

December 13, 2002

The Honorable Rob Portman
House of Representatives
8044 Montgomery Road, Suite 540
Cincinnati, Ohio 45236

Dear Congressman Portman:

This letter is in response to your September 17, 2002, request to respond to a letter from one of your constituents, Ms. Elaine M. Blakely. Ms. Blakely requested that the Defense Nuclear Facilities Safety Board (Board) review the hazard categorization of the Waste Pits Remedial Action Project (WPRAP) and other nuclear projects at the Department of Energy's (DOE) Fernald site near Cincinnati, Ohio.

The hazard category of a DOE nuclear facility denotes the severity of potential accidents based on harm to site workers or members of the public. The hazard category determines the level of detail required for the accident analysis, as well as the types of controls that may be necessary to mitigate or prevent the accidents. DOE nuclear facilities are classified as Hazard Category-1 (HC-1), HC-2, HC-3, and below HC-3, with HC-1 being the most severe and below HC-3 being the least severe. Regardless of what hazard category is determined for a facility, the contractor is required to develop controls providing adequate protection for workers and members of the public. In general, fewer controls are required for a lower hazard category facility.

To respond to Ms. Blakely's requests, the Board reviewed hazard categorization and safety analysis documentation prepared by and for the primary site contractor, Fluor Fernald Corporation (Fluor), along with safety review documentation prepared by DOE's Ohio Field Office and Fernald Environmental Management Project office. A report on the results of the Board's review is provided in the enclosure to this letter. These results are summarized below.

In response to Ms. Blakely's first request, the Board agrees with the determination of Fluor and DOE that projects at Fernald that have been reassessed and assigned a below HC-3 status within the last 5 years have been properly reclassified. Most Fernald projects have been reclassified to below HC-3 as the result of the removal of nuclear materials from the facilities. DOE has reviewed and approved the contractor's safety analysis, controls, and facility hazard categorization, and the Board agrees with DOE's determination.

In response to Ms. Blakely's second request, the Board agrees with the determination of Fluor and DOE that the WPRAP is properly classified as below HC-3. This conclusion is based on data regarding the materials in the waste pits and on the hazard and accident analyses that have been performed for activities involved in the waste pit project. DOE has reviewed and approved the contractor's safety analysis, controls, and hazard categorization for the WPRAP, and the Board agrees with DOE's determination.

Although the Board agrees with the current hazard categorization of the nuclear projects at Fernald, the Board is aware of recent safety issues that have arisen at the site, and understands concerns regarding the safety of site workers and the public. For example, a Price-Anderson Act Notice of Violation was issued in January 2002 for unplanned and unmonitored radiation exposures at WPRAP between December 1999 and August 2000. A “near-miss” occurred at WPRAP on April 25, 2002, when a worker was injured by being pinned between a railcar and a metal platform in the Rail Loadout Building. The Board is also aware of five separate incidents on other projects between February and August of this year in which workers were exposed to nitrogen dioxide fumes.

For each of these safety issues, the Board’s staff held discussions with the site and reviewed the associated incident reports and corrective actions. These events occurred because the potential hazards associated with the specific work activities had not been thoroughly analyzed; consequently, adequate controls to protect the workers had not been developed and implemented. These occurrences demonstrate that, regardless of the hazard category of a facility, a thorough analysis of the potential hazards associated with each work activity must be performed, and adequate controls must be identified and implemented to provide protection for workers and the public.

All former production-related facilities at Fernald are planned to be demolished by 2006 as part of the site closure plan. The Board will continue to perform oversight of the health and safety aspects of the removal and cleanup of nuclear materials at Fernald until this work has been completed. As a key element of its ongoing oversight at Fernald, the Board closely reviews the contractors’ safety programs, self-assessment programs, and resolution of safety issues. Coupled with this effort, the Board continues to emphasize the need for DOE to be actively involved in the safety oversight of the contractors at the site.

Please contact me if you would like additional information, or if I can be of further assistance in this matter.

Sincerely,

John T. Conway
Chairman

Enclosure

Enclosure

Information to Address the September 17, 2002, Inquiry from Congressman Rob Portman

The Defense Nuclear Facilities Safety Board (Board) is an independent federal agency established by Congress in 1988. One of the Board's functions under the Atomic Energy Act is to provide safety oversight of defense nuclear facilities operated by the U.S. Department of Energy (DOE). The Board's responsibilities include oversight of activities to clean up and remove nuclear materials from facilities that are undergoing closure, such as the Fernald site near Cincinnati, Ohio.

Background

The Board's Oversight at Fernald. The Board has a technical staff of engineers and scientists who obtain information and perform reviews of activities at facilities under the Board's jurisdiction, including Fernald. The Board's staff obtains information on activities at Fernald from several sources, including weekly contact with the DOE site office. The staff also reviews daily occurrence reports and weekly activity reports sent to DOE-Headquarters by Fernald. In addition, the staff obtains and reviews numerous other site documents and reports, including work procedures, safety documentation, contractor and DOE assessment reports, and accident investigation reports. The staff also reviews reports on Fernald issued by other organizations, such as the General Accounting Office.

The Board's staff performs oversight reviews of the safety aspects of activities conducted at the Fernald site, including work on the seven major site closure projects: Deactivation and Decommissioning, Waste Pits Remedial Action Project (WPRAP), Waste Management, Soils and Disposal Facility, Aquifer Restoration, Silos, and Maintenance and Infrastructure Support. Appropriate management and technical personnel from DOE and the site contractors are involved in these reviews. When issues are identified by the Board's staff, the Board communicates the information to DOE-Headquarters and the Ohio Field Office by letter, typically accompanied by a staff report. Less significant findings are communicated orally to DOE and contractor management at the site. DOE and contractor management often take actions on their own to address issues identified by the Board's staff without the formal exchange of correspondence. A summary of the results of major reviews performed at Fernald is included in the Board's Annual Report.

Hazard Categorization of DOE Facilities. The hazard category of a DOE nuclear facility denotes the severity of potential accidents based on harm to site workers or members of the public. The hazard categories at DOE nuclear facilities are Hazard Category-1 (HC-1), HC-2, HC-3, and below HC-3. HC-1 represents a facility in which potential accidents could have significant off-site consequences for members of the public. HC-2 denotes the potential for significant consequences to on-site workers, and HC-3 denotes the potential for only localized consequences to on-site workers. Below HC-3, also known as Radiological (RAD), denotes the potential for on-site workers to receive RAD and chemical exposures less than those for HC-3 but in excess of other regulatory limits. The hazard category of a facility may be changed if

materials are removed or if there is a change in the activities performed.

A preliminary hazard category is determined based on comparing the amounts of various radioactive materials and hazardous chemicals that could be released during an accident to certain limits of exposure to site workers and/or members of the public. Minimum thresholds for HC-1 through HC-3 radionuclides and hazardous chemicals are given in DOE Standard 1027 [1]. Minimum thresholds for below HC-3 are given in DOE Environmental Management Standard 5502-94 [2].

A final hazard category is assigned after a hazard and accident analysis has been performed for the facility or activity. The final hazard category may be lower than the preliminary hazard category. The final hazard categorization and supporting analysis are contained in the appropriate safety analysis documents. DOE reviews these safety analysis documents and issues a Safety Evaluation Report, which approves the contractor's safety analysis and hazard category for each facility. Regardless of what hazard category is determined for a facility, a thorough analysis of the potential hazards associated with each work activity must be performed, and adequate controls must be identified and implemented to provide protection for workers and the public. In general, fewer controls are required for a lower hazard category facility.

Issues Identified in Constituent's Letter

A constituent of Congressman Rob Portman, Ms. Elaine M. Blakely, requested that the Board address two issues. The first was whether projects at the Fernald site that have been reassessed and assigned a below HC-3 status within the last 5 years were properly reclassified. The second issue was whether data used to assign the WPRAP a below HC-3 categorization were manipulated to support a preconceived conclusion.

To respond to Ms. Blakely's requests, the Board reviewed hazard and safety analysis documentation prepared by and for the primary site contractor, Fluor Fernald Corporation (Fluor), as well as safety review documentation prepared by DOE's Ohio Field Office and Fernald Environmental Management Project office. The documents reviewed are listed at the end of this enclosure. The Board also obtained information during telephone discussions with contractor and DOE personnel at the site.

The documents reviewed were officially issued (approved) versions. The Board did not attempt to review or reconstruct the process used by the contractor or DOE to arrive at the information presented in official issued documents. The Board also did not evaluate copies of any draft documents, data files, administrative records, or other information that may have been collected by the contractor or DOE. The results of the Board's evaluation are summarized below.

Response to Constituent's Issue No. 1. The first issue was whether projects reassessed and assigned a below HC-3 status within the last 5 years were properly reclassified.

The final hazard categorization of all nuclear facilities at Fernald was first reported in Fluor's *Implementation Plan for Safety Analysis Reports and Technical Safety Requirements at the Fernald Environmental Management Project* (PL-3049) [3], which was issued in 1996. There were no HC-1 facilities. The major uranium processing plant buildings and the Pilot Plant were HC-2, and some material storage locations and Silos 1, 2, and 3 were HC-3. Table 1 shows the original hazard categories reported in PL-3049. Other buildings and on-site areas with radioactive or hazardous chemicals were classified as below HC-3.

Beginning in 1996, final cleanup plans for the site were approved; the removal of radioactive materials, the demolition of buildings, and the environmental cleanup and restoration of the site then began. As radioactive materials and hazardous chemicals were removed from buildings and areas, the hazard categories of the facilities or activities involved were reduced. PL-3049 has been updated periodically to document the changing safety basis and hazard categories of site facilities and activities. The latest version of PL-3049 [4], issued in December 2001, shows that the hazard categories of many facilities have been reduced.

Table 1 presents a comparison of the facility hazard categories in 1996 and those in 2001, and summarizes the reasons for the changes in hazard categories. Most projects have been reclassified to below HC-3 as the result of the removal of nuclear materials from the facilities. Several facilities have been demolished. All former production-related facilities are planned to be demolished by 2006 as part of the site closure plan. The Board's staff reviewed the safety basis documentation referenced in the table, as well as DOE's Safety Evaluation Reports. Based on the information presented in these documents, the Board agrees with the determination of Fluor and DOE that projects that have been reassessed and assigned a below HC-3 status within the last 5 years were properly reclassified.

With regard to new facilities, the site is in the process of designing and constructing the facilities needed to remove, process, and ship off site the waste materials stored in Silos 1, 2, and 3. The Board is reviewing the hazard and accident analyses and hazard categorization of these facilities and activities as they become available. The Board will continue to perform oversight of the health and safety aspects of work involving the removal and cleanup of nuclear materials, including the Silos project, until this work at Fernald has been completed.

Table 1. Comparison of Hazard Facility Categorization, Fernald Site

FACILITY	HAZARD CATEGORY¹	RECLASSIFICATION INFORMATION	OTHER COMMENTS
Fissile Material Handling	HC-2/HC-2	Only enriched restricted materials are HC-2 based on [5].	Operations include storage, handling, and limited processing of enriched restricted materials.
Plant 1	HC-2/RAD ²	Downgraded 06/08/00 based on analysis in 2500-RP-0042.	Storage of uranium, thorium, and other toxic materials; real-time radiography; repackaging of nuclear materials; and hazardous waste management unit remediation
Plant 2/3	HC-2/RAD	Downgraded 07/23/99 based on removal of holdup materials.	Undergoing demolition.
Plant 4	HC-2/RAD	Downgraded 06/08/00. Pads 74E and 74F downgraded based on removal of inventory.	Buildings 4A, 4B, and 7A demolished.
Plant 5	HC-2/RAD	Downgraded 07/23/99 based on removal of holdup materials.	Demolished.
Plant 6	HC-2/RAD	Downgraded 07/23/99 based on removal of holdup materials.	Demolished.
Plant 8	HC-2/RAD	Downgraded 07/23/99 based on removal of inventory.	Undergoing demolition.
Pilot Plant	HC-2/RAD	Downgraded 07/23/99 based on removal of holdup materials.	Deactivated, awaiting demolition.
Quonset Huts	HC-3/RAD	Downgraded 10/19/01 based on removal of inventory.	Demolished.
Thorium Warehouses	HC-3/RAD	Downgraded 10/19/01 based on analysis in SA-2000-1027 [6] and SA-2000-1028 [7].	Buildings 64 and 65 demolished; pads 74L and 74M used for material storage.
Finished Products Warehouse	HC-2/RAD	Downgraded 10/31/00 based on removal of inventory.	Building 77 deactivated, awaiting demolition.
Silos 1 and 2	HC-3/HC-3	Retrieval, treatment, and shipment of silo materials are expected to be approved by the Department of Energy (DOE) as RAD activities.	Silos 1 and 2 and waste treatment facilities to be demolished.
Silo 3	HC-3/HC-3	Retrieval, packaging, and shipment of silo materials are expected to be approved by DOE as RAD activities.	Silo 3 and waste packaging facilities to be demolished.

¹original/current hazard category (HC). Original HC reported in reference [3]; current reported in reference [4].

²RAD = radiological.

Response to Constituent's Issue No. 2. The second issue was whether data used to assign the WPRAP a below HC-3 classification were manipulated to support a preconceived conclusion.

Between 1952 and 1986, large quantities of liquid and solid waste from the various chemical and metal processing activities at Fernald were disposed of in six in-ground waste pits, a burn pit, and a clear well. The purpose of the WPRAP is to remediate the six waste pits, the burn pit, and the clear well. The WPRAP activities include waste pit excavation, material handling, dryer operation, railcar loading, and shipping approximately 1 million tons of contaminated soil off site.

Material Characterization Data—Material characterization data for the waste pits are summarized in a Fluor report, *Technical Basis for Waste Pit Constituents of Concern* [8]. That report states that the radioisotopes and chemical constituents of concern in the waste pits were determined from a combination of information sources, including Remedial Investigation/Feasibility Study (RI/FS) sampling data, other sampling data from a Characterization Investigation Study, and process knowledge based on operator interviews and site material inventory records.

The review of material characterization data led Fluor to the conclusion that the wastes in Waste Pits 3 and 5, the burn pit, and the clear well may be considered to be homogeneous, because the wastes were delivered as slurried solids and pumped into the pits. Waste Pits 1, 2, 4, and 6 are likely to contain stratified layers of wastes, because the pits were filled with a combination of slurried solids and solid residues dumped into the pits by trucks. The waste material in the pits varies, but consists primarily of residual process wastes containing uranium isotopes and their decay products. Isotopes and decay products of thorium are also present, but in much smaller quantities. Additional reported isotopes include small quantities of plutonium, cesium, ruthenium, strontium, and technetium from recycled enriched uranium material that was processed at the site.

Based on the estimated quantities of the various residue materials and the inhalation doses that could result from the airborne dispersion of each of the materials, black oxide (U_3O_8) was selected as the source term for use in the accident analysis and dose calculations. Although there are several different materials in the pits, using black oxide for dispersion and dose calculations results in the worst-case consequences. As an additional measure of conservatism, the specific activity (curies per gram) of the uranium in the black oxide was taken to be at the economic discard limit, which is approximately a factor of 5 greater than the specific activity determined from the RI/FS sample data.

Although they represent only a small contribution, the isotopes from recycled uranium material were added to the black oxide source term for Waste Pits 3 and 5, the burn pit, and the clear well because the materials in these pits are assumed to be homogeneously mixed. The recycle isotopes were not added to the source term for Waste Pits 1, 2, 4, and 6 because pure black oxide from a stratified layer in these heterogeneous waste pits represents the worst physical case (i.e., the reactor recycle isotopes are mixed with materials that, in combination, pose less risk than pure black oxide).

In addition to the radioisotopes, hazardous chemicals of concern were identified for each of the waste pits. Based on the information presented in the Fluor technical basis report [8], the materials selected for the source terms appear to bound the worst-case radiological and chemical materials that

could be involved in an accident.

WPRAP Hazard Categorization—The Documented Safety Analysis for the WPRAP is the *Remedial Action Health and Safety Plan (RAHASP)*, Revision 3, dated April 18, 2002 [9]. The RAHASP includes safety basis information from various Auditable Safety Records (ASRs) and other safety documents that define the safety envelope for WPRAP activities. The ASRs document the hazard analysis, accident analysis, and safety controls for a particular activity. ASR SA 99-1008, *Waste Pits Remedial Action Project Auditable Safety Record*, Revision 1, dated July 20, 1999 [10], identifies the hazard category of the WPRAP activities, except for Waste Pit 4, as below HC-3 (RAD).

Based on material records, the relative quantities of nontypical waste (NTW) in Waste Pit 4 and the burn pit were expected to be greater than those in the other pits. Fluor prepared an integrated hazard analysis report [11] in February 2001 to identify and evaluate potential hazards that might be encountered during the excavation, handling, storage, processing, and disposal of materials expected to be found in Waste Pit 4 and the burn pit, including NTW materials. NTW is waste that does not meet the Permitted Commercial Disposal Facility Waste Acceptance Criteria for WPRAP shipments. Examples of NTW include pyrophoric materials, compressed gas cylinders, transformers and other waste contaminated with polychlorinated biphenyls (PCBs), and asbestos materials. The integrated hazard analysis report [11] concludes that remedial activities for Waste Pit 4 and the burn pit are RAD and are bounded by the WPRAP ASR [10], but identifies additional controls for NTW that are documented in a procedure, *Managing Non-Typical Waste* [12].

Accident Analysis—The WPRAP hazard category calculations [13] identify the worst-case or bounding accident as a collision of two fully loaded (40 cubic yard) dump trucks. After the collision, the two trucks are assumed to fall over and spill their contents (435,000 pounds of pure black oxide) and 400 gallons of fuel, which ignites and burns for 1 hour. The releases calculated for this accident include the black oxide being thrown from the bed of each truck, plus the black oxide released during the fire. This is considered to be the bounding accident for all WPRAP activities and materials. As previously mentioned, the assumption that all of the material is black oxide is conservative because the pits also contain other materials with lower inhalation doses than black oxide. In addition, the specific activity (curies per gram) of the uranium in the black oxide is conservatively assumed to be approximately a factor of 5 greater than the activity based on RI/FS sample data.

The calculated doses for the accident involving the collision of two trucks are 5.39 rem at 30 meters and 0.419 rem at 100 meters. The threshold limits established in [1] for HC-2 and HC-3 facilities are 1 rem at 100 meters and 10 rem at 30 meters, respectively. The calculated doses are below the threshold values for HC-3, but the dose at 30 meters meets the threshold for categorization as a RAD facility. DOE approved this categorization.

The Board found that the accident analysis is based on several assumptions that affect the final dose calculations. For example, assumptions are made with regard to the moisture content of the material, the size of the spill, the thickness of the pile of material spilled on the road, the thickness of the

layer of fuel underneath the material, and the heat flux that dries the material and contributes to airborne dispersion. The Board also notes that the computer code used in the analysis employs an “areal pool” as the source for calculating the plume dispersion, whereas most computer codes for radiological dose use a “point source” for this calculation. In general, a pool source results in lower plume concentrations than a point source.

Based on the potential uncertainties associated with the assumptions used in the analysis and the computer model employed to perform the calculations, the Board believes that the calculated results could be low by a factor of 2 or more. However, as mentioned earlier, the specific activity (curies per gram) of the uranium in the black oxide was conservatively assumed to be approximately a factor of 5 greater than the specific activity determined from RI/FS sample data. The Board considers this additional measure of conservatism to compensate for uncertainties in the accident analysis. The results of the dose calculation therefore appear to bound the potential consequences of this accident. Since this same conservative black oxide source term is used in calculations for other WPRAP accidents, the results of the dose calculations for the other accidents would also be expected to bound the potential consequences of those accidents.

In addition to the conservatism in the source term, the contractor has identified a control to prevent an accident of this magnitude. The analysis states that a speed limit of 10 mph is enforced to ensure that such an event will not occur. It would be difficult for trucks traveling at 10 mph to collide, overturn, and spill their loads. The control to limit the speed of trucks in the WPRAP area appears to be adequate to prevent an accident of the analyzed magnitude.

Conclusion—In response to the issue raised by Ms. Blakely, the Board agrees with the determination of Fluor and DOE that the WPRAP is properly classified as a below HC-3 project. The Board found no evidence that data used to assign the WPRAP this classification were improperly manipulated to support a preconceived conclusion that improperly reduced the hazard category of the project. This conclusion is based on information in the Fluor technical basis report [8] and on the hazard and accident analysis evaluations that have been performed for the WPRAP activities [11, 13]. Although there are potential uncertainties in the assumptions and calculations performed for the limiting accident (a two-truck collision), the resulting consequence calculations appear to be conservative, and the identified controls will further mitigate the consequences of such an accident.

References

1. U.S. Department of Energy, DOE-STD-1027, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*, September 1997.
2. U.S. Department of Energy, DOE-EM-STD-5502-94, *Hazard Baseline Documentation*, August 1994.
3. Fluor Fernald, PL-3049, *Implementation Plan for Safety Analysis Reports and Technical Safety Requirements at the Fernald Environmental Management Project*, Revision 0, January 8, 1996.
4. Fluor Fernald, PL-3049, *Implementation Plan for Safety Analysis Reports and Technical Safety Requirements at the Fernald Environmental Management Project*, Revision 5, December 6, 2001.
5. Fluor Fernald, CSA-SD-980001, *Fernald Nuclear Criticality Evaluation*, Revision 1, January 1999.
6. Fluor Fernald, SA 2000-1027, *Fernald Environmental Management Project Deactivated Facility Auditable Safety Record*, Revision 2, April 2002.
7. Fluor Fernald, SA 2000-1028, *Fernald Environmental Management Project Facility Decommissioning Auditable Safety Record*, Revision 1, April 2002.
8. Fluor Fernald, *Technical Basis for Waste Pit Constituents of Concern*, Revision 2, SAT Calculation, September 1998.
9. Fluor Fernald, *Remedial Action Health and Safety Plan (RAHASP)*, Revision 3, April 18, 2002.
10. IT Corporation, SA 99-1008, *Waste Pits Remedial Action Project (WPRAP) Auditable Safety Record*, Revision 0, June 22, 1999.
11. Fluor Fernald, SA 2000-1034, *Integrated Hazards Analysis Report: Waste Pit 4 and the Burn Pit*, Revision 0, February 8, 2001.
12. Fluor Fernald, 10500-PL-0013, *Non-Typical Waste Management Plan for the Waste Pits Remedial Action Project (WPRAP)*, January 2000.

13. IT Corporation, *Waste Pits Remedial Action Project Hazard Category Calculations—Final*, December 1998.