for a fee at the NRC Public Document Room, 1717 H Street NW, Washington, DC.

FOR FURTHER INFORMATION CONTACT: John Philips, Chief, Rules and Procedures Branch, Division of Rules and Records, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555. Telephone: 301-492-7086 or Toll Free: 800-368-5642.

SUPPLEMENTARY INFORMATION:

I. Background

The petitioners stated that when the Commission published its final rule creating 10 CFR Part 61 (December 27, 1982; 47 FR 57446), the Commission noted that numerous commenters had requested that it develop a "de minimis" standard which would permit certain wastes to be disposed of by less restrictive means than existing practices. At that time, the Commission expressed its agreement that establishment of such de minimis standards would reduce disposal and long-term site maintenance costs, help preserve disposal capacity for wastes with higher activity levels, enhance

overall stability of disposal facilities and tend to reduce groundwater migration impacts. The Commission also expressed its willingness "to accept petitions for rulemaking . . . for declaring certain waste streams to be of no regulatory concern," and identified some of the information necessary to support such a petition.

More recently, the Advisory Committee on Reactor Safeguards (ACRS) recommended that de minimis levels of radiation exposure be established. Presently, certain criteria defining regulatory cutoff levels for radioactively contaminated waste exist in 10 CFR 20.306, which authorizes the disposal of liquid scintillation media and animal tissue containing no greater than 0.05 microcurie per gram of H-3 or C-14 without regard to their radioactivity. The petitioners stated that it was also their understanding that the draft proposed revisions to 10 CFR Part 20 defined de minimis exposure as that exposure to radiation which would present a calculated risk of biological harm so low, relative to the risks faced routinely from daily activities, that the risk from radiation would be a trifle and of no regulatory concern. The petitioners stated that they understood that a numerical dose level of one mrem was determined to represent the de minimis level of radiation exposure.

II. Waste Oil at Nuclear Power Plants

Each year, the petitioners state, quantities of waste oil containing very low levels of radioactive contamination are produced at nuclear power plants. The principal sources of the waste oil are primary system pump motors (including reactor coolant pumps) at pressurized water reactors (PWRs), and turbine and pump motors, such as recirculation and feedwater pump motors, at boiling water reactors (BWRs). Waste oil also collects in turbine and radwaste building sumps, equipment drain trays, and during maintenance operations (miscellaneous waste oils).

Radioactivity levels for sources of waste oil, such as pump turbines and motors at both PWRs and BWRs are typically in the 10⁻⁷ to 10⁻⁶ Ci/ml range with Mo-94, Co-58, Co-60, Cs-134 and Cs-137 the dominant radionuclides. Miscellaneous waste oils at PWRs and BWRs—from sumps, drains, etc.—generally contain the same dominant radionuclides, but concentrations are more variable, typically ranging from 10⁻⁶ Ci/ml to 10⁻⁴ Ci/ml. These often are oil-water mixtures. Prior processing might be necessary before disposal by some of the methods addressed in the petition.

Currently, according to the petitioners, the only generally approved disposal method for low-level radioactively

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contaminated waste oil involves absorption or solidification, transportation to, and burial at a licensed disposal facility. Disposal of waste oil in this manner is costly, inconsistent with the NRC's policy in favor of volume reduction, and represents an inefficient use of Commission, licensee, and burial site resources.

III. Petitioners Solution to this Problem

The petitioners state that waste oil, under certain conditions, may be disposed of in a considerably more efficient manner, while providing adequate protection for both the environment and public health and safety. Data on generation rates, radionuclide concentrations and content were gathered from 15 operating plants, including 29 units (18 PWRs and 13 BWRs). A number of specific disposal methods were considered individually, as follows:

1. To burn the oil on the nuclear reactor site in a controlled location.
 2. To burn the oil off site.
 3. To spray it on an unpaved road, as is done for dust control.
 4. To solidify it and bury it in a landfill.
 5. To recycle it in the same manner as is done commercially with waste oil.
- The ultimate objective was to identify mechanisms by which waste oil at

specific levels of contamination could be disposed of in an efficient, environmentally acceptable, cost-beneficial manner while assuring that the postulated radiation dose does not exceed the regulatory cutoff level.

The detailed analysis which forms the basis of the petition is found in the report entitled "Development of Recommended Regulatory Cutoff Levels for Low-Level Radioactively Contaminated Oils from Nuclear Power Plants." This report was prepared for the UNWMOG by OTHA, Inc., in October 1983. The report notes that it is possible to specify limiting gross activity levels for each disposal method. Specifically, waste oils can be disposed of via the six disposal methods set out in the proposed amendment.

IV. Proposed Amendment to 10 CFR Part 20

The petitioners request amendment of 10 CFR Part 20 as follows:

1. Redesignate existing paragraphs (c) and (d) and (e), respectively; and add paragraph (c) to § 20.306 to read as follows:

(c) Waste oil not exceeding the following gross activity limits by the indicated methods, provided that the total quantity of oil disposed of at a single location by methods (1), (2), (3), and (6) either not exceed 1,000 gallons per year, or that the sum of the ratios of

each radionuclide present to the concentration of that radionuclide in Part 20, Appendix E, not exceed the value of 1,000 divided by the number of gallons disposed of per year at that location, i.e.:

APPENDIX E—CONCENTRATION LIMITS FOR WASTE OIL DISPOSAL UNDER THE PROVISIONS OF 10 CFR 20.306(C) BY ELEMENT AND DISPOSAL METHOD—Continued

Radionuclide	Concn. limit (pCi/gal)	Disposal scenario
Fe-59	2.8x10 ⁴	Burn on reactor site
	1.8x10 ⁴	Solidify/bury/landfill
	2.2x10 ⁴	Spray on road
	2.8x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Recycle
	1.2x10 ⁴	Recycle
Fe-60	3.0x10 ⁴	Burn on reactor site
	6.0x10 ⁴	Spray on road
	2.0x10 ⁴	Burn on reactor site
	3.0x10 ⁴	Burn on reactor site
	2.7x10 ⁴	Solidify/bury/landfill
	1.2x10 ⁴	Recycle
Ni-63	6.2x10 ⁴	Burn on reactor site
	6.2x10 ⁴	Burn on reactor site
	9.1x10 ⁴	Spray on road
	6.2x10 ⁴	Burn on reactor site
	5.2x10 ⁴	Solidify/bury/landfill
	2.1x10 ⁴	Recycle
Ni-64	6.1x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Spray on road
	6.1x10 ⁴	Burn on reactor site
	6.1x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Solidify/bury/landfill
	6.2x10 ⁴	Solidify/bury/landfill
Ni-66	2.1x10 ⁴	Burn on reactor site
	2.1x10 ⁴	Burn on reactor site
	2.1x10 ⁴	Burn on reactor site
	2.0x10 ⁴	Spray on road
	2.1x10 ⁴	Burn on reactor site
	1.0x10 ⁴	Recycle
Pu-238	2.8x10 ⁴	Burn on reactor site
	2.8x10 ⁴	Burn on reactor site
	2.8x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Spray on road
	1.2x10 ⁴	Solidify/bury/landfill
	1.2x10 ⁴	Recycle
Tc-99	1.1x10 ⁴	Recycle
	4.2x10 ⁴	Burn on reactor site
	5.2x10 ⁴	Spray on road
	4.2x10 ⁴	Burn on reactor site
	4.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Recycle
Tc-99m	1.7x10 ⁴	Burn on reactor site
	1.7x10 ⁴	Burn on reactor site
	1.7x10 ⁴	Burn on reactor site
	1.7x10 ⁴	Burn on reactor site
	1.7x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Recycle
Tc-99g	1.2x10 ⁴	Spray on road
	2.3x10 ⁴	Solidify/bury/landfill
	1.2x10 ⁴	Recycle
	7.4x10 ⁴	Spray on road
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
Tc-99m	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
Pu-239	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
Pu-239m	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
Pu-240	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
Sr-90	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
Sr-90	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site

$$\frac{\sum \text{1 radionuclide (Part 20, App. E concentration)}}{\text{Concentration of radionuclide i}} = \frac{1,000}{\text{volume of gallons disposed of at location (gal/yr)}}$$

Disposal method	Gross activity limit (pCi/gal)
(1) Burn on reactor site	4.2x10 ⁴
(2) Burn off site	4.2x10 ⁴
(3) Spray on road	4.2x10 ⁴
(4) Solidify/bury	2.2x10 ⁴
(5) Recycle	4.2x10 ⁴

2. Add a new Appendix E to read as follows:

APPENDIX E—CONCENTRATION LIMITS FOR WASTE OIL DISPOSAL UNDER THE PROVISIONS OF 10 CFR 20.306(C) BY ELEMENT AND DISPOSAL METHOD

Radionuclide	Concn. limit (pCi/gal)	Disposal scenario
Ac-228	6.9x10 ⁴	Recycle
	2.8x10 ⁴	Burn on reactor site
	2.8x10 ⁴	Burn on reactor site
	2.8x10 ⁴	Burn on reactor site
	2.8x10 ⁴	Burn on reactor site
	7.2x10 ⁴	Solidify/bury/landfill
Co-60	1.2x10 ⁴	Recycle
	1.2x10 ⁴	Burn on reactor site
	9.2x10 ⁴	Spray on road
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
Co-60	1.0x10 ⁴	Solidify/bury/landfill
	6.2x10 ⁴	Burn on reactor site
	2.2x10 ⁴	Recycle
	6.2x10 ⁴	Burn on reactor site
	6.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Spray on road

APPENDIX E—CONCENTRATION LIMITS FOR WASTE OIL DISPOSAL UNDER THE PROVISIONS OF 10 CFR 20.306(C) BY ELEMENT AND DISPOSAL METHOD—Continued

Radionuclide	Concn. limit (pCi/gal)	Disposal scenario
Co-60	6.2x10 ⁴	Burn on reactor site
	2.2x10 ⁴	Solidify/bury/landfill
	1.2x10 ⁴	Recycle
	2.2x10 ⁴	Burn on reactor site
	7.2x10 ⁴	Spray on road
	2.2x10 ⁴	Burn on reactor site
Co-60	2.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Solidify/bury/landfill
	3.2x10 ⁴	Burn on reactor site
	6.2x10 ⁴	Recycle
	6.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Recycle
Cs-137	1.2x10 ⁴	Solidify/bury/landfill
	3.2x10 ⁴	Burn on reactor site
	3.2x10 ⁴	Burn on reactor site
	3.2x10 ⁴	Burn on reactor site
	3.2x10 ⁴	Burn on reactor site
	3.2x10 ⁴	Burn on reactor site
Cs-137	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
Cs-137	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
Cs-137	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site
	1.2x10 ⁴	Burn on reactor site

5 x 10⁴ pCi/gal
 10⁻² pCi/gal
 10⁻² pCi/gal

APPENDIX E—CONCENTRATION LIMITS FOR
WASTE OIL DISPOSAL UNDER THE PROVI-
SIONS OF 10 CFR 20.306(C) BY ELEMENT
AND DISPOSAL METHOD—Continued

Radionuclide	Concentration limit (pCi/gm)	Disposal scenario
Y-91	1.0x10 ¹¹	Recycle
	2.0x10 ¹⁰	Burn off-plant stack
	2.0x10 ¹⁰	Burn off-plant stack
	4.0x10 ¹⁰	Recycle
	2.0x10 ¹⁰	Burn off-plant stack
	4.0x10 ¹⁰	Scrub on road
Zr-96	6.2x10 ¹⁰	Scrub on road
	2.7x10 ¹⁰	Recycle
	1.0x10 ¹⁰	Burn off-plant stack
	1.0x10 ¹⁰	Burn off-plant stack
	1.0x10 ¹⁰	Scrub on road
	1.0x10 ¹⁰	Burn off-plant stack
Zr-96	6.2x10 ¹⁰	Scrub on road
	2.7x10 ¹⁰	Recycle
	3.0x10 ¹⁰	Burn off-plant stack
	1.0x10 ¹⁰	Scrub on road
	3.0x10 ¹⁰	Burn off-plant stack
	3.0x10 ¹⁰	Burn off-plant stack

The petitioners conclude that both the Commission and the ACRS have expressed support for the development of regulatory cutoff levels. The Commission, in particular, the petitioners note, has invited petitions for rulemaking of particular waste streams which might be considered below regulatory concern, and has formulated some criteria identifying exposure levels deemed de minimis, and certainly below regulatory concern.

Waste oil generated in nuclear power plants, the petitioners state, appears to be particularly suitable for such treatment, because current methods of disposal are unnecessarily costly, inconsistent with NRC policy favoring volume reduction, and represent an inefficient use of NRC, licensee, and burial site resources. The petitioners conclude that the 1 mrem/year standard is a conservative value which is consistent with current NRC policy.

Dated at Washington, DC, this 12th day of September 1984.

For the Nuclear Regulatory Commission,
Samuel J. Chalk,
Secretary of the Commission.