February 19, 1998

FOR: The Commissioners

FROM: L. Joseph Callan, Executive Director for Operations /s/

SUBJECT: REGULATORY OPTIONS FOR SETTING STANDARDS ON CLEARANCE OF MATERIALS AND EQUIPMENT HAVING RESIDUAL RADIOACTIVITY

PURPOSE:

To request Commission direction on regulatory options for setting standards on clearance[(1)] of materials and equipment having residual radioactivity.

CATEGORY:

This paper covers policy issues requiring Commission consideration.

BACKGROUND:

In a Staff Requirements Memorandum dated March 10, 1994 (COMFR-94-001), the Commission directed the staff to develop a plan and schedule for a rulemaking that would establish radiological criteria for the release of slightly contaminated equipment and material from licensed nuclear facilities. In reply, the staff provided an action plan in SECY-94-221 (August 19, 1994). The staff recently updated the Commission on the status of the plan in SECY-97-119 (June 5, 1997). That update noted that the staff's contractor planned to complete its draft analyses of dose modeling by August 1997, and that when final, the dose modeling report would serve as the technical basis for evaluation of regulatory alternatives in a Generic Environmental Impact Statement (GEIS) and a Regulatory Analysis. In addition, SECY-97-119 stated that an effort was underway to coordinate NRC and EPA contractor efforts (the current status of that effort is described in Sections 1.4.1 and 1.4.2 of the enclosure to this paper). During the September 2, 1997, briefing of Chairman Jackson and Commissioner McGaffigan, Chairman Jackson indicated that the staff should independently assess the costs and benefits of clearance to evaluate the EPA analysis and to support Commission positions. As stated in SECY-96-200, the staff had previously believed that a cost/benefit analysis of various dose criteria for clearance would be developed cooperatively by EPA and NRC. However, in SECY-97-119, the Commission was notified that the cooperative efforts had halted. The staff has already tasked the NRC contractor, Science Applications International Corporation (SAIC), to provide independent technical support for the evaluation of the EPA cost/benefit analysis. Further, the NRC Project Manager has asked the contractor, SAIC, to begin preliminary work to define what, in addition to the EPA cost/benefit analysis, data or models, would be required for an independent NRC cost/benefit analysis. SECY-97-119 also noted that the EPA had begun development of a "pre-proposed" rule,[(2)] and that the NRC staff planned to provide the Commission with a paper soliciting Commission direction on NRC rulemaking options in the fall of 1997. This paper is intended to present and discuss those options. The current status of NRC guidance and practice is briefly stated below.

CONTACT: Robert A. Meck, DRA/RES
(301) 415-6205

Clearance of radioactively contaminated solid materials by NRC licensees is presently carried out in accordance with NRC Regulatory Guide (RG) 1.86 - *Termination of Operating Licenses for Nuclear Reactors*. RG 1.86 addresses only clearance of solid material having surface contamination. There is currently no NRC regulatory guidance for clearance of materials with volumetric contamination. Values used in Table 1 of RG 1.86 were based on instrument detectibility and were set at levels similar to values for Sr-90 detected in the environment as a result of fallout in the 1960s. While doses to protect public health and safety were considered and the levels were deemed protective, no quantitative dose analysis by pathway was conducted as a basis for the guidance, and the dose levels are not uniform as calculated with modern methods. RG 1.86 and similar guidance also state that the survey report should show that residual contamination had been reduced to levels as low as is reasonably achievable (ALARA).

The Commission's rule on *Radiological Criteria for License Termination* published on July 21, 1997 (62 FR 39058), does not address the clearance of material or equipment from decommissioned nuclear facilities. However, since contamination levels used to release a site with volumetrically contaminated soil are based on scenarios that provide an upper bound for doses to individuals, it is unlikely that any soil removed from released sites would result in any dose to a member of the public higher than that postulated to individuals remaining onsite.

The principal benefits of taking regulatory action at this time on clearance appear to be conservation of low-level waste facility space, conservation of materials and manufactured equipment, and regulatory relief from costs of disposal of waste with such low levels of activity that continued treatment as radioactive waste would not enhance safety. It is anticipated that the increased maintenance required for aging operating plants combined with the rising number of decomissionings will result in more material and equipment being available for clearance. Subsequent to SECY-97-119, EPA suspended its schedule for rulemaking in order to address numerous comments on its technical support document and cost/benefit analysis. Therefore, if regulatory action is desired to promote conservation and regulatory relief, as mentioned above, Commission action may be necessary.

DISCUSSION:

The staff has developed three general regulatory options for the Commission's consideration. These are described in detail in the enclosure and summarized here as follows:

Option 1 - Continue with current regulatory guidance; do not conduct an NRC rulemaking.

Option 2 - Support EPA promulgation of a standard and issue conforming rules and/or guidance.

Option 3 - Proceed independently to promulgate a dose-based regulation for clearance.

The staff has no position with regard to favoring one option over another and requests Commission direction before proceeding with rulemaking. The options and their advantages and disadvantages are briefly summarized below and described more fully in Enclosure 1.

Option 1: Continue with current regulatory guidance; do not conduct NRC rulemaking.

NRC would not change its regulations, and there would be no change in the guidance, i.e., current RG 1.86 values would continue to be used to determine if materials and equipment with a surface radioactive contamination could be released.

Advantages:

1. Continued use of current regulatory guidance would allow more flexibility for licensees in that alternate approaches could be proposed by licensees and considered by the NRC staff.

2. No resources for rulemaking would be needed.

Disadvantages:

1. With increasing numbers of licensee facilities undergoing decommissioning, a large increase of requests for clearance of materials and equipment may be anticipated, and in that case, extensive staff resources would be needed to perform case-specific reviews.

2. The flexibility permitted by the continued use of current regulatory guidance for clearance of materials and equipment on a case-by-case basis could lead to different clearance levels for materials entering general commerce.

3. Current RG 1.86 values would still not address volumetric contamination nor would there be a uniform dose basis for clearance.

Option 2: Support EPA promulgation of a standard and issue conforming rules and guidance.

EPA is currently considering issuance of standards for clearance of materials under its Atomic Energy Act authority. The EPA has suspended its schedule for rulemaking in order to address numerous comments on its technical support document and cost/benefit analysis. Following issuance of an EPA standard, NRC could issue a conforming regulation and regulatory guides.

Advantages:

1. This option might require less expenditure of NRC resources than a rulemaking by NRC that would address the issue directly in the absence of an EPA standard. However, close coordination between the respective staffs may be desirable to ensure that the EPA standard meets NRC needs.

2. This option likely would ensure compatibility between the EPA standard and NRC regulations.

3. The issue of clearance standards is extremely controversial with the public. An initial EPA rulemaking would allow this controversy to be fully addressed by the EPA under its authority to set generally applicable standards for radiation in the environment.

Disadvantages:

1. There is presently no EPA standard.

2. There is no certainty that EPA standards will be promulgated. Although an EPA rule promulgated under the Atomic Energy Act would bind the NRC to compliance, there have been several instances in the past where the EPA has not exercised its discretionary authority to promulgate rules in this area.

3. If an EPA rule is promulgated, there is no certainty that it would provide a sufficient basis to meet the full range of the needs of the NRC and the Agreement State licensees. The EPA Technical Support Document and Cost/Benefit Analysis appear to be limited in scope to reactors and do not include materials licensees. Further, these documents have not addressed clearance of non-metals and equipment. Regulatory relief for all types of licensees and over a range of materials and equipment may be desired by the Commission.

4. NRC's schedule for rulemaking and guidance revision would depend on EPA's rulemaking schedule.

5. If the EPA standards were promulgated first, then the Commission may have difficulty gaining public acceptance for a different standard for activities not covered by the EPA rulemaking.

Option 3: Proceed independently to promulgate a dose-based regulation for clearance.

Under this option, NRC would proceed with a rulemaking independent of EPA and develop uniform, dose-based regulations for the clearance of materials and equipment having residual radioactivity. NRC would not proceed with rulemaking until FY00. The staff would undertake this rulemaking following completion of guidance development for the license termination rule and development of the technical bases for this rulemaking.

Advantages:

1. An NRC rule would meet specific NRC regulatory needs for NRC and Agreement State licensees.

2. This option could lead to an earlier completion of the final rule than would waiting for an EPA standard, if EPA continues to suspend its rulemaking schedule.

3. If the Commission were to set standards before the EPA, then the EPA likely would have difficulty gaining public acceptance for a different standard.

Disadvantages:

1. This option could require more resources and more time for NRC to complete an independent rulemaking rather than relying on EPA's results, should EPA choose to act.

2. This option may result in different criteria in an NRC rule as compared to a later EPA standard, should it choose to act, and thus may raise finality issues that could require NRC to revisit its rule.

If the Commission directs the staff to proceed with Option 3, there are several issues regarding the NRC rulemaking process and the specific details of a regulation, that need to be addressed. The principal issues are:

1. What types of regulatory controls are necessary prior to clearance, e.g., should there be restricted release?

2. What types of materials should be included in the regulatory action, e.g., specific metals and concrete?

3. What process should be used to obtain public comment in the rulemaking or revision of guidance (e.g., solicit comments in Federal Register notices, or provide enhanced participation through workshops, increased use of electronic media or, as planned in SECY-94-221, enhanced participation modeled after that for the "license termination rule")? Also, should the NRC staff provide additional opportunities for enhanced early and substantive input by the Agreement States (e.g., task force membership on pre-decisional rulemaking plans)?

These issues, and the advantages and disadvantages of alternative solutions, are fully described in Section 4 of Enclosure 1.

RESOURCES:

Resources for a potential rulemaking on clearance are in the current budget. The enclosed table summarizes the staff's estimates of the resources and time to completion for each of the options. The estimates are judgments based on current spending rates and the resources and time required for another complex rulemaking, namely the rule on *Radiological Criteria for License Termination*.

Under Option 3, the resources estimated for RES to finalize the technical basis documents are $300K and 0.5 FTE per year over 2 years. The NMSS resources to prepare the necessary rulemaking documents (generic environmental impact statement, regulatory analysis, Federal Register notice, regulatory guidance, etc.) are $400K and 4.0 FTE per year for each of 3.5 years. Additional resources would be required during this time period for OGC and OSP support for this rulemaking. If NRC undertook an enhanced public participation rulemaking process, the additional estimated NMSS costs would be $500K in the first year. Development of a rulemaking plan would normally commence once the technical foundations such as the dose assessment and cost/benefit analysis are completed. However, due to other high priority rulemakings in FY 99 (Parts 35, 60, and 70), rulemaking efforts could not begin before FY 2000. Although rulemaking resources are being transferred to NMSS in accordance with the Commission direction on DSI-22, it is anticipated that an additional 3.0 FTE per year over 3 years will be necessary to complete this rulemaking and associated guidance. This will be considered in the FY 2000 budget planning process. In addition, anticipated substantial public interest in this rulemaking will likely result in the need for additional resources. Under Option 2, we would anticipate a savings of about $250K as EPA would bear a portion of the costs for the enhanced public participation. However, the total FTE expenditure by NMSS would likely increase overall as the rulemaking process itself would be expected to take additional time.

If, on the other hand, the Commission wishes to continue the *status quo*, rather than proceed with rulemaking, then staff resources would be directed toward completing other regulatory actions. The staff would monitor the rulemaking activities of the EPA and provide technical review of and comment on of their dose assessments and cost/benefit analyses to ensure that NRC interests are considered in the EPA rulemaking. NMSS would direct its rulemaking efforts to other category I rules. RES would focus its resources on evaluating new information in the areas of: radiation biology underlying risk estimates due to irradiation--including the linear-no-threshold hypothesis of dose response; risk harmonization and risk management decisions, including relationships between measurements, dose, and risk; and reviewing new models of metabolism, of the lung, and of the standard man.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objections.

RECOMMENDATIONS:

That the Commission:

1. Provide direction with regard to Options 1, 2, and 3.

2. If the Commission selects Option 3, provide direction with regard to the rulemaking issues noted above.

Original /s/ by
L. Joseph Callan
Executive Director for Operations

Attachment: As stated

NOTE: TO BE MADE PUBLICLY AVAILABLE WHEN THE FINAL SRM IS MADE AVAILABLE

DISCUSSION OF BACKGROUND, REGULATORY OPTIONS, AND ISSUES ON CLEARANCE OF MATERIALS AND EQUIPMENT

1.0 INTRODUCTION

1.1 Purpose

The purpose of this paper is to briefly describe the background, potential regulatory options (with their associated advantages and disadvantages), and issues on clearance of slightly contaminated materials and equipment.

1.2 Definition of Clearance

Clearance is a term used by the international community and is defined as the release of radiation sources from all nuclear regulatory control (see IAEA-TECDOC-855, Interim report for comment, pg. 1). Note that clearance of materials and equipment may result in their release for reuse or recycling in commerce or disposal.

1.3 Current Clearance Practices

NRC licensees presently release materials and equipment for clearance during facility operations and outages. In practice, such clearance is carried out consistent with the values for surface contamination found in Table I of NRC Regulatory Guide (RG) 1.86, *Termination of Operating Licenses for Nuclear Reactors*, dated June 1974. The same radiological criteria for surface contamination are set for materials licensees by a fuel cycle directive (Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material, Policy and Guidance Directive FC 83-23, Division of Industrial and Medical Nuclear Safety, November 4, 1983.).

NRC regulations applicable to nuclear power reactor licensees do not contain radiological criteria for the release of materials for unrestricted use that are *known* to be radioactively contaminated *at any level*. For small items and small areas, surveys are conducted with instrumentation capable of detecting the average values from RG 1.86, namely, 5000 dpm/100 cm^2 total and 1000 dpm/100 cm^2 removable beta/gamma contamination. There is a subtle difference in practice for materials licensees. FC-83-23 permits clearance of materials and equipment that are known to be contaminated below specified levels consistent with RG 1.86.

NRC regulations also currently do not set out criteria for clearance of solid materials (e.g., metals and concrete), soil, or equipment containing low levels of radioactive contamination as an integral, non-surface part (i.e., volumetric contamination). Therefore, materials and equipment volumetrically contaminated by activation or penetration (e.g., absorption) at nuclear facility sites are either stored by licensees on site or shipped to licensed Low Level Waste (LLW) facilities. Furthermore, the absence of regulations or guidance on an acceptable limit for volumetrically contaminated materials inhibits industry from processing both surface and volumetrically contaminated materials and equipment in ways that would lead to utilization of valuable resources.

1.4 Recent technical information from NRC and EPA

1.4.1 NRC Contractor Draft Report: Radiological Assessment for Clearance of Material and Equipment from Nuclear Facilities

The draft report, by Science Applications International Corporation (SAIC), dated September 23, 1997, provided dose assessments for clearance and is currently under technical review by the staff. When final, it will serve as the foundation for the technical bases documents, e.g., a Generic Environmental Impact Statement (GEIS) and Regulatory Analysis (RA), for rulemaking on clearance of materials and equipment. Clearance scenarios addressed in the report include reuse of surface contaminated equipment and recycle or disposal into a landfill of volumetrically-contaminated scrap materials. The report does not address dose assessments from contaminated soil, but such an analysis could be conducted.

Dose factors were calculated as the annual individual dose per unit activity for a mass or area of scrap. The draft report contains dose factors for 84 nuclides likely to contaminate steel, aluminum, copper, or concrete, applied to over 40 scenarios ranging over the reasonable fates of materials or equipment from transportation to processing, consumer use and disposal.[3] The potential total effective dose equivalent (TEDE) that a member of the critical population group could receive was calculated for various pathways and is presented with the associated uncertainties. Almost all the limiting pathway scenarios involve process workers, e.g., slag pile workers, as opposed to the consumer of a product.

The approach to dose assessment of material recycle was conceptually divided into two parts: a material-specific scrap model (material flow model and nuclide partitioning), and scenario dose assessment models. The conceptual material flow models were used to develop exposure scenarios and serve as tools to identify points of potential exposure. Exposure scenarios were initially developed for the steel recycle evaluation; these served as the basis for the evaluation of the other three materials (copper, aluminum, and concrete).

A radionuclide-specific TEDE was calculated for an average member of the critical population group in the reuse scenarios. Calculated dose factors for reuse scenarios were based on a unit level of residual surface contamination and were expressed in normalized units of Sv/a per Bq/cm^2 (mrem/y per pCi/cm^2). Since the contamination was assumed to be on the surface, dose factors for reuse were independent of material. They ranged from a high of 380 Sv/a per Bq/cm^2 (1.4 mrem/y per pCi/cm^2) for Ac-227 down too much less than 0.01 Sv/a per Bq/cm^2 (< 0.004 mrem/y per pCi/cm^2). Most of the eighty-four radionuclide-specific dose factors (approximately two-thirds) were less than 10 Sv/a per Bq/cm^2 (0.04 mrem/y per pCi/cm^2).

Calculated TEDE dose factors for recycle scenarios were based on a unit level of volumetric contamination in the scrap. The highest dose factor for most nuclides was found in a steel scenario. For steel, occupational doses associated with refinery facilities and transportation most commonly produced the limiting dose factors. Similarly, for copper, product use scenarios did not result in limiting dose factors for any radionuclide. Unlike the steel and copper evaluations, dose factors associated with the use of refined aluminum products most commonly produced the limiting dose factors. Occupational doses associated with concrete reuse in road construction activities and processing concrete for reuse most commonly produced the limiting dose factors.

The draft SAIC dose factors were compared with values published by the International Atomic Energy Agency (IAEA), RG 1.86 values, and NUREG-1500 values. The report presents derived clearance levels (Bq per g or cm^2 scrap) based on both surface and volumetric contamination normalized to the trivial annual dose established by the IAEA, namely, 10 Sv/a (1 mrem/y). The recycle (volumetric) clearance levels in the draft report were based on the limiting dose factors across the four materials examined (steel, copper, aluminum, and concrete). As a result, the currently used RG 1.86 values for 2 radionuclides were less restrictive than SAIC reuse results for surface contamination (viz., Th-229, Th-232), 18 were essentially the same (e.g., Co-60, Cs-137), and for 64 radionuclides RG 1.86 values were more restrictive (e.g., H-3, Ni-63, Ra-226).

1.4.2 Environmental Protection Agency

1.4.2.1 JULY 1997 EPA CONTRACTOR REPORT ***DRAFT TECHNICAL SUPPORT DOCUMENT - EVALUATION OF THE POTENTIAL FOR RECYCLING OF SCRAP***

METALS FROM NUCLEAR FACILITIES

The purpose of this contractor's report is to: (1) characterize potential sources of scrap metal that may be available for recycling; (2) estimate potential normalized annual dose and lifetime risk to the reasonably maximally exposed individual (RMEI)[(4)] associated with recycle; (3) estimate the potential normalized collective dose and risk to the exposed population; and (4) estimate the minimum detectable concentration (MDC) of radionuclides contained within or on the surface of scrap metal.

The scope of the analysis covers management and recycle of scrap metal from 11 large DOE facilities and from 123 NRC-licensed commercial nuclear power reactors. The approach is theoretical and employs a number of simplifying assumptions that appear to be conservative in terms of assessing potential doses and risks but optimistic in terms of ability to measure surface and volume contamination on scrap metal in the field.

The document is primarily a compilation of data to support other analyses. It appears that this data was used to develop the conclusions in the June 1997 EPA contractor report *Preliminary Cost-Benefit Analysis and Radiation Protection Standards for Scrap Metal* (discussed below).

1.4.2.2 JUNE 1997 EPA CONTRACTOR REPORT ***PRELIMINARY COST-BENEFIT ANALYSIS AND RADIATION PROTECTION STANDARDS FOR SCRAP METAL***

The purpose of this document is to support EPA development of preliminary draft regulations on release standards for scrap metal from nuclear facilities. Regarding its scope, this cost-benefit analysis would apply to management of scrap metal from DOE facilities and from facilities licensed by the NRC. However, the only NRC licensees included in the analysis are nuclear power plants. A footnote in the analysis states that EPA may address additional Federal and nonfederal sources of scrap metal in future analyses. Neither this document nor the Technical Support Document discussed above addresses clearance of equipment.

The approach taken in the cost-benefit analysis is as follows: (1) identify and characterize potentially affected scrap metal from 11 major DOE facilities and 123 NRC-licensed commercial nuclear power reactors; (2) predict baseline disposition costs and cancer incidence assuming maximum release at RG 1.86 and DOE Order 5400.5 levels; (3) predict disposition costs and cancer incidence assuming maximum release at levels which would expose the reasonably maximally exposed individual (RMEI) to 0.1, 1 and 15 mrem/y; and (4) estimate impacts on scrap metal management costs and cancer incidence of each approach. The analysis considers other impacts (e.g., effect on waste disposal capacity, demand for virgin materials, and ecological impacts) in a qualitative manner, and concludes that they are minor compared to cancer incidence. Restricted recycling (see section 4.1) is not addressed. Disposition costs include all costs incurred by a facility in disposing of scrap metal. Therefore, the cost of low-level waste disposal is not explicitly addressed.

The principal conclusions offered in the EPA report are as follows: Under the 1 mrem/y standard, scrap metal management costs would remain relatively unchanged compared to the baseline that assumed clearance under RG 1.86 criteria, while cancer incidence would decline. Under the 15 mrem/y standard, costs would decrease compared to the baseline, while cancer incidence would increase. Under the 0.1 mrem/y standard, costs would increase compared to the baseline, while cancer incidence would decrease.

2.0 STATEMENT OF PROBLEM

It is anticipated that future decommissionings will result in more material and equipment potentially available for clearance. One rationale for establishing clearance criteria is avoidance of the cost for commercial disposal of LLW. In 1997 the cost is about $300 per cubic foot. In addition to such economic costs, replacement of metals requires many energy consuming steps (mining, milling, smelting, etc.), that result in at least some environmental degradation, as well as risks to workers.

Cleared scrap and equipment may enter freely the stream of general commerce. For perspective, it is important to realize that NRC and Agreement State licensees are only one of several potential sources for clearance of radioactively contaminated materials and equipment. Naturally-occurring and accelerator-produced radioactive material (NARM) sources, DOE facilities salvage, and imports are potential other sources for radioactivity in general commerce. Thus, both the impacts of regulatory actions on clearance by the NRC and their relative impacts compared to clearance from all sources are relevant to consider. A discussion of non-NRC related clearance and international initiatives regarding clearance is contained in Appendix A.

The scope of these concerns with radioactive scrap metal can be illustrated using iron and steel as an example. The amount of scrap steel that may be available from commercial nuclear power plants, DOE facilities, and the U.S. steel market are illustrated in the following table:

Source	Amount of Steel (Metric Tonnes)	Value (Millions $)	
Nuclear Power Plants	610,000	134	Total
DOE Sites	1,300,000	280	Total
U.S. Annual Production	100,000,000	22,000	per year

Although the values in this table are approximate, they illustrate the point that while the total mass of slightly radioactive steel to be reused/recycled is only a small fraction of the annual production of steel in the United States, the quantity and value of the material is nonetheless significant. Furthermore, the value of avoided costs of disposal in a LLW facility are not included in the value estimate.

2.1 Lack of a Uniform Regulatory Basis for Clearance of Materials

Presently, there is no regulation on radiological criteria for clearance of slightly contaminated solid materials by NRC licenses. As noted above, clearance of materials is presently carried out consistently with guidance in RG 1.86. RG 1.86 provides a table of *Acceptable Surface Contamination Levels* for various radionuclides, including natural and enriched uranium, transuranics, and fission products. These surface contamination levels are stated in terms of measurable quantities (observed disintegrations per minute per 100 square centimeters). Values used in Table 1 of RG 1.86 were developed based on the relative risk compared to Sr-90 at fallout levels in the 1960's and instrument detectibility. While doses to protect public health and safety were considered and the levels were deemed protective, no quantitative dose analysis by pathway was conducted as a basis for the guidance, and the dose levels are not uniform as calculated with modern methods. RG 1.86 and similar guidance also state that the survey report should show that residual contamination had been reduced to levels as low as reasonably achievable (ALARA).

RG 1.86 does not contain specific dose criteria. However, illustration of the consideration of public health and safety may be found in IE Circular No. 81-07, "Control of Radioactively Contaminated Material," which states that even if numerous accumulated items were uniformly contaminated at levels of 5000 dpm/100 cm^2 (beta-gamma activity from nuclear power reactors) [the RG 1.86 levels], the potential dose to any individual would be significantly less than 5 mrem/y. Further, RG 1.86 addresses only clearance of solid material having surface contamination, and the dose levels, as calculated by modern methods, are internally inconsistent. There is no NRC regulatory guidance for clearance of materials with volumetric contamination.

2.2 Present NRC Regulations on Radiological Criteria for License Termination Do Not Address Clearance of Material and Equipment

The final rule on *Radiological Criteria for License Termination* published on July 21, 1997 (62 FR 39058), codifies acceptable criteria and methods for decommissioning. This rule focuses on protection of persons entering and using a decommissioned site, but does not address the clearance of material and equipment for release from a site to the public sector. In its response to public comments on the proposed rule, the Commission stated that it "has a separate consideration underway of the issues related to cases where the licensee proposes to intentionally release material containing residual radioactivity that could become available for reuse or recycle" (62 FR 39085, G.7 Recycle).

2.3 International Standards for Clearance of Materials and Equipment

As noted above, the International Atomic Energy Agency (IAEA) has already published an interim report on clearance levels for radionuclides in solid materials. There is a need for consistent international standards for clearance of materials and equipment having residual radioactivity and for standards for regulating imports and exports of such material and equipment.

3.0 REGULATORY OPTIONS FOR ADDRESSING THE CLEARANCE OF MATERIALS AND EQUIPMENT

There are three principal regulatory options for addressing clearance of radioactive materials. These are:

Option 1	-	Continue with regulatory guidance; do not conduct an NRC rulemaking
Option 2	-	Support EPA promulgation of a standard and issue conforming rules and/or guidance
Option 3	-	Proceed independently to promulgate a dose-based regulation for clearance

These options along with their advantages and disadvantages are described below in Sections 3.1 through 3.3.

3.1 Option 1: Continue with current guidance; do not conduct an NRC rulemaking

Under this option, NRC would not change its regulations. Materials and equipment with surface radioactive contamination would either be disposed of in a low level radioactive waste site, or released on a site-specific basis based on the current provisions of RG 1.86, or other current guidance derived from Table 1 of RG 1.86. Under Option 1, no change in the current regulatory guidance would be needed, i.e., current RG 1.86 values would continue to be used to determine if materials and equipment with surface radioactive contamination could be released. Materials with volumetric contamination that is not covered in existing guidance would continue to be handled on a case-by-case basis.

Advantages:

1. Continued use of current guidance allows more flexibility in implementation for licensees in that alternate approaches could be proposed by licensees and considered by the NRC staff.

   As guidance, case-by-case considerations can be made, thus allowing the flexibility of different clearance levels of activities per unit area to be released.

2. No resources for rulemaking would be needed.

   This option would be considered a simple continuance of an existing practice, thus noticing and public comment particular to rulemaking would not be required.

Disadvantages:

1. Extensive staff resources would continue to be needed to perform case-specific reviews.

   Case specific reviews would require analysis of the circumstances for clearance in each case.

2. The flexibility permitted by use of current guidance for clearance of materials and equipment on a case-by-case basis could lead to different clearance levels for materials entering general commerce.

Different operational quantities (Bq/cm^2 scrap) arising from the flexibility of case-by-case analysis on a uniform dose basis could cause confusion after the material or equipment was cleared. For example, a scrap dealer who received batches of scrap with different concentrations of activity may have difficulty discriminating legitimately cleared scrap from unacceptably contaminated scrap.

3. Current RG 1.86 values still would not address volumetric contamination nor would there be a uniform dose basis for clearance.

   Absence of a volumetric guidance level would inhibit industry from using processes that would change surface contamination to volumetric contamination, e.g., melting.

3.2 Option 2: Support EPA promulgation of a standard and issue conforming rules and guidance

EPA is currently considering issuance of standards for clearance of materials under its Atomic Energy Act authority. However, EPA has suspended its schedule for rulemaking in order to address numerous comments on its technical support document and cost/benefit analysis. Following issuance of an EPA standard, NRC could issue a conforming regulation and regulatory guides.

***Advantages**:*

1. This option might require less expenditure of NRC resources than rulemaking by NRC that would address the issue directly in the absence of an EPA standard. However, close coordination between the respective staffs may be desirable to ensure that the EPA standard meets NRC needs.

   Close cooperation with the EPA could result in the EPA bearing much of the resource expenditures for preparation of supporting regulatory documents, i.e., GEIS, RA, and compiling public input.

2. This option likely would ensure compatibility between the EPA standard and NRC regulations.

   Close cooperation with the EPA could result in a rule with consistent criteria.

3. The issue of clearance standards is extremely controversial with the public. An initial EPA rulemaking would allow this controversy to be fully addressed by the EPA under its authority to set generally applicable standards for radiation in the environment.

   EPA could be the primary federal contact for stakeholders and interested parties in a rulemaking in this area. Facilitation among divergent points of view that encompass federal facilities as well as NRC licensees could be handled by EPA.

Disadvantages:

1. There is presently no EPA standard.

   The desirable benefits of conservation of low-level waste repository space, conservation of materials and equipment, and regulatory relief from costs of disposal of very low contaminated wastes are not achievable under current EPA standards.

2. There is no certainty that EPA standards will be promulgated. Although an EPA rule promulgated under the Atomic Energy Act would bind the NRC to compliance, there have been several instances in the past where the EPA has not exercised its discretionary authority to promulgate rules in this area.

   EPA has suspended its rulemaking schedule to address numerous comments on its Technical Support Document and its Cost/Benefit Analysis. It is possible that EPA may decide not to proceed with this rulemaking at this time.

3. If an EPA rule is promulgated, there is no certainty that it would provide a sufficient basis to meet the needs of the NRC. The EPA Technical Support Document and Cost/Benefit Analysis appear to be limited in scope to reactors and do not include materials licensees. Further, these documents have not addressed clearance of non-metals and equipment. Regulatory relief for all types of licensees and over a range of materials and equipment may be desired by the Commission.

   An EPA rule, limited in scope, would provide no codified basis for clearance of non-metals or equipment, nor for NRC licensed fuel cycle facilities or materials licensees. The Commission may desire to extend the scope of an EPA rule, or if EPA were to include all licensees and materials, the Commission may have numerous comments relating to the technical basis of such a rule.

   Assuming EPA promulgates a rule, this option may require close cooperation with the EPA. The staff has worked closely with the EPA staff and their contractors on the details of dose assessment during the past two years. The cooperation has resulted in a convergence of the results so that the dose assessments generally agree within the uncertainties of the methods. The staffs would continue to address any remaining differences.

   While the technical bases, namely dose assessments, of the NRC and EPA are similar, there are issues that may need to be addressed. For example, the EPA may be reluctant to make surface contamination levels for clearance less restrictive than the levels currently in RG 1.86, even if less restrictive levels would be consistent with a uniform regulatory dose objective.

4. NRC's schedule for rulemaking and guidance revision would depend on EPA's rulemaking schedule.

   NRC's schedule could follow that of EPA, or the two agencies could coordinate their schedules to coincide in timing.

5. If the Commission were to set standards after EPA standards were promulgated, the EPA standard would provide precedence.

   Precedence may be a significant factor in acceptance. Since EPA has authority under the Atomic Energy Act to set generally applicable radiation protection standards, they could withhold a sufficiency finding on any NRC rule that did not match their standard.

3.3 Option 3: Proceed independently to promulgate a dose-based regulation for clearance

In this option, NRC would proceed with rulemaking independent of EPA and develop uniform regulations for the clearance of materials and equipment having residual radiation.

***Advantages**:*

1. NRC rule would meet specific NRC regulatory needs.

   Specific needs include scope of the rule, such as types of licensed activities covered, types of materials present, and whether the rule should address restricted use prior to clearance (See Section 4.).

2. This option could lead to an earlier completion of a final rule than would waiting for an EPA standard if EPA continues to suspend its rulemaking schedule.

   Informally, EPA staff have anticipated the issuance of a "pre-proposed" rule at various times over the past year. At present, their schedule is suspended to address numerous comments on their Technical Support Document and their Cost/Benefit Analysis.

3. If the Commission were to set standards before EPA standards were promulgated, the Commission's standard would provide precedence.

   Precedence may be a significant factor in acceptance. EPA would need to justify to OMB the need for a more stringent rule if NRC were to publish a rule ahead of EPA.

Disadvantages:

1. This option may require more resources and more time for NRC to complete an independent rulemaking than relying on EPA's results.

   Unlike an independent analysis of EPA technical basis and cost/benefit analysis, an independent NRC rulemaking would require preparation of supporting documents and solicitation of public comment. These additional requirements require both resources and time.

2. This option may result in different criteria in an NRC rule as compared to an EPA standard, and thus may raise finality issues that could require NRC to revisit its rule.

   NRC rulemaking actions would not preclude EPA's ability to promulgate a generally applicable standard on clearance under its Atomic Energy Act authority. Completely independent rulemakings by the two agencies could lead to inconsistent standards which would require NRC to revisit its rulemaking.

4.0 NRC RULEMAKING ISSUES IF OPTION 3 IS CHOSEN

If Option 3 is selected, there are additional related issues to consider. These issues include:

1. What types of regulatory controls are necessary prior to clearance, e.g., should there be restricted release?
2. What types of materials should be included in the regulatory action, e.g., specific metals and concrete?
3. What process should be used to obtain public comment on the rulemaking (e.g., solicit comments in Federal Register notices, or provide enhanced participation through workshops, increased use of electronic media or, as planned in SECY-94-221, enhanced participation modeled after that for the "license termination rule")? Also, should the NRC staff provide additional opportunities for enhanced early and substantive input by the Agreement States (e.g., task force membership on pre-decisional rulemaking plans)?

These issues are described in Sections 4.1 through 4.3 which follow, along with any advantages and disadvantages of alternative solutions.

4.1 Clearance By Generators vs. Restricted Release By Generators

Clearance is defined as the release of radiation sources from all nuclear regulatory control. Restrictions placed on the disposition of materials or equipment as a result of their radioactive content or contamination are taken as a form of regulatory control, and the disposition is not clearance. However, it is apparent that gradations of regulatory control prior to clearance may be practical for both the generator of contaminated materials or equipment and the recipient.

It appears reasonable to assume that materials and equipment, well-characterized by a licensee for clearance, could be occasionally co-mingled with "orphaned" or improperly disposed sources, NARM, or imported material containing cleared radioactivity. Expensive clean-up of accidentally melted sources has prompted the industry to install monitors. However, these monitors cannot easily distinguish between a strong source shielded by masses of metal and metal uniformly contaminated at low levels. As a consequence there is an aversion in some sectors of the industry to accepting any detected radioactivity in materials or equipment. Quality assurance and control of and liability for cleared materials and equipment are issues that might be addressed by graded control. Alternatively, the levels of clearance could be set to levels that are both an adequate level of protection of public health and safety AND generally indistinguishable from background radiation.

Graded regulatory controls could include NRC issuance of licenses to handlers and processors of scrap to a given point in the handling of the materials or equipment, or permitted first use, or restrictions limiting reuse or recycle to the licensed community. The Commission could use an enabling rulemaking approach and simply enable industry to set its own controls to distinguish between cleared materials and equipment and shielded "orphan" sources. Alternatively, the rule could prescribe regulations for various handling and process restrictions prior to clearance from a licensed system. For example, the Commission could prescribe that scrap from a nuclear facility could be transported to a licensed smelter and the melter could clear volumetrically contaminated ingots at prescribed levels or for prescribed uses.

An example of a restricted release scenario might involve melting radioactive scrap metal at a licensed facility (a licensed furnace), and subsequently releasing the metal for a specific "first use." This designated initial use most probably would be in heavy industry, such as for bridge supports, locomotive parts, structural supports for large buildings, or for a military application. Radioactive scrap material having very low radioactivity might be used for consumer products such as automobile engine blocks. Since restricted first use is amenable to controls and inspections, exposure rates of workers and the public could be controlled, and maintenance of an inventory is possible. The products of such first use of recycled metals could be labeled, much as irradiated produce is labeled.

There can also be "closed" recycling of material in which the radioactive material never leaves the licensed system, and hence cannot be defined as "cleared." No changes to NRC regulations are necessary to cover this situation. Under current regulations, a furnace operator must have a license to receive any radiologically contaminated metal to be melted and blended with other non-radioactive metal. The licensee must conform to all applicable regulations in its operations, including those of the NRC, as well as Federal, State, and local environmental protection agencies. This closed cycle recycling (licensee to licensee) of slightly radioactive iron and carbon steel is currently being conducted on a moderate scale at selected DOE facilities. Another example is the State of Tennessee which has licensed a furnace operator to melt and process carbon steel being recycled in ORNL's pilot program.

The advantages and disadvantages of both clearance by the generator and restricted release by the generator are described in Sections 4.1.1 and 4.1.2.

4.1.1 Restricted Release By Generators Before Clearance

As noted above, under this issue, the NRC could extend regulatory control of the disposition of radioactively contaminated materials and equipment beyond the generator. In this case, the radioactive material would be partitioned and processed into one or more specific products that would be at low enough levels to ensure adequate protection of public health and safety in their commercial use. The partitioning and processing would be done under specific licenses issued by the NRC.

***Advantages**:*

1. Quality Control, quality assurance and liability could be inspected and enforced in a direct manner.

2. Some materials contaminated only by nuclides having relatively short half-lives could be controlled, with adequate protection to public health and safety, until the radioactivity decayed to a level indistinguishable from background radiation. The control period would be matched with the nuclide, the amount of activity, and the expected duration of use of the product or structure in which the radionuclides reside. An example might be very low levels Co-60 (half-life of 5.3 years) in steel under structures for a bridge with an expected use of 40 years.

Disadvantages:

1. This issue implies a potential for an increased number of licenses and their associated regulation.

2. Public outreach and education efforts may require significantly more resources.

4.1.2 Clearance

In this alternative, the NRC would specify standards and criteria for the release to general commerce of very low levels of radioactive contamination in or on materials and equipment by the generators. For materials and equipment that met the standards, a licensee could sell or otherwise dispose of the material or equipment without any license restrictions.

***Advantages**:*

1. Codified clearance criteria could provide uniformity for reuse, recycle, and disposal of materials and equipment including those with volumetric contamination.

2. Codification could enable generators to avoid costs of radioactive waste disposal of materials and equipment that do not cause significant detriment to public health and safety because of the associated radioactivity.

3. Codification could enable the non-nuclear industry to incorporate radioactively contaminated materials and equipment into commerce while preserving adequate protection of public health and safety.

***Disadvantages**:*

1. Development of a new rule with the rationale and analyses for unrestricted use would involve significant resources.

2. Rulemaking might be perceived as a new practice, rather than an improvement of an existing practice (release under RG 1.86 values), thus arousing public and non-nuclear industry anxiety.

4.2 Kinds of Materials and Equipment to be Encompassed in an NRC Rule

NRC dose assessment was limited to volumetrically contaminated iron (or steel), copper, aluminum, and concrete. A dose assessment based on surface contamination would be independent of the medium contaminated. A rule developed by NRC could cover just iron and steel (the materials analyzed in the technical basis document) or all metals, equipment, and materials, including soil.

The more generic the application of the rule, the more potentially useful it would be to licensees. However, expanding the rulemaking to cover all materials could cause a conflict with existing international standards that limit the materials for recycle to solids, thus reducing licensees' ability to export other cleared materials.

If the amount of contaminated material to be considered for clearance is small, then the generic approach is not an advantage in practice, and the NRC may benefit from limiting the rulemaking to one or a few materials until experience is gained with the new standard.

4.3 What process should be used to obtain public comment on the rulemaking (e.g., solicit comments in a Federal Register notice, or provide enhanced participation through workshops). Also, should the NRC staff provide additional opportunities for enhanced early and substantive input by the Agreement States (e.g., task force membership on pre-decisional rulemaking plans)?

The public interface issues related to any rulemaking on clearance of materials and equipment could be of importance to both the NRC and EPA. Public awareness of and interest in any regulatory action depend in part on the opportunities the public has to provide comment. As reported in SECY-97-119, the participants at an EPA workshop, sponsored by the Environmental Law Institute, on recycling scrap metal from nuclear facilities were largely opposed to the rulemaking effort proposed by the EPA. The following provides several approaches to soliciting public comment if the Commission chooses to pursue rulemaking.

4.3.1 Advanced Notice of Proposed Rulemaking

Publication of an Advanced Notice of Proposed Rulemaking (ANPRM) would provide an opportunity for early public participation and would likely extend the rulemaking process to about three years. Typically, an ANPRM solicits answers sought by the NRC to key questions on how to proceed with a rulemaking. For example, one question could be, "Should NRC await an EPA rulemaking on clearance before proceeding?" Another could be, "What should be the scope of the rulemaking?"

While an ANPRM provides a mechanism for public input early on in the rulemaking process, it may not provide the type of information that could be obtained through a dialogue among all of the affected parties. However, publishing an ANPRM could provide useful input on some of the broader issues such as the scope of the rule or whether the Commission should wait for EPA action.

4.3.2 Enhanced Participatory Rulemaking

The rulemaking process could provide opportunities for early and active public participation, through, for example, a workshop or workshops similar to those used in the *Radiological Criteria for License Termination* rule or the ongoing revision of 10 CFR Part 35. This process could include soliciting public comments on an options paper prior to preparing the draft proposed rule for the Commission's consideration. It could also include information exchange on the world-wide-web through placement of staff draft documents on the NRC website and inviting comments.

An enhanced participatory process invites additional public input beyond that routinely used. This process provides opportunity for substantial early public input but would likely require additional resources.

4.3.3 Normal Rulemaking

When a rulemaking requires an environmental impact statement, there are additional opportunities for public input during that rulemaking: a GEIS scoping meeting; comments on the draft GEIS; and comments on the proposed rule. The opportunities for public comment are published in the Federal Register. Comments are collected by the staff, categorized, and responses are usually published in the Supplementary Information that precedes the text of the final rule.

Normal rulemaking is administratively straightforward but provides limited potential for early public input on potentially contentious issues.

4.3.4 Enhanced Agreement State Input

Management Directive 6.3 provides the Agreement States with an opportunity to comment on the staff's rulemaking plan. For a complex and potentially controversial rulemaking, such as this, the Commission may want to provide the Agreement States with an opportunity to work with the staff on the development of the rulemaking plan.

Appendix A: Domestic and International Clearance Criteria and Approaches

Domestic

DOE's principal guidance for clearance of material and equipment with radioactively contaminated surfaces is contained in DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, dated February 8, 1990. The Order adopts the NRC staff's numerical criteria in NRC Regulatory Guide (RG) 1.86, and also adds and other criteria, including ALARA. The Order applies to Naturally-occurring and Accelerator-produced Radioactive Material (NARM) as well as Atomic Energy Act materials.

DOE has recently become more proactive in this area--inaugurating a new *Policy on Recycling Contaminated Carbon Steel* (Memorandum from Alvin L. Alm, Assistant Secretary for Environmental Management, U.S. DOE, September 20, 1996). This memorandum directed DOE field offices and principal contractors to survey, decontaminate as necessary, and release for unrestricted use such material to the extent that it is economically advantageous and protective of workers and public health. Numerical criteria for release of material with surface contamination is essentially that in RG 1.86. The memorandum directs that if decontamination for unconditional release is not economically feasible, then such radioactively contaminated carbon steel to be recycled will be fabricated into containers for disposal of low-level wastes generated by the DOE Environmental Management program. Oak Ridge National Laboratories (ORNL) has been selected by DOE to inaugurate a trial of this recycling initiative.

In June 1997, DOE published a *Draft Handbook for Controlling Release for Reuse or Recycle of Non-Real Property Containing Residual Radioactive*

Material as an interim guide for use and to obtain comment. It also endorses RG 1.86 for surface contamination. DOE does not provide guidance for the release of material and equipment having volumetric radioactive contamination.

Agreement States

Those States that have formal agreements to implement NRC's regulations (Agreement States) have implemented the NRC guidance in RG 1.86. In particular, Tennessee has licensed a furnace operator to melt and process carbon steel for recycle in ORNL's pilot program. In this instance, the radioactively contaminated carbon steel is always under control of authorized persons (under NRC or Agreement State licenses, or DOE Orders). This is an example of "closed" recycling, for which there would be no need for a new NRC regulation because the material remains under regulatory control.

NARM is generally controlled by State regulations. Contaminated materials from the oil and gas industry are released according to the State regulations. Arkansas, Georgia, Louisiana, Mississippi, New Mexico, Oregon, South Carolina and Texas have specific regulations for the control of naturally occurring radioactive material (NORM). Several other States are in various stages of drafting NORM regulations.

International

The International Atomic Energy Agency (IAEA) has published an interim report *Clearance Levels for Radionuclides in Solid Materials - Application of Exemption Principles* (TECDOC-855, 1996).[5] It is intended for eventual inclusion in the IAEA Radioactive Waste Safety Standards. The report proposes clearance levels for unconditional clearance (i.e., release without any constraint on subsequent use) derived from the principle that individual doses resulting from clearance of these materials be limited to 10 Sv/a (1 mrem/yr). It should be noted that the report uses phrases like "must be sufficiently low not to warrant regulatory concern" and "individual dose that can be regarded as trivial."

Efforts by the international community to achieve consensus on relevant matters have had a focal point in a program begun in 1973 at the International Atomic Energy Agency (IAEA). State-of-the-art reports in 1983, 1985, and 1986 on facility decontamination and decommissioning pointed to the need for "exempt quantity or concentration" criteria to permit unrestricted reuse/recycle or release.

This observation led in 1988 to IAEA Safety Series No. 89 (SS-89) which outlined internationally agreed-upon principles for developing criteria for exempting sources and practices from regulatory control, including reuse/recycle. Two criteria determined exemption candidates: (1) individual risks must be sufficiently low not to warrant regulatory concern; and (2) radiation protection, including the cost of regulatory control, must be optimized by exemption. To meet the first criterion an individual dose considered trivial had to be defined, and for the second, optimization analysis techniques, (e.g., cost-benefit analyses) were needed.

Using two approaches--choosing a risk and corresponding dose of "no significance to individuals" and using natural background as a reference level--the IAEA concluded that a "trivial" individual dose would be about 10 Sv/a (1 mrem/yr). It also concluded that, using a minimum value of US$ 3000 per man-Sv[6] ($30 per person-rem), a practice-related trivial collective dose would be a few hundred person-rem. It further suggested limiting the contribution of an individual practice to one mrem per year for individual dose and a commitment of 100 person-rem per year for collective dose.

In 1996, six international intergovernmental agencies agreed on revised basic safety standards (SS-115) which recognize that "justified" practices, and sources within practices, may be exempted if they meet the criteria of 10 Sv/a (1 mrem/yr) for individual dose and 1 man-Sv (100 person-rem/yr) committed collective dose.

France

The staff understands from recent meetings with French regulators that the French are pursuing a case-by-case approach for the recycle or reuse of material having residual radioactivity. They plan to keep the materials and equipment within the regulatory structure. The case-by-case approach, in their view, greatly reduces the uncertainties of dose assessment calculations, because the character of the source, the processes and use can be specified.

Germany

In December 1995, the German Commission on Radiological Protection (SSK) approved a draft recommendation for unconditional clearance of material with residual radioactivity from regulatory control. As a recommendation, it is not legally binding, but it will be used in licensing procedures to set the clearance criteria for operators wishing to clear material from radiological control. The draft recommendation presents radionuclide-specific volumetric clearance levels and allowed annual clearance quantities. The clearance criteria include: 1) meeting surface contamination levels in the Radiation Protection Ordinance; 2) satisfying the volumetric clearance levels, both on an individual nuclide and mixture basis; 3) utilizing small (< 300 kilogram) batches for volumetric measurements; 4) satisfying the annual clearance levels, both on an individual nuclide and mixture basis; and 5) applying appropriate transportation regulations. The allowed annual clearance quantities are no longer deemed necessary and will be deleted in the final recommendation.

---

1. Clearance is a term used by the international community and is defined as the release of radiation sources from all nuclear regulatory control (see IAEA-TECDOC-855, Interim report for comment, pg. 1). Note that clearance of materials and equipment may result in their release for reuse or recycling in commerce or disposal.

2. EPA's "pre-proposed" rule would contain draft rule language and would be used to solicit stakeholders' views.

3. As a comparison of complexity, the dose assessment model that served as the technical basis for the rule on Radiological Criteria for License Termination, NUREG/CR-5512, only analyzed 4 scenarios for lands and structures.

4. The reasonably maximally exposed individual (RMEI) is defined as the individual who has the potential to receive the high-end exposure (e.g., 90th percentile). See EPA contractor's July 1997 draft Technical Support Document - Evaluation of the Potential for Recycling of Scrap Metals from Nuclear Facilities, p. ES-5.

5. Clearance levels are defined as a set of values, established by the regulatory body in a country or state, expressed in terms of activity concentrations and/or total activities, at or below which sources of radiation can be released from nuclear regulatory control.

6. The sum of all individual doses, in Sv, is called the "collective dose" and is assigned the unit "man-Sv."