Estimated Cost Comparison Using The Rubblized Approach Surface Contamination Values And The Building Occupancy Surface Contamination Values For Demonstrating Compliance With 10 CFR Part 20, Subpart E

The estimate compares the cost of meeting surface contamination values for buildings based on the values published in Federal Register (61 FR 64133, November 18, 1998) to the cost of meeting surface contamination values calculated from the conceptual model for the rubblized approach identified by some licensees. The rubblized values calculated from the conceptual model were approximately 100,000 dpm/100 cm^2 for cobalt 60 and cesium 137. The surface contamination values for the building occupancy scenario were based on the surface contamination screening values published in the Federal Register on November 18, 1998. The surface areas used for this estimate were based on the final survey areas at the Trojan Nuclear Power Station for: 1) Containment Building; 2) Turbine Building; 3) Fuel Building; 4) Auxiliary Building; and 5) Control Building and the surface areas were calculated from the Trojan License Termination Plan (LTP). The Trojan LTP, Section 5, "Final Survey Plan," Table 5-4 lists the surface areas for each of these buildings.

For this evaluation, the estimate assumes that 20 percent of the surface areas of each of the buildings required remediation to meet surface contamination screening values compared to meeting the rubblized surface contamination values, and the surface contamination was within the first 0.5 inches of the building surface. Because the limits for the rubblization were considerably higher, the estimate assumes that the licensee would be required to only remediate one percent of the area for rubblization compared to the twenty percent of the area based on the screening values from the building occupancy scenario. The actual estimate of the surface areas requiring remediation would be based on characterization data, and examined on a building by building, area by area basis. In areas where surface contamination was in the first 0.1 inches, the areas may be decontaminated by grit blasting, and grit blasting is considerably less expensive. Disposal costs were based on $600 per cubic foot for Barnwell disposal facility and $100.00 per cubic foot for Envirocare. Scabbling (mechanically chipping the concrete surface) cost was based on a cost of $30.00 per square foot, and there is a difference in cost to scabble floor areas compared to scabbling wall areas. An average cost was used. A cost of $5.00 per cubic yard to purchase and backfill the structure with soil was assumed if a licensee committed to demolishing the buildings and grading the site. The costs listed below are the differential costs required to meet the building occupancy surface contamination screening values instead of the rubblized surface contamination values. The comparison also assumed that both surface limits resulted in similar levels of worker exposure.

The result of this cost comparison indicates a significant reduction in disposal cost when decontaminating a facility to the rubblized surface limits compared to the Federal Register values. The cost comparison indicates a reduction from $10 million to $16 million. Changes in surface area, depths of contamination, and volume of waste are variables that have a significant impact on the cost estimate.

Attachment 1

NEI

Lynnette Hendricks
DIRECTOR
PLANT SUPPORT
NUCLEAR GENERATION DIVISION

September 15, 1999

Mr. John T. Greeves
Director of the Division of Waste Management
U.S. Nuclear Regulatory Commission
Mail Stop T7J8
Washington, DC 20555-0001

SUBJECT: Industry White Paper on the Rubblization Concept

Dear Mr. Greeves:

On August 18, 1999, the Nuclear Energy Institute gave a presentation at a NRC public workshop on decommissioning. The presentation provided an overview of an emerging conceptual approach to decommissioning known as rubblization. After the presentation, NRC staff indicated that they were preparing a Commission paper on the concept and would welcome a white paper from NEI and other stakeholders who had an interest. NEI committed to provide such a paper by September 15, 1999.

The attached white paper represents the industry's thoughts on this subject. It should be noted that our members see merit in a variety of approaches to the rubblization concept. In addition, many believe the concept holds real promise for increasing the accuracy of the final status survey while reducing the cost. As emerging radiation survey instrumentation allows a shift from random representative sampling to 100 percent surface survey integration, this will increasingly be the case.

NEI appreciates the opportunity to submit the industry's thoughts on Rubblization. If you have questions or need further information, please contact me {by phone: (202) 739-8109 or by e-mail: lxh@nei.org} or Paul Genoa {by phone: (202) 739-8034 or by e-mail: phg@nei.org}.

Sincerely,

Lynnette Hendricks

Lynnette Hendricks
Enclosure

Attachment 2

White Paper
Rubblization Process

Introduction

Following the decision to permanently cease operation, a licensee must propose, to the Nuclear Regulatory Commission (NRC) in the Decommissioning plan/PSDAR, a decommissioning method that meets applicable objectives. The licensee may choose to restore the site to its original condition, reuse portions of the site, release the site with specific use restriction, or maintain the site until radioactivity decays to a level that permits license termination. Ultimately, it is the objective of decommissioning to place the facility in a condition that does not constitute undue risk to human health or the environment.

When decommissioning involves the decision to restore the site to its original condition or reuse the site for other purposes, existing structures must be removed. Demolition is a necessary and acceptable construction practice for removal of structures, and decommissioning plans must account for the reuse or disposal of the resulting debris. For the purposes of this discussion, the process of demolishing concrete structures combined with the use of some or all of the resulting rubble as on-site fill is defined as rubblization.

Background

The NRC has established regulations that govern how licensees decommission nuclear power plants, including criteria for determining the amount of residual radioactivity that can remain at a site following termination of the license. The NRC regulations are based on consideration of exposure via all potential pathways to members of the public from radioactive material remaining at the site. The NRC requires that the dose to the average member of the critical group from residual radioactivity be "as low as reasonably achievable" (ALARA), and no more than 25 mrem/yr. for an "unrestricted release" of the site.

NUREG-0568, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, and NUREG-1496, Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC-Licensed Facilities, address the environmental consequences of decommissioning. Collectively, the Environmental Impact Statements address the physical and radiological impacts of decontamination and demolition activities in addition to the environmental impacts from residual radiation levels.

Rubbilization Process

When a decommissioning strategy includes the demolition of structures, consideration must be given to accomplish the demolition and dealing with the resulting debris. Nuclear facilities are often constructed with large amounts of reinforced concrete that must be removed, if called for in the decommissioning plan. Standard industrial practice involves demolishing concrete structures by any number of destructive means and either removing the resulting debris or using it for fill in foundations or low lying areas of the site. Steel reinforcement material could potentially be recovered and recycled or may remain embedded in the rubble if it is of sufficient size. Existing State and Local solid waste regulations govern the disposition of the debris as either construction/demolition debris or inert fill.

As stated above, the process of demolishing concrete structures combined with the use of some or all of the resulting rubble as on-site fills is defined as rubbilization. The debris resulting from the demolition process is defined as rubble. The rubbilization process may result in rubble of various sizes, dependent on the demolition strategy and method at a particular site. The rubble may be removed or placed in building foundations or other areas requiring fill to meet site restoration criteria. Although considered a low-probability, if the remaining building foundations could credibly be reused in the future, they are rendered unusable or are evaluated under a building occupancy scenario. The determination as to the suitability of a sub-surface building foundation for reuse should be made on a case-by-case basis. Typically, rubble that is used as fill material is covered to a suitable depth with clean soil as governed by State and Local regulations.

If a concrete structure contains radioactive material, either through contamination or activation, remediation is conducted prior to demolition to levels that are ALARA, in accordance with applicable regulatory guidance. Following remediation, some residual radioactivity may remain in or on the concrete structure. Whether the building is reused or demolished, the amount of residual radioactivity must be below levels that could reasonably result in a dose to a member of the public exceeding 25 mrem in any one-year period. The NRC has determined that the 25 mrem/yr. all-pathways dose limit is protective of public health and safety.

In order to determine compliance with the 25 mrem/yr. dose limit, a detailed radiological survey, pathway analysis and dose calculation must be performed. The purpose of the radiological survey is to characterize the concentrations of radioactive material that could potentially be available for transport in the environment. A pathway analysis is required in order to determine all potential transport mechanisms or human activities that could result in the exposure of members of the public to residual radioactivity. A

contaminated dust are no longer credible. Realistic and reasonable exposure pathways such as drinking contaminated groundwater, eating produce irrigated with contaminated groundwater and possible intruder scenarios are evaluated on a site-specific basis. The intruder scenario assumes that rubble is excavated at some time in the future resulting in potential exposure pathways such as handling, transportation, processing, reuse in products, reuse as fill for a house foundation, and other potential site-specific uses.

Radiological survey results, exposure pathways, human characteristics, physical site characteristics, and dose conversion factors are used as inputs to dose calculation models that predict potential dose to members of the public. Dose calculation models are used to calculate the maximum dose to the average member of the critical group, which is the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances. For a building reuse scenario, the critical group may be industrial workers, while for a scenario involving building demolition, the critical group may be the resident farmer. The NRC reviews the dose model inputs, assumptions, and methodology for acceptability.

Alternatives

Three alternatives to or modifications of the rubbilization process are considered below:

Leave buildings standing and do not demolish: This approach is not considered a viable alternative if the decommissioning strategy involves restoration or reuse of the site.

Survey and release buildings prior to demolition using surface contamination limits derived from the building occupancy scenario: While an acceptable approach, the dose assessment for a building reuse scenario may be overly conservative relative to the more applicable dose assessment based on concrete rubble used as fill.

Demolish and remove rubble: While an acceptable approach for some licensees, the demolition of large nuclear facilities would result in substantial quantities of concrete rubble, most of which is clean, that would require transport and disposal off-site. In addition, required fill material may need to be procured in large quantities and brought on site. Requiring all facilities to use this approach will increase decommissioning cost with no commensurate health and safety benefit.

Conclusion

Rubblization and backfill is a reasonable, risk-based decommissioning strategy with tangible benefits that meet the generic intent and specific requirements of applicable regulations. The process is not new or unique, and is consistent with standard industrial practice associated with building demolition and site restoration. The radiological survey and dose assessment performed to demonstrate compliance with radiological criteria for license termination is rigorous and scrutable. Compliance with the 25 mrem/yr. radiological criteria is protective of public health and safety.

September 22. 1999

TO: C.L. Pittiglio. U.S. Nuclear Regulatory Commission
FROM: J.H. Johnsrud, Ph.D., Director, Environmental Coalition on Nuclear Power (ECNP); Trustee, New England Coalition on Nuclear Pollution (NECNP); Chair, Sierra Club National Nuclear Waste division (For identification purposes only)
RE: Comment on Rubblization, Standard Review Plan for Decommissioning

The Nuclear Regulatory Commission (NRC) is considering adoption of a policy, based on requests from licensees, to allow, as part of decommissioning of nuclear power plants and potentially ther nuclear facilities, the demolition of onsite structures at reactor plant sites and elsewhere ("rubblization"), and disposition of the rubble, either onsite as "fill" or release of rubble offsite for disposal, presumably in solid waste landfills or as construction and demolition waste, or for recycle and reuse without restriction. ECNP and NECNP, with which I am associated, advise the NRC against, and strongly oppose, such a policy.

Decommissioning Standards

The NRC has chosen to set decommissioning criteria for license termination at an all-pathways dose level of 25 millirem per year plus ALARA to the average member of the critical group of those expected to be the most exposed at or on a site that is released for unrestricted use. This standard remains embroiled in controversy with the more restrictive EPA exposure standards of 15 mrem/yr and 4 mrem/yr ground water dose limits and with even more restrictive dose limits that may be imposed by the states subsequent to termination of NRC license and of federal preemptive authority. Either EPA or the state may then require additional decontamination of former nuclear reactor sites, at potentially quite significant additional costs to either the former or present site owner.

In the past, NRC regulations have prohibited onsite disposal of low-level radioactive wastes (LLRW) altogether and had limited onsite storage of LLRW to merely five years. As the realities of LLRW disposal have set in * in terms of costs and, for a time, the lack of an available disposal facility * the NRC has relaxed its requirements. However, licensing of nuclear reactors in the first place carried, at the minimum, an implied contract with the resident public that the wastes generated by an operating reactor would be removed from the site for regulated disposal offsite. Now, however, the NRC has set exposure limits that will permit a utility to walk away from a site that remains less than fully decontaminated, and in actuality will be allowed to be contaminated by residual radioactivity, which is in fact low-level radioactive waste.

The maximum permissible dose limit to an individual member of the public from a regulated LLRW disposal facility is 25 mrem/yr. We are reminded that many years ago NRC did away with the allowance in 10 CFR 20 for

Attachment 3

licensees to bury radioactive waste on their sites. At a surface reading of 25 mrem/yr, the buried concrete would fit the definition of a LLRW disposal facility * which in this instance may be correctly described as a "dump." Should the buried concrete contribute that total portion of the permissible dose, the entire remainder of the site would need to be decontaminated to a level that would be below limits of even the best available detection equipment. As a result, there would be, in essence, no ALARA. Moreover, ALARA is limited to a mere $2000 discounted per person-rem of avoided dose. Its applicability to extensive rubblization might be very limited, or the costs might prove to be very high.. To our knowledge, the NRC has not addressed these impacts on decommissioning or their costs. (I would add, however, that providing for the costs of reactor decommissioning properly belongs in the purview of state public utility regulatory commissions, not the NRC.)

Of great concern is the likelihood that this approach would be consistent with, and could lead to, the mixing of clean and heavily contaminated soils in order to reach NRC's "acceptable concentration limits." If merely surface or shallow (few inches) burial readings are allowed to be used, under the NRC's Regulatory Guide DG-4006, "Demonstrating Compliance with the Radiological Criteria for License Termination," or averaging of concentrations is allowed, the buried rubble and contaminated soils could in reality be substantially higher than was supposedly the intent of the Commission's Decommissioning Criteria.

Impacts on Ground Water

The consequence of onsite burial of radioactively contaminated concrete rubble would be the creation of the "bathtub"effect. This concern had earlier caused potential LLRW Compacts and Host States to require above grade monitored retrievable disposal technologies. But the NRC has chosen not to take account of ground water contamination in a manner that is consistent with other federal mandates for protection of drinking water supplies. The NRC cannot rely on speculation that any future leaching would be offset by binding below the burial trench (or platform if the flooring were not reduced to rubble, ignoring that cycles of dissolve and bind will eventually concentrate the radiological contaminants at the bottom of the shallow land burial "basket," and outflow will occur.

Impacts of Methods of Decontaminating and Rubblizing Concrete

If the presumably hard, durable concrete of nuclear reactor-related structures is to reduced to rubble, the first step will have to be very substantial decontamination. Since the entire post-license termination residual radioactivity doses will not be entirely from this one source, the clean-up will have to be to very low levels of remaining surface activity. How deeply into the concrete will activity be detected? We recall that at Three Mile Island Unite 2, contaminated water had soaked into the concrete walls to a substantial extent. Whether washing down the walls or mechanical removal * chipping, scabbling, sand-blasting or other abrasive

techniques * are employed, or potentially biological organisms currently being researched for effectiveness are used, all of the processes of decontamination prior to converting a building to rubble will result in potential additional doses to offsite populations that will not be included in calculations of remaining residual radiation for the final site survey that accompanies the licensee's license termination application at the end of the decommissioning process. It would seems that they will be in a regulatory limbo, neither operational fish nor post-license termination fowl.

Entirely unknown at this time would be potential adverse impacts of experimental biological agents on either human populations or other organisms that inhabit the biosystem. The uninvestigated long-term experimental nature of such methods must preclude them from consideration. We are left with processes that will either contaminate water used for washing down the walls, or solvents that may form mixed wastes (very costly to "dispose of"), or large amounts of dust, contaminated particulates which may be airborne for either short or long distances and deposited in lungs, or as dust which may be ingested, on agricultural land or in potable surface water supplies or enter the food chain via aquatic organisms. It would appear that any or all of these transport mechanisms will supply an added dose to human populations, either nearby or distant, that is not taken into account under operational dose limits or post-decommissioning limits. Workers as well as the public will be placed at additional risk for which they receive not comparable individual benefit.

Impacts on Air Quality

As described above, the decontamination processes prior to "taking down" structures will be expected to constitute additional airborne doses to workers and the public. The ability to demolish concrete buildings without creation of very large quantities of fine to coarse particulates * dust * is limited. Therefore, this process will add further to releases from the site in the course of decommissioning, will linger, will be available for uptake from the surrounding surfaces in moderate to high wind, and to permeate the soil, washing downward eventually into ground water, or be associated with erosion and deposition with further opportunities to become airborne and received as inhalation doses onsite or offsite.

Other Consequences of Rubblization

Since the NRC is also considering allowing release of portions of a nuclear power site during operation decommissioning of a reactor, there are unacceptable potentialities for "spreading the doses" that would ultimately result post-license termination via rubblizing and then burying the rubble onsite prior to fractional deregulation. A future lessee, renter, or purchaser of the early-released portion of a nuclear facility site might find him- or herself liable for later remedial site decontamination and waste disposal. Both the quality and the fair market value of the land would thereby be diminished.

If the NRC allows "rad rubble" (as it will inevitably be called) to be released from the site, it will be recycled, and reused for industrial or consumer purposes under proposed "clearance levels" or "release of solid materials" * or back to NRC's earlier terms for the same thing: deregulation, de minimis or BRC. Whether recycled as construction fill, or roadbed materials, or simply dumped into solid waste or C&D landfills, this "slightly contaminated" rubble will be totally out of regulatory control and will add inevitably to unassessed radiation exposures, a thickening of the radiation environment for all far into the future. This is unacceptable, and we call on the NRC to drop the proposal and not to permit "rubblization or release.

The additive, cumulative, and potentially synergistic radiation exposures to the public, including those from interacting radiation in concert with other environmental contaminants will be ignored by the regulatory agency. The impacts of such multiple, additive, cumulative, and synergistic sources and doses on human health at low doses are unknown. However, despite the current endeavors on the part of both national and international agencies entrusted to protect, not damage, human health or the quality of the environment to relax radiation standards, to deny the existence of low-dose and low dose-rate irradiation that may affect humans in the form of non-fatal, non-cancer illnesses and disorders and to return to the unsubstantiated theory of a "safe threshold" of radiation exposure, or even to hormesis, or "adaptive response," the trend of progressive regulators is in the opposite direction. In other nations, under consideration is the obligation for radiation protection standards for all organisms the comprise the ecosystems in which we live: protection for the environment for its own sake. The United States should be leading the way.

Thank you for this opportunity to comment.

September 14, 1999

Mr. John T. Greeves, Director
Division of Waste Management
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Greeves:

It is our understanding that the NRC staff is embarking on generating a white paper for the Commission to decide the merits of rubblization, as envisioned by Maine Yankee and its decommissioning contractor, Stone & Webster. We are concerned that this technique raises policy issues not only for the Commission, but also for the State. We appreciate this opportunity to express our concerns and raise our questions to the Commission and the NRC staff. Besides our general comments below, additional remarks and queries are attached that expand upon the rubblization concept.

We believe that the rubblization concept represents a distinct departure from the traditional methods and philosophy that have guided past clean-ups. If the proposed plan is approved, the radioactive inventory allowed to remain on-site will greatly exceed what the Commission has deemed appropriate for other decommissioning sites. We have difficulty supporting Maine Yankee's plan to rubblize concrete and urge you to seriously consider the following concerns:

- We see no physical characteristics distinguishing the proposed plan from a radioactive disposal facility. As such, we feel that it is inappropriate to terminate a license for any such facility.

- In order to avoid certain reuse scenarios, Maine Yankee intends to flood the basements of rubblized structures by drilling holes in them. We consider this to be an unsatisfactory method to avert the need to explore that scenario and, most importantly, an unnecessary contamination of the groundwater resource, which may not be bounded by the current Generic Environmental Impact Statement (GEIS). In addition, we are very concerned about unknown long term risks associated with saturated concrete with pHs potentially in excess of EPA's toxicity level. This could possibly result in a hazardous condition to a natural resource.

- There are no safeguards to ensure that, after license termination, any rubble remaining on-site, which exceeds free release standards, will remain on-site.

OFFICE - 157 CAPITOL STREET TTY: (207) 287-2070 FAX: (207) 287-4172

Attachment 4

- No data have been forthcoming to demonstrate that a more conventional clean-up is cost prohibitive.

- We feel that the plan places an unreasonable burden for future users of the site and is not in keeping with the intent of the NRC's decommissioning rule.

In short, we have yet to discern any tangible benefit of allowing plant derived, radioactive waste on-site. Moreover, we believe that conceptually it will be problematic to persuade the public of the merits of this proposition since it is strikingly similar to an unregulated low-level waste facility.

If the Commission decides to pursue this option, we request that a comprehensive review be performed to ensure that the technique will not produce unknown or unwarranted risks to the public and the environment. Furthermore, we believe that the NRC staff should allot whatever time and resources it deems appropriate to ensure a thorough evaluation of this methodology.

Should you have questions, please contact us at 207-882-5349 or at our e-mail address. dostiep@myapc.com.

Sincerely,

Patrick J. Dostie

Patrick J. Dostie
State Nuclear Safety Inspector
Office of Nuclear safety
Division of Health Engineering

C:
Dr. Philip Haines, Dep. Dir., Bureau of Health
Mr. Clough Toppan, Dir., Division of Health Engineering
Mr. Jay Hyland, Mgr., Radiation Control Program
Mr. Uldis Vanags, State Nuclear Safety Advisor, Governor's Office

STATE OF MAINE

Comments on Rubblization

If credit is taken for engineered barriers (the landfill configuration) and the leach rate for rubblized concrete (waste form), the licensee should be held to more appropriate dose models inclusive of the inadvertent intruder scenarios as required for 10 CFR 61 licensing for low-level waste facilities.

Since rubblization has no striking differences from the design of a low-level waste disposal facility, we question the wisdom of not also licensing the site as a Part 61 facility. In this light, we have specific concerns that the plan may be generally in conflict with:

1. The extensive public hearing and siting requirements of a specifically licensed 10 CFR 61 facility;
2. Certain provisions of the Texas Low-Level Waste Disposal Compact;
3. The Maine Department of Environmental Protection's rules governing the permitting of Construction and Demolition Debris;
4. A State Law stipulating that there is no level of radioactive waste below regulatory concern.

The current approach may lead to specific activities similar to those of a low-level waste facility, which is also held to a 25 mrem per year exposure limit to the public. However, unlike low-level waste facilities, the proposed landfill would have no ongoing monitoring requirements or institutional controls.

If licensable quantities of radioactive material remain on-site after license termination, why should the site not become a de facto 10 CFR 30 license? If the NRC has a defensible regulatory basis for stating that it is not a Part 30 license, we would appreciate the opportunity to review this basis.

Could holding contaminated concrete on-site for potential future dilution and backfill be construed as a conflict with the prohibitions relating to the dilution of waste streams of 10 CFR 20?

Before rubblization is to take place, surrogate measurements of concrete to characterize the future rubble will need to be taken. Besides any number of unanswered practical and technical questions about this approach (such as effects on leach rate by acid rain or salt water intrusion, size of the rubble, etc.), there is no guidance from the NRC as to how the characterization should be performed.

Is it prudent and suitable to release a site that has specific activities of rubblized concrete that are in excess of acceptable levels if the buildings were left in a building configuration?

How applicable is the GEIS for decommissioned power plants for a disposal facility?

STATE OF MAINE
EXECUTIVE DEPARTMENT
STATE PLANNING OFFICE
38 STATE HOUSE STATION
AUGUSTA, MAINE
04333-0038

ANGUS S. KING, JR.
GOVERNOR

EVAN D. RICHERT, AICP
DIRECTOR

September 16, 1999

Mr. David Myers
U.S. Nuclear Regulatory Commission
Two White Flint
11545 Rockville Pike
Rockville, MD 20852

Mr. John T. Greeves, Director
Division of Waste Management
U.S. Nuclear Regulatory Commission
Washington D.C. 20555

Dear Mr. Myers and Mr. Greeves:

The State of Maine, Division of Health Engineering (under the signatory of State Nuclear Safety Inspector, Patrick J. Dostie), submitted comments to you on September 14, 1999 concerning Draft Regulatory Guide DG-4006, "Demonstrating Compliance with the Radiological Criteria for License Termination", and the issue of rubblization of contaminated concrete at the Maine Yankee Nuclear Power Station.

I respectfully request your consideration to accept additional comments from the State of Maine that are attached with this letter. The comments pertain to the subject material described above and should be considered as an addendum to the submissions from the Division of Health Engineering. The comments are authored by Dr. George E. Chabot of the University of Massachusetts at Lowel who is presently one of four members of the Governor's Technical Advisory Panel on the Decommissioning of Maine Yankee.

I greatly appreciate the cooperation the U.S. NRC has extended to the State of Maine on the decommissioning of the Maine Yankee plant. Should you have any questions concerning this submission, please contact me at 207.287.8936 or e-mail uldis.vanags@state.me.us.

Sincerely,

Uldis Vanags
State Nuclear Safety Advisor

Attachment: Comments from Dr. George E. Chabot, 2 pages

Cc: Mr. Patrick J. Dostie, State Nuclear Safety Inspector, Division of Health Engineering
Dr. Philip Haines, Dep. Dir., Bureau of Health
Mr. Clough Toppan, Dir., Division of Health Engineering
Mr. Jay Hyland, Mgr., Radiation Control Program
Dr. George E. Chabot, Governor's Technical Advisory Panel

Attachment 5

OFFICES LOCATED AT: 184 STATE STREET
PHONE: (207) 287-3261 Internet: www.state.me.us/spo FAX: (207) 287-6489

Comments Concerning the Proposal to Rubblize and Bury Contaminated Concrete on Licensee's Site - George E. Chabot

Regarding the decision being considered to allow rubblization of contaminated concrete from buildings on-site and burial of the rubble in the ground, or in the foundation cavities of buildings, it seems to me that such action involves adoption of a philosophy that is different from and, in some respects, contrary to the philosophy of ALARA as we have commonly practiced it. In order to meet the goal of 25 mrem TEDE per year, with the added consideration of implementing the ALARA philosophy to reduce the dose further within certain cost-benefit restraints, the usual approach has been to reduce the degree of in-place contamination such that when residual contamination is left in-place doses to the average member of the critical group will not exceed the ALARA objective. The proposed approach seems to be contrary to this in that, rather than reducing in-place activity to meet the ALARA objective, it actually involves increasing activity in an otherwise clean environment and, by such a process, increasing the TEDE of concern to the acceptable value. This process of on-site relocation of radioactivity as a means of meeting ALARA goals and the 25 mrem TEDE requirement seems inconsistent with the ALARA approach as it has been practiced in the past. It is highly likely that by rubblizing building concrete and burying it on-site, one would be able to leave considerably more activity on-site than would be the case if the contaminated buildings were left standing – i.e., they would have to be decontaminated to a greater extent in order to meet legal and ALARA requirements. Independent of the economic costs involved, the notion of being "reasonably achievable", embodied in ALARA, seems to be violated in this type of approach. I find it unlikely that most members of the public would buy off on this solution as being "reasonable", and I suspect that many electricity rate-payers would opt to pick up the cost for what they would deem to be a more reasonable approach (e.g., off-site shipment and disposal) rather than accept the on-site burial.

A similar situation might be envisioned for a site with some soil contaminated by one or more radionuclides. Under usual practices, the licensee would be required to reduce the soil contamination, normally by excavation and removal to an appropriate off-site waste disposal site, so that the residual radioactivity would meet the 25 mrem per year and ALARA requirements. A licensee might propose, using the rationale being considered by the Commission, that the requirements could be met by excavating some of the contaminated soil from the area of concern, excavating clean soil from another area on the site, mixing the clean soil with the contaminated soil, and reburying the mixture in what was a clean area on the site. Such an action as this might be appropriate if an analysis was done that demonstrated that the TEDE to the member of the critical group would be greater for off-site disposal of the contaminated soil (or concrete) than for on-site retention and dispersal; otherwise I would expect the action to be viewed in a negative light by many involved persons, including members of the NRC and EPA as well as members of the public.

One might make a technical argument that, since the same TEDE might result from the proposed action of on-site burial as from other alternatives, such as leaving buildings in-

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC - 2 1999

OFFICE OF
AIR AND RADIATION

John T. Greeves, Director
Division of Waste Management (T7J9)
Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: Preliminary Concerns on Rubblization Concept

Dear Mr. Greeves:

Thank you for the invitation to comment on the proposed concept of "rubblization" as applied to the decontamination and decommissioning of Nuclear Regulatory Commission (NRC) licensed sites. "Rubblization" has been described as a potential method for meeting compliance with the NRC requirements for clean-up and closure of licensed nuclear power plant facilities. Unfortunately, the information available to the Office of Radiation and Indoor Air (ORIA) has been limited to several general presentations by Mr. Fauver, on behalf of Maine Yankee, and a presentation by Connecticut Yankee. Given the generality of those presentations and absent a concrete proposal, ORIA has not yet had an opportunity to address the numerous complex and technical concerns associated with rubblization dose modeling. As a result, ORIA's comments are by necessity, brief, general, and policy-oriented.

Our understanding is that, as currently proposed, rubblization contemplates the demolition and burial onsite of buildings contaminated with radioactivity. As we understand the process, some radioactive contamination would be removed from portions of the building through established radiation removal techniques. After removal of some of the radiological contamination, the building would be demolished, and the remaining material would be buried in the foundation of the building, filled with water or some other material, and covered with a yet unspecified amount of soil as a cap. It is not clear whether steel reinforcing bars and buried piping, etc., would be removed.

Based upon our limited understanding of the proposed process, ORIA, with the input of Region I, has the following preliminary comments:

1. Rubblization is a process for disposing of concrete/brick that may be contaminated with radioactivity at a facility, potentially establishing a low level

Attachment 6

Recycled/Recyclable
Printed with Soy/Canola Ink on paper that contains at least 50% recycled fiber

radioactive waste site that lacks appropriate institutional and monitoring controls. State and other federal regulations and permitting would certainly apply to such a site.

2. Any action taken by NRC in approving rubblization for nuclear power plants could be precedent-setting, resulting in expansion of this concept to any licensed facility handling radiation. Thus, the potential exists for the establishment of a significant number of these waste disposal sites throughout the U.S. We question whether the current statutory and regulatory scheme contemplates such a result.

3. As presented, it is not clear whether rubblization has included a consideration of other non NRC-licensed contaminants that might be left on the material, and their proper isolation from the environment, and any required permits. For example, the presentation by Maine Yankee suggested that water contact with the foundation and material contained within may yield pH levels of 13 – a level that would appear to be a concern to both State and Federal offices dealing with water quality issues. High pH levels may significantly enhance the mobility of some contaminants, resulting in exceedence of health based standards in ground water.

4. The Final Generic Environmental Impact Statements on decommissioning of nuclear facilities, and the associated radiological criteria (NUREG-0586, NUREG-1496) neither discuss rubblization as a potential clean-up technique nor address the associated environmental impacts. EPA believes that NRC must examine the environmental impacts of rubblization, on a generic or site specific basis, in accordance with NEPA requirements, before the NRC decides to approve the technique.

5. Rubblization would represent a break from NRC's present policy and preference for off-site disposal of radioactive waste. From a public standpoint, leaving radioactive waste on-site, in areas that may not have been originally contaminated, could be difficult to explain. Moreover, rubblization engenders "Dilution as the solution," a remedial practice that other agencies do not commonly employ or encourage. Finally, although NRC's decommissioning guidance provides a working definition of ALARA, it may be difficult to convince the public that burying radioactive waste on-site constitutes a reduction of dose to a point "as low as reasonably achievable."

6. Unless it can be demonstrated that residual contaminant levels are low enough that MCLs could not be exceeded by future leaching into ground water, or that possible future exposure to individuals from the rubblized material, if the cap fails, would not exceed protective levels, the site should only be released with institutional controls and some type of monitoring system.

As stated above, these constitute preliminary comments on the concept of rubblization. If this concept develops further and more information becomes available, ORIA would be pleased to submit more comprehensive comments for NRC's consideration.

Sincerely,

for Frank Marcinowski, Acting Director
Radiation Protection Division

Summary Of Major Stakeholders Issues Identified in the Positions

Concern 1: Placing Waste in the Below-Grade Structure Constitutes a Low-Level Waste Disposal Facility Resulting in Proliferation of Low-Level Waste Sites

Several stakeholders have identified a concern about the use of rubblization because rubblization leaves contaminated material below grade. Stakeholders are concerned that rubblization will result in proliferation of low-level-waste sites, and contend that placing the rubblized material in the below-grade structure constitutes a low-level waste disposal facility. Some stakeholders further contend that rubblization has no striking difference from a design of a low-level waste facility and should be licensed under 10 CFR Part 61.

The staff recognizes that the use of rubblization approach results in leaving waste on site: however, Part 20, Subpart E, being a performance based rule, appears implicitly to allow an approach such as the rubblization concept-- leaving contaminated material on the site and placed in the below-grade structure-- provided the licensee demonstrates compliance with the 25 mrem per year and reducing residual radioactivity to as low as is reasonably achievable (ALARA). 10 CFR Part 61 applies to disposal of waste from other site/sources.

Concern 2: Rubblization of Contaminated Material Requires a 10 CFR 20.2002 Approval

Several stakeholders have raised the contention that the application of rubblization for decommissioning requires a 10 CFR 20.2002 application. The relationship between 10 CFR Part 20, Subpart K and Subpart E is not explicitly stated in the Commission's regulations. The staff's position is that Subpart E, the license termination rule, allows the use of rubblization provided the licensee demonstrates compliance with the 25 mrem per year and ALARA. Subpart K, specifically section 20.2002, provides the authority to dispose of material that is not authorized by the regulation. The staff's position is that Subpart K does not apply to decommissioning of the facility. Any approved on-site disposal under section 20.2002 would be reviewed at the time of decommissioning and be subject to the license termination rule.

Concern 3: Departure from Previous Practice

Several stakeholders have raised the concern that leaving elevated contaminated material on the site is a significant departure from past licensing practice. The staff recognizes this is a departure from previous practice before the Commission amended its regulations on July 27, 1997 (62 FR 39058) to 10 CFR Part 20, Subpart E for license termination. The new dose-based license termination rule allows residual contamination to remain, or to be buried on a site, provided the applicant demonstrates compliance with the 25 mrem per year dose limit and ALARA. The staff recognizes rubblization is a new approach. However, Subpart E being a performance based rule, may allow approaches such as rubblization, although it may result in more elevated levels of residual contamination to remain on a site after the license is terminated than has been past practice.

Attachment 7

Concern 4: Demonstration of ALARA Principles

Several stakeholders have raised the concern about the demonstration of ALARA principles in the application of rubblization. As indicated earlier, the staff will review each rubblization application on a case-by-case basis, to make sure the licensee clearly demonstrates compliance with the 25 mrem per year and ALARA. Current guidance on meeting ALARA is available. The staff recognizes that the current guidance is only draft and thus subject to change. The staff also recognizes that the application of ALARA principles for decommissioning generally demonstrates that it is ineffective to remove additional contamination beyond the 25 mrem because of the high additional decontamination cost and minimal reduction in the dose. The licensee's application will be reviewed for demonstration of ALARA principles.

Concern 5: Rubblization has the Potential to Conflict with Proposed Initiative on Control of Solid Materials

Some stakeholders raised the concern about rubblization potentially conflicting with the initiative on control of solid materials–proposed clearance rule. The solid material initiative addresses the release of solid material from a licensee while the license termination rule addresses unrestricted release of a facility provided the licensee demonstrates compliance with the 25 mrem per year and ALARA. The staff recognizes, although it's unlikely, that a piece of rubblized material removed from a site that has been released for unrestricted use may exceed the range of doses being considered in the NRC's current initiative on establishing dose criteria for the release of solid material. The relationship between the license termination rule and the proposed clearance rule will need to be addressed as part of the rulemaking on the clearance rule. In support of the license termination rule, the "Generic Environmental Impact Statement (GEIS) in Support of Rulemaking on Radiological Criteria for License Termination of NRC-Licensed Nuclear Facilities," although not specifically addressing rubblization, concluded that the exposure mechanisms for recycled material were similar, and the resulting individual doses could only be less than those evaluated in support of license termination because contamination of the recycled material will be reduced through dilution with other raw materials.

Concern 6: Rubblization Requires a Generic and/or a Site Specific Environmental Impact Statement

Several stakeholders have raised the concern that the environmental impacts needed to be reconsidered before allowing a licensee to use the rubblization approach. Past generic impact statements do not specifically address rubblization and did not envision the potential for rubblization being used at a significant number of reactors sites or for that matter at any licensed facility contaminated with radioactive material. Given the precedent-setting nature of a policy that allows this new form of decommissioning, the environmental impacts, including the consideration of non NRC-licensed contaminants, must be considered on either a generic or site specific basis before approving this approach. The staff recognizes that it must fulfill its NEPA responsibilities before approving the use of rubblization. The staff intends to update the GEIS for 10 CFR 50.82 which will address rubblization. An environmental review will be conducted for each site.

Considerations That Need To Be Examined When Evaluating Licensees' Applications Using The Rubblization To Demonstrate Compliance with 10 CFR Part 20, Subpart E

Because the staff did not specifically consider rubblization, the staff will need to consider the following areas in the case-by-case review on the acceptability of the approach:

1) Current dose assessment guidance does not address the proposed conceptual models for rubblization including the acceptability of mixing/diluting contaminated material, nor does the current guidance define the scenarios that should be addressed, and the staff will need to develop supporting guidance for both these areas. Until dose modeling guidance is developed, NRC staff will have to review each applicant's dose modeling proposal on a case-by-case basis, and this will increase the review time of the application. The acceptability of mixing/diluting contaminated material must be addressed;

2) Because the rubblized concrete is a heterogeneous mix, the staff will need to develop guidance on how to address hot spots when using this approach; however, the staff recognizes that the use of area factors as defined in NUREG-1575, "MARSSIM," is an acceptable technique to address hot-spot (elevated areas of contamination) analysis for surface contamination and soils;

3) The proposed rubblization approach may allow a higher level of residual contamination per unit area to remain at the site than the surface-screening contamination values, or surface site-specific values for the building occupancy scenario;

4) The revised radiological criterion resulting from the license termination rule requires the licensee to describe in detail the methods and assumptions used to demonstrate that the dose to the average member of the critical group does not exceed 25-mrem per year and that residual radioactivity be reduced to ALARA. The assumptions/scenario must reasonably represent the conditions that will exist at the site. Draft NUREG-1700, "Standard Review Plan for Evaluating Nuclear Power Reactor License Termination Plans" states "If a site-specific scenario is used, a description of the reasonable use of the structure after license termination for the projected lifetime of the structure should be provided." Rubblization represents the conditions that will exist at the time the license is terminated;

5) The below-ground structures that remain should be subjected to the surface contamination limits based on a possible reuse scenario;

6) The rubblized material should be analyzed under some reuse scenario;

Attachment 8

7) A site specific EIS may be needed pending completion of the update to the GEIS supporting 10 CFR 50.82; and

8) Does rubblization demonstrates the application of ALARA principles consistent with existing ALARA guidance?"