THE ROLE OF WEAPONS PRODUCTION AND MILITARY WASTE IN THE REPOSITORY SELECTION PROCESS

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ABSTRACT

The decision to commingle defense waste with commercial waste in the nuclear waste repository program has many impacts on that program. There will be more waste to place in the two repositories authorized under the Nuclear Waste Policy Act, more transport miles to get the waste to a repository, and more costs associated with environmental and socio-economic impact mitigation. The scale of these impacts is not clear: How much military waste is there? How much should be transferred to a repository? How much military waste will be produced in the future? What will be the military share of total disposal costs?

This paper explores the links between weapons production and military waste, and the repository selection process. The paper first describes the importance of state, tribe and public participation to the acceptance of a repository site selection. The paper then examines the various estimates of amounts of existing and future military nuclear wastes, and how these estimates affect repository siting decisions. The final section of the paper addresses the public policy questions which surround this issue. Repository siting may be jeopardized unless there is open public discussion about existing radioactive contamination at military production sites and about future nuclear weapons production. Cost-sharing is considered within this context.

INTRODUCTION

The 1982 Nuclear Waste Policy Act (NWPA) (1) included many provisions to increase public acceptability of geologic repositories for high-level radioactive waste. Public information and participation are highlighted. The public has a right to know the nature and hazard of the wastes to be transported to and disposed of in geologic repositories. Because of the commingling decision by the President in April of 1985, this includes military high-level wastes.

This paper attempts to address how much defense high-level waste there is, and how much more will be produced before 2020, when the first repository is expected to be filled. The answers to these questions have implications for the costs of the repository program and the need for a second repository. The usable area of any of the proposed sites may simply not be large enough to hold all the canisters needed, in spite of a claim by Battelle, issued twelve days before the Secretary of Energy suspended the search for a second repository (2). This Battelle report contradicts the geologic evidence, which points to the likelihood of size limitations at each of the recommended sites. This point is discussed further below in relation to the military waste share of the costs of a repository.

THE COMMINGLING DECISION AND PUBLIC ACCEPTANCE OF THE REPOSITORIES

The decision to commingle military and commercial high-level waste was made by the President on April 30, 1985. Commingling of military wastes with spent fuel from utilities means that the production and management of military wastes directly affects repository siting and development. Actions by USDOE repeatedly confirm the impression that the USDOE is operating its military waste program separately from its Office of Civil Radioactive Waste Management (OCRWM).

For example, the Draft Environmental Impact Statement (DEIS) (3) for disposal of Hanford defense wastes includes the option of sending high-level waste stored in old single-shell tanks to a geologic repository. Including this material increases the number of military waste canisters from 16,500 to 37,500 (4). However, figures used by the civilian program ignore the single-shell tank wastes.

The amount of high-level military waste directly affects the repositories.

1. Under the NWPA, the first repository is limited to 70,000 metric tons of heavy metal (MTHM) until the second repository is constructed. The number of military metric ton equivalents to be disposed affects the need for, timing, and size of a second repository.

2. Defense high-level waste is not measured in metric tons of heavy metal, as is commercial spent fuel, because it has been reprocessed. The definition of metric tons equivalency for military waste will determine the proportion of military waste included in the statutory 70,000 MTHM limit.

3. The number of military canisters and the radiologic and chemical characteristics of these wastes will affect the repository size and design, and in turn determine whether prospective host rock bodies are adequate.

4. Military waste will be vitrified and packaged by USDOE, but its amount and form will affect surface facilities, storage and handling, and transportation impacts.

5. Cost allocation between the commercial power ratepayers and the federal government depends on the quantities of military wastes, and how piece count and cost share are measured. Utilities believe their ratepayers should not subsidize military waste disposal.

The nature, amount and location of military wastes are critical to assessing impacts, adequacy of repository sites, and equity in cost of development. These are key areas for public understanding and input if we are to accurately determine the need for a second or subsequent repository and achieve public acceptance of any repository sites.

HOW MUCH MILITARY WASTE IS THERE?

No one, including the U.S. Department of Energy, really knows the answer to this question. Military high-level wastes exist in a variety of places and forms, and records on the early wastes are not complete. Some older wastes are not fully characterized, and all military wastes will need further processing before final disposal. The technologies for vitrification of liquid high-level wastes are still being worked out.

The most controversial of the military wastes are contained in obsolete, leaky single-shell tanks on the Hanford Nuclear Reservation. The single-shell tank wastes are not included in the 16,000 canisters that USDOE estimates will need to go to geologic disposal, even though they are clearly high-level waste according to the Nuclear Waste Policy Act. Although the Hanford defense waste DEIS supposedly leaves the option of geologic disposal open, the reference case would stabilize single-shell tank wastes in place.

These wastes are chemically reactive mixtures of acids, bases, solvents and other organic substances, intensely radioactive fission products, and transuranics, accumulated in the tanks since the 1940's. Over the years wastes have been mixed from one tank to the other and reprocessed to remove some radioactivity and liquids, especially after the leaks were discovered. Records are incomplete and the waste in the tanks is poorly characterized.

Perhaps the quantity of single-shell tank wastes does not matter to the USDOE, since their apparent preference is to stabilize the single-shell tanks in place, saving the costs and risks of removing the wastes to geologic disposal. However, this option may not be legal under the NWPA. These are high-level wastes, by source and definition, and the State of Washington is concerned that they be disposed of appropriately. Surface disposal may not be adequate. Therefore, the nature and quantity of Hanford single-shell tank waste does matter to the state of Washington and to the states which might host a first or second repository.

HOW MUCH RADIOACTIVITY IS IN MILITARY WASTES?

The total amount of radioactivity in all the defense wastes is uncertain, and, of course, changes from year to year as new wastes are produced, and as short-lived isotopes in the old wastes decay into stable elements.

USDOE estimates of the quantity of Hanford high-level wastes are particularly variable. The Hanford defense waste DEIS of March, 1986, reported that as of 1995 Hanford high level wastes would total 150 million curies (MCi): (5)

single-shell tanks	50 MCi
double-shell tanks	20 MCi
strontium & cesium capsules	80 MCi

A December 1986 report more than doubles these estimates to give a total by the year 2000 of 420 million curies: (6)

single-shell tanks	110 MCi
double-shell tanks	170 MCi
strontium & cesium capsules	140 MCi

Most of the discrepancy results from the neglect in the DEIS of the short-lived daughters of strontium-90 (yttrium-90) and cesium-137 (barium-137) (7).

The new (December 1986) estimated totals for all military high level wastes as of 2020 are shown in Table I.

TABLE I

USDOE Estimates of High-Level Military Waste in 2020 (8)

	canisters	MTHM equiv. (9)	MCi
1940's to 2000:			
Hanford			
single-shell tanks	(21,500)	(<1,000)[10]	(70)
Cs & Sr capsules	(500)		(90)
double-shell tanks	1,500	750	100
Savannah River	7,000	3,500	1,100
1953 to 2020:			
Idaho			
assume volume reduction	6,000	3,000	640
without volume reduction	(22,000)	(3,000)	(640)
2000 to 2020:			
Future production assumes 2 reactors	1,500	750	350
TOTAL BASE CASE	16,000	8,000	2,190
TOTAL MAXIMUM CASE	54,000	9,000	2,350

Note: The figures in parentheses are those excluded from USDOE's reference case. They show the range of probable volumes of waste.

HOW MUCH VOLUME WILL MILITARY WASTE TAKE UP IN THE REPOSITORY?

By 2020, USDOE estimates there will be 16,000 canisters of military waste to be disposed of in a repository--if the Hanford single-shell tank wastes are excluded (11). This "base case" figure of 16,000 canisters also assumes that the wastes now at Idaho National Engineering Laboratory (INEL) can be reduced in volume. If they cannot be, twice as many canisters (32,000) will be needed. Adding the Hanford single-shell tank wastes and strontium and cesium capsules would give a total of 54,000 canisters of military waste. This compares with approximately 60,000 canisters of commercial spent fuel.

54,000 canisters of military waste would greatly expand the volume requirement for the repository, as well as its cost. It would also increase the possibility that a given rock body will be too small to contain both military and commercial high-level wastes.

MILITARY WASTE IS MEASURED IN METRIC TON "EQUIVALENTS"

According to the NWPA, the first repository is limited to 70,000 metric tons of heavy metal, or the amount of solidified high-level waste resulting from the reprocessing of such a quantity (70,000 metric tons) of spent fuel. There is a small amount of high-level waste at West Valley from the reprocessing of commercial spent fuel.

However, the NWPA does not provide a way to measure military wastes, which have also been reprocessed to remove the radioactive uranium and plutonium which spent fuel still contains. Instead, USDOE compares the radioactivity of canisters of spent fuel and reprocessed military wastes.

All calculations assume wastes ten years out of the reactor. USDOE calculates the average radioactivity of commercial PWR spent fuel to be 390,000 curies per MTHM (12). Since they estimate the radioactivity of an average canister of military waste will be one-half this amount, they assume one canister of military waste will contain the equivalent of one-half of a metric ton (0.5 MTHM Eq., or 0.5 eMTHM) of commercial spent fuel. This metric ton equivalent is not, therefore, a measure of weight, but of assumed radioactivity. In other words, 8,000 "MTHM equivalents" of military waste is 3.12 billion curies (390,000 curies x 8,000 MTHM) ten years out of the reactor. (This number can be compared with the estimated 2020 total of 2.19 billion curies.)

WHO PAYS HOW MUCH?

USDOE has published a notice of inquiry (13) delineating three possible methods of calculating the military waste share of geologic disposal. In this notice, USDOE makes the usual assumption of 16,000 canisters of military waste by 2020. This ignores the single-shell tanks at Hanford, as well as assuming volume reduction of the Idaho wastes. Neither assumption makes for sound public policy, given the importance and controversy of the repository program.

USDOE proposes to calculate its share of the costs in three ways: (1) "areal dispersion," which is the share of the repository area taken up by military wastes; (2) by share of canisters processed--handling of commercial canisters and military canisters will differ; and (3) by a "piece count," the actual number of canisters stored in the repository. Military canisters are assumed to be less radioactive and less thermally hot than spent fuel canisters, and can be packed a little more closely together. However, they cannot be placed too close together without compromising the structural integrity of the host rock. Therefore, the total number of canisters is significant in determining the rock volume that will be needed.

How much space will be available in the rock? In May, 1986, Battelle issued a draft report, "Considerations Bearing on the Timing for a Second Geologic Repository." (14) This report bypassed the normal USDOE review process. It was used by decision makers, but states and tribes did not have an opportunity to review it, contrary to Section 117 of the NWPA.

The report claimed that "there are no obvious size limitations based on what is known at this time regarding the Cohassett basalt flow formation selected for the [Hanford] repository." There is no technical support for this statement. Battelle ignores the internal variation typical of large basalt flows, including variations in flow thickness, gas bubble zones, tectonic faults, and other joints and fractures which provide pathways for groundwater. It is extremely unlikely that a Hanford repository would not be limited by such features. For different reasons, rock body capacity may also be limited in tuff and salt.

Even if the repository can be expanded, expansion beyond a certain size may greatly increase costs, especially at Hanford, where vertical expansion is limited by the thickness of the basalt flow. If further mining costs are incurred because of the quantities of military waste to be disposed of, the Nuclear Waste Fund would be subsidizing the USDOE military programs.

HOW MUCH PLUTONIUM DO WE NEED?

Past military production has resulted in an estimated 100 metric tons of plutonium (15) in U.S. stockpiles. Current production of plutonium for bombs is estimated at 2 metric tons per year, (16) or approximately 66 metric tons to be produced in the next 33 years. USDOE also produces tritium for hydrogen bombs.

Comparison of past military waste with the future estimates shows that nearly 60% (9,400 canisters) of the total will be produced between now and 2020, compared with 40% (6,600) from the 1940's to 1986 However, these numbers result from a very low estimate for future production. USDOE estimates of future waste assume only two military reactors will be operating from 2000 to 2020, less than half current production by the N reactor at Hanford and 4 reactors at Savannah River. If production after 2000 were to match current production, there would be at least 1500 more canisters of military waste.

Although the U.S. already has enough plutonium for 26,000 nuclear warheads, there have been reports of plans to vastly increase U.S. production of plutonium to fuel new weapon systems (18). This could lead to a future request by USDOE to build new reactors which would substantially increase military wastes. If future production of plutonium were to double the current rate, this would have a very significant impact on total amounts of military waste and costs of disposal.

PUBLIC POLICY QUESTIONS

The repository program in the Nuclear Waste Policy Act was the result of years of study and negotiation among many groups. It was deemed an acceptable way--by most of the people involved--to deal with a pressing problem: the build-up of nuclear wastes. Many of the same people were apprehensive that permanent disposal of military wastes would not be handled on a par with commercial spent fuel. For them the commingling decision appeared promising.

However, there are some outstanding problems in the way the NWPA has been implemented for military wastes. First, it appears that the Department of Energy has been less than forthcoming about how much military waste there is and will be. It is not even clear that left and right hands within the department have hold of the same projections.

Second, current activities do not adequately address the need for disposal capacity for military wastes, and the consequent ability of the repository program to deal with commercial spent fuel in a timely manner.

If these two problems aren't addressed forthrightly, the whole repository program will be jeopardized.

USDOE's problem with disclosing complete and relevant information is compounded by its low credibility. In dealing with risky and controversial matters, a government agency's credibility is a key element. It is not likely to be high; but USDOE's is worse than most. People will not listen, respond or participate in the program unless the agency goes to extraordinary lengths to demonstrate its openness, objectivity, and receptiveness to "news" that may seem contrary to its own position.

USDOE must display such openness about existing military wastes, what's planned for the future, and how these volumes affect size, suitability of repository sites, and ability to accept commercial spent fuel. Persistent inattention to and misrepresentation of the Hanford single shell wastes and the claim of "unlimited" repository size are just two examples of how not to win public confidence.

If people are not convinced that both commercial and military waste problems are being dealt with, they will increasingly challenge both development of nuclear power and continued production of fissile materials.

The question of cost-sharing for a commingled repository system must be closely examined. If both the immediacy and the volume of military wastes have been underestimated, then one should ask whether the department's preferred solution--piece-count plus areal extent--is most appropriate. It may do fairly well if revised very frequently, as military waste's share of repository needs increases. But it may also always be running behind--leaving civilian power customers to "front" the costs resulting from 40-plus years of sweeping waste problems under the rug (almost literally) and/or any build-up in production of fissile materials.

At least the avoided cost method would focus departmental, congressional and public attention on the full extent of permanent disposal needed for military wastes. In order to determine whether the cost allocation is fair at the outset, one would want pretty accurate figures about the capacity and operating requirements of a separate repository for military wastes. Avoided cost may also be more adequate in dealing with such a heterogeneous collection of wastes, which are somehow averaged together in the preferred formula.

Volumes of military wastes may be considerably greater than USDOE's civilian waste program office admits. Even if one accepts that these wastes are less radioactive and thermally hot, the increased volume makes it likely that either the 70,000 MTHM statutory limit or the physical capacity of a host rock body will be exceeded at an early date. This is particularly true if there are continuing revelations of immediate hazards from military wastes present at Hanford, Savannah River, and other sites around the country. The relative urgency of disposing of these wastes, if recognized by the public and Congress, may tend to shift the balance from civilian to military waste disposal unless adequate capacity for both is developed.

Put bluntly, the second repository issue hasn't gone away. The need may well be there sooner than the Department acknowledges. Continued or increased military production of fissile materials will hasten the need. Increasing public awareness of and concern about existing contamination, not just at Hanford, but in states as far flung as South Carolina, Ohio, Idaho and Nevada, will also increase the pressure for early retrieval, stabilization and permanent disposal of more canisters of military waste than OCRWM acknowledges.

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7. Melvin W. Shupe, Manager, Defense High-Level Waste Technology Program, USDOE Richland Operations Office, Letter received February 4, 1987, to Jane Hope, Washington State Institute for Public Policy, Olympia, WA.

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18. Senator Dan Evans on October 28, 1986, reported that the U.S. Department of Energy and Department of Defense in "two extremely classified briefings" had informed him that nuclear warheads are increasingly being made with plutonium rather than uranium. They are also using detonators which require more plutonium per unit yield. Evans said he could not divulge how much more plutonium was necessary, but the amount increases by multiples of the current amounts. Dave Hoover, "Bomb Change to Alter Need for Plutonium," The Tri-City Herald, Tri-Cities, Washington (October 28, 1986).