United States General Accounting Office

GAO

Fact Sheet for the Honorable
Timothy E. Wirth, U.S. Senate

December 1988

NUCLEAR MATERIALS

Additional Information on Shipments From DOE's Rocky Flats Plant

GAO/RCED-89-61FS

GAO United States
General Accounting Office

Denver Regional Office

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December 14, 1988

The Honorable Timothy E. Wirth
United States Senate

Dear Senator Wirth:

On June 17, 1988, you asked that we answer questions related to our report entitled Nuclear Materials: Information on Transporting Nuclear Materials From DOE's Rocky Flats Plant (GAO/C-RCED-88-2FS, Feb. 29, 1988). The report discusses transportation factors associated with four alternatives for relocating plutonium processing operations from the Rocky Flats plant near Denver, Colorado, to other Department of Energy (DOE) locations.

Specifically, you asked us to answer questions pertaining to (1) Sandia National Laboratory's consideration of human error in estimating risks, (2) testing of DOE transportation containers, (3) continued radiological risks to Rocky Flats workers, (4) other possible relocation sites, including DOE's Idaho site, (5) origins of waste and scrap materials, (6) sufficiency of DOE's transportation fleet, and (7) our use of data that the Nuclear Regulatory Commission used in 1977 to estimate the economic consequences of a hypothetical transportation accident involving nuclear materials.

In summary, we found the following:

-- Sandia's risk analyses associated with shipping plutonium under the four alternatives did not consider potential human error because a Sandia staff member believed that it would not affect the risk calculations.

-- DOE's 2030-2 container used for transporting oxides has not been tested for durability since it was put into service in 1984. Rockwell personnel at Rocky Flats believe container inspection procedures are adequate to detect problems.

-- Radiological risks to Rocky Flats workers would continue because the relocation alternatives would not eliminate all operations involving plutonium at the Rocky Flats plant.

-- DOE is considering relocating plutonium operations to the Idaho site but, unlike the three sites we considered in our earlier review, the Idaho site does not now have plutonium processing capabilities. We did not identify other sites that DOE should consider.

-- Waste and scrap materials would continue to be generated from existing Rocky Flats operations. The materials' pretreatment processes associated with moving some operations elsewhere would generate additional scrap materials.

-- Increases in shipping requirements could require five additional Safe-Secure Trailers.

-- We did not use the data the Nuclear Regulatory Commission used in its 1977 report. Sandia used data pertaining to the four alternatives we reviewed to calculate economic consequences for us.

Sections 1 through 7 of this fact sheet provide more detailed answers to each question.

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To answer the questions, we used data that we had obtained for our February report, as well as additional data we obtained from personnel at DOE and Rockwell International, Rocky Flats plant, Denver, Colorado; DOE and Sandia National Laboratory, Albuquerque, New Mexico; and DOE, Washington, D.C. We performed our work from June to November 1988.

As arranged with your office, unless you publicly announce its contents earlier, we will not distribute this fact sheet further until 30 days after its publication date. At that time we will send copies to the Secretary of Energy, appropriate congressional committees, and other interested parties. If you have any questions, please contact me at (303) 964-0017.

Major contributors to this fact sheet are listed in appendix I.

Sincerely yours,

David A. Hanna

David A. Hanna
Regional Manager

CONTENTS

ABBREVIATIONS

DOE	Department of Energy
DOT	Department of Transportation
GAO	General Accounting Office
NRC	Nuclear Regulatory Commission
SST	Safe-Secure Trailer

SECTION 1

SANDIA NATIONAL LABORATORY'S RISK ASSESSMENT MODEL

QUESTION

The Sandia National Laboratory used a model computer program--RADTRAN III--to calculate risks for plutonium shipments under four alternatives for relocating plutonium processing from Rocky Flats to other DOE locations. Did RADTRAN III recognize and factor in the potential of human error associated with transportation containers?

ANSWER

Sandia's RADTRAN III model can factor human error into risk calculations. The risks cited in our February 1988 report, however, did not include any factor for human error. A staff member in Sandia's Risk Assessment and Safety Evaluation Division, who performed the risk assessment for our report and who has participated in other risk assessments involving transportation, believed the probability of human error affecting plutonium packaging and shipping operations and resulting in risks to the public was too low to affect risk calculations. The staff member based that belief on the fact that several containment levels or barriers exist between the material and the public and that stringent administrative controls are associated with the containment levels.

Several levels of containment are used to ship plutonium materials.[1] For example, the 2030-2, a regularly used container for shipping plutonium oxides, has several containment levels: (1) sealing the radioactive material in plastic, (2) sealing the plastic-encased material in metal cans, (3) sealing the metal cans in metal pipes, (4) placing the metal pipes in metal drums with bolted lids, and (5) placing the metal drums into the Safe-Secure Trailers (SSTs), which are locked to form a sealed container.

Administrative controls ensure that packaging and shipping procedures are performed properly. For example, DOE procedures for properly closing the SST, which is a major barrier between

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[1]Appendixes III through V of our February report illustrate the various features of the containers used to ship plutonium materials, and appendix VI illustrates the features of the SSTs, which are used for all plutonium shipments.

the material and the public on all shipments, require two individuals to perform the locking operation and a third individual to verify that the operation was properly performed. Because the operation at each level is independent of the others, human error or a combination of human error and accident damage resulting in total loss of containment would have to occur before there would be any risk to the public. The staff member indicated that the probability of human error occurring at all containment levels on the same shipment is extremely remote.

Sandia's decision not to include human error in the RADTRAN model for our analysis was also based on the results of a 1987 Sandia study that did include human error in its analysis. The analysis involving spent fuel shipping casks included various types of human errors, such as design errors, procedural deficiency errors, and fabrication errors. The study resulted in calculations showing low probabilities of adverse events, which meant that possible human error had not increased the calculated risks to an unsafe level.

In comparing the transportation of spent fuel casks with the transportation of plutonium materials, the staff member stated that potential human error associated with plutonium shipments would contribute even less to the overall risk calculations than it did in the spent fuel study because the administrative controls for plutonium shipments are greater and more stringent. As a result, the staff member concluded, while the possibility of human error cannot be completely eliminated, any risk resulting from human error in plutonium shipments is too low to affect the overall risk calculations.

SECTION 2

TESTING OF DOE'S TRANSPORTATION CONTAINERS

QUESTION

The LL-D1 and AL-R8 containers used to transport radioactive materials suffered damage (the "birdcage" collapsed) while being tested by DOE after they had been in use for several years. Has the 2030-2 container, which DOE uses to transport oxides, been subjected to live, or full-scale, tests after several years of use?

ANSWER

The 2030-2 container was put into service in August 1984. Since that time, the container has not been subjected to tests to determine its durability. Personnel at Rocky Flats believe inspection procedures are adequate to detect problems.

When we discussed durability tests with Rockwell personnel at Rocky Flats, a product engineer and the Product Control Manager both stated they did not think such tests were necessary once the container was approved and in use. They claimed that current inspection procedures are adequate to detect any problems that may be developing with the container. For example, according to the Product Control Manager at Rocky Flats, to assure container integrity, the manufacturer must radiograph the metal pipes used in the 2030-2 package to contain the plutonium to detect any material flaws before the pipes will be accepted by Rocky Flats. When Rocky Flats receives components of the 2030-2 from the manufacturer, such as the metal drums and the metal pipes, quality control personnel visually inspect the components for defects as well as use inspection gauges to check for proper dimensions and specifications. After containers have been filled, shipped to other locations, and returned to Rocky Flats, Rocky Flats personnel visually reinspect the containers before reusing them. If the metal drums are severely damaged (dents or punctures), they are replaced. The Manager indicated that damaged metal pipes have never been found.

Other tests have been conducted since 1984 to determine (1) whether the inner components can be sealed to be gas tight, (2) whether the insulation material in the container will adequately protect the contents from high temperatures, and (3) what forms and amounts of materials can be packaged safely in the containers. According to a DOE Albuquerque Operations Office nuclear engineer, the tests were conducted to supplement existing data pertaining to the container's safety features. The need for these tests resulted from a DOE process that began when DOE learned

that the Department of Transportation (DOT) was considering the elimination of its regulation, 49 C.F.R. 178.104, also known as DOT Specification 6M. The 2030-2 is one of a number of containers that have been constructed according to DOT specifications and have been labeled as DOT-6M containers.

According to the nuclear engineer, if this regulation is eliminated, the 6M containers, including the 2030-2, would be certified according to Nuclear Regulatory Commission (NRC) regulations. Even though DOE shipments using these containers are exempt from DOT and NRC regulations, DOE's policy is to comply with DOT and NRC regulations. To prepare for the possible elimination of the DOT specifications that had been used by DOE to certify its packages, DOE organized the Specification-6M Safety Task Force to compile all available test and analyses data to determine whether its DOT-6M packages would meet current NRC regulations.

The task force's available data did not identify any deficient areas pertaining to container safety, but, according to the DOE engineer, the task force believed that supplemental data should be developed to describe more completely the safety features in the three areas that were subsequently studied. The task force's report, dated July 27, 1988, states that the 6M containers, including the 2030-2, meet the requirements set out in the NRC regulations.[2]

Along with the task force's efforts, Rockwell personnel are presently redesigning, at DOE's direction, one component of the 2030-2: the metal pipe encapsulating the metal cans that contain the plutonium. A Rocky Flats product engineer said they are attempting to redesign the component so that it will more easily comply with NRC's regulations. With the present design, additional procedures must be used to properly seal and check the container for leaks to comply with regulations. A redesigned component would eliminate the additional procedures, thereby reducing the total time needed to properly package the material

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[2]In September 1988, GAO issued a report addressing DOE's process to certify containers, Nuclear Health and Safety: DOE Needs to Take Further Actions to Ensure Safe Transportation of Radioactive Materials (GAO/RCED-88-195, September 1988). GAO recommended that the Secretary of Energy promptly conduct an independent review of all available documentation to ensure that package designs meet all applicable safety regulations and assign responsibility for certifying nuclear weapons packages to DOE headquarters, as was done for DOE's nonweapons packages. In addition to DOE's review of the 2030-2 container, DOE/Albuquerque is planning to recertify the other two containers discussed in our February report, the AL-R8 and the 2030-1. It is too soon for us to determine whether DOE has complied with GAO's recommendations.

and still meet NRC's requirements. The product engineer emphasized, however, that there have not been any problems with the present design.

SECTION 3

RADIOLOGICAL RISKS TO WORKERS

QUESTION

According to DOE personnel at Rocky Flats, radiological risks to workers would not decrease as a result of relocating plutonium processing to alternate locations. Why?

ANSWER

The plutonium processing relocated under the four alternatives would not eliminate all plutonium operations at Rocky Flats. Radiological risks from fabrication operations would continue to exist. Additionally, not all residues generated from operations at Rocky Flats could be shipped in existing, approved containers without undergoing some pretreatment operations. The radiological risks associated with handling radioactive materials during pretreatment and packaging operations, as well as the radiological risks from the continuation of fabrication operations, were the reasons for the DOE personnel's statement that the overall radiological risk to Rocky Flats workers would not decrease.

SECTION 4

ALTERNATE LOCATIONS FOR PLUTONIUM PROCESSING

QUESTION

In the February report, GAO considered the Hanford site in Washington, the Savannah River Plant in South Carolina, and the Los Alamos National Laboratory in New Mexico as alternate locations for the plutonium processing operations at Rocky Flats. DOE is presently examining its Idaho properties as a potential location for plutonium operations from Rocky Flats. How valid is the Idaho site, vis-a-vis the three GAO considered, and are there other sites that DOE should be looking at as hosts for plutonium operations?

ANSWER

The Idaho site does not have plutonium processing capabilities. New facilities with those capabilities would have to be built. We did not identify other sites that DOE should consider because the selection of other possible sites would depend on the emphasis placed on factors such as capital costs, transportation costs, and health risks.

According to DOE officials at headquarters and Rocky Flats, DOE is now taking a much more favorable view of the Idaho site as a possible location for relocating plutonium operations than it did years ago when problems began with building 371 at Rocky Flats. The DOE officials indicated that the site has two very attractive characteristics as a location for conducting plutonium operations: it is a very large reservation, and it has a very small human population in its proximity.

The headquarters official stated that another factor in its favor is that new operations are planned for the site. DOE is considering Idaho as a location for a facility to process fuel-grade plutonium (Special Isotope Separation facility) and has also very recently decided to locate a new high temperature, gas-cooled reactor at that location. He indicated that the Idaho location and other DOE facilities are presently being evaluated as part of DOE's comprehensive study of its complex as it exists today and what it should look like in the future (2010 study). The study is due to be released in December 1988.

Although DOE is taking a more favorable view of the Idaho site for future operations, the site does not presently have plutonium processing capabilities. The three locations we evaluated as possible alternate locations for plutonium processing were selected because they had existing capabilities similar to those at Rocky Flats. In contrast, the major operation presently being conducted

at the Idaho site is processing spent fuel rods from reactors, which results in the production of enriched uranium. According to the Plutonium Recovery Modification Project Manager at Rocky Flats, only very small quantities of plutonium are generated in this process, and they are eventually discarded as waste. Because of the nature of these operations, none of the processes at the Idaho site have been designed to handle large quantities of plutonium.

To process plutonium at the Idaho site or any other location that does not process plutonium, the DOE official stated, new facilities would have to be built that would meet nuclear safety and safeguard requirements. An August 1988 draft environmental assessment for DOE's proposed project to renovate building 371 at Rocky Flats looked at alternatives to the proposed project that included (1) relocating all plutonium recovery operations to Idaho and (2) relocating only site-return operations to the Idaho location. Estimated capital costs--to construct new processing buildings, utilities expansion, a new waste handling building, a plutonium analytical laboratory addition, a drum storage addition, and safeguards and security upgrades and expansion--were $799.6 million for the relocation of all recovery operations and $806 million for the site-return alternative. The cost estimate for the site-return alternative was higher than the other because it included costs to upgrade facilities at Rocky Flats as well as costs for facilities in Idaho.

In reference to what other sites should be considered by DOE, the DOE Albuquerque Operations Office performed a study in 1982 of economic and technical factors related to transferring the weapons production portions of Rocky Flats to alternative DOE sites. The plant's interdependent operations were categorized into five separate functions: plutonium, depleted uranium, beryllium, conventional metal, and transport modification center. Potential relocation sites for the five operations included all existing DOE locations. After considering the availability of existing and related production and production support expertise, equipment, facilities, utilities, and land, DOE selected the Savannah River Plant as a potential site for relocating plutonium operations. The results of the study were reported in Long-Range Rocky Flats Utilization Study (February 1983).

We did not identify other locations that DOE should consider as possible future hosts for plutonium operations. In our February report we stated that we did not select one alternative as superior to the others because the most attractive alternative would depend on the emphasis placed on factors such as capital costs, transportation costs, and health risks. We did not identify other locations in this fact sheet because the selection of other sites also depends on which factors are deemed most important, as well as on the results of DOE's 2010 study, which is a broad, strategic analysis of DOE's complex.

SECTION 5

ORIGINS OF WASTE AND SCRAP MATERIALS

QUESTION

In GAO's discussion of types of materials and methods of pretreatment for shipment from Rocky Flats, it is unclear in two cases which materials mentioned are generated in existing waste streams and which would be created by increased packaging resulting from moving plutonium operations elsewhere. In one case, a Rockwell program manager is quoted as saying that thousands of gallons of organic fluid with extremely low quantities of plutonium would require processing; in another case, GAO states that approximately 6,000 kilograms of scrap metal, glass, and gloves containing about 25 kilograms of plutonium would be generated annually from operations. In both cases, would the materials be generated as part of the packaging process?

ANSWER

The organic fluids referred to by the program manager would not be created as part of the packaging process. These fluids are generated by the existing fabrication operations. The 6,000 kilograms of other materials--scrap metal, etc.--would be generated from operations that would remain at Rocky Flats, such as fabrication, research and development, and the analytical laboratories, and also from the pretreatment operations that would be conducted to prepare materials for shipment.

SECTION 6

SUFFICIENCY OF DOE'S TRANSPORTATION FLEET

QUESTION

GAO's report on Rocky Flats states that DOE would use its Safe-Secure Trailers (SSTs) to transport plutonium materials to and from Rocky Flats in the event that any of the four primary alternatives are selected. Would DOE's present fleet of SSTs be sufficient to handle the increased transportation requirements? If not, how many more SSTs would DOE need to procure? How many SSTs are in the existing fleet?

ANSWER

In our February report, we stated that a DOE official had indicated the increased shipments of materials to other locations associated with the relocation alternatives could require additional vehicles and personnel. In a recent discussion, the same official estimated that five additional SSTs may be needed, but circumstances preclude a very meaningful estimate at this time. He explained that the exact number needed would depend on which location was selected within an alternative and on the DOE complex's ability to match the supply of plutonium with demand at any given time. As we stated in our February report, depending on which location was selected, it was conceivable that a courier station could be established at Rocky Flats; this could affect the number of SSTs actually needed. The DOE official explained that the plutonium supply and demand ultimately affect the amount of plutonium loaded in each SST and thus affect the number of SSTs needed. For example, if sufficient plutonium is in the system to allow full loads to be shipped each time, there would be less demand on the equipment, and the material could be shipped with fewer pieces of equipment. If, on the other hand, a particular location has an immediate requirement for any available quantities of plutonium, shipments of less than full truckloads would have to be made and would thus create a demand for additional SSTs and escort vehicles.

DOE's existing fleet of equipment presently consists of 45 SSTs, 47 tractors, and 103 escort vehicles. DOE is presently replacing its fleet of tractors with 51 new models. Plans call for the new units to be modified and put in service by December 1989. According to DOE personnel, there are no immediate plans to increase the number of SSTs.

SECTION 7

ECONOMIC CONSEQUENCES DATA

QUESTION

In a 1977 report the NRC, using data generated at Sandia National Laboratory, determined that a worst possible accident involving the transportation of nuclear materials would cost $2 billion to clean up. A later version of that report provided a significantly revised estimate of $100 million. In calculating the economic consequences, did GAO use data on which either of these two estimates was based? If so, which conclusion did GAO accept, and why?

ANSWER

The economic consequence data in our February report were not based on the NRC's 1977 report.[1] For the relocation alternatives that we were evaluating, Sandia calculated health risks using certain data that we provided, such as plutonium quantities and modes of shipments. We asked Sandia to use the same data to develop economic consequences. We did not compare the data used by Sandia for our analysis with data that were used in the earlier NRC analyses.

We did, however, examine the economic consequence data in the 1977 NRC report. The report estimated that, on the basis of estimated 1985 shipments, the cleanup costs associated with a major accident could range up to $1.2 billion. However, the report clearly stated that such an accident was "unlikely." The probability of the accident was estimated to be no greater than once in 300 million years. A staff member in Sandia's Risk Assessment and Safety Evaluation Division believes that reporting consequences in this manner is not very meaningful because it does not present the proper perspective; rather, it is important that probabilities and consequences be considered together, as was done in the Sandia methodology applied to the analysis done for us.

The Sandia methodology looked at adverse events that could release radioactive materials to the environment. The severity of the events is estimated using the parameters in NRC guidance for Category VII or Category VIII events--the two most severe accident categories. The staff member emphasized that this methodology does not look at one particular accident scenario, as the NRC report did, but instead looks at a number of events that could produce

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[1]We were unable to confirm that there is a later version of this report; a NRC staff member stated there is no later version.

crush forces, fires, or both, that would release materials. For our report, Sandia determined (1) possible adverse events that could release material to the environment, (2) the economic consequences associated with each event, and (3) the probabilities of those events. The calculations using those data elements resulted in the statistically expected economic consequences as shown in our report.

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