



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

November 8, 1996

MEMORANDUM TO: Cheryl A. Trottier, Acting Chief  
Radiation Protection and Health  
Effects Branch  
Division of Regulatory Applications  
Office of Nuclear Regulatory Research

FROM: Michael F. Weber, Chief *M. F. Weber*  
Low-Level Waste and Decommissioning  
Projects Branch  
Division of Waste Management  
Office of Nuclear Material Safety  
and Safeguards

SUBJECT: RESEARCH NEEDS FOR A STUDY OF POSSIBLE ELEVATED CONCENTRATIONS OF  
RADIOACTIVE MATERIALS IN SLUDGE/ASH AT SEWAGE TREATMENT PLANTS

A. BACKGROUND

This memorandum identifies a research need of the Division of Waste Management associated with the joint NRC/EPA survey of publicly-owned (sewage) treatment works (POTWs) to be conducted in FY97-98. The overall objective of the survey is to measure the concentrations of radioactive materials in the sludges/ashes that result from the sewage treatment processes at POTWs, and to determine if they can pose a hazard to public health and safety. The assistance required from RES for this task is to prepare table(s) based on calculations that relate potential annual exposure to members of the public from handling and disposal of contaminated sludge/ash, to unit concentrations of radionuclides in that sludge/ash. DWM will use the results from this study, along with the concentrations of radionuclides measured in sludge/ash by NRC/EPA contractor laboratories, to establish "release criteria" for contaminated sludge/ash from POTW sites. In addition, the results of the survey could lead to an updating of NRC rules regarding licensee discharges to the sanitary sewer system.

B. RESEARCH NEED

1. Radionuclides of Concern

For each generic scenario identified below, we request that RES estimate the exposures for the individual member of the public likely to receive the highest annual dose from the handling and disposal of processed sludge/ash. These exposures should be expressed as mrem (TEDE) per year per pCi of radionuclide per gram of sludge or ash. RES should calculate exposures for the following classes of radionuclides:

- Gamma emitters - These are to be selected by RES from NUREG-1500, "Working Draft Regulatory Guide on Release Criteria for Decommissioning: NRC Staff's Draft for Comment," July 1994 and approved by LLDP/DWM;

CONTACT: Robert B. Neel, NMSS/DWM  
415-6696

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- X-ray emitter - I-125;
- Beta emitters - C-14 and Sr-89/90; and
- Alpha emitters - Ra-226, Th-227/228/230/232, U-234/235/238, Pu-238/239, and Am-231

The results of this study should be included in a tabular summary (sometimes called a "look-up table") in a format similar to that of Tables A-1 to A-4 in Appendix A of NUREG-1500.

## 2. Exposure Scenarios

For each of the following scenarios, RES should identify the conceptual model of the biosphere and the transport parameters necessary to characterize the exposure pathways through this biosphere to the individual likely to receive the highest exposure. This description should also include the locations and lifestyle (activities) of the exposed individual.

All scenarios should assume that the sludge/ash, transported, applied to farmland, or buried was released by the POTW for unrestricted use, and that it was not diluted with other solid or liquid wastes (i.e., it was a "free release of sludge"). However, only for scenarios a.(2), a.(3) and b.(2) should RES assume that exposures occur along agricultural pathways developed for the residential scenario in Section 5, Volume 1 of NUREG/CR-5512.

### a. Potential Exposures Associated with a POTW

#### (1) Occupational Exposure

The development of realistic occupational scenarios for employees of a POTW during its lifetime will require that the RES staff consult with the EPA waste water staff, and may also require several field trips to operating POTWs to determine the individual employee likely to receive the highest exposures. For your information, past studies have considered the following activities for occupational scenarios: sludge-process operator, in close contact with dewatered sludge (in lagoons, ash piles) on a full-time basis; sludge-incinerator operator; and the heavy-equipment operator who loads material for transport to retail outlets, farms, or landfills.

#### (2) Exposure to Radionuclides in the Surface Soil Layer

This scenario should assume that after processing, a POTW will sell contaminated sludge/ash to a farmer through a retail outlet, or directly to a farmer, who will use it to condition or fertilize the surface soil (0-15 cm.) on his family farmland.

#### (3) Exposure to Radionuclides in a Pit, Pile or Lagoon

This scenario assumes that, at some point in the long-term future, the activities of the POTW will cease, and that a farm family builds a residence on an area formerly used by the POTW for on-site storage/disposal of sludge/ash. For this scenario, RES should also assume disposal of the sludge/ash into a pit in the earth (it is a

volume source) that has no cover. The farm family is assumed to reside on the surface of the sludge/ash pit.

b. Potential Exposures at a Landfill

RES should develop the following scenarios to estimate the potential exposures to radionuclides in sludge/ash that can be transported from a POTW to an off-site landfill.

(1) Occupational Exposure During Landfill Operations

This scenario involves the individual employee of the landfill operator who is likely to receive the highest exposure during disposal operations. RES should confirm that the exposures from this scenario are nearly the same as those calculated in Scenario a.(1).

(2) Exposure to a Resident Farmer After Closure of a Landfill

This scenario occurs at some future time after the activities at the landfill cease, and after a farm family builds a residence on the landfill area formerly used for disposal of sludge/ash. For this scenario, RES should also assume that the buried waste has no cover. RES should confirm that the exposures from this scenario are nearly the same as those calculated in Scenarios a.(2) and a.(3).

c. Exposure During Transport of Sludge/Ash

In addition to transport to a farm or retail outlet, the processed sludge/ash could also be transported to a landfill. RES should confirm that the exposures of persons involved with transport of sludge/ash to its point of use or disposal is considerably smaller than exposures for the other scenarios in this memorandum.

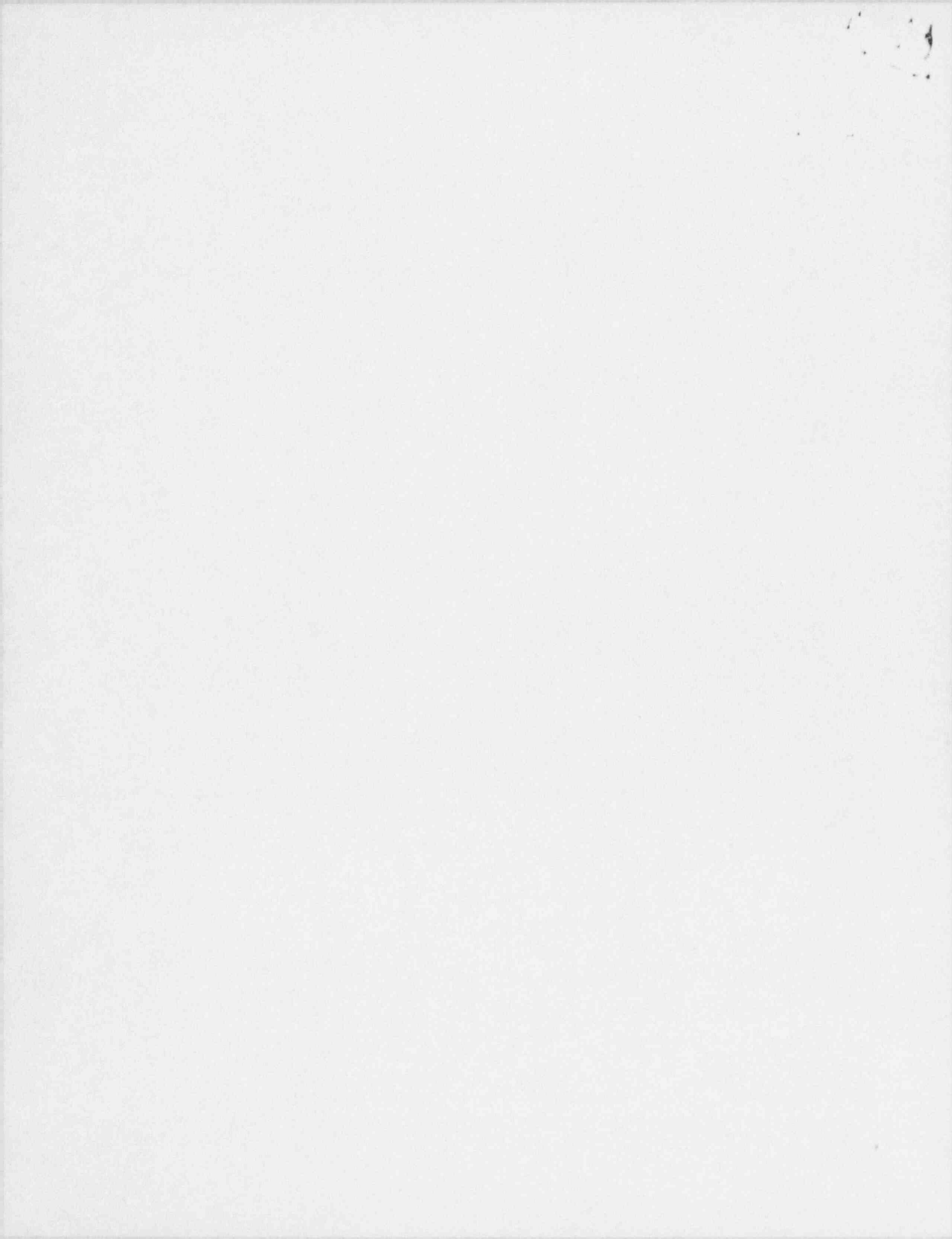
C. REFERENCES

We suggest that RES staff review the following reports before proceeding with any dose assessments for this study:

- "Dose Assessment for Disposal of Radiologically Contaminated Sewer Sludge From Erwin, Tennessee," June 1993;
- "Generic Dose Assessment for Disposal of Incinerator Ash in a Landfill," September, 1994; and
- NUREG/CR-5814, "Evaluation of Exposure Pathways to Man From Disposal of Radioactive Materials into Sanitary Sewer Systems," May 1992.

D. COORDINATION

We request that, after RES staff has reviewed the information provided in this memorandum, the proposed approach to the model study (conceptual models, codes, input parameters, etc.) be presented to my staff for consideration.



C. Trottier

-4-

Please identify your staff point of contact for this study. Dr. Robert Neel of my staff will then schedule a meeting with your staff to discuss this study in more detail. If you have any questions concerning this request, please contact me at 415-7297, or R. B. Neel at 415-6696 or e-mail "RBN."

cc: P. Goode, EPA  
B. Bastian, EPA  
M. Doehnert, EPA

C. Trottier

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