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December 20, 1999

Secretary
US Nuclear Regulatory Commission
Washington, DC 20555

64 FR 14955 2
3/29/99
(18)

Attention: Rulemaking and Adjudications Staff

re: Draft NUREG-1640, Radiological Assessments for Clearance of Equipment and Materials from Nuclear Facilities, and

Proposed Rulemaking – Release of Solid Materials at Licensed Facilities: Issues Paper, Scoping Process for Environmental Issues, and Notice of Public Meetings.(64 FR 35090)

Gentlemen:

The following are comments on NUREG-1640 and the associated proposed rulemaking. These are my own comments and do not reflect the opinions of any steel company or trade association.

In reviewing NUREG-1640, I want to first say that it is an important and much needed addition to the "database" of health physics information. There is now a single reference that contains the practical information necessary to calculate doses from extended masses of contaminated materials. The NRC is to also be commended in their attempt to place solid contaminated materials on the same footing as liquids and gases. However, there are several areas in the documents which contain both errors of fact and errors in assumptions that are likely to result in erroneous conclusions. These in turn may negatively affect the decision making process. Having been a health physicist closely associated with the steel making industry for over 27 years, I have a particular interest in the recycling of contaminated metals.

My comments on NUREG-1640 are divided into general comments and specific comments that apply to particular sections.

Template = ADM-013
E-RIDS = ADM-03
Add = R. Meck (RAM2)

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Comments of Tony Lamastra

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NUREG-1640

General Comments: As a general introduction I wish to emphasize some important points:

1. Since the initial awareness of the melting of radioactive sources at Auburn, NY in 1983 and Mexico in 1984, the steel industry has initiated steps to prevent the inadvertent melting of radioactive materials. This has been an ongoing process that has seen the effectiveness of systems that monitor scrap for contained radioactivity increase over the years. The need for such high sensitivity is due to the difficulty in detecting heavily shielded sources buried deeply in scrap loads. Independent tests [(1)(2)] have shown that today's highly sensitivity monitoring systems are capable of detecting heavily shielded gauging sources when present in the types of scrap most likely to contain shielded source housings, namely demolition type scrap. Heavily lead shielded cesium 137 source housings, typically used for gauging applications, will usually emit a significant portion of their gamma rays with an energy range of (150 to 250 keV) through the lead shielding. The large amount of air present with demolition and other grades of heavy scrap will permit the escape of a sufficient gamma ray flux, even at these low gamma energies, to allow the detection of heavily shielded cesium 137 sources. Sources having an exposure rate at one foot from the sealed source capsule of only 0.1 mR/hr are consistently detected in demolition scrap even when buried under 4 feet of demolition scrap. This is being accomplished with true false alarm rates of much less than 1 in 15,000 scans (this represents much less than one per year). In the case of americium 241 sources, the effective demolition scrap cover thickness is approximately 18 to 24 inches for a one to two curie americium 241 source and approximates the cesium 137 thicknesses for an americium-beryllium neutron source. As both the understanding on the part of industry management and the monitoring equipment itself has advanced, monitoring systems have been developed and installed in locations where detection capabilities are optimized, as it has become practical to do so. For example, we have moved beyond portal monitoring systems and even charge bucket detection systems and are now testing systems that will mount directly on grapples. The current state-of-the-art scrap monitoring systems may well be the most sensitive radiation detection systems in use in any application today. They are capable of extended, unmanned operation, under all weather conditions. This has been done at a great cost to the industry – in some cases the total cost of installation for a single monitoring station has exceeded $300,000. This work has been undertaken by the industry to protect itself from licensed radioactive sources that have escaped from regulatory control, and without governmental input or interference in the development of the systems.

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2. Calculations based on the above data predict that steel scrap having surface contamination, at the limits found in Regulatory Guide 1.86, for many energetic gamma emitters, will be detected if the mass in a vehicle exceeds a few tons in a concentrated mass. [3] A review of the proposed limits in NUREG-1640 shows that the recommended contamination limits are lower for many gamma emitting radionuclides, compared to Regulatory Guide 1.86. However, using the sensitivity derived from the above tests and the model used in NUREG-1640 for a large pile of contaminated material, it still appears that many gamma emitting radionuclides will still be detectable at the proposed limits. For example, using large pile geometry from NUREG-1640 because it best approximates the geometry of a loaded scrap vehicle passing through a portal type scrap monitoring system; and the following assumptions:

   - A truck carrying a total load of 27,000 pounds of mixed scrap
     - 30 percent of 25 centimeter (10 inch) wide flange beams
     - 30 percent of cut 2.5 centimeter (1 inch) plate
     - 10 percent each of 2.5, 5, 10, and 20 centimeter (1, 2, 4, and 8 inch) diameter pipe
   - An average attenuation in the scrap and truck wall of 0.67 (0.33 transmission).
   - A distance of 1 meter from the vehicle wall to the detector. One meter approximates the typical minimum distance between the side wall of a scrap vehicle and the detector of a scrap monitoring system.
   - Only those radionuclides having a half-life exceeding 250 days (including progeny) were evaluated. This criteria was chosen to allow for the decay of short lived radionuclides that would occur in the time interval between the end of production and the commencement of decommissioning and the subsequent of release of the contaminated materials.
   - Those radionuclides not having calculated exposure rates in excess of 500 μR/hr were not considered to have a reasonable likelihood of being detected. This criteria was chosen because of the likelihood that the entire load would not be contaminated and the contaminated material could be in

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the center of the vehicle, or the contamination would be less than the maximum NUREG-1640 limits. In this calculation the following radionuclides are considered to be detectable:

Sodium 22	Potassium 40	Manganese 54
Cobalt 57	Cobalt 60	Molybdenum 93
Niobium 94	Ruthenium 106	Silver 108m
Antimony 125	Barium 133	Cesium 134
Cesium 137	Europium 152	Europium 154
Europium 155	Radium 226 + D	Radium 228
Thorium 232 + D	Uranium 235	

- A second calculation was made using a five year decay period from the time of radionuclide production until the time of release. In this calculation the following radionuclides are considered to be detectable:

Potassium 40	Cobalt 60	Molybdenum 93
Silver 108m	Antimony 125	Barium 133
Cesium 137	Europium 152	Europium 154
Radium 226 + D	Radium 228	Thorium 232 + D
Uranium 235		

It is understood that not all released pieces are likely to be contaminated at the limits presented in NUREG-1640; however, if these limits were used to develop the clearance levels, the NRC should be aware that these clearance levels are likely to cause alarms at modern scrap monitoring systems.

3. While the economic impact on the US steel industry has been severe from the known melting incidents since 1983, I am not aware of any significant internal or external doses to plant workers or the general public, or of any significant releases of radioactive material to the environment from the melting incidents that have occurred in the United States. This suggests that the pollution control systems installed for non-radiological purposes have been effective in preventing both internal and external radiation doses to workers and the general public, during and immediately following a melting incident. This is felt to be important since it shows that a significant risk of radiation dose to steel plant workers and the public has a very low probability of occurring, at least within the United States.

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4. This report suffers from the same deficiencies that have plagued other recent federal studies (EPA's March, 1997, Technical Support Document, Evaluation of the Potential for Recycling of Scrap Metals from Nuclear Facilities) in that the "steel industry" is assumed to be reasonably uniform. Differences in the scrap grades and their relative percentages of use, handling the finished products, types of products and byproducts, recycling rates of home generated scrap and byproducts, among other issues can have a significant impact on dose projections. I believe the research on the steel industry performed by the consultant preparing NUREG-1640 was too limited, and this has created a biased framework from which the dose estimates are made. These dose estimates may fail the comprehensive and appropriate goal criteria set by the NRC for this evaluation.

5. Some significant scenarios have been overly simplified, and these simplifications can result in significant errors in the final dose projections. Also, the report states that the scenarios are not supposed to be "worst case", however, the assumptions used in some scenarios have caused the doses to be maximized above a reasonable level.

6. If a scrap load causes an alarm at a scrap monitoring system, the almost universal practice in the steel industry is to reject the load because: (1), there is no assurance that the detected radioactivity is not coming from a buried shielded source; (2), identifying the cause of the alarm requires significant increased cost to the steel plant; and (3), any additional handling of the scrap could result in the release of radioactive material, contaminating personnel and physical facilities and equipment. Additionally, and probably more important, is the negative perception of harm associated with radiation – a risk reinforced by the NRC and all other regulatory agencies when such concepts as ALARA are codified into regulations. Regardless of the NRC's intent, the public " understands" ALARA as urging zero dose as the optimum, and they conclude that this philosophy is necessary because they have repeatedly heard from the NRC and other regulatory agencies that any amount of radiation, including low level contamination, is harmful. They therefore conclude that melting contaminated scrap will produce harmful steel, or aluminum, or copper, etc. The NRC is going to have a very difficult time convincing the metals industry to accept recycled contaminated scrap, because the industry is fearful of the negative reaction by the public (customers) if it becomes known that radioactively contaminated scrap was used to produce the metal. In one respect, the regulatory agencies have created a monster that has come home to roost.

7. The report uses terms that are not common to the steel industry (and I suspect the other metal producing industries). In some cases this practice makes it difficult to fully

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understand the meaning and the potential impact NUREG-1640 could have on the metal making industries. It is suggested that the authors view the glossary of terms presented on the AISI web page at www.steel.org (or other metals industry web sites) and attempt to use terms that make the report more understandable to the affected industries. It is further suggested that the NRC staff clearly understand the meaning of all terms in NUREG-1640 as they relate to actual plant processes and practices if this document in its draft form is to be used in preparing comments for the commissioners or by the commissioners for decision making regarding whether to proceed with future rulemaking.

Specific Comments: The authors of NUREG-1640 appear to have an incomplete understanding of the steel, recycle, and demolition industries, and their interrelationship. This lack of understanding has resulted in conclusions which are erroneous.

8. In Section 4.2.2, it is assumed that the "primary metal pool" will not be contaminated by the recycling of scrap cleared under this process because scrap is not used to produce iron. This assumption is in error because some blast furnaces do use recycled scrap added to the charge to replace some ore. This practice is influenced by scrap prices and the restrictions that may be placed on the mining and beneficiating of iron ore, and other economic considerations. It is difficult to predict the extent of this practice in the future, but some attempt should be made in the final report.

9. In Section 4.2.2, the term, "old scrap" is used. The report states that one of the disadvantages of this commodity is that its chemistry is not well-known. This is a correct statement when one considers the makeup of old scrap in general. However, when considering steel being recycled from a decommissioned nuclear power plant and the likely method of demolition, such an assumption may be in error. It is likely that the quantity of steel scrap being generated by the decommissioning of a nuclear power plant will be sufficiently large (albeit, miniscule when compared to the total annual amount of recycled scrap steel) to make it likely that the demolition company will prepare most of the scrap on site for direct shipment to a steel plant. This potential appears to have been ignored by the authors in their research. Considering the fact that the NRC imposed very tight specifications for the composition of materials being used in a nuclear plant, the chemistry of the steel is likely to be very well-known and may even have a higher value than normal demolition scrap. If this is the case, the demolition company would have a greater incentive to identify the chemistry and segregate the scrap according to its chemistry. Most of the larger scrap processors and all steel plants perform spectrographic analyses of all received scrap to determine its chemistry, to assure that specified chemistries are being supplied. Also, when one considers the relatively low total tonnage of scrap to be generated from nuclear power plants, an additional incentive

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occurs to segregate and classify the scrap if it will bring an increased price. At an estimated 3300 metric tons in a year from a single nuclear power plant, a demolition company has an incentive to market the scrap to customers seeking a known chemistry.

10. In Section 4.2.2, the report discounts that there will be a buildup of residual radioactivity levels in steel because of the decay process; the fact that non-radioactive material will be added and dilute the concentration of radioactivity; and the cleared material will comprise only a small percent of the total recycled scrap supply. I believe that the authors are taking a very restricted approach and are not addressing issues that can have a significant impact on the steel industry. In the case of electric arc furnaces (EAFs), the dust is captured in a baghouse and creates its own potential risk scenarios. However in a basic oxygen furnace (BOF), much of the dust is recycled as sinter or as compressed briquettes and the potential for increasing the radioactivity concentration in the steel, dust, and slag is thereby increased. The authors of the report appear to have ignored the practice of recycling BOF dust as sinter or compressed briquettes. Rather. they make the assumption that BOF dust will be landfilled. While landfilling is a practice in the industry, the more common practice is to recycle the dust for its iron content. The failure to address this recycling has an important impact on their conclusion that there will not be an appreciable buildup of radioactivity levels in the steel or steel byproducts. The sintering and briquetting processes create the likelihood that radioactivity in the dust coming from a BOF vessel may be recycled and lead to a buildup in both the steel and steel byproducts. Second, the authors assume a static situation in the steel industry and an uniformity within the industry that does not exist. Company practices differ depending on product line, even for the same furnace technology. Practices differ among companies because of R&D capability, ability to change, management decisions, financial resources, size, product lines, and other reasons. The industry has changed and will continue to change due to governmental regulations directed at the industry, economic conditions, trade and tariff decisions made by the United States and foreign governments, internal industry competition, competing materials, tax incentives, and many other pressures external to the industry. The report is developing conclusions using assumptions that are changing even as the NRC is considering this issue. Speaking from a knowledge of the steel industry, it is not the same industry it was 20 years ago and will not be the same 10 years from now. The authors should interview knowledgeable people in the industry and at least determine near term trends.

11. In Section 4.2.3, the report appears to assume that the recycled scrap will be transported to a scrap dealer or processor from the decommissioning site. For large projects it is more likely that the processing will be done on-site and the scrap directly shipped to the

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steel plant because this is likely to result in the lowest cost, and potentially, the highest profit for the demolition company. Transport mode is also a function of cost, quantity, and distance. Low quantities and short distances or highly segregated scrap (by chemistry) is likely to result in truck transportation. Larger quantities or longer distances are likely to result in rail shipments, or barges in the case of available waterways. Depending on scrap market prices at the time of decommissioning, the scrap may be shipped 10 miles or more than 1000 miles. There is no simple rationale to predict shipping distances. It is governed by economics, the need for the scrap grades, and its timely availability. For example, stainless steel scrap originating in Idaho is routinely shipped to Illinois, Indiana, and Ohio.

12. In Section 4.2.3, the report states that scrap is not used to make iron for steelmaking purposes. The authors should realize that there is a practice, albeit low, of using scrap in blast furnaces to produce the "hot metal" used to make steel in BOFs, and factor this practice into their risk assessments.

13. In Section 4.2.3, the statement is made that EAFs produce high strength steels. EAFs do not inherently produce higher strength steels than BOFs. This concept should be deleted from the report. Furthermore, the assumption that distribution occurs much more rapidly and directly from an EAF to the end-user, compared to a BOF is also in error. As will be shown later, this erroneous assumption can have an impact on various scenarios.

14. In Section 4.2.3.1, a statement is made that, "flux is added to achieve a desired composition". The purpose of fluxing is to chemically react with the impurities in the molten bath, and effect their removal through the slag and the dust, and in EAF and BOF furnaces, to provide an insulation over the molten metal bath.

15. Section 4.2.3.1, caused confusion because of the use of unconventional terminology – the report must use conventional terminology. It also appears that using the same assumptions for a BOF shop as are used for an EAF shop is a mistake on the part of the authors of NUREG-1640. The report makes the statement, "the average size of a charge in a BOF refinery is estimated to be 58 t (metric tons) [64 tons] with an average of 5580 charges per year for one refinery." It would be helpful if the report used conventional terminology. It is unclear if the term, "refinery" refers to a single BOF vessel or a single plant with multiple BOF furnaces. Also, does the term, "charge" refers to only the scrap charge per heat (batch of steel) or the number of heats per furnace per year. It appears that it refers to the scrap charge per heat; however, in section 4.2.3.2 for EAFs, it appears

the term, "charge" may refer to the total number of heats. It should be understood that in an integrated plant, economic and other factors will determine the relative percentages of hot metal and scrap charged per heat. One major factor is the need for very low residuals which favors a higher percentage of hot metal and revert scrap over purchased scrap with varying residuals.. If one assumes a scrap charge of 17 to 20 percent in a BOF heat, then a 200 ton heat would require approximately 37 tons of scrap, and a 300 ton heat would require approximately 56 tons of scrap. If the term, "refinery" refers to a single BOF vessel, then the NRC's value of 64 tons appears to be a little low. The average modern BOF shop is likely to produce about 5300 to 5500 heats per year per furnace, which is lower than the report's estimate of "5580 charges per year for one refinery"; provided a " refinery" means a single BOF furnace and not the entire meltshop. Most BOF shops will have 2 to 3 BOF vessels. An efficient BOF shop will produce about 6000 heats per year per furnace – well above the report value.

16. The lack of standard terminology also produces confusion in trying to understand the value, "5580 charges per year for one refinery" in Section 4.2.3.2, as it applies to an EAF shop. As stated above, it is unclear if the word, "charges" refers to the term as it is commonly used in the steel industry to mean a single scrap charge to the furnace. Generally, two to four charges are made to an EAF furnace for a single heat – the number is usually constant at a particular facility, but varies between facilities. The 5580 value appears to be a reasonable average of the number of heats per year, not the number of charges. If a plant used 2 charges per heat this would be over 11,000 charges per year (16,700 for 3 charges per heat, and 22,300 charges for 4 charges per heat). For your information, you will also see a similar range of heats per year from EAF shops as is seen in BOF shops (ranging up to 6000 heats per year).

17. Section 4.2.3.2 uses the term, "carbon" in describing EAF-produced steel and seems to imply that BOFs primarily produced steels other than carbon steel. If this is the belief of the authors of the report, it is in serious error. BOFs are primarily a carbon steel producing furnace, while EAF's are used to produce both carbon and stainless steels. This is not a function of furnace type, but rather of furnace size. BOFs are usually greater than 250 tons per heat, whereas stainless is made in much smaller batches. EAFs range in size from 5 to 400 tons and a smaller furnace is more efficiently suited to the smaller heat sizes in which stainless is produced.

18. In Section 4.2.3.2, the report indicates that the BOF and EAF processes have been treated the same for purposes of partitioning but will be modeled differently for other factors.

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This is a poor decision on the part of the authors. The potential for non-uniformity in the heat is greater with an EAF vessel then in a BOF vessel. Furthermore, EAFs are not as efficient as BOFs in removing undesired elements (residuals) from the heat, thereby increasing the potential for greater partitioning to the steel of some radionuclides in an EAF. The differences could be as much as a few percent, which is significant when speaking of 100 tons or more.

19. Figure 4.2 should show a block for "manufacturing" under the EAF alternative as does the BOF alternative, since most EAF shops also perform "finishing" operations on their steel. This will also impact the conclusions drawn with respect to potential dose scenarios.

20. Table 4.2 should include sintering of BOF dust and the reintroduction of sinter back into the steelmaking process.

21. Section 4.2.6 makes the statement that the "... ultimate endpoint for finished metal products, slag and BOF dust is disposal in a sanitary landfill." The ultimate endpoint for steel is its recycle, as is a large percentage of BOF dust. It is estimated by the American Iron and Steel Institute that more than 90 percent of all steel is ultimately recycled.

22. The assumption in Section 4.4.1 that significant radioactivity will escape the BOF process appears to ignore the use of scrubbers and electrostatic precipitators with their higher removal efficiency (especially in the case of scrubbers for gases), compared to EAF baghouses. Is there any documentation for these assumption used in the report? Practical experience with radioactive melts at EAFs shows no measurable deposition outside the meltshop or the less efficient baghouses.

23. The language used in Section 4.6.2.1 shows that the research conducted for this report focused on a very narrow product line from EAFs. While many EAF shops produce rebar, the product lines include much more than "rebar and metal tractor cleats" as stated in the report. In fact, EAF shops will produce a wide variety of bar, rod and wire products, plates, sheet, rail, structural shapes, tool steels, and iron and steel castings. Secondly, since the average EAF tends to be much smaller than the average BOF, there is a greater likelihood for personnel to be closer to the material (smaller fork lifts and front end loaders, floor operated versus overhead cranes, etc.). Thus, the authors may have seriously miscalculated its doses from handling refined metal from an EAF shop.

24. In Section 4.6.2.1, another error is found in the conclusion that EAF products would undergo less radioactive decay than BOF products. This appears to be another case

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where limited observations have resulted in assumptions that may erroneously impact the potential calculated doses. For example, much of the product line from BOF shops goes directly to large manufacturers who have instituted "just in time deliveries". This would tend to reduce the time from melting to exposure. Also BOF shops tend to limit the inventory on hand of purchased scrap, because they tend to generate more in-house scrap, with its known chemistry and lower residuals. This would limit the time from scrap receipt to exposure for a BOF shop. These would both have the opposite impact from that suggested in the report on radioactivity concentration due to decay. On the other hand, many structural products and rebar are produced and shipped to supply houses and fabrication shops which purchase as wholesalers and then ship smaller orders to end-users as needed, or fabricate the steel into the desired structures (bridge girders, etc.), thereby increasing the time from production to end user for an EAF shop.

25. In Section 4.6.2.5, I disagree that the external pathway is the only one that should be considered for the transportation scenario. Truck drivers often remain in their cab during loading. The potential for resuspension of radioactivity from scrap, slag and dust is significant and should at least be evaluated to see if it could exceed the boundaries imposed by other scenarios.

26. Section 4.6.3.1 suggests a likely potential for environmental and personnel impact from melting radioactive scrap in steelmaking furnaces. I suggest that the authors evaluate actual melting incidents and review real world environmental releases instead of developing models based on conjecture. Present air pollution control regulations require the collection of emissions which would significantly limit this scenario. My information suggests that there have not been detectable public or worker doses due to environmental releases, even when curie quantities of radioactive materials have been melted in the US.

27. I question the decision of the authors in Section 4.6.3.2 to use a model which assumes no retardation in the soil of the radioactive material leached from slag. This creates an unrealistic worst case scenario that does not conform to the goals stated for this document. Furthermore, if radioactive material is assumed to be soluble in water, then the model must account for the loss of radioactive materials through those mechanisms in which water is lost (hydration of soil chemicals, evaporative losses, etc.).

28. In reviewing the scenarios in Section 4.6.3.3, it appears that the scenario of a farmer on a tractor manufactured with contaminated steel or a sailor with a bunk adjacent to a contaminated bulkhead or hull would present a greater external worker exposure potential

than the worker in an office (in closer proximity to larger masses for at least a similar amount of time). The office scenario, however, might be useful for larger population doses. In the case of the automobile scenario, the authors have made an erroneous assumption. Most of the steel in an automobile comes from a BOF and not an EAF. This could have a significant impact on calculated doses. This same error is repeated for steel frame structures. This material is more likely to originate in a BOF.

29. I question whether the authors actually researched the scenario in Section 4.6.3.3 of slag as an aggregate, or if theoretical information was used to develop this scenario. It appears unlikely for practical economic reasons that a concrete company would purchase trap rock, steel slag, and blast furnace slag and maintain an inventory of all three materials, especially when the maximum amount of steel slag that can be used is only three percent.

30. The assumption that radioactive material is uniformly distributed throughout the entire volume of a landfill, in Section 4.6.3.3, is unrealistic and seems to violate the NRC's goal of developing realistic scenarios. The authors should perform more realistic, albeit, more complicated modeling to address this scenario.

31. In Section 4.6.3.3, the authors cannot assume both, no retention in the soil for water scenarios, and leaching and retention of contamination to soil cover in the case of landfill scenarios. Furthermore, it is illogical to make the assumptions used for the closed landfills with EAF dust. Material does not immediately disperse from 55 gallon drums to the total mass of the landfill. This assumption does not meet the NRC's goal of realistic scenarios.

32. Many of the formulas used throughout Section 4 appear to contain typographical errors. There appear to be boxes instead of likely Greek letters. This made it very difficult to evaluate the formulas.

33. The nature of the steel scrap recycle business is rapidly changing in a way that makes some of the assumptions in Section 4.8.3 obsolete. The initial assumption is likely to be incorrect: that is, that all scrap is taken from the site to a dealer. Current large decommissioning projects of both radioactive and non-radioactive steel have the demolition company performing both the demolition and scrap preparation activities. This scrap is being prepared on site to customer specifications and shipped directly to the mills, bypassing scrap yards. This means that much of released recycled scrap will be at the steel mill within a shorter period of time following its generation, than assumed in the

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report.

34. The assumptions in Section 4.8.3, of product residency time at an EAF and BOF are also believed to have been made with erroneous information. No steel product goes from the molten state to a finished product shipped to the end-user without some intermediate processing. If the end-product of an EAF is rebar, the molten steel is first cast into billets by a continuous caster. The billets are then rolled into rebar which is either sold to a steel supply company or a rebar fabricator who forms the rebar into the shapes and lengths that will be ultimately used. The fabricator may also coat the rebar, as currently required for road construction projects. The economies of production also enter into the scenario. One plant is likely to receive all or most of the cleared steel, based on the low generation tonnages stated in the report (3000 tons per year NRC and 80,000 tons per year both NRC and DOE). These tonnages can be compared to 150,000 to 200,000 tons per year for a small rebar producer and 500,000 to 750,000 tons per year for a large mixed rebar and merchant shape shop. A BOF shop will typically have an annual capacity in the range of 2,000,000 to 6,000,000 tons.

35. Based on the partitioning data for cesium 137 in steel (approximately 95% to the dust) and an average dust production rate of 35 pounds per ton of steel, the following scenario was evaluated. It appears that it is possible for steel scrap cleared at the NUREG-1640 limit to exceed the NRC's own limits set for cesium 137 in baghouse dust if more than 30 tons of the contaminated scrap are added to a 100 ton heat.

- Thirty tons of 4 inch schedule 160 steel pipe, surface contaminated with cesium 137 at an average concentration of 150 dpm/100 cm^2 (one half the NUREG-1640 limit) is part of a 100 ton heat. This equates to a total internal surface of 2.52×10^6 cm^2. Thus a total of 1.7×10^6 pCi is added to the heat.

- At a production rate of 35 pounds of dust per ton of steel produced, a total of 3500 pounds (1.589×10^6 grams) of dust is created.

- At 95% partitioning to the dust, the dust will have a cesium 137 concentration of 1.02 pCi/g.
- At a contamination concentration at the NUREG-1640 limit, the concentration in the dust would be 2.02 pCi/g. This is the NRC's limit provided to the Steel Manufacturers Association in July 1993 (2 pCi/g).

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Comments of Tony Lamastra

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Proposed Rulemaking - Release of Contaminated Solid Materials

The question of the clearance of radioactively contaminated solid materials presents a significant challenge to the nuclear power industry, radiation regulatory agencies, solid waste regulatory agencies, solid waste disposal sites (both low level radioactive waste and non-radioactive waste disposal sites), those commercial and industrial firms that will receive the contaminated materials, and the public. The general public has a mistaken understanding of the actual risk of health effects from radiation, in part due to the over-conservatism of regulatory agencies. This population includes the workers in the metals industries and the workers and customers of those industries purchasing the metal. These are the people who would now be asked to work with and use contaminated metal. As an anecdotal example, when we first installed scrap monitors at steel plants, it was a substantial task to convince the plant work force that the monitors were not generating radiation. It required a few years for the work force at each plant to become comfortable with the monitors and the fact that alarms were occurring. To their way of thinking, they were now being irradiated. It took much time and effort to educate the work force about naturally occurring radiation. This education effort was lost when we began upgrading the monitors. The higher sensitivity monitors began alarming on materials that had not caused alarms in the past and more frequently than the older monitors. It again required a large scale educational effort to convince the work force that they were not receiving additional radiation dose; rather we were just able to detect lower levels of radioactivity that had always been present.

If contaminated scrap is free released, it is likely to cause alarms which will institute a new wave of concern. It is likely this concern will be more difficult to address. First, it will be due to " man-made" radioactivity from nuclear reactors. Regardless of the fact that a rem of dose from NORM causes the same biological effect as a rem from man-made radioactive materials, there is a firmly entrenched mindset in the public that man-made radiation is more harmful, simply because it is man-made. For example, how many of us succumb to advertising touting that a product is made from "all natural ingredients?" Second, is the fact that many people are able to make the differentiation in their minds between risks that are voluntarily accepted and those that are forced upon them. Contaminated scrap is one that is clearly seen as being in the second category.

Steel companies are increasingly being asked to certify that steel is "radioactive free" (whatever that means to the person making the request), or that "radioactive scrap has not been used" to make the steel, or that "radioactive materials have not been added to the steel".. This last certification is a difficult one to address because of the naturally occurring radioactive materials present in some ores and most fluxes. Steel companies have been informed by their customers

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that they will be required to provide laboratory analysis data for each heat (batch) if it becomes a practice that contaminated materials are being cleared for unrestricted recycling. This will be a significant added cost to the industry without any benefit.

I appreciate the need for a "clearance rule" for several reasons, not the least are to provide guidance for imports into the country, and to clear materials out of restricted areas. However, the NRC has to understand the position of the metals industries. De-selection of products occurs for sundry reasons – some logical and some illogical. For example, the steel food container industry is a billion dollar a year industry. The shift of only 10 percent of this product to aluminum or plastic would cost the steel industry $100,000,000 annually in sales. This would result in the permanent loss of several hundred jobs. Should major food manufacturers de-select steel food containers, a loss of several hundred million to the full billion dollars per year could be seen – just because Gerber's feared public acceptance of tin coated steel lids on their baby food jars, or Campbell's feared a loss of sales from continuing to use tin plated steel cans. Considering the likely value of 3000 tons of scrap per year at $100 per ton and the cost of disposal at $375 per cubic foot, a crude estimate of net savings to the nuclear industry could be as high as $75,000,000, compared to perhaps a loss to the steel industry of $100,000,000. How can the NRC justify a practice that produces a net negative economic impact? It is certainly not in agreement with the concept of optimizing benefits and costs.

A related incident directly involving the NRC occurred a few years ago when it was discovered that steel destined to be made into shovels contained low level radioactive contamination. Both the NRC and the EPA agreed there was no health risk if the shovels had been manufactured and distributed to the public. Additionally, the manufacturer clearly indicated that he would not use the contaminated steel to manufacture shovels. However, the NRC issued a press release naming the shovel manufacturer. Their competitor had laminated copies of the NRC's press release in the hands of their national sales force, two days later. Two issues are raised by this incident. While the NRC can claim the public has a "right to know", the manufacturer had already made an independent decision not to manufacture and distribute shovels made from the contaminated steel. If the risk was minimal, as indicated in the press release, and in light of the decision made by the manufacturer to not manufacture shovels from the contaminated steel, then the NRC acted in an unresponsible manner – showing no concern for the economic health of a company that was an innocent victim. What assurance does the metals industry have that the NRC will not act in a similar unresponsible manner when a steel manufacturer melts free released contaminated steel scrap that causes an alarm? Will the manufacturer also have to deal with the negative publicity caused by an NRC press release identifying the manufacturer? Actions such as this on the part of the NRC are a serious concern to the metals industry. One

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unnecessary press release can cause the loss of an entire market resulting in the loss of billions of dollars and the loss of thousands of jobs (and taxes). The NRC cannot approach this issue cavalierly.

While the following is a policy issue, I have a concern with the NRC's decision to go to even lower annual dose limits in this project. This was also touched on at the beginning in discussing the problem with the public's perception of harm from radiation exposure. The NRC recently (January 1994) reduced the maximum public dose from 500 to 100 millirem per year. With respect to its decommissioning rule, it requires an annual dose from all pathways of 25 millirem per year. Now it is proposing surface and volumetric contamination limits based on predicted public doses of 1 millirem per year. Forget the fact that we cannot realistically measure a human dose difference of 1 millirem per year (all the person has to do is move from New York to Chicago to negate the added dose projection), the NRC is implying that anything larger is dangerous.

Another practical issue is that the total quantity of recycled carbon steel scrap mentioned in the report is the equivalent of a single year's purchases for two large EAF shops. The likely annual production of the recycled scrap would not even supply a single small mini-mill. Many of these mills are specialty steel producers that manufacture alloy and stainless steels used in the medical industry. Can you imagine the public concern when it becomes known that the stainless steel braces in a child's mouth were made from "radioactive scrap" that the NRC permitted to be recycled. Like I said previously, the NRC and others have fostered the creation of a monster in the form of unjustified public fear of even low doses of radiation. Now you have to live with the results when industries sensitive to public perception must respond to those fears.

One issue that has surfaced in the workshops is the dual standards relative to what is acceptable for release. It appears that fuel cycle facilities are permitted to release contamination that meets a 5000 dpm/100 cm^2 limit, while materials licensees are only permitted to release materials showing no detectable activity above real background. When the nuclear industry uses the term, " not detectable above background", their "background" is actually comparable to about three times ambient background (150 cpm). While the NRC may be able to explain why the dual standard exists, the existence of a dual standard suggests that the NRC is less stringent toward the nuclear industry and gives credence to the environmental community's claim that the NRC is not vigorously regulating nuclear power plants.

Issue 1.

NRC NUREG-1640 and proposed rulemaking on the clearance of solid materials
Comments of Tony Lamastra

December 20, 199917

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The NRC must take into consideration that even at the lower release limits for gamma emitters in NUREG-1640 (both surface and volumetric contamination), many of these would be detectable (and rejected) by current scrap monitoring systems. This is an irresponsible action on the part of the NRC. First, it would create more cost to the metals industry to respond to the alarms. Second, if a scrap yard or steel plant ends up isolating a radioactive source, their costs have typically been around $3000 per disposal because they are small generators that must depend on outside brokers. Most found sources do not exceed 1 cubic foot, so the $3000 can be compared to $375 per cubic foot disposal costs for the nuclear industry. Third, every alarm also requires intervention by a state or Federal agency, thereby causing the expenditure of unnecessary taxes. You will be shifting the disposal costs from the nuclear industry on to the recycling and metals industry, and the states.
Any action by the NRC should take into consideration the potential harm that could result to the metals industries. The dollar amount of potentially cleared metal is minor (except for nickel) when compared to the amount recycled each year. Furthermore, the metals industry has repeatedly said they do not want the material. The full cost to the releasing sector must be considered, including the costs incurred when loads are returned and have to be investigated.

If standards for cleared materials are developed, there should also be a memorandum of understanding between the NRC and the EPA to allow the disposal of such cleared materials in non-radioactive disposal sites.

Issue 2

The NRC should explore the concept of restricted release that is presently being discussed by the NCRP's Standards Committee 87-4. It is recommended that those in the NRC responsible for this proposed rulemaking contact S.Y. Chen at Argonne National Laboratory. Standards Committee 87-4 has been involved with this topic for over three years and has a better understanding of the recycle and metals making industries than has been shown by the contractor used to prepare NUREG-1640.

Any rulemaking should also permit the disposal via municipal and residual landfills, at contamination levels consistent with health based data. One millirem per year is a meaningless number. By quantifying such a number, the NRC is, in effect saying that it is scientifically possible to measure at this rate, and that this dose rate is biologically significant. It is actions such as this that reinforces the public's fear of all radiation dose, and which has been the direct cause of the significant opposition by the metals industry. Diurnal changes in background vary

much more than 1 millirem per year, as would a person's dose who moves from sea level to 1000 feet above sea level.

If the NRC is going to use cost data from the nuclear industry to factor in societal costs and benefits in their decision making, they must factor in potential societal costs (economic and others) that could occur to industries that are likely to be hurt by their decisions. It is political dishonesty to do otherwise.

During the workshops, it was stated that recycling of contaminated steel would reduce environmental impact from mining new ore that would be replaced by the recycled steel. At the quantities likely to be released from fuel cycle and DOE facilities, the impact would be less than 1 percent per year and would have no impact on mining. Mined ore is primarily used by blast furnaces to produce molten iron for BOFs. The fact that BOF shops purchase much less outside scrap than EAF shops would lessen the impact of the recycled steel even further.

There is also a great need for standards to prevent the importation of contaminated steel into the United States.

Issue 3

Restricted release: The NRC has presented the concept of restricted release to dedicated uses and has used bridge girders as an example. This is not seen as practical because the limited quantities involved would not be sufficient for a structural mill, and the cost of including a structural mill and a plate mill would increase the overhead of the plant too prohibitive levels. If the plant also produced "non-radioactive" steel, I would foresee the opposition from other customers, that the same furnace was being used to make clean and contaminated steel. It is possible to have a dedicated furnace to melt the steel and then use the same caster and rolling mills. While the caster and rolling mills are not likely to become significantly contaminated, there is again the perception by customers that the caster and rolling mills would contaminate their product. The second issue is convincing a design engineer to specify "radioactively contaminated steel" in his specifications. Third, how would the NRC convince the state or local government, or the environmental community to accept the idea?

In order to obtain the support of the metals industries, the NRC should incorporate restricted release or disposal in non-radioactive sites in any proposed rulemaking for free released metals. The restrictions should continue for a period in which the metals show detectable radioactivity. It may be difficult for such a restricted release to be economically viable. In this case, the only

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alternative may be disposal.

There have been some preliminary discussions with the American Petroleum Institute, two steel mills in Texas, and the Texas Dept. of Health to pursue the concept of diverting all scrap oil well pipe to the one or two mills, having the pipe remelted and remade into new pipe and returned to the oil fields. The byproducts would be disposed in a non-LLRW site – likely a hazardous waste site. This appears to be practical because API is anticipating 300,000 to 600,000 tons per year, and buying back the pipe. There do not seem to be too many other practical ways to restrict release contaminated metals, other than dispose in a non-LLRW site, and still make the enterprise economical – as shown by the disposal box project.

One possibility is to use a dedicated melter that is fully licensed. The process of melting and refining metal will reduce the radioactive concentration, even for those radionuclides partitioning to the steel. If the furnace is operated for a longer period and at a hotter temperature, more impurities will be driven off, although this is more costly in terms of energy and time. However, if a joint effort is undertaken by the NRC, DOE and EPA to authorize the production of storage containers for waste disposal, and practical solutions are made possible for the disposal of contaminated byproducts, perhaps a new industry can be created that would make recycling to a dedicated melter/fabricator practical.

Issue 4

All solid materials should be covered, even if multiple categories are included in the rulemaking. I would suggest the NRC do its entire rulemaking at one time. This issue has generated a great deal of concern and is likely to generate additional concern once a proposed rule is published. Attempting to separate the total issue into two or more separate rulemakings would tie up the NRC for several decades and waste tax money.

One last issue. The NUREG-1640 report and the NRC's statements in the proposed rulemaking have tried to disassociate this issue with "below regulatory concern" (BRC). I thought BRC was a great idea. However, I was not convinced by all the "politically correct" words in the report that this is not BRC. You are proposing to free release contaminated material so that it no longer comes under regulatory control. How does that differ from BRC? If you have any hope of making this issue work, you will have to come up with a way of convincing the skeptical that this is not BRC. You will not succeed by simply using bureaucratic "double speak". The NRC should stop trying to be "politically correct" and go back to the old days when it was "

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scientifically correct".

I hope the comments on the actual report are useful in the NRC's refining of NUREG-1640, and that a useful final document sees the "light of day".

Sincerely,

A. LaMastra
Certified Health Physicist

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1. Data Analysis, Steel Manufacturers Association Test of Scrap Monitoring Systems, Koppel Steel, Koppel, PA, September 23 to October 4, 1996. Internal association document prepared by Health Physics Associates, Inc., June 2, 1997.

2. Radioactive Material in Steel Scrap: Its Occurrence, Consequences and Detection, Anthony LaMastra, Health Physics Associates, Inc., March 1989.

3. Advances in Monitoring Scrap Steel for Radioactivity, Iron and Steel Engineer, May 1999, Pittsburgh, PA.