Both Benefit and Risk Analyses of High Level Waste Disposal are Needed - 11609

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ABSTRACT

To date, programs to dispose of high level radioactive waste in the USA have been unsuccessful. The question arises whether the failure to identify the benefits of such disposal as thoroughly as the health risks has contributed to the lack of public support.

There continues to be a debate on high level waste management whether to proceed with the development of a repository for disposal at this time or to continue with the storage of these radioactive residuals. The purpose of this paper is to identify the advantages or benefits of such disposal versus the risks associated with that action to enable elected officials and the public to make more informed judgments. To date, we have correctly focused on analyses of health effects from high level waste disposal and it is vital to have regulatory agencies determine the acceptable risk and evaluate the long-term predicted risk from the behavior of these unwanted radionuclides after disposal. However, it appears that regulatory approval by itself is inadequate to secure the necessary public support required to proceed with a repository.

This paper addresses the need to inventory both the advantages and disadvantages for various affected populations from high level waste disposal in terms of economic, sociological, and political impact.

The format of the following matrix will be used to succinctly summarize the merits and problems for each of the affected populations. Risks (Disadvantages) and Benefits (Advantages) for repository workers, the local population, future generations, people on transportation routes, and state and federal government.

INTRODUCTION

The 1982 Nuclear Waste Policy Act established a system to dispose of radioactive high level waste (HLW) [1]. Disposal means a permanent action with no intent to retrieve while storage is a temporary action. A recent paper in Science makes the point , "….[p]eople do not like projects that pose highly uncertain risks unless they see great compensating benefits and have deep trust in the institution managing them." [2]

Whenever a project is proposed, one looks at both the benefits to be derived from that endeavor as well as the risks and compares the weight of both. This includes economic impacts, health impacts, sociological, political as well as perceived effects. For the disposal of radioactive High Level Waste, we have assigned the responsibility to regulatory agencies to only make a determination of the health impacts [3]. The 1982 Nuclear Waste Policy Act of 1982 did not require cost-benefit analyses to be performed for HLW disposal [4]. As required by law, their analyses are confined to determining the impact on the public health and the environment. There is no requirement to address these other factors as we do in our daily lives in assessing whether to proceed with a piece of work.

There is an acute need to quantify the advantages of the disposal of high level waste as well as the disadvantages. The paper addresses the local population, workers doing the actual waste disposal, people along the transportation routes, and the population many years in the future when these unwanted residuals could return to the biosphere; either by man-made intrusions or naturally occurring disruptive events.

LIMITATIONS OF COMPARISON

To compare benefits and risks, it would be preferable to have them in similar units, whether dollars, health effects, confidence, political decisions or some other common factor. It is not possible to do this. Attempts to quantify concepts of environmental justice or ethics have little commonality. To compound the problem, one must recognize that many of the perceived values are subjective and there is no universal agreement on the value of a given benefit or risk. As an example, the New Mexico Environmental Evaluation Group evaluated the impact on public health of the WIPP Project and concluded that DOE had complied with the EPA standards for safe disposal of transuranic waste and recommended that disposal begin. While this contributed to public confidence in the safe disposal, it is not possible to quantify the value of such confidence.

Categorization as either an advantage or disadvantage may depend on the group involved. HLW Disposal is a benefit aiding the future production of additional electrical power but to the local population the potential radiation risk is a disadvantage. Hence the process does not lend itself to tabulating neat columns or lists.

DISCUSSION

Workers

Advantages to workers include jobs and compensation for the work. Since repositories tend to be sited in rural areas, salaries tend to be the highest paying in the area. Monitoring for radioactivity is extensive in the workplace and limits of radiation exposure rigidly enforced. Hence the probability of unknown radiation exposure is quite low. The disadvantages to workers include potential radiation exposure. And workers are laid off at the conclusion of the project.

Local Population

It is necessary to differentiate between radiation workers, who are adults paid to assume a voluntary risk for 40 hours/week and the local population, of all ages, involuntarily exposed to a risk 168 hours/ week. As a consequence, some compensatory mechanism should be put in place. This could include funding for improved education of the children, a college, or creating a major tourist attraction. If a site were selected near Carlsbad, NM, the railroad that parallels the river could be relocated and a river walk with shops and restaurants could be established similar to the Riverwalk in San Antonio, Texas. This would be a permanent benefit to the community. If a new repository was to cost the same as the Yucca Mountain project, $100B, a fair distribution might have ¼ or $25 Billion spent locally. Another fourth could be spent in the host state.

Population along routes

It is obviously necessary to transport the spent fuel from the point of origin and/or processing to the site of a repository. Whether by rail or truck, this entails potential radiation exposure to both the transportation workers and people along the right of way. If by rail, better explanations need to be provided why it has been more advantageous to ship all the TRU waste to WIPP by truck although rail shipments are cheaper [5] and all the HLW is slated to be shipped by rail.

Routine radiation exposures from transportation are low. However, better communication of the analyses of accident consequences is needed. Costs of addressing (and hopefully allaying) political and social concerns need to be calculated since there is considerable apprehension in some quarters of the specter of trucks bearing hazardous radioactive materials traversing Main Street despite the fact there are plans to bypass urban areas.

Future Populations

One unique aspect to the disposal of HLW is the length of time to predict the potential radiation dose from both man-made and naturally occurring intrusions. Standards require predictions of radionuclide behavior up to a million years. [6] The calculation of a dose from Inhalation requires estimates of exhumation and subsequent resuspension of particulates less than 10 microns in size. As an indication of the difficulty, actual measurements of resuspended particulates from uranium mill tailing piles vary by 3 orders of magnitude with model predictions over a few decades [7]. Over 100,000 decades, it becomes meaningless to predict inhalation exposure.

For doses from ingestion of food, the radionuclide intake is the product of the concentration of a radionuclide in a food and the amounts of different foods comprising the diet in the long term future. Assigning values to either to calculate potential radiation doses is of questionable value to defend either technically or in a court of law.

In addition, ice ages have occurred at 50,000 year intervals. Over one million years, there could be 20 ice ages. Predicting the behavior of these radionuclides over such geological disruption is of limited value. The standards must be revisited to be more realistic and achievable.

National

The benefits of a solution to the disposal of radioactive waste help to facilitate the future increased generation of electricity by power reactors, essential to the well-being of the nation.

This also helps to reduce our dependence on foreign oil. The disposal of HLW, generated thru the nation's defense programs, also provides greater predictability by eliminating the costs of indefinite storage. Note that the disposal of defense high level waste aids the nuclear deterrent for national security. Additional factors include the elimination of multiple storage facilities, provision of jobs and contracts in the state where the repository would be located as well as resolving federal government responsibilities. Disadvantages include the substantial financial penalty already caused by the failure of the federal government to take title to spent fuel, the potential radiation risk, the negative sociological impact of locating the facility in a state as well as the positive ones, costs to the general public and political impacts that can reverse any technical regulatory decision. These factors all bear on the public acceptability of such a facility.

Medical diagnostic radiation exposure to the US population has astonishingly increased by a factor of 7.3 over the past 2 decades and is now 899,000 person–Sieverts [8]. Note that the relative risk of exposure from nuclear power is estimated to be 110 person-Sieverts [8]. This clearly suggests that efforts to reduce radiation exposure to the US public need to be directed to the medical community.

The chronic delays in resolving the disposal of HLW also suggest revisiting reprocessing of spent fuel to obviate the need for a disposal facility [9]. Estimates of the costs and effort to do this are essential but might be less than the $97 Billion costs for the abandoned Yucca Mountain Project in Nevada. However a smaller repository would still be needed.

It is assumed that a new HLW repository might be 20% higher or $120 Billion. If necessary to develop new disposal standards, the process could add 10 more years with a substantial increase in costs.

Ratepayers for electricity at commercial nuclear power have paid $22 Billion to the Nuclear Waste Fund [10]. While $10 Billion has been spent to date at the now abandoned Yucca Mountain Project site, additional revenues will continue to be generated by the consumers of electricity.

<u>Social issues</u>

The following examples of perceived risks by the public help to illustrate the complexity of determining acceptability of developing additional sources of energy due to increased future needs.

- Proposed wind farms to generate electricity have aesthetic opposition on the basis they mar views of the landscape but windmills are major tourist attractions in Holland.
- Storage of HLW at a planned Monitored Retrievable Storage site in Tennessee had substantial opposition in comparison to building reactors within the state despite the fact that the relative risks are much greater for reactors.

- The problem has been recognized by the creation of a Presidential Blue Ribbon Commission in 2009 to address America's Nuclear Future. (11)

CONCLUSIONS

- It is vital to identify both the benefits (advantages) as well as the risks (disadvantages) of High Level Waste disposal.
- It is not possible to quantify all benefits and all risks in similar units but essential to inventory both for the various populations involved.
- The populations exposed to the risks are not always the ones receiving the benefits.
- Some compensatory mechanism should be established for the local population who will also be the stewards if the radioactive materials are returned to the biosphere in the long term future.
- The absence of demonstrated progress for a HLW repository raises the threshold of public support for nuclear power.
- We must limit the substantial financial penalty caused by the failure of DOE to take title to existing stored spent fuel by rapidly embarking on a program for a HLW repository.

Every day each of us has to make decisions with imperfect information of the relative benefits versus the risks of a proposed endeavor—whether to buy a new car or keep the old one and whether to approve a new industry for our community. And we make those decisions.

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