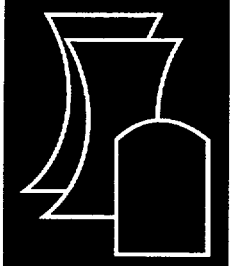
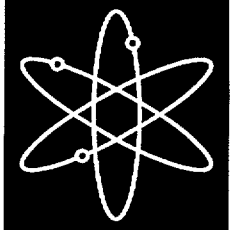
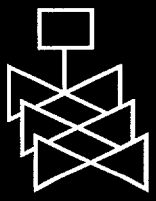
NUREG/CR-6712







Summary and Categorization of Public Comments on the Major Revision of 10 CFR Part 71

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U.S. Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards
Washington, DC 20555-0001

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NUREG/CR-6712

Summary and Categorization of Public Comments on the Major Revision of 10 CFR Part 71

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ABSTRACT

This report presents, in digest form, all comments the Nuclear Regulatory Commission (NRC) received on its issues paper to modify 10 CFR Part 71 requirements pertaining to the packaging and transport of radioactive materials, including fissile materials. NRC first published the issues paper in the Federal Register (65 FR 44360) on July 17, 2000. The NRC proposed rulemaking is intended to: (1) harmonize transportation regulations found in 10 CFR Part 71 with the most recent transportation standards established by the International Atomic Energy Agency, and the U.S. Department of Transportation's requirements at 49 CFR; and (2) address the Commission's goals for risk-informed regulations and eliminating inconsistencies between Part 71 and other parts of 10 CFR. As part of its enhanced public participatory process, NRC invited written comments on the issues paper, established an interactive web site, and held public meetings during August and September 2000 in Oakland, CA; Atlanta, GA; and Rockville, MD. Extensive and wide-ranging comments were received from almost 100 members of the public and industry at these public meetings and during the 75-day public comment period. (All comments received after the comment period ended were included in both the decision-making process and this digest.) This report synthesizes those comments into a publicly accessible digest form without analyzing or otherwise responding to the comments. The issues paper is included in this report as an Appendix.

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FOREWORD

The NRC is conducting an enhanced public participatory process to evaluate its proposal to harmonize 10 CFR Part 71 with the International Atomic Energy Agency's most recent transportation standards, TS-R-1, as well as with U.S. Department of Transportation regulations, 49 CFR. NRC published an Issues Paper in the Federal Register (65 FR 44360) on July 17, 2000 to seek public input on these alternatives and invite written comments. NRC also held public meetings during August and September 2000 in Oakland, CA; Atlanta, GA; and Rockville, MD. The commentary on the alternatives and fundamental issues solicited from interested parties, who participated in these meetings and submitted comments directly, forms part of the official record that NRC's proposed rulemaking to harmonize 10 CFR Part 71 will address. This report summarizes, and presents in digest form, the comments that were categorized from transcripts of the three public meetings and NRC docketed letters from individuals and organizations. The full text of these comments, as well as additional supporting materials, can be accessed from the docket maintained by NRC and the dedicated web site that was developed both for disseminating information and for obtaining comments on the Issues Paper (http://ruleforum.llnl.gov). Comments received with respect to this published report will also be included in the formal docket and be accessible therefrom.

This report includes letters and comments received from July 24, 2000 to December 20, 2000. While the public comment period ended September 30, 2000, letters and comments received after this time were incorporated into both the decision-making process and this digest. The results, approaches, and methods described in this report are provided for information only. Publication of this report does not necessarily constitute NRC approval or agreement with the information contained herein.

Donald A. Cool, Director
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Office of Nuclear Material Safety and Safeguards

ABBREVIATIONS

ANI	Authorized Nuclear Inspector
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
Bq	Becquerel
CFR	Code of Federal Regulations
Ci	Curie
CoC	Certificate of Compliance
CRP	Coordinated Research Project
CSI	Criticality Safety Index
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
g	Gram
GSA	U.S. General Services Administration
HLW	High Level Waste
IAEA	International Atomic Energy Agency
ICC	Interstate Commerce Commission
INEEL	Idaho National Engineering and Environmental Laboratory
ISFSI	Indpendent Spent Fuel Storage Installation
LDM	Low Dispersible Material
LSA-III	Low Specific Activity
MOU	Memorandum of Understanding
NMSS	U.S. NRC Office of Nuclear Material Safety and Safeguards
NON	Notice of Non-compliance
NORM	Naturally Occurring Radioactive Material
NOV	Notice of Violation
NRC	U.S. Nuclear Regulatory Commission
NUREG	Nuclear Regulatory Publication
ORNL	Oak Ridge National Laboratory
PE	Licensed Professional Engineer
PGE	Portland General Electric
PRM	Petition for Rulemaking
QA	Quality Assurance
Rem	Roentgen Equivalent Man
SI	Systeme' Internationale
SMAC	Shipment Mobility/Accountability Collection
SSC	Systems, Structures, and Components
Sv	Sievert
TI	Transport Index
TS-R-1	IAEA Safe Transportation Standards
μCi/g	Microcuries per gram
UF_6	Uranium Hexafluoride
U.S.	United States
USEC	United States Enrichment Company

1.0 INTRODUCTION

1.1 BACKGROUND

The U.S. Nuclear Regulatory Commission (NRC or the Commission) is conducting an enhanced public participatory process to evaluate its proposal to harmonize 10 CFR Part 71 with the International Atomic Energy Agency's (IAEA) most recent transportation standards, TS-R-1, as well as with U.S. Department of Transportation (DOT) regulations, 49 CFR. NRC sought early public input on the major issues associated with this effort in order to confirm the validity of its approach. Towards this end, NRC developed an Issues Paper that presents the key issues associated with conforming NRC regulations with IAEA and DOT regulations. This Issues Paper was published with the goal of developing a public discussion of the issues associated with harmonizing 10 CFR Part 71 with TS-R-1.

The Issues Paper was published in the Federal Register (65 FR 44360) on July 17, 2000. The Federal Register Notice invited public comment on the Issues Paper and, to provide further opportunity for public input, NRC held three facilitated public meetings during August and September 2000. These public meetings included a "roundtable" workshop with invited stakeholders and the general public at the NRC Headquarters, Rockville, MD, on August 10, 2000, and two "townhall" meetings, one in Atlanta, GA, on September 20, 2000, and one in Oakland, CA, on September 26, 2000.

In the Issues Paper, NRC discussed initiating a proposed rulemaking to: (1) conform its transportation regulations found in 10 CFR Part 71 ("Packaging and Transport of Radioactive Material") with the most recent transportation regulations established by the IAEA in TS-R-1; and (2) address the Commission's goals for risk-informed regulations and eliminating inconsistencies between Part 71 and other parts of 10 CFR.

As part of its mission to regulate the domestic use of byproduct, source, and special nuclear materials to ensure adequate protection of health and safety and the environment, NRC is responsible for controlling the transport of radioactive materials. NRC shares responsibility for radioactive material transport with the DOT. DOT's regulations in 49 CFR Parts 171 through 180 (often called the "Hazmat Regulations") address packaging, shipper and carrier responsibilities, documentation, and radioactivity limits. In contrast, NRC's regulations are primarily concerned with special packaging requirements for large quantities of radioactive materials. A Memorandum of Understanding (MOU) published July 2, 1979 (44 FR 38690) specifies the roles of DOT and NRC in the regulation of the transportation of radioactive materials. The MOU outlines that DOT is responsible for regulating safety in transportation of all hazardous materials, including radioactive materials, whereas the NRC is responsible for regulating safety in receipt, possession, use, and transfer of byproduct, source, and special nuclear materials. This joint regulatory system protects health and safety and the environment by setting performance standards for the packages and by setting limits on the radioactive contents and radiation levels for packages and vehicles.

As specified by the Commission in SRM-SECY-00-0117 (June 28, 2000), NRC is now proceeding towards developing a proposed rule for submittal to the Commission by March 1, 2001. Oral and written comments received from the public and invited stakeholders in the public meetings, and written comments received by mail, and electronic comments received on the NRC web site in response

to the Issues Paper will be considered during the decision-making process.

1.2 OVERVIEW OF COMMENTS

NRC received comments from almost 100 individuals, citizen and environmental groups, state government agencies, and members of industry on its Issues Paper. Fifty written comments were submitted to NRC's interactive web site, with another 46 comments received during discussions at public meetings. The Issues Paper is included in this report as Appendix A.

The public meetings were all well-attended events with local citizen groups being present as well as industry and environmental group representatives. Attendees included: Federal agencies (e.g., U.S. DOT; U.S. Department of Energy), state and local government agencies (e.g., Attorney General's Office, State of New Mexico; Clark County Department of Comprehensive Planning), educational institutions (e.g., Oregon State University), members of industry (e.g., AEA Technology; Calvert Cliffs Nuclear Power Plant, Inc.; Mallinckrodt Inc.), as well as private citizens and environmental groups (e.g., Action for a Clean Environment, Tri-Valley CARES).

NRC received extensive and wide-ranging comments during each of the three public meetings as well as via the interactive web site.

NRC received general comments on issues related to the proposed rulemaking. These comments included things such as concerns that regulatory materials were either unavailable or not written for a lay audience or that NRC and DOT should develop a coordinated process for managing the harmonization of NRC, DOT, and IAEA regulations.

The majority of comments received addressed the specific issues under consideration in the rulemaking, and requests for input made by NRC in its Issues Paper. For example, NRC was told that many commenters preferred to continue using dual units of measurement. Other commenters were more than willing to provide new or edited definitions or to ask NRC to clarify particular definitions.

This report presents comment summaries in an easily accessible format. The public meeting transcripts and the written public comments are all available on the NRC's interactive web site.

The public comment period extended from July 24, 2000 to September 30, 2000. But NRC decided that including all comments received after that date in both the decision-making process as well as this digest had merit. Therefore, this digest includes comments received from July 24, 2000 through December 20, 2000. A listing of the commenters, and the issues they addressed, is included in Appendix B.

The organization of this report is similar to the Issues Paper. Chapter 2 presents the general issues and questions while Chapter 3 corresponds to the first issue discussed in the Issues Paper, "Changing Part 71 to SI Units Only." Subsequent chapters focus on Issues 2 through 18.

Comment summaries are found in Chapters 2 through 21. Each comment summary includes a unique comment number assigned to each of the commenters who submitted comments to NRC, either during public meetings, in writing, or via the NRC web site. Although an individual or organization may have addressed an issue in several letters, or in a meeting and a comment letter, the summary includes reference to that commenter only once for any given issue.

When there are multiple submissions by one commenter or organization, the first submission's comment number is used as the

comment number for this report. For example, Commenter Number 15 attended the Rockville, MD meeting and then submitted comments to NRC twice (i.e., Commenter Number 69 and 72). In this instance, the report uses Commenter Number 15, and notes that Commenter Numbers 69 and 72 are the same person in Appendix C.

To try to orient the reader further, the comment number's first two digits identify what public meeting the comment is from. The Rockville, Maryland meeting is denoted with an "MD" while the Atlanta, Georgia and Oakland, California meetings are denoted with "AT" and "OA," respectively. Comments submitted to NRC via its interactive web site, or in the mail, are denoted with two zeros preceding the comment number (e.g., 0073).

Readers can identify the commenter numbers applicable to an individual or organization by referencing Appendix B. Alternatively, the reader may identify the individual or organization name applicable to a comment number by referencing Appendix C. Appendix B also identifies the issues addressed by each commenter in subsections of Chapters 2 through 21.

2.0 GENERAL ISSUES

Commenters provided general comments on NRC's proposed rulemaking. Some commenters were supportive of NRC's efforts while others were not so inclined.

Commenters also spoke to issues not directly included in the Issues Paper, such as the process NRC used to disseminate information to the public or how NRC and DOT would coordinate an international harmonization effort.

2.1 SUPPORT NRC'S EFFORTS

Several commenters supported NRC's efforts with the proposed rule and noted particular benefits that could result.

- Appreciate use of enhanced rulemaking process and encouraged us to continue using this process (OA43) (0094)
- Shifting to risk-informed regulation will increase the safety of nuclear power plants by allowing the operators to focus on risk-significant issues (MD18)
- Adopt regulations based on technical merit (0052)
- Continue with safety and performance-based regulatory focus (MD08) (MD17) (MD20)
- Adopt uniform regulations to ensure both the domestic and international safe use and transport of radioactive materials (MD08) (MD17) (MD20) (0051)
- Regulatory consistency promotes compliance with minimal confusion (0051)
- Support efforts to incorporate TS-R-1 into 10 CFR Part 71 because regulations affecting movement of radioactive materials around the world need to be applied and adopted uniformly as demands on transport of radioactive materials grow (AT27) (0079)

Other commenters wanted to ensure that any changes to NRC's regulations, whether in the context of conformity with international regulations, or solely affecting domestic shipments of radioactive materials, would not result in a reduction in transportation safety for the public.

- Safety considerations are important but also support NRC's shift towards performance-based regulation, similar to the way NRC revised 10 CFR Parts 50 and 70 (MD08)
- Support revising requirements in 10 CFR Part 71 if a publicly available technical justification demonstrates that safety margins are not reduced by the revisions (0050) (0073)
- Do not revise 10 CFR Part 71 solely to be compatible with IAEA TS-R-1. A technical basis document, similar to NUREG-1230 used in the revision of the Emergency Core Cooling System, needs to be cited in support of this proposed revision (0054)
- NRC and DOT should not support changes which increase radiation doses to the general public or increase adverse impacts on the environment (MD16) (0095)
- Aspects of the proposed rules would be beneficial but other portions would be overly burdensome without improving public health, potentially even doing harm (MD04)
- No cost-benefit analysis has justified why the change is necessary but the proposed rule can be successfully developed and still improve public health and safety (MD04)

- Public safety and the integrity of the regulatory process should not be compromised as a result of a cost/benefit analysis -- i.e., cost/benefit analysis should not be an overriding criterion in decision-making because it is based on challengeable assumptions (0096)

- While considering TS-R-1 changes, NRC and DOT should evaluate performance standards from across the world so that international commerce activities are not disrupted (MD08)

2.2 PUBLIC ACCESS TO INFORMATION

Commenters were also concerned with the process NRC uses to make documents and information publicly available that are pertinent to transportation regulations.

- Asked to be placed on NRC distribution list for all correspondence issued related to this rulemaking effort (0050)

- Find alternative publication methods, such as posting documents on the web, materials informing the public of specific proposed changes -- e.g., TS-R-1, pertinent sections from the CFR -- and why they are proposed (AT22) (AT23) (AT25) (AT27) (AT33) (AT35) (AT36) (AT37) (OA43) (0050) (0073)

- Purchase an IAEA web document distribution license, which should not be too expensive (OA43)

- Web site difficult to access and to navigate and find pertinent information (AT23) (AT33) (AT35) (AT36) (AT37) (0050) (0059) (0073)

- Information not readily available prior to public meetings (AT27) (0063) (0095)

- Translate proposed changes and their impacts into language a layperson can understand. One suggestions was to use plain language footnotes (AT23) (AT33) (AT35) (AT36) (AT37) (0050) (0059) (0063) (0073) (0095)

- Entire process is frustrating (AT33) (0095)

- Forced to track down information that NRC should have provided (MD05)

- Identify where people can learn about package routing through their community (AT35) (AT36)

- White paper afforded participants a limited, possibly distorted, view of the proposed changes (MD16)

- Unavailable documents, abridged discussion papers, and limited public meetings must not form the basis for substantive changes in regulations (MD16)

- No substantive information should be suppressed, and no decisions should be made without full public consensus (MD16)

- Supporting documents should not be too expensive for the public to purchase or otherwise access them (AT22) (AT27) (0095)

- Documents expensive and delivery takes too long -- e.g., weeks passed before receiving a copy of TS-R-1 from the contractor listed in the Federal Register (MD06) (MD15)

- NRC and DOT must provide a publicly accessible version of the proposed regulations, and related documents, and make the regulatory process transparent, which is critical if NRC is to develop international standards (MD03) (MD06) (MD15) (MD16) (AT30) (0063)

- NRC and DOT do not have authority to encourage an international reduction in public protection which could preempt more protective, existing national standards (MD06) (MD15) (MD16)

Commenters addressed the public comment period and issues surrounding public meetings.

- Lengthen the comment period and/or otherwise allow for additional public meetings (MD05) (MD15) (AT27) (AT30) (AT40) (OA41) (OA43) (OA44) (0073)
- Provide additional notice of public meetings (AT27) (0063) (0095)
- Hold meetings in locations likely to be affected by any changes in NRC's transportation regulations -- e.g., communities near Yucca Mountain, communities near major transport hub cities (MD15) (AT30) (OA41)
- Coordinate NRC's public meetings for all rulemakings or actions related to transportation (e.g., the Modal Study) so the public can see the interrelationships of various NRC actions (MD15)
- Allow every transport community to have the opportunity to request a formal public hearing (MD16)
- Schedule representative group sessions with Agreement States, affected cities, citizens' groups, and industry representatives, to discuss TS-R-1 (OA44)
- Extend the public comment period by at least 30 days (0073)
- Extend the public comment period by at least 60 days because NRC's white paper is insufficient and does not adequately characterize the proposed changes (MD05)
- Extend the public comment period by at least 180 days (MD06) (MD15)
- Extend the public comment period because, using a mostly trucking scenario, all Yucca Mountain truck shipments will pass through downtown Las Vegas and approximately seven percent of the national shipment miles to Yucca Mountain will occur in Clark County of Nevada (OA43)
- Start the clock on the public comment period once plain language information, including NRC's proposed rule and the basis for its adoption, is publicly available (MD06) (MD15)
- Make the regulatory process as open and democratic as possible (AT22) (AT40)
- To date, inadequate and unrepresentative public participation -- e.g., public meetings scheduled too close to the end of the public comment period, IAEA standards were not established under a cost-benefit regulatory standard, as is Congressionally mandated) for the proposed rule -- which contradicts the Administrative Procedure Act (OA43) (0090)
- To date, inadequate mechanisms exist to encourage public involvement in discussions of modifications to internationally significant policies, and without this, the modifications may lack legitimacy (OA43)

2.3 GENERAL ISSUES

NRC also heard from commenters about general issues related to NRC and the proposed rule.

- NRC and DOT need a coordinated process to jointly study and, after a reconciliation process, address public comments (OA43)

- NRC should limit its focus to areas for which its responsible -- e.g., fissile material, Type B shipments -- and not develop parallel regulations (0078)

Commenters were interested in NRC's proposed standards and their strength of protection.

- NRC should only suggest changing existing standards if said changes improve or otherwise strengthen existing standards (AT22) (AT23) (AT27) (AT34) (AT39) (0090)

- If NRC's regulations are more stringent than IAEA regulations, then NRC regulations should be maintained (AT27) (AT30) (OA41)

- International standards should be considered a regulatory floor, not a ceiling (MD05) (AT22) (AT34) (OA41) (0096)

- NRC should not lower its standards but should work to strengthen international standards (OA41)

- Cost should only be considered if the changes will not decrease public safety (AT27)

- Any change that does not improve public health, safety, and the environment -- e.g., strengthening double-casking requirements -- is not likely to be worth its regulatory costs and should be carefully considered (AT22) (AT34) (0050) (0073)

- Clarify whether the proposed changes discussed in the issues paper would strengthen or weaken public health and safety in the U.S. (0090)

- IAEA should periodically examine its regulations against more stringent ones to ensure the IAEA regulations are as protective of public health as they can be. After such a review, and as necessary, IAEA should revise its regulations (AT30)

- Recent NRC rulemaking initiatives have improved neither public safety nor safety margins, and appear designed only to relieve regulatory burden (0073)

- Current process is being driven by the European nuclear industry, which does not have the safety interests of corridor communities as a first priority (AT30)

Several commenters asked about NRC's plans to regulate Naturally Occurring Radioactive Materials as well as to clarify jurisdiction concerns.

- Materials (including certain bulk materials) not previously regulated by NRC could fall under the Commission's jurisdiction, or become exempt depending on jurisdiction, which could lead to unnecessary public concern (MD01) (MD03) (MD04)

- Clarify that 10 CFR Part 71 focuses on regulating special nuclear source and by-product material, not naturally occurring materials. If NRC plans to regulate naturally occurring materials, then it must clarify its statutory authority to do so (MD01)

- Clarify whether, and how, the proposed rule would affect State Agencies regulating radioactive materials (MD02)

2.4 SCOPE CLARIFICATION

Commenters asked NRC to clarify the scope of the proposed changes to 10 CFR Part 71.

- Clarify whether all items listed in the issues paper are included in NRC's proposed rule (MD12)

- Clarify whether NRC and DOT intend to adopt all changes associated with TS-R-1

or just those contained in the issues paper (MD15).

- Publicize the full scope of the proposed regulations -- e.g., NRC's apparent intention to adopt new standards facilitating clearance or exemption of radioactive materials from regulatory control (which is contrary to public preferences), reducing "already inadequate requirements for Type B transport containers without fully informing or involving all communities along the transport routes" (MD06) (MD15)

Commenters asked for more information on the specific changes NRC proposes.

- Define all terms and provide background information in the next iteration, which will enable the public to understand and evaluate the context and rationale for NRC's proposed actions (AT22) (AT25)

- Provide the public with the full spectrum of ideas that the Commission is contemplating for incorporation (MD15) (MD16)

- NRC has not provided an adequate analysis of the impact of the proposed changes (MD05)

- Failed to identify the evidence on which NRC bases its suggestions to lower safety standards (0074)

- Provide route and transportation mode estimates of the acceptable risks inherent in the proposed changes, specifically, how many people can die legally under the proposed regulatory changes (MD16)

Commenters asked for additional details regarding the transportation process and the security arrangements associated with the proposed rulemaking's changes.

- Detail the links existing between this rulemaking process, the NRC, the DOT, and DOE's currently scheduled shipments of radioactive materials (AT22)

- Explain what security arrangements exist and what preparations NRC and DOT have made to deal with accidents and other such security breaches (AT24)

Commenters were concerned that NRC fully examine the impacts of the proposed changes on the DOE and industry.

- Need to provide a detailed analysis of the proposed changes on the DOE and whether relaxing NRC standards might result in relaxed standards at other federal agencies -- e.g., DOE, EPA (OA41)

- Detail the level and type of accountability industry has for its radioactive materials (AT25) (AT30)

2.5 HARMONIZATION WITH IAEA REGULATIONS

Commenters were concerned with the harmonization of NRC and IAEA regulations.

- Wondered whether the value of harmonization is sufficient when compared to the costs of implementation, especially when the magnitude of the safety benefits of such harmonization are considered (MD02) (MD05) (MD06) (MD10)

- Bottom line for the changes to 10 CFR Part 71 seem to be to enhance the bottom lines of the licensees (0050) (0073)

- NRC should explore what might happen if TS-R-1 is not adopted uniformly internationally and how that might affect international transport (MD02)

- Not adopting TS-R-1 standards risks stopping international commerce (MD06) (MD10)

- It is not incumbent for the U.S. to adopt international regulations simply because other countries are adopting them (MD15)

- Harmonization should not cause public harm -- e.g., restricting the ability to obtain some medical isotopes could cause greater public harm than allowing such shipments (MD01)

- Adopting parts of TS-R-1 will have minimum health and safety benefits but obvious costs (MD02) (MD19)

- The U.S. should have the right to adopt more stringent standards than those contained in TS-R-1, which should constitute a "minimum" set of requirements and not the highest applicable standard (MD05)

- Adopt a set of guiding principles to ensure that harmonization is done openly and in the best interest of public health and safety, such as the guiding principles used in the Transatlantic Consumer Dialogue (MD05) (0096)

- Ensure DOT and NRC regulations are consistent for all public shipments (0049)

- Revise 10 CFR 71 so that "IAEA requirements are the DOT regulations." (0049)

- Continue to first perform a safety check and ensure that safety levels are not diminished (MD06)

- Evaluate whether NRC faces regulatory incompatibility or simply interpretation issues (MD06)

- There is currently no urgency to harmonize because the world community is already harmonized using IAEA's Safety Series 6 (MD06) (MD15)

- NRC needs to address and/or modify parts of TS-R-1 before adopting it (MD20)

- NRC needs to compare TS-R-1 with recent science and engineering and not blindly adopt TS-R-1. Otherwise, revisions to 10 CFR Part 71 could be outdated before being finalized (0070)

2.6 OTHER ISSUES

A number of commenters were concerned with issues that were indirectly related to the proposed rulemaking.

Some commenters were interested in DOT's transition rule.

- Provide information on the timing of DOT's transition rule and whether United Nations (UN) numbering would be allowed under NRC's proposed changes (MD19)

- Clarify the meaning of DOT's transitional rulemaking for implementing the TS-R-1 standards domestically (MD15)

- U.S. agencies should not be encouraged to adopt regulations limiting the current review processes (MD16)

- DOT is acting arbitrarily and capriciously to move forward with preliminary changes in transport regulations and standards without due process (MD16)

Commenters addressed issues related to public exposure.

- NRC's proposed changes should not be allowed because public exposure rates are seemingly increased, and this is done without adequately informing the public of any risks associated with such an increase (AT22) (AT23) (AT27) (0075)

- Lowering containment standards, relaxing the testing requirements, and allowing air

transport of plutonium (as well as overlooking DOE's plan to reverse the plutonium recycling ban) all conflict with regulations used in the 1970's, which were designed to limit the cumulative exposure to man-made radiation (0074)

Commenters also responded to issues that NRC had not addressed in its Issue Paper.

- Clarify and publicize the role, authority, and current U.S. interactions with the ICAO, IMO, and IAEA (MD15)

- Account for the long distances traveled in the U.S. -- i.e., estimated 2,400 mile trip to Nevada from eastern power plant locations -- especially when compared to the shorter distances traveled within and between European countries (0090)

- Assume the lowest level of training for emergency response. The rules should protect emergency responders and other personnel who could be expected to be around these types of shipments (0090)

- Because the complete chemistry of plutonium is not fully understood, NRC should neither minimize the criticality issue nor reduce regulatory stringency and should only allow changes in packaging if the packaging and transportation is made less dangerous and more protective of public health and safety (0096)

- NRC should limit the transport nuclear materials, discard ideas of using Mox fuel, consider deep sea storage of nuclear materials, and consider non-nuclear, non-polluting sources of energy, such as the sun, wind, water, and geothermal power (AT27)

3.0 CHANGING PART 71 TO SI UNITS ONLY

Commenters addressed the change from dual units to SI units only, with several stating their preference that NRC continue to allow the use both English and SI units.

- "Too soon" to switch to only SI units because some instruments are only calibrated to the "old" system (0059)
- English or curie units are required in FDA regulations and in new drug applications. FDA reluctant to move to SI units because the nuclear medicine community accustomed to curie unit (MD19) (AT28)
- TS-R-1 does not prohibit domestic use of dual-unit system by member countries (OA42)
- If switched to SI units only, licensee procedures and computer software would need to be changed throughout the industry, which would bring substantial cost and no safety benefit (0083)
- Keep using both units to eliminate confusion and increased human error that might come from unfamiliarity with a type of unit (OA46)
- Shipment paperwork and documentation are reported in both units (0081)
- The Agency should add another unit, such as calories because it might increase the public's understanding of radiation (AT28)
- Should allow parenthetical equivalences in a familiar unit for each type of quantity mentioned; this will encourage thinking in SI units, while allowing for a gentle transition (0056)
- NRC and DOT do not need to lead on this issue; using only SI units would create a problem with industry and those who certify packages (MD12)
- NRC may be forced to use metric units because the U.S. government has a policy to adopt metric units but until such time, both sets of units should be used to avoid potential problems with industry and with those who certify packages (MD08) (MD12)
- Would be easier to deal in traditional as well as SI units (MD02)
- NRC should clarify the text so the values for fissile materials reflect the values listed in 10 CFR Part 71, and should add notes for uranium and plutonium (0049)

3.1 CONSIDERATION OF RISK

Commenters addressed consideration of risk in changing from dual to SI units only, and would like to use both units.

- Limited risk associated with switching to only SI units for international shipments, but for domestic shipments, dual units should be maintained (MD08) (MD20) (0051)
- In event of an accident, SI units might cause a response delay due to confusion with units (MD08) (MD20) (0051)
- Regulators would be more comfortable with both units because most think in terms of traditional units (MD02)
- Shippers think in English units, which could lead to errors in conversions if only SI units are used (0051)
- Would lead to increase in paperwork errors and an increase in situations that put the public at risk (0081)

- New drug applications and FDA regulations require use of English or Curie units, and FDA reluctant to remove Curie designation (MD19)

- Most packages currently marked with both 10 CFR Part 71 and SI units, which causes problems because the product and paperwork do not agree (MD19)

- If only SI units used in paperwork, when shipping papers are compared against what is labeled on the inside, there would be no correlation (MD19)

- Public transport would not be affected by the unit change (0049)

- Dual headings would be useful, though the change will not increase risk as long as intra-license shipments are allowed to maintain dual units (0049)

- A minimum ten-year transition period is necessary if NRC decides to change to SI units only (OA42)

- Little risk in changing to only SI units because these units are already used in shipping (0078)

- Unit confusion potentially caused the loss of the Mars Climate Orbiter spacecraft (0096)

Commenters said dual units are necessary to minimize the risk of inadvertently exposing workers to radiation.

- Packages have been received labeled only in SI units, and were incorrectly labeled as Type A rather than Type B material quantities (OA42)

- Inadequate carrier training has forced one commenter to essentially train common carriers, such as Federal Express, and trucking firms, in SI units (0048)

- Increased complexity in dealing with SI units greatly increases the possibility of conversion errors and unnecessary radiation exposure to workers (OA42)

3.2 ASSOCIATED COSTS

Commenters addressed the issue of costs associated with changing to SI units only.

- Possibly significant financial implications associated with changing documents for CoCs and licensing packages to SI units (OA42)

- Implementing the SI units only provision could impact all other Parts referenced in 10 CFR Part 71, and might require rewriting licenses and parts of the regulations (OA42)

- Changing to SI units only would result in high costs and numerous errors, with no benefit (MD12) (0066)

3.3 PROBLEMS WITH NON-ADOPTION

Several commenters addressed problems with non-adoption, stating their preference to use both units.

- New drug applications and FDA regulations require use of both units. FDA reluctant to remove curie designation and move to SI units (MD19)

- Most packages currently are marked with English and SI units, which causes problems because the product and paperwork do not agree (MD19)

- In a system with only SI units, there would be no correlation between shipping papers and interior labels (MD19)

3.4 ISSUE-SPECIFIC FACTORS FOR CONSIDERATION (INCLUDING BENEFITS)

Commenters addressed specific factors for consideration in changing to SI units only.

- Because Part 71 references other Parts, changing Part 71 to SI units only would require that every NRC region, licensing agency, and license adopt SI units (0042) (0051)
- Other agencies, including EPA and FDA, use English units in their regulations (0051)
- Until the U.S. adopts SI units, NRC should continue to allow use of dual units (MD08) (MD12) (MD20) (0051)
- In Nevada, majority of first responders are volunteers who will need SI unit training (OA43)
- Most people prefer using traditional units (OA42)
- Would seriously affect inventory records development and maintenance (0049)
- States and NRC should set authorization limits in Bq, and Part 71 and DOT regulations should reflect the unit changes. The Agency should revise RAMREG-01-98 immediately (0049)
- Using only SI units for shipping could cause confusion and safety issues because curie and mR units are currently used throughout the U.S. (MD17)
- Use dual units because in the event of an accident, both units are immediately available to emergency responders to assist in determining radiation risks and potential exposure (0086)
- Many HAZMAT employees do not use SI units on a daily basis, and dual units would improve their knowledge of the equivalency of the two different systems (0086)
- Be consistent throughout Title 10 and in regulations used by other government agencies (MD08) (MD20) (0051)

Several commenters suggested, or otherwise addressed, issues surrounding implementation of a transition period.

- Conversion to SI units could be accomplished within one year (MD08) (MD17) (MD20) (0051)
- Transition for radiological workers is uncertain (0051)
- Time is needed to train employees in carrier and distribution network (MD08)
- Recommends a transition time, where dual units are used, due to highly variable training budgets (OA43)
- Minimize the transition period and include half-life values in A1 and A2 table to avoid confusion and ensure compatibility with IATA rules (0049)
- Allow for three-year transition period (0078)

4.0 RADIONUCLIDE EXEMPTION VALUES

Commenters were concerned with the implications of changing the radionuclide exemption values to harmonize them with TS-R-1.

- Current standard is "reasonably simple" and new standards will disrupt the system and make compliance and enforcement more complex (0059)
- NRC should provide a breakdown of every isotope and whether harmonization would increase or decrease the threshold (MD05)
- Tension between rulemaking responsibilities of NRC and DOT and the science used by agencies in modifying exemption values (OA44)
- Incorporation of activity concentration and activity limits for exempt material and exempt consignment is positive and helpful (0048)
- Eleven of the listed values have DOT exemption values higher than NRC exemption values, but the magnitude of change is not consistent. Might create inconsistencies in transfer of material to other licensed or non-licensed facilities (0048)
- Clarify intent of activity limit for an exempt consignment (0048)
- Issue paper provides little objective basis for exemption values (OA44)
- NRC needs to scrutinize standards to determine whether values are justified to protect human health and the environment (OA44)
- Should incorporate TS-R-1 values into Part 71 for international shipments, but reference DOT exemption values for domestic shipments in 10 CFR Part 71, unless it can be shown that these values compromised public health and safety (OA42)
- To avoid burdensome and unnecessary costs, must set up protocol for adapting DOT values for non-transportation activities (OA42)
- Concerned that DOT would not review or question IAEA standards, and that the U.S., Agreement States, and environmental organizations have not had meaningful input into IAEA forums (OA44)
- Concerned that NRC could not analyze the effect of changes on radionuclide concentrations, and could not inform the public about which radionuclides would be affected (MD05)

One commenter expressed concerns related to the issue of Naturally Occurring Radioactive Materials

- Problem in determining what is exempt, is that when examining the specific activity of a natural material, there is a natural decay chain in a secular equilibrium with all its decay progeny (MD03)
- Clarify convention for evaluating the 70 becquerels per gram exclusion limit under 49 CFR and 10 CFR Part 71 (MD03)
- Review the report from the IAEA special working group on exemptions to understand what IAEA and the drafters of TS-R-1 intended (MD03)
- Document is not an enforceable rule anywhere until it is implemented through a legislative process or administrative procedure in a country or through a national agency (MD03)

- Public needs to know where numbers came from to understand why a standard is being adopted (MD03)

- Not understanding evaluating exemption language could result in uncertain and disharmonious situations worldwide when looking at implementation in other national organizations (MD03)

- If NRC and DOT harmonize the way exemption levels are applied, it should be done consistently with the intention of NRC drafters, which can be discerned by examining the supporting documentation (MD03)

Several commenters were opposed to an increase in exemption levels.

- Appreciates NRC's efforts to eliminate the "one-size-fits-all" approach, but questioned whether the Agency's approach is the best method (AT30)

- EPA's Safe Drinking Water Standards do not define a safe dose of ionizing radiation (AT22) (AT27)

- The Agency does not appear to be operating under the assumption that there is no consensus in medicine regarding a safe threshold for radionuclide contamination (AT23)

- Growing minority concern that lower levels of radiation impact the human body more per unit than higher doses do (AT23)

- Regulatory levels established in one arena are often generalized and improperly adopted in another arena (AT22)

- Concerned with increased, but not personally-approved, personal exposure rates due to NRC's proposed changes (AT27)

- Concerned that NRC is proposing a severe relaxation of exemption values for dangerous materials (OA41)

- Make exemption values as stringent as possible to protect the public (0096)

- Keep current exemption because unaware of a public safety issue associated with the current concentration (0083)

- Implementing radionuclide specific concentrations will require procedure and computer software changes with no apparent safety benefit (0083)

Several commenters had questions related to harmonizing the radionuclide exemptions.

- Has the standard been one millirem per pear per examination? (AT27)

- Explain in laymen's terms how the changes would impact daily life and link them to real-life context (AT37)

- How did NRC establish appropriate dose levels and how does NRC decide a particular does may be problematic? (AT38)

4.1 CONSIDERATION OF RISK

Commenters addressed consideration of risk and unintended consequences of adoption of radionuclide exemption values.

- Questioned risks to public, workers, and emergency responders (0090)

- Would increase total number of shipments by requiring smaller quantities per shipment to meet the higher exemption values (MD04)

- Use/demand for oil and gas would increase (MD04)

- Significant impacts to certain industries (MD04)
- "Knock-on-effect" from NRC to DOT because States would not want to independently examine the technical aspects of the proposed rule (MD04)
- NRC should not promulgate regulations that result in decreased protection, and should not increase the amount of radioactivity allowed in packages (MD15)
- Hazards and risks must be equivalently recognized in all countries shipping radioactive material. Packaging standards should be consistent and afford required level of protection (MD17)
- Current DOT regulations protect transportation workers and the public under ordinary transport and incident/spill scenarios, and the proposed regulation does not present data to show it would significantly increase safety (0086)
- Move toward more stringent exemption values (OA41)
- Exemption values should not be increased because it might jeopardize public safety (0050) (0073)
- Clarify whole-health effects associated with the materials, and not just the cancer risk (OA46)
- Would greatly reduce the threshold definition of radioactive material, which would increase the number of radioactive shipments, and eventually lead to more accidents. Response personnel would be diverted from other tasks to respond to accidents involving shipments labeled as radioactive, that were previously considered non-hazardous (MD04)
- Concerned that personal exposure rates would increase (AT27) (0070)
- Would raise the threshold by approximately 25 percent (AT27)
- Will allow radiological materials with much higher concentrations than current exemptions to be shipped without regard to specific transportation regulations (0070)
- Opposes raising exemption values because, as acknowledged in EPA's Safe Drinking Water Standards, there is no safe dose of ionizing radiation (AT27)
- Exposure to several small doses of radiation from different sources has a cumulative, health-threatening effect (AT27)

4.2 ASSOCIATED COSTS

Commenters addressed the costs changing from current exemption values.

- Additional costs would be incurred for ensuring that activity concentrations are acceptable (MD12)
- Even with addition of exempt activity consignment approach, there would be increased characterizations costs, paperwork, and packaging processing time (MD12)
- Costs will be significant, even though low shipping volumes makes a detailed cost/benefit analysis difficult (MD12)
- Changing the definition of DOT Class 7 radioactive material could result in an additional $6 million of disposal costs (0086)
- Radionuclides, including Ra-228, Th-228, and Am-241 might become regulated

resulting in regulation of some products (MD12)

- Would be possible for shippers of certain products to seek exemptions, but the process would likely be lengthy, burdensome, and may impact operations of the affected industries (MD12)

- Significant increase in cost to classify very low level radioactive material for transportation purposes because shipping personnel would need training and be required to develop methods for making exemption determinations (MD12)

4.3 PROBLEMS WITH NON-ADOPTION

A commenter addressed the problems with non-adoption of radionuclide exemption values.

- NRC should anticipate problems with overseas shipping due to differences in exemption values; a package under the limit in the U.S. might not be exempt under the A1, A2 values (MD08)

4.4 ISSUE-SPECIFIC FACTORS FOR CONSIDERATION (INCLUDING BENEFITS)

Commenters provided information on issues related to radionuclide exemption values.

- Adoption of specific exemption values could result in radioactive metals being sold to scrap dealers and then being recycled into consumer goods (OA41)

- Each radionuclide exemption value should be carefully examined because the values were not developed as a result of an enhanced public participation process (OA44)

- The Agency should allow for public comment on assumptions, data, and scientific analyses, and not simply accept the standards (OA44)

- Include possibility of ingestion and disbursement of radionuclides and their effects on the general public in establishing exemption values (OA42)

- Effects of radionuclide exposure include neurological degeneration, not just cancer (OA46)

- Radionuclide exemption values should apply to domestic shipments to avoid the confusion shippers would face if there were different requirements for exports and domestic shipments (0049)

- NRC and DOT should require all radioactive material be shipped to the address stated on the license or by the recipient, and should require that failure to do so be reported to the NRC (0049)

- Confusion raised by requirements for shipping, licensing, and disposal could be resolved by parenthetical explanations written on the regulations (0049)

- Exemption values should be uniform across the world to eliminate mistakes and delays in shipments (MD08) (MD17) (MD20)

- To prevent conflicts between DOT and NRC regulations, NRC should reference DOT regulations and not adopt unique exemptions for transportation or adopt a separate table (MD17) (0078)

- Should streamline 10 CFR Part 71 by eliminating duplicate requirements (MD08)

- Exemptions outside the transportation regulations should only be considered for

the transportation aspect with just cause (MD08)

- DOT regulations and waste burial manifests already require knowledge of particular nuclides; little extra effort required to apply these methods to exemptions (0078)

- Exemptions should apply to all shipments to enhance compliance and make application easier (0078)

- Make a domestic exemption for low level materials, continuing to exclude materials with activity concentrations below 70 Bq/g provided they are only transported domestically (MD12)

- When the term "bulk" is equated with being unpackaged, it is inconsistent with 49 CFR definition for "bulk packaging" that refers to specific volume and mass ranges (0083)

- Proposal may eliminate certain disposal facilities from consideration without sufficient scientific or technical justification (0086)

Some commenters discussed the need for updates to reflect the new A1/A2 values.

- To identify, measure, and apply the mixture rule for radionuclides when determining the basic values for exempt material, the calculations and computer codes will need to be updated to reflect the new A1/A2 values; this will increase time to prepare a shipment (MD17)

- One year should be allotted for making appropriate updates (MD08) (MD20)

5.0 REVISION OF A_1 AND A_2 VALUES

Commenters addressed revisions to A1 and A2 values.

- Harmonization would not increase safety, but it would be expensive (MD05)
- Proposal is unfair because burden would fall largely on radiopharmaceutical manufacturers, while benefits primarily accrue to transporters (MD05)
- Revisions would increase allowable activity levels for many nuclides, violating the principle of increased safety by conforming with TS-R-1 (MD05)
- NRC should provide a breakdown of which radionuclides would have increased, decreased and unchanged levels (MD05)
- Should not revise values because would be introducing another inconsistency into NRC regulations if ICRP 61 were adopted (0083)
- Unclear why NRC would consider making regulations consistent with IAEA standards, but not with ICRP standards (0070)
- Risk eroding public confidence if accept and then ignore advice of international experts; need strong justification to discount ICRP recommendations (0070)
- Partial adoption of ICRP 61 by U.S. should not be a factor in transportation regulations because universal adoption of ICRP 61 is reflected in TS-R-1 A1/A2 values (MD08) (MD20)
- Models used to estimate the allowable levels have large uncertainties (MD06)
- Increasing A1 and A2 levels may not increase total risk, because of the underlying models' uncertainty (MD06)
- Opposes changes to dose projection because they would result in "dilution as the solution to pollution;" opposes changes that increase amount of radioactivity present in land, air, or water due to increasing the acceptable activity levels for existing dose levels (AT22)
- Existing values for exempt quantities are reasonable from a shipping standpoint, though there are problems with the implications beyond transportation (OA41)
- Revisions to A1 and A2 values would be a shift from an activity to a dose-based limit system, which is the same as the revisions to 10 CFR Part 20 (MD08)
- Opposed revisions in Part 20 and would oppose them in Part 71 for transportation because dose-based limits are more difficult to verify and enforce than activity levels (MD15)
- Any proposed rule should provide a detailed discussion of why A1 and A2 values are being changed for each affected nuclide (0050) (0073)
- Concerned that conforming with TS-R-1 would hinder use of molybdenum-99 generators (MD19)
- Encourages NRC and DOT to continue grandfathering effort (MD19)
- Opposed to proposal because it would reduce A1 value for Californium-252 (0058)
- Concerned with loosening definition of radioactive material (MD04)
- A1 and A2 values for some nuclides have gone up, suggesting overdue relaxing of a too-tight classification (MD04)

- Using assumptions that are too conservative, see thresholds for radioactive material lowered too far, for some materials by a factor of almost 10 (MD04)

5.1 CONSIDERATION OF RISK

Commenters addressed the risks associated with revising A1 and A2 values specified in 10 CFR Part 71.

- Opposes any revisions because they would substantially increase volume and amount of radiation, which would lead to increased risk (MD05)

- Because A values are based on models with large uncertainties, fluctuations in those values are likely subsumed within the models' uncertainties; thus overall risk would not necessarily increase (MD12)

- Opposes increase in allowable levels because it implies assumption of a "standard human being," but exposure to radionuclides might not affect each person identically (AT27)

- Little need to reduce A1 value for Cf-252 because there is little risk associated with use of "properly designed, constructed and maintained Type A packages" (0058)

- Issue needs additional thought because there may be risks besides cancer from exposure (0090)

- Questions if the change would increase or decrease public and worker protection, and what effect it would have on emergency responders (0090)

5.2 ASSOCIATED COSTS

Commenters discussed associated costs.

- Conforming with TS-R-1 will not likely increase or decrease safety, but will impose non-trivial costs on industry; therefore how the effort can be justified if a cost/benefit analysis is conducted? (MD05)

- Changing A1 value for Californium-252 could cost between $500,00 and $1.5 million; consumers' source costs therefore would increase (0058)

5.3 PROBLEMS WITH NON-ADOPTION

Commenters addressed issues related to non-adoption.

- Current grandfather clause specifies a 20 curie level for domestic uses only, and therefore no 20-curie generators can be shipped to Canada; important harmonization issue because 90 percent of the medical diagnostic and therapeutic studies completed are based on technetium generators (MD19)

- A1/A2 values in TS-R-1 are well documented and practical for transportation; appears to be no practical alternative to adoption of these values in Part 71 (OA42)

5.4 ISSUE-SPECIFIC FACTORS FOR CONSIDERATION (INCLUDING BENEFITS)

Commenters addressed issue-specific factors regarding the revision of A1 and A2 values.

- Continue to grandfather A2 values for molybdenum-99 to 20 curies. There is an industry trend to use larger generators in pharmacies (MD19)

- Explain how A1 values for Cf-252 were estimated in TS-R-1, and the note that further study be undertaken has not been adequately explained (0058)

- Although specific values of the A1/A2 table should not differ from those in TS-R-1, footnote "c" in 49 CFR 173.435 for molybdenum-99 should be retained; molybdenum-99 generators have been shipped safely for many years without risk or exposure to the public (MD08) (MD20)

- Would be useful for NRC to adopt the revised values because airlines and other carriers will likely use these values; differing regulations for different shipments would cause confusion (0049)

Commenters endorsed the adoption of new A1 and A2 values.

- Change to use A1 and A2 values is an improvement over previous methods and provided a safety basis for the assigned values (0078)

- Exceptions for domestic use should not be granted (0078)

- Since ICRP 61 values are already reflected in A1 and A2 values, partial adoption of ICRP 61 values should not be a factor (MD17) (0078)

- Supports the adoption, with exceptions (MD12)

- Willing to assist the Agency in developing the appropriate Q-system parameters and performing the necessary calculations to determine numerical values for these radionuclides (MD12)

Commenters said A1 and A2 values should continue to be used for transportation because it is not practical to change systems unless the system is uniformly recognized around the world.

- No uniformly recognized system exists today (MD08) (MD20)

- Specific values of A1 and A2 table should not be different from those in TS-R-1, but should adopt DOE's proposed rule change to TS-R-1 to keep the A1 value for Cf-252 at 5 mg (MD17)

6.0 URANIUM HEXAFLUORIDE PACKAGE REQUIREMENTS

Commenters addressed issues related to uranium hexafluoride package requirements.

- Supports concept that certified packages meet or comply with performance requirements (MD20)
- Concerned with an exception allowing UF-6 packages to be evaluated for criticality without considering the in-leakage of water into the containment system. NRC should consider whether this is a change from current regulation, and whether it should be adopted (OA41)
- Need to conduct a study examining scenarios leading to an undesirable event, the likelihood of such an event, and the consequences, and then measure the event against a transportation safety goal (0052)
- There already have been instances of manufacturing defects with uranium hexafluoride packages; fatal accident in Tokaimura, Japan shows that worker mistakes can lead to inadvertent criticality or water inside an uranium hexafluoride package (0050) (0073)
- Sees little value in the proposed changes (MD12)
- Changes are result of two separate international initiatives and need not be integral part of regulations intended to minimize radiological hazards (MD12)
- Does not support TS-R-1 prohibition of pressure relief devices radiological hazards (MD12)
- Industry agrees with assessment that NRC-certified packages comply with the package performance requirements; industry working with DOT to address non-fissile UF6 packages (MD08)
- UF6 packages approved by DOT in 10 CFR Part 173.417 include fissile and non-fissile packages (0078)
- Instead of TS-R-1 guidance, NRC should do the following: clearly define the types of special design features that would be acceptable to ensure no single packaging error would permit leakage, issue the technical basis for accepting these features, and revise the existing rule to make the features part of the rule rather than an exception (0054)
- Opposes exceptions; packages should be required to meet all tests, including internal pressure, drop, and thermal (AT27)

6.1 CONSIDERATION OF RISK

Commenters addressed the risks associated with uranium hexafluoride packaging.

- Concerned with safety margins for uranium hexafluoride packaging (0050)
- Packages should be examined for criticality with the consideration of in-leakage of water (0050) (0073)
- The Agency should develop a risk assessment methodology for UF6 packages (0054)
- Without quantifying risk and estimating uncertainty and then comparing these results to a transportation safety goal, NRC cannot be assured of protecting public health and safety and the environment (0052)

6.2 ASSOCIATED COSTS

No comments were received.

6.3 PROBLEMS WITH NON-ADOPTION

Commenters addressed problems with non-adoption of uranium hexafluoride package requirements.

- Recognize ANSI N14.1 for UF6 packages and ISO7195 as equivalent standards (MD10) (MD20)

6.4 ISSUE-SPECIFIC FACTORS FOR CONSIDERATION (INCLUDING BENEFITS)

Commenters addressed issue-specific factors related to uranium hexafluoride package requirements.

- Proposed change would likely impact DOE and its sites (OA41)
- Proposed change is not expected to significantly impact the commenter's operations (MD12)
- Recognize ANSI 14.1 and ISO 7195 as equivalent standards for performance, safety, and compatibility with Protective Shipping Packages; this would allow manufacturer to dual rate/certify the UF6 cylinder and avoid confusion (0061)
- ANSI 14.1 and ISO 7195 are consistent in principle (MD08)

7.0 INTRODUCTION OF CRITICALITY SAFETY INDEX (CSI) REQUIREMENTS

Commenters addressed the introduction of criticality safety requirements.

- A labeling system for the index is a good idea (0090)
- Introducing a Criticality Safety Index (CSI) is an effective solution to the confusing double meaning for the current Transport Index (TI) (OA42) (0078)
- Use of the CSI should enhance shipment safety with a minimum burden on shippers (OA42)
- The CSI must be consistent with the TI; in general, NRC regulations must either be consistent with or match the DOT regulations (0083)
- The change provides clear separation of the reasons to limit the number of packages in a shipment (MD12)
- TI will give only an indication of the direct radiation hazard, and the CSI provides control of the criticality potential (MD12)
- With appropriate training, workers and managers in transport should be able to use the new system to control exposure risks more closely (MD12)
- Should not decrease separation distance requirements which are necessary to reduce the possibility of criticality occurring (AT27)
- Does not support adding CSI requirements because the TI already incorporates the more restrictive of the two values: dose and criticality. Adding the CSI requirements will not result in any added safety (MD20)
- Additional costs and efforts necessary to add the CSI to package labels and shipping paperwork outweigh any benefits (MD12)
- Amend 10 CFR Part 71 to include the CSI in order to control criticality (AT30) (AT31)
- The current practice, using the TI as the means to control criticality safety, does not provide responders with information on the undamaged condition of the package (AT30) (AT31)
- Use the TI to indicate the radiation level from the undamaged package (AT31)
- Do not allow transportation of plutonium by air, due to safety and terrorism concerns (AT25 *11 audience members agreed also) (AT27)
- Concerned with the lack of technical justification for the claim that adoption of the criticality safety requirements would result in "equivalent safety" (AT30)
- Safety far outweighs efficiency when considering relaxing regulations (AT30)
- If there are documents to show that increased efficiency will not jeopardize safety, the public needs to see them in order to comment effectively (AT30)

7.1 CONSIDERATION OF RISK

Commenters addressed risk considerations with CSI requirements.

- Should include the underlying technical justification for the term "equivalent safety" (AT30) (OA41)

- Concerned that the change would allow for more packages in a single shipment (OA41)

- How can NRC ensure the safety of criticality requirements? (AT30)

- Adding CSI requirements would create more opportunities for human error (MD20)

7.2 ASSOCIATED COSTS

Commenters addressed costs associated with the introduction of the CSI requirements.

- Benefits of adding the CSI requirements outweighed by the costs of additional labor, material, training, and administration (MD20)

- Introduction of the CSI requirements will impact training costs (MD12)

7.3 PROBLEMS WITH NON-ADOPTION

No comments were received.

7.4 ISSUE-SPECIFIC FACTORS FOR CONSIDERATION (INCLUDING BENEFITS)

Commenters addressed factors for consideration in introducing the CSI requirements.

- Industry supports the use of the new "CSI" label in conjunction with the TI label because separate labels are more meaningful, provide additional safety in transport, and may make some shipments more efficient by allowing an increase in the number of packages per conveyance or cargo hold (MD08)

- The only conceivable issue associated with using two different TI values for one shipment is if the two values are confused; should not happen, assuming people and organizations refer to them properly (MD08)

- Supports the adoption of the CSI because enforcement and compliance are greatly simplified by leaving TI as a value that can be determined largely by direct reading instruments (0059)

- Addition of CSI makes positive identification of fissile shipments much easier (0059)

8.0 TYPE C PACKAGES AND LOW DISPERSIBLE MATERIAL

Commenters provided information on Type C Packages and Low Dispersible Material requirements. Some commenters supported requirements for Type C Packages and Low Dispersible Material.

- Most air carriers follow ICAO regulations and will not accept goods unless shipped in accordance with TS-R-1 (MD10)
- Changes will not have a significant impact on operations (MD12)
- NRC should remove the plutonium-specific air requirements and replace them with the proposed requirements (MD08) (MD17) (MD20)

Some commenters did not support the proposed revisions.

- Supports current standard for plutonium air transport (OA41)
- Increase minimum standard to 129 meters per second to allow for the possibility of two airplanes colliding with one another (MD09) (AT27)
- Conduct testing sequentially to show cumulative effects on package (MD09)
- Postpone adoption of TS-R-1 requirements until questionable contents of TS-R-1 are resolved by the IAEA and the ICAO Dangerous Good Panel, and until ST-2 is finalized and released (MD09)
- Subject changes to packaging requirements to *de novo* technical review, and justify independently as protective of safety (OA44)
- Incorporate LDM concept into U.S. regulations (MD12)
- Reevaluate existing regulations for plutonium and clarify the relationship between Type C package requirements and any domestic requirements which are different (MD12)
- Increases in the number of shipments by a factor of between three and 10 (OA42)

Other commenters posed questions about the proposed requirements.

- How will NRC choose between 0360, IAEA standards, standards proposed by trade associations, or some other option (MD06)
- At what point to DOT and NRC consider the option of not permitting some types of transport? (MD15)
- What scenario did NRC base the value of "90 meters/second impact test) on? (AT30)
- Do Reavis 3300 containers meet Type C certification? (OA42)

8.1 CONSIDERATION OF RISK

Commenters provided information on risk considerations with Type C Packages and Low Dispersible Material. They provided the following recommendations.

- Consider what tests would be practical for demonstrating compliance with the Type C standards (AT27)
- Require that packages be able to be dropped from a plane in mid-air without the package being breached (AT27)
- Consider impacts on public safety (AT27) (OA42)

8.2 ASSOCIATED COSTS

Commenters provided information on the costs associated with Type C packages and Low Dispersible Material.

- Medical costs will increase to reflect higher transportation costs (OA47)
- Food safety costs will increase because of FDA-approved food irradiation (OA42)
- Total costs will increase by at least 25 percent due to replenishing units and excess transportation charges (OA42)
- Shipping costs will increase (OA42)
- Consider medical costs (such as Medicare costs and hospital costs), because process irradiators are needed for medical sterilization (OA42)

8.3 PROBLEMS WITH NON-ADOPTION

A commenter provided information on non-adoption problems regarding Type C packages and Low Dispersible Material.

- Plutonium would never be flown into the United States because TS-R-1 requires that all Type C packages and all Low Dispersible Materials need multilateral approval. Because of the MOU between DOT and NRC, DOT cannot approve these shipments without NRC approval (MD06)

8.4 ISSUE-SPECIFIC FACTORS FOR CONSIDERATION (INCLUDING BENEFITS)

Commenters provided specific factors for consideration regarding Type C packages and Low Dispersible Material.

- If the activity content is limited to the thresholds specified, then the impact on air transport of currently certified Type B packages would be minimal (MD08) (MD17) (MD20)
- Efforts to develop the testing method or acceptance criteria should be pursued later, given that the need for the package is a number of years in the future (MD08) (MD20)
- Process irradiators ship approximately 50 million curies a year, probably by air, not boat or freight. If a limitation is placed on air transport for radioisotope quantities such as Cobalt-60, the number of air shipments would increase by a factor of three to seven (OA42)

9.0 DEEP IMMERSION TEST

Commenters provided information on the proposed changes to the deep immersion test. Some commenters supported the proposed requirement.

- The proposed changes would not have a significant impact on the commenter's program because their packages containing greater than 10^5 A2 are already evaluated for deep immersion or already have been grandfathered (MD12)

- U.S. and IAEA transportation regulations should be consistent, due to the international nature of transportation (MD08) (MD17) (MD20) (0078)

Some commenters opposed the proposed requirement.

- It is insufficient and unrealistic (AT27)

- Need definitions of "rupture" and "buckling" to know which term is more stringent (OA41)

- The language revision makes the exception level more conservative, and the criteria for meeting the requirement less specific. The current criteria for meeting the requirement should be used as a specific definition for the TS-R-1 language of "no rupture." (MD12)

- Suggested that the present criteria be maintained and extended to cover all packages with activity levels greater than or equal to 10^5 A2 quantities, with a note that this is more conservative than TS-R-1 requirements. This would eliminate the requirement for special review and certification of U.S. origin package designs. For non-irradiated fuel element shipments, there would be no impact on availability and shipping costs because there are few shipments of the required quantities of this material (OA42)

Some commenters responded to NRC's question about whether package designs originating from the U.S. have to be specifically reviewed and certified before shippers can export them.

- If the response is not specific to the deep immersion test but applies to all package design criteria, then the shipment of U.S. certified package designs for import/export use beginning in mid-2001 is entirely dependent upon approval of such designs to TS-R-1 performance standards (MD08) (MD17) (MD20)

- Failure to grant U.S. competent Authority Certifications for such designs would seriously hinder the industrial radiography industry, and place U.S. package designers and manufacturers at a strong competitive disadvantage (MD08) (MD17) (MD20)

Other commenters posed questions regarding the proposed requirements.

- What are the criteria for a special form A1 quantity, and is the deep immersion test necessary for BU packages for special form materials? (OA42)

- What technical justification exists to relax our test criteria for packages of irradiated nuclear fuel? (AT30)

- Will previously approved packages be grandfathered, or will they need to be re-certified by means of a deep immersion test? (0066)

- How does 105 A2 compare with 106 Ci? (AT30)

- Is it an oversight that BU packages containing A1 special form sources are exempt from this test? (OA42)

9.1 CONSIDERATION OF RISK

A commenter provided information regarding risk considerations of the deep immersion test.

- The proposed requirements do nothing to ensure the safety of the packages (AT30)

9.2 ASSOCIATED COSTS

No comments were received.

9.3 PROBLEMS WITH NON-ADOPTION

No comments were received.

9.4 ISSUE-SPECIFIC FACTORS FOR CONSIDERATION (INCLUDING BENEFITS)

Commenters provided information on specific factors for consideration on the deep immersion test.

- The Lawrence Livermore National Laboratory did not use the term "rupture" when a tritium-filled underground tank leaked into the ground and groundwater (OA41)

- Because very few packages exceed 10^5 A2, industry has not assessed the impact on availability of packages and shipping costs if all packages with an activity greater than 105 A2 are required to pass the immersion test (MD08) (MD17) (MD20)

10.0 GRANDFATHERING PREVIOUSLY APPROVED PACKAGES

Commenters provided information on the proposed rulemaking for grandfathering previously approved packages.

Several commenters support the proposed provision to grandfather previously approved packages.

- Supports the proposal, assuming new regulations would continue to be stricter (AT30)
- Provision is necessary otherwise NRC would have to set aside hundreds of long-term disposal sites for the various Type B quantity containers currently in use at hospitals and research institution (OA42)
- Older packages should be grandfathered unless safety deficiencies are identified (MD08) (MD17) (MD20) (0057) (0078) (0083)
- Grandfathering should be allowed for domestic shipments, even though it is not allowed for international shipments under TS-R-1 (MD08) (MD17) (MD20)
- Grandfathering should not be limited to the last two major revisions. Grandfathering provisions in the current 10 CFR Part 71.13 should be retained. The approval of fabrication should be revised to reflect TS-R-1 limitations of approval within the last two major revisions or re-certification prior to fabrication (0051)
- Existing packages (even older ones) are safe and durable, because they must be maintained in accordance with the heightened quality assurance regulations of TS-R-1 (MD08) (MD10)
- NRC may immediately withdraw a license if a particular package created a safety concern (MD08) (MD12) (MD17) (MD20)
- TS-R-1 allows for a phase-out of manufacturing of any packages that are not certified to the 1996 version of TS-R-1 by December 31, 2006 (MD08) (MD20) (0051)

Other commenters opposed the grandfathering provision.

- While it is important for more stringent requirements to apply to all existing containers, relaxed provisions would effectively make new containers less safe. In such instances, it is preferable that older provisions remain in effect, instead of the newer, relaxed provisions (AT22) (AT27)
- Opposed grandfathering existing packages, stating safety as a concern (MD05)

Several commenters provided recommendations to NRC regarding the grandfather requirement.

- Include a grandfathering provision for continued transportation of packages, such as fuel C-spec, Certification of Compliance (CoC) packages at NRC, and DOT spec packages (OA42)
- Incorporate specific requirements into the grandfathering provisions in order to maintain an effective package program. Manufacturers of CoC containers or packages should be allowed to show, by calculations or testing, that upgraded standards and TS-R-1 have been achieved (OA42)
- Fabrication of a new packaging to meet existing design approvals could only occur on a case-by-case basis (MD08) (MD20)

- Older packages should follow the 1967 edition of SS #6 that requires old packages to be re-certified, removed from service, or shipped via exemption (AT27)

- Perform a backfit analysis and add it as a requirement to Part 71 (0066)

- Incorporate "Packages that have been prepared for transport prior to (five-year effective date) may be offered for transport provided that the labeling, marking, and placarding provisions of the regulations in effect at the time of shipment are complied with." (MD12)

- Create a system that would allow presently designed packages to be used for a reasonable amount of time after changes to the regulations are adopted (MD10)

Some commenters raised other issues related to grandfathering.

- TS-R-1 and its requirements allow the continued use of existing packages with a valid certification, however, the requirements do not allow the continued manufacturing of new packaging (MD08)

- Depending on the types and numbers of packages impacted, if older packages were removed from service, then their ability to transport radioactive material could be impacted (0083)

- Grandfathering should be based on technical significance of regulatory changes, and not on an arbitrary number of changes to regulations (MD12)

- Grandfathering should prohibit construction of new packages that do not meet regulatory conditions and should allow the continued use of packages proven safe and effective, making replacement necessary only under certain conditions (0059)

Many commenters raised issues regarding the time frame of the certification license.

- A three or five-year certification license is too short (MD08)

- The limited time period (proposed two-year cycle) could result in regulatory changes that affect a package in the middle or end of its design and licensing process because it takes two to three years to fully design and test a new package. The U.S. might adopt a different version of the regulation on a different schedule without knowing what standards they should be approving to (MD08) (MD10) (MD17) (MD20)

- Once a package is approved to the existing standard, its use should continue to be authorized as the packages does not become "unsafe" simply because of a regulatory wording change (MD17)

- The proposed program may be possible if it is conducted as a U.S. regulators update regulations -- i.e., with minor continuous change -- and with major change occurring only periodically (MD08) (MD17) (MD20)

- The two-year cycle would require re-certification at least every six years (MD12) (0051)

- As part of re-certification, every cask's original design might also have to be re-certified, causing additional costs without significantly improving safety (0057) (0066)

- The shorter cycle would likely put pressure on cask designers to make safety a more important design element (AT30)

- A two-year cycle would create confusion on the part of the shippers and officials and thus interrupt shipments (MD20)

- Package designs should be issued for a fixed period, such as 20 years, to assure that they do not become obsolete before they are manufactured (MD08) (MD20)

Commenters posed questions to NRC.

- Who will be the party responsible for determining when a package is no longer certified? (0083)
- How many packages are currently available for shipping radioactive materials? (MD05)
- Can NRC clarify what requirements would be kept in the IAEA regulations and what requirements would be kept in the U.S. regulations? (AT27)
- Clarify "full compliance with TS-R-1 requirements." Will NRC consider partial compliance with TS-R-1? (AT30)
- What pressure would be put on industry or cask makers to bring grandfathered casks into compliance? What would be the time frame for bringing grandfathered casks into compliance? (AT30)
- If NRC does not change the regulatory 10-year time frame, would there be requirements to modify grandfathered casks? (AT30)

10.1 CONSIDERATION OF RISK

A commenter provided information on risk considerations regarding grandfathering previously approved packages.

- The proposed cycle would have a significant adverse impact on the ability of the Navy to refuel and de-fuel the nation's nuclear powered warships. All existing Naval Nuclear Propulsion Program shipping containers could become uncertifiable in as few as six years (MD12)

10.2 ASSOCIATED COSTS

Commenters provided information on the costs associated with grandfathering previously approved packages.

- Grandfathering all current CoCs would greatly reduce costs and administrative burdens (OA42)
- The expense of designing and fabricating large Type B and spent fuel packages cannot be justified if the potential lifetime of the cask is limited to a time period as short as six years (0051)
- The cost of recertifying existing casks would be prohibitive (0057)
- A 10- or 20-year certification license would be more cost-effective (MD08)

10.3 PROBLEMS WITH NON-ADOPTION

No comments were received.

10.4 ISSUE-SPECIFIC FACTORS FOR CONSIDERATION (INCLUDING BENEFITS)

A commenter provided issue-specific factors for consideration in grandfathering previously approved packages.

- There could be unintended consequences if grandfathering ever makes existing safe packages illegal. It is possible that instead of re-qualifying, changing, or replacing the package, the use might go completely out of compliance with the other transport regulations in order to avoid detection and inspection (0059)

11.0 CHANGES TO VARIOUS DEFINITIONS

Commenters provided information on changes to various definitions in the proposed rule.

- Adopt definitions to the extent the terms are used in the updated regulations (MD12)
- Clarify the terms "rupture," "collapse," "buckling," and "in-leakage." (OA41)
- Opposed to adopting the TS-R-1 definition identifying the specific types of packaging allowed for Class 7, and unless DOT revises its regulations, there will be a conflict domestically (MD08) (MD17) (MD20)
- Clarify the differences between "uniformly distributed," "distributed throughout," and "homogeneous." (MD08) (MD17) (MD20) (0078)
- No conflict identified between TS-R-1 and other programs' definitions (0078)
- Need additional knowledge of how the revised definitions will be used in order to estimate the impact of the changes to definitions (MD12)
- The proposed definitions of "confinement system" and "package" are indistinguishable for packages intended to transport fissile material. Use only one term, or clearly distinguish between the two. If the definition of "confinement system" is added, the term "competent authority" must also be defined. If the definition of "package" is incorporated, then definitions of "excepted" and "industrial" must also be added (MD12)
- Paragraph 225 introduces the term "low dispersible radioactive material" but fails to provide any guidance about what characteristics qualify the material (0083)
- The definition of "low dispersible radioactive material" should not refer to surface contamination, but rather activation of a solid material (0049)
- Retain the current 2000 picocuries per gram radioactive material definition for shipments within the U.S. and determine shipping categories based on external gamma flux readings (MD04)
- Add a definition for "sealed source." It means "(for use of A1 values) encapsulated radioactive material that was designed and manufactured under a specific license and has been assigned a sealed source identification registry number." (0049)
- The Confinement System definition should be revised to include fuel assemblies, the PWR Basket, and the Shipping Cask, since all three provide different levels and degrees of confinement (0066)

11.1 CONSIDERATION OF RISK

No comments were received.

11.2 ASSOCIATED COSTS

No comments were received.

11.3 PROBLEMS WITH NON-ADOPTION

No comments were received.

11.4 ISSUE-SPECIFIC FACTORS FOR CONSIDERATION (INCLUDING BENEFITS)

No comments were received.

12.0 CRUSH TEST FOR FISSILE MATERIAL PACKAGE DESIGN

Commenters provided information on crush test requirements for packages containing fissile material. Several commenters supported the proposed requirements.

- Adopt the testing sequence to assure international uniformity (MD08) (MD20)

Other commenters opposed the proposed requirements.

- Keep the current regulations, requiring the crust test and free drop test (MD12) (AT22) (AT27) (0078)
- The crush test is especially useful for large packages (AT22)
- The proposed requirement is problematic because the two types of test have different results (OA41)
- Supports the crush test, especially for shipments that are transported by rail (MD12)
- The proposed requirements would require re-analyzing packages currently used for the Naval Nuclear Propulsion Program (NNPP), however, it would not significantly impact the NNPP because most of the packages weigh more than 1,100 pounds (MD12)

12.1 CONSIDERATION OF RISK

A commenter provided information regarding the risks associated with a crush test for fissile material package design. The commenter suggested the following.

- Increase the reliability of the crush test by: making it a physical test, rather than a computer test; using full-scale packages that are loaded with non-radioactive materials; including crush test for all package sizes; increasing test parameters to reflect real-world conditions (AT22)

12.2 ASSOCIATED COSTS

A commenter provided information on the costs associated with the crush tests.

- It would be an unfair and costly burden to eliminate the 1000A2 activity limit without providing flexibility in test sequencing (0066)

12.3 PROBLEMS WITH NON-ADOPTION

No comments were received.

12.4 ISSUE-SPECIFIC FACTORS FOR CONSIDERATION (INCLUDING BENEFITS)

Commenters provided information on issue-specific factors concerning crush tests for fissile material package design.

- The impact of the elimination of 1000A2 activity limit for fissile material packages having a mass not greater than 500 kg and overall density not greater than1000 kg/m^3 based on external dimensions is currently unknown (MD08) (MD20)
- Remove the 1000A2 threshold for fissile packages on the grounds that A2 levels are intended to be an index of radiological hazard rather than critically potential and that it is inconsistent with TS-R-1 (MD12)

13.0 FISSILE MATERIAL PACKAGE DESIGN FOR TRANSPORT BY AIRCRAFT

Commenters provided information regarding the proposed requirements for fissile material package design for transport by aircraft. Some commenters supported the proposed requirements.

- Supports the requirements, as they are generally parallel to those already in place for surface mode accidents (MD12)

- The regulations need to be understood consistently by the people who approve package designs for transport of fissile materials by air. Because ICAO will adopt TS-R-1 in early 2001, shipments must meet the requirements in TS-R-1 for fissile materials (MD08) (MD20)

- The impact on the Naval Nuclear Propulsion Program (NNPP) is likely to be minimal because more NNPP shipments of radioactive material via air transport are excepted packages (MD12)

- TS-R-1 tested should be adopted in total, to include fissile material package design for transport by aircraft (0078)

Other commenters opposed the proposed requirements.

- Concern for the comprehensibility of the regulations for Type B or below quantities of fissile materials (MD10)

- Consider a streamlined approval process for designs of air transport of fissile material (MD08) (MD20)

- Do not have any radioactive materials transported by air, and due to the case of a crash in a hard-to-reach area fire test requirements should specify at least a two-hour standard (AT27)

- Allowing the transport of plutonium by air is in conflict with the regulations used in the 1970s (0074)

A commenter posed a question regarding fissile material package design.

- When and in what situations will the transportation of fissile level material by air be required? (AT32)

13.1 CONSIDERATION OF RISK

No comments were received.

13.2 ASSOCIATED COSTS

No comments were received.

13.3 PROBLEMS WITH NON-ADOPTION

No comments were received.

13.4 ISSUE-SPECIFIC FACTORS FOR CONSIDERATION (INCLUDING BENEFITS)

No comments were received.

14.0 SPECIAL PACKAGE APPROVALS

Commenters provided information concerning special package approvals. Some commenters supported the special package approvals.

- Supports proposal to create a system for providing special package approvals without using the existing exemption requirements (MD06)
- Part 71 regulations should be consistent for Certificate of Compliance holders and licensees (0083)

Other commenters opposed special package approvals.

- NRC should review and grant each application on a case-by-case basis, and not use a generic regulation for special package approvals (MD16) (AT22) (AT27) (OA41) (0090)
- First responders, emergency management coordinators at the local level, and the people in transport corridor communities have a right to information that a specialized exemption process would provide (0090)
- Concerns for the public need to be given adequate weight in decision-making (0090)
- Eliminate special package approvals from the scope of the rulemaking effort, unless a correlation to IAEA's regulations can be clarified (0050) (0073)
- Adoption of a "Special Arrangement" provision may be more efficient than a special packages approval because of the various types of vessels that must be addressed (OA42)
- A special arrangement certificate would be beneficial to allow the transport of the damaged equipment for disposal when a Type B package has been damaged, continues to secure and shield the sources, but does not meet compliance standards (MD17)
- Category 3 packages should be excluded from this rulemaking. The many Cobalt-60 and Cesium-137 irradiators originally used for research, should be examined for future rulemaking (OA42)
- IAEA's special arrangement provision applies to shipments between countries in nonconforming packages, and does not lend itself to domestic shipments (MD07) (MD08) (MD20)

Commenters provided information on large objects.

- Concern for the definition of a "special large object" (MD12) (OA41)
- If special provisions are added then the term "large" must be defined with respect to both size and weight (MD12)
- Consider revisions to Part 71 to address large objects in general (including reactor vessels, steam generators and condensers, and components from reactors undergoing decommissioning activities) (MD07) (MD08) (MD20) (0066) (0078) (0083)
- Objects such as oil tubes and pipes, that are impossible to package due to their size, should be exempted from transportation requirements outside of the current requirements (MD04)

Commenters raised issues related to Type B quantities.

- Type B orphan sources should be included in a separate rule from the special large packages, because there could be an overlap between orphan sources and Type B quantities (OA42)

- NRC and DOT should collaborate to address the possibility of initiating a program that would minimize package review costs of decommissioning Type B quantities of cobalt-60 and cesium-137 (OA42)

Commenters raised issues related to the Trojan Reactor Vessel (TRV).

- The Trojan Reactor Vessel (TRV) shipment is not an adequate basis for determining whether or not to remove the requirement for exemptions for special packages and replace it with other provisions (MD05) (MD06) (MD16)

- If TRV shipment is the baseline for determining whether to revise the regulations, NRC should limit the scope of this special approval. Evaluation of river and barging conditions are, in reality, under the jurisdiction of the Coast Guard (MD06)

- Revise Part 71 to incorporate the risk-informed basis of the TRV package for other special package approvals (OA42) (0066)

- The special arrangement provisions should be included in TS-R-1 as the model under which shipments such as recent transport of the TRV could be accommodated (MD12)

One commenter posed a question to NRC.

- Will the special package approvals provision apply only to vessels and not to steam generators or reactor internals? (MD05)

14.1 CONSIDERATION OF RISK

Commenters provided information about risk considerations with special package approvals.

- Consider the mode of transportation and avoid letting unqualified person be transporters (AT22) (AT27)

- Transportation risks, in many cases, are much lower than the potential risk of transferring cells at a facility to legal shipping containers (OA42)

- Revising Part 71 to include Category 2 would be difficult because of the associated risks (OA42)

14.2 ASSOCIATED COSTS

A commenter provided information on the costs associated with special package approvals.

- A relaxation of the requirements of special package approvals would potentially reduce the cost of these shipments (MD12)

14.3 PROBLEMS WITH NON-ADOPTION

Commenters provided specific issues that NRC should consider when deciding whether to propose a special package approval process and how that process should be defined.

- With respect to special shipments, any change made to 10 CFR Part 71 will need to be specific to those items that are going to be regulated under NRC's MOU. Some large components such as steam

generator and demineralizers and pressurizers, will likely fall under DOT's jurisdiction, while NRC would regulate items like reactor pressure vessels (e.g., the Trojan reactor pressure vessel) (MD07) (MD08)

Commenters provided information on the issue of whether the risk-informed basis used specifically for the approval of the TRV shipment should be approved and adopted for other special package approvals.

- A precedent has been established, and the possibility exists that the requirements placed on the shipment of the TRV might have been more restrictive than might have been determined as necessary at this particular point in time (MD07)
- The Trojan shipment review is a point of reference for the basis of other similar shipments, but each case should be assessed on its own special circumstances (MD08) (MD17) (MD20)

15.0 EXPANSION OF PART 71 QUALITY ASSURANCE REQUIREMENTS TO HOLDERS OF, AND APPLICANTS FOR, A CERTIFICATE OF COMPLIANCE

Commenters provided information on the proposed rulemaking expansion of Part 71 (Quality Assurance Requirements to Holders of, and Applicants for, a Certificate of Compliance). Some commenters supported the proposed expansion.

- Cask designers and fabricators should be held responsible, as are parties on the reactor side (MD05)
- The proposed changes to expand the quality assurance requirements will not have a significant impact on the Naval Nuclear Propulsion Program (MD12)

Other commenters opposed the proposed expansion.

- Extending responsibility to fabricators or certificate holders would likely encourage fabricators to exit, because of the proposal's excessive regulatory and paper burden (MD08) (MD18)
- NRC might be regulating packages for which it is not responsible under NRC's MOU, resulting in issues when certificate holders do business with the Department of Energy (MD06)
- Issuing a notice of violation (NOV) instead of a notice of nonconformance (NONC) will not result in additional compliance. The current Quality Assurance control on the Part 71 packages under Subpart H is adequate (MD17)

Commenters provided recommendations to NRC.

- Clarify the current proposed provisions, specifically what is in the current regulations and what would be in the proposed regulations (MD12)
- Make publicly available the proposed rule language, and be certain NRC knows all cask producers, in order to ensure effective regulatory compliance (AT22) (AT27)
- Do not assume that "all folks will always conform with all aspects of Part 71 regulations given the abundant evidence of Part 72 conformance problems" (0050) (0073)
- Maintain consistency of quality assurance provisions between 10 CFR Parts 71 and 72 for dual purpose casks used for storage and transportation of spent nuclear fuel and high-level radioactive waste (MD08) (MD15) (MD20) (OA42) (0078)
- Establish the distinction between Part 71/72 packages used to transport/store spent fuel and Part 71 packages used to transport sealed radioactive sources. Also, specifically exempt 10 CFR Part 50 reactor licensees from participation in nuclear power-specific quality assurance activities (OA42)

15.1 CONSIDERATION OF RISK

A commenter provided the following suggestion regarding the consideration of risk for expanding the quality assurance program.

- Require revisions to a certificate of compliance for any safety-related design changes in order to achieve risk minimization (MD10)

15.2 ASSOCIATED COSTS

Commenters provided information regarding the costs associated with expanding the scope of the quality assurance requirements.

- The proposed requirements would cause suppliers to leave the business due to the additional paperwork and regulatory burden (MD08) (MD18)

- The provisions of 10 CFR Part 71 would lower costs for the owner of the certificate of compliance, as well as for the user community. Any change in a 10 CFR Part 71 package currently requires a complete revision to the certificate of compliance, thus necessitating sequential revisions to all international competent authority validations. As a consequence, even a change for a minor issue would result in a financial expenditure in excess of $100,000. (MD10) (0061)

15.3 PROBLEMS WITH NON-ADOPTION

No comments were received.

16.0 ADOPTION OF ASME CODE

Commenters provided information on the adoption of the ASME code. Some commenters supported the adoption of the ASME code.

- Use ASME Codes for all products which are used in transportation and storage of radioactive materials and provide an explanatory guideline in the Code that speaks to the subject of material categorization, whereby all manufacturers are using the same criteria when categorizing (0061)
- Using ASME standards would improve current problems with casks and the current lack of quality assurance (AT22) (AT27)
- Radioactive fuel elements should be required to follow ASME standards (AT22) (AT27)
- Incorporation of the Code by reference is the appropriate regulatory mechanism, following the precedent set by 10 CFR Part 50.55a rulemaking for the ASME Code Section III, Division 1. NRC should consider issuing guidance endorsing the use of Section III, Division 3 Code Cases and incorporation of the revised Division 3 through 10 CFR Part 72 (0080)

Other commenters opposed the adoption of ASME codes. They provided the following concerns.

- Effects on transportation (0061)
- Adoption of voluntary standards into regulations, specifically the inconsistency between industry standards and regulations (MD08)
- Difficulty in following ASME changes if made quickly (MD12)
- Endorsement of the ASME code as it applied to the design, certification and fabrication of packages (0051)
- Widespread impact of the adoption (MD10) (MD12) (MD18)
- Impact on existing Naval Nuclear Propulsion Program packages (MD12)
- Impacts to overseas markets (MD10)
- Any "unintended consequences" (MD18)

Commenters addressed other issues related to adoption of the ASME Code.

- Place standards in the regulatory guides, not codified in NRC regulations in order to better enforce them, keep them current with ASME standard changes, and satisfy the Congressional mandate to consider their use as consensus standards (MD08) (MD12) (MD17) (MD20) (0078)
- When an applicant commits to following Section 3, their compliance with that standard is reviewed -- i.e., it becomes part of NRC's approval process, and NRC can enforce its use in that process (MD12)
- If the ASME code is adopted, the development of it and the information involved must be publicly available (MD15)
- ASME code should not be applied to the smaller Type B packages such as industrial radiography devices (MD17)
- ASME codes for dual-use spent fuel packages should not be applied to other packages based on "risk analysis" comparing irradiated fuel elements with radioactive sources doubly encapsulated in SS with welded closures and certified to meet the "Special Form" requirements

ASME welding specification should not be applied to shipping packages for sealed radioisotopic sources (0066)

Commenters expressed posed questions to NRC.

- Does the proposed change apply to dual use packages or to all Certificate of Compliance holders? (OA42)
- How will the requirement change if the industry standard changes in the future? (OA44)
- Clarify whether all packages are covered, or just spent fuel casks (MD17)
- Is NRC able to enforce the standard without placing in the regulations (MD05)
- Expressed confusion with the proposed changes (OA43)

16.1 CONSIDERATION OF RISK

Commenters provided information about the risk associated with adoption of the ASME Code.

- Questions whether its adoption will improve public safety (0090)
- Incorporation of the ASME code could have a catastrophic effect on parts of DOE and U.S. industry (MD12)

16.2 ASSOCIATED COSTS

Commenters provided information on the costs associated with adoption of the ASME code.

- Regulatory burden significantly increases when voluntary standards become regulations, due to the fact that ensuring regulatory compliance is difficult to accomplish (MD08)
- Adoption of ASME code into Parts 71 and 72 will be more costly due to increased fabrication costs for both storage and shipping casks and burdensome due to the final closure weld requirement (0066)
- Code stamps for all shipping containers would be very costly and would provide no benefit. Restructuring the design and procurement process to satisfy ASME requirements would be costly, would provide no additional assurance of product quality, and would force a separate process to be created that would be different from that used for other work (MD12)
- Cost increases without an equivalent increase in packaging safety (0051)

16.3 PROBLEMS WITH NON-ADOPTION

Commenters provided information about the issue-specific factors for consideration with respect to adopting the ASME code.

- NRC should study the international impacts of the proposal and consider a comparable international standard in conjunction with the proposed adoption of the ASME code (MD10)
- Some benefits of a third-party authorized Nuclear Inspector would accrue to the industry, specifically common standards will decrease complexity and interpretation, lower cost, and increase safety (0061)

17.0 ADOPTION OF CHANGES, TESTS, AND EXPERIMENTS AUTHORITY

Commenters provided information on the issue of change authority. Some commenters supported the effort to allow changes while other commenters asked that change authority be allowed for all packages, not just dual purpose packages.

- Expedite this change -- i.e., possibly on a schedule consistent with the proposed modifications to Part 72 (0066)
- As long as a cask is used for storage only, changes to the cask should not require our prior approval because doing so provides extra burden with little additional public protection (0083)

Commenters encouraged NRC to allow change authority to both domestic and international packages, as TS-R-1 does not have a specific change authority.

- Change authority has been proven in other countries and would allow time savings for both the regulatory reviewer and the package designer and/or manufacturer (MD17)
- Change authority should be extended to all packages, licensees, or users, however, each change should be submitted to the NRC/DOT and maintained in a master file so other users or licensees are aware of the changes (MD08) (MD20)
- Change TS-R-1 so that it allows change authority for all certificate holders (0078)

Several commenters did not support change authority.

- Because the definition of "minimal" has historically been ill-defined (0050)
- Proposed requirements would not result in 10 CFR Part 71 conforming with TS-R-1, specifically where the issues paper states, "the current IAEA standard ST-1 does not contain any equivalent provisions for changing a transportation package's design, without prior review by the competent authority." (0050) (0073)
- In the regulatory presumption that changes to cask design require approval, in the event of a technical debate, the applicant should seek approval (OA44)
- Comprehensively detail and define classes of changes that would be categorized as non-safety related and beneath review authority (OA44)
- Manufacturers and purveyors of transport containers should not be allowed to make changes of any kind without specific approval (MD16)
- Certificate holders should not be allowed to make changes in spent fuel storage cask designs without prior approval (MD05) (AT27)
- Be consistent and revoke the change, test, and experiment authority for 10 CFR Part 72 certificate holders (AT22) (AT27)
- The proposed requirement will result in radioactive waste leaks unless NRC performs a very tight review of the proposed changes (OA43)

- Relaxing testing requirements is in conflict with the regulations used in the 1970's (0074)

Many commenters expressed interest in receiving additional information from NRC about what changes might be allowable and highlighting that these allowable changes should only be for non-safety related activities (e.g., switching to non-reactive paints).

- NRC and DOT should be careful in determining allowable, non-safety changes with the effort to lengthen the certificate re-validation cycle, because it is conceivable that these changes would just be rolled into the new certification without review (MD06)

- An example of a non-safety related activity is ongoing consolidation within the electric power industry where companies that hold a license under one name are merging or being purchased by other companies (MD10)

Commenters posed questions to NRC.

- Will NRC extend the adoption of changes, test, and experimental authority to non-Part 71/72 spent fuel casks? (OA42)

- How will NRC address the issue of conformity with other nation's package and certificates (MD06)

17.1 CONSIDERATION OF RISK

Commenters provided information about issues related to risk and authority to make changes without NRC approval.

- References a GAO report that highlighted problems with transportation casks fabricated by Westinghouse, claiming that 20 out of 40 casks had been found to be defective (MD05)

- Opposes any action, such as moving to performance or risk-based management, that would increase the level and type of public risk (MD05)

- Encouraged NRC to pursue risk-informed decision-making (MD05) (MD08)

- Wants to ensure that NRC would continue to be able to monitor industry performance (i.e., maintain regulatory oversight capability) and be able to undo or revise changes or force amendments when necessary (MD08)

- What NRC believes is a safety issue may be different from what the public believes and what industry believes is a safety issue may be different from what NRC believes (MD15)

- Carefully and completely delineate what the authority is and what types of changes would be possible. Opposed to a case-by-case NRC review of licensee or manufacturer requested changes (MD16)

- Be consistent and revoke the authority from storage casks, and do not give it to transportation casks (AT22) (AT27)

- Certificate holders should not be allowed to make changes that are not reflected in the final safety analysis report or in other steps of the license approval process (AT22)

17.2 ASSOCIATED COSTS

Commenters encouraged NRC to move towards performance-based regulations, as seen in 10 CFR Parts 50, 70, and 76, in order to reduce economic and regulatory burden.

- Opportunity exists to allow small, non-safety related changes to be made to reduce burden without reducing overall safety -- e.g., painting a cask (MD08)

17.3 PROBLEMS WITH NON-ADOPTION

Commenters provided information regarding the problems with non-adoption of changes, tests, and experiments authority.

- Support expanding consideration to include materials that are not as dangerous as spent fuel (MD06)
- One problem with adopting change authority may be the inadequacy of design changes for transporting radioactive waste (OA43)
- Adopting change authority would eliminate the need to obtain NRC agreement with minor package design changes, thereby reducing future efforts (MD12)

18.0 FISSILE MATERIAL EXEMPTIONS AND GENERAL LICENSE PROVISIONS

Commenters addressed the fissile material exemptions and general license provisions.

- Agreed with the necessity for 62 FR 5907, but there are issues yet to be resolved for water moderated shipments (MD08)
- NUREG/CR-5342 is pertinent to NRC's plan to issue a proposed rulemaking (MD08)
- If NRC adopts Issue 16, it will be unable to conform with TS-R-1, as TS-R-1 does not currently contain provisions on general licenses for shipment of fissile material (0050) (0073)
- Who bears the responsibility for the cost of spent fuel removal? (AT27) (AT32)
- If companies must pay to obtain a license for a nuclear power plant, NRC should raise the costs of these licenses to fully cover the cost of transporting spent fuels (AT27) (AT32)
- If licensed corporations do not fully cover the costs of spent fuel removal, then the public will be responsible for bearing a future high cost when those fuels have to be removed (AT27) (AT32)

Other commenters spoke about NUREG/CR-5342.

- Concerned with how recommendations 3 and 4 (from NUREG/CR-5342) would introduce unnecessary complexity; concerns vanish if the ST-1 definitions for regulated material are adopted (MD12)
- Recommendation 17 could eliminate the fissile excepted category, which is something that should not be allowed to occur; if such a change is necessary, the Agency instead should revise the excepted packages definition to reduce the amount of fissile material present and ensure that 10 CFR Part 71.53 and 49 CFR 173.453 are consistent with TS-R-1 (MD12)
- Requests that all of the 16 sub-issues contained in NUREG/CR-5342 that focus on Fissile Material Exemptions and General License Provisions be addressed in the rulemaking (0078)

18.1 CONSIDERATION OF RISK

No comments were received.

18.2 ASSOCIATED COSTS

Commenters said there is no specific cost information available now on the cost impact of the implemented emergency rule or of the ORNL recommendations.

- A simple estimate indicates that during decommissioning, the shipments of contaminated soil or building rubble to a low-level waste disposal facility could double or triple due to the conveyance limit; this would lead to a doubling or tripling in the cost for that portion of the decommissioning (MD08) (MD20)
- In comparison to 49 CFR 173.453, the proposed change would add 22 waste shipments which would increase the public's exposure, as well as significantly increase the transportation costs for this material (0078)

18.3 PROBLEMS WITH NON-ADOPTION

Commenters addressed specific issues related to fissile material exemptions and general license provisions.

- Important to coordinate regulatory actions on fissile material exemptions with the international community (MD06)
- Listen to international counterparts at the next IAEA meeting to ensure that fissile material exempt in the rest of the world is exempt in the United States, and vice-versa (MD06)
- The consignment limit has yet to be justified and it appears that the concentration limits required for this classification are sufficient to ensure safety during transportation (0078)
- Because TS-R-1 includes a similar concentration limit to the limit in NUREG/CR-5342, industry recommends the Agency adopt this exemption (MD08) (MD20)
- While TS-R-1 has a total limit of fissile material, the Agency should not adopt it because there is no basis for the limit (MD08) (MD20)

Commenters responded to each of the 18 sub-issues or recommendations contained in NUREG/CR-5342.

- Industry supports recommendations 1, 2, and 5 (MD08) (MD20)
- Industry supports recommendations 10 and 12, but 12 should also include sec. 71.20, sec. 71.24, and the CSI with TI in this reformulation (MD08) (MD20)
- Industry supports recommendation 15, but it should include sec 71.18, sec. 71.22, and the CSI with TI in this reformulation (MD08) (MD20)
- In supporting recommendation 16 and 17, industry supports use of TI and CSI to limit conveyance. In determining the CSI for a package, special moderators and/or reflectors would be considered. Regarding recommendation 17, industry recognizes that a fissile material package that is exempt from the fissile marking may require a CSI of 0 to assure safe handling during transport (MD08) (MD20)
- Industry supports recommendation 18, but the definition should not be limited to materials having enrichments less than 1 wt% U-235 (MD08) (MD20)
- Industry does not support recommendation 3; fissile material under the appropriate conditions can be shipped in a Type A or industrial package, and there is no safety basis to establish minimal requirements for construction of the package simply because the material is fissile (MD08) (MD20)
- Industry does not support recommendation 4 and believes that CSI and exemption values for criticality need to be established (MD08) (MD20)
- Industry does not support recommendation 6, and use of TI and the CSI will address the concern (MD08) (MD20)
- Industry does not support recommendation 8, and sec. 71.18(e) provides a reasoned basis for considering the moderators, and therefore should be retained (MD08) (MD20)
- Industry does not support recommendation 9. TI and CSI need to be considered when shipping fissile material; however, sec. 71.18(e) and sec 71.20(c)(2-3) need to be harmonized (MD08) (MD20)

- Industry does not support recommendation 11; the combination of the TI and CSI will determine the package necessary to ship Pu-Be source in a package that contains up to 2500-g Pu-239. Controlled shipping conditions are not needed (MD08) (MD20)

- Industry does not support recommendation 13; sec. 71.22(e) provides a reasoned basis for considering the moderators and/or reflectors and should therefore be retained (MD08) (MD20)

- Industry does not support recommendation 14 due to the same objections as in recommendation 9 (MD08) (MD20)

- Industry does not currently have a position on recommendation 7 because little if any U-233 is being shipped by the commercial sector (MD08) (MD20)

19.0 DOUBLE CONTAINMENT OF PLUTONIUM (PRM-71-12)

Commenters provided information on the issue of double containment of plutonium. Some commenters supported eliminating the double containment requirement for plutonium.

- Already uses double containment when transporting plutonium, and anticipates continuing the practice (MD12)
- Eliminate the double containment requirement for plutonium because the additional regulatory requirement of a separate inner container for packages containing plutonium is not congruent with the requirements for all other radionuclides. There would be several benefits: decreased worker exposure if process time were reduced; reduced costs through more efficient handling and packaging; and internal harmonization of regulations (MD12)
- Eliminate double container requirement to be consistent with TS-R-1 concerning all shipments, including plutonium (MD08) (MD20)

Others objected to the relaxation of the double containment requirements.

- Consider that plutonium is shipped shorter distances in Europe than in the U.S. (MD18) (0090)
- Apply the requirement to all packages and shipments, not just plutonium (AT22) (AT27)
- The requirement is inappropriate because there will be significant increases in plutonium transportation in the future, specifically WIPP shipments (MD06) (MD15) (AT30) (OA41) (0050) (0059) (0073) (0077)
- No need has been demonstrated to justify eliminating double containment (0053) (0077)
- Consistency with TS-R-1 is not as important as internal consistency and consistency with the performance basis of the regulations. The proposed provision conflicts with the intent to have a performance based regulatory system (0051)
- Justify to the IAEA why double containment is necessary and revise TS-R-1 (0078)
- Elimination of the double containment requirement must be based on a sound, publicly available (i.e., not only on ADAMS) technical justification demonstrating that existing safety margins are retained (0050) (0053) (0073)
- A double container is required by Congress in the WIPP Land Withdrawal Act (MD05)
- The TRUPACT-II is not sufficient to protect the public and the design criteria are less than the real road conditions that it could endure (MD15)
- If DOE renounces its commitment to use double containment shipping containers, it would be a direct contradiction of the commitments made early in the WIPP program to ensure safe shipping of this material (MD16) (0053)
- Western states have traditionally opposed the relaxation of the requirements for plutonium transport. Plutonium transport is not usually undertaken for commercial reasons (OA44)

- Perform considerable safety analysis before finalized proposed revision (OA44)

- It was not the intent of the petition, PRM-71-12, to compare it with international standards (ST-1). The petition should be considered independently and on its own merits (MD21)

A commenter posed a question to NRC.

- Will adoption of TS-R-1 actually increase permissible concentration levels for approximately 44 percent of the radionuclides addressed? Is plutonium one of the 44 percent of radionuclides that would see an increase in permissible levels? (MD05)

19.1 CONSIDERATION OF RISK

Commenters provided information on risk consideration issues related to double containment of plutonium.

- The proposed revision would reduce the level of public protection (MD05) (MD15) (MD16) (AT22) (OA44)

- What additional protection does double containment provide when containment provisions already exist in the regulations that apply to all radioactive materials including those that are probably as hazardous or as radiotoxic as plutonium (MD12)

- Based on the Q system for the calculation of A1 and A2 values, an A2 quantity of any radionuclide has the same potential for damaging the environment and the human species as an A2 quantity of any other radionuclide (MD21)

- Citing the Environmental Evaluation Group report, double containment would reduce the expected quantity of radionuclides released from accidents to 28 percent of that with the current design. The double containment design would limit the curies released in the class VIII accident to 40 percent of that with the current design. Similar reductions were shown in radiation doses and in environmental contamination and cleanup costs (0053)

- Double containment would drastically reduce the latent cancer fatalities that would occur if a Severity Category VII or VIII accident were to occur. The expected number of radionuclide release accidents would drastically decrease (from 12 to 0.02) (0053)

- Citing a NIH report, there exists a strong correlation between the amounts of radiation and the number of cancer cases in various areas (AT27)

- There is no health or social benefit associated with removing current double containment requirements for plutonium (OA44)

- The existing requirements are overly conservative. The Q-system and the A1 and A2 values of 10 CFR Part 71 can adequately address the hazards associated with plutonium shipments. Special requirements for plutonium do not increase the safety of transportation (0051)

19.2 ASSOCIATED COSTS

Commenters provided information on the associated costs of requiring double containment for shipments of plutonium.

- Conduct a risk/cost analysis and if the cost savings, relative to the risk minimization that double containment affords, then NRC should not revise the current standards. As part of this effort, ask whether the public is willing to bear the added costs associated with double containment relative to the risk minimization (0070)

- Questioned NRC's approach, asking if a regulation costs a lot, is it wrong, and if it does not cost a lot, then is it right? (MD21)

- Unnecessary and burdensome requirement (MD07)

- Cited instances where double containment (i.e., TRUPACT-II containers) was less expensive than single containment -- i.e., $675,000 versus $760,00, respectively (0077)

19.3 PROBLEMS WITH NON-ADOPTION

A commenter provided information on problems with non-adoption, opposing the double containment requirement for shipments of plutonium.

- Double containment is already an overkill that has been brought on by Congress for a radionuclide that is safe in transport due to the A1 and A2 values that have been defined for that particular radionuclide (MD07)

20.0 CONTAMINATION LIMITS AS APPLIED TO SPENT FUEL AND HIGH LEVEL WASTE (HLW) PACKAGES

Commenters provided information regarding contamination limits as applied to spent fuel and High Level Waste (HLW) packages.

- Proposed rule will not result in a significant impact because containers are already inspected prior to shipment to ensure that surface contamination levels are less than 450 pCi/100 square cm (MD12)
- Contamination limits should apply equally to all packages in order to minimize regulatory confusion and ensure a higher rate of regulatory compliance (0078) (0090)

Other commenters opposed increasing package contamination limits.

- NRC should not increase exposure in any way (AT27)
- Increasing package contamination limits would allow an increased, ongoing release of radioactivity into the environment (AT22)
- External contamination on packages of radioactive material in transport is a significant problem and is the source of actual or perceived hazard that can cause damage to the nuclear industry (MD12)
- Do not change contamination limits (i.e., continue to use TS-R-1 limits) unless and until there is a sound technical basis for doing so (MD12)
- Clarify and elaborate the discussion of the 4 Bq/square cm limit (0066)

Commenters spoke to the issue of worker exposure rates.

- Worker exposure rates will conceivably increase by using the existing surface contamination limit (i.e., four becquerels per square centimeter) for large packages (MD06) (MD08) (MD12) (MD15)
- Regulations are designed to protect the public first and the workers second, therefore do not change the regulations (MD08)
- Worker exposure could increase by requiring double containment, thus raising is required, and expressed concern about how this issue with contamination limits impacts international shipments (MD06)
- Worker exposure rates are not likely to be reduced even if allowable surface contamination rates were significantly increased (MD12)
- Workers will be exposed to radiation while measuring the surface contamination level, regardless of the level of the package contamination limit (AT22) (AT27) (AT30) (0083)
- NRC should consider other ways to protect workers, including cask design and the use of robots (AT27) (AT30)
- If radiation levels are too great for workers to get close enough to measure it, it is too great to transport it (AT27)
- Contamination levels should not be reduced for larger packages handled by crane (AT27)
- NRC should consider developing an alternate contamination limit that results in adequate protection for both radiation workers and the public using risk based methodology (0083)

Commenters addressed the issue of public protection.

- Raising surface contamination limits, as applied to spend fuel and HLW packages, will effectively lower public protection, which would reduce public trust and confidence in NRC (AT22)

- The public is already adequately protected from external package contamination and the 4 Bq/square cm criterion should be applied to all packages, which would be consistent with TS-R-1 (MD08) (MD20)

Commenters were concerned with contamination limits as applied to spent fuel and HLW packages.

- Uncertain whether adding complexity to cask standards would help when responding to an accident (OA43)

- Assuming that the acceptable contamination level would be reduced, NRC needs to clarify how low its benchmark needs to be and where it should be taken from (OA46)

20.1 CONSIDERATION OF RISK

Commenters spoke to the risks associated with contamination limits as applied to spent fuel and HLW packages.

- Reducing the risk to nuclear workers with the possible cost of increasing the general public's exposure is unacceptable (AT27)

Some commenters requested that NRC not relax the contamination limits because of the increased exposure risk.

- Carefully consider the added exposure risk to truck and rail crews, intermodal workers, and hypothetically maximally exposed individuals along rail and highway routes before making any changes to the 4Bq/square cm contamination limit (0070)

- Higher external contamination levels on packages eventually stopped German waste shipments (AT22)

20.2 ASSOCIATED COSTS

No comments were received.

20.3 PROBLEMS WITH NON-ADOPTION

Commenters raised two issues associated with non-adoption of revised contamination limits.

- NRC should address work standards because U.S. worker dose rates are two and one-half times greater than those in the rest of the world but no effort has been made to harmonize on this point (MD05)

- If contamination limits are revised upwards, then the allowable revision should depend upon the total design of the package and transport system (i.e., totally enclosed packages might have lower limits that casks with accessible surfaces) (0059)

21.0 OTHER ISSUES

Commenters submitted comments on other issues related to the rulemaking.

- NRC should begin a proactive implementation and adoption of TS-R-1, similar to DOT's efforts with a transition rule, in order to avoid regulatory conflict (MD08) (MD19)
- Clarify whether high level waste is as highly route controlled (i.e., security is with the shipment at all times) as spent fuel (OA47)
- Clarify if and when IAEA/IATA regulations are in effect in NRC's and DOT's regulations (0049)
- Clarify when NRC's regulations supersede DOT's, and vice-versa, for domestic shipments (0049)
- Streamlining regulations may not serve the interests of public health and safety -- e.g., inappropriate design changes, reduced oversight (OA43)
- NRC could reduce public fears by posting signs on canisters of spent nuclear fuel while they are in transport that specify safe distances and lower exposure (ALARA) is desirable (0056)
- NRC needs to perform analyses to delineate increases, decreases, or neutral effects in radiation exposure to persons living in communities along transport routes (MD16)

21.1 CONSIDERATION OF RISK

No comments were received.

21.2 ASSOCIATED COSTS

No comments were received.

21.3 PROBLEMS WITH NON-ADOPTION

No comments were received.

21.4 ISSUE-SPECIFIC FACTORS FOR CONSIDERATION (INCLUDING BENEFITS)

No comments were received.

21.0 GLOSSARY

A_1 means the maximum activity of special form radioactive material permitted in a Type A package. These values are listed in Appendix A or Table A-1 of 10 CFR Part 71 and may be derived in accordance with the procedure prescribed in Appendix A of 10 CFR Part 71.

A_2 means the maximum activity of radioactive material, other than special form, LSA and SCO material, permitted in a Type A package. These values are listed in Appendix A or Table A-1 of 10 CFR Part 71 and may be derived in accordance with the procedure prescribed in Appendix A of 10 CFR Part 71.

Becquerel means the special unit of activity in the SI system, equal to 1 disintegration per second.

Certificate holder means a person who has been issued a certificate of compliance or other package approval by NRC.

Committed dose equivalent means the total dose equivalent (averaged over a given tissue) deposited over the 50-year period following the intake of a radionuclide.

Committed effective dose equivalent means the weighted sum of committed dose equivalents to specific organs and tissues, in analogy to the effective dose equivalent.

Consignee means any person, organization or government which receives a consignment.

Consignment means any package or packages, or load of radioactive material, presented by a consignor for transport.

Consignor means any person, organization or government which prepares a consignment for transport, and is named as consignor in the transport documents.

Conveyance means any vehicle for transport by road or rail, any vessel for transport by water, and any aircraft for transport by air.

Criticality Safety Index means a number which is used to provide control over the accumulation of packages, overpacks or freight containers containing fissile material.

Curie means the unit of radioactivity, equal to the amount of a radioactive isotope that decays at the rate of 3.7×10^{10} disintegrations per second.

Dose equivalent means the product of the absorbed radiation dose, the quality factor for the particular kind of radioactivity absorbed, and any other modifying factors. The SI unit of dose equivalent is the sievert (Sv) and the English or conventional unit is the rem.

Effective dose equivalent means the sum over specified tissues of the products of the dose equivalent in a tissue or organ and the weighting factor for that tissue or organ.

Exclusive use means sole use by a single consignor of a conveyance for which all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the consignor or consignee. The consignor and the carrier must ensure that any loading or unloading is performed by personnel having radiological training and resources appropriate for safe handling of the consignment. The consignor must issue specific instructions in writing, for maintenance of exclusive use shipment controls, and include them with the shipping paper information provided to the carrier by the consignor.

Exempt packages means packages exempt from the requirements of 10 CFR Part 71.

Fissile material means plutonium-238, plutonium-239, plutonium-241, uranium-233, uranium-235, or any combination of these radionuclides. Unirradiated natural uranium and depleted uranium, and natural uranium or depleted uranium that has been irradiated in thermal reactors only are not included in this definition. Certain exclusions from fissile material controls are provided in 10 CFR Part 71.53.

Licensed material means by-product, source, or special nuclear material received, possessed, used, or transferred under a general or specific license issued by NRC pursuant to 10 CFR Part 71.

Low dispersible radioactive material means either a solid radioactive material or a solid radioactive material in a sealed capsule, that has limited dispersibility and is not in powder form.

Low Specific Activity (LSA) material means radioactive material with limited specific activity that satisfies the descriptions and limits set forth in 10 CFR Part 71.4. Shielding materials surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents.

Non-special form (or normal form) radioactive material means radioactive material that has not been demonstrated to qualify as "special form radioactive material," as defined below.

Q system is a series of models to consider radiation exposure routes to persons in the vicinity of a package involved in a hypothetical severe transport accident. The five models are for external photon does, external beta dose, inhalation dose, skin and ingestion dose due to contamination transfer, and submersion in gaseous isotopes dose.

Radioactive material means any material having a specific activity greater than 70 Bq per gram (0.002 microcurie per gram).

Radionuclide means the type of atom specified by its atomic number, atomic mass, and energy state that exhibits radioactivity.

Special arrangement means those provisions, approved by the competent authority, under which consignments which do not satisfy all the applicable requirements may be transported.

Special form radioactive material means either an indispersible solid radioactive material or a sealed capsule containing radioactive material.

Specific activity of a radionuclide means the activity of the radionuclide per unit mass of that nuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the activity per unit mass of the material.

Surface contaminated object (SCO) means a solid object which is not itself radioactive, but which has radioactive material distributed on its surfaces.

Transport index (TI) means the dimensionless number (rounded up to the next tenth) placed on the label of a package, to designate the degree of control to be exercised by the carrier during transportation. The TI is determined as specified in 10 CFR Part 71.4.

Type A package means a packaging that, together with its radioactive contents limited to A_1 or A_2 as appropriate, meets the requirements of 49 CFR 173.410 and 173.412 and is designed to retain the integrity of containment and shielding required by this part under normal conditions of transport.

Type B package means a Type B packaging together with its radioactive contents. A type B package design is designated by NRC as B(U) unless the package has a maximum normal operating pressure of more than 700 kPa (100 lb/in2) gauge or a pressure relief device that would allow the release of radioactive material to the environment under tests specified in 10 CFR Part 71.73, in which case it will receive a designation B(M). B(U) refers to the need for unilateral approval of international shipments. B(M) refers to the need for multilateral approval of international shipments. To determine this distinction see DOT regulations in 49 CFR Part 173.

Type C package means a new package type described in IAEA's ST-1 that could withstand severe accident conditions in air transport without loss of containment or increase in external radiation.

APPENDIX A

THE ISSUES PAPER

NUCLEAR REGULATORY COMMISSION

10 CFR Part 71

Major Revision to 10 CFR Part 71: Compatibility With ST-1--The IAEA Transportation Safety Standards--and Other Transportation Safety Issues, Issues Paper, and Notice of Public Meetings

AGENCY: Nuclear Regulatory Commission.

ACTION: Request for comment on issues paper, and notice of plans for public meetings.

SUMMARY: The Nuclear Regulatory Commission (NRC) is considering a rulemaking that would revise the Commission's regulations on packaging and transporting radioactive material to make it compatible with the International Atomic Energy Agency (IAEA) transportation safety standards as well as codify other requirements. The NRC is seeking early public input on the major issues associated with such a rulemaking. To aid in that process, the NRC is requesting comments on the issues paper included in this notice. Specifically, the NRC is interested in public and industry comments related to: Quantitative information on the costs and benefits resulting from consideration of the factors described in the issues paper, operational data on radiation exposures (increased or reduced) that might result from implementing the contemplated changes; whether the presented factors are appropriate; and whether other factors should be considered, including providing quantitative information for these factors. The Commission believes that the stakeholders' comments will help to quantify the potential impact of these changes and will assist the NRC, as the proposed rule is developed, in developing a risk-informed alternative as its preferred option. NRC also intends to conduct three public meetings in August and September of this year to discuss those issues and solicit public comments.

DATES: Submit comments at the public meetings, or in writing by September 30, 2000. Comments received after this date will be considered if it is practicable to do so, but the Commission is able to assure consideration only for comments received on or before this date.

In addition to providing opportunity for written (and electronic) comments, public meetings on the paper will be held as follows: August 10, 2000 NRC Headquarters, Washington, DC, 8:30 am-5pm; September 20, 2000, Atlanta, Georgia, J.W. Marriott, 3300 Lenox Road Northeast, Atlanta, GA 30326, 6-10 pm; September 26, 2000, Oakland, California, Oakland Federal Building, Edward R. Roybal Auditorium and Conference Center, 1301 Clay Street, Oakland, CA 94612, 6-10 pm.

ADDRESSES: Submit comments to: Secretary, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. Attention: Rulemaking and Adjudications staff.

Deliver comments to 11555 Rockville Pike, Rockville, Maryland, between 7:30 a.m. and 4:15 p.m. on Federal workdays.

You may also provide comments via the NRC's interactive rulemaking web site at http://ruleforum.llnl.gov. This site provides the capability to upload comments as files (any format), if your web browser supports that function. For information about the interactive rulemaking web site, contact Ms. Carol Gallagher, (301) 415-5095 (e-mail: CAG@nrc.gov).

Copies of any comments received and documents related to this action may be examined at the NRC Public Document Room, 2120 L Street NW (Lower Level), Washington, DC Documents created or received at the NRC after November 1, 1999 are also available electronically at the NRC's Public Electronic Reading Room on the Internet at http://www.nrc.gov/NRC/ADAMS/index.html. From this site, the public can gain entry into the NRC's Agencywide Documents Access and Management System (ADAMS), which provides text and image files of NRC's public documents. For more information, contact the NRC Public Document Room (PDR) Reference staff at 1-800-397-4209, 202-634-3273 or email to pdr@nrc.gov.

FOR FURTHER INFORMATION CONTACT: Naiem S. Tanious, telephone: (301) 415-6103; e-mail: nst@nrc.gov, Office of Nuclear Material Safety and Safeguards, USNRC, Washington, DC 20555-0001. Specific comments on the public meeting process should be directed to Francis X. Cameron; e-mail fxc@nrc.gov, telephone: (301) 415-1642; Office of the General Counsel, USNRC, Washington, DC 20555-0001.

SUPPLEMENTARY INFORMATION:

I. Background

By international agreement and through Commission direction, the NRC staff is preparing an overall rulemaking effort that addresses the need to make 10 CFR Part 71 regulations, "Packaging and Transportation of Radioactive Material" compatible with the most current revision of the IAEA Safety Standards Series No. ST-1. Part 71 is based, in general, on the safety standards developed by the IAEA. The IAEA has been revising its transportation standards on approximately a 10-year cycle, with the last edition, ST-1, published in December 1996. Further, several additional issues related to other changes to 10 CFR Part 71 are being considered by NRC. These issues include the fissile material exemptions, general license provisions, and the current requirements for double containment of plutonium.

The NRC is supplementing its standard rulemaking process by conducting enhanced public participatory activities including facilitated public meetings before the start of any formal rulemaking process to solicit early and active public input on major issues with revision of 10 CFR Part 71. The NRC will also utilize its rulemaking web site to make the issues paper available to the public and to solicit public comments. To facilitate discussion and public comments, the NRC has prepared an issues paper that describes 18 rulemaking issues (IAEA and Non-IAEA-related) to be addressed in revisions to Part 71. These issues are described in more detail in Section III of this notice.

II. Request for Written and Electronic Comments and Plans for Public Meetings

The NRC is soliciting comments on the items presented in the issues paper in Section III of this notice. Comments may be submitted either in writing or electronically as indicated under the ADDRESSES heading. In addition to providing an opportunity for written comments, the NRC is holding facilitated public meetings at three different geographical locations on the issues discussed in Section III (see the DATES heading of this notice for the dates and locations of these meetings). In addition to the NRC staff, a representative from the Department of Transportation (DOT) will be available to answer any questions related to their concurrent rulemaking efforts.

In addition to inviting public comments on the issues presented in Section III, NRC is soliciting specific comments related to: (1) Quantitative information on the costs and benefits resulting from consideration of the factors described in the issues paper, (2) operational data on radiation exposures (increased or reduced) that might result from implementing the Part 71 changes; (3) whether the presented factors are appropriate; and (4) whether other factors should be considered, including providing quantitative information for these factors. The Commission believes that the stakeholders' comments will help to quantify the potential impact of these changes and will assist the NRC, as the proposed rule is developed, in developing a risk-informed alternative as its preferred option.

Based on the comments received in written or electronic form, and at the public meetings, the Commission will then be in a better position to evaluate options for Part 71 rulemaking, to decide on the preferred options, and to proceed with development of a proposed rule.

III. Issues Paper on Major Revision to 10 CFR Part 71: Compatibility with ST-1--the IAEA Transportation Safety Standards--and Other Transportation Safety Issues

A. Introduction

1. Background

In 1969, the International Atomic Energy Agency (IAEA), recognizing that its international regulations for the safe transportation of radioactive material should be revised from time to time because of scientific and technical advances, and accumulated experience, invited Member States (the U.S. is a Member State) to submit comments and suggest changes to its standards. As a result of this initiative, the IAEA issued revised standards in 1973 (Regulations for the Safe Transport of Radioactive Material, 1973 Edition, Safety Series (SS) No. 6). The IAEA has periodically reviewed its transportation regulations (about every ten years) to ensure that the regulations are kept current. Thus, a review of IAEA regulations was initiated in 1979 and resulted in the publication of revised regulations in 1985 (1985 Edition, SS No. 6).

The U.S. Nuclear Regulatory Commission (NRC) also periodically revises its regulations to make them compatible, to the extent appropriate, with those of the IAEA. On August 5, 1983 (48 FR 35600), the NRC published, in the Federal Register, a final revision to 10 CFR Part 71, "Packaging and Transportation of Radioactive Material." That revision, in combination with a parallel revision of the hazardous materials transportation regulations of the U.S. Department of Transportation (DOT), brought U.S. domestic transport regulations into general accord with the

1973 edition of SS No. 6. The next IAEA revision of the transportation standards in SS No. 6 resulted in a revision to Part 71 that was published on September 28, 1995 (60 FR 50248), to make Part 71 compatible with the 1985 edition of SS No. 6. DOT published its corresponding revision to Title 49 of the Code of Federal Regulations on the same date.

In each case, the NRC coordinated its Part 71 revisions with the DOT. DOT is the U.S. Competent Authority for transportation of hazardous materials. "Radioactive Materials Regulations" is a subset of "Hazardous Materials Regulations" in Title 49. The DOT and the NRC co-regulate transport of radioactive material in the United States and have a Memorandum of Understanding to that effect.

The last revision to the IAEA SS No. 6 was titled Safety Standards Series No. ST-1, referred to hereafter as ST-1, and was published in December 1996.

2. Scope of Part 71 Rulemaking

The Commission has directed the NRC staff to begin rulemaking to revise Part 71 for compatibility with ST-1. The NRC staff compared ST-1 to SS No. 6 to identify changes made in ST-1, and then identified affected sections of Part 71. Based on this comparison, the NRC staff identified eleven Part 71 IAEA-compatibility issues to be addressed through the rulemaking process. These eleven issues (identified as issues 1 through 11) are discussed in greater detail in Section B. Seven additional issues were identified (issues 12 thru 18) for incorporation in the rulemaking process, through NRC staff identification and through Commission direction, and are also discussed in further detail in Section B.

The Part 71 rulemaking and this issues paper are being coordinated with DOT to ensure that consistent regulatory standards are maintained between NRC and DOT radioactive material transportation regulations, and to ensure coordinated publication of the final rules by each agency. Note that on December 28, 1999 (64 FR 72633), DOT published an Advance Notice of Proposed Rule regarding adoption of ST-1 in its regulations, and plans to proceed to develop a proposed rule for public comments and subsequently a final rule. In order to develop a final rule concurrent with the timing of the DOT final rule, the NRC staff developed the following schedule: (1) the NRC staff will submit to the Commission for approval, a proposed rule to revise Part 71 by March 1, 2001, (2) the proposed rule is expected to be published for public comment in April 2001, (3) the NRC staff is planning to hold public meetings during the public comment period, and (4) after the end of the public comment period, the staff will revise the rule and submit it for approval as a final rule by June 2002.

The NRC proposed rule will include a cost-benefit (regulatory analysis). Contrary to the NRC's rulemaking process under the Administrative Procedure Act, development of the IAEA ST-1 did not directly involve the public or include a cost-benefit analysis, to our knowledge. In contrast, NRC is bound to consider costs and benefits in its regulatory analysis, and is prepared to differ from the ST-1 standards, at least for domestic purposes, to the extent the standards cannot be justified from a cost-benefit perspective.

B. Issues Format

The following format is used in the presentation of the issues that follow. Each issue is assigned a tracking number with a short title, and includes an issue description paragraph and a listing of factors for consideration. The factors for consideration in this document are not meant to be a complete or final listing, but are included to help prompt consideration and discussion of the issue. In August and September 2000, through a series of public meetings and a summary workshop, the public and industry will be requested to (1) comment on and recommend additions, deletions, or modifications to the factors for consideration; (2) propose implementation options for each issue; and (3) provide estimated implementation cost information. Other venues for feedback will be made available through mailings and by internet through the NRC web site. This public feedback will then be used in developing implementation options for Commission consideration as the Part 71 rulemaking process proceeds. Comments received that are outside the scope of this rulemaking may be addressed in future rulemaking if warranted.

Factors for consideration that are common to most of the issues are stated here, rather than repeated in each issue. These include: (1) How should risk considerations (i.e., what can happen, how likely is it, what are the consequences) be factored into rulemaking on applicable issues, (2) costs (i.e., administrative, training, testing) to industry and/or Government agencies in adopting ST-1 requirements (issues 1-11) or the NRC-initiated changes (issues 12-18), and (3) potential problems that may occur as a result of adopting ST-1 requirements, or problems that may occur from partial or non-adoption of the ST-1 requirements resulting in dual standards between domestic (10 CFR 71) and international (ST-1) requirements. For issues 1-11, the "factors for consideration" noted under each issue are generally written in the context of adopting the ST-1 requirements into Part 71.

In the case of the eleven IAEA-compatibility issues, portions of the Safety Standards Series ST-1 are referenced by the corresponding paragraph number from the original IAEA document. The full text of the ST-1 references can be found in Appendix A of this issues paper.

Issue 1. Changing Part 71 to SI Units Only

Description

ST-1, Annex II, page 199 states: "This edition of the Regulations for the Safe Transport of Radioactive Material uses the International System of Units (SI)." The change to SI units exclusively is evident throughout ST-1. ST-1 also requires that activity values contained in shipping papers and displayed on package labels be expressed only in SI units (paragraphs 543 and 549). SS No. 6, 1985 Edition, used SI units as the primary controlling units, with subsidiary units in parentheses; either units were permissible on labels and shipping papers.

The ST-1 requirement regarding only the use of SI units conflicts with the NRC Metrication Policy issued on June 19, 1996 (61 FR 31169). This policy allows a dual-unit system to be used; SI units with English units in parentheses. According to the NRC's metrication policy, the following documents should be published in dual units: New regulations, major amendments to existing regulations, regulatory guides, NUREG-series documents, policy statements, information notices, generic letters, bulletins, and all written communications directed to the

public. Documents specific to a licensee, such as inspection reports and docketed material dealing with a particular licensee, will be issued in the system of units employed by the licensee. Currently, Part 71 utilizes the dual unit scheme in accordance with the NRC Metrication Policy.

Factors for Consideration

- What changes would licensees and Certificate of Compliance holders have to make to relevant documents if NRC revised 10 CFR Part 71 to require SI units only?
- What risks and safety impacts might occur in shipments because of possible confusion or erroneous conversion between the currently utilized English units and SI units?
- What sort of transition period would be needed to allow for the conversion to exclusive use of SI units?
- What other conforming changes would have to be made to Title 10?

Issue 2. Radionuclide Exemption Values

Description

Exempt materials are those which are of such low potential hazard that they may not be required to be shipped in accordance with specific transportation regulations. In ST-1, the IAEA adopted a new approach to specifying these materials by developing radionuclide-specific activity concentration values for exempt materials and activity limits for exempt consignments. These new values are found in ST-1, Tables I and II, and Section IV. Related information is provided in paragraphs 401 through 406 of ST-1. Exempt materials are those that fall below the listed activity concentration values. Exempt consignments are packages or loads that have a total activity less than the listed activity values.

The exempt materials activity concentration values range from 0.1 to 1,000,000 Bq/g, with most radionuclides in the 1 to 100 Bq/g range. This IAEA requirement does not currently exist in Part 71. Appendix A to Part 71--Determination of A_1 and A_2, does not contain exemption values for each radionuclide because the exemption for low-level radioactive material as contained in 10 CFR 71.10(a) is 70 Bq/g (2000 picoCuries per gram) or less.

Some materials, such as ores containing naturally occurring radionuclides, would be brought into the scope of the regulations for the first time; however, provisions are included in ST-1 that reduce the potential impact on natural materials containing radionuclides at these low levels. The provisions continue to exempt natural material and ores containing naturally occurring radionuclides, that are not intended to be processed for the use of these radionuclides, provided the activity concentration of the material does not exceed 10 times the values [ST-1 paragraph 107(e)]. Additionally, for materials that may appear in the scope of the regulations for the first time, but which have activity concentrations not exceeding 30 times the exempt activity concentrations, provisions exist in ST-1 to allow them to be transported as LSA-I materials that may be transported unpackaged (in bulk). However, there may be unintended consequences in implementing the ST-1 concentration values where applied to non-transportation activities. The DOT current exempt material standard of 70 Bq/g (2000 picoCuries per gram), based on previous IAEA transportation standards, has application by cross-reference outside the domain of transportation.

Factors for Consideration

- In some cases, would shippers have to expend resources to: (1) Identify the radionuclides in a material; (2) measure the activity concentration of each radionuclide; and, (3) apply the method for mixtures of radionuclides when determining the basic radionuclide values for exempt material?
- Should the exemption values apply to domestic as well as export shipments?
- If the exemption values only applied to export shipments, would the resulting standard be practical to implement?
- If DOT specifies the exemption values in its regulations (49 CFR 173), should the NRC incorporate those same exemption values in Part 71, or simply make reference to the exemption values in the DOT regulations?
- There may be unintended consequences to adoption of specific exemption values as the current exemption value is used for non-transportation related activities. To what extent and in what manner would a change to specific exemption values affect entities whose non-transportation activities are linked to the current exemption value?

Issue 3. Revision of A_1 and A_2

Description

The A_1 and A_2 values specified in Part 71, Appendix A, are basic dose-based values used in several areas of the regulations, including determining the type of package that must be used for transporting radioactive material. For example, the A_1 values are the maximum activity of special-form materials allowed in a Type A package, and the A_2 values are the maximum activity of non-special-form material allowed in a Type A package. The A_1 and A_2 values are also used for several other quantitative limits including Type B-package activity release limits, low-specific activity material specifications, and excepted package content limits.

The ST-1 revised A_1 and A_2 values are primarily based on dosimetric models that use the IAEA's Q system for dose determination. The Q system includes consideration of a broad range of specific exposure pathways consisting of: External photon dose, external beta dose, inhalation dose, skin and ingestion dose because of contamination, and dose from submersion in gaseous isotopes. The main changes in the Q system resulted from making the dosimetric models consistent with those used in International Commission on Radiation Protection (ICRP) Publication 61. The lung model and dose conversion factors were updated to the latest ICRP models and the radionuclide values were recalculated. The Q system reference doses and exposure pathways were not changed.

Factors for Consideration

- Is there a practical alternative to adoption of the A_1 and A_2 values?
- Are there specific values that should be modified for domestic use only? What would be the justification for doing so?
- To what extent should the US partial adoption of ICRP 61 be considered for revising the A_1 and A_2 values?

Issue 4. Uranium Hexafluoride Package Requirements

Description

ST-1 introduces detailed requirements for uranium hexafluoride (UF_6) packages designed for more than 0.1 kg UF_6 NRC certifies Type B and fissile (i.e., enriched uranium) UF_6 packages under 10 CFR Part 71. Although most of these issues are under DOT in 49 CFR Part 173, the new ST-1 provisions relevant to 10 CFR Part 71 are summarized as follows (see Appendix A for a listing of the specific ST-1 provisions):

Para 629: Packages shall be packaged and transported in accordance with an international standard, ISO 7195, "Packaging of Uranium Hexafluoride (UF_6) for Transport." ST-1 also allows [para 632(a)] for use of equivalent national standards (e.g., ANSI N14.1); provided that approval by all countries involved in the shipment is obtained (i.e., multilateral approval).

Para 630: ST-1 requires that packages must withstand: (a) A minimum internal pressure test to 2.8 MPa (1.4 MPa for multilateral approval), (b) the "normal conditions of transport" drop test, and (c) the hypothetical accident condition thermal test (except that packages containing grater than 9000 kg are exempt from this test if given multilateral approval).

Para 631: ST-1 prohibits packages from utilizing pressure relief devices.

Para 677(b): ST-1 includes an exception that allows UF_6 packages to be evaluated for criticality without considering the in-leakage of water into the containment system. This provision means that a single fissile UF_6 package does not have to be subcritical assuming that water leaks into the containment system. This provision only applies when there is no physical contact of the cylinder valve to any other component of the packaging after the hypothetical accident tests, the valve remains leak-tight, and when there is a high degree of quality control in the manufacture, maintenance, and repair of packaging coupled with tests to demonstrate closure of each package before each shipment.

Factors for Consideration

- NRC practice has been to certify fissile UF_6 packages (including the cylinder which is the containment vessel and a protective overpack) that are shown to be leaktight when subject to the hypothetical accident tests and to specify that the cylinder meets ANSI N14.1 (ANSI N14.1 has the domestic pressure test requirement in 630(a), not the regulations). For this reason, it is believed that NRC-certified UF_6 packages already comply with the above package performance requirements (para 630 and 677(b)). However, these changes appear to have significant ramifications for non-fissile UF_6 packaging that are under the purview of DOT.
- NRC practice has been to reference the ANSI N14.1 standard in the certification, but not to reference the standard in the rule. Although the ISO-7195-2000 standard (in draft) has been drafted taking into account ANSI N14.1, a detailed confirmation of the compatibility of the two standards has not been performed. NRC has representation on the ANSI N14.1 revision panel.

Issue 5. Introduction of Criticality Safety Index (CSI) Requirements

Description

For fissile material packages, ST-1 defines a new term, "criticality safety index" (CSI) (paragraph 218), that applies in addition to the traditional package transport index (TI). In current domestic regulations and in the previous IAEA regulations, the overall package TI was determined based upon the more limiting of a "TI based upon criticality considerations" and a "TI based on package radiation levels." Both NRC and DOT regulations define and rely on the TI to determine appropriate safety requirements.

The CSI is determined in the same manner as the current TI "based upon criticality considerations," but it now must be displayed on shipments of fissile material (paras 544-545) using a new "fissile material" label. A package TI is still determined in the same way as the "TI based on package radiation levels" and continues to be displayed on the traditional "radioactive material" label.

Factors for Consideration

- Under the new approach, it is believed that some shipments of fissile material packages might be made more efficiently (equivalent safety but more packages allowed in a single shipment), due to avoiding the situation where separation distance requirements (radiological safety) restrict package accumulation (criticality safety), or vice versa.
- Are any issues envisioned in the use of two TI values for shipments?

Issue 6. Type C Packages and Low Dispersible Material

Description

IAEA has adopted the concept of a new category of package, the Type C package (paragraphs 230, 667-670, 730, 734-737) that could withstand severe accident conditions in air transport without loss of containment or significant increase in external radiation levels. At the same time, ST-1 introduced a new category of material, Low Dispersible Material (LDM), which due to its limited radiation hazard and low dispersibility could continue to be transported by aircraft in Type B packages. U.S. regulations have no Type C package or LDM category, but do have specific requirements for the air transport of plutonium. These specific NRC requirements for the air transportation of plutonium (10 CFR 71.64 and 71.74) continue to apply, and will not be addressed in this rulemaking.

The Type C requirements apply to packages destined for air transport that contain a total activity above the following thresholds: for special form material--3,000 A_1 or 100,000 A_2, whichever is lesser, and for all other radioactive material--3,000 A_2. Below these thresholds, Type B packages would be permitted to be used in air transport.

The Type C package performance requirements are significantly more stringent than those for Type B packages. For example, a 90 m/s impact test is required instead of the 9 m-drop test. A 60-minute fire test is required instead of the 30-minute Type B requirement. Other additional tests, such as a puncture/tearing test are also imposed. These tests are more

stringent and are expected to result in package designs that will survive more severe aircraft accidents than Type B package designs.

The LDM specification was added to account for materials (package contents) that have inherently limited dispersibility, solubility, and external radiation levels. The test requirements for LDM are a subset of the Type C package requirements (90 m/s impact and 60 minute thermal test) with an added solubility test, and must be performed on the material without packaging. Specific acceptance criteria are established for evaluating the performance of the material during and after the tests (less than 100 A_2 in gaseous or particulate form of less than 100 micrometer aerodynamic equivalent diameter and less than 100 A_2 in solution). These stringent performance and acceptance requirements are intended to ensure that these materials can continue to be transported safely in Type B packages aboard aircraft.

Factors for Consideration

- What would be the impact on air transport of currently certified Type B packages if the activity content is limited to the activity content thresholds specified above?
- What tests and analyses would be a practical method for demonstrating compliance with the type C package standards?

Issue 7. Deep Immersion Test

Description

The IAEA performance requirement for deep water immersion contained in ST-1 (para. 657 and 730) is an expansion of the requirement contained in SS No. 6. Previously, the deep immersion test was only required for packages of irradiated fuel exceeding 37 PBq (1,000,000 Ci). The ST-1 requirements apply to all Type B(U) and B(M) packages containing more than 10^5A_2 and to Type C packages.

10 CFR 71.61 requires a deep immersion test for packages of irradiated nuclear fuel with activity greater than 10^6 Ci. Currently, 10 CFR 71.61 is more conservative than SS No. 6, with respect to irradiated fuel package design requirements because it requires that a package for irradiated nuclear fuel must be designed such that its undamaged containment system can withstand an external water pressure of 2 MPa for a period of not less than one hour without collapse, buckling, or in leakage of water. The conservatism lies in the test criteria of no collapse, buckling, or in leakage as compared to the "no rupture" criteria found in SS No. 6 and ST-1.

To be consistent with ST-1, the NRC would have to revise 10 CFR Part 71.61 to apply to all packages with activity greater than 10^5A_2 and adopt the ST-1 test criteria.

Factors for Consideration

- How should the differences in the acceptance standards be addressed?
- What would be the impact on availability of packages and shipping costs if all packages with an activity greater than 10^5A_2 are required to pass the immersion test requirements?

- Would US origin package designs have to be specially reviewed and certified before shippers could export them in accordance with international regulations if ST-1 requirements were not adopted?

Issue 8. Grandfathering Previously Approved Packages

Description

Historically, IAEA, DOT, and NRC regulations have included transitional arrangements or "grandfathering" provisions whenever the regulations have undergone major revision. The purpose of grandfathering is to minimize the costs and impacts of implementing changes in the regulations. Package designs and packagings compliant with the existing regulations do not become "unsafe" when the regulations are amended (unless a significant safety issue is corrected in the revision).

Grandfathering typically includes provisions that allow for: (1) Continued use of existing package designs and packagings already fabricated, although some additional requirements may be imposed, (2) completion of packagings in the process of being fabricated or that may be fabricated within a given time period after the regulatory change; and (3) limited modifications to package designs and packagings without the need to demonstrate full compliance with the revised regulations, provided that the modifications do not significantly affect the safety of the package.

A major change in ST-1 is that "grandfathering" should be limited to only those package designs that have been certified under the last two major revisions of the regulations. Packages approved under an earlier revision would either be removed from service or be required to be re-certified under the revised regulations that result from this rulemaking.

As revised in 1996, IAEA regulations in ST-1 only recognize the "grandfathering" of package designs certified under the 1973 and 1985 editions of IAEA regulations (SS No. 6). Package designs approved under the 1967 edition of SS No. 6 would be required to be re-certified, removed from service, or shipped via exemption (i.e., special arrangement). If this approach to "grandfathering" is adopted in DOT and NRC regulations, package designs approved to earlier versions of DOT and NRC regulations (i.e., those based on 1967 IAEA regulations) would be required to be re-certified, removed from service, or shipped via exemption.

Factors for Consideration

- Should the "grandfathering" of previously approved packages be limited to those approved under the last two major revisions of the regulations? If not, on what basis should the "grandfathering" of previously approved packages be allowed?
- How long should "grandfathered" packages be allowed to be fabricated or used?
- What type and magnitude of package design changes should be allowed for "grandfathered" packages, before re-certification to the current set of regulations is required?
- IAEA has initiated a process to review and update ST-1 on a two-year frequency and does this new process raise any issues on the grandfathering limitations to the last two major revisions?

Issue 9. Changes to Various Definitions

Description

The NRC is contemplating changes to various definitions in Part 71 to provide internal consistency and improve correlation with ST-1. 10 CFR 71.4 includes defined terms used throughout Part 71. These terms require clear definition so that they can be used to accurately communicate requirements to licensees. The NRC would add the following definitions from ST-1: (1) Confinement system (paragraph 209), (2) Criticality safety index (paragraph 218; reference issue 5), (3) Low dispersible radioactive material (paragraph 225; reference issue 6), and (4) Quality assurance (paragraph 232). Additionally, the NRC would propose to revise the definition of "package" in 10 CFR 71.4 to be consistent with ST-1. For reference, the ST-1 definitions are contained in Appendix A and provided below.

Para. 209. "Confinement System shall mean the assembly of fissile material and packaging components specified by the designer and agreed to by the competent authority as intended to preserve criticality safety."

Para. 218. "Criticality safety index (CSI) assigned to a package, overpack or freight container containing fissile material shall mean a number which is used to provide control over the accumulation of packages, overpacks or freight containers containing material."

Para. 225. "Low dispersible radioactive material shall mean either a solid radioactive material or a solid radioactive material in a sealed capsule, that has limited dispersibility and is not in powdered form."

Para. 232. "Quality assurance shall mean a systematic programme of controls and inspections applied by an organization or body involved in the transport of radioactive material which is aimed at providing adequate confidence that the standard of safety prescribed in these Regulations is achieved in practice."

Factors for Consideration

- Do the definitions conflict with existing programs, or introduce other issues or concerns?
- Are there other definitions of terms that are recommended for incorporation in Part 71?

Issue 10. Crush Test for Fissile Material Package Design

Description

Under requirements for packages containing fissile material, ST-1 682(b) requires tests specified in paragraphs 719-724 followed by whichever of the following is the more limiting: the drop test onto a bar as identified in paragraph 727(b) and, either the crush test listed in paragraph 727(c) for packages having a mass not greater than 500 kg and an overall density not greater than 1000 kg/m\3\ based on external dimensions, or the nine meter drop test listed in paragraph 727(a) for all other packages; or the water immersion test of paragraph 729.

SS No.6 and Part 71 presently require the crush test for fissile material packages having a mass not greater than 500 kg and an overall density not greater than 1000 kg/m^3 based on external dimensions, and radioactive contents greater than 1000 A_2 not as special form radioactive material. Under ST-1, the crush test is no longer limited to fissile material packages containing an activity greater than 1000 A_2 because ST-1 has extended the crush test requirement to include fissile material package designs regardless of the activity of the contents. This was done in recognition that the crush environment was a potential accident force that should be protected against for both radiological safety purposes (packages containing more than 1000 A_2 in normal form) and criticality safety purposes (fissile material package designs).

To be consistent with ST-1, the NRC would have to revise 10 CFR Part 71 wording to recognize removal of the 1000 A_2 activity limit with respect to the crush test requirement for fissile material package designs. However, full compliance with ST-1 requirements for fissile material packages would also require changes to the hypothetical accident conditions test sequencing of 10 CFR 71.73 and would require performance of the nine-meter free drop test or the crush test, but not both as presently required by Sec. 71.73.

Factors for Consideration

- How should the differences in the test sequencing and required tests be addressed? Would the test sequencing requirements be applied to Type B packages as well?
- What would be the impact on availability of packages and shipping costs due to elimination of the 1000 A_2 activity limit for fissile material packages having a mass not greater than 500 kg and an overall density not greater than 1000 kg/m^3 based on external dimensions?
- If Part 71 is changed to only eliminate the 1000 A_2 activity limit for fissile material packages, but all other tests and the testing sequence remains unchanged, what implications would this have for US origin packages for export?

Issue 11. Fissile Material Package Design for Transport by Aircraft

Issue Description

For shipment of fissile material by air, ST-1 requires that packages with quantities greater than excepted amounts (that would include all the NRC certified packages) require an additional criticality evaluation. Specifically, the requirements are:

Para 680(a): Packages must remain subcritical, assuming 20 centimeters water reflection but not inleakage (i.e., moderation) when subjected to the tests for Type C packages (see Issue 6). The specification of no water ingress is given as the objective of this requirement is protection from criticality events resulting from mechanical or physical rearrangement of the geometry of the package (i.e., fast criticality).

Para 680(b) This provision states that if a package takes credit for "special features," this package can only be presented for air transport if it is shown that these features remain effective even under the Type C test conditions followed by a water immersion test. "Special

features" are specified in ST-1 Para 677, and include features that provide moderator exclusion.

The application of the paragraph 680 requirement to fissile-by-air packages is in addition to the normal condition tests (and possibly accident tests) that the package already must meet. Thus:

- A Type IF or AF package by air must: 1) Withstand incident-free conditions of transport with respect to release, shielding, and maintaining subcriticality (single package and array of packages), (2) withstand accident condition tests with respect to maintaining subcriticality (single package and array of packages), and (3) comply with para 680 with respect to maintaining subcriticality (single package).
- A Type BF package by air must: (1) Withstand incident-free conditions of transport and Type B tests with respect to release, shielding, and maintaining subcriticality (single package and array of packages); and (2) comply with para 680 with respect to maintaining subcriticality (single package).
- A Type C fissile material package must withstand: incident-free conditions of transport (single package and array of packages), Type B tests (single package and array of packages), and Type C tests (single package) with respect to release, shielding, and maintaining subcriticality.

Factors for Consideration

- Certain factors need to be considered in determining the practical impacts of domestic adoption of ST-1 paragraph 680. First, all uranium can be shipped in non-Type C package (IF, AF) due to its A_1 and A_2 values. The paragraph 680(a) requirements appear to be readily satisfied by low-enriched uranium, because low enriched uranium (less than approximately 5% enrichment) would typically require moderation (e.g., by water) to achieve nuclear criticality, but the test specifies no water ingress. Secondly, there are statutory restrictions on air transport of plutonium in the U.S. Finally, packaging for air transportation may follow International Civil Aviation Organization Technical Instructions that are also being revised for compatibility with ST-1.

Issue 12: Special Package Approvals

Description

The transport of large objects that are too large for certified packagings and cannot satisfy the packaging requirements was not considered in the development of Part 71. However, as decommissioning activities increase, the need to transport large objects is rising. For example, in 1997, Portland General Electric Company (PGE) requested approval of the Trojan Reactor Vessel Package (TRVP) (including internals) for transport to the disposal facility operated by US Ecology on the Hanford Nuclear Reservation near Richland, Washington. The TRVP contained approximately 74 petabequerels (2 million curies) in the form of activated metal and 5.7 terabequerels (155 curies) in the form of internal surface contamination; was filled with low-density concrete; and weighed approximately 900 metric tons (1000 tons).

The Commission approved the Trojan shipment under exemptions issued through 10 CFR Part 71.8. Also, the U.S. Department of Transportation's (DOT's) regulations that govern radioactive material shipments do not recognize packages approved via NRC exemption, so DOT also had to consider and issue an exemption for the Trojan shipment.

Because it is the Commission's policy to avoid the use of exemptions for recurring licensing actions, the NRC staff is considering adding regulatory provisions to Part 71 to address special package approvals. If adopted, these provisions would provide a mechanism for review of special packages under the regulations without the need for exemptions.

Factors for Consideration

- Should Part 71 be revised to address reactor vessels specifically or to address large objects in general?
- Should NRC consider adopting an analogue of IAEA's special arrangement provision modified to address packaging?
- What (additional) determinations should be included in an application for a special package approval?
- Should the risk-informed basis used specifically for the Trojan approval be adopted for other special package approvals?

Issue 13. Expansion of Part 71 Quality Assurance Requirements to Holders of, and Applicants for, a Certificate of Compliance

Description

The NRC has observed problems with the performance of 10 CFR Part 72 Certificate of Compliance (CoC) holders in implementing the Part 72 quality assurance (QA) requirements. Problems have occurred in design, design control, fabrication, and corrective action areas. Although CoCs are legally binding documents, certificate holders or applicants for a CoC and their contractors and subcontractors have not clearly been brought within the scope of Part 72 requirements. Therefore, because the terms "certificate holder" and "applicant for a certificate of compliance" do not appear in the Part 72, Subpart G regulations, the NRC has not had a clear basis to cite these persons for violations of Part 72 requirements in the same way it treats licensees.

The NRC Enforcement Policy[1] and its implementing program were established to support the NRC's overall safety mission in protecting public health and safety and the environment. Consistent with this purpose, enforcement actions are used as a deterrent to emphasize the importance of compliance with requirements and to encourage prompt identification and comprehensive correction of the violations. Enforcement sanctions consist of Notices of Violation (NOVs), civil penalties, and orders of various types. In addition to formal enforcement actions, the NRC also uses related administrative actions such as Notices of Nonconformance (NONs), Confirmatory Action Letters, and Demands for Information to supplement its enforcement program. The NRC expects licensees, certificate holders, and applicants for a

[1] NUREG-1600, "General Statement of Policy and Procedures for NRC Enforcement Actions," May 2000.

CoC to adhere to any obligations and commitments that result from these actions and will not hesitate to issue appropriate orders to ensure that these obligations and commitments are met. The nature and extent of the enforcement action are intended to reflect the seriousness of the violation involved. An NOV is a written notice setting forth one or more violations of a legally binding requirement.

However, when the NRC has identified a failure to comply with Part 72 QA requirements by certificate holders or applicants for a CoC, it has issued an NON rather than an NOV. Although an NON and an NOV appear to be similar, the Commission prefers the issuance of an NOV because: (1) The issuance of an NOV effectively conveys to both the person violating the requirement and the public that a violation of a legally binding requirement has occurred; (2) the use of graduated severity levels associated with an NOV allows the NRC to effectively convey to both the person violating the requirement and the public a clearer perspective on the safety and regulatory significance of the violation; and (3) violation of a regulation reflects the NRC's conclusion that potential risk to public health and safety could exist. Therefore, the NRC believed that limiting the available enforcement sanctions to administrative actions was insufficient to address the performance problems observed in industry.

In response to this problem, the NRC staff submitted a rulemaking plan to revise Part 72 to the Commission in SECY-97-214.[2] In a Staff Requirements Memorandum (SRM) to SECY-97-214, the Commission approved the staff's rulemaking plan and directed the staff to also consider whether conforming changes to the quality assurance (QA) regulations in Part 71 would be necessary, because of dual purpose cask designs. Dual purpose cask designs are intended for both the storage of spent fuel under Part 72 and the transportation of spent fuel under Part 71. In a memorandum from the EDO to the Commission, dated December 3, 1997, the NRC staff indicated that expansion of the Part 71 QA provisions to include certificate holders and applicants for a Certificate of Compliance (CoC) would be made as part of the rulemaking to conform Part 71 to IAEA standard ST-1.

The Commission recently issued a final rule expanding QA regulations in Part 72, Subpart G, to specifically include certificate holders and applicants for a CoC. Consequently, the NRC is now considering similarly expanding the QA regulations in Part 71, Subpart H, to specifically include certificate holders and applicants for a CoC. The NRC believes that this change is necessary to ensure consistency between the QA provisions of Parts 71 and 72, particularly in light of NRC approval of dual purpose cask designs. As with the Part 72 final rule, this issue would provide explicit notice to certificate holders and applicants for a CoC of their QA responsibilities; and would provide the NRC staff with additional enforcement sanction--should violations of the Part 71 QA requirements occur.

Factors for Consideration

- Should consistency be maintained between the QA provisions of Parts 71 and 72, in light of the existence of dual purpose cask designs?

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[2] SECY-97-214, "Changes to 10 CFR Part 72, Expand Applicability to Include Certificate Holders and Applicants and Their Contractors and Subcontractors," dated September 24, 1997. This rulemaking plan expanded the applicability of the QA provision of Part 72, Subpart G, to specifically include Part 72 certificate holders and applicants for a Certificate of Compliance.

Issue 14. Adoption of ASME Code

Description

The NRC staff proposes that the ASME (American Society of Mechanical Engineers) Code, Section III, Division 3, be incorporated by reference in 10 CFR Part 71 via rulemaking. This rule will ensure implementation of the ASME Code in cask fabrication, including all QA aspects of the code, such as the presence of an authorized nuclear inspector (ANI) during the fabrication to ensure that the code requirements are met, and stamping of components after fabrication is complete. This approach would be similar to how the ASME Code is endorsed for power reactors under 10 CFR 50.55(a) and would make the fabrication process for transportation cask containments commensurate with that used for nuclear power plant components.

NRC inspections of vendors'/fabricators' shops (for fabrication of spent fuel storage canisters and transportation casks) have identified, over the past several years, quality control (QC) and quality assurance (QA) problems in these fabricated systems. A major reason for these problems is that these fabricators/vendors do not fully use a code for QA in the fabrication process of these systems. These QA problems have in some instances continued in spite of repeated adverse NRC and licensee findings.

The NRC staff intends to incorporate two recent developments. First, ASME issued a consensus code in May 1997 entitled: "Containment Systems and Transport Packages for Spent Fuel and High Level Radioactive Waste," ASME B&PV Code Section III, Division 3, that would require stamping of components constructed to it (i.e., the transportation cask's containment). Second, Public Law 104-113 "National Technology Transfer and Advancement Act" was enacted in 1996 to require that Federal agencies use consensus standards (e.g., the ASME B&PV Code), except when there are justified reasons for not doing so. These two developments support efforts to initiate rulemaking in this area.

Factors for Consideration

- Can other regulatory vehicles for NRC endorsement of Code be used or should this only be done by rulemaking?
- Are there other voluntary consensus standards that should be considered in addition to, or in lieu of, ASME code?

Issue 15. Adoption of Changes, Tests, and Experiments Authority

Description

The Commission recently approved a final rule to expand the provisions of 10 CFR 72.48, "Changes, Tests, and Experiments," to include Part 72 certificate holders (October 4, 1999; 64 FR 53582). 10 CFR Part 72 Certificate holders are allowed to make changes to a spent fuel storage cask design or conduct tests and experiments, without prior NRC review and approval, if certain requirements are met. However, Part 71 contains no similar provisions to permit a certificate holder to change the design of a Part 71 transportation package. The NRC has issued Certificates of Compliance (CoC) under Parts 71 and 72 for dual purpose casks [packages] (i.e., containers intended for both the storage and transportation of spent fuel). This

has created the situation where a 10 CFR Part 72 certificate holder is authorized to change a storage design feature of a dual-purpose storage/transportation cask without obtaining NRC prior approval; however, the 10 CFR Part 71 certificate holder is not authorized to modify transportation package design without obtaining NRC prior approval, even when the same physical component and change is involved.

In SECY-99-130[3] and SECY-99-054.[4] The staff indicated that comments had been received on the proposed rule that requested that authority similar to 10 CFR 72.48 be created in Part 71, particularly with respect to dual purpose casks. Staff indicated that this issue would be addressed in the subsequent rulemaking to conform Part 71 with IAEA standard ST-1. The Commission adopted the staff's recommendations in a Staff Requirements Memorandum (SRM) dated June 22, 1999.

In SECY-99-054 staff recommended that a similar authority to 10 CFR 72.48 be created for spent fuel transportation packages intended for domestic use only. Staff also recommended that this authority be limited to Part 50 and 72 licensees shipping spent fuel and the Part 71 certificate holder. Furthermore, other supporting changes to Part 71 would be required to ensure consistency with the process contained in 10 CFR 72.48. These changes would include using common terminology such as "changes to the cask design, as described in the final safety analysis report" (FSAR) and a process for requesting amendments to a CoC. Requirements for periodically updating a transportation package FSAR would also be required to ensure an accurate "licensing" basis is available for evaluating future proposed changes, and requirements for package users to have a copy of the FSAR, and the updated FSAR.

The current IAEA standard ST-1 does not contain any equivalent provisions for changing a transportation package's design, without prior review by the competent authority.

Factors for Consideration

- Should this change authority apply to spent fuel packages involved in domestic commerce only?
- Should this change authority be expanded to include all types of transportation packages, licensees, or users?
- Should the change authority apply to all domestic transportation packages?
- Should the change authority apply to dual purpose spent fuel packages?

Issue 16. Fissile Material Exemptions and General License Provisions

Discussion

The NRC published an emergency final rule on February 10, 1997 (62 FR 5907), amending Part 71 regulations that deal with shipments of exempt quantities of fissile material and shipments of fissile material under a general license. An NRC licensee had identified that a

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[3] SECY-99-130, "Final Rule--Revisions to Requirements of 10 CFR Parts 50 and 72 Concerning Changes, Tests, and Experiments," dated May 12, 1999.

[4] SECY-99-054, "Plans for Final Rule--Revisions to Requirements of 10 CFR Parts 50, 52, and 72 Concerning Changes, Tests, and Experiments," dated February 22, 1999.

shipment of waste material (beryllium oxide containing a low concentration of high-enriched uranium) that met the fissile exemption provisions of 10 CFR 71.53 had the potential for an accidental criticality in certain specific circumstances. Packages shipped under the provisions of 10 CFR 71.53 were considered inherently safe for criticality-safety purposes. These regulations assumed that only ordinary water (H_2O) could be present as a moderating material. The regulations did not contemplate the presence of special moderating materials (e.g., beryllium, graphite, or deuterium). Because of this criticality safety issue, the NRC published a rule that was immediately effective with no opportunity for pre-promulgation public comment. The NRC did solicit comments after the rule was effective. All public comments supported the need for the emergency final rule when the shipments contained special moderators (moderators other than water); however, the commenters stated that the rule had gone too far for water moderated shipments, that it was excessively restrictive and costly to licensees, and that further rulemaking was necessary.

Based on these comments, NRC staff contracted with Oak Ridge National Laboratory (ORNL) to thoroughly review fissile material exemptions and general license provisions. ORNL performed computer model calculations of k_{eff} (k-effective) for various combinations of fissile material and moderating material--including beryllium, carbon, deuterium, silicon-dioxide, and water--to verify the accuracy of minimum critical mass values. These minimum critical mass values were then applied to the regulatory structure contained in Part 71, and revised mass limits for both the general license and exemption provisions to Part 71 were determined. Also, ORNL researched the historical bases for the fissile material exemption and general license regulations in Part 71 and discussed the impact of the emergency final rule's restrictions on NRC licensees. The ORNL study was issued as NUREG/CR-5342 in July 1998 (available via the following NRC web site: http://www.nrc.gov/NRC/NUREGS/CR5342/index.html). The ORNL study confirmed that the emergency rule was needed to provide safe transportation of packages with special moderators that are shipped under the general license and fissile material exemptions, but may be excessive for water-moderated shipments.

NUREG/CR-5342 identified 16 recommended actions for additional rulemaking. Additionally, the Commission's SRM on SECY-96-268 approving the emergency final rule directed the staff to issue guidance for instances where fissile materials may be mixed in the same shipping container with different moderators. The staff indicated that this issue would be addressed in a forthcoming rulemaking (memorandum from the EDO to the Commission, dated September 8, 1998). On October 27, 1999, the NRC published Federal Register Notice 64 FR 57769 responding to public comments on the emergency final rule, and also requesting information on the cost impact of the final rule from the public, industry, and the DOE, because the NRC staff had not been successful in obtaining this information. The requirements for the fissile material general licenses are provided in 10 CFR 71.18, 71.20, 71.22, and 71.24, and the fissile material exemptions are provided in 71.53.

IAEA standard ST-1 contains language on fissile exemptions and restrictions on the use of special moderators. However, ST-1 does not presently contain provisions on general licenses for shipment of fissile material; previous version did contain general license conditions.

Factors for Consideration

- Should all, or only some, of the 16 sub-issues (i.e., the recommendations contained in NUREG/CR-5342) be included in this rulemaking on this issue?
- Should additional issues or alternative approaches on the fissile exemptions or general license provisions be included in this rulemaking?
- Is there available cost data that may help to understand the cost impact of the implemented emergency rule; or help to better understand the possible cost impact of the ORNL recommendations?

Issue 17. Double Containment of Plutonium (PRM-71-12)

Description

The NRC received a Petition for Rulemaking from International Energy Consultants, Inc. (IEC), dated September 25, 1997. The petition was docketed as PRM-71-12 and was published for public comment on February 19, 1998. The comment period was extended to July 31, 1998. The petitioner requested that regulations in 10 CFR 71.63 be eliminated. The petitioner argued that the double containment requirement in 71.63(b) was not consistent with the basis for other packaging standards (i.e., the Q-value system for identifying the A_1 and A_2 values for each nuclide). The petitioner also argued that the use of double containment for shipments of plutonium imposed unnecessary costs (i.e., fabrication of shipping packages and a weight penalty). As an option, the petitioner requested that 71.63 be entirely eliminated.

In 1974, the Atomic Energy Commission (AEC) issued 10 CFR 71.63 which imposed special requirements on the shipment of plutonium in excess of 0.74 terabecquerels (20 curies). These requirements specify that plutonium must be in solid form (71.63(a)) and that packages used to ship plutonium must provide a separate inner containment (i.e., the "double containment" requirement) (71.63(b)). In adopting these requirements, the AEC specifically excluded plutonium in the form of reactor fuel elements, metal or metal alloys, and other plutonium-bearing solids that the Commission determines, on a case-by-case basis, do not require double containment. These regulations have remained essentially unchanged since 1974, except for the addition in 1998 of vitrified high-level waste in sealed canisters to the list of exempt forms of plutonium. Double containment is in addition to Type B packaging standards and is not required for any other nuclides that are listed in Part 71. Additionally, IAEA standard ST-1 does not contain a double containment requirement for any nuclide.

The AEC issued this regulation at a time when wide-spread reprocessing of commercial spent fuel was anticipated. The AEC expected increases in the quantities of plutonium to be shipped and the number of shipments of plutonium. In addition, the specific activity of the plutonium was expected to increase with increased burnup, resulting in higher gamma and neutron radiation levels, greater heat generation, and greater pressure generation potential from plutonium nitrate solutions in shipping containers. Because of these expected changes and because of the susceptibility of liquids to leakage, the AEC believed that safety would be significantly enhanced if the basic form for shipments of plutonium were changed from liquid to solid, and if the solid form of plutonium were required to be shipped in a package providing double containment of the contents.

The AEC indicated that "The arguments for requiring a solid form of plutonium for shipment are largely subjective, in that there is no hard evidence on which to base statistical probabilities or to assess quantitatively the incremental increase in safety which is expected."[5] The AEC also indicated that the double containment provision compensates for the fact that the plutonium may not be in a "nonrespirable" form. Notwithstanding these rationales, some of the underlying assumptions for this rule were altered in 1979 when the U.S. government decided that reprocessing of civilian spent fuel and reuse of plutonium was not desirable. Consequently, the expected plutonium reprocessing economy and wide-spread shipments never materialized.

With respect to PRM-71-12, eight public comments were received on the petition; of those, three supported the petition and five opposed the petition. The supporting comments essentially stated that the IAEA's Q-System accurately reflects the dangers of nuclides, including plutonium, and that elimination of 10 CFR 71.63(a) and (b) would make the regulations more performance based, reduce costs and personnel exposures, and be consistent with the IAEA standards.

The five opposing comments essentially stated that plutonium is very dangerous, especially in liquid form, and therefore additional regulatory requirements are warranted, that existing regulations are not overly burdensome, especially in light of the total expected transportation cost, that TRUPACT-II package meets 71.63(b) requirement, that a commenter (i.e., the Western Governors Association) has worked for over 10 years to ensure a safe transportation system for WIPP, including educating the public about the TRUPACT-II package, and that any change now would erode public confidence and be detrimental to the entire transportation system for WIPP shipments, and that additional personnel exposure due to double containment is insignificant.

Factors for Consideration

- Should NRC change any of the special requirements for the transportation of plutonium?
- Should the double containment requirement in 71.63(b) be eliminated?
- Should both the solid form and the double containment requirements of 71.63(a) and (b) be eliminated?
- Is consistency with IAEA standard ST-1 important on this issue?

Issue 18. Contamination Limits as Applied to Spent Fuel and High Level Waste (HLW) Packages

Description

As part of the NRC's upcoming public meetings on proposed changes to 10 CFR Part 71, the Commission will consider the issue of removable package contamination limits for transportation (i.e., radioactive material that can be removed from the surface of a package prior to shipment). This issue involves contamination limits for all transportation packages, including spent fuel and HLW packages, contained in DOT regulations which are based on the international transportation standards for contamination limits. The NRC staff requests public and stakeholder views on whether different contamination limits should be considered for spent

[5] SECY-R-74-5, dated July 6, 1973.

fuel and HLW packages, and recommendations for future interactions that NRC has with DOT and IAEA on this issue. NRC staff is aware that the IAEA is starting a review of contamination models and limits, and this review will be conducted over the next few years.

The removable contamination limit of 4 Becquerels per square centimeter (4Bq/cm2) is contained in IAEA Safety Series 6, in ST-1, in U.S. DOT regulations (49 CFR 173.443), and by reference to DOT's regulations in NRC's 10 CFR Part 71. The limit applies to the transportation of all packages, regardless of size. Thus, the 4 Bq/cm2 contamination limit applies to shipment of spent fuel and HLW packages, even though the unique aspects of these packages were not explicitly considered in the modeling assumptions used in developing the contamination limit. Specifically, the contamination limit was designed to reduce delivery worker exposure from external contamination on small packages during frequent manual handling of these packages in freight facilities; however, unlike small packages moved by delivery workers, handling of spent fuel and HLW packages is done by cranes and other manipulation equipment, due to the large weights involved, and does not involve extensive personnel contact, thereby reducing worker exposure from external package contamination.

Irrespective of remote handling, workers must obtain contamination readings on a spent fuel or HLW package's external surfaces to ensure compliance with the 4 Bq/cm2 limit prior to release for shipment. Due to the large surface areas involved in the contamination checks, and the prolonged time that workers are in the vicinity of a loaded package while performing these checks, they receive exposure from radiation emanating through the package walls. Further, should the contamination checks reveal contamination above 4 Bq/cm2, then additional worker exposure occurs during decontamination activities and subsequent checks of contamination levels to achieve the 4 Bq/cm2 limit. It should be noted that if the contamination limit for spent fuel and HLW packages was changed, workers would still be required to check the packages for contamination (under the changed limit) and thus receive exposure while performing this activity and any required decontamination activities.

Factors for Consideration

- Should the 4 Bq/cm2 limit continue to apply to spent fuel and HLW packages or should an alternative limit be developed? Is there an alternate contamination limit or alternative approach that will result in lowered exposure to workers, yet ensure that the rail and truck workers as well as the public are adequately protected from external package contamination?
- If alternative contamination limits are established for spent fuel and HLW packages, is there any concern with the possible resulting difference in US domestic regulations and international standards?

Appendix A--Paragraphs Referenced from IAEA ST-1

Appendix A contains the full text of specific paragraphs from ST-1 referenced in the eleven IAEA-compatibility issues. Paragraphs are listed numerically in ascending order, with the corresponding issue identified in bold text at the end of the reference.

107. The Regulations do not apply to:

(e) natural material and ores containing naturally occurring radionuclides which are not intended to be processed for use of these radionuclides provided the activity concentration of the material does not exceed 10 times the values specified in paras 401-406. (Issue 2)

209. Confinement system shall mean the assembly of fissile material and packaging components specified by the designer and agreed to by the competent authority as intended to preserve criticality safety. (Issue 9)

218. Criticality safety index (CSI) assigned to a package, overpack or freight container containing fissile material shall mean a number which is used to provide control over the accumulation of packages, overpacks or freight containers containing fissile material. (Issue 9)

225. Low dispersible radioactive material shall mean either a solid radioactive material or a solid radioactive material in a sealed capsule, that has limited dispersibility and is not in powder form. (Issue 9)

230. Package shall mean the packaging with its radioactive contents as presented for transport. The types of packages covered by these Regulations, which are subject to the activity limits and material restrictions of Section IV and meet the corresponding requirements, are:

(a) Excepted package;

(b) Industrial package Type 1 (Type IP-1);

(c) Industrial package Type 2 (Type IP-2);

(d) Industrial package Type 3 (Type IP-3);

(e) Type A package;

(f) Type B(U) package;

(g) Type B(M) package;

(h) Type C package.

Packages containing fissile material or uranium hexafluoride are subject to additional requirements. (Issue 6)

232. Quality assurance shall mean a systematic programme of controls and inspections applied by any organization or body involved in the transport of radioactive material which is aimed at providing adequate confidence that the standard of safety prescribed in these Regulations is achieved in practice. (Issue 9)

401. The following basic values for individual radionuclides are given in Table I:

(a) A_1 and A_2 in TBq;

(b) activity concentration for exempt material in Bq/g; and

(c) activity limits for exempt consignments in Bq. (Issue 2)

402. For individual radionuclides which are not listed in Table I the determination of the basic radionuclide values referred to in para. 401 shall require competent authority approval or, for international transport, multilateral approval. Where the chemical form of each radionuclide is known, it is permissible to use the A_2 value related to its solubility class as recommended by the International Commission on Radiological Protection, if the chemical forms under both normal and accident conditions of transport are taken into consideration. Alternatively, the radionuclide values in Table II may be used without obtaining competent authority approval. (Issue 2)

403. In the calculations of A_1 and A_2 for a radionuclide not in Table I, a single radioactive decay chain in which the radionuclides are present in their naturally occurring proportions, and in which no daughter nuclide has a half-life either longer than 10 days or longer than that of the parent nuclide, shall be considered as a single radionuclide; and the activity to be taken into account and the A_1 or A_2 value to be applied shall be those corresponding to the parent nuclide of that chain. In the case of radioactive decay chains in which any daughter nuclide has a half-life either longer than 10 days or greater than that of the parent nuclide, the parent and such daughter nuclides shall be considered as mixtures of different nuclides. (Issue 2)

404. For mixtures of radionuclides, the determination of the basic radionuclide values referred to in para. 401 may be determined as follows:

$$X_m = \frac{1}{\sum_i \frac{f(i)}{X(i)}}$$

Table I. BASIC RADIONUCLIDE VALUES

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
Actinium (89)				
Ac-225 (a)	8×10^{-1}	6×10^{-3}	1×10^{1}	1×10^{4}
Ac-227 (a)	9×10^{-1}	9×10^{-5}	1×10^{-1}	1×10^{3}
Ac-228	6×10^{-1}	5×10^{-1}	1×10^{1}	1×10^{6}
Silver (47)				
Ag-105	2×10^{0}	2×10^{0}	1×10^{2}	1×10^{6}
Ag-108m (a)	7×10^{-1}	7×10^{-1}	1×10^{1} (b)	1×10^{6} (b)
Ag-110m (a)	4×10^{-1}	4×10^{-1}	1×10^{1}	1×10^{6}
Ag-111	2×10^{0}	6×10^{-1}	1×10^{3}	1×10^{6}
Aluminium (13)				
Al-26	1×10^{-1}	1×10^{-1}	1×10^{1}	1×10^{5}
Americium (95)				
Am-241	1×10^{1}	1×10^{-3}	1×10^{0}	1×10^{4}
Am-242m (a)	1×10^{1}	1×10^{-3}	1×10^{0} (b)	1×10^{4} (b)
Am-243 (a)	5×10^{0}	1×10^{-3}	1×10^{0} (b)	1×10^{3} (b)
Argon (18)				
Ar-37	4×10^{1}	4×10^{1}	1×10^{6}	1×10^{8}
Ar-39	2×10^{1}	4×10^{1}	1×10^{7}	1×10^{4}
Ar-41	3×10^{-1}	3×10^{-1}	1×10^{2}	1×10^{9}
Arsenic (33)				
As-72	3×10^{-1}	3×10^{-1}	1×10^{1}	1×10^{5}
As-73	4×10^{1}	4×10^{1}	1×10^{3}	1×10^{7}
As-74	1×10^{0}	9×10^{-1}	1×10^{1}	1×10^{6}
As-76	3×10^{-1}	3×10^{-1}	1×10^{2}	1×10^{5}
As-77	2×10^{1}	7×10^{-1}	1×10^{3}	1×10^{6}
Astatine (85)				
At-211 (a)	2×10^{1}	5×10^{-1}	1×10^{3}	1×10^{7}

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
Gold (79)				
Au-193	7×10^{0}	2×10^{0}	1×10^{2}	1×10^{7}
Au-194	1×10^{0}	1×10^{0}	1×10^{1}	1×10^{6}
Au-195	1×10^{1}	6×10^{0}	1×10^{2}	1×10^{7}
Au-198	1×10^{0}	6×10^{-1}	1×10^{2}	1×10^{6}
Au-199	1×10^{1}	6×10^{-1}	1×10^{2}	1×10^{6}
Barium (56)				
Ba-131 (a)	2×10^{0}	2×10^{0}	1×10^{2}	1×10^{6}
Ba-133	3×10^{0}	3×10^{0}	1×10^{2}	1×10^{6}
Ba-133m	2×10^{1}	6×10^{-1}	1×10^{2}	1×10^{6}
Ba-140 (a)	5×10^{-1}	3×10^{-1}	1×10^{1} (b)	1×10^{5} (b)
Beryllium (4)				
Be-7	2×10^{1}	2×10^{1}	1×10^{3}	1×10^{7}
Be-10	4×10^{1}	6×10^{-1}	1×10^{4}	1×10^{6}
Bismuth (83)				
Bi-205	7×10^{-1}	7×10^{-1}	1×10^{1}	1×10^{6}
Bi-206	3×10^{-1}	3×10^{-1}	1×10^{1}	1×10^{5}
Bi-207	7×10^{-1}	7×10^{-1}	1×10^{1}	1×10^{6}
Bi-210	1×10^{0}	6×10^{-1}	1×10^{3}	1×10^{6}
Bi-210m (a)	6×10^{-1}	2×10^{-2}	1×10^{1}	1×10^{5}
Bi-212 (a)	7×10^{-1}	6×10^{-1}	1×10^{1} (b)	1×10^{5} (b)
Berkelium (97)				
Bk-247	8×10^{0}	8×10^{-4}	1×10^{0}	1×10^{4}
Bk-249 (a)	4×10^{1}	3×10^{-1}	1×10^{3}	1×10^{6}
Bromine (35)				
Br-76	4×10^{-1}	4×10^{-1}	1×10^{1}	1×10^{5}
Br-77	3×10^{0}	3×10^{0}	1×10^{2}	1×10^{6}

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
Br-82	4×10^{-1}	4×10^{-1}	1×10^{1}	1×10^{6}
Carbon (6)				
C-11	1×10^{0}	6×10^{-1}	1×10^{1}	1×10^{6}
C-14	4×10^{1}	3×10^{0}	1×10^{4}	1×10^{7}
Calcium (20)				
Ca-41	Unlimited	Unlimited	1×10^{5}	1×10^{7}
Ca-45	4×10^{1}	1×10^{0}	1×10^{4}	1×10^{7}
Ca-47 (a)	3×10^{0}	3×10^{-1}	1×10^{1}	1×10^{6}
Cadmium (48)				
Cd-109	3×10^{1}	2×10^{0}	1×10^{4}	1×10^{6}
Cd-113m	4×10^{1}	5×10^{-1}	1×10^{3}	1×10^{6}
Cd-115 (a)	3×10^{0}	4×10^{-1}	1×10^{2}	1×10^{6}
Cd-115m	5×10^{-1}	5×10^{-1}	1×10^{3}	1×10^{6}
Cerium (58)				
Ce-139	7×10^{0}	2×10^{0}	1×10^{2}	1×10^{6}
Ce-141	2×10^{1}	6×10^{-1}	1×10^{2}	1×10^{7}
Ce-143	9×10^{-1}	6×10^{-1}	1×10^{2}	1×10^{6}
Ce-144 (a)	2×10^{-1}	2×10^{-1}	1×10^{2} (b)	1×10^{5} (b)
Californium (98)				
Cf-248	4×10^{1}	6×10^{-3}	1×10^{1}	1×10^{4}
Cf-249	3×10^{0}	8×10^{-4}	1×10^{0}	1×10^{3}
Cf-250	2×10^{1}	2×10^{-3}	1×10^{1}	1×10^{4}
Cf-251	7×10^{0}	7×10^{-4}	1×10^{0}	1×10^{3}
Cf-252	5×10^{-2}	3×10^{-3}	1×10^{1}	1×10^{4}
Cf-253 (a)	4×10^{1}	4×10^{-2}	1×10^{2}	1×10^{5}
Cf-254	1×10^{-3}	1×10^{-3}	1×10^{0}	1×10^{3}
Chlorine (17)				

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
Cl-36	1×10^{1}	6×10^{-1}	1×10^{4}	1×10^{6}
Cl-38	2×10^{-1}	2×10^{-1}	1×10^{1}	1×10^{5}
Curium (96)				
Cm-240	4×10^{1}	2×10^{-2}	1×10^{2}	1×10^{5}
Cm-241	2×10^{0}	1×10^{0}	1×10^{2}	1×10^{6}
Cm-242	4×10^{1}	1×10^{-2}	1×10^{2}	1×10^{5}
Cm-243	9×10^{0}	1×10^{-3}	1×10^{0}	1×10^{4}
Cm-244	2×10^{1}	2×10^{-3}	1×10^{1}	1×10^{4}
Cm-245	9×10^{0}	9×10^{-4}	1×10^{0}	1×10^{3}
Cm-246	9×10^{0}	9×10^{-4}	1×10^{0}	1×10^{3}
Cm-247 (a)	3×10^{0}	1×10^{-3}	1×10^{0}	1×10^{4}
Cm-248	2×10^{-2}	3×10^{-4}	1×10^{0}	1×10^{3}
Cobalt (27)				
Co-55	5×10^{-1}	5×10^{-1}	1×10^{1}	1×10^{6}
Co-56	3×10^{-1}	3×10^{-1}	1×10^{1}	1×10^{5}
Co-57	1×10^{1}	1×10^{1}	1×10^{2}	1×10^{6}
Co-58	1×10^{0}	1×10^{0}	1×10^{1}	1×10^{6}
Co-58m	4×10^{1}	4×10^{1}	1×10^{4}	1×10^{7}
Co-60	4×10^{-1}	4×10^{-1}	1×10^{1}	1×10^{5}
Chromium (24)				
Cr-51	3×10^{1}	3×10^{1}	1×10^{3}	1×10^{7}
Caesium (55)				
Cs-129	4×10^{0}	4×10^{0}	1×10^{2}	1×10^{5}
Cs-131	3×10^{1}	3×10^{1}	1×10^{3}	1×10^{6}
Cs-132	1×10^{0}	1×10^{0}	1×10^{1}	1×10^{5}
Cs-134	7×10^{-1}	7×10^{-1}	1×10^{1}	1×10^{4}
Cs-134m	4×10^{1}	6×10^{-1}	1×10^{3}	1×10^{5}

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
Cs-135	4×10^{1}	1×10^{0}	1×10^{4}	1×10^{7}
Cs-136	5×10^{-1}	5×10^{-1}	1×10^{1}	1×10^{5}
Cs-137 (a)	2×10^{0}	6×10^{-1}	1×10^{1} (b)	1×10^{4} (b)
Copper (29)				
Cu-64	6×10^{0}	1×10^{0}	1×10^{2}	1×10^{6}
Cu-67	1×10^{1}	7×10^{-1}	1×10^{2}	1×10^{6}
Dysprosium (66)				
Dy-159	2×10^{1}	2×10^{1}	1×10^{3}	1×10^{7}
Dy-165	9×10^{-1}	6×10^{-1}	1×10^{3}	1×10^{6}
Dy-166 (a)	9×10^{-1}	3×10^{-1}	1×10^{3}	1×10^{6}
Erbium (68)				
Er-169	4×10^{1}	1×10^{0}	1×10^{4}	1×10^{7}
Er-171	8×10^{-1}	5×10^{-1}	1×10^{2}	1×10^{6}
Europium (63)				
Eu-147	2×10^{0}	2×10^{0}	1×10^{2}	1×10^{6}
Eu-148	5×10^{-1}	5×10^{-1}	1×10^{1}	1×10^{6}
Eu-149	2×10^{1}	2×10^{1}	1×10^{2}	1×10^{7}
Eu-150(short lived)	2×10^{0}	7×10^{-1}	1×10^{3}	1×10^{6}
Eu-150(long lived)	7×10^{-1}	7×10^{-1}	1×10^{1}	1×10^{6}
Eu-152	1×10^{0}	1×10^{0}	1×10^{1}	1×10^{6}
Eu-152m	8×10^{-1}	8×10^{-1}	1×10^{2}	1×10^{6}
Eu-154	9×10^{-1}	6×10^{-1}	1×10^{1}	1×10^{6}
Eu-155	2×10^{1}	3×10^{0}	1×10^{2}	1×10^{7}
Eu-156	7×10^{-1}	7×10^{-1}	1×10^{1}	1×10^{6}
Fluorine (9)				
F-18	1×10^{0}	6×10^{-1}	1×10^{1}	1×10^{6}
Iron (26)				

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
Fe-52 (a)	3×10^{-1}	3×10^{-1}	1×10^{1}	1×10^{6}
Fe-55	4×10^{1}	4×10^{1}	1×10^{4}	1×10^{6}
Fe-59	9×10^{-1}	9×10^{-1}	1×10^{1}	1×10^{6}
Fe-60 (a)	4×10^{1}	2×10^{-1}	1×10^{2}	1×10^{5}
Gallium (31)				
Ga-67	7×10^{0}	3×10^{0}	1×10^{2}	1×10^{6}
Ga-68	5×10^{-1}	5×10^{-1}	1×10^{1}	1×10^{5}
Ga-72	4×10^{-1}	4×10^{-1}	1×10^{1}	1×10^{5}
Gadolinium (64)				
Gd-146 (a)	5×10^{-1}	5×10^{-1}	1×10^{1}	1×10^{6}
Gd-148	2×10^{1}	2×10^{-3}	1×10^{1}	1×10^{4}
Gd-153	1×10^{1}	9×10^{0}	1×10^{2}	1×10^{7}
Gd-159	3×10^{0}	6×10^{-1}	1×10^{3}	1×10^{6}
Germanium (32)				
Ge-68 (a)	5×10^{-1}	5×10^{-1}	1×10^{1}	1×10^{5}
Ge-71	4×10^{1}	4×10^{1}	1×10^{4}	1×10^{8}
Ge-77	3×10^{-1}	3×10^{-1}	1×10^{1}	1×10^{5}
Hafnium (72)				
Hf-172 (a)	6×10^{-1}	6×10^{-1}	1×10^{1}	1×10^{6}
Hf-175	3×10^{0}	3×10^{0}	1×10^{2}	1×10^{6}
Hf-181	2×10^{0}	5×10^{-1}	1×10^{1}	1×10^{6}
Hf-182	Unlimited	Unlimited	1×10^{2}	1×10^{6}
Mercury (80)				
Hg-194 (a)	1×10^{0}	1×10^{0}	1×10^{1}	1×10^{6}
Hg-195m (a)	3×10^{0}	7×10^{-1}	1×10^{2}	1×10^{6}
Hg-197	2×10^{1}	1×10^{1}	1×10^{2}	1×10^{7}
Hg-197m	1×10^{1}	4×10^{-1}	1×10^{2}	1×10^{6}

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
Hg-203	5×10^{0}	1×10^{0}	1×10^{2}	1×10^{5}
Holmium (67)				
Ho-166	4×10^{-1}	4×10^{-1}	1×10^{3}	1×10^{5}
Ho-166m	6×10^{-1}	5×10^{-1}	1×10^{1}	1×10^{6}
Iodine (53)				
I-123	6×10^{0}	3×10^{0}	1×10^{2}	1×10^{7}
I-124	1×10^{0}	1×10^{0}	1×10^{1}	1×10^{6}
I-125	2×10^{1}	3×10^{0}	1×10^{3}	1×10^{6}
I-126	2×10^{0}	1×10^{0}	1×10^{2}	1×10^{6}
I-129	Unlimited	Unlimited	1×10^{2}	1×10^{5}
I-131	3×10^{0}	7×10^{-1}	1×10^{2}	1×10^{6}
I-132	4×10^{-1}	4×10^{-1}	1×10^{1}	1×10^{5}
I-133	7×10^{-1}	6×10^{-1}	1×10^{1}	1×10^{6}
I-134	3×10^{-1}	3×10^{-1}	1×10^{1}	1×10^{5}
I-135 (a)	6×10^{-1}	6×10^{-1}	1×10^{1}	1×10^{6}
Indium (49)				
In-111	3×10^{0}	3×10^{0}	1×10^{2}	1×10^{6}
In-113m	4×10^{0}	2×10^{0}	1×10^{2}	1×10^{6}
In-114m (a)	1×10^{1}	5×10^{-1}	1×10^{2}	1×10^{6}
In-115m	7×10^{0}	1×10^{0}	1×10^{2}	1×10^{6}
Iridium (77)				
Ir-189 (a)	1×10^{1}	1×10^{1}	1×10^{2}	1×10^{7}
Ir-190	7×10^{-1}	7×10^{-1}	1×10^{1}	1×10^{6}
Ir-192	1×10^{0}(c)	6×10^{-1}	1×10^{1}	1×10^{4}
Ir-194	3×10^{-1}	3×10^{-1}	1×10^{2}	1×10^{5}
Potassium (19)				
K-40	9×10^{-1}	9×10^{-1}	1×10^{2}	1×10^{6}

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
K-42	2×10^{-1}	2×10^{-1}	1×10^{2}	1×10^{6}
K-43	7×10^{-1}	6×10^{-1}	1×10^{1}	1×10^{6}
Krypton (36)				
Kr-81	4×10^{1}	4×10^{1}	1×10^{4}	1×10^{7}
Kr-85	1×10^{1}	1×10^{1}	1×10^{5}	1×10^{4}
Kr-85m	8×10^{0}	3×10^{0}	1×10^{3}	1×10^{10}
Kr-87	2×10^{-1}	2×10^{-1}	1×10^{2}	1×10^{9}
Lanthanum (57)				
La-137	3×10^{1}	6×10^{0}	1×10^{3}	1×10^{7}
La-140	4×10^{-1}	4×10^{-1}	1×10^{1}	1×10^{5}
Lutetium (71)				
Lu-172	6×10^{-1}	6×10^{-1}	1×10^{1}	1×10^{6}
Lu-173	8×10^{0}	8×10^{0}	1×10^{2}	1×10^{7}
Lu-174	9×10^{0}	9×10^{0}	1×10^{2}	1×10^{7}
Lu-174m	2×10^{1}	1×10^{1}	1×10^{2}	1×10^{7}
Lu-177	3×10^{1}	7×10^{-1}	1×10^{3}	1×10^{7}
Magnesium (12)				
Mg-28 (a)	3×10^{-1}	3×10^{-1}	1×10^{1}	1×10^{5}
Manganese (25)				
Mn-52	3×10^{-1}	3×10^{-1}	1×10^{1}	1×10^{5}
Mn-53	Unlimited	Unlimited	1×10^{4}	1×10^{9}
Mn-54	1×10^{0}	1×10^{0}	1×10^{1}	1×10^{6}
Mn-56	3×10^{-1}	3×10^{-1}	1×10^{1}	1×10^{5}
Molybdenum (42)				
Mo-93	4×10^{1}	2×10^{1}	1×10^{3}	1×10^{8}
Mo-99 (a)	1×10^{0}	6×10^{-1}	1×10^{2}	1×10^{6}
Nitrogen (7)				

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
N-13	9×10^{-1}	6×10^{-1}	1×10^{2}	1×10^{9}
Sodium (11)				
Na-22	5×10^{-1}	5×10^{-1}	1×10^{1}	1×10^{6}
Na-24	2×10^{-1}	2×10^{-1}	1×10^{1}	1×10^{5}
Niobium (41)				
Nb-93m	4×10^{1}	3×10^{1}	1×10^{4}	1×10^{7}
Nb-94	7×10^{-1}	7×10^{-1}	1×10^{1}	1×10^{6}
Nb-95	1×10^{0}	1×10^{0}	1×10^{1}	1×10^{6}
Nb-97	9×10^{-1}	6×10^{-1}	1×10^{1}	1×10^{6}
Neodymium (60)				
Nd-147	6×10^{0}	6×10^{-1}	1×10^{2}	1×10^{6}
Nd-149	6×10^{-1}	5×10^{-1}	1×10^{2}	1×10^{6}
Nickel (28)				
Ni-59	Unlimited	Unlimited	1×10^{4}	1×10^{8}
Ni-63	4×10^{1}	3×10^{1}	1×10^{5}	1×10^{8}
Ni-65	4×10^{-1}	4×10^{-1}	1×10^{1}	1×10^{6}
Neptunium (93)				
Np-235	4×10^{1}	4×10^{1}	1×10^{3}	1×10^{7}
Np-236(short-lived)	2×10^{1}	2×10^{0}	1×10^{3}	1×10^{7}
Np-236(long-lived)	9×10^{0}	2×10^{-2}	1×10^{2}	1×10^{5}
Np-237	2×10^{1}	2×10^{-3}	1×10^{0} (b)	1×10^{3} (b)
Np-239	7×10^{0}	4×10^{-1}	1×10^{2}	1×10^{7}
Osmium (76)				
Os-185	1×10^{0}	1×10^{0}	1×10^{1}	1×10^{6}
Os-191	1×10^{1}	2×10^{0}	1×10^{2}	1×10^{7}
Os-191m	4×10^{1}	3×10^{1}	1×10^{3}	1×10^{7}
Os-193	2×10^{0}	6×10^{-1}	1×10^{2}	1×10^{6}

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
Os-194 (a)	3×10^{-1}	3×10^{-1}	1×10^{2}	1×10^{5}
Phosphorus (15)				
P-32	5×10^{-1}	5×10^{-1}	1×10^{3}	1×10^{5}
P-33	4×10^{1}	1×10^{0}	1×10^{5}	1×10^{8}
Protactinium (91)				
Pa-230 (a)	2×10^{0}	7×10^{-2}	1×10^{1}	1×10^{6}
Pa-231	4×10^{0}	4×10^{-4}	1×10^{0}	1×10^{3}
Pa-233	5×10^{0}	7×10^{-1}	1×10^{2}	1×10^{7}
Lead (82)				
Pb-201	1×10^{0}	1×10^{0}	1×10^{1}	1×10^{6}
Pb-202	4×10^{1}	2×10^{1}	1×10^{3}	1×10^{6}
Pb-203	4×10^{0}	3×10^{0}	1×10^{2}	1×10^{6}
Pb-205	Unlimited	Unlimited	1×10^{4}	1×10^{7}
Pb-210 (a)	1×10^{0}	5×10^{-2}	1×10^{1} (b)	1×10^{4} (b)
Pb-212 (a)	7×10^{-1}	2×10^{-1}	1×10^{1} (b)	1×10^{5} (b)
Palladium (46)				
Pd-103 (a)	4×10^{1}	4×10^{1}	1×10^{3}	1×10^{8}
Pd-107	Unlimited	Unlimited	1×10^{5}	1×10^{8}
Pd-109	2×10^{0}	5×10^{-1}	1×10^{3}	1×10^{6}
Promethium (61)				
Pm-143	3×10^{0}	3×10^{0}	1×10^{2}	1×10^{6}
Pm-144	7×10^{-1}	7×10^{-1}	1×10^{1}	1×10^{6}
Pm-145	3×10^{1}	1×10^{1}	1×10^{3}	1×10^{7}
Pm-147	4×10^{1}	2×10^{0}	1×10^{4}	1×10^{7}
Pm-148m (a)	8×10^{-1}	7×10^{-1}	1×10^{1}	1×10^{6}
Pm-149	2×10^{0}	6×10^{-1}	1×10^{3}	1×10^{6}
Pm-151	2×10^{0}	6×10^{-1}	1×10^{2}	1×10^{6}

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
Polonium (84)				
Po-210	4×10^{1}	2×10^{-2}	1×10^{1}	1×10^{4}
Praseodymium (59)				
Pr-142	4×10^{-1}	4×10^{-1}	1×10^{2}	1×10^{5}
Pr-143	3×10^{0}	6×10^{-1}	1×10^{4}	1×10^{6}
Platinum (78)				
Pt-188 (a)	1×10^{0}	8×10^{-1}	1×10^{1}	1×10^{6}
Pt-191	4×10^{0}	3×10^{0}	1×10^{2}	1×10^{6}
Pt-193	4×10^{1}	4×10^{1}	1×10^{4}	1×10^{7}
Pt-193m	4×10^{1}	5×10^{-1}	1×10^{3}	1×10^{7}
Pt-195m	1×10^{1}	5×10^{-1}	1×10^{2}	1×10^{6}
Pt-197	2×10^{1}	6×10^{-1}	1×10^{3}	1×10^{6}
Pt-197m	1×10^{1}	6×10^{-1}	1×10^{2}	1×10^{6}
Plutonium (94)				
Pu-236	3×10^{1}	3×10^{-3}	1×10^{1}	1×10^{4}
Pu-237	2×10^{1}	2×10^{1}	1×10^{3}	1×10^{7}
Pu-238	1×10^{1}	1×10^{-3}	1×10^{0}	1×10^{4}
Pu-239	1×10^{1}	1×10^{-3}	1×10^{0}	1×10^{4}
Pu-240	1×10^{1}	1×10^{-3}	1×10^{0}	1×10^{3}
Pu-241 (a)	4×10^{1}	6×10^{-2}	1×10^{2}	1×10^{5}
Pu-242	1×10^{1}	1×10^{-3}	1×10^{0}	1×10^{4}
Pu-244 (a)	4×10^{-1}	1×10^{-3}	1×10^{0}	1×10^{4}
Radium (88)				
Ra-223 (a)	4×10^{-1}	7×10^{-3}	1×10^{2} (b)	1×10^{5} (b)
Ra-224 (a)	4×10^{-1}	2×10^{-2}	1×10^{1} (b)	1×10^{5} (b)
Ra-225 (a)	2×10^{-1}	4×10^{-3}	1×10^{2}	1×10^{5}
Ra-226 (a)	2×10^{-1}	3×10^{-3}	1×10^{1} (b)	1×10^{4} (b)

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
Ra-228 (a)	6×10^{-1}	2×10^{-2}	1×10^{1} (b)	1×10^{5} (b)
Rubidium (37)				
Rb-81	2×10^{0}	8×10^{-1}	1×10^{1}	1×10^{6}
Rb-83 (a)	2×10^{0}	2×10^{0}	1×10^{2}	1×10^{6}
Rb-84	1×10^{0}	1×10^{0}	1×10^{1}	1×10^{6}
Rb-86	5×10^{-1}	5×10^{-1}	1×10^{2}	1×10^{5}
Rb-87	Unlimited	Unlimited	1×10^{4}	1×10^{7}
Rb(nat)	Unlimited	Unlimited	1×10^{4}	1×10^{7}
Rhenium (75)				
Re-184	1×10^{0}	1×10^{0}	1×10^{1}	1×10^{6}
Re-184m	3×10^{0}	1×10^{0}	1×10^{2}	1×10^{6}
Re-186	2×10^{0}	6×10^{-1}	1×10^{3}	1×10^{6}
Re-187	Unlimited	Unlimited	1×10^{6}	1×10^{9}
Re-188	4×10^{-1}	4×10^{-1}	1×10^{2}	1×10^{5}
Re-189 (a)	3×10^{0}	6×10^{-1}	1×10^{2}	1×10^{6}
Re(nat)	Unlimited	Unlimited	1×10^{6}	1×10^{9}
Rhodium (45)				
Rh-99	2×10^{0}	2×10^{0}	1×10^{1}	1×10^{6}
Rh-101	4×10^{0}	3×10^{0}	1×10^{2}	1×10^{7}
Rh-102	5×10^{-1}	5×10^{-1}	1×10^{1}	1×10^{6}
Rh-102m	2×10^{0}	2×10^{0}	1×10^{2}	1×10^{6}
Rh-103m	4×10^{1}	4×10^{1}	1×10^{4}	1×10^{8}
Rh-105	1×10^{1}	8×10^{-1}	1×10^{2}	1×10^{7}
Radon (86)				
Rn-222 (a)	3×10^{-1}	4×10^{-3}	1×10^{1} (b)	1×10^{8} (b)
Ruthenium (44)				
Ru-97	5×10^{0}	5×10^{0}	1×10^{2}	1×10^{7}

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
Ru-103 (a)	2×10^{0}	2×10^{0}	1×10^{2}	1×10^{6}
Ru-105	1×10^{0}	6×10^{-1}	1×10^{1}	1×10^{6}
Ru-106 (a)	2×10^{-1}	2×10^{-1}	1×10^{2} (b)	1×10^{5} (b)
Sulphur (16)				
S-35	4×10^{1}	3×10^{0}	1×10^{5}	1×10^{8}
Antimony (51)				
Sb-122	4×10^{-1}	4×10^{-1}	1×10^{2}	1×10^{4}
Sb-124	6×10^{-1}	6×10^{-1}	1×10^{1}	1×10^{6}
Sb-125	2×10^{0}	1×10^{0}	1×10^{2}	1×10^{6}
Sb-126	4×10^{-1}	4×10^{-1}	1×10^{1}	1×10^{5}
Scandium (21)				
Sc-44	5×10^{-1}	5×10^{-1}	1×10^{1}	1×10^{5}
Sc-46	5×10^{-1}	5×10^{-1}	1×10^{1}	1×10^{6}
Sc-47	1×10^{1}	7×10^{-1}	1×10^{2}	1×10^{6}
Sc-48	3×10^{-1}	3×10^{-1}	1×10^{1}	1×10^{5}
Selenium (34)				
Se-75	3×10^{0}	3×10^{0}	1×10^{2}	1×10^{6}
Se-79	4×10^{1}	2×10^{0}	1×10^{4}	1×10^{7}
Silicon (14)				
Si-31	6×10^{-1}	6×10^{-1}	1×10^{3}	1×10^{6}
Si-32	4×10^{1}	5×10^{-1}	1×10^{3}	1×10^{6}
Samarium (62)				
Sm-145	1×10^{1}	1×10^{1}	1×10^{2}	1×10^{7}
Sm-147	Unlimited	Unlimited	1×10^{1}	1×10^{4}
Sm-151	4×10^{1}	1×10^{1}	1×10^{4}	1×10^{8}
Sm-153	9×10^{0}	6×10^{-1}	1×10^{2}	1×10^{6}
Tin (50)				

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
Sn-113 (a)	4×10^{0}	2×10^{0}	1×10^{3}	1×10^{7}
Sn-117m	7×10^{0}	4×10^{-1}	1×10^{2}	1×10^{6}
Sn-119m	4×10^{1}	3×10^{1}	1×10^{3}	1×10^{7}
Sn-121m (a)	4×10^{1}	9×10^{-1}	1×10^{3}	1×10^{7}
Sn-123	8×10^{-1}	6×10^{-1}	1×10^{3}	1×10^{6}
Sn-125	4×10^{-1}	4×10^{-1}	1×10^{2}	1×10^{5}
Sn-126 (a)	6×10^{-1}	4×10^{-1}	1×10^{1}	1×10^{5}
Strontium (38)				
Sr-82 (a)	2×10^{-1}	2×10^{-1}	1×10^{1}	1×10^{5}
Sr-85	2×10^{0}	2×10^{0}	1×10^{2}	1×10^{6}
Sr-85m	5×10^{0}	5×10^{0}	1×10^{2}	1×10^{7}
Sr-87m	3×10^{0}	3×10^{0}	1×10^{2}	1×10^{6}
Sr-89	6×10^{-1}	6×10^{-1}	1×10^{3}	1×10^{6}
Sr-90 (a)	3×10^{-1}	3×10^{-1}	1×10^{2} (b)	1×10^{4} (b)
Sr-91 (a)	3×10^{-1}	3×10^{-1}	1×10^{1}	1×10^{5}
Sr-92 (a)	1×10^{0}	3×10^{-1}	1×10^{1}	1×10^{6}
Tritium (1)				
T(H-3)	4×10^{1}	4×10^{1}	1×10^{6}	1×10^{9}
Tantalum (73)				
Ta-178(long-lived)	1×10^{0}	8×10^{-1}	1×10^{1}	1×10^{6}
Ta-179	3×10^{1}	3×10^{1}	1×10^{3}	1×10^{7}
Ta-182	9×10^{-1}	5×10^{-1}	1×10^{1}	1×10^{4}
Terbium (65)				
Tb-157	4×10^{1}	4×10^{1}	1×10^{4}	1×10^{7}
Tb-158	1×10^{0}	1×10^{0}	1×10^{1}	1×10^{6}
Tb-160	1×10^{0}	6×10^{-1}	1×10^{1}	1×10^{6}
Technetium (43)				

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
Tc-95m (a)	2×10^{0}	2×10^{0}	1×10^{1}	1×10^{6}
Tc-96	4×10^{-1}	4×10^{-1}	1×10^{1}	1×10^{6}
Tc-96m (a)	4×10^{-1}	4×10^{-1}	1×10^{3}	1×10^{7}
Tc-97	Unlimited	Unlimited	1×10^{3}	1×10^{8}
Tc-97m	4×10^{1}	1×10^{0}	1×10^{3}	1×10^{7}
Tc-98	8×10^{-1}	7×10^{-1}	1×10^{1}	1×10^{6}
Tc-99	4×10^{1}	9×10^{-1}	1×10^{4}	1×10^{7}
Tc-99m	1×10^{1}	4×10^{0}	1×10^{2}	1×10^{7}
Tellurium (52)				
Te-121	2×10^{0}	2×10^{0}	1×10^{1}	1×10^{6}
Te-121m	5×10^{0}	3×10^{0}	1×10^{2}	1×10^{5}
Te-123m	8×10^{0}	1×10^{0}	1×10^{2}	1×10^{7}
Te-125m	2×10^{1}	9×10^{-1}	1×10^{3}	1×10^{7}
Te-127	2×10^{1}	7×10^{-1}	1×10^{3}	1×10^{6}
Te-127m (a)	2×10^{1}	5×10^{-1}	1×10^{3}	1×10^{7}
Te-129	7×10^{-1}	6×10^{-1}	1×10^{2}	1×10^{6}
Te-129m (a)	8×10^{-1}	4×10^{-1}	1×10^{3}	1×10^{6}
Te-131m (a)	7×10^{-1}	5×10^{-1}	1×10^{1}	1×10^{6}
Te-132 (a)	5×10^{-1}	4×10^{-1}	1×10^{2}	1×10^{7}
Thorium (90)				
Th-227	1×10^{1}	5×10^{-3}	1×10^{1}	1×10^{4}
Th-228 (a)	5×10^{-1}	1×10^{-3}	1×10^{0} (b)	1×10^{4} (b)
Th-229	5×10^{0}	5×10^{-4}	1×10^{0} (b)	1×10^{3} (b)
Th-230	1×10^{1}	1×10^{-3}	1×10^{0}	1×10^{4}
Th-231	4×10^{1}	2×10^{-2}	1×10^{3}	1×10^{7}
Th-232	Unlimited	Unlimited	1×10^{1}	1×10^{4}
Th-234 (a)	3×10^{-1}	3×10^{-1}	1×10^{3} (b)	1×10^{5} (b)

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
Th(nat)	Unlimited	Unlimited	1×10^{0} (b)	1×10^{3} (b)
Titanium (22)				
Ti-44 (a)	5×10^{-1}	4×10^{-1}	1×10^{1}	1×10^{5}
Thallium (81)				
Tl-200	9×10^{-1}	9×10^{-1}	1×10^{1}	1×10^{6}
Tl-201	1×10^{1}	4×10^{0}	1×10^{2}	1×10^{6}
Tl-202	2×10^{0}	2×10^{0}	1×10^{2}	1×10^{6}
Tl-204	1×10^{1}	7×10^{-1}	1×10^{4}	1×10^{4}
Thulium (69)				
Tm-167	7×10^{0}	8×10^{-1}	1×10^{2}	1×10^{6}
Tm-170	3×10^{0}	6×10^{-1}	1×10^{3}	1×10^{6}
Tm-171	4×10^{1}	4×10^{1}	1×10^{4}	1×10^{8}
Uranium (92)				
U-230 (fast lung absorption)(a)(d)	4×10^{1}	1×10^{-1}	1×10^{1} (b)	1×10^{5} (b)
U-230 (medium lung absorption)(a)(e)	4×10^{1}	4×10^{-3}	1×10^{1}	1×10^{4}
U-230 (slow lung absorption)(a)(f)	3×10^{1}	3×10^{-3}	1×10^{1}	1×10^{4}
U-232 (fast lung absorption)(d)	4×10^{1}	1×10^{-2}	1×10^{0} (b)	1×10^{3} (b)
U-232 (medium lung absorption)(e)	4×10^{1}	7×10^{-3}	1×10^{1}	1×10^{4}
U-232 (slow lung absorption)(f)	1×10^{1}	1×10^{-3}	1×10^{1}	1×10^{4}
U-233 (fast lung absorption)(d)	4×10^{1}	9×10^{-2}	1×10^{1}	1×10^{4}
U-233 (medium lung absorption)(e)	4×10^{1}	2×10^{-2}	1×10^{2}	1×10^{5}
U-233 (slow lung absorption)(f)	4×10^{1}	6×10^{-3}	1×10^{1}	1×10^{5}
U-234 (fast lung absorption)(d)	4×10^{1}	9×10^{-2}	1×10^{1}	1×10^{4}
U-234 (medium lung absorption)(e)	4×10^{1}	2×10^{-2}	1×10^{2}	1×10^{5}
U-234 (slow lung absorption)(f)	4×10^{1}	6×10^{-3}	1×10^{1}	1×10^{5}
U-235 (all lung absorption types)(a),(d),(e),(f)	Unlimited	Unlimited	1×10^{1} (b)	1×10^{4} (b)

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
U-236 (fast lung absorption)(d)	Unlimited	Unlimited	1×10^{1}	1×10^{4}
U-236 (medium lung absorption)(e)	4×10^{1}	2×10^{-2}	1×10^{2}	1×10^{5}
U-236 (slow lung absorption)(f)	4×10^{1}	6×10^{-3}	1×10^{1}	1×10^{4}
U-238 (all lung absorption types)(d),(e),(f)	Unlimited	Unlimited	1×10^{1} (b)	1×10^{4} (b)
U (nat)	Unlimited	Unlimited	1×10^{0} (b)	1×10^{3} (b)
U (enriched to 20% or less)(g)	Unlimited	Unlimited	1×10^{0}	1×10^{3}
U (dep)	Unlimited	Unlimited	1×10^{0}	1×10^{3}
Vanadium (23)				
V-48	4×10^{-1}	4×10^{-1}	1×10^{1}	1×10^{5}
V-49	4×10^{1}	4×10^{1}	1×10^{4}	1×10^{7}
Tungsten (74)				
W-178 (a)	9×10^{0}	5×10^{0}	1×10^{1}	1×10^{6}
W-181	3×10^{1}	3×10^{1}	1×10^{3}	1×10^{7}
W-185	4×10^{1}	8×10^{-1}	1×10^{4}	1×10^{7}
W-187	2×10^{0}	6×10^{-1}	1×10^{2}	1×10^{6}
W-188 (a)	4×10^{-1}	3×10^{-1}	1×10^{2}	1×10^{5}
Xenon (54)				
Xe-122 (a)	4×10^{-1}	4×10^{-1}	1×10^{2}	1×10^{9}
Xe-123	2×10^{0}	7×10^{-1}	1×10^{2}	1×10^{9}
Xe-127	4×10^{0}	2×10^{0}	1×10^{3}	1×10^{5}
Xe-131m	4×10^{1}	4×10^{1}	1×10^{4}	1×10^{4}
Xe-133	2×10^{1}	1×10^{1}	1×10^{3}	1×10^{4}
Xe-135	3×10^{0}	2×10^{0}	1×10^{3}	1×10^{10}
Yttrium (39)				
Y-87 (a)	1×10^{0}	1×10^{0}	1×10^{1}	1×10^{6}
Y-88	4×10^{-1}	4×10^{-1}	1×10^{1}	1×10^{6}
Y-90	3×10^{-1}	3×10^{-1}	1×10^{3}	1×10^{5}

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Radionuclide (atomic number)	A_1	A_2	Activity concentration for exempt material	Activity limit for an exempt consignment
	(TBq)	(TBq)	(Bq/g)	(Bq)
Y-91	6×10^{-1}	6×10^{-1}	1×10^{3}	1×10^{6}
Y-91m	2×10^{0}	2×10^{0}	1×10^{2}	1×10^{6}
Y-92	2×10^{-1}	2×10^{-1}	1×10^{2}	1×10^{5}
Y-93	3×10^{-1}	3×10^{-1}	1×10^{2}	1×10^{5}
Ytterbium (79)				
Yb-169	4×10^{0}	1×10^{0}	1×10^{2}	1×10^{7}
Yb-175	3×10^{1}	9×10^{-1}	1×10^{3}	1×10^{7}
Zinc (30)				
Zn-65	2×10^{0}	2×10^{0}	1×10^{1}	1×10^{6}
Zn-69	3×10^{0}	6×10^{-1}	1×10^{4}	1×10^{6}
Zn-69m (a)	3×10^{0}	6×10^{-1}	1×10^{2}	1×10^{6}
Zirconium (40)				
Zr-88	3×10^{0}	3×10^{0}	1×10^{2}	1×10^{6}
Zr-93	Unlimited	Unlimited	1×10^{3} (b)	1×10^{7} (b)
Zr-95 (a)	2×10^{0}	8×10^{-1}	1×10^{1}	1×10^{6}
Zr-97 (a)	4×10^{-1}	4×10^{-1}	1×10^{1} (b)	1×10^{5} (b)

FOOTNOTES:

(a) A_1 and/or A_2 values include contributions from daughter nuclides with half-lives less than 10 days

(b) Parent nuclides and their progeny included in secular equilibrium are listed in the following:

Sr-90	Y-90
Zr-93	Nb-93m
Zr-97	Nb-97
Ru-106	Rh-106
Cs-137	Ba-137m
Ce-134	La-134
Ce-144	Pr-144
Ba-140	La-140
Bi-212	Tl-208 (0.36), Po-212 (0.64)

Table I. BASIC RADIONUCLIDE VALUES (Continued)

Pb-210	Bi-210, Po-210
Pb-212	Bi-212, Tl-208 (0.36), Po-212 (0.64)
Rn-220	Po-216
Rn-222	Po-218, Pb-214, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
Ra-228	Ac-228
Th-226	Ra-222, Rn-218, Po-214
Th-228	Ra-224, Rn-220, Po-216, Pb212, Bi-212, Tl208 (0.36), Po-212 (0.64)
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209
Th-nat	Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-234	Pa-234m
U-230	Th-226, Ra-222, Rn-218, Po-214
U-232	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
U-235	Th-231
U-238	Th-234, Pa-234m
U-nat	Th-234, Pa-234m, U-234, Th-230, Ra-226, Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
U-240	Np-240m
Np-237	Pa-233
Am-242m	Am-242
Am-243	Np-239

(c) The quantity may be determined from a measurement of the rate of decay or a measurement of the radiation level at a prescribed distance from the source.
(d) These values apply only to compounds of uranium that take the chemical form of UF_6, UO_2F_2 and $UO_2(NO_3)_2$ in both normal and accident conditions of transport.
(e) These values apply only to compounds of uranium that take the chemical form of UO_3, UF_4, UCl_4 and hexavalent compounds in both normal and accident conditions of transport.
(f) These values apply to all compounds of uranium other than those specified in (d) and (e) above.
(g) These values apply to *unirradiated uranium* only.

where,

f(i) is the fraction of activity or activity concentration of radionuclide i in the mixture;
X(i) is the appropriate value of A_1 or A_2, or the activity concentration for exempt material or the activity limit for an exempt consignment as appropriate for the radionuclide i; and
X_m is the derived value of A_1 or A_2, or the activity concentration for exempt material or the activity limit for an exempt consignment in the case of a mixture. **(Issue 2)**

Table II. BASIC RADIONUCLIDE VALUES FOR UNKNOWN RADIONUCLIDES OR MIXTURES

Radioactive contents	A_1 TBq	A_2 TBq	Activity concentration for exempt material Bq/g	Activity limits for exempt consignments Bq
Only beta or gamma emitting nuclides are known to be present	0.1	0.02	1×10^{1}	1×10^{4}
Only alpha emitting nuclides are known to be present	0.2	9×10^{-5}	1×10^{-1}	1×10^{3}
No relevant data are available	0.001	9×10^{-5}	1×10^{-1}	1×10^{3}

405. When the identity of each radionuclide is known but the individual activities of some of the radionuclides are not known, the radionuclides may be grouped and the lowest radionuclide value, as appropriate, for the radionuclides in each group may be used in applying the formulas in paras and . Groups may be based on the total alpha activity and the total beta/gamma activity when these are known, using the lowest radionuclide values for the alpha emitters or beta/gamma emitters, respectively. **(Issue 2)**

406. For individual radionuclides or for mixtures of radionuclides for which relevant data are not available, the values shown in Table II shall be used. **(Issue 2)**

543. Each label conforming to the models in Fig. 2, Fig. 3 and Fig. 4 shall be completed with the following information:

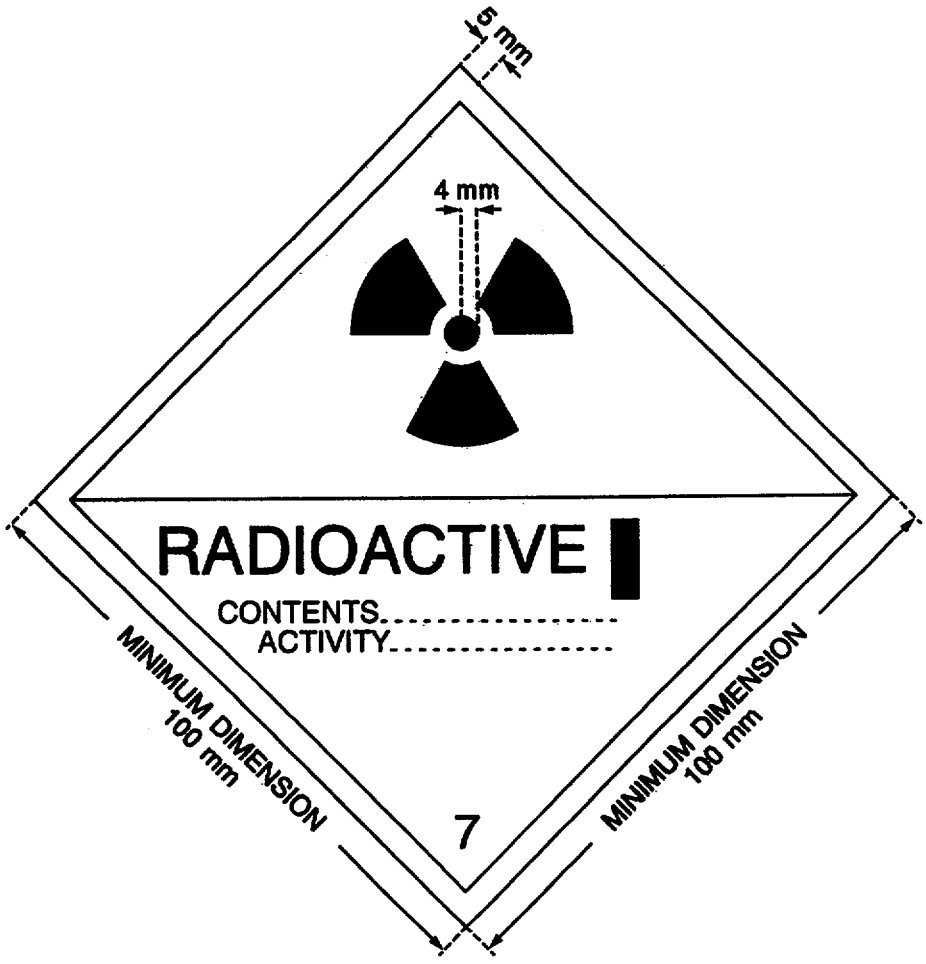

FIG. 2. Category I-WHITE label. The background colour of the label shall be white, the colour of the trefoil and the printing shall be black, and the colour of the category bar shall be red.

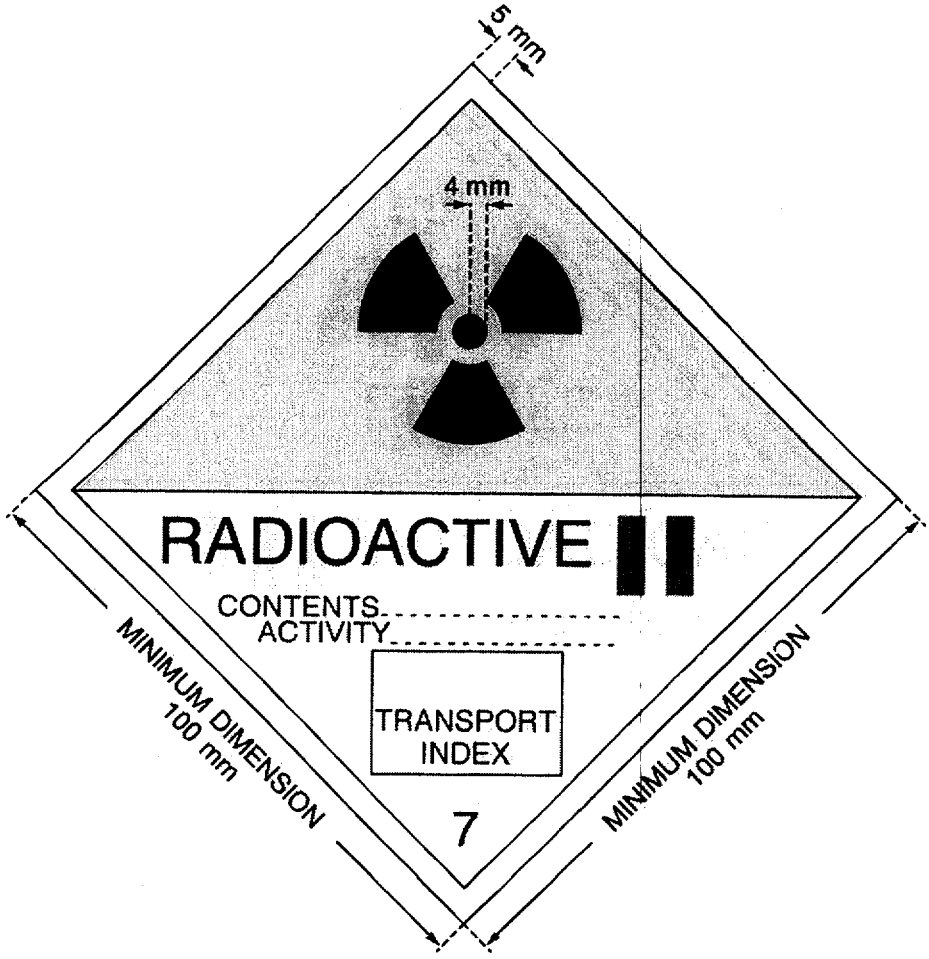

FIG. 3. Category II-YELLOW label. The background colour of the upper half of the label shall be yellow and the lower half white, the colour of the trefoil and the printing shall be black, and the colour of the category bars shall be red.

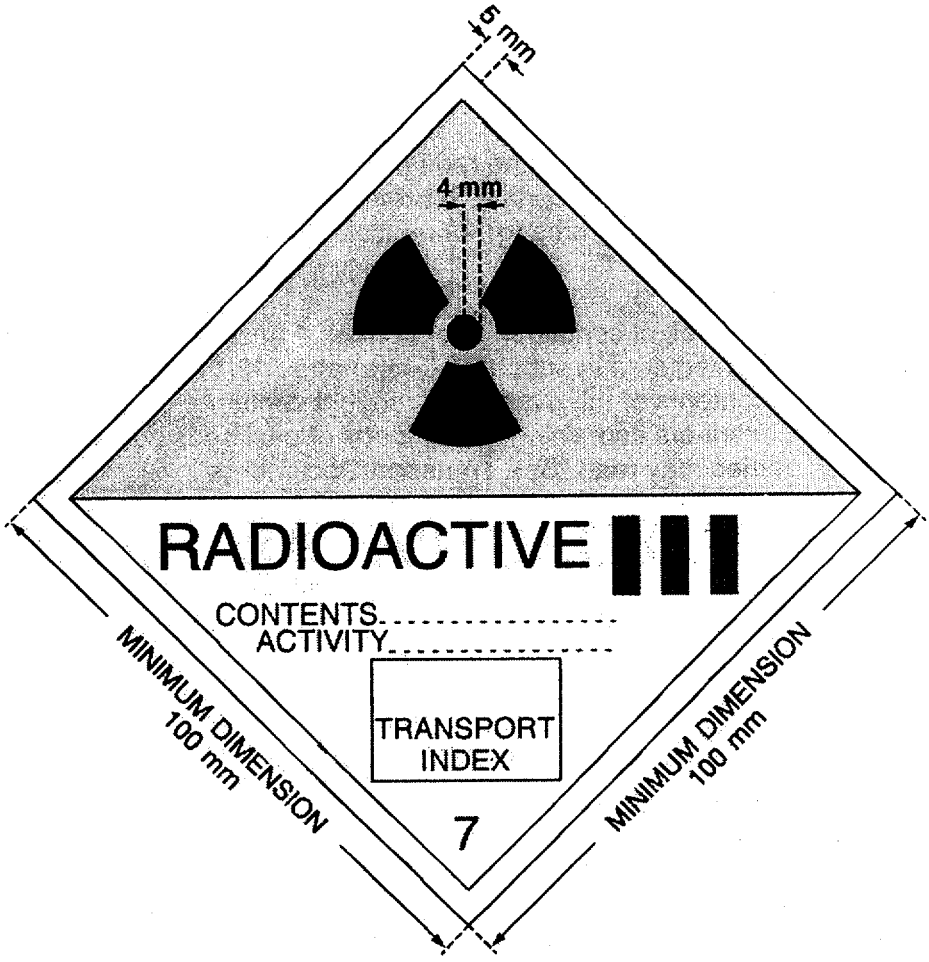

FIG. 4. Category III-YELLOW label. The background colour of the upper half of the label shall be yellow and the lower half white, the colour of the trefoil and the printing shall be black, and the colour of the category bars shall be red.

(a) Contents:

(i) Except for LSA-I material, the name(s) of the radionuclide(s) as taken from Table I, using the symbols prescribed therein. For mixtures of radionuclides, the most restrictive nuclides must be listed to the extent the space on the line permits. The group of LSA or SCO shall be shown following the name(s) of the radionuclide(s). The terms "LSA-II", "LSA-III", "SCO-I" and "SCO-II" shall be used for this purpose.

(ii) For LSA-I material, the term "LSA-I" is all that is necessary; the name of the radionuclide is not necessary.

(b) Activity: The maximum activity of the radioactive contents during transport expressed in units of becquerels (Bq) with the appropriate SI prefix (see Annex II). For fissile material, the mass of fissile material in units of grams (g), or multiples thereof, may be used in place of activity.

(c) For overpacks and freight containers the "contents" and "activity" entries on the label shall bear the information required in subparas 543(a) and 543(b), respectively, totalled together for the entire contents of the overpack or freight container except that on labels for overpacks or freight containers containing mixed loads of packages containing different radionuclides, such entries may read "See Transport Documents".

(d) Transport index: See paras 526 and 527. (No transport index entry is required for category I-WHITE.) (Issue 1)

544. Each label conforming to the model in Fig. 5 shall be completed with the criticality safety index (CSI) as stated in the certificate of approval for special arrangement or the certificate of approval for the package design issued by the competent authority. (Issue 5)

545. For overpacks and freight containers, the criticality safety index (CSI) on the label shall bear the information required in para. 544 totalled together for the fissile contents of the overpack or freight container. (Issue 5)

549. The consignor shall include in the transport documents with each consignment the following information, as applicable in the order given:

(a) The proper shipping name, as specified in Table VIII;

(b) The United Nations Class number "7";

(c) The United Nations number assigned to the material as specified in Table VIII, preceded by the letters "UN";

(d) The name or symbol of each radionuclide or, for mixtures of radionuclides, an appropriate general description or a list of the most restrictive nuclides;

(e) A description of the physical and chemical form of the material, or a notation that the material is special form radioactive material or low dispersible radioactive material. A generic chemical description is acceptable for chemical form;

(f) The maximum activity of the radioactive contents during transport expressed in units of becquerels (Bq) with an appropriate SI prefix (see Annex II). For fissile material, the mass of fissile material in units of grams (g), or appropriate multiples thereof, may be used in place of activity.

(g) The category of the package, i.e. I-WHITE, II-YELLOW, III-YELLOW;

(h) The transport index (categories II-YELLOW and III-YELLOW only);

(i) For consignments including fissile material other than consignments excepted under para. 672, the criticality safety index;

(j) The identification mark for each competent authority approval certificate (special form radioactive material, low dispersible radioactive material, special arrangement, package design, or shipment) applicable to the consignment;

(k) For consignments of packages in an overpack or freight container, a detailed statement of the contents of each package within the overpack or freight container and, where appropriate, of each overpack or freight container in the consignment. If packages are to be removed from the overpack or freight container at a point of intermediate unloading, appropriate transport documents shall be made available;

(l) Where a consignment is required to be shipped under exclusive use, the statement "EXCLUSIVE USE SHIPMENT"; and

(m) For LSA-II, LSA-III, SCO-I and SCO-II, the total activity of the consignment as a multiple of A_2 (Issue 1)

629. Except as allowed in para. 632, uranium hexafluoride shall be packaged and transported in accordance with the provisions of the International Organization for Standardization document ISO 7195:, "Packaging of uranium hexafluoride (UF_6;) for transport" [1] and the requirements of paras 630-631. The package shall also meet the requirements prescribed elsewhere in these Regulations which pertain to the radioactive and fissile properties of the material. (Issue 4)

630. Each package designed to contain 0.1 kg or more of uranium hexafluoride shall be designed so that it would meet the following requirements:

(a) withstand without leakage and without unacceptable stress, as specified in the International Organization for Standardization document ISO 7195\10\, the structural test as specified in para. 718;

(b) withstand without loss or dispersal of the uranium hexafluoride the test specified in para. 722; and

(c) withstand without rupture of the containment system the test specified in para. 728. (Issue 4)

631. Packages designed to contain 0.1 kg or more of uranium hexafluoride shall not be provided with pressure relief devices. (Issue 4)

632. Subject to the approval of the competent authority, packages designed to contain 0.1 kg or more of uranium hexafluoride may be transported if:

(a) the packages are designed to requirements other than those given in ISO 7195[10] and paras 630-631 but, notwithstanding, the requirements of paras 630-631 are met as far as practicable. (Issue 4)

657. A package for radioactive contents with activity greater than 10^5 A_2 shall be so designed that if it were subjected to the enhanced water immersion test specified in para. 730, there would be no rupture of the containment system. (Issue 7)

667. Type C packages shall be designed to meet the requirements specified in paras 606-619, and of paras 634-647, except as specified in para. 646(a), and of the requirements specified in paras 651-654, paras 658-664, and, in addition, of paras 668-670. (Issue 6)

668. A package shall be capable of meeting the assessment criteria prescribed for tests in paras 656(b) and 660 after burial in an environment defined by a thermal conductivity of 0.33 W/m.K and a temperature of 38 deg.C in the steady state. Initial conditions for the assessment shall assume that any thermal insulation of the package remains intact, the package is at the maximum normal operating pressure and the ambient temperature is 38 deg.C. (Issue 6)

669. A package shall be so designed that, if it were at the maximum normal operating pressure and subjected to:

(a) the tests specified in paras 719-724, it would restrict the loss of radioactive contents to not more than 10^{-6} A_2 per hour; and

(b) the test sequences in para. 734, it would meet the following requirements:

(i) retain sufficient shielding to ensure that the radiation level at 1 m from the surface of the package would not exceed 10 mSv/h with the maximum radioactive contents which the package is designed to contain; and

(ii) restrict the accumulated loss of radioactive contents in a period of 1 week to not more than 10 A_2 for krypton-85 and not more than A_2 for all other radionuclides.

Where mixtures of different radionuclides are present, the provisions of paras 404-406 shall apply except that for krypton-85 an effective A_2 (i) value equal to 10 A_2 may be used. For case (a) above, the assessment shall take into account the external contamination limits of para. 508. (Issue 6)

670. A package shall be so designed that there will be no rupture of the containment system following performance of the enhanced water immersion test specified in para. 730. (Issue 6)

677. For a package in isolation, it shall be assumed that water can leak into or out of all void spaces of the package, including those within the containment system. However, if the design incorporates special features to prevent such leakage of water into or out of certain void spaces, even as a result of error, absence of leakage may be assumed in respect of those void spaces. Special features shall include the following:

(a) Multiple high standard water barriers, each of which would remain watertight if the package were subject to the tests prescribed in para. 682(b), a high degree of quality control in the manufacture, maintenance and repair of packagings and tests to demonstrate the closure of each package before each shipment; or

(b) For packages containing uranium hexafluoride only:

(i) packages where, following the tests prescribed in para. 682(b), there is no physical contact between the valve and any other component of the packaging other than at its original point of attachment and where, in addition, following the test prescribed in para. 728 the valves remain leaktight; and

(ii) a high degree of quality control in the manufacture, maintenance and repair of packagings coupled with tests to demonstrate closure of each package before each shipment. (Issue 4 and issue 11)

680. For packages to be transported by air:

(a) the package shall be subcritical under conditions consistent with the tests prescribed in para. 734 assuming reflection by at least 20cm of water but no water inleakage; and

(b) allowance shall not be made for special features of para. 677 unless, following the tests specified in para. 734 and, subsequently, para. 733, leakage of water into or out of the void spaces is prevented. (Issue 11)

682. A number "N" shall be derived, such that two times "N" shall be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:

(a) Hydrogenous moderation between packages, and the package arrangement reflected on all sides by at least 20 cm of water; and

(b) The tests specified in paras 719-724 followed by whichever of the following is the more limiting:

(i) the tests specified in para. 727(b) and, either para. 727(c) for packages having a mass not greater than 500 kg and an overall density not greater than 1000 kg/m3 based on the external dimensions, or para. 727(a) for all other packages; followed by the test specified in para. 728 and completed by the tests specified in paras 731-733; or

(ii) the test specified in para. 729; and

(c) Where any part of the fissile material escapes from the containment system following the tests specified in para. 682(b), it shall be assumed that fissile material escapes from each package in the array and all of the fissile material shall be arranged in the configuration and moderation that results in the maximum neutron multiplication with close reflection by at least 20 cm of water. (Issue 10)

719. The tests are: the water spray test, the free drop test, the stacking test and the penetration test. Specimens of the package shall be subjected to the free drop test, the stacking test and the penetration test, preceded in each case by the water spray test. One specimen may be used for all the tests, provided that the requirements of para. 720 are fulfilled. (Issue 10)

720. The time interval between the conclusion of the water spray test and the succeeding test shall be such that the water has soaked in to the maximum extent, without appreciable drying of the exterior of the specimen. In the absence of any evidence to the contrary, this interval shall be taken to be two hours if the water spray is applied from four directions simultaneously. No time interval shall elapse, however, if the water spray is applied from each of the four directions consecutively. (Issue 10)

721. Water spray test: The specimen shall be subjected to a water spray test that simulates exposure to rainfall of approximately 5 cm per hour for at least one hour. (Issue 10).

722. Free drop test: The specimen shall drop onto the target so as to suffer maximum damage in respect of the safety features to be tested.

(a) The height of drop measured from the lowest point of the specimen to the upper surface of the target shall be not less than the distance specified in Table XIII for the applicable mass. The target shall be as defined in para. 717.

(b) For rectangular fibreboard or wood packages not exceeding a mass of 50 kg, a separate specimen shall be subjected to a free drop onto each corner from a height of 0.3 m.

(c) For cylindrical fibreboard packages not exceeding a mass of 100 kg, a separate specimen shall be subjected to a free drop onto each of the quarters of each rim from a height of 0.3 m. (Issue 10)

723. Stacking test: Unless the shape of the packaging effectively prevents stacking, the specimen shall be subjected, for a period of 24 h, to a compressive load equal to the greater of the following:

(a) The equivalent of 5 times the mass of the actual package; and

(b) The equivalent of 13 kPa multiplied by the vertically projected area of the package.

The load shall be applied uniformly to two opposite sides of the specimen, one of which shall be the base on which the package would typically rest. (Issue 10)

724. Penetration test: The specimen shall be placed on a rigid, flat, horizontal surface which will not move significantly while the test is being carried out.

(a) A bar of 3.2 cm in diameter with a hemispherical end and a mass of 6 kg shall be dropped and directed to fall, with its longitudinal axis vertical, onto the centre of the weakest part of the specimen, so that, if it penetrates sufficiently far, it will hit the containment system. The bar shall not be significantly deformed by the test performance.

(b) The height of drop of the bar measured from its lower end to the intended point of impact on the upper surface of the specimen shall be 1 m. (Issue 10)

727. Mechanical test: The mechanical test consists of three different drop tests. Each specimen shall be subjected to the applicable drops as specified in para. 656 or para. 682. The order in which the specimen is subjected to the drops shall be such that, on completion of the mechanical test, the specimen shall have suffered such damage as will lead to the maximum damage in the thermal test which follows.

(a) For drop I, the specimen shall drop onto the target so as to suffer the maximum damage, and the height of the drop measured from the lowest point of the specimen to the upper surface of the target shall be 9 m. The target shall be as defined in para. 717.

(b) For drop II, the specimen shall drop so as to suffer the maximum damage onto a bar rigidly mounted perpendicularly on the target. The height of the drop measured from the intended point of impact of the specimen to the upper surface of the bar shall be 1 m. The bar shall be of solid mild steel of circular section, (15.0 ± 0.5) cm in diameter and 20 cm long unless a longer bar would cause greater damage, in which case a bar of sufficient length to cause maximum damage shall be used. The upper end of the bar shall be flat and horizontal with its edges rounded off to a radius of not more than 6 mm. The target on which the bar is mounted shall be as described in para. 717.

(c) For drop III, the specimen shall be subjected to a dynamic crush test by positioning the specimen on the target so as to suffer maximum damage by the drop of a 500 kg mass from 9 m onto the specimen. The mass shall consist of a solid mild steel plate 1 m by 1 m and shall fall in a horizontal attitude. The height of the drop shall be measured from the underside of the plate to the highest point of the specimen. The target on which the specimen rests shall be as defined in para. 717. (Issue 10)

729. Water immersion test: The specimen shall be immersed under a head of water of at least 15 m for a period of not less than eight hours in the attitude which will lead to maximum damage. For demonstration purposes, an external gauge pressure of at least 150 kPa shall be considered to meet these conditions. (Issue 10)

730. Enhanced water immersion test: The specimen shall be immersed under a head of water of at least 200 m for a period of not less than one hour. For demonstration purposes, an external gauge pressure of at least 2 MPa shall be considered to meet these conditions. (Issue 7)

734. Specimens shall be subjected to the effects of each of the following test sequences in the orders specified:

(a) the tests specified in paras 727(a), 727(c), 735 and 736; and

(b) the test specified in para. 737.

Separate specimens are allowed to be used for each of the sequences (a) and (b). (Issue 6)

735. Puncture/tearing test: The specimen shall be subjected to the damaging effects of a solid probe made of mild steel. The orientation of the probe to the surface of the specimen shall be as to cause maximum damage at the conclusion of the test sequence specified in para. 734(a).

(a) The specimen, representing a package having a mass less than 250 kg, shall be placed on a target and subjected to a probe having a mass of 250 kg falling from a height of 3 m above the intended impact point. For this test the probe shall be a 20 cm diameter cylindrical bar with the striking end forming a frustum of a right circular cone with the following dimensions: 30 cm height and 2.5 cm in diameter at the top. The target on which the specimen is placed shall be as specified in para. 717.

(b) For packages having a mass of 250 kg or more, the base of the probe shall be placed on a target and the specimen dropped onto the probe. The height of the drop , measured from the point of impact with the specimen to the upper surface of the probe shall be 3 m. For this test the probe shall have the same properties and dimensions as specified in (a) above, except that the length and mass of the probe shall be such as to incur maximum damage to the specimen. The target on which the base of the probe is placed shall be as specified in para. 717. (Issue 6)

736. Enhanced thermal test: The conditions for this test shall be as specified in para. 728, except that the exposure to the thermal environment shall be for a period of 60 minutes. (Issue 6)

737. Impact test: The specimen shall be subject to an impact on a target at a velocity of not less than 90 m/s, at such an orientation as to suffer maximum damage. The target shall be as defined in para. 717. (Issue 6)

Dated at Rockville, Maryland, this 11th day of July, 2000.

For the Nuclear Regulatory Commission.
William F. Kane,
Director, Office of Nuclear Material Safety and Safeguards.

APPENDIX B

CROSS-REFERENCE OF COMMENTERS BY COMMENTER NAME

Commenter	Commenter Number	Sections
Action for a Clean Environment	AT33	2.2
AEA Technology QSA, Inc.	MD17, 0055	2.1, 3.1, 3.4, 4.1, 4.4, 5.4, 8.0, 8.4, 9.0, 9.4, 10.0, 11.0, 14.0, 14.3, 15.0, 16.0, 17.0
Airline Pilots Association	MD09	8.0
American Petroleum Institute	MD04, 0087	2.1, 2.3, 3.0, 4.1, 5.0, 11.0, 14.0
ASME International	0080	16.0
Attorney General's Office, State of New Mexico	0053	19.0, 19.1
Barrowes, Steven C.	0056	3.0, 21.0
Bastin, Clinton	AT28	3.0
Blue Ridge Environmental Defense League	MD16, 0068	2.1, 2.2, 2.4, 2.6, 14.0, 17.0, 17.1, 19.0, 19.1, 21.0
Calvert Cliffs Nuclear Power Plant, Inc.	MD18	2.1, 15.0, 15.2, 16.0, 19.0
Chem-Nuclear Systems/Nuclear Energy Institute	MD07	14.0, 14.3, 19.2, 19.3
Clark County Department of Comprehensive Planning	OA43, 0092	2.1, 2.2, 2.3, 3.4, 7.0, 16.0, 17.0, 17.3, 20.0, 21.0
Columbiana Boiler Company	0061	6.4, 15.2, 16.0, 16.3
Connecticut Department of Environmental Protection	MD01	2.1, 2.3, 2.5
Environmentalists, Inc.	0074	2.4, 2.6, 13.0, 17.0, 19.0
Eureka County, Yucca Mountain Information Office	0090	2.2, 2.3, 2.6, 3.0, 4.0, 4.1, 5.1, 7.0, 9.0, 12.0, 14.0, 16.1, 19.0, 20.0
Fabilli, Virginia	0075	2.6
Falchi, Frank	MD21	19.0, 19.1, 19.2
Ferguson, Tom	AT34	2.3
Flemming, Bill	AT32	13.0, 18.0
Florida Department of Health, Bureau of Radiation	MD02	2.1, 2.3, 2.5, 3.0, 3.1
Frontier Technology Corporation	0058	5.0, 5.1, 5.2, 5.4

Commenter	Commenter Number	Sections
Fulk, Marion	OA46	3.0, 4.1, 4.4, 20.0
GA/DNR/EPD	AT31	7.0
General Atomics	0057	10.0, 10.2
Georgia Public Service Commission	0059	2.2, 3.0, 4.0, 7.4, 10.0, 10.4, 16.0, 19.0, 20.3
GTS Duratek	0051	2.1, 3.0, 3.1, 3.4, 10.0, 10.2, 14.3, 16.0, 16.2, 19.0, 19.1
Human Race	AT24	2.4
J.L. Shepherd & Associates	OA42, OA45, 0067	2.4, 3.0, 3.1, 3.2, 3.4, 4.0, 4.4, 5.3, 7.0, 8.0, 8.1, 8.2, 8.4, 9.0, 10.0, 10.2, 14.0, 14.1, 15.0, 16.0, 17.0
League of Women Voters of South Carolina	0096	2.1, 2.3, 2.5, 2.6, 3.1, 4.0
Lincoln County/City of Caliente	0070	2.5, 3.0, 4.1, 5.0, 19.2, 20.0, 20.1
Mallinckrodt Inc.	MD19, AT26	2.5, 2.6, 3.0, 3.1, 3.3, 5.0, 5.3, 5.4, 21.0
Member of Audience	AT35	2.2
Member of Audience	AT36	2.2
Member of Audience	AT37	2.2, 4.0
Member of Audience	AT38	4.0
Member of Audience	AT39	2.3
Member of Audience	AT40	2.2
N/A	0048	3.1, 4.0
N/A	0094	2.1
N/A	0095	2.1, 2.2
New England Coalition on Nuclear Pollution	0073	2.1, 2.2, 2.3, 2.5, 3.0, 4.1, 5.0, 6.0, 6.1, 14.0, 15.0, 17.0, 18.0, 19.0
New Mexico Environmental Evaluation Group	0077	19.0, 19.2

Commenter	Commenter Number	Sections
NIRS Southeast	AT22	2.2, 2.3, 2.4, 2.6, 4.0, 4.1, 5.0, 10.0, 12.0, 12.1, 14.0, 14.1, 15.0, 16.0, 17.0, 17.1, 18.0, 19.0, 19.1, 20.0, 20.1
Nuclear Energy Institute	MD08, 0084	2.1, 2.5, 3.0, 3.1, 3.3, 3.4, 4.3, 4.4, 5.0, 5.4, 6.0, 6.4, 7.4, 8.0, 8.4, 9.0, 9.4, 10.0, 10.2, 11.0, 12.0, 12.4, 13.0, 14.0, 14.3, 15.0, 15.2, 16.0, 16.2, 17.0, 17.1, 17.2, 18.0, 18.2, 18.3, 19.0, 20.0, 21.0
Nuclear Fuel Services	0078	2.3, 3.1, 3.4, 4.4, 5.4, 6.0, 7.0, 9.0, 10.0, 10.4, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 18.2, 18.3, 19.0, 20.0
Nuclear Information and Resource Service	MD15, 0069, 0072	2.1, 2.2, 2.4, 2.5, 2.6, 5.0, 8.0, 15.0, 16.0, 17.0, 17.1, 19.0, 19.1, 20.0
Oregon State University	0054	2.1, 6.0, 6.1
Ortinger, Pat	0063	2.2
PECO Nuclear	0081	3.0, 3.1
Physicians for Social Responsibility Atlanta	AT23	2.2, 2.3, 2.6, 4.0
Port of Oakland	OA47	8.2, 21.0
Portland General Electric	0066	3.0, 3.2, 9.0, 10.0, 11.0, 12.2, 14.0, 15.0, 16.0, 16.2, 17.0, 20.0
Public Citizen	MD05, 0060, 0062	2.1, 2.2, 2.3, 2.4, 2.5, 4.0, 5.0, 5.1, 5.2, 6.0, 10.0, 14.0, 15.0, 16.0, 17.0, 17.1, 19.0, 19.1, 20.3
Shundahai Network	AT25	2.2, 2.4, 7.0
The Pennsylvania State University	0049	2.5, 3.0, 3.1, 3.4, 4.4, 5.4, 11.0, 21.0
Transport Logistics International/Columbiana Boiler Company	MD10	2.5, 6.3, 8.0, 10.0, 13.0, 15.0, 15.1, 15.2, 16.0, 16.3, 17.0, 17.1, 17.2

Commenter	Commenter Number	Sections
Tri-Valley CARES	OA41	2.2, 2.3, 2.4, 4.0, 4.1, 4.4, 5.0, 6.0, 6.4, 7.1, 8.0, 9.0, 9.4, 11.0, 12.0, 14.0, 19.0, 21.0
U.S. Department of Energy	MD12, MD13, MD14, 0065, 0091	2.1, 2.4, 3.0, 3.2, 3.3, 3.4, 4.0, 4.1, 4.2, 4.4, 5.1, 5.4, 6.0, 6.4, 7.0, 7.2, 8.0, 9.0, 10.0, 10.1, 11.0, 12.0, 12.4, 13.0, 14.0, 14.2, 15.0, 16.0, 16.1, 16.2, 17.0, 17.3, 18.0, 19.0, 19.1, 20.0
U.S. Department of the Army	0086	3.0, 3.4, 4.1, 4.2, 4.4
U.S. Department of Transportation	MD06, MD11, 0088, 0089	2.2, 2.4, 2.5, 5.0, 8.0, 8.3, 14.0, 15.0, 17.0, 17.3, 18.3, 19.0, 20.0
U.S. Nuclear Regulatory Commission	0052	2.1, 6.0, 6.1
Union of Concerned Scientists	0050, 0076	2.1, 2.2, 2.5, 3.0, 4.1, 5.0, 6.0, 6.1, 14.0, 15.0, 17.0, 18.0, 19.0
United States Enrichment Corporation	MD20, 0071	2.1, 2.5, 3.0, 3.1, 3.4, 4.4, 5.0, 5.4, 6.0, 6.3, 7.0, 7.1, 7.2, 8.0, 8.4, 9.0, 9.4, 10.0, 11.0, 12.0, 12.4, 13.0, 14.0, 14.3, 15.0, 16.0, 17.0, 18.2, 18.3, 19.0, 20.0
Virginia Power	0083	2.1, 3.0, 4.0, 4.4, 5.0, 7.0, 10.0, 11.0, 14.0, 17.0, 20.0
WAND	AT27, AT29, 0064	2.1, 2.2, 2.3, 2.6, 3.0, 4.0, 4.1, 5.1, 6.0, 7.0, 8.0, 8.1, 9.0, 10.0, 12.0, 13.0, 14.0, 14.1, 15.0, 16.0, 17.0, 17.1, 18.0, 19.0, 19.1, 20.0, 20.1
Western States Legal Foundation	OA44, 0085	2.2, 4.0, 4.4, 8.0, 16.0, 17.0, 19.0, 19.1
Womens Active for New Orleans/Women's Action for New Directions	AT30, 0082	2.2, 2.3, 2.4, 2.5, 4.0, 7.0, 7.1, 8.0, 9.0, 9.1, 10.0, 19.0, 20.0
World Nuclear Transport Institute	0079, 0093	2.1
Zirconium Environmental Committee	MD03	2.2, 2.3, 4.0

APPENDIX C

CROSS-REFERENCE OF COMMENTERS BY COMMENTER NUMBER

Commenter Number	Commenter	Organization Type
Rockville, Maryland Public Meeting (August 10, 2000)		
MD01	Connecticut Dept. Environmental Protection	State Government
MD02	Florida Dept. of Health, Bureau of Radiation	State Government
MD03	Zirconium Environmental Committee	Nuclear Industry
MD04	American Petroleum Institute	Citizen/Environmental Group
MD05	Public Citizen	Citizen/Environmental Group
MD06	U.S. Department of Transportation	Federal Government
MD07	Chem-Nuclear Systems/Nuclear Energy Institute	Nuclear Industry
MD08	Nuclear Energy Institute	Nuclear Industry
MD09	Airline Pilots Association	Professional Association
MD10	Transport Logistics International/Columbiana Boiler Company	Nuclear Industry
MD11	U.S. Department of Transportation	Federal Government
MD12	U.S. Department of Energy	Federal Government
MD13	U.S. Department of Energy	Federal Government
MD14	U.S. Department of Energy	Federal Government
MD15	Nuclear Information and Resource Service	Citizen/Environmental Group
MD16	Blue Ridge Environmental Defense League	Citizen/Environmental Group
MD17	AEA Technology QSA, Inc.	Nuclear Industry
MD18	Calvert Cliffs Nuclear Power Plant, Inc.	Nuclear Industry
MD19	Mallinckrodt Inc.	Nuclear Industry
MD20	United States Enrichment Corporation	Nuclear Industry
MD21	Falchi, Frank	Private Citizen
Atlanta, Georgia Public Meeting (September 20, 2000)		
AT22	NIRS Southeast	Citizen/Environmental Group
AT23	Physicians for Social Responsibility Atlanta	Citizen/Environmental Group
AT24	Human Race	Citizen/Environmental Group
AT25	Shundahai Network	Citizen/Environmental Group
AT26	Mallinckrodt Inc.	Nuclear Industry
AT27	WAND	Citizen/Environmental Group

Commenter Number	Commenter	Organization Type
AT28	Bastin, Clinton	Private Citizen
AT29	WAND	Citizen/Environmental Group
AT30	Womens Active for New Orleans	Citizen/Environmental Group
AT31	GA/DNR/EPD	State Government
AT32	Flemming, Bill	Private Citizen
AT33	Action for a Clean Environment	Citizen/Environmental Group
AT34	Ferguson, Tom	Private Citizen
AT35	Member of Audience	Private Citizen
AT36	Member of Audience	Private Citizen
AT37	Member of Audience	Private Citizen
AT38	Member of Audience	Private Citizen
AT39	Member of Audience	Private Citizen
AT40	Member of Audience	Private Citizen
Oakland, California Public Meeting (September 26, 2000)		
OA41	Tri-Valley CARES	Citizen/Environmental Group
OA42	J.L. Shepherd & Associates	Nuclear Industry
OA43	Clark County Department of Comprehensive Planning	Local Government
OA44	Western States Legal Foundation	Professional Association
OA45	J.L. Shepherd & Associates	Nuclear Industry
OA46	Fulk, Marion	Private Citizen
OA47	Port of Oakland	Local Government
NRC-Received Electronic and Hard Copy Comments		
0048	N/A	N/A
0049	The Pennsylvania State University	Educational Institution
0050	Union of Concerned Scientists	Citizen/Environmental Group
0051	GTS Duratek	Nuclear Industry
0052	U.S. Nuclear Regulatory Commission	Federal Government
0053	Attorney General's Office, State of New Mexico	State Government
0054	Oregon State University	Educational Institution

Commenter Number	Commenter	Organization Type
0055	AEA Technology QSA, Inc.	Nuclear Industry
0056	Barrowes, Steven C.	Private Citizen
0057	General Atomics	Nuclear Industry
0058	Frontier Technology Corporation	Nuclear Industry
0059	Georgia Public Service Commission	State Government
0060	Public Citizen	Citizen/Environmental Group
0061	Columbiana Boiler Company	Nuclear Industry
0062	Public Citizen	Citizen/Environmental Group
0063	Ortinger, Pat	Private Citizen
0064	WAND	Private Citizen
0065	U.S. Department of Energy	Federal Government
0066	Portland General Electric	Nuclear Industry
0067	J. L. Shepherd & Associates	Nuclear Industry
0068	Blue Ridge Environmental Defense League	Citizen/Environmental Group
0069	Nuclear Information and Resource Service	Citizen/Environmental Group
0070	Lincoln County/City of Caliente	Local Government
0071	United States Enrichment Corporation	Nuclear Industry
0072	Nuclear Information and Resource Service	Citizen/Environmental Group
0073	New England Coalition on Nuclear Pollution	Citizen/Environmental Group
0074	Environmentalists, Inc.	Citizen/Environmental Group
0075	Fabilli, Virginia	Private Citizen
0076	Union of Concerned Scientists	Citizen/Environmental Group
0077	New Mexico Environmental Evaluation Group	Citizen/Environmental Group
0078	Nuclear Fuel Services	Nuclear Industry
0079	World Nuclear Transport Institute	Nuclear Industry
0080	ASME International	Nuclear Industry
0081	PECO Nuclear	Nuclear Industry
0082	Women's Action for New Directions	Citizen/Environmental Group
0083	Virginia Power	Utility
0084	Nuclear Energy Institute	Nuclear Industry

Commenter Number	Commenter	Organization Type
0085	Western States Legal Foundation	Professional Association
0086	U.S. Department of the Army	Federal Government
0087	American Petroleum Institute	Citizen/Environmental Group
0088	U.S. Department of Transportation	Federal Government
0089	U.S. Department of Transportation	Federal Government
0090	Eureka County, Yucca Mountain Information Office	Local Government
0091	U.S. Department of Energy	Federal Government
0092	Clark County Department of Comprehensive Planning	Local Government
0093	World Nuclear Transport Institute	Nuclear Industry
0094	N/A	Private Citizen
0095	N/A	Private Citizen
0096	League of Women Voters of South Carolina	Citizen/Environmental Group

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10. SUPPLEMENTARY NOTES

N. Tanious, NRC Project Manager

11. ABSTRACT *(200 words or less)*

This report presents, in digest form, all comments the Nuclear Regulatory Commission (NRC) received on its Issues Paper to modify 10 CFR Part 71 requirements pertaining to the packaging and transport of radioactive materials, including fissile materials. NRC first published the Issues Paper in the Federal Register (65 FR 44360) on July 17, 2000. The NRC proposed rulemaking is intended to: (1) harmonize transportation regulations found in 10 CFR Part 71 with the most recent transportation standards established by the International Atomic Energy Agency and the U.S. Department of Transportation's requirements at 49 CFR; and (2) address the Commission's goals for risk-informed regulations and eliminating inconsistencies between Part 71 and other parts of 10 CFR. As part of its enhanced public participatory process, NRC invited written comments on the Issues Paper, established an interactive website, and held public meetings during August and September 2000 in Oakland, CA; Atlanta, GA; and Rockville, MD. Extensive and wide-ranging comments were received from almost 100 members of the public and industry at these public meetings and during the 75-day public comment period. (All comments received after the comment period ended were included in both the decisionmaking process and this digest.) This report synthesizes those comments into a publicly accessible digest form without analyzing or otherwise responding to the comments. The Issues Paper is included in this report as an Appendix.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

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