POLICY ISSUE
NOTATION VOTE

July 15, 2002 SECY-02-0133

FOR: The Commissioners

FROM: William D. Travers
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SUBJECT: CONTROL OF SOLID MATERIALS: OPTIONS AND RECOMMENDATIONS FOR PROCEEDING

PURPOSE:

To inform the Commission of (1) results of a study by the National Academies' National Research Council (hereafter, NA) on alternatives for control of solid materials, (2) staff activities related to other factors that can affect decision-making on this issue, and (3) options and recommendations for proceeding.

SUMMARY:

The Commission has been examining its approach for control of solid materials and, in June 1999, requested public comment on an Issues Paper on this subject. In Staff Requirements Memorandum (SRM) dated August 18, 2000, the Commission decided to defer a decision on rulemaking in this area and request that the NA conduct a study on alternatives for control of solid materials. This paper provides the Commission with information about findings and recommendations of the NA in their final report, and also provides NRC staff analyses of alternatives for proceeding, including a recommended approach.

BACKGROUND:

On June 30, 1999 (64 FR 35090), the Nuclear Regulatory Commission (NRC) published, in the Federal Register, for public comment, an Issues Paper indicating that NRC was examining its

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approach for control of solid material. To provide further opportunity for public input, NRC held a series of public meetings during the fall of 1999.

On March 23, 2000, the NRC staff provided the Commission with a paper (SECY-00-0070) on the diversity of views expressed in public comments received on the Issues Paper. The staff also provided the status of its technical analyses and noted the related actions of international and national organizations and agencies. Based on these various factors, the staff recommended that a final decision on whether to proceed with rulemaking be deferred and that the NA be requested to conduct a study of alternatives for control of solid materials. SECY-00-0070 also recommended that, while the NA study was ongoing, the staff continue to develop a technical information base for decision-making and stay informed of international and U.S. agency activities in this area. On August 18, 2000, the Commission approved the staff's recommendations in SECY-00-0070 and directed the staff to provide the Commission with its recommendations on how best to proceed, as well as the status of the technical bases, approximately 3 months after completion of the NA study. The Commission also directed the staff to provide Quarterly Reports to the Commission on progress made on pertinent issues, while the NA study was underway; Quarterly Reports were sent to the Commission in December 2000, March, July, and September 2001, and January and April 2002,and can be found on NRC's website at: http://www.nrc.gov/materials.html.

DISCUSSION:

Based on the NA report and on other factors affecting decision-making, the staff has developed a set of options for proceeding with a regulatory process for examining alternatives for control of solid materials. The NRC staff's review of the NA report and a summary of the NA report are contained in Attachments 1 and 2, respectively. Other factors considered in development of the options include the status of NRC's technical information base and a review of related activities by national and international organizations; these are described in Attachments 3 and 4, respectively.

Summary of the NA's Study

On August 31, 2000, a contract was awarded for the NA to conduct a study of, and provide recommendations on, possible alternatives for control of solid materials. The contract called for the NA to consider: existing technical bases; national and international policies and approaches; guidelines from standards-setting organizations; and public concerns. The contract specified that the NA should provide recommendations on whether NRC should: continue the current system of case-by-case decisions and, if so, whether, and how, the current system should be revised; establish a national standard by rulemaking and, if so, provide the approach to be used, the basis for release criteria, and the basis for establishing a numerical limit or, if appropriate, propose a numerical limit; or consider another alternative approach. The contract also noted that the NA should provide recommendations on how stakeholder concerns can be integrated into an acceptable approach and also how NRC might consider international standards in its efforts.

On March 21, 2002, the NA submitted its final report to the NRC, containing two overarching findings, seven recommendations, and 31 specific findings. Overarching finding 1 (OA1) notes that NRC's current approach is workable and is sufficiently protective of public health that it does not need immediate revamping. However, OA1 also notes that the current approach is incomplete, has inconsistencies, and lacks a risk basis and that, therefore, NRC should move

ahead, without delay, with a process to evaluate alternatives for control of solid material. Overarching Finding 2 (OA2) notes that broad stakeholder involvement and participation in NRC's decision-making process is critical. OA2 notes that the likelihood of acceptance of an NRC decision increases greatly if the process engages all responsible viewpoints, is perceived as fair and open, and evaluates a broad range of alternatives in an even-handed way.

The seven recommendations focus on this process rather than recommending a specific approach for handling solid material. In particular, Recommendations 1, 2, and 3 (R1, R2, R3) stress the need for, and methods for, building public confidence and involving stakeholders in this effort. The report notes that NRC has a difficult task in this area as a result of issues from prior NRC activities in related areas, as well as stakeholder concerns specific to this effort. The NA report does not contain a detailed recommendation for a specific technical approach for controlling solid materials, because it indicates that it does not want to prescribe the outcome of the decision process. Although a specific technical approach isn't provided, the NA report provides broad information on: impacts and benefits that need to be considered (R1) (including the possible use of an alternative which would restrict future uses of solid material to certain authorized uses (the NA report refers to this alternative as "conditional clearance")); the nature of a standard (R4); a criterion that could be a "starting point" for discussions (R5); and the need to assess international efforts in this area (R7). R6 notes that NRC should use the conceptual framework of its technical bases developed to date, but that it should have more complete analyses available for use in the decision-making processes recommended by R1 and R2.

An outline summary of the final report, including the NA's findings, recommendations, and supporting rationale, is presented in Attachment 2.

Staff Review of the NA's Study

In its review of the NA's study and recommendations, the NRC staff used as its basis NRC's Strategic Plan, NUREG-1614. As noted in the Strategic Plan, NRC's overall goal is to "...conduct an effective regulatory program that allows our Nation to use nuclear materials safely for civilian purposes and in a manner that protects the public and the environment." To accomplish this goal, the Strategic Plan lists four performance goals, which are: 1) maintain safety, protection of the environment, and the common defense and security; 2) increase public confidence; 3) make NRC's activities and decisions more effective, efficient, and realistic; and 4) reduce unnecessary regulatory burden on stakeholders, both licensees and other affected industries.

The staff's review of the NA report is contained in Attachment 1. The following is a brief discussion of the staff's review.

In general, the NRC staff agrees with a number of the NA's recommendations including: R1, on the need to study all alternatives, factors, and associated impacts; R2, on the need to integrate meaningful stakeholder input into the decision-making process; R3, on the need to have an overarching decision framework to govern our evaluation of this issue; and R7, on the need for consistency with, and cognizance of, international approaches. The staff finds these recommendations broadly consistent with existing Commission policies and the four performance goals, as well as with previous NRC documents, such as the Issues Paper, and with its current effort to develop technical bases in this area. If a rulemaking is conducted, the staff also agrees with R4, on considering use of a risk-informed dose standard, and R5, on the use of 10 µSv/yr (1 mrem/yr) as a "starting" point in assessing alternatives, although, in any

rulemaking process, this alternative would be only one amongst several evaluated.

However, the staff questions, or does not completely agree with, other aspects of the NA recommendations. With regard to the findings supporting R1, the report does not provide sufficient supporting information as to whether the alternatives it suggests, e.g., restricted use, are workable or practical. With regard to R2 and R3, the staff notes that, despite previous NRC efforts to engage stakeholders on the Issues Paper, the NA findings indicate that there is significant distrust and lack of confidence in NRC and that obtaining it will be a difficult process.

Thus, R2 and R3 recommend a fairly prescriptive list of actions. However, the NA report did not address the expending of a potentially large amount of resources to take these actions for an issue which OA1 and R5 indicate has very low associated radiological risk at the levels being considered. Therefore, the NRC staff, in developing options for proceeding, has focused on how best to make use of NRC's limited resources in a manner that achieves the performance goals of maintaining health and safety, improving public confidence, increasing efficiency and effectiveness, and reducing unnecessary regulatory burden on stakeholders.

With regard to R5, which discusses the basis for a dose standard, the staff notes that the report has not provided detailed scientific bases to facilitate the understanding of risk management issues or to resolve disagreements amongst stakeholders in this area. In R6, related to the NA review of NRC's draft report, "Radiological Assessments for Clearance of Equipment and Materials from Nuclear Facilities," NUREG-1640, the NA report generally complimented NUREG-1640 regarding its rigor, traceability, and risk analysis. However, R6 was also critical of certain perceived shortcomings in NUREG-1640. It appears to the staff that these criticisms stem from a misunderstanding in the NA report that all technical work is being conducted as part of the NUREG-1640 document. While the staff agrees that its assessment should include evaluation of a broad range of alternatives, including their impacts and costs, NUREG-1640 was not designed to be a comprehensive report covering all necessary technical work. In actuality, NUREG-1640 is limited in scope to developing information on individual dose factors and was not intended to form the entire technical basis for assessing impacts and other factors necessary to support decision-making. Previously published NRC documents, such as the Issues Paper and Attachment 1 of SECY-00-0070, describe the additional analyses that are needed in a technical information base to support decision-making; these analyses are either underway or being considered in various NRC-sponsored studies.

Status of Technical Basis Development

Consistent with the August 18, 2000, SRM, the staff has proceeded with development of a technical information base to support decision-making. The principal elements of the information base and their status are summarized here and discussed in detail in Attachment 3.

The intent of NRC's effort to develop technical bases is to provide a means to assess a broad range of alternative approaches for control of solid material, including impacts on human health, on the environment, and on industries, both licensees and others. A first step in this effort is developing the ability to estimate the dose an individual might receive as a result of implementing the different alternatives. To accomplish this first step, NUREG-1640, which analyzed metals and concrete, was issued for public comment in March 1999 and will be published as a final report in December 2002, to incorporate public comments. As follow-ons, a draft study analyzing soil is planned for issuance in October 2002, and an analysis of other materials is planned as Supplement 1 to NUREG-1640 in June 2003. Further analyses assessing the potential for

exposure to multiple sources as well as collective doses are due in December 2002 and June 2003, respectively. Supporting these analyses is a report on the inventory of solid material at licensed facilities scheduled for issuance as a draft NUREG in July 2002. An effort to assess capabilities to conduct radiation surveys of solid materials at levels near background is planned for issuance as a draft NUREG for public comment in July 2002.

Other Factors Affecting Decision-Making

Consistent with the August 18, 2000, SRM, the staff has maintained cognizance of and, as appropriate, provided input to, various other activities and initiatives by international and national organizations and agencies. A detailed discussion of these other factors is provided in Attachment 4. Specifically, the relationships of these initiatives to NRC efforts are presented in Section E of Attachment 4. Some of these initiatives are summarized here.

With regard to international activities, there is an interrelationship between actions being taken internationally and within the U.S. International agencies, like the International Atomic Energy Agency and the European Commission, as well as individual nations, are in the process of establishing standards for clearance of material. Inconsistency in standards between the U.S. and other nations has resulted in confusion regarding international trade, in particular if materials released under other nations' regulations arrive as imports in the U.S.

With regard to U.S. agency activities, the U.S. Environmental Protection Agency (EPA) has responsibility for setting generally applicable environmental standards under the Atomic Energy Act. However, it does not currently have a program to set standards on control of solid materials in the U.S. Instead, EPA has been focusing its activities on orphan source issues as well as on the interception of imports with sufficient radioactive content to warrant regulatory control, and has set up pilot programs with the U.S. Department of State for monitoring imports. Other federal agencies, including the U.S. Department of Energy (DOE), have engaged in monitoring U.S. borders and other locations for radiological threats in response to terrorist activities. The DOE has a large inventory of stored solid material having low amounts of radioactivity from its various defense activities and has had, since calendar year 2000, a moratorium on release of volumetrically contaminated metals and on release of scrap metal for recycling. During 2001, DOE conducted a scoping process for issuance of a Programmatic Environmental Impact Statement (PEIS) on alternatives for disposal of DOE scrap metals. Currently, DOE plans to issue the PEIS for public comment later this year.

Agreement States have regulatory responsibilities under their agreements with the NRC for control of solid materials for licensees in their States. These States and the non-Agreement States, through the Conference of Radiation Control Program Directors, recently approved a resolution recommending that NRC move forward with a rulemaking process for developing national standards for the control of solid materials from nuclear facilities, that the standards include a prohibition against import of solid materials exceeding the U.S. standard, and that the technical bases developed by NRC include considerations of naturally-occurring and accelerator-produced and technically enhanced naturally-occurring radioactive material.

With regard to other organizations, the American National Standards Institute published a report (N13.12-1999) containing criteria for unrestricted release of solid materials. Under the National Technology Transfer and Advancement Act of 1995, Federal agencies are to use this type of technical standard, unless its use is inconsistent with applicable law or otherwise impractical. Another organization, the National Council on Radiation Protection and Measurements (NCRP), is

preparing a report with recommendations on alternatives for disposition and possible recycling of solid material.

NRC Staff List of Options for Proceeding

Based on the NA's report and considering other related factors, the staff has developed various options for proceeding. As noted above, the NA report recommends a coordinated decision-making process for moving forward, rather than recommending a specific technical approach for control of solid material. Thus, the staff's options and recommendations also focus on the process for making decisions on a workable technical approach.

Option 1 - Take no action on a process. The rationale for Option 1 includes OA1 which states that the current approach is sufficiently protective of public health and does not need immediate revamping, although it has certain shortcomings. However, Option 1 would not begin a broad process, as suggested by OA2, to correct shortcomings in the current approach because NRC is currently involved with other higher-priority safety issues. The rationale for Option 1 also includes existing provisions in NRC's regulatory structure (e.g., 10 CFR 20.2002, "Method for obtaining approval of proposed disposal procedures") for restricted use, which was suggested by the NA report as a potentially acceptable approach. Option 1 could take one of the following forms:

> Option 1a - Take no action on a process; maintain status quo. In this option, NRC would not conduct a rulemaking, or other broad process, at this time. NRC would continue to use its current approach and practices, as described in the Issues Paper and in an All-Agreement States letter (STP-01-081), dated November 28, 2001, and as noted above regarding restricted use.
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> Option 1b - Take no action on a process; modify current approach to harmonize gaps. In this option, NRC would modify its current approach to harmonize some of the gaps noted in the NA report. This could include resolving differences between NRR and NMSS on the current approach for solid material, providing added guidance on use of 10 CFR 20.2002, and/or considering appropriate means for review of specific licensee requests. Option 1b would not significantly alter the current approach from that evaluated by the NA, but would harmonize and improve its consistency. Option 1b could involve modifying staff review practices, preparing an information notice, or be part of a consolidated guidance effort. Documents describing the harmonized approach could be issued for public comment.

Option 2 - Defer a process - instead, engage stakeholders on the NA report and review related activities. The rationale for Option 2 includes OA1, which states that the current approach is sufficiently protective of public health and does not need immediate revamping. Therefore, before moving forward, Option 2 would seek broader stakeholder input in review of the NA report and also allow for staff review of other related actions underway at this time, as discussed below. Option 2 could involve use of the NA report as a discussion tool for written public comment and/or at 1 to 2 workshops focused on the report's findings and recommendations, and on NRC's next steps. The staff could report to the Commission on the comments received. Because Option 2 would defer rulemaking or other broad process, Option 2 might include, as an interim measure, some modification of the current approach for controlling solid materials, as suggested by Option 1b.

As part of this effort, the NRC staff could also follow a number of related efforts, discussed in some detail in Attachments 3 and 4, to determine their possible impact on this issue. These

include the additional NRC analyses (described above and in Attachment 3) being conducted during FY2002/2003. In addition, there are certain international efforts being conducted, and nearing completion, at this time. Also, the results and experience gained from completion of DOE's PEIS and completion of the NCRP report on disposition of solid material may provide additional insight as to stakeholder views on certain aspects of the different approaches for control of solid material.

Option 3 - Conduct a process, either a rulemaking or a broad NA-like process, at this time. The rationale for this option is that it could incorporate the OA2 suggestion for a process engaging stakeholders and/or the Administrative Procedures Act (APA) and National Environmental Policy Act (NEPA) processes by which NRC decisions are generally made. Also, it can build on efforts expended by NRC and stakeholders in preparing and providing both written and oral comment on the Issues Paper. Option 3 could take one of the forms noted here.

Option 3a - Begin a broad, deliberative process as suggested by NA. This option could involve discussion of broad policy issues, as well as more focused ones in a manner in keeping with OA2 and R1, R2, and R3. Option 3a is similar to Option 2, but would involve specifically starting a process, as suggested by the NA report, whereas Option 2 would take a more preliminary stance of continuing the review of the NA report. Option 3a could consist of a deliberative approach addressing both broad and focused issues in a series of workshops and/or advisory board review. The timing of the process would be based on the issues to be discussed, as well as the time for preparation, and stakeholder review, of a discussion document. The discussion document suggested by R3 is an overarching policy statement similar to the International Atomic Energy Agency's Safety Series 89, "Principles for the Exemption of Radiation Sources and Practices from Regulatory Control." The discussion document used by the staff under Option 3a could be a policy statement or a supplemental issues paper. In keeping with the recommendations and findings of the NA report, Option 3a would be conducted in a manner to allow sufficient time for stakeholder review of the discussion document, as well the as supporting technical basis documents. The Option 3a process would be input to NRC decision-making on proceeding. Option 3a could also include some modification of the current approach for controlling solid material as an interim measure.

Option 3b - Proceed with rulemaking. Under this option, an enhanced participatory rulemaking process (such as that used for the license termination rulemaking (LTR) proposed rule, using APA and NEPA processes and a workshop format) could be used to accomplish the objectives of OA2 and R1, R2, and R3. The NA report cited the LTR proposed rule process as an example of a success, but it would be important to maintain consistent opportunity for stakeholder input throughout a rulemaking process. The document used for discussion and for soliciting stakeholder input could be an Advance Notice of Proposed Rulemaking (ANPR). This process would represent a deliberate, but still focused, rulemaking effort to evaluate a broad range of alternatives as suggested in the NA report. Similarly to Option 3a noted above, Option 3b would be conducted in a manner to allow sufficient time for stakeholder review of the discussion document, as well the as supporting technical basis documents.

An alternative approach under Option 3b could be use of a more direct rulemaking process that begins with preparation of a rulemaking plan and a proposed rule. Public comment would be requested on the proposed rule, but a workshop process to solicit further input would not necessarily occur, or be less extensive, and this option would proceed in a more traditional manner.

Option 3c - Conduct a rulemaking focused on a narrow area. Under this option, a rulemaking could be conducted which is focused on developing a workable solution in a narrow area. This could involve, for example, developing a standard for only certain material(s), such as concrete or routine trash-type material. The overall process could be similar to Option 3b, however the nature of the meetings and discussions could be more focused on the material being considered and specific solutions to issues surrounding the material.

Advantages and Disadvantages of Options

In evaluating Options 1, 2, and 3, it should be noted that any of the process options, if properly carried out, would maintain health and safety. Thus the evaluation of options centers on how best to use NRC's limited resources to achieve the goals of increasing public confidence, increasing efficiency and effectiveness, and reducing unnecessary regulatory burden on stakeholders. As noted in the NA report, it is important, whichever of these options is used, that there be clarity regarding the nature of decision-making and the role that all stakeholders can play.

Advantages of Option 1a include that the current approach is workable and familiar, that decommissionings on a large scale are not expected until 2020, and that no resources for rulemaking would be committed. However, disadvantages of Option 1a include its lack of an overall risk basis or consistent approach, use of outdated measurement bases, and international consistency issues. In particular, there is not regulatory finality associated with Option 1a because there is not a regulation as the basis for the guidance in the current approach. Also, although the current approach has been in general use for some time, licensees have indicated problems with its use in dealing with materials they handle day-to-day, and the NRC staff has had to expend resources on case-specific reviews as well as in explaining the risk basis of the current approach to stakeholders and in responding to Congressional inquiries. In addition, it is anticipated that staff resources necessary to review activities on a case-by-case basis may increase due to expanded use of radiation monitors for detecting solid materials with small amounts of radioactivity outside NRC-licensed facilities.

An advantage of Option 1b is that some of the inconsistencies and gaps noted above, and in the NA report, could be addressed and that specific licensing actions could therefore be completed more effectively and efficiently. Also, under Option 1b, fewer resources would be used than in a major rulemaking, although this option could involve considerable staff resources in preparing guidance documents. Disadvantages associated with Option 1b include that it could raise legal issues as to the extent that a modified current approach, based on guidance without a corresponding regulation, can be implemented in a consistent manner, as it may not be binding or enforceable. In addition, some of the same issues that exist for Option 1a may remain (e.g., overall lack of risk basis, international consistency, the need for case-specific reviews, and the lack of regulatory finality).

An advantage of Option 2 is that it opens the process to the public at an early stage to address broad issues without beginning a rulemaking process. It also allows inclusion of other information and results, is consistent with the philosophy of the NA report, and, initially, resources would be lower than rulemaking. Disadvantages include that the total resources associated with the Option 2 and any follow-on efforts could ultimately be similar to or larger than the processes described under Options 3a or 3b. Also, Option 2 does not build on the substantial efforts expended by NRC

and stakeholders in conducting, participating in, and developing comments for, the 1999/2000 public meetings on the Issues Paper. In addition, because the time to develop a standard under Option 2 may be lengthy, it may be necessary to develop an interim approach, which may have certain limitations, as discussed previously under Option 1b.

Advantages of Option 3a are that it involves stakeholders at a very early stage in the process. In addition, it is consistent with OA2 and R1, R2, and R3, with the intent of developing an acceptable approach. However, disadvantages include that it does not build on substantial efforts expended by NRC and stakeholders in conducting, participating in, and developing comments for, the 1999/2000 public meetings on the Issues Paper. In developing an overarching policy statement as suggested by R3, Option 3a may be repetitive of the effort already expended in preparing the policy guidelines contained in the performance goals of the Strategic Plan. The Strategic Plan provides NRC's policy and approach for evaluating issues, incorporates input from the public, licensees, and other interested parties, and contains a decision framework for guiding the staff's work. Thus, the Strategic Plan could be used as a policy-level, decision framework that can be applied to the control of solid materials, which may be more efficient than developing a new and separate policy statement as suggested by R3. Also, developing general policy issues could be repetitive of activities associated with the Below Regulatory Concern Policy which had significant expenditure of resources for a controversial policy that later was withdrawn. In addition, Option 3a could involve more resources than for rulemaking under Option 3b.

Advantages of Option 3b are that it provides more timely risk-informed criteria and a regulatory tool for licensees, promotes consistency within NRC offices and with international efforts, and presents the issues involved with the various approaches for control of solid material in an APA/NEPA forum through which the Federal agencies normally conduct their business. Disadvantages of Option 3b include that it will involve large resources for a complex, controversial rulemaking, when NRC has other high priorities involving health and safety issues, including those related to homeland security. Also, certain approaches are strongly opposed by stakeholders and thus the end result of this resource-intensive action is not clear. In particular, there is a diversity of stakeholder views that range from those that favor a standard for unrestricted use at an established dose criteria to those that favor a prohibition on all future releases and a recall of previous releases.

As noted previously, Option 3b includes alternative approaches that would entail varying levels of stakeholder involvement. While the enhanced rulemaking process might involve more resources than the more direct process, it would also be more in keeping with the performance goal of increasing public confidence and with the concepts of OA2 which notes that broad and meaningful stakeholder involvement in the decision-making process is important in the success of the process.

An advantage of Option 3c is that it could allow materials that were deemed most important to be worked on first and could focus stakeholder discussions on issues associated with that specific material and/or an associated approach for disposition of the material. Another advantage is that a narrowly focused rulemaking could be completed using fewer resources. Disadvantages of Option 3c are that if the Commission conducted rulemakings on other materials or approaches at a later time, this might involve duplication of effort and, ultimately, more total resources expended. Another disadvantage of the narrow effort of Option 3c is that it might be perceived as setting precedent for control of other solid materials.

If either Option 3a, 3b, or 3c is selected, NRC would carry out a process involving meaningful stakeholder involvement, which is the intent of any APA/NEPA process, as well as in keeping with

OA2 and R1, R2, and R3. Both Option 3a and 3b are also processes by which the various alternatives for controlling solid material suggested by stakeholders, as well as the suggestions made in R4, R5, R6, and R7, could be explored.

Recommendation:

The acceptability of any standards-setting action depends on a variety of factors, including both the process to move discussions forward as well as the technical basis to support any criteria that might be established. An important factor affecting any decision on how best to proceed is the safety significance of the matter under consideration. As noted in the NA report in OA1, the current approach is considered to provide a sufficient level of safety. The NA report (in R5) also notes that one of the potential criteria (i.e., 10 µSv/yr (1 mrem/yr)) discussed in the Issues Paper is a reasonable "starting point" regarding levels of risk when considering alternatives for controlling solid material. These statements call into question whether significant resources should be devoted to a rulemaking or other process that might have minimal impact on maintaining health and safety. However, the NA report also notes, and NRC staff tends to agree, that there are significant issues associated with implementing the current approach, and its replacement with a standard could improve NRC's overall efficiency and effectiveness, and likely reduce overall burden on stakeholders. The NA report also highlights that there are important issues of public confidence that need to be considered in any process for moving forward in this area.

After assessing these factors, the staff recommends conducting a rulemaking process. Specifically, the staff considers Option 3b to be the best means for providing support to the licensing offices in their handling of wide variety of cases involving control of solid material, and also incorporates beneficial features of the other options. Option 3b can involve the activities of an enhanced participatory rulemaking with opportunity for substantial and substantive stakeholder involvement beyond that previously used for the LTR, as described below. The staff considers Option 3b to be an appropriate balancing of the beneficial aspects of Option 3a and the direct proposed rule process noted as an alternative under Option 3b.

In developing a timetable for Option 3b, the staff has taken into account both the schedule for NRC's development of key technical bases and the admonition of R1, R2, and R6 to bring an appropriately complete information base (including characterization of various materials and individual, multiple, and collective exposures) to stakeholders as part of engaging them in meaningful dialogue. Thus, the staff recommends that efforts to engage the public as part of Option 3b begin when this information is more fully developed. This approach will also allow the staff to factor in other activities that are going on both nationally and internationally. Inclusion of all this material was noted earlier as a beneficial feature of Option 2. This approach would also allow the NRC to focus its resources at this time on more pressing issues, including homeland security. Finally, in the interim, the staff would continue with its current approach, as endorsed by the NA report in OA1, thereby incorporating the beneficial aspects of Option 1a.

The specific activities and timing of the staff's recommended approach involve completion of technical bases by mid-2003. The staff would then plan to engage stakeholders, in the fall of 2003, on the nature and scope of information that should be included in an ANPR, including invitation to a public meeting on this subject. The staff anticipates that the ANPR could then be issued for public comment in late 2003 and this comment process could be supplemented by holding 2 to 4 workshops on the ANPR. The first 1 to 2 of these workshops would be broad-based, seeking public comment on concerns, issues of trust, further analyses needed, and positions. The next 1 to 2 workshops would be focused on workable solutions on specific issues (e.g., restricted use) supplemented with focused meetings with specific stakeholders. Use of

focused meetings, or other forum for seeking advice, could be vehicles by which advice and recommendations are obtained in keeping with the item in the August 18, 2000, SRM, regarding the steel industry's recommendation for a blue ribbon panel.

Alternatively, the Commission may prefer to proceed with a more focused effort than Option 3b by pursuing rulemaking for only certain material (Option 3c). While the overall process would be similar to that for Option 3b, the nature of the meetings and discussions could thus be focused on the material(s) being considered and specific solutions to issues surrounding those materials. If the Commission prefers this approach, the staff recommends that a decision on the specific material to be addressed in such a focused rulemaking be made following completion of additional technical bases and the ANPR meetings, which could be used to better identify those material disposition issues most needing resolution by the licensed community.

The staff anticipates extending the Quarterly Report process for keeping the Commission and the public informed of the status of technical bases development and other related factors.

RESOURCES:

If Option 3b is chosen, the staff notes that a similar effort to establish criteria for license termination in Subpart E was a resource and time-intensive effort that spanned a period between 1991 and 1997, and required significant staff effort over those 6 years. Although the staff has previously obtained a range of stakeholder views and developed technical bases on control of solid material, the strong and diverse viewpoints held by stakeholders indicate that the resources to be expended here may be similar to, or greater than, the experience of the LTR. Thus, Option 3b is anticipated to involve a minimum of 10 to 15 full-time equivalents (FTEs) and over $1 million in contract support, over a 3 to 4 year period, to develop a final rule, prepare the regulatory analyses and generic environmental impact statement, develop technical bases for implementation, respond to public comments, and conduct public workshops. For Option 3b, FTE resources and funding for contract support are available in the current FY 2003 budget; resources for control of solid materials-related activities beyond FY2003 have been addressed in the proposed budget request under rulemaking activities.

Under Option 3c, resources might be somewhat reduced, at least initially. It is estimated that both Options 2 and 3a, if they ultimately led to rulemaking, could involve more resources than Option 3b because they would begin with broader initial discussions with stakeholders than Option 3b. However, initially it is estimated that Option 2 would involve 1.5 to 2 FTEs, and about $300K-500K, to conduct meetings on the NA report, follow other activities, and further develop technical bases. Additional resources for these technical bases would be addressed through the PBPM process. Harmonization of the current practice under Option 1b would involve about 2 to 3 FTE and limited additional funding to review areas and prepare staff guidelines in areas where greater staff consistency can be developed. For Options 1a and 1b, resources necessary to review activities on a case-by-case basis are separate and are included in the current budget. It is estimated that continuing the current approach under Option 1a

would involve at least 3 to 5 FTE; over the long term, this resource estimate could decrease, if rulemaking is conducted, because the staff would then have a more efficient and effective regulatory tool in place for licensing reviews.

COORDINATION:

This paper has been coordinated with the Office of the General Counsel, which has no legal objection. The Office of the Chief Financial Officer has reviewed this Commission Paper for resource impacts and has no objection.

/RA/

William D. Travers
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for Operations

Attachments:
1. NRC staff review of NA report
2. Outline summary of NA report
3. Status of technical basis development
4. Review of international and domestic activities

Attachment 1

Summary of NRC Staff Review of National Academies Report

NRC is examining its current practice for control of solid material. As input to this effort, the National Academies (NA) submitted a report to the NRC containing findings and recommendations regarding alternatives for control of solid material.

This attachment presents a short discussion of the results in the NA report, the NRC staff's method for reviewing the NA report, and the results of the NRC staff's review of the NA's overarching findings and recommendations.

A. RESULTS OF THE NA REPORT

In response to an August 2000 contract request from the NRC, the NA delivered a report to the NRC in March 2002. An outline summary of the report and its preparation is contained in Attachment 2. The NA report contains 2 overarching findings and 7 recommendations to the NRC, as well as 31 specific findings. The following can be noted about the report:

1) Review of issues and factors: The report contains a broad review of a number of items, including the regulatory framework for control of solid materials, anticipated inventories, costs, dose analysis methods, measurement issues, international approaches, and stakeholder reactions.

2) Process for stakeholder involvement: The report's recommendations present, and focus strongly on, a decision-making process for moving forward, rather than recommending a specific method for control of solid material. In particular, 4 of the 7 recommendations (and 5 of the 10 chapters) contain discussion on problems caused by NRC's prior stakeholder involvement activities in related efforts and on the need for, and approaches to, rebuilding public confidence and trust and involving stakeholders in this effort.

3) Technical approaches for control of solid material: Although Task 4 of the Statement of Work in the August 2000 contract requested the NA to develop specific recommendations for the approach that should be used for control of solid materials, and for a numerical limit that should be set, the report does not address either of these items.

   The report notes that this level of detail was not provided because the NA did not want to prescribe the outcome of the decision process, but that it was making several recommendations for a foundation from which to begin a broad-based stakeholder participatory decision-making process with which the NRC should move ahead without delay. Along those lines, the report presents recommendations regarding the nature of any standard, impacts and benefits that need to be considered, and technical analyses that are still needed.

B. APPROACH OF NRC'S ANALYSIS; USE OF PERFORMANCE GOALS

In its review of the NA report and recommendations, the NRC staff used as its bases NRC's Strategic Plan in NUREG-1614 which contains four performance goals for accomplishing the agency's mission. As noted in the Strategic Plan, the NRC's overall goal is to "conduct an effective regulatory program that allows our Nation to use nuclear materials safety for civilian purposes and in a manner that protects the public and the environment." To accomplish this goal, the Strategic Plan lists four performance goals, which are:

1) Maintain safety, protection of the environment, and the common defense and security;
2) Increase public confidence;
3) Make NRC's activities and decisions more effective, efficient, and realistic; and
4) Reduce unnecessary regulatory burden on stakeholders.

The Strategic Plan notes that protection of public health and safety remains paramount among our goals and will drive our decisions, however NRC recognizes that it must consider other key issues, including the effect of our decisions on the public's trust in our regulatory process, the industries we regulate, and our own effectiveness and efficiency.

C. NRC STAFF ANALYSIS OF RECOMMENDED ALTERNATIVES IN NA STUDY

As noted in Section A, the recommendations in the NA report present a process for moving forward, rather than a specific technical approach on how to control solid material. The NRC staff's review of this process considered its component pieces to better understand the pros and cons of each of the recommendations and their merit compared to the NRC's four performance goals. Based on this understanding of the process components, NRC staff could then develop options and recommendations for a path forward using components of the NA report.

The NA report does discuss the technical approaches for control of solid material but, as noted in Section A above, the report does not choose one, preferring instead that they be developed and evaluated as part of the process suggested in the report. Thus, the NRC staff's review of the NA report does not include a separate evaluation of the merits of the technical approaches themselves.

The sections below describe the NA report's overarching findings and recommendations and the NRC staff's review based on the four performance goals of its Strategic Plan.

Overarching findings #1 and 2 and NRC conclusions on the overarching findings

The NA report presented two overarching findings. Overarching finding 1 (OA1) notes that NRC's current approach on control of solid materials is workable and sufficiently protective of public health and safety and does not need immediate revamping. However, OA1 also notes that the current approach is inconsistently applied, is not explicitly risk-based, and has no guidelines for volume-contaminated material and, therefore, NRC should move ahead without delay and start a process of evaluating alternatives to the current system. Overarching finding 2 (OA2) notes that broad stakeholder involvement in NRC's decision-making process on alternatives is critical, as the likelihood of acceptance of an NRC decision greatly increases when

the process engages all responsible stakeholder viewpoints and is perceived as fair and open in discussing advantages and disadvantages of alternatives. OA2 thus notes that NRC must focus on the process and not prescribe an outcome for disposition of solid material which must evolve from the process.

In general, the staff agrees with OA1 and OA2. In particular, OA1 is consistent with discussions in the Issues Paper and SECY-00-0070, which noted that potential exposures received as a result of material released are a fraction of public health guidelines and that the current approach is flexible and a useful tool that is currently in use and well understood. The Issues Paper and SECY-00-0070 have also previously noted that the current case-by-case approach has certain problems including: implementation by licensees; inconsistent release levels; lack of risk-informed criteria; and the need to sometimes expend large NRC resources to respond to problems caused by different instrument detection capabilities and to Congressional inquiries about safety of the current approach. In addition, OA2 is consistent with discussions in SECY-00-0070 regarding use of an open process for developing a national standard based on a full evaluation of health and environmental impacts, cost-benefit analyses, and the wide diversity of public comment on various courses of action. OA2 is also consistent with requirements of the Administrative Procedures Act (APA) and the National Environmental Policy Act (NEPA), and with NRC's Strategic Plan for accomplishing the agency's mission through the four performance goals.

An issue not addressed in OA1 or OA2 is the relationship of the level of radiological risk associated with alternatives for control of solid material with the potentially large amount of NRC resources that would be needed in any process undertaken and the issues of public confidence and trust raised by the NA. This is discussed further in section C.2 below.

C.1 Recommendation 1 (R1) : NRC should devise a new decision framework that would develop, analyze, and evaluate a broader range of alternative approaches to the disposition of solid materials. At a minimum, these alternatives should include the current case-by-case approach, clearance, restricted use (the NA report refers to this alternative as "conditional clearance"), and no release.

C.1.1 NRC staff review:

With respect to the performance goals of maintaining public health and safety and of increasing public confidence, R1 is consistent with NRC's intentions in this area, as noted in the Issues Paper, to use an APA and NEPA process to evaluate the full range of alternatives (including unrestricted use, restricted release, not permitting release, and "other" alternatives as determined during the process). Some specific "other" alternatives are noted in Table 8-1 of the NA report and would be considered as part of further NRC analyses. R1 is also consistent with NRC's intent, as discussed in the Issues Paper, to evaluate factors such as health and safety, environmental impacts, cost-benefit, ability to implement, international and national standards, impacts that may be competing, net collective impact, and industries that may be adversely affected (including metal recycling industries).

R1 is also consistent with the findings in SECY-00-0070 which noted the "extensive and wide-ranging" comments received from various stakeholders in public meetings and in over 800 public comment letters (including the metals and concrete industries, citizens groups and individuals,

licensees and licensee representatives, and other organizations). SECY-00-0070 also noted the need for additional analyses and evaluation of other factors to support decision-making for all of the alternatives.

With regard to the performance goals of efficiency and effectiveness and reducing unnecessary burden, R1 is consistent with NRC's guidelines in NUREG/BR-0058, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," under which evaluation of the full range of alternatives is intended to reduce unnecessary burden on stakeholders by considering costs and ability to implement any proposed new requirement. However, the NA report leaves certain questions open because it does not provide sufficient supporting information as to whether the alternatives that it suggests are workable or practical, especially with regard to concerns expressed in earlier stakeholder comments. In particular:

1) The NA report lists restricted use at landfills as a possible alternative. However, the report does not indicate or confirm that local landfills would accept solid materials released from NRC facilities or assess the overall feasibility of sending scrap metal for disposal at Resource Conservation and Recovery Act (RCRA) landfills (the Issues paper had noted that many RCRA Subtitle C and D landfills have prohibitions against accepting radioactive material).

2) In its discussion of restricted use where material is released from licensed control, the report does not address concerns associated with assuring that material intended for either a landfill or other specified use would be transported to and remain at the designated site and not be diverted to a general recycling facility or dispositioned in some other manner, e.g, directly to users. The Issues Paper noted these concerns, and Attachment 2 of SECY-00-0070 noted commenter concerns about these issues.

3) The report does not provide specific information as to how the "no-release" alternative in the report differs from the "prohibition" option in the Issues Paper which involved sending "solid material that has been in an area where radioactive material has been used or stored" to a low-level waste disposal facility. It may be interpreted that the "no release" option would extend the "prohibition" option to include all material on site. If this is the case, the report does not present information to respond to licensee stakeholders' concerns that a no-release alternative would disrupt normal day-to-day operations and would be a significant waste of resources with no accompanying health benefit.

C.1.2 NRC staff conclusion on R1

Based on the above, NRC staff agrees with R1 that it is important to study a broad range of alternatives and associated impacts and other factors listed in Box 9-2 of the NA report, including those identified by stakeholders and listed in the NA report. The staff has been in the process of studying these items as part of its technical development (see Attachment 3).

However, NRC considers R1, and its associated findings, limited in scope because they do not address technical and policy considerations related to the workability or practicality of certain alternatives suggested.

C.2 Recommendation 2 (R2): The NRC's decision-making process on the range of alternative approaches should be integrated with a broad-based stakeholder participatory decision-making process and include:

1) A commitment by NRC to establish and maintain a meaningful and open dialogue with a wide range of stakeholders;

2) An ad-hoc advisory board that would advise NRC in its consideration of approaches for the disposition of solid materials. The advisory board would suggest additional stakeholder mechanisms that NRC could use in the decision process, including establishing a NEPA process, alternative dispute resolution, and partnering, arbitration, mediation, or a combination of such methods;

3) Assistance to the NRC as needed from outside experts in order to: (a) assist it in establishing the ad hoc stakeholder advisory board and to facilitate dialogue between NRC and stakeholders during the decision-making process, and (b) assess, evaluate, and perhaps conduct portions of the stakeholder involvement program and make recommendations, as appropriate.

C.2.1 NRC staff review

In its general review of the NA report, the staff notes that the report does not balance the performance goals of the Strategic Plan in making its specific recommendations. In particular, R2 would tend to increase public confidence, however the report does not assess how factors related to the performance goals of maintaining health and safety, and efficiency and effectiveness, should also be considered. Specifically, the report does not integrate R2 with OA1 which notes that the current approach is sufficiently protective of public health and Recommendation 5 (R5) which notes that a 10 µSv/yr (1 mrem/yr) level is within risk ranges for developing health-based standards for exposure to radiation in the U.S., is a small fraction of natural background radiation, and is widely accepted by recognized national and international organizations. Thus, while R2 and the associated processes may provide useful information to aid in increasing public health and safety, OA1 and R5 appear to indicate that it is neutral with regard to making a significant difference in maintaining public health and safety

With respect to the area of public confidence, R2, and specifically R2-1, are consistent with the NRC's stated approach for accomplishing the agency's mission in the Strategic Plan in which it is noted that, as successful regulators, NRC must consider the effects of its decisions on the public. The Strategic Plan was developed with input from the public, those that NRC regulates, and other interested parties. R2-1 is also consistent with the NRC's intended process in this area, in particular:

1) The NRC's overall intent, as stated in the Issues Paper, was to seek to enhance public participation by conducting facilitated public meetings before any formal rulemaking would begin to elicit early and active public input on major issues through informed discussion of options. In so doing, NRC staff held 4 public meetings in fall 1999 in various regions of the

country to provide an opportunity for a broader public involvement and also invited stakeholders to a meeting with the Commission in May 2000 to air their views. The specific objectives of NRC's process were twofold. The first objective was to address relevant issues by identifying them, exchanging information on them, and identifying underlying concerns and areas of disagreement; the second objective was, where possible, to identify approaches for resolution. To accomplish these objectives, the Issues Paper contained a number of items for discussion including: (1) regulatory framework; (2) alternatives, including "other" alternatives identified in the process; (3) issues and questions associated with each alternative, including whether restricted use was feasible; (4) protection of public health and safety, including potential for multiple exposures; (5) economic factors, including impacts on other industries; (6) analysis of pathways for exposure, including the pathways to consider; (7) EPA, DOE, and international considerations; and (8) NRC resources to conduct a rulemaking.

2) As noted in SECY-00-0070, the NRC did obtain a wide range of views from stakeholders attending the public meetings and in over 800 letters that were received (including comments from citizens groups and individuals expressing concerns about health impacts; metals and concrete industry representatives expressing concerns about potential severe economic impacts; and licensees and licensee organizations expressing concerns that a "no release" option would disrupt normal day-to-day operations without accompanying health benefit). In addition, the Commission stakeholder meeting were attended by a similar range of stakeholders. Thus, the first of NRC's objectives in the Issues Paper was at least partly accomplished, although the latter was not.

However, R2 (and Findings 8-2 and 8-4) indicates that, despite NRC's effort to seek public input, there are serious problems with stakeholder trust and confidence in NRC, and that obtaining stakeholder trust will be a difficult task for NRC. Findings 8.2 and 8.4 note that these problems stem in part from:

1) The LTR effort in which, after a proposed rule was issued with a 0.15 mSv/yr (15 mrem/yr) criteria following a successful public process, the level was changed to 0.25 mSv/yr (25 mrem/yr) in the final rule without additional public process. Stakeholders indicated they would not participate in a process on control of solid material because it appeared to be too much like the LTR process.

2) Some stakeholder views that NRC has prejudged this effort towards the clearance, or restricted release, option.

3) Public concern about health effects of radiation and metals industry concerns about severe economic problems associated with clearance.

As noted above, R2 does not also take into account how considerations of efficiency and effectiveness or regulatory burden should be considered. Specifically, R2-2 and R2-3 do not address balancing potential health impacts of various technical approaches for controlling solid material against expended staff and stakeholder resources in establishing standards or NRC legal or regulatory authority issues. In particular,

1) Implementing R2-2 and R2-3 could involve significant expenditure of resources whereas OA1 and R5 indicate that levels being considered are protective of public health, within risk ranges for developing health-based standards for exposure to radiation in the U.S., and widely accepted by recognized national and international organizations. Based on experience with similar efforts, NRC resources involved in a major effort like this could be about 10 to 15 FTE and a million dollars in contract support. Thus a major consideration for NRC is to assess how best to assign its limited resources when there are other regulatory issues with greater potential health and safety impacts.

2) R2-2 does not consider legal and agency authority issues associated with an advisory committee and the nature of whether and how their advice would be used by the Commission, nor does it consider efficiency issues as to the length of time it would take to set up, and develop results from, such a committee which would have to be chartered under the Federal Advisory Committee Act .

3) R2-2 does not consider other approaches, other than an advisory board, for soliciting stakeholder input that may also have merit. Other processes could include the enhanced participatory process carried out during the LTR proposed rule stage, which Chapter 8 of the NA report notes was a success; use of an established advisory body, such as the Advisory Committee on Nuclear Waste, which already has a charter to advise the Commission on issues such as control of solid materials and which can seek assistance from experts on various topics; or use of focused meetings as forums for seeking advice and recommendations from stakeholders on specific topics which would be in keeping with a metals industry comment (see SECY-00-0070, Attachment 2) on convening a panel of stakeholders to work out acceptable solutions.

C.2.2 NRC staff conclusion on R2

The staff agrees that it is important that NRC have a commitment to integrate stakeholder input into its decision-making process. The staff notes that the Strategic Plan, the APA and NEPA processes, and specific aspects of prior efforts, have shown a commitment by NRC that its decision-making process should be integrated with broad-based stakeholder participation.

Despite these prior NRC efforts, the NA report indicates that there is significant distrust and lack of confidence in NRC and that obtaining trust and confidence will be a difficult process. Thus, NRC's process for evaluating alternatives for control of solid material will need to address these concerns regarding stakeholder involvement as part of a reasoned and balanced evaluation of potential alternatives against the four performance goals. At issue is coordinating a satisfactory level of agency commitment amongst the various stakeholders.

C.3 Recommendation 3 (R3): NRC should adopt an overarching policy statement describing the principles governing the management and disposition of solid materials. A good starting point for developing such a policy would be review and discussion of IAEA Safety Series No. 89 (SS89) with a broad based stakeholder group to provide a foundation for evaluating alternatives for control of solid material.

C.3.1 NRC staff review

As noted above, the NA report did not balance the four performance goals in making its recommendations. In particular, R3 does not indicate how, or to what extent, it will contribute to maintaining health and safety.

The recommendation for an overarching policy statement can increase public confidence and is consistent with the NRC's intent, as expressed in the Issues Paper, to provide consistency in NRC's regulatory framework for control of all materials and to "foster discussion" about issues and alternatives before a rulemaking would begin. The recommendation is also consistent with the Strategic Plan which presents strategic goals and specific performance measures for assuring that the agency's mission for protecting public health and safety is met.

However, R3 does not appear to make NRC's activities more efficient or effective or to reduce unnecessary regulatory burden. In particular:

1) It appears more appropriate to build NRC's overall policy statement into whatever rulemaking or guidance revision process is undertaken, rather than going through a separate process of developing a policy statement. For example, if a rulemaking were undertaken, an supplemental Issues Paper or Advance Notice of Proposed Rulemaking (ANPR) could clearly delineate the thought process of how a rule might be formulated and criteria developed.

2) The four performance goals of the Strategic Plan already provide NRC's policy and approach for evaluating issues, including those related to control of solid materials. The Strategic Plan was developed and issued in 2000 and incorporated input from the public, licensees, and other interested parties. Thus, creating a separate policy statement would not seem to be efficient of NRC's resources because a broad-based safety policy already exists in the Strategic Plan.

3) If R3 is suggesting inclusion of some of the specific approaches regarding exemptions in SS89, then those may be premature and too controversial to present in a policy statement, and better addressed in an open NEPA/APA public comment process.

4) Developing a general policy could be repetitive of activities associated with the Below Regulatory Concern Policy which had significant expenditure of resources for a controversial policy that later was withdrawn.

5) Findings 2.5 and 3.5 note that regulation of technologically enhanced naturally-occuring radioactive material (TENORM) is inconsistent or absent and that TENORM represents a large quantity of solid material. Chapter 9 indicates that NRC should consider that consistency with other regulations for other materials would be important, such as naturally occurring and accelerator produced radioactive material (NARM and NORM). However, the NA report does not contain a recommendation regarding NRC's role in control of these materials, nor does it address the implications of the findings, such as potential legal issues and prior efforts of the EPA in developing regulations for TENORM, or NRC resources that would be needed for such an effort

C.3.2 NRC staff conclusions on R3

NRC staff agrees that it is important to have an overarching decision framework to govern our evaluation of this issue. However, the staff notes that NRC already has in place the Strategic Plan which contains performance goals to attain the agency's mission. The Strategic Plan contains a decision framework similar to SS89 but has been developed specifically to guide NRC's daily work. Thus, it may be more efficient of agency resources to use the Strategic Plan as a policy-level, decision framework that can be applied to the process for control of solid materials, rather than developing a new and separate policy as suggested by R3.

C.4 Recommendation 4 (R4): A dose-based standard should be employed as the primary standard when considering clearance or restricted use . To employ such a standard, a range of scenarios must be considered, a critical group selected, and concentration levels associated with the dose standard developed which can be used in practice. The NRC should also consider the pros and cons of establishing a separate collective dose standard.

C.4.1 NRC staff review:

If a rulemaking with clearance or restricted use is conducted, R4 is considered by the staff as consistent with the four performance goals.

In particular, R4 reflects agency policy to be risk-informed in agency decisions and is consistent with the Issues Paper which noted that NRC was considering a dose-based standard so that NRC reviews would be conducted in a consistent manner to protect public health and safety. R4 is also consistent with SECY-00-0070 which noted that a disadvantage of the current detectability-based approach is that it is inconsistent with a "risk-informed" approach that relates regulatory requirements to the potential risk that might be associated with the regulated activity.

C.4.2 NRC Staff conclusion on R4

If a rulemaking with clearance or restricted use is considered, the staff agrees with the need to consider use of a dose-based standard.

C.5 Recommendation 5 (R5): An individual dose standard of 10 µSv/yr (1 mrem/yr) provides a reasonable starting point for the process of considering options for a dose-based standard. This starting point is reasonable because 10 µSv/yr (1 mrem/yr) is: (1) a small fraction of the dose received per year from natural background sources; (2) significantly less that the dose we receive from our own body due to radioactive potassium and other elements and to routine medical procedures; (3) within the range of acceptable lifetime risks used in developing health-based standards for exposure to radiation in the United States; (4) able to be measured with radiation measurement technologies available at reasonable cost; and (5) widely accepted by recognized national and international organizations. The final selection of an individual dose standard should nonetheless be a policy choice, albeit one informed by the above considerations.

C.5.1 NRC staff review

With regard to maintaining public health and safety, R5 (and its supporting findings) is consistent

with the broad range of potential alternative dose levels, from 0 to 0.1 mSv/yr (10 mrem/yr), presented in the Issues Paper and in SECY-00-0070. These documents presented a discussion of factors influencing these levels, such as comparisons with background and its variability, EPA requirements on permissible levels such as coal ash, NCRP discussion of the trivial risk at these levels, the capability of instruments to measure at these levels, and other factors.

With regard to increasing public confidence, R5 does not significantly aid the discussion nor provide insight into how this recommendation could be used to foster public confidence. In particular:

1) It does not explain sufficiently what is meant by use of 10 µSv/yr (1 mrem/yr) as a "starting point," nor does it correlate it to Findings 5.2 and 6.3 concerning dose modeling and measurement. It is recognized that having a firm number at this time would seem to be contrary to R2 and not appropriate before beginning a decision-making process. To properly assess the dialogue that will occur in any process, the staff has been and will continue to evaluate levels both above and below this level for all alternatives.

2) It does not provide added information regarding risk management implications of the 10 µSv/yr (1 mrem/yr) value other than to reference other sources and put the information into context. In particular, R5 does not indicate how to use risk management discussions to address public comments ranging from those which state that 10 µSv/yr (1 mrem/yr) is a level that scientific studies consider negligible to those that express concerns about its health effects. R5 also does not indicate how to discuss risk management issues with stakeholders that express concern that NRC is not fully disclosing the health effects and uncertainties from low levels of radiation. Although the staff presented information similar to that in Finding 5.1 at the 1999 public meetings, existing stakeholder concerns remained unchanged.

With regard to efficiency and effectiveness and regulatory burden, R5 is consistent with international levels being considered which could thus make NRC's decisions more effective and efficient in dealing with import issues (see Recommendation #7). R5 is consistent with regulatory analysis guidelines of NUREG/BR-0058 in that any process would need to evaluate whether having a lower level in a standard could impose burden in extra cost of having to measure lower levels with no additional health benefit

C.5.2 NRC Staff conclusions on R5

The staff agrees that a level of 10 µSv/yr (1 mrem/yr) can represent a "starting" point in assessing alternatives, however it notes that any process conducted must assess a broad range of impacts and factors in evaluating alternatives and the starting point suggested in R5 is only one alternative amongst several. However, R5 has not provided substantial scientific discussion to advance the understanding of risk management issues or resolve disagreements amongst stakeholders in this area.

C.6 Recommendation 6 (R6): For any dose-based alternative approach to control of solid materials, the NRC should use the conceptual framework of draft NUREG-1640 to assess dose implications. However, NRC must first establish confidence in the NUREG's numerical values,

expand the scope of its applicability, and overcome certain limitations. At a minimum, the following actions are required: (1) review the parameter distributions and median values for each parameter in the report; (2) develop complete scenarios and dose factors for restricted use; (3) provide sufficient information to calculate collective doses; (4) expand the current set of scenarios to compute additional dose factors for human error and multiple exposure pathways; and (5) an independent group of experts should provide peer review of these activities.

C.6.1 NRC staff review

It is important to note, in discussing R6, that NRC is developing a broad assessment of impacts and other factors as part of an overall technical basis to support decision-making. NUREG-1640 is only one piece of this technical information base and is more limited in scope than the NA report and R6 appear to imply. Thus, the staff's review here addresses R6 in the context of the entirety of NRC's technical bases development and clarifies the role of NUREG-1640 in relation to other technical studies being conducted by the staff.

With respect to the performance goals of maintaining public health and safety as well as increasing public confidence, it is important that there be a scientifically rigorous and traceable tool for evaluating potential impacts. R6 is consistent with NRC's intention in this area to prepare a broad, peer-reviewed technical basis which is also presented for public review and comment. In particular:

1) R6 and Finding 5.4 (which state that NRC should use the conceptual framework of NUREG-1640 to assess dose implications) are consistent with NRC's broad approach in preparing this document, which includes completion of an independent peer review of the report and issuing a final NUREG-1640 to incorporate the responses to comments on the report.

2) R6-1 (with regard to reviewing parameter distributions) is consistent with NRC's broad approach in finalizing NUREG-1640 which involves reassessment of parameters and parameter distributions as an integral part of responding to all comments. Where changes to the parameters or further explanation of their rationale are needed, they are planned for inclusion in the final version of NUREG-1640.

3) R6-2 (and supporting Finding 5.6), on evaluation of restricted use criticizes NUREG-1640 for not addressing all alternatives, in particular restricted use, and thus appearing biased. While R6-2 is consistent with NRC's intent, noted in the Issues Paper, to evaluate a broad range of alternatives, the criticism in R6-2 does not note that the analyses conducted in NUREG-1640, to date, is useful for a broad range of alternatives based on the following:

    a) With restricted use there is the potential that the "restrictions" may not be fully implemented and that unanticipated exposures could exceed the dose criterion for that release. For example, metals intended for restricted release to an authorized use might be diverted to a more general use or could prematurely enter the general commerce pool of scrap metal if the authorized use ended earlier than expected. The assurance that the material remains in its restricted use depends on the

controls in place for the authorized uses. Thus, the analyses contained in NUREG-1640 provides a bounding analysis which can be useful for assessing restricted use scenarios.

b) The critical group for restricted use may be similar to that for clearance.

4) R6-3 calls for sufficient information to enable calculation of collective doses to support consideration of a collective dose standard. This is consistent with NRC's intent, as discussed in the Issues Paper, to evaluate collective doses, and in particular to conduct an "assessment of collective doses to different population groups," and with NRC's current effort to evaluate collective doses as part of a follow-on work to develop a technical basis for Commission decisions.

5) R6-4 (and Finding 5.6) calls for scenarios that include human error and multiple exposure pathways. These recommendations are addressed below:

a) The recommendation for the analysis of human error is consistent with NRC's approach to incorporate realism into its analyses. The impacts of human errors on the dose factors depend both on the frequency of errors and the magnitude of the error. Based on review of data, distributions of frequencies and magnitudes can be estimated and could include accident scenarios.

b) The recommendation on the evaluation of multiple exposures is consistent with NRC's intent, as discussed in the Issues Paper and in SECY-00-0070. The discussions in SECY-00-0070 reflect stakeholder information obtained during the fall 1999 public meetings and in the public comment letters. It is also consistent with NRC's current effort to evaluate multiple exposure scenarios as part of follow-on work for the technical information base (see Attachment 3).

With regard to efficiency and effectiveness in preparation of a detailed technical basis, R6 does not note that, as part of the overall NEPA process, NRC staff would develop an overall assessment of impacts and other factors. As noted above, NUREG-1640 is only one component of this technical basis and is purposely limited in scope. R6-2 (on analyzing other scenarios), R6-3 (on collective doses), and R6-4 (on multiple exposures) are consistent with analyses that would be required by a NEPA process, an NRC rulemaking, and a regulatory analysis process. They are also consistent with the Issues Paper and with SECY-00-0070, Attachment 1, which discussed analyses needed for all the alternatives, including evaluation of multiple exposures. Analyses for other alternatives, collective doses, and multiple exposures are ongoing under existing contracts, separate from NUREG-1640.

R6 and Finding 5.7 indicates that NRC should not simply use the dose factors of NUREG-1640 to derive clearance standards for other categories of slightly radioactive solid material without first assessing the appropriateness of the underlying scenarios.

1) Finding 5.7 is consistent with NRC's current plans for other material at licensed sites such as soil and routine trash. For soil, NRC is conducting an effort separate from NUREG-1640 to develop dose factors; an initial effort in this area, NUREG-1725, was published to

provide background information useful for developing parameters. For trash and similar materials, NRC has contracted to develop a supplement to NUREG-1640 for dose factors specific to the pathways for those materials.

2) Finding 5.7 does not recognize that NUREG-1640 does analyze mixtures of transuranics at NRC licensees, such as fuel facilities and rare earth facilities. Mixtures of radionuclides are addressed and apply equally to transuranics. Of course, the analyses are limited to radiological assessments, and requirements for disposition of solid materials with hazardous chemical properties need a separate assessment. Specific efforts related to Department of Energy (DOE) materials rest with DOE, which is developing information for a Programmatic Environmental Impact Statement (see Attachment 4). NRC exchanges pathway modeling information specific to control of solid materials with DOE, where appropriate.

3) Finding 5.7 also mentions TENORM. Except as addressed in the AEA, the NRC does not regulate TENORM, however, the NUREG-1640 approach for assessing TENORM would not treat it as a material *per se*.

C.6.2 NRC Staff conclusions on R6

The staff notes that the NA report appears to indicate that all technical work is being conducted as part of NUREG-1640. In reality, NRC is developing an assessment of impacts and other factors as part of an overall technical basis to support decision-making. NUREG-1640 is only one component of this technical basis, i.e., development of information on individual dose factors, and was not intended to form the entire technical basis for assessing impacts and other factors to support decision-making. The staff agrees that its assessment should include evaluation of a broad range of alternatives, including their impacts and costs; these analyses are either underway or being considered in various NRC-sponsored studies.

The staff agrees that its assessment should include evaluation of a broad range of alternatives, including their impacts and costs. Such analyses is underway or being considered in the various studies underway at this time

C.7 Recommendation 7 (R7): The NRC should continue to review and assess, and participate in, the ongoing international effort on control of solid materials and develop a scientific rationale for consistency between concentration levels associated with dose criteria that may be adopted by the US and by other countries. However, NRC should ensure that the technical basis for the concentration levels is not adjusted for consistency unless these adjustments are supported by scientific evidence.

C.7.1 NRC staff review

The staff considers R7 to be consistent with the four performance goals and with the information in the Issues Paper and in Attachment 1 of SECY-00-0070, which noted that NRC should consider policies set by other nations and international agencies.

R7 (and Finding 5.3) is also consistent with NRC staff view that an effort to benchmark dose

factors for radionuclides common to NUREG-1640 and other international studies is appropriate. The technical basis for differences will be examined as part of the staff's technical information base. In addition, R7 is consistent with NRC's approach to assist in developing IAEA standards so that NRC can maintain cognizance of international approaches.

Attachment 2

Outline Summary of the National Academies Study on
Alternatives for Control of Slightly Contaminated Solid Material

A. BACKGROUND

In June 1999, the NRC published in the Federal Register (64 FR 35090), for public comment, an Issues Paper indicating that the NRC was examining its approach for control of solid material. To provide further opportunity for public input, the NRC held a series of public meetings during fall 1999. In March 2000, the NRC staff provided the Commission with information (SECY-00-0070) on the diversity of views expressed in public comments received on the Issues Paper. In addition, SECY-00-0070 provided the status of the staff's technical analyses and also noted the related actions of international and national organizations and agencies. Based on these various factors, SECY-00-0070 recommended that a final decision on whether to proceed with rulemaking be deferred and that the National Academies (NA) be requested to conduct a study of alternatives for control of solid materials.

In an August 2000 Staff Requirements Memorandum (SRM), the Commission approved the staff's recommendations as contained in SECY-00-0070, including deferral of rulemaking and the conduct of a study by the NA.

B. AWARD OF A CONTRACT TO NA

Consistent with the direction in the August 2000 SRM, a contract was awarded, in August 2000, for the NA to conduct a study of, and provide recommendations on, possible alternatives for controlling the release of solid materials.

The statement of work in the contract called for the NA to:

1) Make a comprehensive review of a wide variety of factors which can impact possible alternatives for control of solid materials, including: (a) technical bases development, including ongoing and planned staff activities; (b) studies by the U.S. Environmental Protection Agency (EPA) on environmental impacts of clearance of materials and exemption of materials containing naturally occurring radioactive material (NORM) (e.g., coal ash), and development of screening guidelines for import of material; (c) criteria and guidelines of the U.S. Department of Energy (DOE) for controlling release of solid materials and current activities of DOE to review its policies on release of materials; (d) recommendations or policies of the Conference of Radiation Control Program Directors (CRCPD) on control of solid materials; (e) experience of individual States regarding release criteria for solid materials, in particular issues related to disposal of radioactive materials at landfills and issues related to NORM; (f) directives, standards, or recommendations of the International Atomic Energy Agency (IAEA) or European Union (EU) as they pertain to international trade and import; (g) recommendations of the International Commission on Radiological Protection (ICRP) and National Council on Radiation Protection and Measurements; (h) implications of the issuance of a standard in 1999 by the American National Standards Institute (ANSI) (N13.12) and the National

Technology Transfer and Advancement Act of 1995; and (i) stakeholder input and comments on prior NRC proposals on possible alternatives for control of solid material.

2) Explicitly consider how to address public perception of risks associated with alternative approaches and to provide recommendations on how concerns of stakeholders can be integrated into an acceptable approach for control of solid materials;

3) Determine whether there is sufficient technical bases to establish criteria for control of solid materials, including an evaluation of available dose analyses methods and measurement methods for demonstrating compliance with any criteria established, and to indicate what additional analyses or technical bases are needed before criteria can be established;

4) Provide recommendations on whether the NRC should: (a) continue the current system of case-by-case decisions, (b) establish a national standard by rulemaking, or (c) consider another alternative approach. As part of the recommendation, the contract stated that: (a) if continuation of the current approach was recommended, the NA should also provide recommendations on whether the current system should be revised, and, if so, how it should be revised; and (b) if promulgation of a national standard was recommended, the NA should also recommend an approach, set the basis for release criteria, and suggest a basis for establishing a numerical limit or, if it deems appropriate, propose a numerical limit.

5) The contract also noted that the NA should recommend how NRC might consider international clearance standards in its efforts.

More information on the project scope can be found in the NA report, Appendix C, and on their website: http://www4.nas.edu/webcr.nsf/ProjectScopeDisplay/BEES-J-00-02-A?OpenDocument.

C. ACTIVITIES CONDUCTED BY THE NA

Following award of the contract to the NA, the first step in the NA study was formation of a study committee. The study committee included representatives from academia, scientific and health organizations, and public groups and was formally approved by the NA in February 2001. More information on the membership of the NA study committee can be found in the NA report in Appendix A and on the NA website.

In conducting the study, the NA committee held an information gathering meeting in January 2001, with representatives of NRC, DOE, and EPA. Subsequently the NA held additional information gathering meetings in March and June 2001, with a variety of stakeholders. The invited stakeholder groups include representatives from NRC licensees and licensee associations, metals and cement industry organizations, solid waste organizations, a licensed waste disposal company, a waste broker, States and State associations, citizen groups, and international agencies. The June 2001 meeting also involved obtaining information on technical support documents.

Following the stakeholder meetings, the NA held five additional meetings in July, August, and December 2001, to develop and review draft report sections and chapters and to develop findings

and recommendations.

More information about the meetings held by the study committee can be found on both the NA website as well as on the NRC website, as part of the Quarterly reports prepared by the NRC, at http://www.nrc.gov/materials/medical.html.

D. SUBMITTAL OF FINAL NA REPORT TO THE NRC

The final report from the NA containing their findings and recommendations was submitted to the NRC in March 2002.

E. SUMMARY OF NA REPORT AND CHAPTER FINDINGS

E.1 Overall summary

The NA report is a 10-chapter report discussing a range of topics related to control of solid materials, including the regulatory framework, anticipated inventories of materials, pathways and costs of disposition, methodology for dose analysis, measurement issues, international approaches, stakeholder reactions, and a framework for decision-making. The first chapter presents introductory material; each of the subsequent chapters discusses a specific technical or policy area and contains a set of findings related to that chapter. Based on these findings, Chapter 10 presents two overarching findings and seven recommendations.

The following sections briefly summarize Chapters 2 through 9 of the NA report.

E.2 Summary of Chapter 2: The Regulatory Framework

E.2.1 Risk-based standards: The report notes that the trend in environmental regulation is towards risk-based standards which typically focus on estimated increased lifetime risks posed by regulated material. The report notes:

a) Need for transparency: An important challenge is to ensure that the methods used, including the simplifying assumptions and inherent constraints, are sufficiently transparent to both technical peers and the concerned public.

b) Benefits of risk-based approach: Benefits include: (1) ensures that contaminant levels are controlled to achieve acceptable levels of public health protection; (2) promotes consistency among different regulations, (3) is responsive to public policy decisions; and (4) is assumed to be rationally based on estimates of dose and risk. Although such dose-based standards have unavoidable uncertainties built into them, these uncertainties are offset by the approach's capacity to incorporate policy determinations into a rigorous scientifically based framework.

c) Assessing risk: Part of a risk-based approach is assessing the dose which involves:

1) Critical group: A set of exposure scenarios and resultant potential dose to a

certain group of individuals, referred to as the “critical group,” must be developed in order to assess risk.

2) Multiple exposures: An important aspect that must be considered in assessing the risk is the potential that a member of the public could be exposed to multiple exposure pathways. Thus, the standard for release of a site may be a relatively large fraction of the public exposure safety limit, while the standard for release of material into commerce would be a much smaller fraction.

3) Uncertainty: The inherent complexity of dose assessment analyses requires that numerous simplifying assumptions be made and that there be an assessment of the uncertainty in the analyses and a sensitivity analysis of the results.

E.2.2 Technology based standards:

a) Characteristics: the report indicates that technology-based standards may be based on the limitations of existing control or measurement technologies and notes that:

1) NRC’s existing guidance documents for control of solid materials are based on survey practices in use in the 1970s and 1980s.

2) Some environmental laws are based on “best available technology ” in which the focus is not on risk, which is difficult to estimate, but on promoting the use of the most advanced technologies and fostering their further development.

3) A technology based regulation in this area could prescribe limits on radioactivity levels or require that specific instruments or methods be employed.

b) Advantages and disadvantages: Technology-based regulation has the advantage of being relatively simple to implement. A major disadvantage is that, if potential impacts are not carefully considered, it can result in either under-regulation and thus increased risk to the public or over-regulation and hence increased costs to regulated industries. Thus, an analysis of risk reduction and cost-benefit should be part of any development of technology-based regulations.

E.2.3 Critical uncertainties: The report notes that there are several important uncertainties including the following:

a) Buildup of radioactivity: The risk that radionuclides will concentrate in certain solid materials released into commerce.

b) Ability to measure: The capabilities of existing radiation monitoring equipment and survey methods.

c) Multiple exposures: The significance of multiple exposure pathways for cumulative exposure to the public.

d) Accuracy: The reliability of conservative hypotheses in designating critical groups.

E.2.4 Historical evolution of the regulatory framework for control of solid materials: The report discusses the historical evolution of a regulatory framework in this area.

a) The Atomic Energy Act (AEA) and the Code of Federal Regulations (CFR): Issuance of the AEA and Title 10 of the CFR established licensing requirements for all practices using nuclear materials.

b) Liquid and gas effluents: The NRC's general radiation protection regulations in 10 CFR Part 20 contain permissible levels of radioactivity for gaseous and liquid effluents.

c) Solid materials:

1) Handling of materials with larger amounts of radioactivity: 10 CFR 61 contains disposal requirements for 3 classes of low-level radioactive waste (LLW), i.e., Class A, B, and C, which impose upper bounds for radioactive content.

2) Handling of materials with lower amounts of radioactivity: There are no requirements in 10 CFR 61 specifying a threshold content of radioactivity below which material may be treated as non-radioactive waste.

3) Current practice for handling materials with lower amounts, or no, radioactivity: Without a regulatory basis for what solid material can be treated as non-radioactive, NRC has used Regulatory Guide 1.86 which contains acceptable surface contamination levels for equipment based on detection limits of instruments available at the time of the guide's issuance in 1974. NRC also uses Inspection and Enforcement Circular 81-07 in its reviews of material and equipment and 10 CFR 20.2002 in case-by-case reviews for disposing of radioactive solid materials in unlicensed facilities when procedures are not specifically prescribed by existing regulations using license conditions and existing regulatory guidance.

E.2.5 Past efforts to set standards for solid materials: The report notes NRC's efforts to set standards in this area:

a) Issuance of the Below Regulatory Concern Policy: In 1990, NRC sought to establish a policy by which certain radiation levels would be considered "below regulatory concern" (BRC) to establish threshold levels of radioactivity below which solid materials could be cleared from further regulatory control. There was significant public comment on the BRC policy and NRC rescinded the policy following Congressional revocation of it in 1992.

b) 1999 Issues Paper and NUREG-1640: In June 1999, NRC released an Issues Paper containing issues and alternatives for discussion regarding alternatives for the control of solid materials. At that same time, NRC issued for public comment NUREG-1640 which contained a method for converting dose-based risks to concentration of radioactivity on materials by evaluating a range of pathway exposure scenarios.

E.2.6 Current regulations and guidelines in the U.S. pertinent to solid materials: The report highlights some pertinent regulations and states that the levels of protection afforded by federal regulation of radioactive materials vary widely.

a) NRC regulations on license termination requirements for structures and lands: NRC has license termination requirements in Subpart E of 10 CFR 20 which require that facilities meet a 0.25 mSv/yr (25 mrem/yr) dose standard before they can be released for unrestricted use.

b) NRC regulations on control of solid materials: There are currently no generally applicable NRC regulations for solid materials with low amounts of radioactivity, except for disposal of H-3 or C-14 in animal tissue in 10 CFR 20.2005(a)(2). Except for that one area, NRC evaluates control of solid materials on a case-by-case basis as noted in Section E.2.4(c)(3). The report reviewed SECY-00-0070 which lists advantages and disadvantages of the current "non-regulation" based NRC approach and generally agrees with that appraisal.

c) State guidelines: The report notes that for some NRC requirements, such as basic radiation standards or those that have significant implications for interstate commerce, Agreement States must adopt essentially identical requirements to NRC. States may also adopt more restrictive requirements if they have an adequate supporting bases. Criteria that have been applied by States on a case-by-case basis for solid material have included use of radiation levels indistinguishable from background, guidelines similar or equivalent to Regulatory Guide 1.86, and the use of dose-based analysis.

d) DOE guidelines: The DOE's standards for surface contamination are set forth in DOE Order 5400.5 which incorporates Regulatory Guide 1.86. The DOE was considering a large scale recycling project in 1996 at its Oak Ridge complex, but in response to strong opposition from the private and public sectors, DOE issued a moratorium in January 2000 on releases of volume contaminated materials and also suspended unrestricted recycling of scrap metal in July 2000. DOE currently has initiated a process for preparing a programmatic environmental impact statement (PEIS) on alternatives for recycling surface contaminated metals.

e) EPA regulations: The report notes that:

   1) EPA emissions and operations standards: EPA regulations in 40 CFR 190 set limits of 0.25 mSv/yr (25 mrem/yr) on nuclear plant operation, in 40 CFR 141-142 set a 40 μSv/yr (4 mrem/yr) standard from drinking water, and in 40 CFR 61 set limits of 0.1 mSv/yr (10 mrem/yr) from airborne emissions.

   2) EPA risk goals for standards: EPA has developed standards for Superfund sites based on having remediation goals being consistent with a lifetime risk range of 10^{-4} to 10^{-6}.

3) EPA clearance efforts: EPA does not have a clearance related effort ongoing but has focused its efforts on promoting consistent international import-export controls for materials containing residual radioactivity.

f) As low as reasonably achievable (ALARA) requirements: With regard to application of ALARA in requirements, the report noted that it is not appropriate to apply the ALARA principle at or below the dose limits that are typically proposed for clearance. The rationale given is that these are not dose safety limits but are levels at which solid material may be released, and that dose levels of 1 μSv/yr to 0.1 mSv/yr (0.1 to 10 mrem/yr) are already orders of magnitude below natural background and below the variation in natural background dose.

g) Technologically enhanced naturally occurring radioactive material (TENORM): Federal regulation of TENORM has been largely absent (an exception to this is DOE Order 5400.5 which covers this material for activities authorized under the AEA). This regulatory gap in regulation of TENORM persists despite the fact that many forms of TENORM can be substantially more radioactive than low level waste subject to regulation under the AEA. The existing State regulations that apply to TENORM have been largely limited to disposal and handling requirements and, while the CRCPD has drafted model state regulations for TENORM, they have not be finalized nor adopted by any State. State regulations remain limited and vary from State to State.

E.2.7 Stakeholder concerns with regulations in this area: The report discusses stakeholder reactions to a previous effort in this area, the 1990 BRC policy, and relates the comments to current efforts on control of solid materials.

a) BRC policy: The report states that NRC public meetings on the BRC policy were contentious and notes that:

1) Themes of public comments: The prevailing sentiment was one of opposition to the BRC policy. Themes of opposition included: (a) extreme concern over possible deregulation of nuclear power waste, (b) opposition to recycling of materials into unlabeled consumer products; and (c) concern that the policy would permit a large number of deaths per year.

2) Overall concern with NRC: Stakeholder concerns centered on whether NRC could adequately protect the public.

3) Concern with radiation and trust of government: Many stakeholders expressed belief that low levels of radiation were much more harmful than the regulatory agencies had determined them to be.

4) Concerns with ability to monitor materials: There was concern that it would not be possible to monitor solid materials adequately before release.

5) Concerns over multiple exposures: Many stakeholders were concerned that the regulatory system failed to take into account multiple exposures.

6) Concerns over individual rights: Stakeholders were concerned that general standards for release would undermine individual rights to decide the nature and magnitude of risk to which members of the public would be exposed.

7) Support for BRC: The nuclear industry and some other stakeholders supported the policy on the grounds of economic and resource efficiency.

8) Termination of BRC policy: There was an effort at a consensus seeking process, however it did not succeed and the policy was nullified by Congress in 1992.

b) Current effort on control of solid materials: The report notes that many of the same concerns still exist today and stakeholders remain adamantly opposed to NRC rulemaking on control of solid materials.

E.2.6 Findings: Based on its review, the NA made the following specific findings with regard to the regulatory framework:

a) Finding 2.1 - Current practice and lack of overall approach: The NRC does not have a clear, overarching policy statement for management and disposition of solid material. However, solid material has been released from licensed facilities into general commerce or landfill disposal for many years pursuant to existing guidelines (e.g., Regulatory Guide 1.86) and/or following case-by-case reviews. The NRC advised the committee of no database for these releases.

b) Finding 2.2 - Dose-based standard: A dose-based clearance standard can be linked to the estimated risk to an individual in a critical group from the release of solid material. The general regulatory trend is toward standards that are explicitly grounded in estimating risks.

c) Finding 2.3 - Current practice has been used satisfactorily: For clearance of surface-contaminated solid materials, the clearance practices regulated by the NRC and Agreement States are based on the guidance document Regulatory Guide 1.86, which is technology based and has been used satisfactorily in the absence of a complete standard since 1974.

d) Finding 2.4 - Volume contaminated material: For clearance of volume-contaminated solid materials, the NRC has no specific standards in guidance or regulations. Volume-contaminated material is evaluated on a case-by-case basis. This case-by-case approach is flexible, but it is limited by outdated, incomplete guidance, which may lead to determinations that are inconsistent.

e) Finding 2.5 - Regulation of TENORM is inconsistent or absent: Industrial activities are generating very large quantities of TENORM. Federal regulation of TENORM has been largely absent. State regulations vary in breadth and depth.

E.3 Summary of Chapter 3: Anticipated Inventories of Solid Materials

E.3.1 General: This chapter presents information on quantities of solid material expected to arise over the next 25 years and makes the following general points in considering inventories of materials:

a) Scarcity of information and impact on analyses: The report did not find readily available information on inventory and anticipated dates for disposal of materials, and therefore the report notes that one must often infer or estimate the amount of materials that may satisfy particular clearance criteria based on information created for a different purpose.

b) Source used: The report relied heavily on a recent draft letter report on material inventory developed for the NRC by its contractor, SC&A.

E.3.2 Need for NRC awareness of implications of its actions: The report notes that NRC needs to be aware that any new regulations that it issues could have impacts on management of contaminated materials currently unregulated at the federal level.

E.3.3 Inventories of solid materials: The report provides information as follows:

a) Power reactors:

1) Inventory from reactors: The report notes that some data are available for estimating types and annual quantities of materials from power reactors and refers to several NUREG/CRs containing decommissioning data. From this information, tables are provided on materials inventories.

2) Relation of reactors to other facilities: Most material from NRC-licensed facilities comes from nuclear reactors.

3) Types of materials: Material to be dispositioned at decommissioning of reactors includes activated materials; nonreusable materials, such as ion exchange resins, filters, and insulation; and metallic solid material that might be uncontaminated but is from a radioactive work area or might be only slightly contaminated.

4) Concrete: Structural concrete can also be available at decommissioning. The volume of concrete is larger than the combined volumes of all other material by at least a factor of 10. Determining what to do with the concrete is complicated by several factors, including determining quantities and levels of radionuclides that have penetrated into the concrete and sampling costs to demonstrate the material is clean. Public perception and regulatory factors can also affect disposition choices such as whether the concrete is left as on-site fill after a license is terminated.

5) Timing: Most of the inventory will arise during decommissioning of reactors during an extended time period between the years 2006 and 2030. If licenses are extended for an additional 20 years, which seems probable for most facilities, little material would be generated until the time period 2030 to 2050.

6) Comparison of reactor inventory with total scrap: The amount of ferrous metal scrap arising from decommissioning of nuclear reactors would constitute only about 0.1 percent of the total scrap steel recycled each year by the U.S. steel industry; therefore the effect on the available scrap metal resources is negligible if the metal from nuclear reactors is not recycled.

b) Non-power reactors: In estimating inventory, the report notes that the weights of structural steel and concrete are assumed to all be clearable without any exclusions for LLW materials. The inventory of steel and concrete represents about 1.4 percent of the weight from power reactors.

c) NRC licensed fuel cycle and non-fuel-cycle facilities: The total quantity of materials compared to reactors is considered to be small.

d) Non-NRC facilities: The report also discussed inventories existing at DOE facilities and at EPA superfund sites, as well as inventories of NORM and TENORM.

E.3.3 Findings: Based on its review, the NA made the following specific findings with regard to inventories of material:

a) Finding 3.1 - Quantities of material from licensed facilities and comparison to general scrap: Licensees may seek to clear about 740,000 metric tons of metal that arise from decommissioning the current population of U.S. power reactors during the period 2006 to 2030 (about 30,000 to 42,000 metric tons per year). About 8,500 metric tons per year are expected to arise from decommissioning NRC-licensed facilities other than power reactors during the same time period. The total quantity of metal from both power reactor and non-power reactor licensees, up to approximately 50,000 metric tons per year, represents about 0.1 percent of the total obsolete steel scrap that might be recycled during that same 25-year period.

b) Finding 3.2 - Timing of materials available for release: If most of the licensees of currently operating reactors obtain 20-year license extensions, relatively little solid material will arise from power plant decommissioning during the 2006 to 2030 period.

c) Finding 3.3 - Concrete: Because of the difficulty of determining the quantities and levels of contamination that have penetrated into the concrete, concrete is generally considered to be volume contaminated. Concrete constitutes more than 90 percent of the total solid material arising from decommissioning population of U.S. power reactors.

d) Finding 3.4 - DOE facilities and comparison to NRC facilities: About 1 million metric tons of metal, and about 3.7 million to greater than 12 million metric tons of concrete, are projected to arise from cleanup and decommissioning of DOE facilities during the coming 25 years. This quantity of metal is comparable to the quantity of metal estimated to arise from decommissioning the population of U.S. power reactors and corresponds to only an additional 0.1 percent of the total obsolete steel scrap recycled in the United States during the same 25-year period.

e) Finding 3.5 - TENORM is largest quantity of material: TENORM is generated in the United States at an annual rate of about 2.3 million metric tons per year. The quantity of TENORM predicted to arise over the coming 25-year period is nearly 16 times larger than the quantity of solid material estimated to arise from decommissioning the population U.S. power reactors.

E.4 Summary of Chapter 4: Pathways and Estimated Costs

This chapter provides information on costs for different disposition alternatives.

E.4.1 Bases for disposition decisions and for developing costs:

a) Alternatives for disposition: In the cost analyses, the report assumes three possibilities for disposition of solid material arising from operation and decommissioning nuclear facilities (no release, clearance, and restricted use of material to certain authorized uses (the NA report refers to this alternative as “conditional clearance”)).

b) Illustration of disposition paths and decision points: The NA report presents Figure 4-1 which illustrates the general decision pathway for disposition.

c) Disposition system decisions: The report presents a discussion of some of the factors that go into decisions regarding disposition of material, including: (1) material that might go to waste disposal under a no release option; (2) sorting of material; (3) types of restricted use options; (4) the length of a storage period for decay of material (including the material half-life, facility storage capability, financial stability of the facility owner, costs, and public views); and (5) potential decontamination of materials.

E.4.2 Relative costs: The report develops some estimated costs based on the following:

b) Costs not included in analysis: The report notes that costs of decontamination, segmentation of materials, and transport costs are not included in the report’s analysis.

c) Factors in determining costs: Determining the costs for disposition can be difficult but some useful data are available. Many factors affect costs, including volume, physical and chemical characteristics of the material, taxes and fees, and past relationship between the generator and disposal facility.

d) Nature of analysis: The report notes that it does not contain a detailed analysis of all factors, nor did it find that the NRC had prepared a detailed economic analysis. The analysis in the report principally focuses on costs of disposal at a licensed waste disposal facility, cost of placement in a landfill, and cost saved by clearance.

    1) LLW site disposal cost: The report notes that the disposal cost of waste from decommissioning can constitute a major share of the total cost of decommissioning. Costs for disposal in commercial LLW sites at Barnwell, US Ecology, and Envirocare are presented in the report.

2) Landfill disposal costs Costs for disposal in Subtitle C and D landfill sites are presented in the report.

e) Comparative costs of no release and restricted use: Based on estimated volumes of metals sent to LLW, assuming that there was a "no release" approach and all material went to a LLW site, compared to the same volumes sent under a restricted use approach to Subtitle C or D landfills, and using pertinent cost information, the report notes that landfill disposal is significantly less expensive.

f) Concrete costs: The costs of disposal of concrete at Envirocare, at a landfill site, and if reused in roadway foundations, were compared.

E.4.3 Finding: Based on the analysis in Chapter 4, the NA report made the following finding:

a) Finding 4.1 - Cost of disposal of material in LLW sites compared to landfills: Disposal of all solid material arising from decommissioning U.S. power reactors into LLW sites would be about $4.5 to $11.7 billion as compared to disposal at Subtitle C or D landfills which would be much cheaper ($0.3 billion to $1 billion). If the material is cleared the costs would be lower and might even result in some income arising from the sale of scrap materials for recycle or reuse.

E.5 Summary of Chapter 5: Methodology for Dose Analysis

E.5.1 Key technical assessments of annual doses associated with clearance of solid material: The report notes that there has been a considerable effort in several countries in studying dose factors for clearance of solid material. Critical groups are used in these studies to identify the most exposed group of persons and bound the potential dose that any other member of the general public may receive from solid material that is cleared.

a) NRC studies: Two NRC studies were evaluated. NUREG-1640 is considered state of the art in its risk assessment methodology and provides an in-depth analysis of recycling of steel, copper, aluminum and concrete with either volumetric or surficial contamination. The conceptual plan of NUREG-1640 was found to be the best of all studies reviewed. A formal uncertainty analysis is incorporated into NUREG-1640, unlike the other studies. A decision needs to be made about which dose factor to use for deriving secondary activity (radionuclide concentration) standards. From a scientific perspective, the NAS committee does not believe it is cost-effective to repeat the work done in NUREG-1640, in response to a previous conflict of interest question. An independent technical review of NUREG-1640 was performed by the Center for Nuclear Waste Regulatory Analysis, but there has not been a thorough review of the parameters and associated ranges in the report. Other limitations of NUREG-1640 are noted in E.5.4 below.

The second NRC study evaluated was a risk assessment of scrap metals from gaseous diffusion plants and other sources, which was published in 1980 in report NUREG-0518. NUREG-0518 does not contain uncertainty estimates and relies instead on conservative bounding conditions. There was negative public reaction to this effort at that time and further efforts were suspended.

b) Environmental Protection Agency documents on dose factors: The 1997 Technical Support Document (TSD 97) provides estimates on sources and inventories of metal scrap from government and commercial sources and contains information on dose factors, detection limits, scrap metal processing methods, scenarios, and timetables for when certain solid materials may become available. NCRP critiqued TSD 97 and concluded that: (a) TSD 97 overemphasized the evaluation of a limited number of scenarios; (b) uncertainties should be analyzed using a probabilistic risk assessment model; and (c) implementation methods should be considered for standards development.

c) American National Standards Institute and Health Physics Society Standard N13.12-1999: The NA report notes that the primary dose standard in this standard is 10 uSv/yr (1 mrem/yr), which is consistent with international values, and contains useful information, including an implementation protocol. However, this standard did not use a range of dose estimates across categories to define a critical group in a documented manner, so the NA report stated the method for deriving the screening levels is not traceable and therefore not judged or ranked by the NA committee.

d) International Atomic Energy Agency documents: The NA report reviewed two documents developed by the International Atomic Energy Agency (IAEA) - Safety Practice No. 111-P.1-1 and TECDOC-855. The NA report notes that the first report provides the IAEA's dose factors that were derived based on technical assessment principles established in IAEA Safety Series No. 89 (SS89), and that the NRC has not developed a generic document such as SS89. Two potential differences were identified between IAEA recommendations and existing U.S. concepts for control of solid material, which concern the potential effect of similar practices on critical groups or populations exposed and the issue of dilution of material or fractionation of practice. The NA report also noted that both documents do not include uncertainty analyses and, in Safety Practice No. 111-P.1-1, certain parameter values were assigned without a citation reference. TECDOC-855 was developed in a similar fashion as ANSI/HPS N13.12-1999, but was considered traceable by the NA committee because TECDOC-855 included the steps taken to discount various studies that were not used to form the technical basis for the dose factors.

e) European Commission documents: Two reports were reviewed that were prepared by the European Commission (EC). These reports address metals recycling, equipment and building reuse and building demolition. The NA noted uncertainty estimates were not performed and that a few scenarios were assumed to be representative of many other scenarios. A suggestion made by the NAS report was for NRC to consider certain assumptions used to derive the dose factors in these EC reports, such as the variation in contaminant level of a material being surveyed for clearance.

E.5.2 Comparison of clearance studies: The studies reviewed do not always agree on the numerical value for the best estimate of the dose factor. Although there is relatively good agreement between the NRC and EPA studies, there is less agreement between the NRC study and those conducted by the IAEA and EC. Dissimilarities are attributed to differences in assumptions, critical groups, exposure scenarios, degree of conservatism, and the presumed heterogeneity of contamination in or on the solid material. The NA committee evaluated the uncertainty in the dose factors by estimating the variability between studies and concluded that there is greater variability than predicted by the uncertainty bands utilized in NUREG-1640. Thus,

the uncertainty bands in NUREG-1640 may need to be rechecked and, at a minimum, the NRC should be able to understand and explain the discrepancy. An order of magnitude difference in dose estimates is reasonable for risk estimates of this type, but an international bench marking exercise would make sense for major disagreements.

a) Usefulness and quality of dose factors: Some dose factors can be shown to be reliable, such as those involving external gamma radiation, but some other dose factors require the use of parameters that are highly uncertain. A way to account for uncertainty is to set the dose factor at a fixed margin above the best estimate in order to compensate for incomplete knowledge. The selection of an additional margin of protection is a policy decision - if one is not chosen, then uncertainties should be evaluated closely or, less preferably, rely on the protectiveness of the analysts. Decision-makers need to be informed of the quality of the supporting information. One way to deal with hypothetical model error is to adopt a policy of "adaptive management" in which real-world performance is validated after implementation or through retrospective analysis of case studies, which is endorsed by the IAEA. Such a validation program could be used to adjust dose factors after a standard is implemented, if needed, but for solid materials cleared from NRC facilities under a potential future standard, field data will probably only be useful in assessing how well the clearance models have bounded the concentrations and estimated the doses. A modest monitoring effort would boost confidence in the dose factors.

b) General limitations of the reviewed studies:

   1) Failure to consider uncertainties associate with implementation of a primary dose standard: Dose factors are useful tools, but have practical value only within a specific implementation protocol that can itself introduce additional uncertainties, such as averaging error, sampling error, rounding error and treatment of multiple radionuclides.

   2) Lack of validation of model estimates: A validation program should be used to correct and refine a clearance standard, given the uncertainties in the dose factors. Only one study has attempted this and the NA committee encourages future efforts.

   3) Lack of inclusion of accidents and human errors in the dose factors: The IAEA recommends consideration of accidents in estimating exposures of the public from disposal exemptions and human error can initiate or contribute to accidents in clearance. Human error was not explicitly addressed in any of the studies reviewed by the NA, but NRC is assessing one form of human error (accidents). It must be presumed that some shipment will leave licensed facilities with contamination in excess of a clearance standard and a probabilistic-based study, such as NUREG-1640, can account for this possibility. Human error may only have a limited impact on dose factors.

c) Potential inconsistencies in dose factors between countries: Two types of inconsistencies exist, which are the primary dose standard and the dose factors that are used to derive the secondary clearance standard. Consistency of clearance standards across national borders is desirable, but it would be inappropriate for one country to change scientific

evidence to achieve consistency with standards in effect in other countries because it could undermine public confidence. If rationalization of transnational consistency of clearance dose standards becomes paramount, the changes should be based on a policy choice.

E.5.3 Detailed comments on NUREG-1640 The NA committee believes that the following issues with NUREG-1640 have to be considered explicitly in the technical support process:

a) Landfill disposal scenarios: Landfill issues were difficult to understand and require clarification and justification. Examples are the fraction of material that goes to a landfill, alternative economic models for landfill deposits, and uncertainties related to leaching rates, liner failure, long-range transport issues and lack of a defined critical group.

b) Incineration pathway: This pathway was not addressed and should be explicitly considered even though it is unlikely to be significant.

c) Sensitivity analysis: A sensitivity analysis would be constructive because it would yield information about the significance of a parameter's value and would allow a better assessment of the effect of the parameter's uncertainty on the calculated dose factors.

d) Validation: There is no bench marking or validation and it would be appropriate to demonstrate the validity of the modeling technique.

e) Sample calculations: More sample calculations could have provided clarity as to the overall method.

f) Multiple pathways: Multiple pathways should be considered, as recommended by IAEA.

g) Resuspension of contamination: There is only limited consideration of resuspension of surface contamination into the air. At a minimum, a sensitivity analysis should be performed to inform readers as to how the dose factors would vary with a change in the resuspension coefficient. A sufficient technical basis may not exist for assigning a credible uncertainty factor to certain types of releases that are sensitive to resuspension. If so, such clearance categories could be excluded by regulation until a sufficient technical basis is developed.

h) Collective dose: The technical analysis does not include collective dose and focuses on individual dose. Other studies have examined collective dose. It may be of interest in shaping policy to have some idea of collective dose.

i) Size of critical groups: The total number of people exposed in any critical group is not discussed. Knowledge of the approximate size of critical groups assists in building confidence that a more important subgroup has not been overlooked.

j) Total activity and mass balance: There is limited information on total activity buildup and mass balance. Although this lack of information made the NA committee uncomfortable it believes that buildup is not likely to be significant and supporting estimates are useful.

k) Accounting for human error: Human error is not accounted for. More analysis is needed

because it is a good risk assessment practice and, specifically for the control of solid materials, the potential consequences may be sufficient to require further evaluation.

l) Uncertainty in conversion between intake and dose: The uncertainty in the coefficients that convert inhalation and ingestion to dose were not considered, but should be explicitly considered even though their overall contribution may not be significant to other uncertainties that enter the estimate of dose factors.

E.5.4 Findings

a) Finding 5.1 - Development of dose factors: Analytical work in the United States and abroad over the past two decades is useful in understanding the likely doses associated with exposure scenarios that might occur under various clearance standards. Much of the technical analysis in this field has the objective of understanding "dose factors," which to date have been analyzed in depth only for clearance scenarios. A dose factor is used to convert a concentration of radioactivity that is about to be released, whether it be confined to a surface or contained within a volume, to a primary dose level (measured in microsieverts per year or millirem per year). With such a dose factor in hand, a primary dose standard can be converted to obtain a secondary clearance standard in terms of radionuclide activity, which could then be used at NRC-licensed facilities. A dose factor can be used with any choice of primary dose standard.

b) Finding 5.2 - Standard of 10 µSv/yr (1 mrem/yr): Selecting a primary dose standard is a policy choice, albeit one informed by scientific estimates of the health risk associated with various doses. For instance, as shown in Table 1-2 of the report, a lifetime dose rate of 10 µSv/yr (1 mrem/yr) equates to an estimated increased lifetime cancer risk of $5x10^{-5}$, which falls within the range of acceptable lifetime risks of $5x10^{-4}$ to 10^{-6} used in developing health-based radiation standards other than radon in the United States. When setting primary dose standards, regulators can make a policy decision to include a level of conservatism such that the final standard is in excess of the "best-estimate" dose factor and in this way account for uncertainty (e.g., selecting the 90th, 95th, or other percentile in the distribution for the dose factor, instead of the best-estimate value).

c) Finding 5.3 - Uncertainty and variations of dose factors among analysts: The uncertainty in dose factor estimates is a key technical issue. When an uncertainty has been estimated, a quantitative determination can be made of the likelihood that the dose to an individual in the critical group will be below the primary dose standard. Quantitative uncertainty estimates can also assist regulators in assigning a level of conservatism to dose factors in excess of the best estimate. Dose factors developed by analysts from different countries show wide variation, which highlights the need for careful consideration of uncertainties.

d) Finding 5.4 - Merits of NUREG-1640: The committee concludes from its review that of the various reports, draft NUREG-1640 provides a conceptual framework that best represents the current state of the art in risk assessment, particularly with regard to its incorporation of formal uncertainty, as judged using recommendations of this committee and other committees of the National Research Council. Once the limitations in draft NUREG-1640 have been resolved (see Findings 5.5 and 5.6) and the results are used in conjunction

with appropriate dose-risk estimates, the NRC will have a sound basis for considering the risks associated with any proposed clearance standards and for assessing the uncertainty attached to these dose estimates.

e) Finding 5.5 - Need for re-assessment of NUREG-1640 parameters: The development of the NUREG-1640 draft has been clouded by questions of contractor conflict of interest. The mathematics and completeness of scenarios considered in draft NUREG-1640 have been verified through an audit carried out by another NRC contractor. The committee also carried out its own review that generally confirmed the reasonableness of several dose factor analyses. However, a thorough review of the choice of parameters and parameter ranges, term by term, is needed to complete the reassessment of draft NUREG-1640.

f) Finding 5.6 - Need to analyze human error, restricted use, and multiple exposure: Draft NUREG-1640 did not consider human error and its possible effect on dose factor predictions, nor did it consider scenarios involving multiple exposure pathways. In addition, draft NUREG-1640 does not provide a sufficient basis to analyze restricted use options, such as disposal in a Subtitle D landfill.

g) Finding 5.7 - Need to expand NUREG-1640 for other material, DOE material and TENORM: The dose factors developed in draft NUREG-1640 should not be used to derive clearance standards for categories of solid material other than those considered in the draft NUREG-1640, without first assessing the appropriateness of the underlying scenarios. Some of the dose factors developed in draft NUREG-1640 are likely to require modification when applied to other mixtures of radionuclides (e.g., mixtures in which transuranics dominate) and other clearance scenarios, such as may be relevant to DOE material and TENORM.

E.6 Summary of Chapter 6: Measurement Issues

This chapter provides information on measurement issues for different disposition alternatives.

E.6.1 Factors affecting ability to measure: The chapter provides information on:

a) Level of complexity: The quantitative determination of the identify and activity of radionuclides present in a sample is a process that ranges from straightforward to complex.

b) Factors affecting measurability:

1) Concentration of nuclides on material: The concentration of any nuclides in samples to be measured is low relative to licensed levels, and the dose received by individuals from contact with these materials is a small fraction of natural background doses and thus too low to be directly measurable.

2) Other factors: Because dose cannot be measured directly, the concentration of the radionuclide on the material is what is determined and this can be affected by many factors, including: (a) the magnitude of dose factors; (b) specific instrumentation used, including detection limits for both field survey instruments

and laboratory instruments; (c) counting conditions, including background radiation levels; (d) sample characteristics; and (e) identity and quantity of the radionuclide. NUREG-1507 discusses each of these factors in detail including their impact on the minimum detectable concentration (MDC).

E.6.2 Levels of detectability and measurement costs:

The report notes that a reasonable question to ask is whether a radionulide can be measured at the concentrations corresponding to a dose standard.

a) Evaluation factors:

1) Use of EPA technical support document in analysis: To assess whether existing instrumentation can observe different radionuclide concentrations at low levels, the report used an EPA technical support document prepared in 1997 presenting MDC data from 24 laboratories.

2) ANSI N13.2: The report also considered the conclusions of ANSI N13.2, which provides similar conclusions as the EPA technical support document for surface contamination.

3) Costs of measurement: The cost of measurement activities depends on the difficulty of analysis. For clearance alternatives, the tradeoff between the cost of clearance and the cost of disposal at a LLW site will ultimately determine which option a licensee chooses. To provide some information in this area, the report provides some cost information on surveys.

b) Conclusions:

1) The fraction of nuclides detectable under field conditions is 39 of 40 for 0.15 mSv/yr (15 mrem /yr), 31 of 40 for 10 µSv/yr (1 mrem/yr), and 11 of 40 for 1 µSv/yr (0.1 mrem/yr).

2) For both volume contaminated and surface contaminated solid materials, measurement of radionuclide activity at levels being considered for dose based standards is not the limiting factor if the primary dose standard is at or above 10 µSv/yr (1 mrem/yr), in both laboratory and field measurements.

3) Based on the short analysis done, the cost of sampling and analysis does not appear to be a constraint limiting an option for a dose standard at or above 1 µSv/yr (0.1 mrem/yr).

E.6.3 Current measurement practices of a waste broker

a) The report notes that waste brokers and processors handle a significant fraction of the 30,000 tons of waste materials processed in the U.S.

b) Waste brokers provide services for the disposition of solid materials and may transport,

collect, or consolidate shipments or process waste.

c) If material is clean, a waste broker ships it to Subtitle D landfill. As a further check, portal monitors at the exit of the waste broker facility are used to ensure that the clean material shipped to a landfill does not trigger portal monitors upon arriving there.

E.6.4 Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM): The report briefly discusses the MARSSIM methodology and notes:

a) MARSSIM includes a statistical sampling methodology suitable for release of land and buildings potentially containing residual radioactive material in soil or on building surfaces.

b) The MARSSIM method could be valuable tool for licensees in demonstrating compliance with the type of dose-based standards under consideration for control of solid material.

c) There are a number of radiation detection instruments available to scan surfaces and the characteristics of the detector enable the licensee to relate the release level to a corresponding instrument response, referred to as the "derived concentration guideline level."

d) Having selected appropriate instrumentation, the licensee must then develop an integrated survey design, including collection of survey data and data assessment.

E.6.5 Findings: Based on the analysis in the chapter, the report made the following findings in Chapter 6:

a) Finding 6.1 - Complexity of measurements: The concentration of radioactive material in released solids directly affects radiation detection requirements and costs. Measurement of the amount of radioactive material in a solid matrix is a complex task. No single measurement method would be appropriate or adequate for all nuclides.

b) Finding 6.2 - Impact of measurement costs: The overall measurement costs affect clearance decisions. If the measurement costs are too high, it may be more cost-effective to dispose of the material as LLW.

c) Finding 6.3 - Ability and cost to measure at low levels: For a 10 µSv/yr (1 mrem/yr) or higher standard, the majority of radionuclides can be detected at reasonable costs in a laboratory setting. For a 1 µSv/yr (0.1 mrem/yr) standard, the measurement capability falls below the upper bound of MDCs for some radionuclides in some laboratories, although 85 percent of the radionuclides are still detectable. Using field measurements, a more rapid fall-off of detectability is observed at the lower dose levels, with 31 of 40 key radionuclides detectable at 10 µSv/yr (1 mrem/yr) and 11 of 40 detectable at 1 µSv/yr (0.1 mrem/yr).

E.7 Summary of Chapter 7: International Approaches to Clearance

This chapter provides information on international issues related to disposition alternatives.

E.7.1 The Global context:

a) Growth in import-export activities: Import-export involving recycled materials has increased greatly with the growth of international trade over the past several decades, particularly for metals such as steel, aluminum, copper, and nickel.

b) Level of trade: Scrap metal is actively traded worldwide and the U.S. imports about 3 million metric tons of scrap steel per year.

c) Orphan sources as a concern: An issue that has caused a concern both with the U.S. and the EU has been the introduction, whether accidental or deliberate, of sealed high radioactivity sources in metal scrap for recycling. These “orphan sources” can cause problems during the recycling of steel but are noted as being outside the scope of the NA report and are being addressed in a separate effort by NRC, EPA, and the EU.

E.7.2 Efforts by international organizations:

a) Development of Standards: Various international organizations, including the United Nations Scientific Committee on Exposure to Ionizing Radiation, the European Commission (EC), IAEA, ICRP, and EU have, in various stages of completion, work on standards for slightly radioactive solid material.

b) United Nations (UN) proposed guidelines: To address concerns about import-export of metal scrap with undetected levels of radioactivity above clearance levels, the UN Economic Commission for Europe proposed guidelines including: (1) prior notification to receivers of material of the origin of the material; (2) information on materials with NORM should also be provided; and (3) the information should be conveyed with the released material to the successive suppliers and buyers of the metal scrap.

c) EU directive: The EU has been establishing standards and methods of control for solid material within Europe. Clearance practices in the EU are subject to a directive of the Council of the EU of May 1996 which states that materials can be released from regulatory control if the quantities and concentrations of activity do not exceed the concentration limits in Table A of Annex I (from Council Directive 96/29/EURATOM), or that regulatory agencies can use their own assessment process to decide on concentration values if the associated dose level is on the order of 10 μSv/yr (1 mrem/yr) (collective dose of 1 man-Sv/yr (100 personrem/yr)).

d) Standards in EU nations: The report notes that EU countries are in various stages of developing detailed regulations to implement the 1996 EU directive. The report notes potential quantities of potentially clearable materials and notes (based on Table 7-1) that different clearance procedures are currently in use among EU countries.

e) Standards in other countries: It is noted that there is also potential for material release from other countries including Japan, Russia, India, and China.

E.7.3 Findings: Based on the analysis in the chapter, the report made the following findings in Chapter 7:

a) Finding 7.1 - EU and IAEA standards set at 10 µSv/yr (1 mrem/yr): The EU and the IAEA have each established a dose-based standard of 10 µSv/yr (1 mrem/yr) for clearance of solid materials. A collective dose standard is also included, expressed as a committed dose equivalent of 100 person-rem total effective dose equivalent per year.

b) Finding 7.2 - EU concentration tables: The EU has derived tables of radionuclide concentrations based on a set of exposure scenarios against which solid materials can be evaluated for clearance.

c) Finding 7.3 - EU and IAEA data and policies: A body of science, policy, and literature supports development of the EU safety directives related to radioactive solid material clearance. In particular, the IAEA has developed policy guidance found in a 1988 IAEA document, "Principles for the Exemption of Radiation Sources and Practices from Regulatory Control."

E.8 Summary of Chapter 8: Stakeholder Reactions and Involvement

This chapter reviews recent and current efforts by NRC to involve stakeholders in the decision-making process that are relevant for this effort on control of solid materials and presents basic principles that NRC can follow to involve its stakeholders more effectively.

E.8.1 Previous NRC efforts on related issues:

a) BRC Policy: The report discusses NRC's efforts in issuing the BRC policy.

   1) Scope of BRC: The BRC policy, issued in 1990, was intended to cover four basic areas, including termination of licenses for facilities, distribution of consumer products, disposal of materials with very low levels of radioactivity, and recycling or reuse of materials.

   2) Public process on BRC: There was issuance of a policy statement for public comment and a series of public meetings on the BRC policy.

   3) Problems indicated with BRC public process: The public meeting process became polarized and there was strong stakeholder opposition . Subsequently, there was an effort at a consensus building process which did not succeed as a result of stakeholders declining to participate because of certain conditions placed on participation and a general distrust of the BRC process by certain stakeholders.

   4) End point of BRC process: The BRC process was ultimately terminated in 1993 after the NRC rescinded the policy and Congress revoked it.

b) License termination rule (LTR): The report indicates the following in discussing NRC's efforts in issuing the LTR.

   1) Scope of LTR: The LTR provided criteria in the regulations for decommissioning of lands and structures at licensed facilities.

2) Public process on LTR: The LTR effort was begun with a series of public workshops in 1993 designed to identify issues, areas of concern, and disagreement. In addition, a "initial draft rule" was issued for review by stakeholders in early 1994. A proposed rule was published by the NRC in August 1994 after considering the outcome of the workshops, the results of a scoping process carried out under the National Environmental Policy Act (NEPA), and comments on the initial draft rule. The proposed rule contained a 0.15 mSv/yr (15 mrem/yr) standard for release of decommissioned sites and the use of site specific advisory boards (SSABs) for review of sites seeking restricted use.

3) Problems indicated with LTR public process: Subsequent to issuing the proposed rule after completion of the consensus process, a final rule was issued with a 0.25 mSv/yr (25 mrem/yr) standard and dropping of the SSABs for a performance based criteria for obtaining public advice on restricted use for a site. Environmental groups and the EPA had objected to the revision to the dose standard before issuance of the final rule because of health and safety concerns but no extensive stakeholder process was held to address these concerns.

   The report states that after publication of the proposed rule, the NRC should have been able to conclude a successful public participation process, however subsequent NRC actions fundamentally undercut the consensus that had been achieved, further alienating those who had participated.

4) End point of LTR process: The LTR process was completed in July 1997 with issuance of a final rule.

E.8.2 Current NRC efforts on control of solid material:

a) Public process for control of solid materials: In June 1999 the NRC published, for public comment, an Issues Paper indicating that NRC was initiating another "enhanced participatory process" for a proposed clearance rule. The process began with a series of four public meetings in fall 1999 and an additional stakeholder meeting with the Commission in May 2000.

   The report notes that the Issues Paper presented three alternatives including:

   1) Do not conduct rulemaking and continue the current case-by-case approach;
   2) Do not conduct rulemaking and explore options for updating existing guidance to improve consistency;
   3) Conduct a rulemaking.

   If the third option, rulemaking, were pursued, the Issues Paper noted that three "technical approaches" could be explored:

   1) Permit release for unrestricted use if doses are less than a specified level;

   2) Restrict release to only certain authorized uses; and

3) Prohibit release of material from areas where radioactive material is used or stored, otherwise allow clearance.

a) Problems with process used for effort on control of solid materials: The NRC's public meetings were initially boycotted by some national environmental and consumer advocacy groups as a result of their severe criticism of the NRC process, doubt as to whether it had been adequately reformed, and skepticism over whether it would be any different from the BRC or LTR processes.

b) Public views on alternatives: The NA report indicates that the Issues Paper does not capture the full spectrum of alternatives favored by stakeholder groups and presents information representing the range of stakeholder positions on preferred alternatives.

1) Preclude any release of contaminated materials from regulatory control (no option specified but isolate solid waste from general commerce).
2) Continue NRC's case by case process.
3) Promulgate a restricted clearance standard (e.g., landfill disposal).
4) Promulgate a clearance standard.
5) A dialogue cannot be engaged in because the dialogue process is tainted.
6) Delay decision until a process is established for arriving at a consensus and stakeholder views are integrated with NRC decision framework.

c) Themes of public concerns: Citizens groups did participate in the latter two fall 1999 public meetings and the May 2000 Commission meeting. In addition, NRC received over 800 comment letters on the Issues Paper. Three major themes in the stakeholders' comments are noted:

1) There is little support for a clearance standard.

2) There is a legacy of institutional distrust of the NRC by some of its stakeholder groups based on factors that undermine trust including: (a) the BRC and LTR experience noted in Section E.8.1, above; (b) NRC has not fully disclosed risks and uncertainties associated with a clearance standard; (c) NRC is just providing a "regulatory cover" for DOE to recycle its metal; (d) NRC is just focused on economic issues rather than protecting public health; (e) the NRC public process is merely implemented mechanically; and (f) NRC does not know how to implement a rule.

3) Numerous stakeholders are unclear on the meaning or importance of certain technical terms and issues.

d) In summary, the report notes that the current situation is:

1) Many stakeholders distrust the NRC and remain confused about important technical questions.

2) There are misperceptions about intentions on both sides and NRC has not been effective in its risk communication.

3) There is no consensus evident among stakeholders about the alternatives.

4) The NRC must overcome serious levels of distrust generated by its actions during the BRC policy and the LTR efforts before the public participation process associated with the 1999 Issues Paper is likely to succeed.

E.8.3 Risk communication and its role in the rulemaking process: The report discusses the approaches for effective risk communication and notes the following:

a) What effective risk communication is: A report by the National Research Council indicates that risk communication is an interactive process of exchange of information and opinion among individuals and groups.

b) Risk communication as part of Government business: The concept of risk communication is consistent with federal laws on open government which were meant to promote public participation in NRC decision-making, including the Federal Advisory Committee Act, Sunshine Act, Freedom of Information Act, and the Administrative Procedures Act, and NEPA.

c) NRC's successes and failures in risk communication: NRC has successfully engaged in risk communication in limited contexts such as the initial public participation process during development of the LTR, however its inability to follow through on the 1994 consensus is an equally compelling example of poor risk management and communication.

d) Difficulties of risk communication for control of solid materials: Communicating risk and benefits of a clearance standard is challenging because:

1) There are public concerns associated with radiation in general.

2) Prior risk communication problems in the BRC and LTR cases have resulted in a stalemate on clearance issues, as well as increased distrust of the NRC.

3) While NRC's request for stakeholder input on the issues paper should in principle be acceptable as an honest effort to respect and consider all stakeholder views, many stakeholder groups do not view it that way and have expressed concern that NRC did not solicit their views prior to publishing the Issues Paper.

4) Many concerns are not related to technical issues but to issues of process.

5) NRC is aware of "the state of the art" in using risk communication with both the public and decision makers through studies done in 1999; if NRC uses the studies, its efforts will be better informed than past work that employed, but did not follow through with, participatory processes and risk communication.

E.8.4 DOE efforts:

a) Recycling of nickel in Tennessee: DOE proceeded with efforts to recycle nickel and steel in Oak Ridge Tennessee. However, that effort was initiated with no public involvement or process, and subsequent review of this effort revealed several problems with the contractor involved in that work.

b) PEIS: DOE is presently developing a PEIS on recycling of metal from DOE facilities.

c) Links between NRC and DOE: Publicly perceived links between DOE efforts and NRC efforts have further undermined NRC's credibility. Stakeholders suggest that NRC and DOE are collaborating behind the scenes to establish standards allowing clearance.

E.8.5 The importance of trust.

a) Institutional trust is the single most important factor influencing acceptance of controversial government policies.

b) The NRC must be perceived as honestly presenting the level of risk associated with the policy.

c) When the NRC does not address issues consistently or has provided misinformation, stakeholder distrust develops.

d) The more transparent the process, the more likely it is that stakeholders will perceive that NRC has nothing to hide.

e) NRC has lost the trust and confidence of some of its stakeholders and must either work to regain trust or continue to contend with an adversarial relationship.

E.8.6 Examples of successes: Examples of successes in obtaining public trust are cited:

a) EPA: The EPA carried out an effort to publish for review a draft plan for public involvement in 2000.

b) U.S. Army: The U.S. Army carried out an effort to use a dialogue process designed by Keystone to obtain public acceptance of a method for destruction of chemical weapons.

c) U.S. Army Corps of Engineers: The Army Corps of Engineers carried out an effort to use partnering approaches to minimize disputes.

d) NRC use of these examples: NRC should reach out to the contractors that have been involved in the programs run by these other agencies.

E.8.7 Examples of how stakeholder involvement should work

a) Purpose of stakeholder involvement: The purpose is to give stakeholders an opportunity to be heard prior to a decision and to involve them in the framing of problems and solutions.

b) Dispute resolution techniques:

1) Various types of such techniques may be appropriate at steps along the way including unassisted procedures, third party assistance including facilitation, mediation fact finding, nonbinding arbitration, and partnering.

2) Approaches such as facilitation, fact finding, mediation, and nonbinding arbitration allow stakeholders to participate in the evaluation of alternatives, impacts, and proposed decisions; some forms of dispute resolution are designed to require stakeholder approval before a final decision is made.

c) Up-front determinations for stakeholder involvement process: Some determinations must be made before selecting and moving forward with any of the methods or techniques for public participation

1) It is critically important that the agency and stakeholders both believe that they can benefit from the process whether it is a public consensus building process or an alternative dispute resolution approach.

2) Entities must believe that the outcome is more likely to be favorable to them if they participate in the joint process rather than remain outside of the process.

3) If the NRC is legally bound to one option, or if the agency does not believe that stakeholder involvement is important and worthwhile, these methods should not be employed; if parties on either side are not acting in good faith, such methods can do more harm than good.

d) Benefits from using public involvement strategies appropriately

1) The NRC can build legitimacy for a decision.
2) The NRC can gain new information and perspective.
3) The affected public can gain new information and perspectives.
4) All constituents are kept better informed.

E.8.8 NRC's next step: The report provides the following general suggestions on how NRC should proceed:

a) Some prior limited NRC success: The report notes that NRC has had limited success in obtaining meaningful stakeholder involvement.

b) Difficulty of rebuilding public trust: The report states that determining the proper strategy or process for NRC to increase effective public participation and rebuilding trust of stakeholder groups will be difficult .

c) Specific actions for NRC: If NRC truly believes that it is important and worthwhile to involve stakeholders, then:

1) The NRC should assess willingness of stakeholder groups to begin a dialogue to

cover items contained in the Issues Paper, as well as all issues that stakeholders claim to have been omitted.

2) The NRC should address stakeholder views about desirable and feasible mechanisms for obtaining stakeholder input into: (a) how issues should be framed; and (b) how decision processes can be made transparent and open.

3) This assessment should be the first step toward rebuilding the credibility of the NRC and beginning to re-establish trust by stakeholders.

4) It is critical that the dialogue spells out up front what flexibility NRC has in responding to specific stakeholder concerns and where NRC feels it is statutorily precluded from taking action. This will allow stakeholders to know they can have some influence and to determine if this amount of influence on the outcome is sufficient to justify their participation in the process.

5) To increase belief that stakeholders that their input matters, NRC should provide ongoing feedback as to how the agency is using the input from the dialogue groups. This feedback should include when, and how, decisions were affected by input as well as the reasons why certain input did not have an affect.

6) Legitimacy can only be achieved by fostering trust in the NRC's fairness, integrity, and competence; if the process appears biased, many stakeholders will view the process as biased.

d) Contractors: NRC has tended to rely on small and closed circle of contractors for certain services. Although this may simplify procurement of specialized technical services, it fosters negative perceptions by those outside the circle regarding the openness and fairness of the process and competence of the analyses.

E. 8. 9 Findings: Based on the analysis in the chapter, the report made the following findings in Chapter 8.

a) Finding 8.1 - Concerns of stakeholder with radiation and control of solid materials: The NRC involved stakeholders in the processes for the BRC policy and the LTR for decommissioning, as well as in the initial stages of considering standards for release of solid material. Despite these efforts, environmental and consumer advocacy groups remain concerned with radiation effects, and industrial groups continue to be concerned with the potential economic consequences of the clearance of solid material.

b) Finding 8.2 - Problems with past NRC stakeholder efforts: Most of the issues of concern to those stakeholder groups that oppose the NRC's recent efforts to establish a rule for the release of solid material are the same issues expressed by these groups 10 years ago during the effort to establish the BRC policy. The committee's review of the record on the BRC policy, the LTR, and the 1999 issues paper found that stakeholders distrust the NRC and remain confused about important technical questions. There are misperceptions about intentions on both sides, and the NRC has not been effective in its risk communication.

c) Finding 8.3 - Differing stakeholder views and principal concern with recycle: Stakeholder groups differed in their viewpoints on regulating disposition of solid material. Generally, professional societies associated with the nuclear industry supported clearance, industrial groups endorsed restricted use, and environmental groups opposed any type of clearance. However, much of the opposition to a clearance standard was associated with recycling metal into general commerce.

d) Finding 8.4 - Distrust of NRC among some stakeholders: A legacy of distrust of the NRC has developed among most of the environmental stakeholder groups. This distrust results from their experience with the BRC policy, the LTR, and the 1999 Issues Paper on the release of solid material. Reestablishing trust will require concerted and sustained effort the NRC, premised on a belief that stakeholder involvement will be important and worthwhile, as well as a prerequisite for making progress.

E.9 Summary of Chapter 9: Decision-Making Framework

This chapter provides information on a framework for decision-making about alternatives for control of solid material.

E.9.1 General:

a) Need to modify current approach: For the reasons noted in Section E.9.2, below, various stakeholders have argued for modifying or replacing the current approach. Stakeholder proposals for alternatives differ widely from no release, to unrestricted release, to restricted use.

b) Modifying current approach will be controversial: Given different and strongly held views, the development, evaluation, and implementation of a regulatory approach will likely create substantial controversy and will take significant time and effort to develop an acceptable solution.

c) Current approach is safe and adequate in the short term; but a process to revise is needed: The NA report recognizes there are problems with the current approach and that a new approach is needed, however the study committee has not found any evidence that the problems with the current approach cause significant health effects or amount to an immediate crises, and therefore concludes that it is possible for NRC to conduct, with deliberate speed, a thorough analysis and evaluation of several alternatives for control of solid material including a broad-based stakeholder involvement process.

d) Content of this section: This section discusses both a decision-making process (see Section E.9.3, below) and a systematic decision framework (see Section E.9.4).

E.9.2 Problems with current approach: The report notes problems with the current approach:

a) From a regulatory perspective: It has certain issues, including that: (1) it does not handle volume contamination generically, (2) it is not risk based, (3) it may lead to inconsistent determinations from one case to another; (4) the levels in Regulatory Guide 1.86 are dated, (5) the current levels have not kept up with international developments on release

standards; and (6) the levels were not adopted through a rulemaking process.

b) From a NRC resource perspective: It can produce additional workload and cost for NRC (although this burden appears manageable for the foreseeable future).

c) From licensee's perspective: It is unpredictable and costly and creates undesirable operational impacts, and can cause future liabilities if materials released under Regulatory Guide 1.86 are later suspected to have caused harm.

d) From the perspective of environmental groups and some members of the public: It allows unrestricted use of solid material if it passes the surface contamination levels without external review; these groups do not favor dose-based standards as a remedy but rather a no-release approach.

E.9.3 Decision making process: The report discusses that NRC has various process options for making the decision about control of solid materials.

a) NRC regulatory authority: The report notes that, as the regulatory body, NRC holds the statutory decision-making authority.

b) Need for NRC to obtain public trust: Some concerned groups perceive the NRC as non-responsive to public input and some perceive the Commission and its staff as not operating cohesively. Unless confidence and trust in NRC increases, acceptance by the public and Congress of a clearance or restricted use standard is unlikely.

c) NEPA process: One way to proceed is to follow a variation of the NEPA process, including announcement of a proposal; solicitation of public input as to the appropriate range of alternatives and impacts through a scoping process; and subsequent review of environmental analysis with public input.

d) NEPA concept of tiering: This would allow NRC to obtain input on issues of broad scope and later move to NEPA review of increasingly specific options.

e) Lessons to learn from LTR process: The enhanced participatory rulemaking for the LTR was an open NEPA approach and appeared to have achieved consensus until the NRC's process changed following issuance of the proposed rule. NRC might reconsider the LTR experience to evaluate a tiered NEPA approach overall.

f) Involvement of affected groups: NRC decision-making processes can be improved by including a broad range of affected groups and individuals while remaining flexible, open transparent and fair. Administrative appeals processes and administrative guidelines may have to be altered to ensure greater access to NRC's decision making process by a broader range of affected parties.

g) AEA as basis for public involvement: The AEA provides a somewhat less extensive legal basis for public review or citizens suit challenges, however the AEA's legal basis is fully adequate if used properly and, whatever the AEA's shortcomings are, NRC can and must employ appropriate mechanisms to reach out to develop stakeholder participation,

acceptance, and support.

h) Regulation of TENORM: A broad-based scoping process could include consideration of whether NRC should regulate TENORM by some national standard rather than continuing State-only regulation.

i) Public advisory committees: NRC might consider supplementing its decision process with enhanced and expanded use of public advisory committees. Many federal agencies include members of the broader public, not just highly technical experts, on their advisory committees.

j) Use of facilitators: Any process to develop a standard might be enhanced by using professional facilitators.

E.9.4 Alternative approaches: Alternative approaches for control of solid material listed in the report include:

a) Case-by-case approach: This involves NRC approving license conditions in accordance with Regulatory Guide 1.86 or modifications. The report notes that there is little support for minor modifications of the current approach, although it notes that it could be improved by developing additional criteria for volume contamination, possibly based on dose assessment using coefficients similar to those in development in NUREG-1640.

b) Dose-based clearance standard: Unrestricted reuse, including commercial recycling. The report notes that several possible dose limits for use in a dose-based standard have been discussed, including 1 µSv/yr (0.1 mrem/yr), 10 µSv/yr (1 mrem/yr), and 0.1 mSv/yr (10 mrem/yr).

c) Dose based restricted use standard: This alternative would involve beneficial reuse in controlled environments, e.g., shield blocks at DOE facilities. It is noted in the report that placing restrictions on use of the material has the effect of limiting potential exposure scenarios.

d) Dose based restricted use standard: This approach could involve, for example, landfill disposal and/or commercial reuses for low exposure scenarios, e.g., concrete rubble base for roads. As above, placing restrictions on use of the material limits potential exposure scenarios. It is noted that, because the critical group under this alternative might be less restrictive than for clearance, it would be possible to release solid materials with higher concentrations under a restricted use standard than a clearance standard.

e) No release: All solid material is disposed of at a LLW site.

E.9.4 Impacts and issues to consider in deciding on an alternative: The report discussed some impacts and issues to consider in deciding on an alternative. These include the following:

a) Health impacts and environmental impacts: The primary objective of any alternative for control of solid material is that there are minimal health and environmental impacts for any individual and the public at large. The report notes that:

1) Part of this analysis must be an evaluation of impacts from multiple sources and collective doses.

2) There is a need to consider indirect and unintended impacts of alternatives, including transportation impacts of shipping materials (including routine transportation accident risks), transport to landfills, etc.

b) Direct and indirect costs: It is important that NRC conduct a thorough cost analysis that accounts for:

1) The direct costs of disposal of solid material among the different alternatives, including whether the material goes to LLW site or to a landfill or into recycle. This should include a thorough cost analysis that accounts for differences in disposal options and the uncertainties in costs estimates caused by regulations and by supply and demand.

2) Transport costs and operational costs (material preparation and sample analyses). These other costs would be much lower than disposal costs.

3) Indirect costs of alternatives which include the potential liabilities of licensees and other waste handlers, as well as concerns from metals and concrete industries that they will suffer economic hardship because consumers would not want to buy their products because of concerns that they may contain radioactive material in them.

c) Direct benefits: The report noted that there will be some opportunity for direct benefit, for example sale of material as scrap.

d) Consistency with existing regulations: The report noted that consistency with other regulations and standards is desirable, though it is not the main reason for selecting an alternative. The following are noted:

1) There should be consistency with international, national, State, and local regulations.

2) There may be an economic advantage to the U.S. in establishing a clearance standard consistent with international standards which would make import-export and control of materials easier and, if monitored properly, of no consequence to public health.

3) Consistency with other Federal regulations is also important, in particular the approach to regulation preparation taken by EPA.

4) Also consistency with the regulation of other radioactive materials, in particular TENORM, is important.

e) Implementation, enforcement, and reporting: The report notes that to be effective and to establish confidence in any approach to control solid material, the approach must be

implementable and enforceable, and that there must be a capability to detect, measure, and monitor very small amounts of radiation with few false alarms. There should also be reporting requirements.

f) Public perception: The NRC faces perhaps no greater challenge than winning widespread public acceptance of any regulation for control of solid material. It is noted that acceptance does not equate directly with consensus of unanimous agreement. The likelihood of public acceptance is increased by: (1) adhering faithfully to an announced process that engages all responsible stakeholder representatives and views; (2) being perceived as fair and open; (3) bringing out pros and cons of all alternatives in an even handed way; (4) participation throughout by informed and knowledgeable persons, and openness to a broad and creative range of alternatives.

g) Decision impact matrix: The report provides a suggested table (Figure 9-1) of how the impacts and issues discussed above should be considered in relation to the various alternatives under consideration.

E. 9. 5 Findings: Based on the analysis in the chapter, the report made the following findings in Chapter 9:

a) Finding 9.1 - Current approach does not have immediate problems; sufficient time to develop revised approach: The committee found no evidence that the problems with the current approach to clearance decisions require its immediate replacement. The committee concludes that there is sufficient time to conduct a thorough and systematic analysis and evaluation, including a sound process of stakeholder participation and involvement, of alternative approaches to the disposal of solid material.

b) Finding 9.2 - Alternatives: Although there are many possible alternatives for the disposal of solid material from NRC-licensed facilities, the committee heard substantial support from stakeholders for only a few. In general terms, the supported alternatives are a dose-based clearance standard, a dose-based restricted use standard and a no-release policy. Different stakeholders expressed preferences for different conditions for a dose-based restricted use standard: beneficial reuse in controlled environments, commercial reuse in low-exposure scenarios, or landfill disposal. Source-based standards and minor modifications of the existing case-by-case approach received limited support.

c) Finding 9.3 - Analysis of impacts and benefits: There are many possible impacts of the approaches that the NRC might select for the clearance of solid material. Potentially important impacts include the degree of public protection against exposure from radioactive materials, environmental impacts, direct costs (e.g., for disposal), indirect costs (e.g., through product stigmatization), consistency with existing regulations, implementation and enforcement, and public perception. To date, the NRC has focused its analyses of alternative approaches fairly narrowly on protecting the public from exposure to solid material. The NRC has done very little analysis of the other important impacts on this list.

Attachment 3

Status of Technical Basis Development

A. INTRODUCTION

In a Staff Requirements Memorandum (SRM) dated August 18, 2000, the Commission decided to defer a final decision on whether to proceed with rulemaking on control of solid materials. In that SRM, the Commission directed the staff to proceed with a National Academies (NA) study on possible alternatives for control of solid materials and to also continue development of a technical information base necessary to support a Commission policy decision in this area.

The intent of the NRC's effort to develop a technical basis in this area is to be able to provide a complete analysis of a broad range of alternatives for control of solid material. As discussed in the Issues Paper (64 FR 35090, June 30 1999), principal factors included for analysis could include human health and environmental impacts, cost-benefit considerations, impacts on other industries, and the capability to survey the material for the various alternatives. To support this effort, technical information being developed in accordance with the SRM includes individual dose assessments, inventories of solid material potentially available for release, potential collective doses, the potential for exposure to multiple sources that could occur as a result of any releases, and costs associated with handling of these materials. It is also useful to have information on methods that could be used for performing radiation surveys of solid material available for release. The types of solid materials which are being analyzed as part of this effort are metals, concrete, soil, and other materials found at nuclear facilities, including rubbles and sediments, lead, glass, paper, wood, plastic, and ordinary trash.

Descriptions of the technical basis work are divided into four sections, each with the following format: (1) approach for technical information development; (2) work to date; and (3) future work plans.

B. ASSESSMENT OF INDIVIDUAL DOSES

1. Approach for Technical Information Development

As noted in the Issues Paper, a first step in the assessment of alternatives is to develop the capability to estimate the hypothetical dose an individual might receive as a result of the alternatives. To accomplish this first step, a report, "Radiological Assessments for Clearance of Equipment and Materials from Nuclear Facilities," Draft NUREG-1640, was published for public comment in March 1999. This report is only one piece of the overall technical bases described in Section A, above, and is limited in scope to assessing individual dose assessments resulting from possible recycle or reuse of material.

NUREG-1640 specifically assessed the scenarios, models, calculation methods, and results of such analyses for individuals over a broad range of scenarios for a control alternative in which materials would be permitted to be released at some to-be-established dose criteria. This was

determined to be an appropriate first step in NRC's effort because analysis of the "unrestricted release" alternative is likely to be a limiting case for dose analyses. Other alternatives were also suggested for study in the Issues Paper, including restricted release or prohibition of release, but are not explicitly addressed in NUREG-1640. It is intended that a broad range alternatives will be fully analyzed (see Section D below), however the analyses conducted in NUREG-1640 to date is useful for this broad range of alternatives based on the following:

1) With restricted release for some authorized use there is the potential that the "authorized" use may not be fully implemented and that unanticipated exposures could exceed the dose criterion for that release. For example, metal intended for an authorized use might be diverted to a more general use or could prematurely enter the general commerce pool of scrap metal, if the authorized use ended earlier than expected. The assurance that the material remains in its authorized use depends on the controls in place for the authorized use. Thus, the analyses contained in NUREG-1640 provides a bounding analysis which can be useful for restricted use scenarios.

2) The critical group (i.e., limiting scenario) for "restricted" use may be similar or identical to that for unrestricted use (as analyzed in NUREG-1640).

3) Another alternative, referred to in the Issues Paper as prohibition, would not permit release of materials from areas in a facility where radioactive materials are used or stored. Such an alternative would result in such material being directed to licensed disposal and the opportunity for exposures to recycled or reused material being minimal. Thus, detailed analysis of such scenarios for recycle or reuse, as done in NUREG-1640, is not needed for this alternative. Analysis of other impacts resulting from this alternative would be done as part of the overall evaluation of technical bases described in Section D below.

The scenarios analyzed in NUREG-1640 were designed to cover the probable fates of iron and steel, copper, aluminum, concrete and equipment for reuse if cleared to enter the general stream of U.S. commerce from a nuclear facility, and also to identify the group of individuals reasonably likely to receive the highest dose, i.e., the critical group. NUREG-1640 did not address certain materials available for release, such as wood, paper, glass, trash, soil, or other equipment and furniture, although analysis of these materials is being developed (see Section B.3, below).

2. Work to Date

Following publication of NUREG-1640 for public comment, there were a number of public comments provided to the Commission on NUREG-1640 at both the fall 1999 public meetings on the Issues Paper and in comment submittal specifically on NUREG-1640. There were a number of comments made on the technical content of NUREG-1640, including those related to modeling of materials in the steel melting process. There were also comments expressing overall concern with the validity of the report due to a potential conflict of interest by NRC's contractor; these commenters noted that the draft NUREG should be withdrawn.

In June 2000, a contract was awarded to the Center for Nuclear Waste Regulatory Analyses (CNWRA) to conduct an independent technical review of NUREG-1640. The CNWRA review of NUREG-1640, provided to the NRC in November 2000, found that NUREG-1640 was of high-

quality, but also provided suggestions for future work, including the addition of three exposure scenarios.

In July 2001, following a competitive procurement process, a contract was awarded to SC&A to address public comments and the independent CNWRA review, and to prepare a final version of NUREG-1640.

The work done to finalize NUREG-1640 has included an evaluation of several additional scenarios and subscenarios, in response to public and independent review comments, and the inclusion of dose factors for several additional radionuclides. This work has also involved reassessment of parameters and parameter distributions, as an integral part of responding to all comments. Where changes to the parameter or further explanation of their rationale are needed, they are planned for inclusion in the final version of NUREG-1640.

It is planned that a draft version of the revised NUREG-1640 will be provided for a peer review process by October 2002. Based on that review, a revised NUREG-1640 would be published in December 2002.

As part of its contract to consider possible alternatives for control of solid material, the NA reviewed NUREG-1640 along with other technical documents. The NA report noted that NUREG-1640 is considered state of the art in its risk assessment methodology and provides an in-depth analysis of recycling of steel, copper, aluminum and concrete with either volumetric or surficial contamination. The chemistry, metallurgy, geology, and physics appear sound technically and the conceptual plan of NUREG-1640 was found to be the best of all studies reviewed. A formal uncertainty analysis is incorporated into NUREG-1640, unlike the other studies. In response to a previous conflict of interest question, the NA committee noted that, from a scientific perspective, it does not believe it is cost-effective to repeat the work done in NUREG-1640. The mathematics and completeness of scenarios considered in NUREG-1640 have been verified through an audit carried out by another NRC contractor and the NA committee also carried out its own review that generally confirmed the reasonableness of several dose factor analyses. However, the NA did also note that a thorough review of the choice of parameters and parameter ranges, term by term, is needed to complete the reassessment of NUREG-1640. The NA report also noted that NUREG-1640 did not consider human error and its possible effect on dose factor predictions, nor did it consider scenarios involving multiple exposure pathways nor provide sufficient basis to analyze restricted use options. In considering these findings, the staff notes that it is involved in review and revision of various parameters and scenarios, but that several components of the technical basis indicated by the NA for inclusion in NUREG-1640 (e.g., multiple exposures) are actually broader in scope than NUREG-1640 and are being done as part of separate efforts (see Section D).

3. Future Work Plans

Further work to revise NUREG-1640 for metals and concrete, beyond that noted above, is not anticipated at this time. The individual dose conversion factors will be used in the work described in Section D below to develop additional dose and cost analyses.

Currently, individual dose factors are being developed for materials that could be available for release as part of routine operations at the variety of facilities NRC licenses, including hospitals, clinics, research, medical, and industrial laboratories, power plants, research reactors, and fuel facilities. Such materials include rubbles and sediments, lead, glass, paper, wood , plastic, and ordinary trash (a composite category of routine disposals for landfill). The dose conversion factors for these other materials is planned for inclusion as a Supplement 1 to NUREG-1640, anticipated for issuance in mid-2003.

C. ASSESSMENT OF INDIVIDUAL DOSES FOR SOILS

1. Approach for Technical Information Development

Section B describes the staff's analyses in NUREG-1640 of the hypothetical dose an individual might receive as a result of possible recycle or reuse of material. NUREG-1640 was limited in its analyses to metals and concrete. To provide similar information for decision-making for soil, the staff is developing a technical bases for estimating potential exposures if soil is cleared from NRC-licensed facilities. Like NUREG-1640, this is seen as a first step in evaluation of various alternatives for controlling release of this material. Section D below discusses analyses planned for assessment of all alternatives.

The first part of this effort included developing information on the ways in which soils are transported and/or reused in commerce (e.g., landscaping) or by the general public (e.g., rural residential gardening) in the U.S. This information is an integral part of the technical basis for assessing possible exposures that could result if soil is released from NRC-licensed facilities. Specifically, this information can be used in characterizing scenarios, estimating parameters, and selecting models for soils reuse for dose assessment. The second part of this effort was to conduct an analysis, similar to that in NUREG-1640, of scenarios, parameters, and resultant dose factors. This was broken into two steps: a preliminary dose assessment and a more detailed analysis of soil reuse.

2. Work to Date

As noted above, to aid in development of scenarios, parameters, and assumptions, and as the bases for specific parameters and their distributions, the NRC staff conducted an information search in cooperation with the U.S. Department of Agriculture's National Agricultural Library. In July 2000, draft NUREG-1725, "Human Interaction With Reused Soil: A Literature Search," documenting the initial search of available information sources and data and the process used to obtain this information, was issued for public comment. In January 2001, a focused search for additional information from internet, university, professional organization, and foreign sources was initiated. A final version of NUREG-1725 was issued in January 2002, which expanded the initial literature search and addressed public comments on draft NUREG-1725.

In February 2001, NRC began a preliminary dose assessment intended to provide a bounding analysis based on reasonable scenarios and parameters. Four scenarios were included in the preliminary assessment: (1) farm/field worker; (2) truck operator; (3) recreational user; and (4) rural resident baseline scenario for comparison purposes with technical support analysis done for the 1997 rulemaking on license termination. These scenarios were characterized, and

information for estimating parameter distributions was identified. The dose modeling was coordinated with similar dose modeling efforts for sewage sludge being conducted by the Interagency Steering Committee on Radiation Standards (ISCORS); and for metals and concrete in Draft NUREG-1640 to utilize established technical bases and common scenarios. This preliminary dose assessment, which was completed in January 2002, provided estimates of individual dose factors for soil reuse for the four scenarios. Based on the results of the preliminary analysis, a more detailed dose assessment was begun. One additional scenario was developed, additional coordination with the ISCORS subcommittee on sewage sludge was conducted, and parameters and calculation techniques were refined.

3. Future Work Plans

As part of the more detailed analysis of soils, additional soil reuse subscenarios are being characterized, and the initial scenarios and parameters are being refined. This assessment is planned for completion as a draft report for issuance for public comment in October 2002.

Further analysis regarding collective doses, the potential for exposure to multiple sources, and costs associated with alternatives for handling this material will be developed as part of the effort in Section D.

D. OVERALL ANALYSES OF ALTERNATIVES

1. Approach for Technical Information Development

As discussed in the Issues Paper, among the principal factors in making decisions regarding alternatives for control of solid material are human health and environmental impacts, cost-benefit considerations, impacts on other industries, resource conservation, and the capability to survey material. The Issues Paper also noted that, in assessing and making decisions on various potential alternatives, NRC would consider a broad range of possible impacts, both radiological and non-radiological, including evaluation of doses to indivdiuals, assessment of collective doses to different population groups, impacts on biota, societal impacts, possible impacts on other industries, etc. Some of these impacts may be competing in that reduction in one impact could increase another impact. In addition, Executive Order 12291 requires Federal agencies, as part their decision-making, to consider cost-benefit evaluations of alternative courses of action, including costs to licensees, the public, and other affected industries.

This staff effort is intended to provide a technical base for decision-making in the areas noted above. Information developed as part of an overall evaluation of various alternatives would include information on inventories of material potentially available for release, doses to individuals and doses to collective populations if that material were released, doses to an individual based on exposure to multiple items, and costs associated with various alternatives. As described in Sections B and C of this attachment, one part of this information base, i.e., the analyses of doses to an individual based on exposure to a single item, has been completed in draft form in NUREG-1640. The additional analyses noted here are ongoing as part of this effort.

2. Work to Date

Inventory estimates are being developed for materials that could be available for release as part of routine operations at the variety of facilities NRC licenses, including hospitals, clinics, research, medical, and industrial laboratories, power plants, research reactors, and fuel facilities as well as at U.S. Department of Energy (DOE) and U.S. Department of Defense (DOD) facilities, and facilities that handle technologically enhanced naturally occurring radioactive materials. This includes four categories of materials analyzed in NUREG-1640, ferrous metals, aluminum and its alloys, copper and its alloys and concrete. It also includes rubbles and sediments, lead, glass, paper, wood, plastic, and ordinary trash.

3. Future Work Plans

Information on the inventory of materials at NRC-licensed facilities, which are potentially available for release, is planned for publication as a draft NUREG in September 2002.

An analysis of potential exposures of an individual to multiple sources made from recycled materials from licensed facilities is planned for publication as a draft NUREG in December 2002.

Collective doses to the population which could result from any of the alternatives for control of the various materials, discussed above, are being developed based on the individual doses discussed in Section B. It is anticipated that the collective dose analyses would be published in mid-2003.

Cost information for the alternatives and materials being considered would be developed based on material inventory and dose assessments.

E. SURVEY METHODS

1. Approach for Technical Information Development

As part of decision-making on alternatives for control of solid materials, it is useful to have information on methods that could be used for performing radiation surveys to control solid material. The extent of the radiation survey of solid materials at nuclear facilities is dependent on the various alternatives under consideration but the objective in each case is the same, i.e., to assure protection of public health and safety by assuring that criteria are being met.

During the 1990's, there was an interagency effort to improve the planning, conducting, evaluating, and documenting of radiological surveys of building surfaces and surface soil. This effort included the preparation of NUREG-1505, “A Nonparametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys,” and NUREG-1507, “Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions” by the NRC and culminated with the issuance of Multi-Agency Radiation Survey and Site Survey Manual (MARSSIM) (published by NRC as NUREG-1575) which was a joint effort by NRC, DOD, DOE, and the U.S. Environmental Protection Agency (EPA). MARSSIM is a consistent approach for planning, performing, and assessing the ability of surveys to meet standards while at the same time encouraging effective use of resources. MARSSIM provides

guidance on developing appropriate survey designs using the Data Quality Objectives (DQO) process to ensure that survey results are of sufficient quality and quantity to support a final decision.

The staff's current effort in this area is developing technical information on survey approaches for a range of possible alternatives for control of solid material. It provides information on surveys associated with alternatives where material would not be released, as well as surveys for a range of nuclide concentrations for alternatives where material would be released.

Work being done as part of this effort assesses how the DQO process would need to be extended to the design and implementation of surveys if solid materials were released from licensed facilities. This information is important to assure that, for any of the alternatives where material could be released, material being released meets the standard that is set. In addition, it addresses the need for increased survey complexity to allow for the ability to distinguish actual material levels from background.

The alternative of not permitting material to be released if it is located in an area where radioactive materials are used or stored, referred to in the Issues Paper as prohibition, would rely principally on process knowledge of where the material had originated because it would use that information as a basis for determining disposition of the material. Information on process knowledge is developed as part of this effort. This alternative would not be as dependent upon detailed methods for radiological surveys and thus much of the information developed as part of this effort would not be applicable to this alternative. The alternatives of continuing current practice or permitting release using dose-based criteria rely upon process knowledge of where the solid materials originate in the facility, as well as comprehensive radiological surveys to demonstrate that the level of radioactivity on the material would meet the required criteria. Information on various survey methodologies are being developed to ensure that criteria for control of solid material could be reliably met. The alternative of restricted use may use process knowledge to determine those materials that would be limited to authorized uses but may be similar to unrestricted use in the need for comprehensive surveys.

An program, Spatial Analysis and Decision Assistance (SADA), was developed by DOE and EPA to implement MARSSIM concepts in November 1999. SADA provides a number of integrated tools in geospatial modeling, spatial analysis, visualization, statistical analysis and sampling design.

2. Work to Date

Coordinated efforts are continuing on clearance survey procedures using common off-the-shelf instrumentation and on advanced instrumentation and analytical approaches for the assay of residual radioactivity in, and on, solid materials. Information from these efforts is planned for inclusion in a draft NUREG entitled, "Radiological Surveys for Controlling Release of Solid Materials," in July 2002.

To support the overall analysis of alternatives discussed in Section D, in particular with regard to cost-benefit analyses, a draft NUREG entitled, "Clearance Survey Costs" for various alternatives under consideration is being prepared.

A proof-of-concept test to determine the feasibility of using a statistical methodology to evaluate subsurface concentrations was conducted. The results indicated that it is feasible and NRC plans to develop detailed methodologies.

3. Future Work Plans

As noted above, the staff has worked previously with other Federal agencies to develop the MARSSIM. MARSSIM was developed to deal with issues associated with making radiological measurements at low levels, but was limited to surface contamination in buildings and land areas. MARSSIM currently does not address subsurface contamination measurements or volumetric contamination in soils, materials and equipment. NRC staff is considering a plan to work with other Federal agencies to revise MARSSIM to address these limitations. In addition, NRC has initiated the development of optimized statistical methodologies to evaluate subsurface concentrations in soil based on the successful feasibility test. The methodology will add components to previously developed components of SADA. These efforts can provide useful information independent of the alternative for control of solid material chosen.

Attachment 4

Review of International and Domestic Activities
Related to Decision-making on Control of Solid Materials

A. PURPOSE

The purpose of this attachment is to provide information on activities being conducted by international agencies, U.S. Federal and State agencies, and other organizations for consideration in NRC's decision-making process on the control of solid materials.

B. INTRODUCTION

On August 18, 2000, the Commission directed the staff to stay informed of international initiatives in the area of clearance and on related U.S. Environmental Protection Agency (EPA), Department of State (DOS), and Department of Energy (DOE) activities.

Both international and domestic (including other Federal and State agencies) initiatives include technical and policy issues that have played, and will continue to play, an important role in decision-making process on the control of solid material. Sections C and D discuss international and domestic initiatives in this area, respectively, and Section E specifically discusses the relationship of these activities to NRC efforts.

C. INTERNATIONAL INITIATIVES

Individual countries have developed national guidance for the release of solid material with small amounts of radioactivity, including Belgium, Finland, France, Germany, Japan, Sweden, Taiwan, and the United Kingdom. The activities of two major international radiation protection organizations, the Commission of European Communities (EC) and the International Atomic Energy Agency (IAEA), are attempting to harmonize international clearance standards and implementing guidance. Both organizations have developed standards containing clearance levels for individual radionuclides, which share three conceptual bases: (1) the term "clearance" means the total cessation of radiological control; (2) annual doses on the order of 10 μSv (1 mrem) for a practice is considered a trivial dose; and (3) a committed dose equivalent of 1 man-Sv (100 man-rem) per year of practice or less requires no further analysis for optimization. Although these harmonization efforts have focused on clearance, both organizations also provide for "authorized releases" of solid materials on a case-by-case basis.

C.1 Status of IAEA Efforts to Develop and Implement Clearance Levels

The IAEA established the concept of clearance based on "established trivial doses and risks" described in IAEA's "Principles for the Exemption of Radiation Sources and Practices from Regulatory Control" (Safety Series No. 89, 1988). This document, which was also sponsored by the Nuclear Energy Agency (NEA) of the Organisation for Economic Cooperation and Development (OECD), is based on the principles that (1) individual risk must be sufficiently low as not to warrant regulatory concern and (2) radiation protection,

including the cost of regulatory control, must be optimized.
The term “trivial” is used by the IAEA and the EC to describe an individual effective dose equivalent in the range of 10 to 100 µSv/yr (1 to 10 mrem/yr). In IAEA’s Safety Series No. 89, a level of risk or dose is “trivial” based on (1) the risk and corresponding dose is considered of no significance to individuals (annual risk of death of 10^{-5} to 10^{-6}) and (2) a reference level of dose from natural background radiation (a few percent of natural background, or 20 to 100 µSv/yr (2 to 10 mrem/yr).

Similarly, the National Council on Radiation Protection and Measurements (NCRP) refers to these levels as a "negligible individual dose" in its report, “Limitation of Exposure to Ionizing Radiation” (NCRP-116, 1993). The International Commission on Radiological Protection (ICRP) does not explicitly quantify trivial risk or doses. Rather, ICRP’s “Recommendations of the International Commission on Radiological Protection (ICRP-60, 1990) notes that “the basis for exemption on the grounds of trivial dose is much sought after, but very difficult to establish.” However, the ICRP recommends that in exemption of scenarios and event sequences, the grounds for exemption are that the source gives rise to small individual doses (of the order of 10 µSv (1 mrem) per year) and the protection is optimized; i.e., regulatory provisions will produce little or no improvement in dose protection.” This is reiterated in ICRP’s “Protection from Potential Exposure: A Conceptual Framework” (ICRP-64, 1993), which further explains that optimization is achieved by demonstrating that the collective dose is small; e.g., on the order of 1 man-Sv (100 person-rem) per year.

Following the publication of Safety Series No. 89, the IAEA prepared a Safety Practice document, entitled “Application of Exemption Principles to the Recycle and Reuse of Materials from Nuclear Facilities” (Safety Series 111-P-1.1, 1992). At the time of publication, the scope of the document included “clearance” or unconditional release of materials and equipment, as well as controlled reuse. The document provides dose to source ratios in terms of annual committed effective dose equivalent per either Bq/g (pCi/gm) or Bq/cm^2 (pCi/cm^2). The intent of the document was to provide implementation guidelines to evaluate compliance with the safety guidance in Safety Series No. 89. The recycle materials were limited to steel, aluminum and concrete, but dose to source ratios were also provided for various tools and equipment. The NEA and the EC participated in the preparation of this document. A number of subsequent analyses utilized the calculations from this document in evaluating various materials and scenarios involving reuse and recycle of metals, concrete, slags, tools, equipment and structures. It should be noted that a Safety Practice is a lower level document than a Safety Guide (e.g., Safety Series No. 89), which is, in turn, a lower level document than a Safety Requirement (e.g., “International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources,” Safety Series No. 115, 1996).

Since 1993, NRC and EPA staff have participated with IAEA Member States on the development of the assumptions and parameters used to derive the IAEA's clearance levels. In 1996, the IAEA published an interim report, “Clearance Levels for Radionuclides in Solid Materials, Application of Exemption Principles, Interim Report for Comment ” (TECDOC-855) that related a 10 µSv/yr (1 mrem/yr) level to concentrations of radioactivity distributed on surfaces and throughout volumes of selected materials and radionuclides.

This document provided a compendium of action levels based on the available relevant sources at that time, including NRC's "Residual Radioactive Contamination from Decommissioning*" (*NUREG/CR-5512, 1992) and IAEA's Safety Series 111-P-1.1. Since publication of TECDOC-855, the IAEA has held a series of Technical Consultants meetings to further develop the technical bases contained in the report. This work has included the development of clearance values for solid materials and the role of exclusion and exemption as they pertain to commodities. In the past two years, the IAEA has included in its clearance efforts the development of a Draft Safety Guide and associated supporting technical documents on specification of radionuclide content in commodities requiring regulation for purposes of radiological protection. Draft Safety Guide DS-161, "Specification of Radionuclide Content in Commodities Requiring Regulation for Purposes of Radiological Protection," (DS-161) is being developed with participation of the European Commission, Pan American Health Organization (PAHO), International Labor Organization (ILO), World Health Organization (WHO), and Food and Agricultural Organization (FAO), and representatives from IAEA Member States.

Included in the criteria for commodities in the current version of DS-161 is a dose criterion of 10 µSv/yr (1 mrem/yr) for artificial radionuclides, which could be used to establish clearance values for solid materials. The technical approach for establishing clearance values for natural radionuclides differs from the approach used for artificial radionuclides, as the former are based on a worldwide distribution of natural radioactivity, which results in "scope-defining levels" ranging from 0.5 to 5 Bq per gram (14 to 135 pCi per gram). The IAEA provided tables of scope defining levels for both artificial and natural radionuclides. A value of 1 Bq per gram (27 pCi per gram) had been suggested previously by the IAEA. This value is considered relatively high by some representatives of international regulatory authorities.

Currently, there are concerns about the parameters, modeling, scenarios, and the overall scope of the document. U.S. Federal agencies participating in this activity recommend the continuation of the coordination process to better align the fundamental approaches being pursued by the IAEA, the EC, and other stakeholders, such as the NEA, WHO, FAO, and ILO. The IAEA is working with the FAO and WHO to revisit technical and policy issues associated with other commodities such as foodstuffs and drinking water. This effort should begin in 2003 and may take more than one year to complete. DS-161 has been transmitted to Member States for comment, review and approval by September 15, 2002.

C.2 Status of EC Efforts to Develop and Implement Clearance Levels

Recommendations of the EC are followed by nations that are members of the European Union, which has promulgated Council Directive 96/29/EURATOM (May 13, 1996) which lays down basic safety standards for the protection of the health workers and of the general public against the dangers arising from ionizing radiation. It can be confusing that the EC refers to this directive also as the "Basic Safety Standards (BSS)." The scope of the EC/BSS is defined in terms of "practices" which involve a risk from ionizing radiation emanating from an artificial source or from a natural radiation source in cases where natural radionuclides are or have been processed in view of their radioactive, fissile or fertile properties. The EC's standards also require justification of the use of radioactivity.

In cases where certain practices result in radiological risks to individuals which are sufficiently low as to be of no regulatory concern, then the subject practice can be *exempt* from the EC/BSS system of reporting and prior authorization.

Once a practice has been placed in the regulatory system, the activities and movement of materials are controlled, but these materials can be released using a case-by-case procedure under the responsibility of the competent national authorities. The removal from regulatory control of a material that has radionuclide levels below the recommended limits is defined as clearance. Materials that are cleared are then considered exempt from the EC/BSS requirements of reporting and authorization. This Directive required Member States to bring into force the laws, regulations and administrative provisions necessary to comply with this Directive before May 13, 2000.

Recently, the EC has been developing implementing recommendations that translate the applicable clearance dose criteria to radionuclide concentrations. The first EC publication of this type is “Recommended Radiological Protection Criteria for the Recycling of Metals from the Dismantling of Nuclear Installations, (Radiation Protection 89, 1998), which provides clearance levels for recycling of metals from dismantled nuclear installations. The basis for the recommendations is the radiological protection criteria contained in IAEA Safety Series No. 89 by adopting for a given practice an individual dose criterion of 10 µSv/yr (1 mrem/yr) and a collective dose criterion of 1 man-Sv/yr (100 man-rem/yr) with a skin dose limit of 50 mSv/yr (5 rem/yr). The clearance levels for radioactivity in recycled and directly reused metal were derived by constructing and analyzing a set of hypothetical exposure scenarios and then selecting the most critical scenario. The technical basis for the calculation of mass specific clearance levels published in Radiation Protection 89 is documented in the EC report entitled ”Methodology and Models used to Calculate Individual and Collective Doses from the Recycling of Metals from the Dismantling of Nuclear Installations” (Radiation Protection 117, 2000).

Two related EC publications, “Recommended Radiological Protection Criteria for the Clearance of Buildings and Building Rubble Arising from the Dismantling of Nuclear Installations“ (Radiation Protection 113, 2000), and “Definition of Clearance Levels for the Release of Radioactively Contaminated buildings and Building Rubble (Radiation Protection 114, 1999), provides clearance levels for the release of buildings and building rubble, which are based on IAEA Safety Series radiological protection criteria. Another EC document is “Practical Use of the Concepts of Clearance and Exemption Part I” (Radiation Protection 122, 2000), which provides general clearance levels that are applicable to all materials and are usually more restrictive than the specific clearance levels also provided in the document. The underlying assumption is that the destination of the material is not defined in the case of general clearance. Part II of this document addresses general clearance and exemption levels for work activities involving materials arising from industries which mine or process ores or other materials for which the presence of naturally occurring radionuclides are of concern. These levels refer to NORM materials, which are addressed in Title VII of the EC/BSS.

Table 1 of this attachment provides the status of a number of nations in implementing clearance standards, including the status of several European Union (EU) member nations

in implementing the Directive.

C.3 United Nations Economic Commission for Europe

In May 1999, the United Nations Economic Commission for Europe (UN/ECE) organized a seminar on "Radioactive Contaminated Metal Scrap" to develop and maintain a partnership between government authorities, the metal scrap recycling and steel industries, and competent authorities in the field of atomic energy. A recommendation of the seminar was the establishment, under the auspices of the UN/ECE, of a Team of Specialists on Radioactive Contaminated Metal Scrap that would serve to harmonize the legislation, the levels of investigation concerning radioactivity content of metal scrap, the system of measurement, and possibly develop codes of practice/conduct in this area.

The Team of Specialists produced a document entitled, "Report for the Improvement of the Management of Radiation Protection Aspects in the Recycling of Metallurgical Scrap," which was co-sponsored by the IAEA and EC. The fifth draft of the report (March 2001) contains the following recommendations for managing materials that have been properly released from the nuclear industry: (1) the regulatory framework associated with the clearance of material should include provisions for prior notification to the receivers of the material that of the origin of the material and the regulatory framework under which it was released; (2) this information should be conveyed with the released material to the successive suppliers and buyers of the scrap metal, as part of contractual provisions; and (3) cleared material with radioactivity other than natural background should be identified and kept separate from the normal scrap recycling circuit so as not to enter unrestricted metal products. These recommendations are also applicable to extraction industries where naturally occurring radioactive materials may concentrate and for activities involving the use of radioactive sources for medical, industrial and research purposes.

D. DOMESTIC INITIATIVES

There are several Federal and State agencies, and other organizations, involved in activities related to control of solid materials. Some of these activities do not directly involve potential standards-setting for solid materials with low amounts of, or no, radioactivity, for example those that involve orphan sources or radiation monitoring efforts to detect radioactivity in solid materials entering U.S. borders. Nevertheless, it is important to be aware of the range of related activities and how they can be factors that need to be considered by NRC in its decision-making on the control of solid materials.

D.1 EPA

D.1.1 Activities related to Development of a Standard on Control of Solid Material

EPA has responsibility for setting generally applicable environmental standards under the Atomic Energy Act, but is not pursuing a rulemaking in this area at this time. Instead, currently EPA is focusing on orphan source issues and on the interception of imports with

sufficient radioactive content to warrant regulatory control (see Section D.1.2).

Although EPA has suspended development of a domestic standard for clearance, it has continued to develop dose factors for translating radioactivity in cleared metal to the dose a person would receive. This is a continuation of the collaborative work between NRC and EPA staff in developing technical information bases on scenarios and pathways related to potential exposures. The EPA staff and its contractor presented technical information to the NA, including a summary of EPA's ongoing technical basis work on scenarios, pathways, and parameters and comparisons of domestic and international clearance studies. The summary focused on the EPA 1997 analysis contained in the Technical Support Document on the Evaluation of the Potential for Recycling of Scrap Metals from Nuclear Facilities and more recent EPA efforts to add analyses of copper and aluminum to the existing analysis of carbon steel. EPA has completed its analysis and the revised Technical Support Document is posted on EPA's Clean Materials Program website.

D.1.2 EPA Activities Related to Monitoring of Imported Scrap Metal

As noted above, EPA has been focusing its activities on review of potential imports of solid materials containing radioactivity. Such imports can be either orphan sources or the result of materials containing small amounts of radioactivity cleared from other countries.

With regard to this effort, EPA, at the request of the U.S. Customs Service, initiated a pilot study in August 2001, at the Cooper/T. Smith Stevedoring Company port in Darrow, Louisiana to collect data on the frequency with which radioactively contaminated scrap metal is imported into the United States. EPA installed radiation detection systems in grapples used by cranes to provide for continuous radiation monitoring of ships offloading either scrap ferrous metal or stainless steel. A goal of this study was to investigate the need for, and feasibility of, safeguarding against illicit or inadvertent inclusion of radioactive contamination in imported scrap metals. Inclusion of radioactive materials with scrap metal can have major economic consequences, as well as health risks for workers and the public. EPA planned to complete the study by December 15, 2001, and report its findings to the U.S. Customs Service. However, an abrupt decline in scrap steel imports through the Port of New Orleans in 2001 and early 2002 severely limited opportunities for data collection. As of May 2002, four shipments (two barges and two vessels) of scrap steel totaling 74,000 tons were monitored and there were no detections of contaminated steel or sources by the grapple monitors in any of these shipments. In May 2002, the EPA submitted a report with the study results for the U.S. Customs Service to provide to Congress. The current plan is to continue monitoring efforts at this port for an indefinite period of time. The EPA is considering expansion of this type of monitoring at other U.S. ports, subject to the availability of funds.

Independent of the EPA effort, a similar scrap steel monitoring program began operating in 2001 at the Port of Moorehead City, North Carolina. The Port of Moorehead City purchased and installed a radiation detection system in cranes that unload scrap metals in an agreement with the Nucor Steel in Hertford, North Carolina, and the David J. Joseph Company (a scrap metal broker). As of April 2002, there have been 12 cargoes unloaded at this port with no detected radioactivity above background. Almost all of the cargoes

unloaded since the installation of the detectors were grades of scrap metals that seldom yield a radioactive device, such as metal from demolition projects. At this port, scrap metals are purchased as being free of radioactive materials, which is construed as material that has no radioactivity greater than normal background levels. This is consistent with scrap metal specifications, such as the European EFR-

EUROFER, which generally stipulates that all (scrap) grades shall exclude hazardous radioactive material.

For activities conducted by the EPA at the Darrow, Louisiana port and the scrap steel monitoring activities at the Port of Moorehead City, notification protocols were developed to inform State and Federal regulatory authorities of the detection of radioactivity in a scrap steel shipment. For activities at the Port of Moorehead City, protocols were coordinated between the Port Authority of North Carolina, North Carolina State Division of Radiation Protection, NRC, EPA, the U.S. Coast Guard, U.S. Department of Commerce (if the scrap metal is to be returned to the foreign port), DOS (if the scrap metal is to be returned to certain countries), and the U.S. Department of Transportation (if material is to be transported by truck or rail). For activities at the port in Darrow, Louisiana, the NRC staff met with EPA staff on May 17, 2001, to discuss the respective roles of both agencies if AEA material were to be discovered during the EPA's pilot study. Additional notification protocols were coordinated between EPA, the Cooper Smith Stevedoring Company, Louisiana Department of Environmental Quality, U.S. Customs Service, and the David J. Joseph Company. Other domestic ports are currently in the process of installing monitoring systems to detect radioactivity in imported materials.

D.2 DOE Activities

D.2.1 DOE activities related to handling of, and setting criteria for, solid materials

DOE has a large inventory of stored solid material having low amounts of radioactivity from its various defense activities. In handling of these materials, DOE has established requirements in DOE Order 5400.5, "Radiation Protection of the Public," for allowable radioactivity levels on solid materials and for surveying those solid materials for unrestricted release. In general, these limits are comparable to those in use at NRC-licensed facilities and Agreement States, e.g., Regulatory Guide 1.86.

In 1999 industry groups and some members of the public expressed concern with the potential impacts from radioactivity in or on material released from DOE facilities. In response to stakeholder concerns, on January 12, 2000, the DOE established a moratorium on the release of volumetrically contaminated metal from any DOE location. Another DOE action, taken on July 13, 2000, was the establishment of a suspension of the unrestricted release of scrap metal from radiological areas within DOE facilities for recycling. At that time, the DOE also initiated a process to improve its release limits and enhanced its criteria for controlling the release of metal for recycling.

Following these actions, DOE proposed revisions to DOE Order 5400.5 that would allow the unrestricted release of scrap metal for recycling if the metal had no residual radioactivity as determined by process knowledge or measurement. The proposed

revision was made available for public comment on October 12, 2000 (65 FR 60653) and posted on the DOE website. NRC staff prepared comments on the proposed revision, provided to the comment to the Commission for review, and sent them to DOE on December 4, 2000. The NRC position noted in the letter is that a detectability based standard is inconsistent with a risk informed approach.

On January 19, 2001, the DOE decided to suspend work on the proposed revision to DOE Order 5400.5 and, instead, prepare a programmatic environmental impact statement (PEIS) on the disposition of scrap metals to allow for a more open discussion of the issues associated with scrap metal releases from the DOE complex. Although the moratorium and suspension have remained in effect, certain DOE release procedures were not affected by the January 19, 2001, decision - metals and all other materials located outside a radiological area can be reused or recycled if DOE Order 5400.5 requirements are met.

On July 12, 2001, DOE published in the Federal Register a Notice of Intent to prepare a PEIS that will address policy options for managing metals located in radiological areas on DOE sites, and any other scrap metals at DOE sites that might have some potential for residual surface radioactivity. The metals being evaluated are aluminum, copper, carbon steel, gold, iron, lead, platinum, silver, and stainless steel. Nickel was not originally proposed in the scope of the PEIS because it was volumetrically contaminated, however, the DOE is currently considering nickel and volumetrically contaminated material in the draft PEIS scope. The Notice of Intent proposes four disposition alternatives: (1) continuation of an existing suspension on the release of scrap metals from DOE radiological areas for unrestricted use in recycling, which is the no-action alternative; (2) release of scrap metals for recycling under existing DOE requirements; (3) release of scrap metals for recycling under alternative requirements; and (4) no release for recycling of scrap metals with any potential for residual surface radioactivity.

Beginning on July 31, 2001, the DOE conducted public scoping meetings at locations across the country and obtained comments on the Notice of Intent until November 9, 2001. Of the approximately 4,000 written comments received from stakeholders, more than 3,500 were opposed to release of metals to consumer products and requested that the DOE maintain its moratoriums on the release of scrap metal from its facilities. Currently, DOE staff are preparing the draft PEIS and intend to publish it for public comment later this year. The DOE plans to hold additional public meetings approximately 45 days after the publication of the draft PEIS and then prepare a final PEIS by the end of 2002. A Record of Decision would be issued by DOE no sooner than 30 days after publication of the final PEIS.

DOE staff intend to use the RESRAD-RECYCLE code for dose assessments in their draft PEIS. A training workshop on the RESRAD-RECYCLE code was held on March 15, 2001 which was attended by NRC and DOE staff. Also discussed in this workshop were the results of an international validation study of the RESRAD-RECYCLE code at a Swedish metals processing facility. The NA's report did not evaluate the RESRAD family of codes, including RESRAD-RECYCLE.

D.2.2 DOE Efforts Related to Enhanced Monitoring of Radiation in Solid Materials

Recently, DOE has been involved in developing sophisticated sensors for radiation detection. Relatively simple radiation detection equipment has been used by the U.S. Customs Service for some time and there are newer devices that have been emplaced at fixed locations and temporarily at national security special events. Currently, there is a concerted effort at three national laboratories to build more advanced radiation detectors.

DOE and U.S. Customs Service staff have participated in studies organized by the IAEA to determine the effectiveness of radiological monitoring equipment in detecting illicit trafficking of radioactive materials. This work has included field testing of large portal monitors at national borders and evaluation of hand-held radiation survey meters. NRC met with U.S. Customs staff on February 27, and March 28, 2002 to discuss issues of the U.S. Customs Service's Automated Export System and NRC licensing regulations for import and export.

In a separate effort begun since September 11, 2001, DOE, the U.S. Department of Justice Office of Domestic Preparedness Office, and the Health Physics Society recently began an equipment reuse program in response to radiological terrorist threats. In this program, the nation's emergency response organizations will reuse excess DOE radiological detection instruments, which may be supplemented with additional equipment from new Homeland Defense funds in 2003. Emergency response police and fire departments in ten metropolitan areas will be receiving refurbished equipment for the pilot program, including hand-held dose rate meters, electronic pulsers, microrem meters, and other radiation detection equipment. Additional equipment may be added to the program, such as weapons detection systems, glove boxes, and air samplers.

D.3 U.S Department of Transportation

On April 30, 2002, the NRC and the U.S Department of Transportation (DOT) published proposed rules (67 FR 21390 and 67 FR 21328, respectively) to make their regulations for the domestic transportation of radioactive material compatible with the latest revision of the IAEA regulations (TS-R-1), "Regulations for the Safe Transport of Radioactive Material." Revision of TS-R-1 includes the replacement of the 70 Bq/g (2000 pCi/g) radioactivity concentration threshold for determining whether radioactive material is subject to the radioactive material transport regulations. The new IAEA regulations provide nuclide-specific exemptions values that take into account both the nuclide-specific activity concentration and the total activity of the consignment in determining whether radioactive material to be transported would be exempt from the provisions of the radioactive material transport regulations. The revised values consider both the individual and collective doses from radioactive material transport under representative use and accident scenarios. The total annual effective dose from the exempted practice or source should be of the order of 10 μSv (1 mrem) or less for an individual member of the public and the collective dose should be no greater than 1 man-Sv (100 person-rem).

The basis for these revisions is IAEA's BSS, which provides exemption values for activity concentrations and total activities related to practices involving radioactive materials and to sources of radioactive material infixed facilities. However, the BSS did not explicitly address radioactive material transport, so additional calculations were performed for transport scenarios, which also served as a verification of the adequacy of the IAEA's BSS

exemption values for exposure scenarios involving radioactive materials transportation. For commodities not including food or water, the suggested thresholds for establishing radiation protection measures are from 10 to 100,000 smaller than the IAEA's BSS exemption concentrations.

D.4 Other Related Domestic Activities

D.4.1 Information on NRC's Current Approach for Control of Solid Materials and Related Agreement State Activities

The NRC staff and Agreement States continue to receive requests from licensees to recycle, reuse, or dispose of solid material when it becomes obsolete or otherwise unuseable during operations or when their facility is being decommissioned. These requests are reviewed on a case-by-case basis using a set of current practices and guidelines. To aid in use of the current approach while the NA' study was in progress, the NRC staff issued two memoranda, dated August 7, 2000, and July 27, 2001, clarifying the use of these practices and guidelines for licensing decisions involving the control of solid materials. The memoranda indicated that requests for release of solid materials should be handled on a case-by-case basis using existing guidance, i.e., 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. The second memorandum provided some clarification with regard to disposition of soil from licensed facilities and noted that requests for such approvals should be coordinated with staff contacts on a case-by-case basis. These memoranda are consistent with information in the Issues Paper and were provided to the Agreement States as information in an All Agreement States Letter No. STP-00-0070, dated August 22, 2000 and No. STP-01-081, dated November 28, 2001.

NRC staff obtained information from the Agreement States on their practices with respect to the release of surficial and/or volumetrically contaminated materials for unrestricted use. The responses indicate the States vary in their approaches. The types of criteria applied on a case-by-case basis include use levels that are indistinguishable from background, use of guidelines similar or equivalent to Regulatory Guide 1.86 and other NRC guidance documents and use of dose based analyses with maximum doses of 1, 10, 15 and 25 mrem/year.

At the annual meeting of the Conference of Radiation Control Program Directors (CRCPD) on May 8, 2002, the CRCPD passed a resolution recommending that NRC move forward with a rulemaking process for developing national standards for the control of solid materials from nuclear facilities, that the standards include a prohibition against the importation of solid materials exceeding the US standard, and that the technical bases developed by NRC include considerations for naturally occuring and accelerator produced radioactive material (NARM) and technologically enhanced naturally occurring radioactive material (TENORM).

D.4.2 ANSI and HPS Surface and Volume Radioactivity Standards for Clearance

A standard issued jointly by the American National Standards Institute (ANSI) and the Health Physics Society (HPS) (ANSI/HPS N13.12-1999), contains guidance on the clearance of solid materials based on a individual dose limit of 10 µSv/yr (1 mrem/yr) or higher dose levels when justified on a case-by-case basis, taking into account exposures to multiple sources will be maintained ALARA and will provide an adequate margin of safety below the public dose limit of 1 mSv/yr (100 mrem/yr) TEDE. The screening levels for solid materials or items containing surface or volume activity concentrations of radioactive materials are tabulated into four groups based on similarity of exposure scenario results. The screening levels range from 0.1 to 100 Bq/cm^2 (or Bq/g), depending on the group considered. This standard also contains guidance on an approach for applying collective dose to case-by-case clearance requests.

Previously, NRC deferred judgement on the adoption of the ANSI/HPS standard while the NA's study was under way or while it was considering rulemaking on the control of solid materials. The NA's report states that the ANSI/HPS standard was not being evaluated because the method for deriving the screening levels was not traceable by independent reviewers. Thus, the ANSI/HPS standard was not judged and ranked by the NA's committee, but was noted to contain useful information and addressed implementation protocols. Based on the NA's evaluation of the ANSI/HPS standard, the NRC staff plans to take the information in this standard into consideration on the path forward for the control of solid materials.

D.4.3 American Nuclear Society

The American Nuclear Society (ANS) Special Committee on Site Cleanup and Restoration Standards is responsible for reviewing draft regulations from federal organizations related to the decommissioning of nuclear facilities and providing ANS input to the rulemaking process. The ANS is currently preparing a position paper on the endorsement of ANSI N13.12, which is expected to be released later this year.

D.4.4 ANSI Standard on TENORM

Since 1993, ANSI has been working through the HPS on a national standard to provide general guidance and numerical criteria for the control and release of TENORM. Although NRC does not regulate TENORM, this proposed standard represents another industry effort to establish "administrative release levels" or clearance levels for solid material with surface or volume contamination. Similar to the previously described ANSI/HPS effort in developing ANSI/HPS N13.12-1999, the concentrations of TENORM that are exempted from controls in this proposed standard are based on an annual dose of less than or equal to 10 µSv/yr (1 mrem/yr). In fact, the administrative release levels in the proposed standard are identical to the clearance screening levels contained in ANSI/HPS N13.12-1999 for natural uranium, radium, thorium and associated decay products. The administrative release level for potassium-40 was also benchmarked to the results of ANSI/HPS N.13.12-1999.

The proposed standard is concerned with practices and operations that might concentrate

or relocate radioactivity such that members of the public may receive doses that would warrant the application of appropriate protective measures and corrective actions. The activities considered by this standard include mining and beneficiation of ores; processing of ore material, gangue, and wastes; feedstock used in the manufacture of consumer and industrial products; and distribution of products containing TENORM. The proposed dose criteria for members of the public exposed to TENORM are: (a) 1 mSv/yr (100 mrem/yr) for site and facility operations and effluent discharges into the environment; (b) 0.25 mSv/yr (25 mrem/yr) from lands and facilities that have been remediated and released for unrestricted use; (c) dose constraints for a

practice or source to ensure that dose limits are not exceeded when individual dose contributions are added in determining the total dose; and (d) referral to Maximum Contaminant Levels for ground water impacts.

This proposed standard, ANSI/HPS N13.53-2002, is currently under review by the Health Physics Standards Committee and is expected to go to the N13 committee for balloting this spring. The standard would apply to industries or activities that are not covered by existing Federal or State regulations, but could also be applied in foreign countries where such guidance is unavailable.

Independent of the ANSI/HPS effort in this area, the EC is also developing guidance on this subject. A draft report has been prepared, entitled “Practical Uses of the Concepts of Clearance and Exemption - Part II, Application of the Concepts of Exemption and Clearance to Natural Radiation Sources, Recommendations of the Group of Experts set up under the terms of Article 31 of the Euratom Treaty.”

D.4.5 NCRP Report on Managing Potentially Radioactive Scrap Metal

The National Council on Radiation Protection and Measurements is preparing a report on managing potentially radioactive scrap metal by Scientific Committee 87-4. A draft report was posted on the NCRP website for comment earlier this year.

E. RELATIONSHIP OF INTERNATIONAL AND DOMESTIC INITIATIVES TO NRC EFFORTS

E.1 Differences between International and NRC technical approaches

The IAEA and EC technical approaches for deriving clearance levels differs from the approaches used by organizations within the United States. The IAEA and EC approaches incorporate dose conversion factors from ICRP (ICRP-60, ICRP-68, and ICRP -72) whereas the U.S. agencies use Federal Guidance Report Nos. 11 and 12, which are based on ICRP-26 and ICRP-30 (1977-82). The IAEA and EC analyze external exposure, inhalation, and ingestion pathways, evaluate skin exposure, and separately analyze doses to children. IAEA and EC do not sum the pathways because the exposure scenarios are conservative and most of the dose typically comes from only one pathway. In comparison, the technical approaches used by NRC and EPA sum the external exposure, inhalation, and ingestion pathways, but do not evaluate skin exposure or separately analyze doses to

children.

There are differences amongst each agency's selection of the scenarios for representing hypothetical exposure conditions that an individual may come in contact with cleared materials, as well as the assignment of parameter values used in the scenarios. Some of these variations are due to real differences between exposure conditions in the United States and other countries, e.g., the size of trucks that are used to transport cleared material or materials used for the construction of dwellings. Other differences are due to decisions on what scenarios are realistic across all IAEA Member States as compared to realistic scenarios in the U.S., e.g., use of a slag dump as a sports playing field.

E.2 International Trade Policy Issues

As noted in Section C, international organizations are active in establishing clearance initiatives. A factor in the relationship of those activities to NRC decision-making is that potential differences in clearance policies can have ramifications on commercial trade involving domestic exports and international imports. For example, the ability of exported DOE materials may be affected by the development of a national standard on clearance. It seems reasonable to expect that trade of cleared materials and equipment could take place at least among EU countries. The impacts of cleared materials and equipment on trade outside the EU, including the U.S., are not predictable at this time. Although many of the national and proposed international clearance levels are within reasonable agreement, an overlying concern is that, by defining the legal acceptance of exports and imports, different standards amongst organizations could adversely impact international trade because there would not be a common set of values to determine whether solid materials could be accepted in trade.

Another key factor of practical importance is international agreement on the amount of radioactivity that corresponds to any dose standard. For compliance purposes, it is the amount of radioactivity, in terms of radioactivity concentration or dose rate from the radioactivity in the solid material, that would be measured by persons in the field. Thus, international agreement on dose modeling approaches remains an important technical issue with significant policy implications should differing levels of radioactivity or measurement protocols be assigned to the same clearance standard. International agreement on a dose standard for clearance standard, as well as the corresponding radioactivity levels and measurement protocols, would be beneficial for the domestic activities discussed previously.

E.3 Monitoring of radioactive materials at U.S. borders

Several Federal agencies have coordinated on activities related to the international aspects of clearance, the management of orphan sources, and illicit trafficking of radioactive material across national borders. There are overlapping technical and policy issues on these activities, as well as those related to the commercial trade of metal produced with either a discrete radioactive source or contamination from an uncontrolled release of naturally occurring or man-made source of radioactivity.

A common aspect is the detection of radioactivity in solid material and the related disposition decisions. An essential difference, however, is that clearance is a release of solid material from regulatory control based on an individual receiving a "trivial" dose, whereas the other activities are not authorized releases of solid materials and can involve larger doses.

Detection of unauthorized radioactive material in imported solid material can require evaluation of alarm levels, assessment of the radiation hazard, coordination of any emergency response, identification of options for disposition, and clearance and exemption determinations. The jurisdictional issues associated with unauthorized import of solid materials containing radioactive material can involve NRC, EPA, DOS, DOT, U. S. Customs Service, U. S. Coast Guard, U.S Commerce Department, and State agencies.

In cases involving the import of solid materials containing radioactive material, the NRC is responsible for licensing the import of byproduct, source, and special nuclear material, as stipulated in Section 274 of the Atomic Energy Act. However, the recipient of the material would likely not possess a NRC general license under 10 CFR Part 110 for domestic possession of the imported radioactive material. The general license applies only if the recipient, at the time the material enters the U.S., is authorized for domestic possession of the imported radioactive material under either a specific or general license, an exemption, or a DOE contract. The general license does not apply to most radioactive waste imports.

The Federal Radiological Emergency Response Plan (FRERP) may be activated if an unauthorized import of radioactive was determined to be a radiological emergency involving radioactive material of foreign or unknown origin, or is not licensed by the NRC or an Agreement State. The FRERP designates EPA as the lead federal agency responsible for coordinating with the State for the initial response to a radiological threat involving the unauthorized import of radioactive material. The NRC retains its regulatory responsibility for imported material, but in such cases, licensing and inspection activities are typically deferred until the response under the FRERP has ended. NRC would assume its traditional regulatory role of determining the appropriate licensing requirements for any radioactive material that is to remain in the U.S. When unauthorized imports of AEA material have occurred in the past, the NRC has worked with the EPA to safely disposition the material. However, absent an established national clearance standard that can be applied to these circumstances, each occurrence has been evaluated on a case-by-case basis, which can require significant resources.

E.4 DOE preparation of a PEIS

As noted in Section D.2.1, DOE is preparing a PEIS on scrap metal. Results and decisions regarding this action are factors which NRC should consider in its decision-making. NRC staff has maintained communication with DOE on this activity, but NRC is not currently involved in a more active manner such as a cooperating agency on the PEIS, as noted under NEPA implementing regulations in 40 CFR 1500. Currently, DOE intends to publish the PEIS for public comment later this year.

E.5 DOE development and use of more sensitive detection equipment

DOE's current initiative to enhance radiological monitoring of radiation in solid materials, discussed in Section D.2.2, may also affect NRC activities, as it could lead to identification of more solid materials with small amounts of radioactivity. Many of these identifications may be associated with authorized transfers of radioactive materials, naturally occurring radioactive materials, NARM, and TENORM, rather than terrorist activities. The extent of this occurrence would be dependent on several factors, such as the sensitivity of the detectors, the ability of the detector to distinguish different types of radioactive materials, and the reliability of accurately interpreting the radiation detector's signal. NRC would continue its existing practice of reviewing such events on a case-by-case basis in cooperation with the EPA, absent a national standard on clearance. The U.S. Customs Service, when working with the DOE on this activity, would be impacted in their decisions to allow or reject imports with detected radioactivity at national borders if a national standard were to be developed.

E.6 State issues

Differing standards amongst the NRC and Agreement States discussed in Section D.4 have implications with regard to consistency of approach by the various regulatory bodies and in explaining such differences in replies to Congressional inquiries on activities involving solid materials with slight amounts of contamination. Previous responses to such inquiries have expended large amounts of staff resources in discussing the varied current approaches. The recent resolution of the CRCPD will need to be addressed, which recommends that NRC move forward with a rulemaking process for developing national standards for control of solid materials, that the standards include a prohibition against the importation of solid materials exceeding the US standard, and that the technical bases developed by NRC include considerations for NARM and TENORM.

E.7 Domestic Consensus Standards

As discussed in Section D.4, there are domestic consensus standards that have been prepared by ANSI/HPS. According to the National Technology Transfer and Advancement Act of 1995, Federal agencies are to use technical standards that are developed or adopted by voluntary consensus standards bodies unless the use of such standards is inconsistent with applicable law or otherwise impractical. There are also recommendations on metal scrap management that have been under development by NCRP, that should be taken into account in moving forward with decisions on the control of solid materials. Harmonization amongst Federal and international regulatory agencies would simplify the management of these materials.

Table 1. Comparison of International Clearance Standards

Country	Clearance Levels Surface	Clearance Levels Volumetric	Based on	Situation	Remarks
Belgium	0.4 Bq/g (11 pCi/g) for ß-? and low toxicity a emitters; 0.04 (1 pCi/g) for all other a emitters	EP RP 122 (rounded values)	IAEA Transport Regulations exemption levels for surfaces 10 µSv/yr (1 mrem/yr) for an exposure pathway	Regulations in force	Effective September 2001
France	Nuclear power industry moratorium on generic levels; case-by-case allowed	Nuclear power industry moratorium on generic levels; Case-by-case allowed	Waste Stream analysis, QA, impact study, presentation to public, specific authorization	Incorporations of Directive 96/29/Euratom is in preparation incorporation planned mid-2001	Ministerial order issued Dec 31, 1999, requesting the nuclear industry to implement waste stream analysis Generic Clearance levels may be required for non-nuclear power very low level waste Authorized release is possible, through rarely used
	Non-nuclear power industry: case-by-case	Non-nuclear power industry: case-by-case			

Country	Clearance Levels Surface	Clearance Levels Volumetric	Based on	Situation	Remarks
Germany	Nuclide specific based on 10µSv (1mrem) to a person in a year [generally higher than RP 122]	Nuclide specific based on 10µSv (1 mrem) to a person in a year e.g., 0.1 Bq/g (2.7 pCi/g) ^{60}Co [generally in agreement with RP122]	SSK [Commission on Radiological Protection] recommendations	Ordinance (regulations) is in force	Effective July 26, 2001 Authorized release is possible, e.g., 4Bq/g (108 pCi/g) ^{60}Co for landfill or incineration; 0.6 Bq/g (16.2 pCi/g) ^{60}Co for metals to be melted Clearance of sites based on 10 µSv (1 mrem)
Italy	Applied domestically: ≤EC guidance RP122; for metals Imported metals meet environmental levels	Applied domestically; ≤EC guidance RP122; for metals Imported metals meet environmental levels		10 µSv/yr (1 mrem/yr)	
Japan	No general criteria	No general criteria	Ongoing discussions among government organizations		Nuclear Safety Commission based clearance calculations on 10 µSv (1 mrem) criterion; these agree well with TECDOC-885 with a few exceptions
The Netherlands				10 µSv/yr (1 mrem/yr)	Modified EC exemption levels used for clearance

Country	Clearance Levels Surface	Clearance Levels Volumetric	Based on	Situation	Remarks
Spain	Generic clearance level 1.3 Bq/cm^2 (35 pCi/cm^2) approved industry plan for surface clearance			10 µSv/yr (1 mrem/yr)	
U.K	Case-by-case basis	0.4 Bq/g (10.8 pCi/g) for non-naturally occurring radionuclides Naturally occuring radionuclides range from 0.37 to 11.1 Bq/g (10 to 300 pCi/g) depending on the element	Implementation of Directive 96/29Euraton by incorporation of existing regulations, except disposal of waste in a few months	*Status quo*, except disposal of waste regulation is expected in a few months	Basis for clearance is 10 µSv (1 mrem) criterion Exemption Orders exist that allow less restrictive clearance levels for naturally occurring radionuclides