

THE MRS IN OAK RIDGE

HERBERT INHABER

Risk Concepts Inc., P.O. Box 1231, Oak Ridge, TN 37831 (U.S.A.)

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Summary

The storage, either temporary or permanent, of high-level nuclear wastes in the form of spent fuel from reactors has been a source of controversy for decades. When Congress passed the National Waste Policy Act of 1982, it thought it was finally solving the problem. This turned out to be a mirage. One of the most unusual aspects of the arguments which have raged since 1982 has been Monitored Retrievable Storage (MRS). Originally only a little-known provision of the NWPA, it became a major issue in Tennessee. One town, Oak Ridge, was the first community in the United States to vote officially to accept high-level wastes under any conditions. This paper outlines some of the debates and the considerations going into this decision, from a social viewpoint.

Introduction

The rest of the papers in this issue deal with the legal and regulatory aspects of hazardous wastes. These studies are valuable. But unless they take account of the social conditions producing laws and regulations, the latter will appear to be produced in a vacuum. The history of hazardous waste regulation in the U.S. and other countries is the story of social pressure, sometimes wisely applied and sometimes not, on legislators and regulators.

This paper will be somewhat different from the others in this issue, in that it takes a more impressionistic view of the high-level nuclear waste (HLW) debate. The fact stressed is the strong approval given to the temporary storage of these wastes in Oak Ridge, Tennessee. The evidence is a unanimous vote of the Oak Ridge City Council and the Roane County Commission, in October 1985, to accept these wastes, albeit with stringent conditions. To my knowledge, this is the first time that any governmental body or bodies in the U.S. has agreed to accept HLW under any circumstances. The rest of this paper will explore some aspects of this decision – which may never be carried out due to factors beyond the control of Oak Ridge and Roane County – as well as giving some background on the subject.

An analogy with low-level nuclear wastes

In principle, the question of what to do about HLW in the United States was resolved in 1982, when Congress passed the Nuclear Waste Policy Act (NWPA). The Department of Energy was required to choose three potential sites for the first final repository, narrow them down on geologic and other criteria, and open the chosen site for business in 1998. This brief description condenses an act of sixty-three pages with scores of requirements, including a tax of a tenth of a cent on all nuclear-generated electricity to pay for the design, construction and operation of the repository. Included at the eleventh hour was a little-noticed provision requiring the Department of Energy to study the possibility of a Monitored Retrievable Storage (MRS) facility. This would be a temporary facility for repackaging of the spent fuel rods and a place for storing them until the final repository was ready. Congress merely specified a study of the MRS, but did not require it to be built. This obscure aspect of a complicated law was later to become one of its first major tests and successes.

Many laws passed by Congress are carried out, but others are not for various reasons. The optimism which suffused Congress in 1982 would have been tempered if its leaders could have foreseen what would happen to the law on low level wastes (LLW) passed in 1980. As Thomas Connolly has written, the problem of these wastes is "technically modest, if not downright trivial".

Yet the LLW law, by any description, has to be judged a failure. It produced so few results that it had to be substantially modified in December, 1985.

Jon Payne, editor of *Nuclear News*, gives a succinct outline in May 1986 [1] of how this came to pass. While the present paper deals with HLW, the analogy with LLW is strong.

In 1980, there were three LLW sites in the U.S. - Barnwell, SC, Richland, WA, and Beatty, NV. By 1985, all states were to establish their own sites either by themselves or in cooperation with other states by means of interstate compacts.

But, "not only were there no new sites in operation at the end of 1985, but none were even under consideration, and, worse, not one site had been chosen". Payne said that "the Southeast Compact (is) taking both an enlightened and determined approach" in contrast to other groups of states. In the ranking that this compact agreed to, North Carolina and Alabama headed the list. In the days between the time Payne wrote his editorial and it appeared in print, a North Carolina state legislator said that his state would probably withdraw from the compact, and the governor of Alabama, George Wallace, said that he would never allow his state to be a repository for LLW. So much for the shining light of the state compacts.

Much the same has happened with respect to HLW. The lead time for the opening of a repository was 16 years, surely one of the longest such times that Congress has ever specified for a project. Yet most observers doubt that the

deadline can be met. In the meantime, the spent fuel rods are being stored at reactor sites. James Tomonto [2] has stated that to date, utilities have deposited \$2.2 billion in the Nuclear Waste Fund, based on the tax noted above. So far they have nothing concrete to show for it.

Oak Ridge attitudes towards the MRS

Thomas Connolly characterized one aspect of the debate over LLW by saying that "state officials are acting as if they had been asked to store tons of active bubonic plague bacilli". Another analogy, perhaps more up to date, might be used here.

Imagine a train, pulling out of the communities in the country where AIDS (Acquired Immune Deficiency Syndrome) victims reside. Because of the extreme fear that many of this disease, all those who have contracted it have been bundled aboard. Now the train is circling the nation, looking for a place to discharge its pain-wracked passengers.

"Keep moving," ring the cries, "there must be a better place. Maybe in that city across the state, or on the Coast. Anywhere but here".

Such a train never started from the station, and never will. Yet the situation of HLW is similar. For years, if not decades, the irradiated fuel rods have been hypothetically wandering, asking for room at the inn. It's always been full.

But now space has finally opened up. Not the presidential suite by any means, but at least a cot in the lobby.

The place? Oak Ridge, Tennessee, self-proclaimed "Energy Capital of the World". With a population of 28,000, it lies about 20 miles from Knoxville in the Appalachians. The evidence is a unanimous vote of the Oak Ridge City Council and the Roane County Commission, approving storage of the these wastes in their communities. The proposed site will be within Oak Ridge, but on land in Roane County. Most of Oak Ridge lies in Anderson County.

Further evidence? An extensive poll of Oak Ridge residents, who indicated by 64% to 18% - the rest were either undecided or didn't know - that they would favor such a site in their area. If any community would do as well for wandering AIDS victims, they have yet to be heard from.

It is true that the acceptance was hedged in with many conditions, ranging from finances to environmental monitoring. Yet the fact that the acceptance was given under any circumstances is unusual.

The matter is far from settled. At the time of writing, a number of road-blocks, some of which are described elsewhere in this paper, had been erected. Yet the Oak Ridge example should not be forgotten, especially in view of the hostility expressed by almost all communities suggested as HLW or LLW sites.

The tentative acceptance was not solely due to the goodness of Oak Ridgers' hearts. The storage site, according to Rep. Edward Markey, chairman of a House subcommittee on energy, would cost about \$1 billion [3]. This would

be one of the largest investments in East Tennessee in years, and the largest in Oak Ridge since its uranium-processing facilities were built in World War II. The total investment would be about one-quarter that of the General Motors Saturn plant, to be built in Middle Tennessee.

The city fathers made one of their major conditions that the facility be taxed as a private investment, although it will be presumably owned by the Department of Energy. Oak Ridge has engaged for years in a legal dispute over taxation of other DOE plants, owned by the government but operated by private contractors. The city does not want that situation to continue with the MRS. Since the NWPA apparently provided for the facilities built under its aegis to be taxed, this requirement does not pose a legal problem.

The number of jobs associated with the storage facility will not be great. Early estimates were about 700 to 800 permanent employees [3]. Still, in an economically depressed area, where one of the largest employers, the Oak Ridge Gaseous Diffusion Plant, is placed in mothballs, any paycheck counts. The wandering fuel rods will be taken in, but they have to pay the price of admission.

The proposed Oak Ridge site will not be permanent, but supposedly temporary. However, the three candidate sites for a permanent repository, one each in Texas, Washington and Nevada, have become embroiled in legal disputes. The governors of each state have taken the Federal government to court on various interpretations of the NWPA. Manning Muntzing has noted that by March 1986, 16 cases had already been filed in the federal courts, "and certainly more will follow" [2].

John Graham, writing for the American Nuclear Society, described an October 1985 Congressional hearing [4]:

"Almost all witnesses faulted DOE's dogged determination that it must start receiving spent fuel (in the final waste repository) by the year 1998. They note that the Department continues to fall behind in all its schedules, yet it argues resolutely that it will meet the ultimate deadline".

If this is true, the MRS will be *the* waste site for some years or at least until a machete can be found to hack through the legal thickets surrounding the final site.

Rusche and the MRS

Director of the Office of Civilian Radioactive Waste Management (OCRWM), Ben Rusche has had more to say about the MRS than practically any other Federal official. Before the three potential sites for an MRS were announced in April 1985, Rusche talked about its nature [5]:

"This is one of the concerns ... that I have in the deep recesses of my mind the conviction that a (permanent) repository will never operate and MRS is the long-term solution for handling waste in this country. This is an absolute non-truth. I have never thought of the MRS facility as an option, or an alternative to a repository..."

Over the course of the next year, Rusche would be subjected to continual questioning of his motives and that of DOE. This subject will be discussed in more detail below. But regardless of what the motives of any of the actors are, does the MRS proposal advance the solution of HLW disposition in this country? This question was never really answered in the ensuing debate, because from the start contending parties could not agree on what was meant by a "solution". It is not clear if this consensus will ever be reached.

The nuclear industry and HLW

There is a major reason why comparatively little progress has been made in storing or disposing of HLW, in addition to fears of the public. The reason is peculiar to the nuclear industry, and may not be appreciated by those outside of it.

For many years, the industry favored reprocessing, or removing the plutonium from the spent fuel rods. In turn, the plutonium would have been used in breeder reactors, of which the cancelled Clinch River Breeder was the last attempt to date in this nation. It is almost forgotten, but the first U.S. reactor to produce electricity was not the pressurized or boiling water versions of which about 100 are in operation here, but a small breeder, the EBR-1. Why bury spent fuel rods thousands of feet underground when valuable plutonium could be extracted first?

The viability of breeders economically depends to a large extent on the price of uranium fuel. If the latter is low, indicating large uranium reserves, there will be less emphasis on breeders, all other factors remaining equal. If there is little effort to build breeders, there will be little incentive to reprocess the plutonium in the HLW, at least from a civilian viewpoint. Yet many in the nuclear industry do not want the rods buried permanently until the plutonium can be extracted.

The industry was mollified somewhat by the NWPA provision that the final waste repository is not to be sealed for 50 years. That is, if and when the repository operates, the HLW, in casks or other devices, will be placed underground. But the final sealing, making it more difficult to retrieve the HLW, will not take place for five decades, according to present law. This would allow present anti-breeder opinions and economics to change. It is not clear if the 50 years refers to time from when the first or last of the HLW is deposited. If the span between the first and last shipment is short, this point will make little difference. If there is a span of a decade, say, between the first and last shipment, we may hear more arguments about the 50-year period. In any case, it is probably true that most of the public believes that the repository will be sealed off shortly after the last HLW is deposited. This is not the case.

Even if the climate were favorable to breeders, there would still be HLW left

over after reprocessing. Whether or not they would be more toxic or radioactive as spent fuel rods depends on many factors, such as the type of reprocessing, and is still a matter of debate. As a first approximation, it would be fair to assume that post-reprocessing HLW would cause as much concern in the public as do spent fuel rods, regardless of whether the toxic or radioactive balance were slightly on one side or the other. So reprocessing would push back the data of opening of a final repository, but not eliminate the need for one.

In general, the position of the industry might be summarized as follows: one of the biggest single-industry taxes in the nation's history has been levied on us. For this money, we expect to see a repository, either final or temporary, according to the schedules of the NWPA. Whether or not reprocessing eventually takes place should not affect the schedule, because of the five-decade span before final sealing.

Reasons for Oak Ridge acceptance

Why did Oak Ridge decide to accept the MRS when the mention of it was enough to set other communities running in the opposite direction? According to one report issued before the Department of Energy listed its final three candidates for an MRS, sites in Alabama, North and South Carolina, Kentucky and Mississippi were being considered in addition to Tennessee. However, when the final choices were made, only Tennessee appeared on the list. Whether this was due to political influence on the part of the states that were deleted or merely an incorrect report in the first place is unknown [6]. However, it is fair to say that no state volunteered to be on the list.

When the Department of Energy announced on April 25, 1985 that Oak Ridge would have two of the three potential MRS sites (the other was at Hartsville, Tennessee), the City Council and Roane County Commission appointed three task forces to consider different aspects of the proposal.

By itself, this procedure was hardly out of the ordinary. City councils everywhere set up groups to study various matters. But most rush to judgement without the time or funding to study the matter before them in detail.

Not so in the case of Oak Ridge. The Federal government provided enough funds for the three task forces to travel across the state and country, engage consultants, and find the facts for themselves. When it came down to the City Council endorsement on October 21, 1985, it was one of the task force members – Ray Garrett, a physicist with Oak Ridge National Laboratory – who provided the crucial phrase that produced a unanimous vote. The task forces had originally proposed that the city “welcome” the MRS, but the Council balked at perhaps too much friendliness. Garrett said [7], “we honestly felt that the world ‘welcome’ overstated (the task forces’) position”. After further discussion, the Council said they “would willingly accept” the MRS, a more neutral phase.

Characteristics of Oak Ridge

The city is nuclear oriented, and probably more sophisticated scientifically than all except a handful of cities in the nation, if not the world. Built from the ground up during World War II, it supplied the key material, uranium-235, that went into the Hiroshima bomb. Since then, it has produced much of the nuclear fuel in U.S. and foreign reactors, bomb parts in its Y-12 plant, and led the way in atomic research.

Outsiders might expect that all Oak Ridgers are highly educated. It is true that the latest count has 1,500 Ph.D.'s working in town [8]. However, this is far from a majority of a population of 28,000, and many of the doctorates live outside city limits. A quick check of the City Council membership revealed no Ph.D.'s. The Roane County Commission, representing a mostly rural and poverty-stricken county, has even less scientific representation. Trying to get these two bodies to agree unanimously on anything beyond the most innocuous resolution is extremely difficult.

So the fact that the Oak Ridge and Roane County governing bodies made their task forces look into the HLW question in much more detail than is usually done, and then voted without exception to "willingly accept" the HLW deserves note. That their judgment was confirmed by a ratio of almost four to one in a poll soon afterwards [7] is perhaps more remarkable.

There are, of course, other characteristics of Oak Ridge and Roane County that might be considered. For example, the economic level, rate of attraction of new industry, and other similar attributes come to mind.

One of the problems in discussing these aspects is the fact that Oak Ridge is substantially different from Roane County, yet the two were yoked together in terms of MRS approval. For example, Oak Ridge is much more affluent and industrialized than Roane County. Any conclusions drawn on the basis of economic level, industrialization and other economic measures might be applicable to one, but not the other.

Both political entities have, from time to time, expressed the need for more jobs. However, this hardly makes them different from most other political jurisdictions in the nation. Indeed, one would be hard pressed to find a county, city or town whose leaders hadn't stated a similar desire. Admittedly, few of them have considered it in terms of a high-level nuclear waste facility.

One way of determining the motivation for accepting (or rejecting) the MRS would be to subdivide the local population by education, economic status, knowledge of the nuclear industry, or other characteristics. The polls that were taken apparently did not do this. As a result, the claim of the nuclear industry, that approval rates for nuclear power in general and for acceptance of waste sites in particular would rise with educational level and knowledge of nuclear matters, remains unverified. On a macro-scale, the fact that Oak Ridge and its environs, both knowledgeable about things nuclear, approved the MRS, gives

some credence to the industry's claim. On a micro-scale, the question is unresolved.

State opposition

Since October 1985, the rest of the state has come out in fairly uniform opposition to the MRS in Oak Ridge. Some of the characteristics of that opposition will be discussed in detail below.

Perhaps the most significant step so far has been the court action on the part of the state. It has sued the Department of Energy, stating that it had not been adequately consulted, as provided for in the NWPA. The DOE has countered by saying, in effect, that since the MRS is not the final repository, the consultation procedures outlined for the latter in the NWPA do not have to be followed. The merits of the complaint and response were not heard in the Sixth Circuit when the case was first brought. A federal judge issued an injunction in February 1986 forbidding DOE from taking Congressional steps, such as budget proposals, until such time as a full hearing was held. This hearing took place in the Sixth Circuit Federal Court of Appeals in July 1986, and at time of writing no decision had been rendered. The injunction remains in place. As a result, the entire MRS proposal is in abeyance until the decision is forthcoming, and the likely appeals by the losing side are exhausted.

The pattern of a community or communities being reasonably favorable to a waste site but the rest of the state being in opposition apparently has been repeated in at least one other state, Nevada. In the March 1986 Waste Management meeting in Tucson, Arizona, Robert Loux, director of Nevada's Nuclear Waste Project Office, "agreed with the assessment that local communities tend to be much more supportive of proposed repositories than are the people farther removed from the site area" [2].

Exactly why this should be so is not known. One reason may be that the communities with the proposed sites are selected carefully, sometimes partly on the basis of their scientific expertise. Of the four sites chosen for either a permanent or a temporary repository, two, Richland and Oak Ridge, have substantial scientific expertise. One, in Nevada, has little expertise but was the site of the largest U.S. above-ground nuclear weapons testing program. The last, in Deaf Smith Country, Texas, has little or no scientific expertise and was never used for weapons testing.

While certain cities may be regarded as scientifically sophisticated, there is apparently no entire state which so qualifies. As a result, merely choosing the site on the basis of the social make-up of a nearby community is inadequate. The state surrounding it has to be chosen as well. So far, the Federal government has been unable to develop criteria that would allow it to select a state favorable to HLW storage and burial.

Chronology of the MRS debate

The following is a brief chronology of the MRS debate and related matters, from March to October 1985. The subsequent section will outline some of the legal and regulatory questions that arose in the April–October 1985 period and later.

In a hearing in March 1985, the aforementioned Rep. Markey of Massachusetts was apparently the first to mention publicly the possibility of the old Clinch River Breeder site being the eventual MRS location [3]. Prior to that hearing, the site had been mooted at a presentation at the Atomic Industrial Forum [9]. At the AIF meeting, Nuclear Regulatory Commissioner James Asselstine raised some regulatory points with respect to MRS.

He was concerned that the MRS, according to a contention of the Department of Energy, would not have to go through the same rigorous licensing procedures as the permanent repository. He said, “I think a bit more formal approach is needed”, implying that DOE was trying some type of end run around the NRC. Asselstine predicted that once states are notified that they are candidates for MRS, they will request stringent licensing procedures for the facilities. In this Asselstine was incorrect. Rather than going the regulatory route, Tennessee preferred the political one, avoiding bureaucratic questions.

Returning to the Markey hearing, held shortly after Asselstine spoke, the Congressman said that whatever site for an MRS was chosen, it would be a “political powderkeg”. He went on to say to Ben Rusche, “If a permanent repository is delayed, the MRS might hold a lot of nuclear waste for a long, long time”. In so doing, he identified one of the key issues: how temporary is temporary? If the final repository is delayed or abandoned for political or other reasons – so far there have been no substantive scientific objections raised – will the MRS become the *de facto* final repository?

As noted in a previous section, Rusche and his department have said no in a thousand different variations. They clearly were not believed by all concerned.

Adding to DOE’s problems around the time that the three MRS sites were announced was a report from the congressional Office of Technology Assessment (OTA) [10]. Reviewing the entire DOE HLW plan in detail, the OTA said that, “MRS facilities will not be necessary for safe waste management unless major difficulties with geological disposal are encountered”. This seemed to pour cold water over DOE’s plans, since at the time OTA wrote no geological problems had been encountered. Rather, DOE’s problems have been in the legal and political realm. It had not progressed beyond these to the scientific aspects of geology.

OTA went on to say that DOE should evaluate three MRS alternatives: early construction, federal at-reactor storage starting in 1998, and deferring MRS until at least 1990, when DOE expects to recommend a site to Congress for the first permanent repository. OTA concluded by saying that “If a decision were

made in 1990 to construct an MRS facility, it could begin operation by 2001, DOE's current target date for operation of the first full-scale loading for the first (permanent) repository."

The second alternative, at-reactor storage, seems to be favored by at least some environmental groups. This aspect will be discussed below. It is not clear whether OTA meant repackaging at reactors by this suggestion. If so, DOE might object that this proposal would mean repackaging facilities at scores of reactors throughout the nation, which seems inefficient. If it does not mean repackaging, then the utilities might well question what they are getting for the tax which has been levied on them, other than continual delays.

A major issue in the debate was maps. This is somewhat unusual in policy differences, where geography rarely plays a significant part. In the entire debate over MRS, maps were one of the few scientific or semi-scientific points raised. The issue first surfaced on April 9, 1985 [11]. Ginger King, speaking for Rusche's office, said that "Knoxville, Tennessee (was used) as a center point (of) a circle with a radius of approximately 100 miles ... Knoxville was chosen as the middle point because it was determined to be in the center of the area in which much of the nation's commercial spent nuclear fuel is generated."

All this would be reasonable, if the facts are as represented. The MRS is planned as a site where the spent fuel would be compacted in concrete and steel containers, about 22 feet in height and weighing over 200 tonnes [12].

Since the overriding objective of the entire waste program is to reduce, in some sense, the radioactive risk to the public, the location of the MRS site plays a part in reducing that risk. It has to be reasonably close to some type of mathematical center of all present and planned reactors. The words "some type" are used advisedly here. There may be more than one center, depending on the weights assigned to different types of fuel rods in terms of their radiological hazards, as well as other factors. In addition, the center or centers will be time-dependent, as fuel rods are added at varying rates to each reactor's inventory. In spite of all these complications, it is likely that these centers are not far geographically from each other. However, the calculations do not seem to have been done as yet.

Geographers and those who choose industrial sites are familiar with the calculations. While the mathematical techniques vary, if one is chosen it will be scientifically defensible.

The question then is, did Knoxville, adjacent to Oak Ridge, lie at the center because of mathematical procedures, or were the calculations pre-determined because Oak Ridge has a large cadre of nuclear experts?

Albert Gore Jr., junior Tennessee senator, quickly seized on the map issue. He concluded that the Department of Energy was "misrepresenting the facts" [13]. Was it just a coincidence, he asked Rusche in a series of Congressional hearings and statements to the press, that Knoxville happened to be at the center of the map? Gore was helped somewhat by a cartoon in the Nashville

Tennessean showing a sad-sack government official pointing to a map of the nation [14]. It was distorted so that Tennessee appeared in the center, rather than the more logical Kansas. The official says, "Can we help it if your state happens to be in the exact nuclear center of the whole country?"

By late April, Rusche was contending [15] that Gore was arguing a "relatively irrelevant" point. He said that "the center of the circle is of relatively little importance. Any of the proposed sites within the circle have equal value". However, by the fall Rusche admitted that the mathematically best site to minimize the transportation risk would have been in Ohio, not Tennessee.

In retrospect, it might have been better from DOE's viewpoint not to have had a map of any description. Senator Gore, not a mathematician, did not need that training to see it was more than somewhat peculiar that Knoxville was at the center. DOE might have said, in effect, "There's a broad region extending from Ohio to Tennessee where the number of ton-miles of fuel rods to be shipped is about constant. Within that region, the greatest source of nuclear expertise is Oak Ridge. Therefore it makes sense to look there". With this degree of forthrightness, the hostile reaction of the state Congressional delegation might have been muted. Instead, the implication was given that the choice was mathematically fore-ordained.

The arguments over maps didn't end there, possibly because this was one aspect of the debate that members of the public who had little knowledge of radioactivity could understand. In late June, state newspapers [16] published a map, obtained from the Environmental Policy Institute (EPI) in Washington, showing potential routes of HLW into the state if the MRS were built. Since the map had been obtained under the Freedom of Information Act, newspapers implied that DOE had had something to hide.

What was this mysterious map? DOE merely connected the reactors that would send their wastes for repackaging at the MRS to the nearest interstate highways, and then traced these roads to Oak Ridge. Tennessee is crossed by four major interstates: 24, 40, 65 and 75. All were shown on the map. As in most states, a large fraction of the population lives within 20 miles or so of an interstate highway, so most newspaper readers would have noticed they were close to an HLW transport route. But what they saw in the map were merely the major highways, rather than a singling out of their nearby roads for waste shipments. Many of the readers undoubtedly failed to notice that the routes went through other states as well, admittedly with a lower density.

DOE also had difficulty in the two sets of maps it used. The first set showed [17] HLW from Western states such as California being shipped to Oak Ridge via interstate highways, but a later edition did not. Fred Millar of the EPI said, "The Department of Energy wanted to draw new maps to obfuscate an embarrassing problem". He went on, "The fact is the older maps are embarrassing to DOE because they don't know what to do with waste from western reactors. If they tell the western reactors to keep the waste on site (until it can be sent to

a final repository) then why don't they do it with the others (from eastern and central reactors)? And if they built a special packaging facility at the repository to take care of the western waste, then they're duplicating the facility proposed for Tennessee".

Leaving aside the rhetoric, Millar had raised a key point. The final repository would be in a western state, and it would make little sense to ship HLW from the west to Oak Ridge and back again. But what should be done about western HLW? If it waits on-site at reactors for the final repository to open, it may be waiting for a long time. And if it is deemed proper to have it wait there, why not have all on-site HLW wait in its present location?

The public may have had difficulty comprehending these esoteric "what if" arguments. They seemed to have no difficulty with a map circulated by a candidate for Governor, Frank Cochrane. A Public Service Commissioner, he seemed to make opposition to the MRS the major plank in his platform.

The unknown cartographer had merely drawn straight lines connecting Oak Ridge to all the 100 or so reactors with an operating license, and to 30 or so with a construction license. This gave the nation the look of a spider web, with Oak Ridge representing the hapless fly at the center.

During the period under consideration, a meeting was held in Knoxville, with the featured speaker being Marvin Resnikoff, staff scientist with the Sierra Club in New York. He used the "spider-web" map in his talk, explaining his organization's opposition to the MRS. One questioner said that this map could well be accurate, if all HLW shipments were to be flown to Oak Ridge. But nobody had proposed this. All shipments were to be on truck or rail, mostly the former. It would then be more accurate to use the highway map, less ominous than the spider-web version.

The questioner went on, "But how did the fuel rods get to the reactors in the first place? Most of the fuel in U.S. reactors originated from the Oak Ridge Gaseous Diffusion Plant, and shipments are still going out. In order to be fair, one should have a companion map, with lines leading out of, not into, Oak Ridge. This would show the uranium shipments over the past three decades.

"True, the new fuel is less hot, both in terms of radioactivity and temperature, than the spent fuel proposed to return. But it would be more enlightening to show past, present and future shipments."

"Now add to this the bomb parts coming out of Y-12 in Oak Ridge. The material there may be more dangerous than the new fuel and the spent fuel combined. Yet this is also not shown on the maps presented."

This concluded the questioner's comments. The points he raised would have to be taken into account in addition to those of Millar, Resnikoff and other opposing the MRS.

Maps were not the only graphics to confront readers and television viewers. The state's editorial cartoonists saw an opportunity for comment.

Cartoons, as Marshall McLuhan wrote in *Understanding Media*, have "low

definition because little information is provided compared to a newspaper photograph or television picture". Certainly, a cartoon has fewer picture elements or pixels than a photo. But there have been no photos of the MRS, since it doesn't exist. In their initial coverage of developments, Knoxville newspapers showed [18] an aerial view of the proposed MRS site, looking like a cleared field in a forest. Later graphics [19] showed an artist's conception of the MRS, looking similar to oblong factory buildings.

Small wonder that newspaper cartoons, in spite of their low definition, have made the largest graphical impression on the state.

With one exception, from the period of April to October 1985 there were no cartoons in the state's press that showed the MRS in a neutral light, let alone a favorable one. The exception occurred after a Ralph Nader visit to Jackson in May [20], where he criticized the state for its "arrogance" in promoting nuclear power. He said that a nuclear waste facility should be built here as a type of punishment for this arrogance. Nader went on to say, however, that he doubted "whether you have geologically stable structures, so you are safe by the ancient accident of how this state was formed geologically in the Ice Age".

There may have been some confusion in Nader's mind between a temporary site and a permanent repository. The former will be above ground, and thus not much dependent on geology. The latter will be thousands of feet underground, and its effectiveness in keeping the wastes from seeping into the water table will depend on geologists' estimates of how stable the underlying rock is. And while the surfaces of many areas in North America were disturbed by the glaciers of the Ice Age, the subterranean rock was formed many millions of years before. Nader was wrong on all counts.

Editors everywhere don't appreciate out-of-staters criticizing their state, and Nader was greeted the next day with an editorial in a Memphis paper [21] denouncing him as a "much travelled figure clad in baggy ideas, railing at figments of his imagination with drivel running from his mouth".

His appearance also provoked the only cartoon in the period showing the MRS in a nonnegative light [22], again in the Memphis newspaper. Nader is portrayed in cowboy garb and a maniacal look on his face, riding a garbage can labelled "nuclear waste" over the state. The implication is that an outlander is using the issue to have fun at Tennesseans' expense or for his own political purposes.

Other cartoons were highly negative, indicating that the efforts of the nuclear industry and the Federal government to convince the public that HLW can be handled and stored safely have been ineffective. One cartoon by Tom Oliphant showed two skeletons in the outlines of human bodies, in front of a field of small cylinders labelled "Tennessee Nuclear Waste Dump". They are telling a visitor, "Yes, this is Tennessee. How did you know?" A later one by Bissell in the *Tennessean* shows two highways meeting [23]. Prominently displayed at the junction is a cross-buck similar to that at railway crossings. The difference

is that the cross-buck, titled "N-Waste Crossing", has a skull perched on top. The skies lower ominously over the lifeless scene, and the caption reads, "For Every Tennessee Road".

Not content with a downbeat image, the cartoonist for the *Jackson Sun* [24] showed what he thought would be the brighter side of the MRS. The Grand Ole Opry would have a new slogan, "The Oldest Continuous Radioactive Program in the U.S.A.". Seemingly half the barns in the state now bear a slogan for a tourist attraction, "See Rock City", painted on their roofs. This would be amended to "See Rod City – temporary home of spent fuel rods". Showing a drunk hoisting a jar of moonshine, the cartoon reads, "A new meaning will be given to the term 'Tennessee "Shine"!' " The quaffer says, "Puts a real glow on your face". A new state flag is proposed, one with the international symbol for radiation on its furls.

The opposition to the MRS within the state but outside Oak Ridge grew in the months following the April 25 announcement. Because of its diversity, it is divided into three sources: environmental groups, the public, and elected officials.

Environmental groups spoke up quickly. On the very day the proposal was announced, David Barrick [25], director of the nuclear waste safety project of the Environmental Policy Institute, said, "DOE hasn't adequately considered the transportation routes out to these repositories... DOE is falling behind schedule (and) has selected sites that have a lot of serious problems". Kingston attorney Richard Evans said, "DOE thinks we're going to become a dumping ground very easily because we're used to (waste). They're using this to avoid the political football that comes with selecting a permanent site in another state". Joanne Thompson, member of a citizens group, accused the government of using the 700 jobs created by such a facility as a "carrot" to Anderson and Roane counties. "I don't think you can buy out a community", she said, "I would call this a form of arm twisting" [26].

A major reason why environmental groups are so distrustful of the proposal is that many feel the MRS, if built, will relieve pressure to construct a final repository. They point out that the NWPA mandated a final repository, but only asked for a study of an MRS. If the MRS comes about, then in a decade or two there would be a forest of concrete and steel – the gigantic caskets – but the HLW would still be above the ground. The government would continue to say they were studying a permanent underground site. Gradually these claims would fade away.

Congress doesn't always enforce the laws it writes, in their opinion. They fear that, as the turn of the century approaches, Congress might say, "We've labored to produce a mountain, but all we've piled up is a good-sized hill – the MRS. That's the best we can do".

From conversations with Department of Energy officials and some in the nuclear industry, a partial reconstruction can be made of their reasoning behind

the MRS proposal, and why it was suggested for Oak Ridge. (The proposed alternate site in Hartsville, the site of an abandoned and incomplete reactor, was a non-starter. The townspeople, feeling left in the cold by nuclear energy, weren't about to take its wastes.)

DOE officials were surprised by the hostility engendered in the three states chosen as candidates for a permanent repository. A brief description of the complex legal situation was given above. When and how the 16 lawsuits will be concluded, and whether they are the first pebbles of an avalanche of litigation that would push the repository well back into the 21st century, is not predictable.

Thoughts similar to these may have occurred in DOE headquarters: "Why not have a temporary facility, if the permanent one keeps receding in time? That way we kill two birds with one stone. First, we actually give the utilities something for their money. The NWPA will generate perhaps \$30 billion in tax revenues over the lifetime of all reactors. So far not an ounce of waste has been taken off their hands, nor a shovelful of dirt lifted.

Second, if we can choose the right place for a temporary site, we might be able to convince the people in Nevada, Washington and Texas that a permanent site won't be so bad. If they can see citizens a few miles from a temporary site going about their business without being irradiated or having radioactivity seep into their water, they'd be more amenable and less litigious. At least we hope so.

"But where to put it? Oak Ridge is a logical place – lots of nuclear experience, scientists and engineers galore, and not too far from most reactors. Chances are the people there would be as favorable as anywhere.

"Look at what the Knoxville *News-Sentinel* has been writing [27]:

'But it's unlikely that any other place (than Oak Ridge) in the country would give such a project a more dispassionate review. It would be naive to think this hasn't been discussed many times at DOE headquarters in Washington.'

If the three final repository states hadn't objected, and if the rest of the legal pathways seemed clear to DOE officials, the subject of a temporary MRS would probably have never arisen.

Feelings about the MRS among the public have been divided, with Oak Ridge and its environs being somewhat or mostly in favor, with the rest of the state lukewarm or opposed in varying degrees. The first reactions came from Oak Ridge. Alvin Bissell, the retired mayor, said, "We're used to things like that. We've had no nuclear incidents here and that's made people more accepting. Nuclear research began here. It sounds like the circle is complete". Benson Garrett, a retiree in the area, noted, "We created the monster, now let's take care of it" [28].

Leaving aside for a moment the question of temporary versus permanent

repositories, this is a considerably more responsible attitude than possessed by those who created toxic waste dumps. Those who do the dumping usually don't acknowledge responsibility.

In estimating the dose one gets from radioactivity, the farther away from the source, the safer, all other factors being equal. In the statewide battle over MRS, the laws of physics seem to be repealed. The farther from Oak Ridge, the more concerned people seemed to be. This was noted above in the case of Nevada as well.

A few examples: Herbert Larsen of Oak Ridge [29]: "The writer of this letter believes that nuclear waste ... is not waste in any usual sense of the term. It is a substance of great value ... a substance too valuable to be consigned to anybody's DUMP ... What better place for this storage to commence than in Oak Ridge ... where we have a population which has yet to be persuaded that things 'nuclear' are automatically bad".

Now Buddy Muchison of Carthage, perhaps 100 miles away [30]: "I had just finished half watching some weird movie about a 'thing' that had been spawned and developed in a nuclear waste dump and was going around eating people ... If I wasn't against it before, I sure was by then". And at the other end of the state, in Jackson [31], Mal Matthews observed, "Just that name 'nuclear' bothers me". The news report went on to say that Matthews does not know how harmful spent fuel is or where it comes from.

Interviews or letters to the editor only record the loudest voices. By October 1985, there had been three polls in the area, giving opinions of those whose names haven't been published or broadcast. They produced different results, because of different wording and geographical areas covered.

The first poll asked residents of Anderson County, of which Oak Ridge constitutes about half by population, their opinion on the MRS. There was a favorable response of 45% to 42% [32]. Of those opposed, the large majority was strongly, as opposed to mildly, against the MRS.

Another poll done around the same time, but encompassing the entire Congressional district, of which Oak Ridge makes up around 5%, produced a 60%-25% no vote. This poll was used by the local Congresswoman, Marilyn Lloyd, to voice her opposition to the project.

As mentioned previously, the poll confined solely to Oak Ridge produced a 64%-18% favorable vote. The wording was slightly different in all three polls, but probably not so variable to bias seriously the results.

The conclusions are simple. Oak Ridge is strongly in favor. When its views are diluted in its county, the strengths of the two sides are about equal. When it is further diluted in its Congressional district, its voice is faint in the chorus of no's.

The reaction of political leaders in the state has varied, from wanting more information to strong, almost frothing, opposition. By the time of the Oak Ridge poll in late October 1985, no major politician had come out in favor of the MRS.

This undoubtedly disappointed the Oak Ridge and Roane County city and county leaders.

The three major politicians in the state – the two senators and the governor – had, by the time of the Oak Ridge decision, still reserved judgement. The senior senator, Jim Sasser, had said comparatively little on the subject. Senator Al Gore has been more vocal, skewering DOE officials with ease. He has said, “It doesn’t make sense to have the Congress get into the site question until the concept (of temporary storage) is reviewed”. Governor Lamar Alexander has kept the most silent of the trio, letting a state committee investigate the question. However, he later came out strongly against the MRS.

Frank Cochrane, a state Public Service Commissioner, provided the strongest opposition. Only five days after the DOE proposal was made public, and before most copies of it had been studied at all, let alone carefully, Cochrane stated he “will fight with every resource at his disposal” [33]. The choice of the last word in his statement was perhaps unfortunate. Organizing a “Don’t Dump on Tennessee” movement, he gathered tens of thousands of signatures on an anti-MRS petition. However, his fellow Public Service Commissioner, Keith Bissell, has said that none of the commissioners, himself included, has said much publicly in the past about the radioactive shipments moving daily out of Oak Ridge.

One newspaper outside Oak Ridge criticized Cochrane [34]: he has “provided sterling examples of the rankest political motives when dealing with public issues ... Cochrane’s crusade against the MRS ... is worse than ... a ‘political joke’. We’d just as soon see (Cochrane) in his own political swamp and take (his) ideas with him”. Cochrane disavowed any political connection to his state-wide crusade.

The rest of the Tennessee Congressional delegation expressed varying degrees of opposition, with the possible exception of Rep. Harold Ford of Memphis. From the viewpoint of ultimate failure or success of the MRS, probably the most important congressional member is Marilyn Lloyd. In a statement issued when the proposal was first made, she said she would abide by the will of her constituents, almost always a safe, if not wise, decision by a politician. Her poll of her district showed a substantial majority against, so she said she would also oppose the MRS. However, the Oak Ridge Council pro-MRS decision and the subsequent city poll reinforcing this created some confusion in her office, causing her to say that these results showed an endorsement of her decision. They did not. By November 1985, it was not clear what her eventual vote in Congress would be.

If the MRS is defeated for any reason or combination of reasons – political, technical or social – what are the alternatives? In principle, the way would then be clear to proceed directly to the permanent repository. The spent fuel would be sent on its way underground.

It is not known if the residents of the areas around the other two potential

final repositories have been polled, but the attitudes of Deaf Smith County in Texas, where a detailed survey was published in May, 1985, may be typical [35]. While a wide range of questions and responses were shown, it is fair to characterize their overall feeling as wanting a permanent repository as much as they desire the lone star torn off the state flag.

The NWPA demands a strict schedule, but provides for many legal avenues of appeal and delay. Perhaps not all these avenues will be explored, but by late 1985 it seemed likely that most would be.

Another alternative was suggested by the aforementioned Marvin Resnikoff, leader of the Sierra Club's national nuclear waste project. "Let the utilities store the spent fuel themselves until the final repository opens. When their pools are full, they can build casks like the ones proposed for the MRS".

That is indeed another alternative. It would avoid transporting spent fuel to an MRS. However, when the utilities supported the NWPA, it was under the assumption that the government would take the wastes off their hands. If the Sierra Club gets its way, the responsibility would revert back to them. This would be decidedly unwelcome to most.

In addition, these mini-MRS's presumably would all have to get separate licenses from the Nuclear Regulatory Commission, most likely a long, drawn-out process. The quick fix which at first seems attractive is likely to be neither quick nor a true fix. The alternatives to the MRS proposed so far have assumed that utilities, localities or states will do something sometime in the future they will not or cannot do now.

Other legal and regulatory issues

The following is a brief description of some of the legal and regulatory issues that arose either during April–November 1985 or thereafter. No attempt is made to arrange them in order of importance. As well, because of space limitations, no effort is made to be comprehensive.

Revision of NWPA

The NWPA has not been amended, and DOE has proceeded under the original legislation. If it is amended for any purpose, some fear that Congressional delegations from some states will try to attach provisions exempting those states from being considered for permanent or temporary sites. This might leave the framework of the NWPA standing, but the interior gutted, as appropriate repository states are removed from the list. The NWPA would then be a shell, and the HLW would be in a similar situation as it was from 1945 to 1982.

Morris Udall, chairman of the House subcommittee on energy and the environment, brought forth in April 1985 [36] a bill approved by that subcommittee. It dealt primarily with financial questions related to the Nuclear Waste

Fund, the proceeds of the tax on nuclear utilities. For example, utilities would pay into the fund on a monthly rather than a quarterly basis.

However, the bill, by using the power of the purse, can alter the NWPA. For example, it proposed to reduce funding for the MRS by 70% in fiscal 1986 and by 96% in fiscal 1987. By so doing, it suggested the elimination of the MRS as a possibility under the NWPA. Whether or not specific amendments to the NWPA are passed, it is clear that it can be effectively amended or eliminated by other devices.

Regulation in Tennessee

During the course of the MRS debate, the question arose as to what extra regulations would be required on the state level for shipments to the MRS. In its set of requirements, the Oak Ridge–Roane County task forces said that DOE should pay for increased state regulatory costs. Provision was made in the NWPA for these costs, so no difficulty is anticipated.

However, some lingering distrust between the two levels of government will undoubtedly continue. For example, K. Bissell, head of the Public Service Commission responsible for HLW transport, noted [37] that only one state health department official is notified when radioactive waste is hauled through the state and that employee cannot share the information with anybody. Bissell said, “The commissioner is not always informed, even second-hand”. The requirement is presumably to avoid any public expressions of disapproval.

On the other hand, some of the civil servants, as opposed to the elected PSC officials, seem more optimistic about the situation. Tom Davis, chief hazardous materials specialist for the PSC, said “(Waste) has been transported for many, many years with no significant problems with it” [37].

Environmental status of proposed MRS site

One of the main reasons why the Clinch River Breeder site was favored by DOE, in preference to the many other areas owned by the Federal government, was its environmental status. In 1983, the site was deemed to have such a good data base by the Nuclear Regulatory Commission [38] that a limited work authorization for the breeder was granted. DOE’s separate study did note that there were some endangered plants and fish there which could present “potential for delay” in its approval by regulatory bodies. The U.S. Fish and Wildlife Service has said that 11 endangered species of freshwater mussels “may be present” in the Clinch River next to the proposed site. However, DOE’s study said “the department expects that these (species) can be adequately protected during construction and operation”.

Vetoes and counter-vetoes

The NWPA set up an elaborate system of checks and balances to ensure that, as far as possible, both the states and the federal government are satisfied

over HLW emplacement. Specifically, the state, by a notice of disapproval, can disallow the building of a repository on its territory. However, Congress has reserved the final word to itself: it can override a state veto [39].

It is by no means clear that this procedure, designed for the final repository, also applies to a temporary one like the MRS. Since both the state legislature and the governor have voiced their disapproval, it seems likely that this will be yet another issue to be settled in the courts.

There seem to be few, if any, precedents for the system of vetoes and counter-vetoes. One of the interesting implications will be a test in Congress, if and when an override vote comes up. Observers believe that a state with a small population is likely to have either a temporary or permanent repository thrust upon it, the larger states combining to have the cup pass from them. According to this unverified scenario, Texas, with one of the largest state populations, was on the list of three final repository states so it could be dropped when the three are narrowed to one. Its representatives would then be only too glad to override the expected veto of either Washington or Nevada. This would be for fear that Texas would get the repository if the first override vote failed. This scenario is, of course, hypothetical, and may never come to pass.

Tennessee's suit against DOE

In late August, 1985, Tennessee sued DOE in U.S. District Court to block further work on the MRS [40]. Attorney General Mike Cody filed the suit, in which he contended that the governor and legislature should have been consulted. He asked that the Secretary of Energy be enjoined from presenting to Congress any proposal for an MRS in Tennessee. Cody also said that the NWPA may be unconstitutional, because it allows Congress to override the state's disapproval, but includes no method to present such a joint resolution to the President. It is not clear from the news report whether this aspect of potential unconstitutionality was part of the lawsuit, or whether it was merely mentioned as another legal gun in the state's arsenal. Others, outside state government, contend that the constitutional problem arises because the states were given the right to overrule an act of Congress [41].

Cody said his specific concerns about the DOE site selection are: the lack of criteria by which Tennessee sites were chosen over those in other states; the lack of discussion of health effects in residents near the proposed site; and inadequate geological evaluations. In previous statements, DOE officials have said that the NWPA requires consultation after, not before, Congress authorizes construction of any type repository.

In late October [42], DOE asked U.S. District Court Judge Thomas Wiseman to dismiss Tennessee's suit. It said that the suit was filed in the wrong court, contending it should have been launched in the Circuit Court of Appeals. As a precaution, the state immediately filed a similar suit in the Circuit Court of Appeals in Cincinnati.

In early February 1986, Judge Wiseman ruled that he did have jurisdiction, and gave Tennessee an injunction preventing DOE from moving forward with MRS plans until the case was fully heard in court. At the time of writing, the case still had not been heard, so no full discussion of its merits had been held. In effect, the MRS is at a standstill until this takes place. If DOE loses its case, it is difficult to predict what will happen next. The state has not contended that the MRS is inappropriate under any circumstances. In principle, if adequate – and the precise definition of “adequate” may prove to be elusive – consultation is undertaken, the state may have to be satisfied. Even DOE does not contend that adequate consultation with Tennessee was undertaken, because its legal interpretation of the NWPA leads it to believe that none is required at this preliminary stage.

House Republican 1986 initiative

In April 1986, a House Republican group [43] urged that the MRS concept not be abandoned, as some had urged in the light of the legal delays since February. They viewed it as a reasonable temporary measure in view of the mounting problems in other parts of the HLW program. They said it would be a return to the MRS’s “primary role” as it was conceived in 1982.

This is contrary to DOE’s view, which is that the MRS should serve mostly as a repackaging facility with limited storage capacity. However, the Republican group says that DOE “is unlikely to complete work on a permanent nuclear waste repository by the legally mandated deadline of 1998 ... this target is rapidly becoming a fantasy”.

In the original plan for the MRS, which included capacity for 70,000 metric tons instead of 15,000 in DOE’s revised MRS plans, there would be several advantages, the group claims. Wastes could be easily retrieved, unproven technologies avoided, fewer questions would be raised about siting, and adequate backup storage capacity would be available.

Exactly what will happen to this report is not clear. Obviously, in a Republican administration the views of the party must be respected. This occasion is one of the few, if not the only, times that any segment of the Republican party has commented in detail on the MRS. Their advocacy may boost the sagging spirits of MRS supporters.

Conclusions

As is easily deduced from the preceding discussion, one word can summarize the arguments that have raged about the emplacement of HLW, and that word is “complex”. The uncertainties in either permanent or temporary HLW storage or burial seem to multiply with each passing month. As soon as one factor becomes certain, it is undermined and consigned to the bin of uncertainty.

In spite of this, the MRS episode described above suggests there is at least

one community in the U.S. which has not been washed away in the riptide of emotion. Regardless of what happens in the HLW debate or to the HLW itself, the fact that Oak Ridge approached the subject in a rational and fair way should not be forgotten.

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