

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF INSPECTION AND ENFORCEMENT  
WASHINGTON, D.C. 20555

June 10, 1985

IE INFORMATION NOTICE NO. 85-46: CLARIFICATION OF SEVERAL ASPECTS OF REMOVABLE  
RADIOACTIVE SURFACE CONTAMINATION LIMITS FOR  
TRANSPORT PACKAGES

Addressees:

All nuclear power reactor facilities holding an operating license (OL).

Purpose:

This information notice is provided to clarify the application of the U.S. Department of Transportation (DOT) requirements pertaining to the control and monitoring of removable radioactive surface contamination on packages and transport vehicles. It is expected that recipients will review this information for applicability to their transportation activities, and consider actions, if appropriate, to preclude any problems from arising due to inappropriate applications of the DOT requirements. However, suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required. Specific clarification and guidance is provided in the Attachments on:

1. Averaging of Wipe Samples
2. Use of Higher Efficiency Wipe Sampling Methods
3. "Wrapping" of Packages
4. Exclusive-use Vehicle Surveys for Surface Contamination

Background:

The recent resumption of transportation of commercial power reactor spent fuel in the U.S. has focused renewed attention on the chronic problem of cask "weeping." This is a phenomena whereby certain casks, after their removal from underwater storage basins (pools) and decontamination, subsequently exhibit an increase in the level of removable radioactive surface contamination during and after transport. This increase is believed to be the result of a "weeping" or "sweating" of previously entrapped activity within surface pores, fissures, etc. Its occurrence and magnitude appear to be dependent on such variables as cleanup methods, surface porosity, types of detergents used, surface treatment history, duration of and temperature during transport, and the period of time between completion of transportation and performance of a contamination survey. Although the levels of contamination which have been observed in cask "weeping" episodes do not present a significant health and safety problem, the levels have been

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technically above the regulatory limits, particularly when no further consideration is given to determining the wiping efficiency more precisely than the ten percent efficiency that is assumed within the regulatory limit. Recent changes to DOT regulations as promulgated in Docket HM-169 (48 FR 10218, March 10, 1983, and 48 FR 31214, July 7, 1983) have also raised a question because of an apparent unintended revision in the regulatory language relating to averaging of wipe samples. Notwithstanding the guidance in this notice, shippers of radioactive packages, particularly spent fuel casks, are reminded of the continuing need for improving cask decontamination methods and spent fuel pool techniques, so as to maintain removable radioactive surface contamination levels as low as practicable.

Current Regulatory Requirements:

The DOT regulations in 49 CFR 173.443 prescribe limits for control of removable (nonfixed) radioactive contamination. The level of such contamination on the external surfaces of each transport package offered for shipment must be kept as low as practicable. Determination of the nonfixed contamination may be made by wiping (e.g., "smears") an area of 300 cm<sup>2</sup> of the surface concerned with an absorbent material, using moderate pressure, and measuring the activity on the wiping material. Sufficient wipe samples should be taken in the most appropriate locations so as to yield a representative assessment of the nonfixed contamination levels. The limits of §173.443, Table 10, are restated below:


TABLE 10 - REMOVABLE EXTERNAL  
 RADIOACTIVE CONTAMINATION - WIPE LIMITS

Contaminant	Maximum Permissible limits	
	uCi/cm <sup>2</sup>	dpm/cm <sup>2</sup>
Beta-gamma emitting radionuclides; all radionuclides with half-lives less than ten days; natural uranium; natural thorium, uranium-235; ura- nium-238; thorium-232; thorium-228 and thorium-230 when contained in ores or physical concentrates.....	10 <sup>-5</sup>	22
All other alpha emitting radionuclides..	10 <sup>-6</sup>	2.2

The above limits apply to packages transported as nonexclusive use, e.g., mixed freight. For packages shipped as exclusive-use by rail or public highway, the provisions of §173.443(b) provide that the removable (nonfixed) radioactive surface contamination at any time during transport may not exceed 10 times the limits stated above. At the beginning of transport, however, the levels may not exceed those stated above. Further, pursuant to §173.443(c), any transport

vehicle in which packages are transported within the "factor of 10" higher values, e.g., above the Table 10 limits, must be surveyed with appropriate radiation detection instruments after each use and shall not be returned to service until the radiation dose rate is below 0.5 mrem/hr and the removable contamination is below the limits stated in the above table. (An exception to this vehicle survey requirement is provided by §173.443(d) for closed transport vehicles (highway) which are dedicated solely to the transport of radioactive materials packages and are appropriately marked on the exterior of the vehicle. Also, in such cases the removable surface contamination on packages within such vehicles may be at the "factor of 10" limits at the start of transport).

No specific action or written response to this information notice is required. If you have any questions on this matter, please contact the appropriate NRC Regional office or the technical contact listed below.

  
Edward L. Jordan, Director  
Division of Emergency Preparedness  
and Engineering Response  
Office of Inspection and Enforcement

Contact: A. W. Grella, IE  
(301) 492-7746

Attachments:

1. Averaging of Wipe Samples
2. Use of Higher Efficiency Wipe Samples
3. "Wrapping" of Packages (Casks)
4. Exclusive-use Vehicle Surveys for Surface Contamination
5. List of Recently Issued IE Information Notices

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\*See previous concurrence

DD: DEPER: IE\*  
SASchwartz  
4/ /85

D: DEPER: IE  
ELJordan  
5/31/85

PSAS: IE\*  
DGable  
3/ 85sc

SMPB\*  
AGrella  
3/ /85

C: SMPB: IE\*  
LCobb  
3/ /85

DEPER: IE\*  
WFisher  
3/ /85

D: DI: IE\*  
JPartlow  
4/ /85

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(See previous concurrences)

PSAS: IE*	SMPB*	C: SMPB: IE*	DEPER: IE*	D: DI: IE*	DD: DEPER: IE*
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packages that indicate removable contamination above the Table 10 limits, but within the "factor of ten" higher limit of 22,000 d/m/100 cm<sup>2</sup>.

- ° §173.443(c) does not address quantitative limits on the surface of the vehicle during the survey, however, the vehicle may not be released for other service until the 2,200 d/m/100 cm<sup>2</sup> and 0.5 mrem/hr limits are met.
- ° Noncompliance with §173.443(c) would therefore exist if the survey to return a vehicle to service was not performed, and/or the contamination or radiation dose rate on the vehicle exceeded the stated limits upon its release for other service.

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(see previous concurrence)

PSAS: IE\*  
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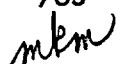
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*Reviewed by D. Gable*

PSAS: IE  
DGable  
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### AVERAGING OF WIPE SAMPLES

The DOT regulations currently state in §173.443(a) that "... the amount of radioactivity measured on any single wiping material when averaged over the surface wiped ..." shall not exceed the Table 10 values. Prior to the regulatory amendments by DOT in 1983 (see Docket HM-169, 48 FR 10238, March 10, 1983), formerly applicable §173.397(a) provided that wipe samples could be "... averaged over any area of 300 square centimeters of any part of the package surface." A February 21, 1984 query was made by NRC to DOT to clarify this matter. It read as follows:

The language of §173.443(a) has been modified somewhat from that contained in the previous §173.397(a). The new language no longer specifically addresses averaging of multiple wipe samples within any given 300 cm<sup>2</sup> area of a package surface. We understand that it was not DOT's intention to disallow such averaging and further that DOT will consider processing a future rule change to restore such a provision to §173.443. A suggested text for such a modification is enclosed. In the interim, until the text has been formally modified, we will continue to consider that averaging of multiple wipe samples over any 300 cm<sup>2</sup> area of a package surface is an acceptable practice.

In their March 19, 1984, reply to NRC the DOT stated:

It was not our intent to disallow averaging of wipe samplings over a 300 cm<sup>2</sup> area. Consequently, we believe this is an acceptable practice and will take the necessary action to clarify this in §173.443(a)....



## USE OF HIGHER EFFICIENCY WIPE SAMPLES

As is stated in §173.443(a): "Other methods of assessment of equal or greater efficiency may be used. When other methods are used, the detection efficiency of the method used shall be taken into account and in no case shall the nonfixed contamination on the external surfaces of the package exceed ten times the limits listed in Table 10." NRC also queried DOT on this matter, as follows:

We understand that DOT considers that the reference in §173.443(a) stating that 'other methods of assessment of equal or greater efficiency may be used,' may include other wipe sampling methods wherein the efficiency has actually been demonstrated to be greater than 10 percent. Therefore, in effect, the wipe sample limits stated in §173.443(a) and (b) and Table 10 therein, are limits "by default," which do not take advantage of utilizing an efficiency which has been demonstrated to be greater than 10 percent. In our evaluations of licensees' package surveys, we therefore plan to accept assessments based on efficiencies which have been appropriately demonstrated to have a higher than 10 percent efficiency.

The reply by DOT on the usage of higher efficiency wipe samples was as follows:

It is our interpretation of this section that wiping methods with a demonstrated efficiency greater than 10 percent may take this greater efficiency into account. As you point out, the higher efficiency must be documented and in no case may the removable levels exceed 10 times the values in Table 10.

It should be understood that where the term "detection efficiency" is used, it refers to the efficiency of alternate methods for quantifying the amount of removable contamination on a package surface. It does not refer to the laboratory term relating to instrument effectiveness for counting analyses.

An additional clarification also was received from DOT relative to use of contamination assessment techniques with greater than 10% efficiencies in exclusive-use vs nonexclusive-use shipments. It stated that "the provision for using higher efficiency techniques, described in 49 CFR 173.443(a) may also be used when operations are being performed in accordance with §173.443(b)."

An acceptable method of demonstrating wipe (smear) efficiency is repetitive wiping of a portion of the package surface. The demonstrated wipe efficiency is the ratio of the initial smear activity to the summation of activity on all the wipes of the designated portion of the package surface. For the purpose of this calculation, one can assume all activity is removed when two consecutive wipes show less than 10% of the activity of the initial wipe. Because of variations in package surfaces and contamination characteristics, care should be

taken to ensure that the demonstrated wipe efficiency is representative of the wipes to which it is applied. This will normally require delaying package decontamination until after conduct of wipe efficiency determinations if an efficiency greater than 10% is used. In no case, however, may the removable contamination levels exceed ten times the Table 10 limits for packages in exclusive-use shipments when no consideration is given to a demonstrated higher wiping efficiency. Upon such an appropriate demonstration, however, removable contamination limits may not exceed 100 times the Table 10 limits, as would be the case for a wiping method demonstrated to have been 100% efficient.

In general, licensees may only utilize demonstrations of high smear collection efficiencies which have been determined by smear results taken on the same cask for which the initial smears (using the assumed 10% efficiency) indicated the regulatory limit was exceeded. Licensees will not be allowed to use the generic collection efficiencies obtained on one specific cask for other future cask shipments.

### "WRAPPING" OF PACKAGES (CASKS)

The question of "wrapping" the exterior of transport packages has been raised on several occasions, particularly in instances where "weeping" of contamination has occurred on casks that have been immersed in spent fuel storage pools prior to transport. DOT also was queried on this matter by NRC as follows:

The issue of whether exterior "wrapping" of casks can be used to achieve compliance with removable contamination limits has been raised on a number of occasions. Our position on this, with which I understand you also concur, is as follows:

- ° The addition of "wrapping" to an NRC-certified package would not be permissible without obtaining prior authorization of the modification in the applicable NRC certificate. In proposing such a provision, an applicant's safety analysis obviously would have to address heat retention since the contents are a heat source.
- ° The "wrapping" of a non-NRC certified package would not relieve the shipper from compliance with the removable contamination limits applicable to the exterior surface of the unwrapped package unless the wrapping constituted an integral part of a DOT Specification 7A, Type A, package design. In such cases, the shipper's documented package safety evaluation would need to address whether the wrapping would maintain its closure integrity during the normal conditions of transport.

The reply to NRC by DOT on this matter read as follows:

For both NRC-certified and non-NRC-certified packages, any wrapping must be addressed in the package design evaluation. For NRC-certified packages this would include specific mention in the certificate of compliance. For DOT Specification 7A, Type A, packages, the shipper's package safety evaluation would have to document the ability of the wrapping to successfully pass the Type A tests.

## EXCLUSIVE-USE VEHICLE SURVEYS FOR SURFACE CONTAMINATION

The exact requirements of §173.443 are sometimes misunderstood as they relate to quantitative limits on the vehicle surface during the survey required by §173.443(c). For this purpose, the vehicle surface is meant to be those surfaces wherein or on which packages are stowed during transport. That paragraph does not actually set forth any quantitative limit on the surface of the vehicle itself during the survey which is performed to return the vehicle to service. The important subtlety therein is that the quantified limit of §173.443(b) applies to the packages in the vehicle. The "bottom line" of §173.443(b) and (c), considered collectively, is as follows:

- ° The packages within an exclusive-use vehicle may have up to 22,000 d/m/100 cm<sup>2</sup> during and at the completion of transport but must be limited to 2,200 d/m/100 cm<sup>2</sup> at the start of transport, unless the vehicle is dedicated to radioactive materials service only, and so marked, pursuant to §173.443(d), in which case the 22,000 d/m/100 cm<sup>2</sup> limit applies at the start of transport.
- ° §173.443(c) requires a survey of an exclusive-use vehicle (and also, presumably the dedicated vehicles) after transport of packages that indicate removable contamination above the Table 10 limits, but within the "factor of ten" higher limit of 22,000 d/m/100 cm<sup>2</sup>.
- ° §173.443(c) does not address quantitative limits on the surface of the vehicle during the survey, however, the vehicle may not be released for other service until the 2,200 d/m/100 cm<sup>2</sup> and 0.5 mrem/hr limits are met.
- ° Noncompliance with §173.443(c) would therefore exist if the survey to return a vehicle to service was not performed, and/or the contamination or radiation dose rate on the vehicle exceeded the stated limits upon its release for other service.

LIST OF RECENTLY ISSUED  
 IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
85-45	Potential Seismic Interaction Involving The Movable In-Core Flux Mapping System Used In Westinghouse Designed Plants	6/6/85	All power reactor facilities holding an OL or CP
85-44	Emergency Communication System Monthly Test	5/30/85	All power reactor facilities holding an OL
85-43	Radiography Events At Power Reactors	5/30/85	All power reactor facilities holding an OL or CP
85-42	Loose Phosphor In Panasonic 800 Series Badge Thermoluminescent Dosimeter (TLD) Elements	5/29/85	All power reactor facilities holding an OL or CP
85-41	Scheduling Of Pre-Licensing Emergency Preparedness Exercises	5/24/85	All power reactor facilities holding a CP
85-40	Deficiencies In Equipment Qualification Testing And Certification Process	5/22/85	All power reactor facilities holding an OL or CP
85-39	Auditability of Electrical Equipment Qualification Records At Licensees' Facilities	5/22/85	All power reactor facilities holding an OL or CP
85-38	Loose Parts Obstruct Control Rod Drive Mechanism	5/21/85	All PWR facilities designed by B&W holding an OL or CP
85-37	Chemical Cleaning Of Steam Generator At Milestone 2	5/14/85	All pressure water reactor facilities holding an OL or CP

OL = Operating License  
 CP = Construction Permit