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Chief, Rules Review and Directives Branch
U.S. Nuclear Regulatory Commission
Office of Administration
Mail Stop T-6D59
Washington, D.C. 20555-0001

SUBJECT: Industry Comments on draft NUREG-1640, "Radiological Assessments for Clearance of Equipment and Materials from Nuclear Facilities," (F.R. Vol. 64, No. 59)

The following comments are provided by the Nuclear Energy Institute (NEI) on behalf of the nuclear energy industry in response to the subject notice. The industry appreciates the opportunity to provide input on the draft technical basis document.

The industry commends the Commission's efforts to establish a regulatory framework for the release of solid materials from nuclear facilities consistent with the existing framework for liquids and gases. The enhanced participatory rulemaking process selected for this initiative is appropriate and has been well proven through the successful, "*Radiological Criteria for License Termination*" rulemaking process. NEI will fully participate in the current enhanced participatory rulemaking process.

Establishing a clear, dose-based standard for the release of solid materials should increase public confidence in the regulatory process. The lack of a clear standard has increased public concern, in some cases, to the point where actions were required that exceeded any quantifiable benefit to health and safety. It should reduce unnecessary regulatory burden on licensees and reduce the number of case-by-case alternate disposal requests that must be processed by the NRC. An appropriate standard will facilitate the recycling of large amounts of metals and other materials while reducing the environmental impacts associated with replacing these resources through mining and processing of raw ores. Finally, if the established standard is consistent with the international community, American

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products will not be placed at a competitive disadvantage in the international market.

A technical basis document is a necessary foundation to support the rulemaking being considered by the Commission. Draft NUREG-1640 takes a comprehensive and thoughtful approach toward addressing a range of important materials released from nuclear facilities. However, soils and soil-like materials are not covered in the document and represent a serious omission. In the Staff Requirements Document dated June 30, 1998, the Commission directed the staff to promulgate a rule that, "*should be comprehensive and apply to all metals, equipment, and materials, including soil.*" NEI recommends that a technical basis be developed to support the release of these materials, perhaps borrowing from the dose modeling work in development to support license termination.

The bounding approaches used in the draft, and the scenarios identified are, in general, a reasonable approach. In fact they lead to very practical conclusions that should be highlighted. For instance, on page 2-1, "*Reuse dose factors are less restrictive than recycle dose factors, so they are not discussed further in this section.*" and "*Residual radioactivity in consumer products rarely yields any critical groups.*" This means that if you control the dose to a limited number of individuals who transport, handle, and process recycled scrap, the public at large will be protected. This simplifies the approach significantly and should reduce public concern.

However, the assumptions and input parameters used to model the doses during the transport, handling, and processing of scrap metal yield improbable and impractical results. Direct implementation of a rule based on this draft would require the selection of a dose criteria significantly above the proposed range (.1-10 mrem/yr.) or would result in constraints on the release of material as much as forty (40) times more restrictive than current guidance. The resulting burden on licensees would be significant and perhaps makes material release totally impractical.

In addition, the NUREG-1640 values for key radionuclides are significantly below the clearance levels being considered by the European Commission and the IAEA. NEI agrees with the comment found in the recently released NRC Issues Paper [7590-01-P, Section A.3, p. 13], "*Consistency with standards set by other nations and international agencies is important because materials can be both imported and exported between the U.S. and other countries and differing standards could create confusion and economic disparities in commerce.*" International consistency regarding these standards is an important consideration. Consistent implementation of those standards is just as important.

NEI established a technical review team to review the assumptions and input parameters which led to the questionable results. The team has identified the use of suspect input values and the questionable application of those values in some cases. The results of our review are detailed in the attached comments.

The complexity and shear volume of the material compiled in the draft over a six year period limited the depth and scope of our review in the allotted time. If the staff is committed to improving the usefulness of the document, the industry will commit the resources to continue our review and/or provide industry data to improve the accuracy of the input parameters.

In conclusion, NEI appreciates the opportunity to comment on this draft technical basis document and stands willing to develop specific industry data and documentation that could be incorporated into the final version to address deficiencies identified through our comments. If you have questions concerning the enclosed comments, please contact me at (202) 739-8109 or Paul Genoa at (202) 739-8034.

Sincerely,

Lynnette Hendricks

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PHG/tnb

Enclosure

Detailed Industry Comments
Draft NUREG-1640

The bounding approaches used in the draft, and the scenarios identified are, in general, a reasonable approach. However, the draft should make it clear that when using bounding assumptions to simplify the calculation the results do not "*...produce reasonable estimates...*" nor do they meet the definition of "*realistic*" as defined in the Forward (p. xvii) section of the document.

Although we agree that the reuse scenario which identifies the critical group as the commercial driver of a truck released with uniform fixed contamination on the interior cab does bound all other reuse scenarios, we note that is not realistic. A far more realistic scenario is the reuse of small hand tools or building materials which are not uniformly contaminated but have perhaps one or more small areas which are contaminated at levels generally less than 10,000 dpm/100cm^2.

In addition, the truck reuse scenario makes the assumption that all smearable contamination has been removed. This is not a valid assumption in all reuse scenarios. Practical clearance limits for materials with superficial contamination must be based on total activity, fixed and smearable. While this may introduce additional complexity to the models, it is necessary to produce results that meet the "*realistic*" definition provided in the draft.

For many licensees and all nuclear power plants, Co-60 and Cs-137 will be the limiting isotopes in the recycle scenarios due to their gamma emissions. For Co-60, the average member of the critical group is the truck driver that transports the scrap from the plant. For Cs-137, the average member of the critical group is the truck driver who transports the baghouse dust.

In both cases, the assumptions surrounding the volume/mass of the contaminated material available to be transported, the geometry of the material transported, the time the driver is exposed to the material, the dilution of the material by uncontaminated material, and the true activity of the material are all critical to the calculations.

In reviewing these input parameters we noted the following:

For Co-60, given the following assumptions, one driver appears to be responsible for transporting twice the estimated annual production of material.

- Approximately 3000 tons/yr of cleared material is generated from NRC licensed facilities per year (Section 4.4.4, p.4-6)

- For steel with Co-60 contamination, the average member of the critical group is the truck driver that transports the scrap from the plant (Table 4.8, p.4-33)

- Exposure time is one half of a normal 40 hr. work week, 250 days/yr (Section 4.8.4.2, p. 4-95 and Table B-7, p. B-21)

- The truck carries a 57,000 lb. load of steel (Section C.3.4, p. C-16)

- This results in one driver transporting over 7,000 tons of cleared material per year (57,000 lbs. * 250 shipments * 1 ton/2000 lbs.) or twice the twice the estimated annual production of material

For Cs-137, given the following assumptions, one driver is responsible for transporting the baghouse dust from over 350,000 tons of cleared material which is equivalent to 100 times the estimated annual production of material.

- Approximately 3000 tons/yr of cleared material is generated from NRC licensed facilities per year (Section 4.4.4, p.4-6)

- For steel contaminated with Cs-137, the average member of the critical group is the truck driver who transports the baghouse dust from the furnace for disposal (Table 4.8, p. 4-33)

- Exposure time is one half of a normal 40 hr. work week, 250 days/yr (Section 4.8.4.2, p. 4-95 and Table B-7, p. B-21)

- The truck carries a 57,000 lb. load of baghouse dust (Section C.3.4, p. C-16)

- Baghouse dust contains 95-100% of the cleared material (Table 4.5, p. 4-22) while representing only 2% of the original mass of the scrap steel

- This results in one driver transporting the baghouse dust from over 350,000 tons of cleared material per year (57,000 lbs. * 250 shipments * 1 ton/2000 lbs. * 1/.02) which is equivalent to 100 times the estimated annual production of material

These quick calculations make us question the input parameters used but also encouraged us that with refined values, practical clearance limits are achievable through this approach.

NUREG-1640 provides excellent documentation of the pathways by which radiation exposure may occur to the average individual of various population groups. The NUREG's attempt to view such exposures in a probabilistic manner is appropriate. However, in the end, many significant doses are driven by very conservative point estimates of input parameters rather than probabilistic evaluations: the assignment of an arbitrary driver exposure time of 1,000 hours per year, while exposed to scrap at 100% of the contamination limit, for all trucking scenarios, is an important example.

Because of several overly conservative assumptions made in the selection of input parameters, a number of which are described here, the limiting values of residual surface contamination for Cobalt-60 (steel scrap transport scenario) and cesium isotopes (Cs-134 and Cs-137 in electric arc furnace baghouse dust transport) are factors of from 18 to 42 below the current guidance for survey monitoring sensitivity (NUREG-1640 Table 2.3).

Such restrictions on Cobalt-60 and the cesium isotopes would be extremely costly to the nuclear industry. The NUREG-1640 values for these radionuclides also are significantly below the clearance levels of the European Commission and the IAEA (NUREG-1640 Tables 2.5 and 2.6), and as such, would create significant import trade restrictions.

NUREG-1640 could be significantly improved by a more careful application of the nuclear industry volumes of contaminated scrap which would be affected by this rule. The EPA draft TSD "*Radiation Protection Standards for Scrap Metal: Preliminary Cost-Benefit Analysis*" (June 1977) is referenced as the basis for the NUREG-1640 contaminated steel scrap data. However, the EPA reference cases from which the NUREG volumes are taken (TSD Appendix G) include scrap contamination levels above 70,000,000 dpm/100 cm^2 (TSD Table A5-4). Only 29% of this scrap exhibits contamination levels of less than 100,000 dpm/100 cm^2.

The draft NUREG-1640 suggests limits of only a few hundred dpm/100 cm^2 for nuclides of most interest to nuclear power facilities. Consequently, even with significant decontamination effort, it is not appropriate to assume clearance of scrap from the categories above 100,000 dpm/100 cm^2. By including scrap with much higher contamination levels than allowed under the clearance rule, NUREG-1640 calculations artificially skew the limits to overly conservative values that are no longer practical.

NUREG-1640 also neglects clean scrap dilution prior to shipment at the nuclear facility. The EPA data (ratio of Table A5-4 to A4-4) demonstrates that only 16% of nuclear facility steel (other metals also listed) is contaminated, and that the volume under 100,000 dpm/100 cm^2 is only 4.6% of the clean volume. This results in a dose reduction (or contamination limit increase) equal to a factor of 22 because a lower initial volume is diluted by clean scrap. It should be noted that there would be no incentive (and there is no simple mechanism available) to segregate clean scrap from scrap contaminated below the clearance level under a clearance rule---**there would be dilution prior to shipment.**

Both trucker and downstream public doses are reduced by a factor of 22 by use of appropriate volumes. We believe that use of inappropriately high contaminated scrap volumes, coupled with the neglect of dilution by clean scrap at the nuclear facility, contribute significantly to the exceptionally low limits resulting from the draft NUREG-1640 analysis.

Volumes for all types of scrap (steel, copper, aluminum and concrete) have been overestimated in NUREG-1640 relative to the amounts of contaminated materials available in the range of the proposed contamination limits. Pre-shipment dilution by clean material also has been neglected for each of these materials.

Post-shipment mixing factors at the recycle facility should be improved by true probabilistic analysis (use of ½ the maximum mixing factor does not approximate the actual mixing distribution). With steel as an example, NUREG-1640 Section D.3.2 uses maximum and average annual values from the EPA's draft TSD, Appendix G, for maximum and minimum mixing factors, respectively, applied (contrary to EPA data) as a uniform distribution. This results in a chosen value equal to ½ the maximum since the minimum approaches zero.

It is inappropriate to call the foregoing a "probabilistic analysis". The EPA draft TSD provides volume distributions as a function of time over the 55-year interval of nuclear power plant decommissioning which describe the actual distribution. It is not a uniform distribution. Both the modal and median values of this mixing factor distribution are far smaller than the value chosen under the false assumption of uniform distribution.

We support the use of probabilistic analyses in the derivation of limits such that the concept of dose to an average individual of the critical population group may be determined. However, individuals performing such analyses must take care to establish appropriate distribution models for key parameters rather than making simplifying assumptions which are not justified by available data.

Sensitivity analyses are suggested in order to define the key parameters which have the greatest effect on dose. Our own analyses indicate that scrap volume assumptions (for both contaminated and clean scrap), mixing factors throughout the process stream (particularly at the nuclear facility, since this affects all downstream doses), and exposure time for truckers (as related to available regional scrap volumes) have the greatest effects on limiting pathway doses.

In summary, we believe that the chosen dose pathways are appropriate, but corrections are required for the input parameters and distribution assumptions discussed above, before contamination limits are finalized. In the areas where we have identified concerns, it appears that very conservative assumptions were applied in order to err on the safe side. While this may have been appropriate as a first iteration, it is now time to replace these conservatism's with real data in order to improve the accuracy of the dose calculations and derived limits.