Department of Energy
Washington, DC 20585
JUL 2 9 2002

Mr. E. William Brach, Director
Spent Fuel Project Office
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Brach:

The Department of Energy (DOE) supports the Nuclear Regulatory Commission (NRC) proposal to change 10 CFR Part 71.63 and remove the requirement for "a separate container" (double containment) for plutonium. The DOE prepared the enclosed study, "*Impacts of Eliminating Double-Containment Requirements for Plutonium*," in response to the NRC "Federal Register" Notice "*Major Revision to 10 CFR Part 71: Compatibility with ST-1, the IAEA Transportation Safety Standards and Other Transportation Safety Issues, and Notice of Public Meetings*," dated July 17, 2000. A multi-disciplinary team of experts from the DOE program offices, site offices, laboratories, contractors, and consultants conducted this in-depth study. The study is presented for your consideration during the rule making process for 10 CFR Part 71.

This study supports eliminating requirements for double containment of plutonium. Using double containment causes unnecessary worker radiation exposure which is estimated to be 1,200 to 1,700 person-rem over a 10-year period. The DOE had projected spending $57 million to provide double containment in shipping plutonium oxides, plutonium residues, and damaged spent nuclear fuel in the next decade. This additional cost would not have resulted in increased worker protection.

If you have any questions, please contact me at (202) 586-5151, or Kent Hancock, Director, Office of Transportation at (301) 903-2102.

Sincerely,

Patrice M. Bubar

Patrice M. Bubar
Associate Deputy Assistant Secretary
for Integration and Disposition
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Enclosure

Add: E. William Brach
NMSS24

U.S. Department of Energy

THE IMPACTS OF ELIMINATING DOUBLE-CONTAINMENT REQUIREMENTS FOR PLUTONIUM

July 2002

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EXECUTIVE SUMMARY

Radioactive material packaging and transportation activities are an important link to the successful implementation of the Department of Energy's (DOE) *Accelerated Cleanup* strategy. Transportation of plutonium (Pu) is a notable component in the Department's challenges in this area.

The Nuclear Regulatory Commission (NRC) regulations for transportation of radioactive material in 10 CFR Part 71.63, "Special requirements for plutonium shipments" contain three significant provisions. Paraphrased, they are:

- Quantities of Pu in excess of 0.74 TBq (20 Ci)/package must be in the solid form.
- Such materials must be in a Type B packaging and within a separate inner container that meets the Type B release criteria for normal and accident conditions of transport.
- Some specific material forms are exempted and other forms can be exempted from 10CFR71.63 by action of the Commission.

In contrast with this NRC regulation, International Atomic Energy Agency (IAEA) regulations (TS-R-1) do not require any special consideration for plutonium isotopes.

In the NRC Federal Register Notice of July 17, 2000, "Major Revision to 10 CFR Part 71, Issue #17, Double Containment of Plutonium," NRC solicited comment on 10 CFR 71.63. On September 29, 2000, DOE provided comments to NRC recommending elimination this rule in its entirety. In regard to comment on Issue #17, NRC staff briefed the NRC Commission on April 9, 2001, stating that a single-containment barrier is adequate for Type B Pu transportation packages for plutonium bearing solids.

To provide more in-depth and detailed analysis to NRC's revision process on Issue #17, the DOE/EM National Transportation Program (NTP) has led a multidisciplinary team of experts from DOE program offices, site offices, laboratories, contractors, and consultants to investigate the impacts of eliminating double-containment requirements for plutonium. This study found that:

- The 10 CFR 71.63 (b) should be removed from the regulations. It has no technical basis for existence and presents a continuing cost to DOE without any commensurate safety benefit.
- DOE is projected to incur penalties from double containment in shipping transuranic (TRU) wastes, plutonium oxides and residues, and damaged spent nuclear fuel, amounting to more than $57M in the next decade. For TRU waste alone it is estimated to be $47 to 60M. The penalty for Pu oxides and residues is estimated to be $12M over the same period. Damaged DOE spent fuel could incur a significant, but undefined, cost penalty from double containment.
- In addition to these cost impacts, double containment has and will result in additional worker radiation exposure during operations with doubly contained packaging. These doses are estimated to be 1200 to 1700 person-rem over a 10-year period. This penalty is attributable almost entirely to the additional operations required for double containment of TRU wastes.
- Risk assessment estimates suggest that removing double containment may result in an imperceptible increase in public radiological risk in an accident. But the excellent safety record of single containment Type B packages in 40 years of shipments, confirmed by DOE and NRC safety studies, as well as improved QA and analysis capability developed in that period, provide reasonable assurance that this revision to the Type B packaging standards for Pu will provide adequate protection to public health, safety, and the environment during transport.
- In addition to the specific impacts cited above, not removing 10 CFR 71.63 requirements for plutonium-bearing solids in amounts greater than 20 Curies could have significant cost impact from design, certification, and fabrication of future packagings, such as the TRUPACT III or the DPP-1 and DPP-2, needed to complete DOE's *Accelerated Cleanup* strategy for resolution of the legacy wastes and materials from the cold war.

1 Recommendation: Remove 10 CFR 71.63 in its entirety from NRC regulations.

The Department of Energy (DOE) recommends eliminating the special requirements for plutonium shipments in 10 CFR 71.63. The recommendation is justified on the following grounds:

- Consistency with the use of prescriptive, performance-based safety standards
- Disappearance of the factors that motivated promulgation of 10 CFR 71.63
- Harmonization with the IAEA rules
- Consideration of impacts and benefits on DOE operations

To explore the impacts and benefits that could result if the rule is eliminated, DOE packages and shipments that might be affected are identified and impacts of 10 CFR 71.63 are estimated in this paper. This report is intended to comprehensively identify factors that pertain to the recommended action. The detailed quantitative analysis provided here is based on current best estimates of the impact of the double containment requirement past and future. The analysis strongly supports DOE's position that 10 CFR 71.63 should be removed from the regulations. It is important to emphasize that only a few implications of the cost to DOE of 10 CFR 71.63 are cited in this report and presented as examples to illustrate the impact of this requirement. However, DOE believes that the cost impact data and worker radiological dose reductions provided here, taken with the absence of regulatory justification for double containment and virtually undetectable change in public risk, should be sufficient to justify removal of 10 CFR 71.63 from the regulations.

2 Basis for the Recommendation

2.1 Consistency with the Use of Prescriptive, Performance-Based Safety Standards

The transport regulations in 10 CFR 71 may be characterized as prescriptive, performance-based safety standards. That is, the package (i.e., packaging and its radioactive contents) must meet specified radiological protection standards when subjected to certain prescribed regulatory conditions (normal and accident tests). For containment, acceptance following normal and accident conditions is based on a normalizing quantity (i.e., the A_2 value). An A_2 value is set for each radionuclide on the basis of its specific radiological health effects. The IAEA's current regulations[1] TS-R-1 and predecessor documents (SS-6) developed and used the Q-System scheme to establish the normalized values for the activity of any radionuclide that presents a specific radiological hazard to man. The A_2 quantity is the upper limit content for shipment of a normal form material in a Type A package and is an index for the allowable release rate from packages in normal transport and accident situations. The use of A_2 values was in place in the IAEA rules in the mid-1970s, so this is not a new concept. The U.S. adopted A_2 values derived from the Q system in the 1990s. Thus, this regulatory scheme is already linked to the hazard of the nuclide and, logically, no additional nuclide specific restrictions are needed.

Using this normalized approach, one can expect approximately the same health effect from the release of an A_2 quantity of any radionuclide. The result is that packagings for a specific number of Curies of plutonium are designed to more stringent containment requirements than packages containing similar Curie-amounts of tritium, molybdenum, or uranium (to name a few), because plutonium has a much lower A_2 value than these materials. To establish containment design requirements for transport packages, the A_2 values given in 10 CFR 71 are used. Of all the nuclides, only plutonium, which already has one of the lowest A_2 values and, thus, one of the most stringent leakage design limits, must be doubly contained.

[1] Regulations for the Safe Transport of Radioactive Material (1996 edition), IAEA No. TS-R-1 (formerly ST-1)

Logically, this is incompatible with current regulatory practice, but the requirement exists in the regulations as a throwback to an earlier time and different regulatory framework.

The appropriate features for containment of solid Pu contents in any quantity above the Type B limit should be determined by the package design and by NRC's analysis of its adequacy. To continue the artificial requirement for double containment plutonium contained in 10 CFR 71.63 removes flexibility in package designs that might be needed to meet DOE's mission. Thus, the DOE urges NRC to eliminate the double containment requirement as early as practicable.

2.2 Disappearance of Conditions Justifying Double Containment in the Early 1970s

The double containment requirement of 10 CFR 71.63, issued in 1974 (39 FR 20960), was motivated by anticipation, in the early 1970s, of transporting large quantities of plutonium to support reprocessing in the U.S. (see Note 1 for details). Faced with the imminent need for shipments and uncertainties in containment criteria and quality assurance requirements, the Atomic Energy Commission (AEC) didn't consider the opportunity to upgrade containment and QA requirements and invoked a requirement for double containment.

Since its inception in the mid-1970s, reprocessing in the U.S. has not materialized, containment requirements have evolved to sophisticated and quantitative procedures, and quality assurance is rigorously practiced for all transport activities, including the package design, fabrication, operations, and maintenance. Since reprocessing did not proceed in the U.S., there was little need to ship plutonium and relatively little concern with the regulatory burden imposed by double containment. However, in recent time, the need to move plutonium-bearing material has raised concern over the impact of this requirement in the regulations.

At about the time that 10 CFR 71.63 was promulgated, containment requirements in 10 CFR 71 did not have the same level of sophistication as today. In terms of containment requirements, nuclides were placed in only eight classes that grouped materials approximately according to potential hazard. The somewhat crude hazard classification and containment requirements that existed when 10 CFR 71.63 was promulgated suggest a motivation for the rule at that time. Instead of the current A_2 value classification, the radionuclides were categorized by radioactivity into several transport groups. Furthermore, containment requirements were qualitative and generally less rigorous than those of the current rules.

Although quantitative standards for containment (i.e., use of individual A_2 values) were being developed and put into practice in the U.S. at the time 10 CFR 71.63 was promulgated, they were not formally adopted. It is noted that NRC Regulatory Guide 7.4, which was issued in 1975, endorsed use of the current practice (use of A_2 values to establish containment criteria). However, the formal rule requiring this approach, which was already in use in the IAEA regulations, was not included in 10 CFR 71 until 1983 (48 FR 35600, 48 FR 38449).

In addition to concern with containment requirements, another factor that may have motivated the promulgation of the double containment rule was the absence of adequate quality assurance requirements in 10 CFR 71. The quality assurance requirements for transportation, which are contained in 10 CFR 71, were originally published on August 4, 1977, with an effective date of October 18, 1977 (42 FR 39364). On June 23, 1978, the NRC extended the implementation period for these quality assurance requirements until January 1, 1979 (43 FR 27174). The double-containment requirements of 10 CFR 71.63 and quality assurance requirements were being developed at the same time, but implementation of 10 CFR 71.63 preceded implementation of quality assurance requirements for transportation of radioactive materials. The timing would certainly suggest awareness of ensuring quality assurance requirements by the developers of 10 CFR 71.63. However, full appreciation of the positive affects of the new quality assurance requirements would not have been likely. However, it is likely that in the interim these changes improved the overall capability of packagings to provide the needed level of containment. Thus there is an expected offset to any potential increase in risk by removing a level of containment.

2.3 Harmonization with the International Atomic Energy Agency Rules

Harmonization of 10 CFR 71 with IAEA TS-R-1 is an important goal of this rulemaking because it allows for consistent regulation among the principal nations shipping nuclear materials (See Attachment 1 for an IAEA view on double containment). Only the U.S. requires double containment, but other countries that ship Pu bearing materials do not. France, Germany, Japan, and the United Kingdom, all plutonium shipping nations, follow the IAEA lead in this area and do not require double containment for plutonium. Other IAEA member nations also follow the IAEA's lead in this regard. Thus, 10 CFR 71.63 presents a striking inconsistency with the regulations of other nuclear states. To achieve harmonization with the IAEA requirements and maintain consistency with other nations requires that 10 CFR 71.63 be removed from the U.S. regulations.

2.4 DOE Shipments Affected

The requirements of 10 CFR 71.63 will affect those DOE shipments of plutonium and plutonium-containing wastes and materials that:

- are in a dispersible physical form,
- cannot be shown to contain less than 0.74 TBq (20 Ci) of plutonium, and
- have not received an exemption or been the subject of an amendment to the regulation.

These primarily include transport of:

- transuranic (TRU) wastes to the Waste Isolation Pilot Plant (WIPP) in Carlsbad, NM,
- plutonium oxides and plutonium-bearing residues and perhaps
- damaged spent nuclear fuel (spent fuel).

2.4.1 *TRU Shipments*

Current data indicates that approximately 28,000 packages of contact-handled- (CH-) TRU wastes in the TRUPACT II and HalfPACT[2] containers and approximately 960 packages of remote-handled- (RH-) TRU waste in the recently certified RH-72B container are planned to move to WIPP for the near term (2002 through 2012). Over the disposition life cycle, it is estimated that there will be approximately 50,000 packages of CH-TRU wastes and approximately 7,000 packages of RH-TRU waste to WIPP.

WIPP now owns 61 TRUPACT II packagings and has 24 more on order. Long-range planning calls for an inventory of approximately 85 0 TRUPACT II packagings and up to 15 HalfPACT packagings and approximately 20 TRUPACT III packagings for oversize TRU waste packages. Procurement plans for the RH-72B cask assumes that 12 casks will be purchased. While the restrictions of 10 CFR 71.63 remain in effect, the DOE must continue to expend funds unnecessarily for double containment packaging.

2.4.2 *Plutonium/Plutonium Oxide Shipments*

[2] One "shipment" of CH-TRU may include up to three TRUPACT II or HalfPACT packages.

Approximately 10,000 packages ("9975" packaging) of plutonium oxide wastes are planned to move from Rocky Flats to Savannah River by the year 2002 to achieve closure of Rocky Flats by the year 2006. Movement of plutonium oxide from Richland to Savannah River, consisting of approximately 4000 packages (SAFKEG), is planned to begin in 2003 or 2004 and will require three to four years to complete. In addition, there will be a large number of "9975" packagings used to transport strategic assemblies to Savannah River for processing. There will also be approximately 200 similar packages sent from Lawrence Livermore National Laboratory (LLNL) and Los Alamos National Laboratory (LANL) to Savannah River. These shipments will likely be in the 9975 packaging. Since it is not completely clear that the Pu processing line will be operating at a speed that allows multiple use of the packagings for shipments, it is assumed that most of these containers will be tied up in storage mode from now until 2012. As a result, it is assumed that package procurement is approximately 50% of the number of shipments required.

2.4.3 *Damaged Spent Nuclear Fuel Shipments*

Spent fuel that is damaged to the extent that the rod cladding's integrity is in question may be subject to the requirements of 10 CFR 71.63. However, for the Foreign Reactor Spent Fuel Return Program, damaged fuel was placed into canisters prior to placement in the cask. The canisters used for this purpose provide a certain degree of confinement but fail to meet the regulatory definition of containment because they incorporate a screen to allow drainage of the water from both the canisters and the cask. Thus, it is not clear that all damaged fuel will require double containment (see Note 3).

There is no data concerning the amount of damaged DOE spent fuel to be transported. It is known, however, that of the spent fuel generated at DOE sites, a significant portion of the elements, ten percent or more, are damaged. Some fraction of those elements would require double containment packaging or canistering. Analysis based on current assumptions suggests that in the near term (2002 through 2012), 55 metric tons of heavy metal (MTHM) of damaged spent fuel will be transported. Because of variation in this material's geometry and damage state, this will require approximately 1,000 shipments (assuming one cask per shipment), most of which will go to the Savannah River Site (SRS) and the Idaho National Engineering and Environmental Laboratory (INEEL). Over the entire disposition life cycle for intact DOE spent fuel, approximately 2,500 MTHM is to be transported, most of which will go to a geologic repository site. The number of shipments to a geologic repository site is estimated to be approximately 800 in the large capacity cask system being developed at INEEL.

2.5 Radiological Impacts and Costs of Double Containment

The impacts from meeting the double-containment standard are threefold.

- First, the time needed to prepare a double-containment package for shipment will be greater than that for an ordinary Type B package. Extra radiation exposure and cost results from the additional time and effort to secure closure on the separate inner container that would not be included if 10 CFR 71.63 were not in force.
- Second, the requirement imposes constraints on package capacity and/or cost penalties to pay for moving extra weight or more shipments.
- Third, double containment makes packages more complex and more costly to certify and build or drives a potential shipper into the costly exemption process.

Each of these areas is explored in some detail with examples in the following sections. The time period for the estimates is 2002 to 2012 and includes all expected shipments where they are reasonably known. Parameters for the estimates are given in each section and are based on data or best estimates.

2.5.1 *Exposure and Cost in Preparation and Receipt*

Additional procedures (e.g., closures and testing) are required to implement 10 CFR 71.63, which lead to added worker exposures. Exact estimates are difficult to make; these are based on the best available information at this time.

2.5.1.1 TRU Waste TRUPACTs, HalfPACTs, and RH-TRU packages take from four to seven hours to load and one to three hours to unload, depending on the facility and containers loaded. Crews performing these tasks have three to five members. From one to three hours of the loading time is directly related to operations on the separate inner containment. While the average exposure rate is approximately 1.4 mr/hr for TRUPACT IIs handled to date, dose rates three times larger are possible (and as high as 10 mr/hr is possible) when the full spectrum of packages is faced. RH-TRU packages are assumed to have exposure rates of 10 mr/hr. DOE has controlled and will control worker dose through automation and other methods but extra dose from processing doubly contained packagings is inescapable. Additional worker dose from extended exposure performing necessary work activities using the double-containment features could range from 1100 to 1600 person-rem depending on the shipping/receiving facility and crew size. The impact of dealing with the additional collective dose at WIPP, which has self-imposed an administrative worker dose limit of 1 rem/yr, would be to use more workers or develop more restrictive work processes. Both methods would be costly and unwarranted. Using only the option of increased crew sizes for loading and unloading as a measure, the additional radiation exposure would cause an incremental labor cost estimated to range from $17M to $25M (at $70/hr) for the shipments expected between now and 2012.

2.5.1.2 Plutonium Oxides For operations using the SAFKEG package, the preparation time is doubled from 30 to 60 minutes. Thus, every shipment incurs at least 1.5 extra person hours in labor cost and radiation exposure at a rate of 1 mr/hr for three members of the shipping and receiving crew. Similar increases in receipt time were assumed to add 25% additional cost and dose. For the 4000 shipments estimated by DOE for this package, this will amount to $520K (at $70/hr) and 60 person-rem exposure.

For operations using the "9975" packaging, the preparation time is increased by 30 minutes. Thus, every shipment incurs at least two extra person hours in labor cost and the opportunity for an additional two person hours of radiation exposure at a rate of 1 mr/hr for four members of the shipping and receiving crew. Similar increases in receipt time were assumed to add 25% additional cost and dose. For the almost 11,000 shipments estimated by DOE for this package, this will amount to $1,780 K (at $70/hr) and 102-person-rem exposure.

2.5.1.3 Damaged Spent Nuclear Fuel One of the more complex steps when loading a transportation cask is the sealing of its closure. Sealing and leak testing of the closure are critical steps in all cask-loading operations and are also the most time-consuming tasks. Under normal circumstances, and depending on the payload and neglecting crane travel times and distances which are highly variable among facilities, the sealing and leak testing sequence takes up to about 10 to 15 percent of the total time devoted to the loading operations. A dual-containment cask doubles the time and the complexity and the consequent exposure of the personnel to radiation without a corresponding added benefit of safety in transit. Because it is not known at this time how much damaged DOE spent fuel will need to be shipped doubly contained, no estimate of cost and worker dose during loading and unloading is possible at this time (see Note 3).

2.5.2 *Transportation Cost and Capacity Penalties*

Additional containment systems reduce cask capacities and consequently require more shipments to move the same material. In addition, the double containment represents extra weight that must be moved. The cost for moving the extra weight in the double-containment structure is estimated below. The cost of additional shipments and additional public health impacts resulting from the additional shipments that could be required are not considered here.

2.5.2.1 TRU Waste The net weight of the TRUPACT II is 12,000 pounds, of which about 2,620 pounds is the separate inner containment. The HalfPACT and RH72B separate containment weighs about 1,000 pounds. Because of the constraints of the drum configuration in the TRUPACT II, removal of the separate inner container would not increase the number of drums carried, but would allow somewhat greater mass to be contained in the drums carried in a single TRUPACT or in the total carried in a two or three TRUPACT trailer-load.

Without increased mass in the drums, the cost penalty of the inner containment is in the ton-mile tariff for shipments and additional trips. Based on typical tariffs cost range from $0.10 to $0.40 per ton-mile. Using a value of $0.20/ton-mile suggests that, for the 2002 to 2012 time period in which 321,500 CH- and RH-TRU round trip shipments of about 1,400 mile average length might be made, the extra costs would amount to about $19.7M. While this extra cost is not visible in the cost per trip that DOE pays, it was a component in bidding the contract and could be a potential future saving. Another way to look at the cost of double containment is its effect on shipment efficiency. Currently most shipments to WIPP use two TRUPACTs rather than three because heavier drums reach carload weight limit before the volume in all three TRUPACTS can be used. With increased cargo capacity attained from single containment more three TRUPACT shipment could be made. Fewer trips would be required made, resulting in decreased costs and risks. The cost reduction does not take in account the cost of certification (testing of the single containment package), additional documentation, and modification of hardware.

2.5.2.2 Plutonium Oxides The net weight of the SAFKEG is approximately 230 pounds, of which 50 pounds is the separate containment vessel. Removal of the separate containment would have no effect on the carrying capacity of the package because it is the outer vessel. However, the cost of moving the extra mass of the outer vessel amounts to $79.1K for the 3960 round trip shipments of 1,900 miles average length at a $0.20/ton-mile rate.

The net weight of the "9975" packaging is approximately 404 pounds, of which 54 pounds is the separate containment vessel. The cost of moving the extra mass of the outer vessel amounts to about $113K for the approximately 1,900 round trip shipments of 1,100 miles average length at a $0.20/ton-mile rate.

2.5.2.3 Damaged DOE Spent Nuclear Fuel A second level of containment in a spent fuel cask is normally a stainless-steel vessel that adds five to 10 percent more weight to the entire cask system. Although the weight is not a very grave concern for rail transportation, it is a fairly substantial expense for road shipments. The increased weight requires more axles to distribute the load, which in turn leads to longer vehicles requiring not only overweight, but also oversize permits. Aside from the obvious permitting cost impacts, there are restrictions of days, times, and routes of transit resulting in longer times on the road, all of which are factors that translate into added manpower costs and potentially greater cumulative exposures to the worker and public alike. Because it is not known at this time how much damaged DOE spent fuel will need to be shipped doubly contained, no estimate of operational cost impact is possible.

2.5.3 *Certification and Capital Cost Penalties*

Design costs and cost for NRC certification services are incurred by increased design complexity relating to the provision of the double-containment barrier. The alternative to the design and certification cost penalty is to petition for an exemption under 10 CFR 71.63(b)(4). Preparing the petition is not a simple process; it is time-consuming and is probably similar in cost to getting a separate containment boundary designed and certified.

2.5.3.1 CH-TRU and RH-TRU Wastes Initial TRUPACT II costs were approximately $350K per unit. Future costs are estimated at $450K for the TRUPACT II and the HalfPACT. Of this cost, approximately 25 to 30 percent is in the cost of the separate inner containment vessel. For the current procurement of an additional 24 TRUPACTs, the cost of double containment is $3,240K. For the HalfPACT (a half-height TRUPACT for higher density materials), which is in procurement, the potential cost of double containment for 15 units is estimated to be $2,025K. To produce 15 TRUPACT III (estimated to cost as much as a TRUPACT II) will cost approximately $1,700 K more for double containment than single containment. This is a potential cost saving for DOE if double containment is not required. RH-TRU casks are estimated to cost about $750K per unit. About 1/3 of the cost is for the separate inner container. With 12 units being procured, the cost of double containment is estimated to be about $2,500K. Except for TRUPACT III, DOE has incurred the costs shown. In the case of TRUPACT III, the projected savings would be reduced by the cost of certification of the revised design This process could take two years and cost more than $1M.

2.5.3.2 Plutonium Oxides The separate containment of the SAFKEG is the outer containment vessel. The additional capital cost for the feature is about 40 percent of the total cost of the package. The cost of a package will be from $12K to $8K, depending on the number produced. To procure the additional 1942 packagings estimated to be required by DOE (assumes some would be used for storage and the remainder for shipping) suggests that the cost of double containment will be $6,200K.

The separate containment of the "9975" packaging is the inner containment vessel. The additional capital cost for the feature is about 35 percent of the total cost of the package. The cost of a package will be $8.5K, depending on the number produced. Procurement is underway for about 3500 double containment packages, which will cost an extra $8.8M for the feature. To procure an additional 1940 packagings estimated to be required by DOE (assumes some would be used for storage and the remainder for shipping) suggests that the avoidable cost of double containment will be $3.3M.

2.5.3.3 DHLW Glass Exemption One successful petition has been recently granted for the "glass logs" that come out of the DHLW processing facility at Savannah River. This petition took approximately five man-years of work to prepare and staff the effort to obtain the exemption. In addition, more than $1,000K was spent testing the material form to verify that significant amounts of plutonium bearing aerosols were not released from the glass log. It took five years for the NRC to complete action on the application. Thus, the total cost to DOE to comply with 10 CFR 71.63 was approximately $2,000K (see Note 2).

2.5.3.4 Damaged Spent Nuclear Fuel The second level of containment in a spent fuel cask is normally a stainless-steel vessel that will add five to 10 percent more weight to the entire cask system and, under accident conditions, imposes its load on the entire vessel and the closure of the primary containment. This force is in addition to the payload being shipped. This requires that the primary vessel and its closure be more substantial to withstand increased impact forces. This adds increased cost of engineering and fabrication that, for the purposes of this discussion, is estimated to be in the range of five to 10 percent more than for a cask without dual containment. Thus, for spent fuel casks that can cost $4M to $8M, double containment can cost $200K to $800K per cask. Because it is not known at this time how much damaged DOE spent fuel will need to be shipped doubly contained, no estimate of capital cost impact is possible.

2.5.4 *Summary of Costs*

The net result from all three areas (TRU wastes, plutonium oxides and residues, and damaged spent nuclear fuel) is that the double-containment requirement will produce an avoidable cost to DOE of approximately $12M in capital cost, $20M in operational cost, and $26M to $40M in shipping and receiving costs. In addition, the double containment requirement will result in additional worker radiation exposure amounting to 1250 to 1770 person-rem.

Table I. Additional Cost and Radiological Impact from Double Containment Requirement for the Period from 2002 to 2012 (Based on Limited Data)

Material Shipped	Shipping and Receiving Cost ($M)	Transport Operational Costs ($M)	Avoidable Package Capital Cost ($M)	Worker Radiological Dose (person-rem)
CH- and RH-TRU Wastes (TRUPACT II, HalfPACT, and 72B)	$23.7-$37.5	$19.7*	$2.25	1086 to 1607***
Pu Oxides and Residues ("9975" packaging and SAFKEG)	$2.3	$0.190	$9.5	165
Damaged DOE Spent Fuel	TBD	TBD	TBD	TBD
Totals	$26 to $39.8	$19.89	$11.75	1251 to 1772

* Savings amounting to two to three times the amount shown may result if the weight saving from eliminating the second level of containment were fully available for moving heavier drums in TRUPACT IIs and reducing the total number of shipments.

** The glass log exemption for Savannah River DHLW cost an additional $2 million, which is not reflected here.

*** These projected doses will likely to be reduced to meet WIPP personnel radiation dose goals, however actions to reduce dose by process change or adding additional personnel could add $17M to $25M in additional cost

2.6 Benefits of Double Containment

Double containment provides some additional protection to the public in both normal and accident situations. These benefits are evaluated in the sections below, but generally relate to a potential reduction in population exposure. The total radiation exposure reduction in the cases examined below amounts to a maximum of about 30 person-rem/year distributed among a potentially exposed population of tens of millions of persons. Such an effect will not be perceptible by any measure.

2.6.1 *Risk in Incident-Free Transport*

The risk incurred by the public in incident-free transport relates principally to exposure to radiation from the package. Double containment has an impact on this source of risk because the extra boundary shields some small fraction of the radiation. However, the reduction is likely to be relatively small. In any case, the dose rate is already small enough at distances where the public is likely to be exposed that the impact of single- or double contained material will not be consequential.

One effective containment boundary is sufficient to meet containment requirements implicit in the Type B design approvals, but the materials shipped are already within one or more inner containers. The presence of these redundant containers effectively rules out any problems that might result from human errors in achieving a required level of leak-tightness for singly contained Type B package. The likelihood of failing to make an effective seal is not well known, but human factors research suggests that operations undertaken with a checklist and specific go/no go criteria, as required for Type B package shipments, would occur in less than 1 in 1,000 operations. Even such a failure presents little hazard because, as indicated above, there is at least one additional level of confinement within the Type B package.

2.6.2 *Accident Conditions*

To determine if the double-containment requirement leads to increased or decreased system safety, the results for all plutonium shipments must be integrated. This requires estimating the number of shipments of each type discussed above.

Putting quantitative estimates on the risk differential is difficult without detailed analysis of the behavior of the package and all its containers. An approximate estimate is that the fractional change in risk is the same as the fractional change in probability of accidents that might cause a release in singly versus doubly contained packages times the risk of a single-containment failure. However, this is an exercise that is based on our current understanding of containment capability, but does not relate well to the less sophisticated QA requirements and analysis capability when double containment came into the regulations.

In general, the likelihood of achieving an accident sufficient to compromise containment of a singly contained Type B package has been estimated to be fewer than 1 in 200 given that a severe accident occurs. Achieving damage to two redundant containments is likely to be a factor of 10 (or more) less likely. Thus, one could expect as much as factor of 10 lower risk relative to the single containment case. While this might seem like a large benefit, the decrease in absolute risk will be very small because the risk of shipping singly contained plutonium is exceedingly small to start. Some specific cases are examined in the following sections.

A shipment of plutonium-bearing wastes could be involved in an accident. Whether shipped in doubly or singly contained packages, most of the accidents that might occur would not likely cause either type of package to leak. A very few accidents might cause a singly contained package to leak. Because of the extra containment, even fewer accidents would cause a doubly contained package to leak. Thus, doubly contained packages will pose smaller accident risks than singly contained packages.

The fact that doubly contained packages pose lower risks is not by itself sufficient justification for using doubly contained packages. Double containment is warranted only if the absolute risks associated with the use of single-containment packages are not within the NRC's acceptable limits for public risks or the additional costs associated with using double-containment packages are not excessively large.

The following paragraphs discuss these ideas for each plutonium-containing waste and the package that would be used to ship that waste. Data from NUREG-0170 and program environmental impact statements (EIS) are used to qualitatively estimate the reduction in risk that double-containment packages would provide. At most, exposure of the public to 30 person-rem per year might be averted through use of doubly contained Pu packages for transport. The cost per avoided person-rem to members of the public is estimated and found to be high. Therefore, since the absolute risks associated with shipment of plutonium-containing wastes in single-containment packages are estimated to be small, incurring the extra costs and worker doses that are associated with shipment in double-containment packages is not warranted.

2.6.2.1 Contact-Handled TRU Waste The only assessment of TRUPACT II accident risk is contained in the WIPP EIS. The EIS follows the methodology of NUREG-0170 and the Modal Study using a package release fraction that is zero in accident severity classes I - IV and unity in accident severity classes V - VIII. To approximate the effect of single containment, the two 0170 release fractions were substituted in the calculation in order to represent single containment. The 0170 fractions were used because at the time of 0170 publication, single containment was the rule for Type B packagings considered in the analysis. The result suggests that the benefit of double containment for TRUPACT is about a factor of 1.6. Given that the largest aggregate transportation dose-risk is about 0.8 latent cancer fatalities (LCF), see Table E-

22 in WIPP EIS, the expected dose averted in using double containment is about 30 person-rem/year over 30 years. Since the total penalty for using a doubly contained TRUPACT for CH-TRU is between $31M and $45M over ten years, the cost of a person-rem averted is estimated:

about $3.1-4.5M/yr x 30 year/900 person-rem or about $100 to $145K per person rem.

This is well above the $1000/person-rem value suggested in some early NRC guidance as appropriate in cost/risk tradeoffs. This analysis is very approximate and based on two dated risk assessments. If the huge reduction in estimated risk from spent fuel shipments (NUREG-0170 vs. NUREG/CR-6672) resulting from application of modern analysis is obtained for CH-TRU, the cost-per-person-rem averted by using double containment is likely to be much higher. Ideally, an evaluation similar to that performed for NUREG/CR-6672 would be done for this type of container to better estimate the impact of double containment, but it seems unlikely to yield results that make double containment justified.

2.6.2.2 Plutonium Oxide and Plutonium-Bearing Wastes The accident risk for shipments of plutonium oxides and residues was estimated in a Rocky Flats EIS relating to the disposition of Pu residues and scrub alloys. The analysis used the methods and release fractions from NUREG-0170 for Pu oxides as a basis for the analysis. The model in NUREG-0170 was based on high-speed crash testing of the 6M and FL-10 containers performed during the 1970s. There is no equivalent data for doubly contained oxide packages, but NUREG-0170 contains a relationship of release fraction vs. severity for doubly contained packages in its 1985 Pu package release model. Packages that might replace the 6M that are doubly contained ("9975" and SAFKEG) typically have two nearly identical containment vessels. Thus, the outer containment provides significant protection to the inner one.

Based on the release models in NUREG-0170 (see Model II in Table 5-8), the relative release risk for the two types of packages is estimated to be about 0.14 (ratio of double containment risk over single containment risk). As a result, the overall accident risk in the FEIS cited above, amounting to about 0.016 person-rem for moving all the material in a 6M-like package, might become as small as 0.0024 person-rem if the packages used were doubly contained. For the total campaign, where $12M could be spent, this amounts to:

$12M / [(1-0.14) x 0.016 person-rem]

or about $850M/person-rem averted.

2.6.2.3 Remote-Handled TRU Waste For this waste form, no reduction in accident risk by using double containment is expected, because there is very little differential pressure to drive particulates from the cask. A single contained RH-TRU cask would look sufficiently like the spent fuel casks studied in NUREG/CR-6672 that the leak area from those casks could be used to estimate the accident risk. Thus, the accident risk for double containment is assumed to be zero.

2.6.2.4 Failed Fuel Because there is very little differential pressure to drive fuel particulates out of the cask and the presence of the canisters provides a tortuous path for release, damaged spent fuel in a canister has virtually no incremental accident risk over intact spent fuel, whether singly or doubly contained. An estimate of the decrease in accident risk resulting from double containment can be made by assuming that the doubly contained package has no accident risk and using the cask hole sizes computed for NUREG/CR-6672 to determine the accident risk for the single-containment case.

Where the canister is considered a containment boundary, changing the double-containment requirement would have little effect on safety or on the process for shipping the material, as operational considerations would most likely require a leak-tight canister and a leak-tight cask.

3 Summary and Conclusions

From the standpoints of consistency, risk impact, and cost, 10 CFR 71.63 should be removed from NRC regulations. Moreover, the stated motivations for initiating the rule in the mid-1970s (large numbers of shipments of nitrate solutions or other forms from reprocessing, compounded by crude containment requirements, and the absence of quality assurance requirements) no longer exist.

DOE believes that the argument for consistency with IAEA is sufficient, in itself, to justify eliminating 10 CFR 71.63 from the transport regulations. This fact, along with the considerable cost impact and lack of significant benefit, makes the case for eliminating the double containment requirements for plutonium in 10 CFR 71.63 more compelling.

The IAEA model regulations as provided in SS-6 and TS-R-1 embody the Q-system concept and are reflected in almost all parts of the U.S. national regulations. The requirements of 10 CFR 71.63 are contrary to this concept. Its removal from 10 CFR 71 should be completely justified on this basis alone.

In addition, this regulation imposes a significant cost burden and increased risk to the facility worker with little resultant reduction in risk to the public during transport of the plutonium shipment. The costs to DOE of double containment for the period from 2002 to 2012 have been conservatively estimated and are summarized in Table II.

Table II. Economic and Radiological Costs of Double-Containment Requirement for the Period from 2002 to 2012

Material Shipped	Cost ($M)	Worker Radiological Dose (person-rem)
CH- and RH-TRU Wastes (TRUPACT II, HalfPACT, and 72B)	$45.6 to $59.5	1086 to 1607
Pu Oxides and Residues ("9975" packaging and SAFKEG)	$12.1	165
Damaged DOE Spent Fuel	TBD	TBD
Total	$57.7 to 71.5	1251 to 1772 person-rem

* If additional work restrictions are imposed at WIPP to meet facility dose budget

The double-containment requirement is expected to cost DOE over $42 million and result in additional worker radiological dose of 1251 to 1772 person-rem. At the same time, the double-containment requirement is expected to reduce the dose to the public by approximately 30 person-rem/year. Incurring the extra costs and worker doses that are associated with shipment in double-containment packages is not warranted by the comparatively small reduction in risk to the public. Moreover, this risk reduction is mostly illusory, because the more primitive QA and analysis capability during the time double containment was placed into the regulations are not represented in the risk estimates.

While removing this requirement from the regulation has a cost to NRC, that one-time cost is not significant compared with its continuing burden on DOE, the nuclear industry, and the taxpayer. DOE has demonstrated the costs of the requirement and its lack of standing in international regulations. Thus, DOE urges NRC to act to remove 10 CFR 71.63 in its entirety from its package certification requirements.

NOTES

Note 1: Details on the Inception of 10 CFR 71.63

In the early 1970s, the U.S. was preparing for commercial reprocessing of spent nuclear fuel, an activity that had previously been performed exclusively by the federal government. At the time, commercial and government activities related to atomic energy were conducted under the authority of the AEC. The AEC's Directorate of Licensing (AEC-DL) regulated commercial nuclear power-related activities. Activities such as weapons production and research and development for commercial or government use were conducted by the AEC's General Manager (AEC-GM).

It was determined by the AEC that commercial reprocessing would significantly increase transport of plutonium over what was already being done to support AEC activities. Plutonium was then typically shipped as plutonium nitrate, a liquid solution of plutonium in nitric acid. The main concern expressed by some at the AEC was that, if released, the nitrate solution would be quite mobile due to its liquid state. It was also determined that plutonium oxide, which is a solid, but powdered, compound of plutonium, was a good candidate to serve as an alternate shipping form of plutonium for reprocessing. Critics of the powder form of plutonium oxide argued that it too was mobile or dispersible, as well as highly respirable. In addition to these questions, other secondary criticisms of either form were abundant. Considerable discussion followed on this subject as to which, if either, form was preferable, and if the then-existing regulations were adequate for the increased transport of plutonium expected once commercial reprocessing of spent fuel began.

When a plutonium transport rule was finally adopted into the Federal Regulations, the AEC no longer existed. In 1975, the AEC was replaced by the NRC, which succeeded the DL, and the Energy Research and Development Administration (ERDA), which succeeded the GM. To complete this short history of the AEC and its successors, it should be noted that ERDA was expanded and made a cabinet department when the DOE was formed in 1978.

The final rule, which was issued in June 1974 by the AEC, forbids the transport of liquid forms of plutonium that exceeds 0.74 tera-Becquerel (TBq) (20 Curies) and requires that solid forms exceeding the same quantity limit be double contained (39 FR 20960). (Although the final rule was published in 1974, applicants were given until 1978 to achieve compliance.) The notice of the final rule indicated that the reason for requiring double containment for the plutonium oxide powder was its respirability. The notice also recognized two common physical forms of plutonium-bearing materials that were determined not to be highly respirable, and therefore were exempted from the double-containment requirement. It was further recognized that other forms of solid plutonium, not then identified, might have similar properties of low respirability. The final rule included exemptions for reactor fuel elements, metal or metal alloys, and other solid plutonium forms, as determined by the Commission, to be exempt from the double-containment requirement that were not considered in the proposed rule.

Note 2: Details of DOE Efforts to Gain an Exemption from 10 CFR 71.63 for Glassified Wastes

Recently, DOE identified a need to ship high-level radioactive waste and other plutonium-bearing materials that were not exempt from double-containment requirements in the original 10 CFR 71.63. In November 1993, DOE petitioned the NRC to amend the transport regulations by specifically exempting canisters containing solid plutonium in vitrified glass from the double-containment requirements of 10 CFR 71.63. On February 18, 1994, the NRC published DOE's petition (U.S. Federal Register. 1994), announcing its availability under NRC docket number PRM-71-11, and requesting public comment on the petition.

The final rule was issued on June 15, 1998. The final rule includes reference to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (ASME Section VIII), which applies to non-nuclear pressure vessels. The Code was described in the documentation submitted by DOE Office of Civilian Radioactive Waste (RW) to support the petition, but only applied to some aspects of fabrication. The final rule applies to construction, which covers design and fabrication. Although the exemption is in place for canistered high-level waste transport, it is a limited exemption that requires actions beyond what would be expected in a complete exemption.

Note 3: Effects of Double Containment on Transport of Damaged Spent Fuel

An NRC Director's Decision issued in 1984 set requirements that addressed transport of damaged fuel. The requirement for all dry shipped spent fuel, damaged or undamaged, is backfilling the containment with a non-oxidizing gas. Known failed fuel, under the Director's Decision, must be held in a canister. Since the Director's Decision was issued, there have been few shipments of damaged spent fuel. Anticipating an increase in spent fuel shipments, and expecting that some of the fuel will be damaged, NRC has recently issued guidance on damaged spent fuel (ISG-1). The guidance provides information on the need for separate inner containers that meet 10 CFR 71.63 for damaged fuel, including fuel that is badly damaged, but gives no details. Although there is little experience to draw from in this area, there are several examples in which simple canisters, even ones with opened screened-bottoms, have been approved. An example of a situation where 10 CFR 71.63 was invoked is the canisters used to ship core debris from the damaged Three Mile Island 2 nuclear reactor (TMI 2). The examples cited suggest that most shipments of damaged commercial spent fuel will not require double containment, but some will. More work is necessary before DOE can estimate the inventory and extent of its failed fuel and how it will be shipped. At this point, it is not expected to generate major impacts, but should be investigated to verify and quantify that expectation.

If the canister is not considered a containment boundary (such as TMI fuel debris and the planned spent fuel cask), using double containment will significantly increase the facility worker dose. Examining the amount of time required securing the lid of the inner containment vessel and estimating the dose rate during this operation can quantify this increase in dose. It is assumed that the worker dose for securing the outer containment vessel lid is the same for both single containment and double containment.

Appendix 1

IAEA Letter of 10 July 1986, R. B. Pope to J. W. Arendt

Re: "...international attitudes, policies and procedures relating to the packaging and transport of plutonium and plutonium contaminated wastes, specifically concerning the need for separate inner containment..."

Attachment 1

IAEA Letter of 10 July 1986, R. B. Pope to J. W. Arendt

Re: "...international attitudes, policies and procedures relating to the packaging and transport of plutonium and plutonium contaminated wastes, specifically concerning the need for separate inner containment..."

INTERNATIONAL ATOMIC ENERGY AGENCY
AGENCE INTERNATIONALE DE L'ENERGIE ATOMIQUE
МЕЖДУНАРОДНОЕ АГЕНТСТВО ПО АТОМНОЙ ЭНЕРГИИ
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IN REPLY PLEASE REFER TO:
PRIERE DE RAPPELER LA REFERENCE: 611-J1.31

DIAL DIRECTLY TO EXTENSION
COMPOSER DIRECTEMENT LE NUMERO DE POSTE

10 July 1986

Dear Mr. Arendt,

This responds to your 5 June 1986 letter concerning the international attitudes, policies and procedures relating to the packaging and transport of plutonium, and plutonium contaminated wastes, specifically concerning the need for separate inner containment for plutonium packagings and concerning the venting of non-radioactive gas from packages containing transuranic wastes.

Relative to a double-containment requirement for packages containing plutonium, to my knowledge the requirement is unique to the USA. The Agency's Regulations (Safety Series No. 6) do not require double containment for plutonium. The release and radiological protection model used to establish current A_1 and A_2 values for all radionuclides considers what is allowed to escape from the package, establishes comparable hazard levels for each radioisotope, but does not provide requirements on whether this is accomplished through a single-layered or multi-layered containment system.

For plutonium-239, the A_2 value in the 1985 Edition of the Regulations is 2×10^{-4} TBq (approximately 5×10^{-3} Ci) which is a factor of 2.5 greater than that previously prescribed (i.e., in the 1973 As Amended Edition of Safety Series No. 6). The new A_2 values resulted from a very detailed study performed by the United Kingdom, and overseen by an international committee, using a model known as the "Q-System". A copy of a report documenting this study (UK CEGB Report TPRD/B/0340/R83) is enclosed. The assumptions incorporated in the Q-System include:

(a) following a "median accident" involving a radioactive material Type A transport package, a maximum intake of 10^{-6} A_2 per individual could occur (this assumption is justified on page 2 of the report enclosed), and

(b) for all radionuclides, the A_2 value will always be equal to or less than 10^6 ALI_{min}, where ALI_{min} is the minimum of the annual limits on intake (ALI's) specified in the 1982 Edition of the IAEA's Basic Safety Standards, Safety Series No. 9. (For radionuclides where the controlling hazard is from either inhalation or ingestion, the above inequality becomes an equality; i.e., $A_2 = 10^6$ ALI_{min}.)

Mr. John W. Arendt
Chairman, ANSI-Related Panel
Oak Ridge Associated Universities
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Oak Ridge, TN 37830
U.S.A.

Thus, the A_2 values in the 1985 Edition of Safety Series No. 6 are all internally consistent (i.e., consistent risk levels between radionuclides), and are also consistent with the internationally accepted basic radiation protection standards. As a result, and in the interest of providing comparable protection within the Regulations from the various radioisotopes, the A_1 and A_2 values were adjusted. For such transuranics as Pu-239, Pu-241, Am-241 and Cm-242, it was found that the previous edition of the Regulations (without a double containment requirement) was providing excessive protection when compared with such radioisotopes as P-32, S-35, Kr-85, Y-90, Xe-133, Ce-144 and Au-198. Hence the A_2 value for the former group of radioisotopes was adjusted upwards and the values for the latter group were adjusted downwards. With such an argument, it could then be asked "why would added protection (perceived or real) be required for plutonium when we have just raised its Type A package contents limits to provide a balanced risk level between radioisotopes?"

I believe it would be worthwhile to pursue this balanced-risk concept a little further. One underlying philosophy of the Transport Regulations is that a properly designed package which satisfies both the appropriate test requirements and the corresponding acceptance criteria will provide an adequate and acceptable level of radiation safety irrespective of the radioisotopes the package contains. For example, consider two packagings, each carrying a readily dispersable radioisotope (in powder or pellet form), and in each packaging the contents is 5000 times the A_2 value for that radioisotope as follows:

(a) in the first package, the contents is Pu-239, the A_2 value is 2×10^{-4} TBq and thus the package contains 1.0 TBq (27 Ci) of plutonium; and

(b) in the second package, the contents is Co-60, the A_2 value is 0.4 Bq and thus the package contains 200 TBq (54,000 Ci) of cobalt-60.

Both of these shipments are possible; both would be in Type B packages which, under normal conditions could not release more than $A_2 \times 10^{-6}$/hr (2×10^{-10} TBq/h for Pu-239 and 4×10^{-7} TBq/h for Co-60), and following the accident-simulating tests (9 m drop, 1 m drop on a punch, and 800°C, 1/2 hour thermal exposure) could not release more than A_2 per week (2×10^{-4} TBq/wk for Pu-239 and 4×10^{-1} TBq/wk for Co-60), and under these design and test conditions both would present comparable and acceptable radiological hazards; and should they both be involved in an unlikely but extra-severe accident where containment is failed and all or most of the contents are released, they would pose comparable radiological hazards (the first from inhalation, the latter from external penetrating radiation).

Ultimately the question must be asked "Can a requirement for a separate inner containment vessel be justified?" This question was posed to a group of experts during one of the panel discussions at PATRAM '86 (June 1986, Davos, Switzerland) and the only answer forthcoming was that it could only be justified emotionally.

Thus, on the first issue, the international regulatory community has found no need to single out plutonium for special treatment in the Regulations, it has not suggested a need for an inner, second containment system, and in fact recently eased the requirements on plutonium (by raising the A_1 and A_2 values) to bring plutonium more in line with other radioactive materials.

Relative to the venting of radioactive gas from a package, all I can indicate is that:

(a) the 1973 (As Amended) Edition of Safety Series No. 6 allowed a pressure relief system to be included in a Type B(M) package design (para. 244 of the 1973 (As Amended) Edition);

(b) the 1985 Edition of Safety Series No. 6 clearly specifies "Intermittent venting of Type B(M) packages may be permitted during transport provided that the operational controls for venting are acceptable to the relevant competent authorities." (para. 558 of the 1985 Edition)

Underlying the acceptability of venting of gases from Type B(M) packages, is the philosophy that the design of the package and operational controls related to the use of the package provide a level of safety comparable to that which would have been provided for a Type B(U) package, where a Type B(U) package "shall not include a pressure relief system which would allow the release of radioactive material to the environment under the conditions specified (i.e., for the tests for demonstrating ability to withstand normal conditions of transport and accident conditions in transport). Basically, the requirements set forth in Sections V and VI of the 1985 Edition of Safety Series No. 6 can be interpreted to mean that any pressure relief system on a Type B(U) package shall not release any measurable radioactive material (para. 552), and on a Type B(M) package shall not release, intermittently, more than the allowable release limit for Type B packages of 10^{-6} A_2/h following exposure to the normal conditions of transport tests and A_2/wk following exposure to the accident conditions in transport tests (para. 558).

Also, it should be noted that the Regulations preclude the use of filters in demonstrating compliance with the activity release limit requirements for a Type B(U) package (para. 551), but do not preclude the use of filters for satisfying the activity release limit requirements for a Type B(M) package.

Thus, on the second issue, the international Transport Regulations do allow intermittent venting and the use of filters on Type B(M) packages subject to demonstrating that they provide a level of safety comparable to that which would be provided by a Type B(U) package with no intermittent venting or filters; and the bases for comparison are the activity release limits imposed by para. 548 of the 1985 Edition of Safety Series No. 6.

Relative to the transport of transuranic wastes in Europe, I am afraid that the Agency has no information in this area.

I hope the preceding proves of some benefit. If you have further questions or need clarification on what is presented above, I will be available in Vienna until 15 August. I then leave the Agency and will be available at Sandia National Laboratories after 22 September.

Yours sincerely,

Ronald B. Pope
Division of Nuclear Safety

cc: R. Rawl, ORNL
L. Shappert, ORNL
J. Stiegler, SNL
R. Lynch, SNL
F. Falci, DOE