WHO NEEDS BRC?

Michael F. Weber
Division of Low-Level Waste Management and Decommissioning
U.S. Nuclear Regulatory Commission
Washington, D.C.

ABSTRACT

In July 1990, the U.S. Nuclear Regulatory Commission (NRC) issued its Below Regulatory Concern (BRC) policy statement to provide a unifying framework for making exemption decisions involving very low levels of radiation. The NRC identified potential applications of the BRC policy to address specific needs in the areas of decommissioning, distribution of consumer products, management of very low-level radioactive wastes, and reuse and recycle of slightly contaminated material. Reaction to the policy from the public, Congress, and the States has caused the Commission to reconsider the approach taken in development of the BRC policy and to place a moratorium on the implementation of the policy pending the outcome of a consensus process on BRC issues. Although the Commission has now terminated the consensus process, the indefinite moratorium on the policy remains in effect. The present lack of consensus on BRC, however, does not eliminate the need for consideration and agreement upon acceptably low levels of radiation exposure. The NRC, Agreement States, and licensees routinely make BRC-like decisions implicitly and explicitly through ongoing licensing and operation of nuclear facilities. Other Federal and State agencies are making similar decisions involving non-radiological hazards and risks in a variety of regulatory and public programs. Agreement on acceptably low levels of radiation exposure will help ensure that these decisions are made in a consistent and efficient manner.

INTRODUCTION

Since the beginning of the nuclear age in the 1940s, there has been a need to define an acceptable lower level of radiation exposure below which further regulation and control are no longer necessary or appropriate. The philosophical basis for such a lower level is grounded in the beliefs that the health risks caused by radiation exposure decrease proportionately as the exposure itself decreases and that, below some level, the effort associated with imposing additional controls exceeds the potential benefits of applying such control. The lower level of exposure should be integrated with the established hierarchy of safety limits and objectives as established by national and international standard setting organizations, such as the International Commission on Radiological Protection (ICRP), the National Council on Radiation Protection and Measurements (NCRP), and other competent authorities and regulatory agencies (1,2,3,4). The hierarchy would consist of safety limits not to be exceeded under normal circumstances (e.g., an annual limit on total dose) and objectives set below the safety limits based on the optimization or As Low As Reasonably Achievable (ALARA) principle (1,2). The lower level of exposure would be expected to be well below the safety limits and provide a floor to the application of ALARA considerations (4).

The Nuclear Regulatory Commission (NRC) attempted to define acceptable lower levels of exposure in terms of individual and collective doses in its Below Regulatory Concern (BRC) policy statement, which was released in July 1990 (5). The BRC policy statement was intended to apply to exemption decisions potentially involving very low levels of radiation exposure to members of the public. In the policy statement, the NRC identified that the policy may be applied in the areas of decommissioning, consumer products, low-level radioactive waste disposal, and reuse and recycle of slightly contaminated material. Of particular importance to the Commission, the BRC policy was intended to address the perpetual question of "How clean is clean enough?" in determining whether commercial nuclear facilities had been sufficiently decontaminated to allow them to be released for unrestricted use (5,6).

Despite the Commission's best intentions in developing and releasing the BRC policy, the policy provoked a negative reaction from the public, Congress, and States. In addition to raising the prospect of involuntarily exposing unsuspecting members of the public to increased risks, the policy was perceived as being a relaxation in regulatory controls on radioactive material. Negative comments also highlighted perceived inconsistencies with the recommendations and risk levels attained under other regulatory programs, such as those administered by the Environmental Protection Agency (EPA). Most commentors focused their criticism on the process through which the NRC developed the policy (7). These organizations complained that NRC had developed the policy in virtual isolation of the interests and concerns of affected parties.

After the BRC policy encountered significant broad-based objections, the Commission placed an indefinite moratorium on its implementation in June 1991 and initiated the first stage of a phased approach to build a consensus on BRC issues among interested parties (8). This consensus-building process was intended to seek common ground among interested parties and to share with them, in an open and equitable process, NRC's justification for developing a BRC policy to improve the efficiency and effectiveness of regulatory efforts to control nuclear materials under the Atomic Energy Act of 1954, as amended (7,9).

After months of extensive discussions and coordination, the Commission officially terminated the consensus building process on December 4, 1991, because it was unable to attract the participation of a representative of the environmental community (10,11). In conjunction with this decision, the Commission reaffirmed the indefinite moratorium on the BRC policy and directed the NRC staff to submit plans for a participative rulemaking to identify and seek consensus on issues associated with a particular rulemaking topic, such as radiological criteria for decommissioning. The Commission is

currently considering the NRC staff's plans for conducting this high priority rulemaking and hopes to involve a wide range of affected interests, including States, EPA, and the environmental community, in the scoping and conduct of the rulemaking (12).

NEED FOR A BRC

While the rulemaking process to develop radiological criteria for decommissioning runs its course and the BRC policy remains in its moratorium status, the NRC continues to make routine licensing and other regulatory decisions that affect exposures of members of the public to very low levels of radiation exposure. NRC is making these decisions based on current NRC requirements, regulatory guidance, and policies, but without the benefit of the unifying, risk-based framework provided by the BRC policy. The present lack of consensus on the BRC policy does not eliminate the need for a BRC policy or some comparable framework for defining lower levels of radiation exposure below which additional regulation or control is no longer necessary or appropriate.

When the Commission initiated the first phase of the consensus process on the BRC policy, it directed the NRC staff to continue to make licensing and other regulatory decisions in the same manner as they were conducted before the existence of the BRC policy (8). BRC-like decisions are necessarily made routinely by licensees, NRC, and Agreement States (States that have established an Agreement with the NRC to conduct the regulation of certain types of radioactive materials and facilities). For example, these decisions are made implicitly through the approval and implementation of licensee procedures for controlling the use and release of radioactive materials such as deciding on the isolation practices and procedures for radiopharmaceutical therapy patients, or approving survey instrumentation and procedures for wastes that may be contaminated with radioactive materials. Similar decisions are made explicitly through a variety of practices, such as selecting and implementing contamination criteria for so-called "free release" wastes that may contain small quantities of radioactive materials, but are discharged as normal garbage to sanitary landfills and other waste management units. Other examples of BRC-like levels include the Department of Transportation's 2 nCi/g threshold for identifying radioactive material, the Nuclear Regulatory Commission's biomedical waste rule allowing disposal of certain types of wastes containing low concentrations of ^{3}H and ^{14}C to be disposed of without regard to their radioactivity, the Environmental Protection Agency's action level of 4 pCi/l of ^{222}Rn in indoor air, or the Department of Energy's developing procedures for release of hazardous waste shipments (13).

Another example of a BRC-type decision is the determination of appropriate levels of potential radiation exposure associated with the release of slightly contaminated lands and structures at decommissioned nuclear facilities (5). In 1988 the Commission established that one of the objectives of decommissioning is to decontaminate a facility sufficiently to allow its unrestricted release for public use (14,15). The NRC has been making decisions on the appropriateness of cleanup of contaminated soils and structures on a case-by-case basis guided by a patchwork of regulatory guidance documents since the early 1970s (16,17,18). However, binding requirements have not been available to define what radiation exposure levels are appropriate for determining the adequacy of site decontamination or when a site has been sufficiently cleaned up to allow its release for unrestricted use. In short, NRC's existing regulations do not answer the question "How clean is clean enough."

The Commission intended that the BRC policy would provide a framework for developing a generic regulation on cleanup criteria as well as guiding cleanup decisions on a site-specific basis until the generic regulation could be promulgated (19). If the BRC policy were being implemented today, for example, the NRC could use the BRC policy to guide the selection and approval of site-specific clean up criteria (5). However, with the moratorium on the BRC policy, NRC staff develops and approves cleanup criteria as it did before the BRC policy was released. These criteria are generally proposed by the licensees based on long-standing NRC general guidance and on the basis of site-specific ALARA analyses confirmed by the NRC staff through independent evaluations associated with licensing reviews. Although this approach is flexible, licensees, NRC, and States would benefit from the efficiencies gained by having site cleanup criteria codified through rulemaking. In addition, there is a continuing emphasis on the part of the NRC staff to ensure that the criteria selected and implemented are generally consistent with one another and with comparable criteria being established by other agencies, such as EPA, for the cleanup of similarly contaminated sites.

EXAMPLES

The need for a BRC level can be illustrated by analyzing a few representative examples, which could have been resolved more efficiently and consistently by the general application of a BRC-type decision framework.

Contaminated Sewer Sludge

Sewer sludge slightly contaminated with radioactive material is being detected with increasing frequency in the U.S. as a result of the increased use of gamma scintillation detectors at the entrances to sanitary waste landfills across the country. One such case occurred in the central U.S. during June 1991, when the discharge of demineralizer backflush solution from an NRC-licensed research reactor caused elevated levels of radionuclides in sewage sludge and ash from a municipal sewage treatment plant (20). NRC and the licensee detected elevated levels of a variety of radionuclides in the sewage sludge ash, including ^{108}Ag, ^{110m}Ag, ^{65}Zn, ^{54}Mn, ^{60}Co, and ^{131}I up to concentrations as high as 3.1E-4 uCi/g. Piles of contaminated ash at the sewage treatment site exhibited exposure rates as high as 1.5 milliRoentgen/hour on contact.

Based on detailed gamma spectrometry of representative sludge and ash samples performed by both the licensee and the NRC and a review of available effluent records, the NRC determined that the licensee had complied with relevant requirements on effluent discharge (10 CFR 20.303 (20,21)). In addition, NRC determined that the remaining amount of contamination within the sludge ash was well below the public dose limit in 10 CFR Part 20 and below the exempt concentration limits in 10 CFR 30.70 (20,15). Consequently, it did not appear prudent or feasible to regulate the disposition of the contaminated sewage ash. However, the elevated levels of radioactivity in the sewage ash aroused concern on the part of the local public and the municipality.

In determining whether disposal of the contaminated sewage sludge ash at a nearby municipal landfill should be allowed to continue, the NRC staff conducted a site-specific dose pathways analysis to estimate potential human exposures to the contamination. In the absence of an appropriate BRC

level or framework, the NRC staff had to justify the maximum potential exposure level, in this case as much as 4 millirem per year, on its own merits. The existence of a generally-applicable, broadly accepted BRC level may have also helped to resolve the concerns of exposed workers and members of the public.

In addition, the NRC has been evaluating potential exposures to members of the public and workers resulting from the reconcentration of radionuclides in sanitary sewer systems over the last several years (4). Although the results of this research are currently being reviewed by the NRC, the research may ultimately result in reductions to the existing limits in NRC's requirements on effluents to sanitary sewers in 10 CFR 20.303 or 20.2003 (21,4). A consistent and acceptable BRC framework could be useful in developing any potential revisions to the existing requirements if the research indicates a need for such changes.

Even such general revisions to the requirements if completed, however, may not be sufficient to address and foresee all potentially significant reconcentration of radioactive materials in all cases. A workable and accepted BRC framework could also be used as the basis for establishing screening levels that could be implemented by municipal sewer systems with relatively large amounts of contaminated input or a moderate to high potential for significantly reconcentrating radioactivity in sludge and ash. These systems could use the screening levels on a continuous basis to provide early warning of significant increases in radionuclide loading sufficiently early to take any appropriate corrective action to prevent unacceptable short- and long-term exposures to members of the public.

Cleanup of High Enriched Uranium

In a recent decommissioning action, a licensee requested the NRC to approve proposed plans for decontamination and remediation of a septic leach field that was contaminated with small amounts of high enriched uranium (HEU). On the basis of a preliminary ALARA analysis of alternative remediation approaches, the licensee determined that a significant fraction of the HEU contamination could remain in the leach field without posing an unacceptable risk to members of the public and the environment. In the ALARA analysis, the licensee attempted to show that remedial alternatives did not substantially reduce the residual risk to potential onsite residents despite large increases in the costs associated with the alternatives as progressively more contaminated soil would have been removed from the site.

Based on the NRC staff's review of the licensee's site characterization and the ALARA analysis, the licensee generally agreed to complete the decontamination of the leach field in accordance with the concentration limits of the NRC's 1981 Branch Technical Position on Disposal or Onsite Storage of Thorium and Uranium Wastes from Past Operations (BTP; 18). However, the BTP did not explicitly address protection of groundwater resources. Consequently, NRC staff had to select and justify an appropriate protection objective for the groundwater resources to ensure that potential users of groundwater at the site would be adequately protected and the quality of the resource would be preserved.

If a general BRC framework or level had been available, these general objectives could have been used to guide selection of specific cleanup criteria. In the absence of such a BRC policy, however, the NRC staff selected and justified a dose objective for the groundwater pathway that was consistent with the technical basis for the BTP (18). Significant staff effort was devoted to evaluation of alternative groundwater protection objectives before the NRC staff selected the objective, which corresponded to a dose to the maximum reasonably exposed individual of a few millirem per year for that single pathway. The assessment and approval process for this licensing action would have been facilitated by the availability and application of an appropriate BRC framework.

NARM Waste

This example covers a whole range of radioactive materials in a variety of settings to illustrate the scope of potential applications for a BRC framework or policy. Throughout the last several decades, there has been considerable discussion about regulating the possession, use, and disposal of different types of naturally occurring and accelerator produced radioactive material (NARM) (22). These types of radioactive materials are not regulated under the Atomic Energy Act of 1954, as amended, because they do not generally fall into the classes of radioactive material specifically defined in the Act (i.e., source, special nuclear, and byproduct material) (9). Consequently, the Nuclear Regulatory Commission does not regulate NARM.

In contrast, regulatory authority for NARM has been vested with several other agencies under a variety of statutes, such as the Toxic Substances Control Act and the Resource Conservation and Recovery Act, as amended (23,24). Individual States have also taken the initiative to establish and implement regulatory programs for NARM under general provisions of State law for protecting the health and safety of State citizens. The Conference of Radiation Control Program Directors has been instrumental in the development and support of such programs and is continuing to develop criteria for controlling NARM wastes.

Over the last couple years, there has been growing concern among industry, radiation protection professionals, and the public that certain types of NARM waste may pose significant hazards unless they are properly managed and disposed (25). In certain circumstances, NARM wastes could cause doses to members of the public on the order of several hundred millirem per year, well above the international and national recommended levels for protection of the public (i.e., 100 millirem per year) (1,2,4). One of these wastes is pipe scale from the oil and gas industry that contains significantly elevated levels of ^{226}Ra and ^{228}Ra (26). Management and disposal of these wastes are often complicated because of a lack of disposal facilities and specific regulations. In certain situations, this actual or perceived complexity may be sufficient to thwart owner efforts to safely dispose of the wastes.

An accepted BRC framework or level could provide the basis for developing general and consistent requirements for State regulation of NARM wastes or for developing site-specific criteria for ensuring the wastes are properly and uniformly managed. Without such a framework, however, it may be difficult to develop a mutually acceptable set of criteria for controlling and defining NARM waste (22,26). It has also been difficult for States and organizations like the CRCPD to develop a consistent basis for distinguishing between those wastes that should be regulated and those that should not.

DISCUSSION

In a larger sense, the lack of a consistent and acceptable definition of BRC levels has produced a diverse societal approach to radiation protection at the lowest levels of exposure. Although some of the differences in doses and risks

associated with the differences in accepted lower levels of exposure can be explained based on ALARA considerations, some of the inconsistencies also result from the historical context in which the criteria were originally developed. Unless and until the radiation protection community develops a broadly accepted approach to defining these lower levels of exposure, public skepticism and inefficiency will continue in regulating the uses of nuclear materials that potentially cause low levels of radiation exposure to the public.

The inability of the community to achieve an accepted approach on BRC also erodes public confidence in the public programs and institutions charged with responsibility for protecting the public. The ultimate cost of this erosion in confidence must be added to the inefficiency associated with inconsistent approaches to defining BRC levels in the absence of an accepted, unifying framework on BRC.

The public would benefit from a generally agreed upon acceptable lower limit on radiation exposure. In the absence of an accepted approach towards BRC issues, regulatory and operational decisions involving potential exposures of members of the public to low levels of radiation will likely continue to made in an inconsistent and inefficient manner. With growing emphasis on fiscal constraint at all levels of government and industry and heightened awareness to the risks of radiation, an optimal approach would appear to be to develop broad-based consensus on lower limits of exposure.

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