

# **Nuclear Waste Disposal: An Independent View of the Big Picture and a Proposal for CARD**

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Methods to isolate nuclear waste successfully from the biosphere for the long term can be developed if our society can agree that that is important. The fundamental problem is that we mistrust each other so much that cooperation on a large scale endeavor is next to impossible, even though we become more and more capable technologically. No matter how thoroughly the relevant physics and geology may be understood, a repository has to be built in some political jurisdiction, and it has turned out that there is no place in the United States remote enough that it is not in somebody's backyard. Carlsbad was never remote enough. Yucca Mountain is about the best you can do in this country for remoteness, but there are plenty of people scared and angry about that too, because groundwater travels, and so does fear.

## **Introduction: How did we get to this impasse?**

In the 1940's at the beginning of the nuclear age, nuclear waste was seen as a "problem" only in the physics sense, not in the life sense. And physicists, in those heady days of having just created the atomic bomb, brushed off the waste problem as almost trivial. Now DOE estimates that the cost of disposal of military waste alone could come close to the cost of the United States' entire 50-year program of nuclear weapons development and testing. In 1957 the National Research Council of the National Academy of Sciences first endorsed the concept of burying radioactive waste in a repository in a deep, stable geological formation to keep the radioisotopes isolated from the biosphere until they had decayed. The original idea was to choose an "excellent geological setting." But little thought was given to the difficulties of dealing with the people living above these formations. Unexpected levels of fear and public protest were

encountered. The idea now is to find a “good geological setting” and rely on man-made barriers to contain the radioactivity.

In the sad history of nuclear waste, there have been individuals but there have really been no interest groups that have proven themselves entirely trustworthy. The nuclear industry has made the bottom line the top priority, and its arrogance combined with a few well-publicized episodes of terrifying technical and bureaucratic incompetence have seriously compromised its credibility. The Department of Energy is also compromised, unwilling to admit its inherent conflicts of interest, and guilty of denying scientific reality for short term political gains, despite the almost cosmic consequences. The scientific community is not above reproach. Although some scientists are the real heroes, insofar as there are any heroes in this business, too many others have slid into the role of hired brains, interpreting scientific reality the way they are best paid to, and palming off questions of moral responsibility on politicians and philosophers. Environmentalists are not off the hook either. As an interest group their credibility on nuclear waste disposal is deeply suspect, because a very large subgroup of them believe it is essential to keep the waste problem unsolved in order to stop nuclear power. Nothing such environmentalists say about disposal of nuclear waste can be taken seriously by the other players, since their goal is to sabotage any real-world solution.

Twenty years ago it was completely predictable to many people, including myself, that if the government kept as its main goal opening a permanent disposal site by a certain arbitrary date, rather than developing a general social as well as scientific consensus on the entire issue of nuclear waste, it would waste huge amounts of money and possibly create a permanent nightmare, but it would never find a solution that in a hundred years our great-grandchildren will look back upon with gratitude and admiration. A solution will not have to be technically perfect to allow future people that gift – there is no way that current science can provide complete safety – but it will have to be the best we were capable of doing, given ALL we knew, not just the technical things. We are slowly cleaning up superfund sites. We have apologized for the internment of Japanese-Americans in World War II. Gulf War Syndrome was finally admitted. In the United States, these mistakes are eventually rethought. A “permanent” waste disposal site that is a mistake will not be permanent.

## I. What is the real problem?

It is difficult to see what real progress we have made as a society in the last twenty years of facing this problem, because the most important question in the nuclear waste controversy today is one to which virtually none of the vast amounts of money and attention allocated toward nuclear waste management has been directed. The question is this: how can our democratic society deal honorably with the Frankenstein's monsters our technology has created? Nuclear waste is not the only monster – there are also global warming, extinction of species, arms races, and others. How we deal with nuclear waste can set precedents for how we deal with the others. In a social process that moves as glacially as nuclear waste disposal has, any major policy decision that actually gets made, and probably also some seemingly minor ones, will persist long enough to have snowballing distant consequences. Causing geological-scale consequences is a cosmic event from the point of view of human responsibility.

Proponents of a quick and “clean enough” solution argue that there will be no cosmic or even major consequences from any particular waste dump. Regardless of how little radioactivity may ever emerge, they are wrong. The US is playing a leading role in world research with its large investments in the DOE environmental management program. As Charles McCombie, the chief of science and technology for the Swiss nuclear waste disposal organization Nagra, writes, “The recent trend in [the US] program toward more realistic goals defined by justifiably achievable levels of cleanup will be viewed with relief by various countries that do not wish to see overly ambitious programs setting international precedents.” Thus the sloppier and more secret and authoritarian our program, the easier we make it for other countries to get away with worse. The US can't claim to be the world's only superpower and worm out of this. No country has yet figured out how a democracy of unequally informed and unequally interested citizens can deal responsibly with such a decision.

McCombie points out that worldwide, nuclear waste disposal is taking much longer than insiders predicted decades ago because:

1. The technology is harder than expected,
2. Figuring out technically whether a site is good or not is harder than expected, and
3. “The sociological and political problems” are harder than expected.

This is all true. But he concludes, “Of course, no solution to the broad third issue can be expected before the technical issues are properly solved.” This is absolutely wrong, so wrong that as long as people believe it, we will never have a nuclear waste solution. For the United States the truth is precisely the opposite: *until the political questions are solved or at least taken as seriously as the technical ones, there can be no **scientifically credible plan***. The only scientists working on the issues will be ones that have been hired to do so by the industry, the military, or DOE. In questions on the forefront of science, new ideas rarely come from such places. It is not only “democracy” that requires broad public participation in the question of how society handles nuclear waste: it is the need for real science.

Modern science is as successful as it is because practitioners are rewarded for shooting down wrong theories, finding the mistakes of other people, and suggesting sometimes wild and creative new ways of looking at the phenomena. In the current state of the nuclear waste problem – and most other large public, technological endeavors – independent scientists have almost no role. They’re not funded, but without funding they can’t adequately evaluate or criticize official projects. ***Good science cannot precede a political solution – it is only demanded, and thus created, by a politically open situation.*** The need for independent scientists can hardly be overstated. You can fool some of the people all the time and all of the people some of the time, but you can’t fool Mother Nature at all.

Now that the EPA has approved the opening of Carlsbad as the first permanent repository, time to redirect the national policy is running very low indeed. It is running low, however, because decisions are being made that will be almost impossible to change – not because there is any pressing need for immediate permanent storage. With respect to high level nuclear waste, no other country thinks it has to be buried after cooling only about ten years. Industry pressure on DOE is not so much because cooling ponds at reactors are reaching capacity – they have been claiming the same thing for at least twenty years. It is because in a few more years reactors will start in large numbers to reach the end of their useful lives and shut down. Then the utilities will not be able to charge the expense of maintaining the spent fuel rods against operations but only against storage. Transuranic wastes of the type to be buried at Carlsbad are not even very hot, so the rush argument is even weaker with respect to them. The whole process of nuclear waste disposal has been moving at glacial speeds, but this is

absolutely appropriate for a problem that will endure on geological time scales. The last thing anyone concerned with human safety should want is for our society to commit ourselves and all future generations to a 10,000 year human catastrophe in order to serve the interests of a few government employees, including Congressmen and Senators who see only vaguely beyond a 2 or 4-year political horizon, or of business people trying to salvage what they can in a dying nuclear industry.

With the DOE, EPA, NRC, the military, the nuclear industry, environmentalists, people living near sites, scientists, state and local governments, public interest organizations, and other concerned citizens all having different interests and all to some extent mistrusting each other, we can expect to see continued paralysis – or, if a “final solution” is imposed by impatient powers that be, possibly sabotage on an entirely new scale. People who mistrust each other can rarely agree on anything of substance, because they fear the other side may always use it against them, but when time is running low enough, the one thing they can sometimes agree on is a procedure, a first step in cutting through the logjam. A procedure can be inherently neutral, and no one is necessarily giving anything up by agreeing to a procedure. But such agreement can be pivotal, because any agreement at all makes further agreements easier.

So the immediate question is this: is there any procedure for developing a long term nuclear waste solution on which all the above interests could possibly agree? The second part of this paper proposes such a procedure.

## **II. A Solution: How to achieve a sound national policy**

A complete plan should be put together describing the lifetime of the waste from its production through each phase of transportation and handling to the proposed repository and into its long-term resting place, predicting the paths and rates of radionuclide escape and migration to the waste forms that will exist thousands of years from now. The plan should explicitly contain: 1) an explanation of the reasons behind the main technological choices – not a list of the options which are possible, but a choice among the options and the justification for each choice; and 2) unvarnished worst case analyses – what is the worst that can happen if they are wrong, and what will people realistically be able to do about it?

The report should include an assessment of ancillary requirements too, such as providing infrastructure support on all travel routes to the repository so that if there is a nuclear waste spill because of a traffic accident, equipment and trained people can respond in a reasonably short time. This is an essential part of the transportation phase of disposal.

The plan should be published, both on paper and the internet, as an acknowledged first draft. This acknowledgment is crucial, because it lets criticism of the plan be welcomed as constructive rather than defended against as adversarial. Numerous independent critical reviews should then be funded by the government, including a substantial number performed by genuine public interest organizations (not industry-dominated groups with public-sounding names), which would with this funding be able to hire competent scientists. These reviews would seek to find all the problems and unsupported assumptions inevitable in such an ambitious plan.

The plan and reviews would then be discussed at a conference or series of conferences in Washington, DC, to assure attentive and sophisticated press coverage as well as attendance by the largest possible number of decision-makers. It is always easier to rewrite a draft than to start from scratch, and this plan would be the nation's first draft.

The first part of this process was done in the late 1970's by Sweden, a country of only 8 million people, after their utilities produced a plan for nuclear waste disposal, called the KBS Report. The KBS Report was sent out by the government for review around the world by about 50 organizations and experts. However, no official conference was held to publicize the results, and so an unofficial conference of critical experts was called in Stockholm. As these experts were revealing serious problems in the KBS plan to the press and public at that conference, the government went ahead and approved the plan anyway – and the government fell. It is likely that if the government had taken those comments as positive contributions to a national effort and offered to re-think the plan (which eventually happened anyway), it would have kept the confidence of the people and the parliament. But it lost that confidence by caving in prematurely to political pressures in the face of a public now informed about the scientific problems of the plan. Having learned from this episode, I, together with Joel R. Primack, professor of physics at the University of California, Santa Cruz, who is a reactor safety expert and co-author of the book *Advice and Dissent: Scientists in the Political Arena*, developed the

idea for the strategy laid out here. Let us call the entire process (of preparing a scientific plan, funding critical experts and public participation in reviewing the plan, discussing their responses at public conferences and integrating them into the next iteration of the plan) “Cooperative Science.”

Who should prepare the plan? For civilian waste, no US government agency is in a position to do this. In Sweden, the utilities prepared it and the government reviewed it. This could be a good idea for us, too. Unlike the DOE, EPA, NRC, etc., the utilities are not limited in their planning capacity by jurisdictional divisions and could prepare a more complete scenario. Furthermore, government agencies are incomparably better at regulating industry than at regulating each other. The nuclear utilities could form a consortium to prepare the plan, but their already existing research organization, the Electric Power Research Institute (EPRI), seems the logical candidate. This would not compel EPRI or any government agency to redo the massive effort that has already been made in studying nuclear waste disposal. To the contrary, such efforts would in fact be the basis of the published plan, which would present them in a politically constructive way.

For military waste, the plan could be put together by DOE or possibly the civilian contractors who actually handle the waste. Some people will object that the nature of the waste is a military secret, because deep in some desert bunker someone could calculate from this information something about our bombs, and therefore the US cannot have a democratic process concerning the disposal of that waste near civilians at WIPP. First of all there are far easier ways of discovering the nature of our bombs than by attempting a calculation which our own government has not yet been able to do: that is, to calculate what exactly is in all those barrels of radioactive waste. Probably the greatest contribution the US could make to nuclear non-proliferation would be to reveal the horrendous extent of our military radioactive waste problem.

At least one of the reviews, possibly one sponsored by the White House, or, as in Sweden, by an independent government commission, should be performed by the method called Scientific Mediation. Scientific Mediation is a procedure to be followed by a government agency or any decision-maker who is not a scientific expert, who is faced with a decision involving complicated scientific questions, and there are competent scientists on both sides. Briefly, Scientific Mediation brings together two first-rate scientists representing the opposite points of view as to what should be done

technologically. With the help of a mediator they produce a joint report that explains what the sides agree on (thus narrowing the dispute as much as possible), what crucial points they disagree on, and an agreed upon explanation of why they disagree on each of those points. The report is written in ordinary language to the greatest extent possible and includes suggestions as to further research necessary to assure a successful technological project. The goal of Scientific Mediation is a readable report signed by both scientists that makes clear to concerned non-scientists why a particular scientific dispute exists, what the range of possibilities supported by the evidence is, and why a particular scientist might fall one place rather than another along that range. One of its surprising results is that it brings out the real trade-offs, both qualitative and quantitative, in a technical plan involving scientific controversy. In the worldwide review process of Sweden's KBS nuclear waste disposal plan, the Swedish Energy Commission performed its own in-house review by this simple procedure and uncovered problems with the plan that none of the other approximately 50 reviews found.

In our proposed US endeavor at Cooperative Science, once the conferences have been held, the plan must be revised, and all serious concerns raised by the various critical reviews must be answered and dealt with in the next iteration of the plan. This will permit public input to be integrated into the final result, rather than being heard, as happens too often in public hearings and interventions now, when a decision is basically a *fait accompli*. The second iteration of the national plan will be not only more democratically arrived at but incomparably better in scientific quality than the first. It too should be reviewed in the same way until a consensus is reached.

### **III. What CARD could do now**

The goals of CARD, as explained by Maria Santelli in the *Enchanted Times*, Fall 1997, are:

- 1) to prevent the opening of WIPP as a permanent nuclear waste repository,
- 2) to keep nuclear waste in retrievable storage near where it is produced in order to avoid transportation problems, and
- 3) to have the government fund a "Manhattan" type project to figure out the best way to dispose of nuclear waste.



Are these the most effective and inspiring goals possible at this point?

To oppose the opening of WIPP because it is demonstrably unsafe requires logically that opponents demand that the repository plan be changed to be made safe, if this is possible. If they argue, however, that the repository can never be safe and should not be permitted to open *no matter what*, then this is equivalent to saying “not in my backyard.” Since anyone and everyone says this, the argument appears simply self-interested. No one commands the moral high ground with the argument, “not in my backyard.” If, on the other hand, opponents of WIPP are willing to have it made genuinely safe, they need to clarify what, exactly, would convince them that it was safe. Assurances by DOE never will, but the results of a national Cooperative Science project would be very likely to convince most people whose objections were deeper than just “not in my backyard.” This alone should be motivation enough for the government to sponsor such a project.

What about goal number two? Retrievable storage makes sense, given the substantial scientific uncertainties concerning how the wastes will behave over millennia. But retrievable storage, especially scattered across many sites, is by its nature a temporary solution; therefore, it can only be desirable if there is some benefit in delay. What would that benefit be? Presumably to await the results of the “Manhattan-type” project.

The Manhattan Project, however, is not a very good model for the anti-secrecy, publicly open effort required for nuclear waste disposal. The original Manhattan project was done in secrecy because its goal was a bomb, and therefore the will of the people who would eventually be most affected by it was of no concern whatsoever. Furthermore, it is hard to see how a Manhattan-type project performed by the government could be any better than the massive effort DOE has made over the past decades, both on its own and in cooperation with other nuclear countries.

There are problems with all three of the CARD goals as final goals, but all three of them could be achieved in practice, at least in the short term, and CARD could have real credibility – and a national voice – if it said something like this instead: “We don’t want the repository here but we realize there is a serious national problem with everyone saying ‘not in my backyard,’ and so we are willing to try to solve the whole national problem

to show that there is a better way.” Then, rather than taking a position from the start on what should be done in the end, CARD could propose a method like Cooperative Science for arriving at an equitable solution.

It would be extremely useful to agree, also, on guiding principles:

1. Fairness and respect for all parties and interests
2. Democratic openness and debate
3. First class science
4. Awareness of the cosmic dimension of the decision as to how our society will handle nuclear waste.

This last principle needs some explanation. Nuclear waste itself may not be of cosmic significance, but in deciding how to handle it, we are answering the question of how a great democratic nation should deal with its Frankenstein’s monsters. There is no more important issue in determining the future health and success of the human race, and this “cosmic” dimension of the political decisions should not be trivialized.

But raising support for a Cooperative Science project will take time. What can CARD do immediately, before any waste shipments actually get buried? The State of New Mexico still has to approve WIPP. CARD could lobby the State to demand the use of Scientific Mediation to resolve the central scientific dispute between its own experts and DOE’s, which is relevant to its decision. Scientific Mediation is a powerful procedure that favors the truth emerging. How can DOE object to having two scientists meet with a mediator if New Mexico says it will accept the results? The absolute key to the success of Scientific Mediation in this case will be the choice of question posed to the two scientists. It must be central to the decision required by New Mexican law. One thing this Roswell conference could do of tremendous value would be to zero in on what that question should be.

With respect to the question of encouraging civil resistance to WIPP, civil resistance is deeply admirable and probably the most effective means that civilians have to be noticed when they are protesting an injustice. But civil resistance is only worth the suffering if it is part of a larger strategy of achieving some positive goal. Protest with a purpose no larger than stopping something bad generally leads to burn-out before success. If you are going to take a stand on a technological issue, know how it fits into the larger picture. The larger picture is never irrelevant or utopian. It is our

personal understanding of how each of us fits into a larger picture that gives us the strength to fight for and to care about a world beyond our own lifetimes.

CARD and its affiliated activist groups can advocate for a national solution and hold the moral high ground. It is pointless to keep postponing WIPP's opening with technical objections, except to gain time to accomplish a larger goal. As long as the only issue is whether to open it or not, it will open. But there is much less chance that the use of it will escalate haphazardly or lead to increased secrecy if there is a larger strategy – and much more chance that, however those tunnels are eventually used, the science upon which the technology is based will be far more sound. The Department of Energy, the military, and nuclear utilities are not peopled by evil demons but by human beings pressured by the structural demands of their institutions to behave in predictable ways – i.e. ways that protect government bureaucrats from their superiors and utilities executives from their shareholders. To change their way of thinking requires a change in the demands being made upon them, and that is what a new national strategy could do.

After a Cooperative Science project, WIPP may or may not remain a site by the time of the second iteration of the plan. Possibly, the fact that the salt tunnels are collapsing far faster than expected will eliminate it – if it turns out that retrievability is desirable and not completely in conflict with the goal of taking responsibility for the waste in our generation. But no one really knows what the best strategy for the US will be until a major, open effort of the kind described in Part II above is mounted.

Nor is it obvious what the ethical thing to do is. There is a long-standing controversy as to whether our generation should dispose of the waste because we created it or whether we should leave it retrievable for the next generations because we don't know how to dispose of it safely yet. There is ethical validity for both positions. There is another possibility, too, which is to develop the best technology we can and set aside substantial funding in escrow to pay for permanent disposal when the technology is better understood. This is probably the most ethical position, but it requires that the money be left in trust for decades and not looted in bad times for short term purposes. A general consensus on this would emerge in the larger strategy.

DOE does not have the credibility now to suggest a fair procedure for arriving at a national strategy even if it wanted to. The very fact that it suggested one would make that procedure suspect. But DOE can be required to participate in such a procedure from the outside – by public organizations like CARD putting pressure on elected officials to put pressure on DOE, and by raising these issues in the national press. The time may at last be right to deal with the nuclear waste problem on a national level because soon people in many parts of the country will realize that nuclear waste shipments will be passing along roads near their homes.

The thing to remember is that it is actually possible we could do this right. That is certainly the impetus for this paper. We cannot, however, do it right the way we have been proceeding for the last twenty years. It is in the interest of the people of New Mexico to spearhead the fight for a sane national policy and to show the rest of the country that it is in their interest as well.