

NRC ACTIVITIES FOR CONTROLLING THE DISPOSITION OF SOLID MATERIALS

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ABSTRACT

The U.S. Nuclear Regulatory Commission's (NRC's) regulations that set standards for protection of the public against radiation do not currently contain specific regulatory requirements for controlling the disposition of solid materials with very small amounts of radioactivity. For several years, NRC has been examining its approach for controlling the disposition of solid materials, and has involved the public in its examination through several venues. This paper discusses NRC's decision to proceed with a rulemaking to evaluate alternatives for controlling the disposition of solid materials, in view of a report from the National Academies' (NA's) National Research Council. It also describes NRC's technical basis development for decision-making, and summarizes related National and international activities.

INTRODUCTION

NRC currently addresses the release of solid material on a case-by-case basis, using license conditions, existing regulatory guidance, or other case-specific criteria, because there are currently no generally applicable NRC regulations, in 10 CFR Part 20, for the control of the majority of solid materials containing very small amounts of radioactivity (1). For the past several years, NRC has been reexamining its approach for controlling the disposition of solid materials and soliciting public input using several avenues. In 1999, NRC published an Issues Paper, and held public meetings throughout the United States, to obtain input on the following alternative courses of action: (a) continue current practice (i.e., no rulemaking); (b) establish a new standard to permit release of material for unrestricted use, based on dose levels; (c) establish a new standard that prohibits release of material that had been in an area in a licensed facility where radioactive material was used or stored; and (d) establish a new standard that restricts release to only certain authorized uses (2). NRC also established a dedicated website for this activity, and has used web-based methods to obtain stakeholder input regarding control of solid materials (3). In 2000, NRC staff summarized, in a paper sent to the Commission, and published in report NUREG/CR-6682, the comments received on this topic (4, 5, 6). Stakeholders sent more than 800 comments. Their views ranged from opposition to releases of radioactivity that could end up in consumer products, to general support for the establishment of a National standard for unrestricted release of solid materials. At that time, one approach for controlling the disposition of solid materials that appeared feasible to many commenters was conditional clearance, also referred to as restricted use or authorized use.

Based on public input and other factors, the Commission directed the staff to proceed with an NA study on possible alternatives for controlling the disposition of solid materials. Throughout 2001, the NA obtained additional stakeholder input by holding meetings with stakeholder groups. In 2002, the NA issued findings and recommendations in a final report entitled, "The Disposition Dilemma: Controlling the Release of Solid Materials from Nuclear Regulatory Commission-Licensed Facilities" (7). This report contains two overarching findings and seven recommendations, supplemented with 31 specific findings. The first finding is that NRC's current approach on control of solid materials is workable and sufficiently protective of public health, but NRC should begin a process of evaluating alternatives to the current system because it is not explicitly risk-based, it lacks guidelines for volume-contaminated material, and there are inconsistencies in its application. The second finding is that NRC should focus on the decision-making process on alternatives and

consider broad stakeholder involvement, rather than prescribing an outcome for controlling the disposition of solid material. The recommendations of the NA report are: (a) devise a new decision framework to develop and evaluate a broader range of alternative approaches to the disposition of solid materials; (b) NRC's decision-making process should be integrated with a broad-based stakeholder participatory decision-making process; (c) NRC should adopt an overarching policy statement describing the principles governing the management and disposition of solid materials; (d) a dose-based standard should be employed as the primary standard when considering clearance or restricted use; (e) an individual dose standard of 10 microsieverts per year ($\mu\text{Sv/yr}$) [1 millirem/yr (mrem/yr)] provides a reasonable starting point for the process of considering options for a dose-based standard; (f) any dose-based standard should use the conceptual framework of NUREG-1640 to assess dose implications; and (g) NRC should continue to review and assess the ongoing international effort on control of solid materials and develop a scientific rationale for consistency between concentration levels associated with dose criteria the United States and other countries may adopt.

In summary, the NA report presents a process for moving forward on the control of solid materials issue, rather than a set of recommendations on how to control solid materials. However, it does not recommend a preferred approach for controlling the disposition of solid materials and advocates use of a decision-making process to obtain one. The NA report also discusses the existing regulatory framework for control of solid materials, stakeholder reactions, anticipated inventories, dose analysis methods, costs measurement issues, international approaches, and other considerations related to this issue.

After a review of the NA report, NRC staff prepared a paper containing a set of options for proceeding with a regulatory process for examining alternatives for control of solid material. Public health and safety would be maintained under any of the options developed by the NRC staff, so an important consideration is how to best use Agency resources to achieve the goals of increasing public confidence, increasing efficiency and effectiveness, and reducing unnecessary regulatory burden on stakeholders. NRC staff recommended a rulemaking process because it provided the opportunity for stakeholder involvement. It also supports licensing casework involving control of solid material, and is consistent with the Administrative Procedures Act and the National Environmental Protection Act, and with other factors described in SECY-02-0133 (8). The Commission subsequently directed the NRC staff to proceed with an enhanced participatory rulemaking to develop specific requirements for the control of solid material at licensed facilities. It also stated that the rulemaking process should give fair consideration to all alternatives in developing a proposed rule and seek stakeholder participation and involvement in considering alternative approaches, including the current case-by-case approach, clearance, conditional clearance, and a policy of no release (9). Also, based on public input and other factors, the Commission directed the staff to explore and document the feasibility of conditional clearance.

STATUS OF NRC STAFF RULEMAKING ACTIVITIES

The staff is currently engaged in a number of interrelated activities that support development of an NRC regulation for controlling the disposition of solid materials. One step that was taken in February 2003 was the issuance of a Federal Register notice (FRN) to reopen the 10 CFR Part 51 environmental scoping process initiated in 1999 and obtain additional stakeholder input on alternative approaches (10). The February 2003 FRN and another FRN, published in April 2003, announced the conduct of a public workshop, in May 2003, that focused on conditional clearance, per the Commission's directive (11). Significant stakeholder input was obtained on conditional clearance, as well as the overall topic of clearance, during the May 2003 workshop (12) and public comments submitted to NRC. The May 2003 workshop was widely attended and approximately 3000 additional letters and e-mails were submitted to NRC from stakeholders. One of the rulemaking alternatives that was discussed in detail at the May 2003 workshop was the feasibility of conditional clearance. Previously, the NA noted that a conditional clearance approach would require that the solid material be used in a specific application and would be subject to regulatory control until certain

conditions were met. Examples cited in the NA report are release of metal for use as shield blocks at nuclear facilities, and the release of concrete for use in roadbeds. However, the NA report did not offer a method to restrict the use of solid materials once they were released from a licensed facility. National Council on Radiation Protection and Measurements (NCRP) Report No. 141, entitled “Managing Potentially Radioactive Scrap Metal,” noted that it is feasible to designate conditional clearance uses, such as underground sewer systems, to reduce further potential radiological doses to the general public, and that internal recycling, rather than unrestricted release, could be an acceptable approach (13). The NCRP also recommended that a phased approach be considered regarding the release of solid material, so as to initially prohibit recycling into consumer products.

The comments NRC received from the February 2003 FRN and May 2003 workshop were similar to those from previous outreach efforts. Consistent with their previous positions on this topic, the metals industry, cement industry, and citizen groups opposed the release of solid materials into general commerce because of concerns about health effects on workers and the public, and the introduction of residual radioactivity into consumer products. Other concerns the citizen groups raised were the ability to model doses and measure releases, trustworthiness of licensees and government, health effects of low-level radiation, cumulative impacts, and multiple exposures. Certain stakeholders continue to be concerned with financial and legal liabilities if solid materials are incorporated into their products. In contrast to these views, licensees, States, the Health Physics Society (HPS), and other commenters supported the development of a regulation that would allow solid materials to be released for unrestricted use, based on a dose criterion near 10 $\mu\text{Sv/yr}$ (1mrem/yr). Scientific studies conducted by the NCRP and the International Commission on Radiation Protection (ICRP) are cited by these stakeholders to support the position that health risks at such levels are negligible and are a small fraction of natural background.

Many stakeholders continue to be concerned about economic issues because of potential cost advantages and disadvantages for specific industries, if a regulation were established to allow unrestricted release of solid materials into general commerce. Some of these commenters stated that a disposition requirement that only allowed disposal in a licensed low-level radioactive waste facility could cause economic hardship for certain categories of licensees. On the other hand, certain stakeholders oppose these solid materials being released to their industries, because it would shift the economic burden to them and would require the installation of additional, costly monitoring systems. Other commenters thought that the market place would influence release practices independent of NRC setting a health-based standard for unrestricted release of solid materials. The Nuclear Energy Institute (NEI) represents utility licensees and stated that it does not endorse generic recycling that would allow metal into consumer products.

Regarding potential health effects associated with the release of solid materials with very small amounts of radioactivity, citizen groups expressed concern with the conditional clearance alternative and questioned who would be responsible for ensuring that the conditions were maintained on the solid materials. Other stakeholders viewed this option favorably because it was a method for limiting the introduction of solid materials into consumer products. Many stakeholder comments concerned enforcement provisions of conditional clearance and the potential burdens to both regulators and recipients of the material. Regarding the feasibility of conditional clearance on a generic basis, many comments were received that considered it difficult to characterize because of the diversity of potential conditional clearance uses. The NEI did not endorse the establishment of generic standards for conditional clearance, and recommended that a regulatory process should be established for restricting the release of solid materials on a case-by-case basis, taking into account the solid material type, socioeconomic impacts, stakeholder input, and other factors.

Draft Generic Environmental Impact Statement Analyses

The purpose of the draft Generic Environmental Impact Statement (DGEIS) is to assess the environmental impacts of each of these disposition alternatives and their associated implementation costs. This document will evaluate dose criteria of 0.3, 1, 10, and 100 $\mu\text{Sv}/\text{yr}$ (0.03, 0.1, 1, and 10 mrem/yr), and alternate disposition methods, such as unrestricted release, conditional clearance, disposal only, and continuation of the current approach for controlling the disposition of solid materials. Stakeholder input is considered for each of the proposed alternatives, along with a broad range of potential radiological and non-radiological impacts, including evaluation of doses to individuals, assessment of collective doses to different population groups, impacts on biota, societal impacts, and implementation considerations. The DGEIS will consider doses to individuals and doses to collective populations, as well as doses to an individual from exposure to multiple items that can be made from solid material released from licensed facilities. The DGEIS is planned for publication and public comment.

Inventory Estimates

One of the more important technical considerations is the inventory of material potentially available for release at the various facilities NRC licenses. Staff is currently preparing inventory estimates for the amount and kinds of radionuclides for different material types at each of the dose levels being analyzed in the DGEIS. The facility types being analyzed include: (1) power reactors; (2) non-power reactors; (3) fuel cycle facilities, such as uranium mills, uranium hexafluoride production facilities, fuel fabrication facilities, and spent fuel storage facilities; and (4) non-fuel cycle materials licensees, such as medical facilities, research and development laboratories, and complex sites undergoing decommissioning.

Individual Dose Assessments

The NRC report, "Radiological Assessments for Clearance of Equipment and Materials from Nuclear Facilities," NUREG-1640, provides a method for estimating the hypothetical dose an individual might receive annually from residual radioactivity in solid materials (14). The materials analyzed in the report are iron, steel, copper, aluminum, and concrete, which are postulated to be released to general U.S. commerce from a nuclear facility. Potential individual doses are calculated probabilistically for 115 radionuclides in each of 86 scenarios that represent realistic situations that are likely to yield the greatest normalized doses. This report analyzes recycle, disposal, and direct reuse alternatives using probabilistic methods in material flow and dose assessment models. Normalized doses are presented for exposure to solid material with surficial or volumetric radioactivity. The NA and the Center for Nuclear Waste Regulatory Analyses technically reviewed a draft version of NUREG-1640. These independent reviews concluded that the draft analyses were of a high quality and represented the current state of the art in risk assessment. Based on these reviews and public comments received on the draft report, a final version of the report was published in 2003.

Assessment of Individual Doses for Soils and Other Solid Materials

Similar to the development of NUREG-1640 for iron, steel, copper, aluminum, and concrete, the NRC staff is developing a technical basis for estimating potential exposures if soil is released from NRC-licensed facilities. As part of this effort, the NRC staff conducted an information search, in cooperation with the U.S. Department of Agriculture's National Agricultural Library, to identify the ways in which the general public or commercial interests in the United States transport and/or reuse soil. This information was published in report NUREG-1725, "Human Interaction with Reused Soil: A Literature Search" (15), and subsequently used to characterize scenarios, estimate parameters, and select models for soil reuse for dose assessment. Based on this, and on a review of similar efforts for sewage sludge, being conducted by the Interagency Steering Committee on Radiation Standards (ISCORS), and with modeling for metals and concrete in NUREG-1640, a

dose assessment for soils is currently underway that includes information on soils inventories that could potentially be released at the dose levels being evaluated in the DGEIS.

Individual dose factors are also being developed for materials that could be available for release as part of routine operations, such as rubble and sediment, lead, glass, paper, wood, plastic, and ordinary trash (a composite category of routine disposals for landfill). It is anticipated that these types of solid material could be released from a variety of facilities NRC licensees, such as hospitals; clinics; research, medical, and industrial laboratories; power plants; research reactors; and fuel-cycle facilities. The dose conversion factors for these other materials are planned for inclusion as supplements to NUREG-1640.

Guidance for Rule Implementation

The NRC staff is developing a draft consolidated guidance document for implementing the requirements of the rule. It is planned to provide guidance to NRC applicants and licensees for demonstrating compliance with the radiological criteria for controlling the disposition of solid materials at licensed facilities. This guidance is not intended to address release of a licensed site or facility for restricted or unrestricted release, under Part 20, Subpart E, and would not apply to building structures or land. Protocols for conducting radiation surveys to control solid material, for the alternatives under consideration, were in a draft report, NUREG-1761, entitled "Radiological Surveys for Controlling Release of Solid Materials" (16). The technical approaches contained in NUREG-1761 have been considered in developing the Multi-Agency Radiation Survey and Assessment of Materials and Equipment (MARSAME). MARSAME is a supplement to the Multi-Agency Radiation Survey and Site Survey Manual [published by NRC as NUREG-1575 (17)], that addresses control of solid materials. The MARSAME committee has met periodically, throughout 2002 and 2003, to prepare a draft version of MARSAME for public comment.

OTHER STUDIES OF SOLID MATERIAL RELEASE ALTERNATIVES

NRC staff maintains cognizance of other National and international studies in this area that may contribute to decision-making during the rulemaking process. NCRP report No. 116 defines the Negligible Individual Dose (NID) as "...a level of effective dose that can be dismissed," which is 10 $\mu\text{Sv}/\text{yr}$ (1mrem/yr) (18). This concept is based on recommendations contained in NCRP report no. 91, which introduced the term "Negligible Individual Risk Level" [NIRL](19). The NIRL was determined to be an annual risk of $10\text{E}-7$ and is associated with an annual effective dose equivalent of 10 $\mu\text{Sv}/\text{yr}$ (1mrem/yr).

The radiation levels corresponding to the NID, and its predecessor, the NIRL, are annual dose rates of radiation below which "...effort to reduce radiation exposure to the individual is unwarranted."

NCRP Report No. 141 contains NCRP's position on disposition of potentially radioactive scrap metal from facilities regulated by NRC, the U.S. Department of Energy, and States. It considers a few mrem/yr (tens of $\mu\text{Sv}/\text{yr}$) an appropriate dose criterion for a clearance standard, but notes there is increasing consensus, both nationally and internationally, on a dose criterion of 10 $\mu\text{Sv}/\text{yr}$ (1 mrem/yr), and that the ICRP recommends this dose level for cessation of regulatory control. This report also recognizes, however, that certain industries and the public are concerned about the release of scrap metal into general commerce and therefore recommends a phased approach to the release of scrap metal, as discussed above.

The staff is evaluating the American National Standards Institute, Inc., (ANSI)/HPS N13.12-1999 (20). ANSI/HPS N13.12-1999 contains guidance on the clearance of solid materials, based on an individual dose limit of 10 $\mu\text{Sv}/\text{yr}$ (1mrem/yr) or higher dose levels, when justified on a case-by-case basis. Federal agencies are required to use this type of technical standard unless its use is inconsistent with applicable law or otherwise impractical, in accordance with the National Technology Transfer and Advancement Act of 1995.

Coordination amongst Federal agencies on clearance issues is active through the Recycle Subcommittee of ISCORs.

NRC staff has continued to stay informed of potential import and trade issues, as well as international initiatives, in this area because harmonization with international regulatory agencies could simplify the management of these materials. The International Atomic Energy Agency has been preparing a Draft Safety Guide, No. DS-161, entitled, "Application of the Concepts of Exclusion, Exemption and Clearance" (DS-161) (21). This document contains clearance criteria that could form the basis for international radionuclide concentrations for transboundary shipments. Establishment of internationally accepted radioactivity values for commerce could influence import and export trade, and is a factor that NRC staff is evaluating in its rulemaking activities. DS-161 has been in member State review and comments are being addressed. Another major international radiation protection organization - the Commission of European Communities – is attempting to harmonize international clearance standards and implementing guidance.

EVALUATION OF LICENSEE REQUESTS FOR RELEASING SOLID MATERIAL DURING RULEMAKING ACTIVITIES

While the staff is working on the technical basis development for a rule on controlling the disposition of solid materials, licensees continue to seek approval to recycle, reuse, or dispose of solid material from their facilities. NRC licensees planning to disposition solid material from their facility must be generally consistent with the radiation protection requirements of Part 20. The licensee must evaluate the waste in accordance with 10 CFR 20.1501, "Surveys," and subsequently manage the waste in accordance with applicable regulations, license conditions, and existing guidance.

Absent a specific regulatory requirement, at this time, for controlling the disposition of solid materials, NRC generally addresses a licensee's request to release solid material on a case-by-case basis. In each case, material may be released from a licensed facility containing very low levels of radioactive material, but with the concentration of radioactive material so small that its control, through further licensing, for the protection of public health and safety, is no longer necessary. If a licensee detects radioactivity in its waste, or if an operator of a landfill or incinerator returns a waste shipment containing detectable levels of byproduct, source, or special nuclear material to a licensee, the licensee must manage the waste as licensed material, unless the licensee has been granted a specific exemption. Also, compliance with NRC regulations does not relieve NRC licensees from complying with other local, State, and Federal requirements on waste disposal for radiological and hazardous constituents.

During the time NRC is preparing a rule on this topic, staff will continue to review licensee requests, using information contained in three memoranda, which were developed for clarifying existing practices and guidelines for controlling the disposition of solid materials. The first NRC memorandum, dated August 7, 2000, was sent to the Agreement States as an All-Agreement States Letter No. STP-00-0070, dated August 22, 2000 (22). This memorandum outlines the existing regulatory guidance; namely, application of U.S. Atomic Energy Commission Regulatory Guide 1.86 and its equivalent, Fuel Cycle Policy and Guidance Directive FC 83-23, for materials licensees, and Office of Inspection and Enforcement Circular 81-07 and Information Notices 85-92 and 88-22 for reactor facilities (23, 24, 25, 26, 27). The second NRC memorandum, dated July 27, 2001, provides staff guidance regarding the disposition of soil using the provisions of 10 CFR 20.2002, which was sent to the Agreement States in All-Agreement States Letter No. STP-01-081, dated November 28, 2001 (28, 29). The third NRC memorandum, dated December 27, 2002, concerns the disposition of concrete, which was sent to the Agreement States in All-Agreement State Letter No. STP-03-003, dated January 15, 2003 (30).

CONCLUSIONS

NRC staff is continuing to develop a technical basis in support of an enhanced participatory rulemaking to develop specific requirements for controlling the disposition of solid material at licensed facilities. NRC staff has given, and will continue to give, fair consideration to all reasonable alternatives in developing a proposed rule, so that a broad range of alternatives is identified for Commission consideration. The NRC staff remains knowledgeable about National and international activities, and engages stakeholders through participation and involvement in the alternatives under consideration which, principally, are: (a) the current case-by-case approach; (b) clearance; (c) conditional clearance; and (d) a policy of no release. The NRC staff is preparing several supporting technical documents as part of a rule package that will be sent to the Commission, for its evaluation some time this year. In the meantime, NRC staff will continue to protect public health and safety in this area by applying existing guidance for controlling the disposition of solid materials.

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