

Low Level Waste Shipment Accident Lessons Learned

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## LOW LEVEL WASTE SHIPMENT ACCIDENT LESSONS LEARNED

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### ABSTRACT

On October 1, 1994 a shipment of low-level waste from the Fernald Environmental Management Project, Fernald, Ohio, was involved in an accident near Rolla, Missouri. The accident did not result in the release of any radioactive material. The accident did generate important lessons learned primarily in the areas of driver and emergency response communications.

The shipment was comprised of an International Standards Organization (ISO) container on a standard flatbed trailer. The accident caused the low-level waste package to separate from the trailer and come to rest on its top in the median. The impact of the container with the pavement and median inflicted relatively minor damage to the container. The damage was not substantial enough to cause failure of container integrity. The success of the package is attributable to the container design and the packaging procedures used at the Fernald Environmental Management Project for low-level waste shipments. Although the container survived the initial wreck, it was nearly breached when the first responders attempted to open the ISO container. Even though the container was clearly marked and the shipment documentation was technically correct, this information did not identify that the ISO container was the primary containment for the waste.

The lessons learned from this accident have DOE complex wide applicability. This paper is intended to describe the accident, subsequent emergency response operations, and the lessons learned from this incident.

### BACKGROUND

The Fernald Environmental Management Project, formerly known as the Feed Materials Production Center, is located about 20 miles northwest of Cincinnati, Ohio. Uranium metal products for the nation's defense programs were produced at the facility between 1953 and 1989. During those years the facility produced slightly enriched or depleted products for use in production reactors to make plutonium and tritium at other DOE sites. Uranium production was suspended in July 1989 to focus on environmental restoration. The Fernald workforce has been dedicated entirely to environmental restoration since 1989. Also in 1989, the site was added to the Environmental Protection Agency's National Priority List of federal facilities in need of remediation. In 1991, the DOE officially announced that production at the facility was ended and the program management responsibility within the DOE was transferred to the Office of Environmental Restoration and Waste management. In February 1992, an Ohio Field Office was established to oversee all aspects of a full-scale environmental restoration and waste management effort which is expected to last several years.

On October 1, 1995 at about 1550 (all times in Central Standard Time), an accident occurred involving a shipment of low-level waste from the Fernald Environmental Management Project, in Fernald, Ohio. The shipment was in route to Mercury, Nevada for disposal. The vehicle transporting the waste for the Fernald Environmental Management Project lost control and rolled over in the

westbound lane of Interstate 44, approximately one mile southwest of Rolla, Missouri.

The shipment was comprised of a single cargo container designed in accordance with International Standards Organization (ISO) specifications. The Fernald Environmental Management Project uses ISO containers for packaging contaminated debris for disposal at the Nevada Test Site. Loose bulk radioactive waste is not accepted for disposal at the Nevada Test Site. All bulk waste must be packaged to prevent the spread of contamination at the disposal facility. The use of large scale bulk packaging is more economical and a more efficient disposal practice compared to the use of smaller individual packages.

The container involved in this accident contained radioactive contaminated debris generated as a result of the ongoing remediation activities at the Fernald Environmental Management Project. The material in this package, crushed drums and wood pallets, was loaded directly into the container.

The ISO containers are transported from the Fernald Environmental Management Project to the Nevada Test Site on standard flatbed tractor trailers. A loaded ISO container can weigh between 20,000 and 42,000 pounds gross weight. The container involved in this accident weighed 29,160 pounds gross weight. Containers are fastened to the trailer using chains, binders, and straps.

When the transport vehicle involved in this accident rolled onto its side, the force of the impact, combined with the abrasion of the tie-downs between the trailer and the road surface caused the container to separate from the trailer. The container slid about 40 feet before coming to rest in the median. The transport vehicle continued to slide on its side more than 100 feet further down the pavement. There were no injuries as a result of the accident and the container maintained its integrity thus preventing the release of material.

#### INITIAL RESPONSE

The Rolla Missouri local emergency organizations provided first response to the accident scene. The container placarding and shipping papers correctly identified the hazards associated with the container and resulted in additional notifications. The State of Missouri Department of Natural Resources and Department of Health were called to assist the local responders. A hazardous materials response team from Fort Leonard Wood Missouri was also contacted for support.

Initially, the Missouri Department of Natural Resources attempted to contact the Fernald Environmental Management Project. Failing to contact the consignor of the bill of lading, they contacted the consignee, the Nevada Test Site. The Nevada Test Site emergency operations personnel contacted DOE-HQ who then notified the Oak Ridge office. The Oak Ridge office was contacted because it was the nearest DOE facility with an established Radioactivity Assistance Program team.

Once the Fernald Environmental Management Project was notified, the Fernald Environmental Management Project Assistant Emergency Duty Officer requested a 100 foot exclusion zone around the container until all the facts concerning the waste were established. The Assistant Emergency Duty Officer then contacted the Fernald Environmental Management Project Emergency Duty Officer to report the

event.

The Missouri Department of Health, Department of Natural Resources, and the HazMat team from Ft. Leonard Wood had previously determined that there was no contamination as a result of the accident. After determining that there was no breach of containment, the local response organizations announced their intention to initiate recovery operations.

For unknown reasons, the local fire department attempted to open the ISO container. Had the fire department been successful in this attempt to open the ISO container, the containment would have been breached resulting in a high probability of a material release.

The Fernald Environmental Management Project personnel in contact with the on scene commander requested that recovery operations involving the waste container be postponed until a recovery team from the Fernald Environmental Management Project was on the scene. This decision was based on indeterminate level of confidence in the radioactive material experience and instrumentation available at the scene to truly evaluate the situation. The equipment on the scene was assumed to be civil defense 7000 series portable radiation detection instrument. This instrumentation is not sensitive enough to accurately assess the potential contamination released from this container. Given this situation, the Fernald Environmental Management Project determined that it was best to have representatives from the facility at the scene. Recovery operations would be safer with the assistance of a team of personnel familiar with the waste and supported with the proper instrumentation.

Since initial surveys indicated that no contamination was detected and the container was out of traffic, the recovery operations were postponed until the Fernald Environmental Management Project team arrived. Security of the accident scene was maintained by the Phelps County Sheriff Department. One deputy was at the scene when the Fernald Environmental Management Project team arrived at the scene at 0200, October 2, 1994.

#### RECOVERY OPERATION

The Fernald Environmental Management Project sent a team of personnel knowledgeable of the waste and equipped with the proper equipment to Rolla Missouri to assist with the recovery operation.

A chartered jet flew the team to St. Louis, Missouri where they rented a car for the last leg of the trip. The accident scene was 80 miles southwest of St. Louis, Missouri. The Fernald Environmental Management Project team arrived at the scene at 0200 CST, eleven hours after the accident occurred. This response time was entirely dictated by the conditions. Because the Fernald Environmental Management Project knew there was no release of contamination, additional time could be used to assemble the necessary equipment for the response team.

Once on the scene, the Fernald Environmental Management Project team immediately started air monitoring and surveyed the site to establish a clean command point. The area between where the container contacted the road and where it came to rest in the median was surveyed first. After confirming that this area was not contaminated, the team began to survey the container. The container survey confirmed that there was no release of contamination. Further surveys of the

ground beneath the container had to wait until recovery operations were initiated.

The Missouri State Highway Patrol requested that recovery operation be delayed until daylight. During this time, the Fernald Environmental Management Project recovery team evaluated the accident scene to assist with anticipated internal investigations. The team also used this time to coordinate recovery operation activities with the local wrecker operator. A trip to the wrecker yard was made to inspect the original trailer. This inspection identified minor repairs which were completed while waiting for sunrise. The wrecker operator also located a power unit to pull the repaired trailer to and from the accident scene.

The wrecker operator had contracted two cranes with operators to remove the container from the median. Both eastbound lanes of Interstate 44 were stopped by the Missouri state police for approximately ten minutes while the cranes were positioned in the left lane. Once the cranes were in position, the right lane was reopened for east bound traffic. The west bound lanes remained open for the entire recovery operations.

The Fernald Environmental Management Project recovery team remained at the scene ready to provide radiological support during the recovery. Because the container was lying on its top, the team could not certify the integrity of the entire container. As planned, the wrecker crew attached cables to the container. Using the cranes, the container was rolled 90 degrees exposing the top of the container. The Fernald Environmental Management Project radiological support personnel then completed the survey of the container and the ground beneath it to complete the container integrity examination. The Missouri Department of Health, Department of Natural Resources representatives were then invited to perform their own surveys to confirm the Fernald Environmental Management Project results.

After determining that the container was strong tight, the wrecker operator was directed to attach cables and roll the container into an upright position. After a final survey of the container to confirm the container did not breach during recovery operations, the container was lifted onto the highway. The Missouri State Highway Patrol stopped east bound traffic one final time to allow the container to be loaded onto the trailer. Once the container was on the trailer, the loaded trailer and the cranes were moved out of the left lane on to the right shoulder. Traffic was released to use the entire eastbound interstate.

The entire recovery operation was complete by 1150 CST, October 2, 1994, less than 20 hours after the accident first occurred. The actual recovery operations only required 45 minutes from the time the cranes were in position until the time the container was on the shoulder of the road. Eastbound traffic was restricted only during the actual recovery operation and totally stopped for a total of 20 minutes. The entire recovery operation was completed without further incident.

The trailer with the ISO secured to it was hauled to the wrecker yard to await a properly trained and licensed driver to arrive in Rolla and haul the load back to the Fernald Environmental Management Project. The local power unit was used only to get the container off the highway. An authorized driver with the proper training and permits was required to return the container back to Ohio. The container arrived back at the Fernald Environmental Management Project on October 4, 1994.

## ACCIDENT EVALUATION

The root cause of the accident was driver inattention. The driver indicated that he was looking in his right side rear view mirror to determine if he had cleared a vehicle that he was passing. While checking the mirror, he failed to realize that his truck was drifting toward the median. The left front wheel dropped into the median which was six to eight inches below the pavement. The driver immediately attempted to recover from this path but the center of gravity of the load had already shifted causing him to lose control of the vehicle.

The driver fought to regain control over a distance of more than 700 feet before the truck rolled over. The speed limit in the accident area is 65 mph. The police report did not identify the truck speed, mechanical condition, or the physical condition of the driver as possible contributing causes of the accident.

## LESSONS LEARNED

The Fernald Environmental Management Project conducts regular emergency response exercises at the facility. These exercises have intentionally focused on more likely potential on-site emergencies or natural disasters. The transportation accident in Rolla, Missouri made it perfectly clear that the facility was not completely prepared for an off-site transportation emergency. During the event, each person involved maintained personal field notes of actions taken or observed. After the event was declared to be secure, the parties involved convened a meeting to critique the response. The following observations were noted during this review.

The Fernald Environmental Management Project Emergency Communication Center was not notified of the accident until nearly two hours after it occurred. The primary cause of this delayed notification was the location of the emergency phone number on the bill of lading. This number was in very small type and not conspicuously displayed. The number that was more prominently displayed and called first by the local responders is a dispatcher office which is not manned 24 hours. The corrective action for this issue is to revise the bill of lading and drivers instructions to clearly identify the emergency phone number.

After the Fernald Environmental Management Project was notified of the incident, initial response efforts were dedicated to working with the on scene commander to determine the magnitude of the situation, and assemble the appropriate personnel. Once the situation was clearly communicated to the Fernald Environmental Management Project Emergency Operations Center, the task of classifying the event was initiated.

The Emergency Duty Officer could not find an appropriate reference in DOE Order 5000.3b that addressed transportation accidents with no release of material. This order primarily addresses transportation accidents where there is a release. The Emergency Duty Officer then referred to the "Fernald Environmental Management Project Emergency Plan". In the chapter entitled "Emergency Action Levels", he identified the classification for transportation accidents involving non-release of material. This plan and event classification is applicable to all site transportation accidents involving shipment of hazardous or radiological material coming from the Fernald Environmental Management Project in which the integrity of the shipment is in doubt or can not readily be determined. This plan determined the incident classification as Emergency/Alert. This classification



required additional notifications of DOE-HQ and USEPA Region 5. The delay in classifying the event and subsequent notification of DOE-HQ resulted in a temporary confusion as to ownership of the response actions. The Fernald Environmental Management Project Emergency Operations Center was working independently of the DOE-HQ. Until the Fernald Environmental Management Project contacted DOE-HQ to notify them of the incident, neither had any indication that the other was involved. Once DOE-HQ was apprised of the situation and knew the Fernald Environmental Management Project Emergency Operations Center was involved, the response was turned over to Fernald.

The corrective action for this issue will be addressed by the revised shipping papers. Clearly identified emergency phone numbers will prevent the delayed notification of incidents to the Fernald Environmental Management Project. This issue will also be addressed by issuing the completed Fernald Environmental Management Project Transportation Emergency Response Plan. The plan was in rough draft and out for review at the time of the accident. The plan will address the lessons learned from this incident, and provide a ready resource to assist in classifying incidents and identifying the notification requirements.

The delay in contacting the Fernald Environmental Management Project was complicated when specific information concerning the waste in the container was not readily available. The Fernald Environmental Management Project shipment certification files are stored in locked files as required by DOE orders. To protect the integrity of the files, only authorized personnel can open them. No authorized personnel were available to retrieve them at the time of the accident. The on scene commander had the bill of lading but the description on this document is based on DOT proper shipping name. The DOT shipping name does not specify that the container was full of contaminated metal and wood. As a result, the on scene response team, unaware that the ISO contained loose bulk waste, attempted to open the container. There was no indication in the shipping documentation that this was a bulk waste container.

The corrective action for this issue is to revise the drivers instructions provided with every load to better identify the contents of the container. Additionally, a daily shipping record is provided to the Fernald Environmental Management Project Assistant Emergency Duty Officer and available if needed.

After the Fernald Environmental Management Project Emergency Operations Center committed to send a response team to the accident scene, additional time was required to assemble the people and equipment. There was no established response team for off-site transportation emergency responses. The team that was assembled for this response was well informed but there was no guarantee that these individuals would have been contacted in different circumstances. Once on the scene, the team realized that the emergency communications equipment on hand was limited. The cellular phones provided to support the team were not fully charged and there was no adapter to charge the batteries or operate the phones using the rental car electrical system. Use of these phones was limited to short calls and resulted in some calls being disconnected in mid-conversation. The phones could not be left on due to the weak batteries and the "sky-pager" provided for the trip did not function as expected. The team was basically out of direct contact with the Emergency Operations Center which stood down soon after the team departed for the airport.

The corrective action for this issue is to staff an emergency response team with

knowledgeable personnel and provide them with the proper equipment and training. This issue will be included in the Fernald Environmental Management Project Transportation Emergency Response Plan.

The wrecker operator involved in the accident recovery operation was extremely cooperative and well organized. The operator assembled the necessary equipment and personnel to quickly and safely recover the container. This situation is more likely the exception than the rule and therefore, better planning will be required in the event such a wrecker operator is not available. In the Rolla incident, the wrecker operator was very instrumental in the success of the operation. As a corrective action for this issue, the Fernald Environmental Management Project secured funding from DOE-HQ for an outreach program for communities along the route. This funding is intended for training first responders along the transportation route but this stakeholder interaction will enable the Fernald Environmental Management Project to identify potential resources for future reference.

The recovery operation was delayed while the wrecker operator repaired the original transport trailer. This was necessary because the transporter of record could not provide another trained driver with truck and trailer in the time frame required. The container could not be placed on a trailer that was not permitted to haul the waste back to Ohio. An alternative plan would have been required had the original trailer been damaged beyond repair.

The corrective action for this issue is to identify transportation services along the route that can provide emergency support and include them in the Fernald Environmental Management Project Transportation Emergency Plan.

## CONCLUSION

The Fernald Environmental Management Project has been shipping low-level waste to the Nevada Test Site for disposal since 1985. During this time, more than three-thousand truck loads have been successfully shipped without a serious transportation accident. This performance has resulted in more than 6.4 million loaded miles traveled before the first serious accident was encountered. This performance exceeds national highway transportation safety statistics and the Fernald Environmental Management Project risk assessment projections. Nevertheless, a thorough review of the occurrence was conducted to enable the Fernald Environmental Management Project to improve future transportation emergency response.

During the critique of this incident, several commendable aspects of the response was documented. One of the more notable highlights of this review is the recognition of the professionalism exhibited by the people involved in this response. The local response organizations performed well and were augmented by competent Fernald Environmental Management Project individuals. The successful integration of the multiple response organizations at the scene resulted in a completed response in a relatively short period of time.

The actual circumstances surrounding this accident dictated the response actions and time frames. The Missouri Department of Health, Department of Natural Resources, and the HazMat team from Ft. Leonard Wood had previously determined that there was no contamination as a result of the accident. Because the container did not fail and was not in the traffic lanes, the actual response

permitted some degree of deliberation. Had the container failed or if it was lying on the highway, the two hour delay in notification to the Fernald Environmental Management Project would have had greater consequences.

Recognizing that the primary cause of the delayed notification was due to the format of the shipment documentation, the Fernald Environmental Management Project has revised these documents to better delineate the emergency response information. This communication will be duplicated on a pocket emergency response instruction card to be provided to the drivers. These corrective actions are intended to prevent recurrence of the destination facility receiving first notification of the transportation accident and to prevent emergency response actions from proceeding without Fernald Environmental Management Project involvement. It is imperative that the facility generating the shipment be involved with the response actions because that facility has the most personal knowledge of the shipment contents. This involvement is most important in the event that the driver's paperwork could not be retrieved from the power unit. The originating facility has the only other copy of the shipment documentation for deciding response actions.

An accidental breach of the container, which nearly happened in this incident, must be addressed. Even though the shipping papers clearly identified the hazards associated with the shipment and the container was properly marked, local first responders attempted to open the container. While it is not known why they tried to open the container, it is clear that the communication to local emergency response organizations must be better. The Fernald Environmental Management Project recognizes that the many local communities along the transportation route must be provided better information concerning the waste. The Fernald Environmental Management Project is pursuing an outreach program to promote awareness for communities along the transportation route, but the effectiveness of this program will be too limited in scope. The primary communication must be provided in the shipment documentation and driver training. The Fernald Environmental Management Project is in the process of implementing these changes.

Instrumental to the success of this recovery operation was the local wrecker operator. This individual secured the required equipment to hoist the container back onto the truck. The wrecker operator also made repairs to the original trailer making it road worthy and able to be used to reload the container. This support was crucial to the recovery operation and cannot be taken for granted. Had the original trailer been rendered unfit for reuse, a local transporter would have been required to support the recovery operation. Finding a driver permitted to haul radioactive material for the return trip to Fernald, Ohio, would have resulted in a longer delay before the operation would have been completed. As it occurred, the original transporter was used to return the container to the Fernald Environmental Management Project. The corrective action for this issue will be for the Fernald Environmental Management Project to contact the transporter to initiate transportation support earlier in the response action.

The final improvement developing as a result of this incident is an improvement of the Fernald Environmental Management Project off-site emergency response capability. Once on the scene, the Fernald Environmental Management Project team performed well but it took too long to assemble the equipment and the communications equipment did not function as required when the team arrived at the scene. The Fernald Environmental Management Project is in the process of

organizing a trained and knowledgeable staff of personnel to participate on a facility response team. The lessons learned from this incident will improve the readiness of this team in the future. The team will be assigned Emergency Operations Center pagers to directly contact the team members on duty. This corrective action is intended to prevent recurrence of the obstacles encountered by the team involved with this response.

The Fernald Environmental Management Project is the first DOE facility to be declared a total remediation project. As the remediation of the Fernald Environmental Management Project continues, the volume of off-site transportation will increase. Because the root cause of the accident was driver inattention and no mechanical or driver physical conditions were identified as contributing factors, it is safe to assume that the incident was not the result of a system failure. In actuality, the proper preparation of the shipment contributed to the success of the response. However, despite the best efforts of the generating facility to properly package the waste, an accident will occur involving the release of material. A review of the current notification communication process by the generating facility prior to an accident could minimize the impact of the incident. The primary revisions required for improved response notifications at the Fernald Environmental Management Project have been identified and implemented. This paper is intended to share the Fernald Environmental Management Project lessons learned from this low-level waste transportation accident to provide other radioactive waste generators an opportunity to be better prepared for a transportation accident.