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The Next Nuclear Gamble

Transportation and Storage of Nuclear Waste

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The NAC-1 Cask—A Troubled Record

"As for the care taken in past shipments of spent nuclear fuel, the record speaks for itself," says one industry spokesperson (Mills, 1982). While it is true that no major accidents have taken place, in the case of one model of truck shipping cask, the NAC-1, the record is troubled.

On March 28, 1979, two irradiated fuel casks (type NAC-1) were being loaded at the Dairyland Power Cooperative reactor at La Crosse, Wis. for transfer to the fuel storage pool at Morris, Ill. (NRC, 1979b). The reactor had been shut down for refueling and an NRC inspector was present. Simultaneously, another cask of the same type was being checked out by technicians at Duke Power Company in South Carolina. Duke informed Nuclear Assurance Corporation (NAC), owner of the NAC casks, that the internal shell of their cask was bowed out of shape. Copper plates had been welded on the outside shell due to a lack of sufficient radiation shielding on the inside of the cask. This was in violation of NAC's license. NAC, however, made no effort to locate the other casks of the same type or to stop any impending shipments. The NRC inspector on duty at La Crosse, unaware of the problem at Duke, observed the filling of the NAC-1 casks and cleared the shipments for transportation to the Morris pool.

During the next nine days at least eight shipments were made between La Crosse and Morris (NRC, 1979b). The NRC was unable to say whether other casks of the same type were simultaneously in use elsewhere. The route for the shipments probably took them on Illinois Route 47, a two-lane north-south highway to the west of Chicago. However, the NRC has no record of the route actually taken (NRC, 1979c) because at the time it had no regulations restricting shipments to approved routes.

After the shipments were completed, the NRC issued a suspension order blocking further use of the casks. When the casks in use at La Crosse were finally inspected, one of them was also bowed (NRC, 1979d). Of greater significance was the fact that two other models of the same cask were also found to be bowed out of shape, although they were manufactured by a *different* company (NRC, 1979d). Of the six in use, a total of four were taken out of service due to the bowing problem.

The source of the bowing problem remains officially "undeter-

mined." It is reasonable to conclude, however, that there is a generic fault with either the design or the manufacturing process as it is unlikely that two different companies (Stearns-Roger, Denver, Col., and Exelco Co., Silver Creek, N.Y.), separated by thousands of miles and several years, could make exactly the same mistake. The NRC has indicated that crashworthiness cannot be assured in a cask with this defect.

Further research revealed that the attachment of the copper plates was done at the behest of NAC, without approval from NRC. Welding copper to stainless steel can result in embrittlement of the steel during a subsequent fire, as well as reducing the strength of the shell in other ways (Sandia, 1980c).

These problems are not surprising in the overall context of quality control on these casks. Only one month before the La Crosse incident, an internal NAC audit of its own procedures "identified the need for a complete revision of all NAC-1 operating and maintenance procedures" (NAC, 1979a). Some documentation of welding procedures during manufacture had been "lost in a fire" with no copies maintained by NAC (NAC, 1979b). Although the quality assurance program appeared to be a good plan in 1974, "problems existed with effectively implementing the program" (NAC, 1979b). It is unfortunate that such realizations came after more than five years' use of faulty casks, involving over 300,000 miles of shipments (NAC, 1979c).

Of the two casks still in service, one (NAC-1D) was checked on August 22, 1980 to assure that the same bowing problems had not befallen it since an inspection six months earlier. It was then used to ship irradiated fuel from the San Onofre reactor in California to the Morris, Ill. pool on September 4, 1980. After the shipment was completed, however, NAC told the NRC that "reevaluation of the cask measurements" indicated that this cask had the same problem. It too was withdrawn—after the fact (NRC, 1980d).

The latest model NAC-1 cask (NAC-1E) was also pressed into service and delivered to San Onofre on August 20, 1980. Unbeknownst to the San Onofre technicians, this cask had been used four months previously to ship a leaking fuel assembly from the Oyster Creek, N.J. plant to a research facility near Columbus, Ohio. The cask had become so severely contaminated in the process that external lead shielding had to be added (NRC, 1981d). When the *empty* cask arrived at San Onofre, the radiation level in the truck driver's cab was over twice the maximum legal limit (NRC, 1981d). Two Nuclear Assurance Corporation technicians were flown in to decontaminate their cask which, at several points, emitted 11 to 40 times the legal limit of radiation. Several health physics technicians working at San Onofre helped with the task. At nuclear power plants, the health physics technician is responsible

for safeguarding the worker's health during such operations. However, documents indicate that the technician in this case was not qualified for the job. "He had no familiarity with irradiated (spent) fuel casks"; and "he received no briefing or instruction with regard to the potential hazard" associated with the cask in question or even "what procedure or actions were going to be performed" (NRC, 1981d).

A capped pipe, where a valve used to be, was opened, forming a port into the cask. Highly contaminated water began pouring out. One of the NAC technicians caught it in a plastic bag and surveyed it for radiation. It emitted up to 100 rems/hr of radiation (a five-hour, whole-body exposure to that amount of radiation could be fatal). An absorbent napkin was used to wipe up some residual moisture in the port. It gave off 300 rems/hr. The technician's glove was also contaminated.

The NAC representatives then obtained *another* technician, also unaware of the hazards associated with the job and with the radiation detector he was using, according to NRC Inspection Reports. One of the NAC technicians picked up the previously filled bags of waste and attempted to dispose of them in a shielded waste container. "Because the bags would not fit into the shielded cavity, he stated that he held his breath, turned his head, pushed the bags into the cavity while puncturing them with a screwdriver" (NRC, 1981d). At no time were air samples taken, as is standard procedure, or the proper respiratory equipment used "when action was performed resulting in the disposal" of the contaminants. So Cal Edison, operator of San Onofre, was fined $150,000, later reduced to $125,000, for lax health physics supervision (NRC, 1981e).

Numerous other incidents have occurred with this particular cask:

—Exceeding by 40 percent the decay heat limit placed on it as a result of the problems stemming back to the La Crosse incident (again, the error was found *after* completion of the shipment)
—A leaking valve
—The inexplicable movement of a radioactive "hot spot" from one end of the cask to the other *after* it had been decontaminated several times.

It was even suggested that the *wrong* fuel assembly may have been placed in the cask at the Haddam Neck reactor (NRC, 1981d). The problems were so severe that Nuclear Assurance Corporation did not try to move the NAC-1E cask until six months later, and then asked NRC for permission to move it, again empty, to a nearby site for decontamination (NRC, 1981f).

The problems created by this cask occurred primarily when it was

empty, when it was in transit without guards or route restrictions, and when drivers did not need to call in every two hours. How would an accident involving such an empty cask be treated by radiological health personnel unaware of its contamination? While the total radioactive contents of the cask in question were not reported at this time, samples taken at San Onofre show that the concentration of contaminants in the water was so high that a release of several gallons of it could have caused a contamination incident similar to that postulated by Sandia Labs in its TRUE study* in which a two-billion-dollar cleanup bill could result.

The other cask (the NAC-1D), which left San Onofre in September 1980, was found *not* to be bowed out of shape after further measurement and was released for use later that year. However, upon arrival (still empty) at the Oyster Creek, N.J. plant in February 1981, it was found to have surface contamination even though it had not been used to ship fuel for five months (NRC, 1981g). An NRC inspector on duty at the time observed decontamination of the cask and the addition of a layer of heavy paint designed to hold any contamination in place during the cask's next journey (in this case, to Battelle Laboratories in Ohio). However, the wrong type of paint was used. It began to dissolve off the cask during a rain storm in Pennsylvania. The drivers noticed the peeling paint but continued on to Ohio (NAC, 1981), apparently oblivious of the fact that surface contamination was probably being spread on the highway. Most of the paint remained on the truck, but only because of the wire cage surrounding it (not a required item on all shipments). How much radiation was released will never be known. NAC notified NRC of the event five days after it occurred, but NRC took no action.

The problem of high surface contamination continued. In June of 1981, shipments arrived at La Crosse, Wis. with radiation levels 90 times higher than the legal limit (Aspin, 1981). Rather than stop the shipments, NRC allowed them to continue, merely *containing the cask in a large plastic bag*. When the shipments were completed, however, the NRC directed the La Crosse officials to hold the cask until it could be cleaned up to NRC specifications (NRC, 1981h). Unfortunately, the La Crosse officials did not warn their technicians about the cask and several were contaminated when they handled it without gloves (NRC, 1981i).

The problem was now so severe that the NRC issued an order on July 22, 1981 pulling the cask off the road until further notice (NRC,

*Calculation based on (NRC, 1981d) and comparison to Cobalt-60 content in accident studied in (NRC, 1980e).

1981j), just as Congressman Les Aspin of Wisconsin was about to demand suspension of *all* irradiated fuel shipments. The NRC order noted that between August 1980 and July 1981 the cask had exhibited excess surface contamination seven times and released some of it in transit (NRC, 1981j).

Four of the original seven NAC-1 casks have now been put out of action. One (NAC-1D) remains, limited to the transportation of older, cooler fuel, while only two, the NAC-1E and NAC-1B, are in full service. The NAC-1 cask had been the "workhorse" of irradiated fuel transport by truck. The loss of these casks reduced the available capacity for moving commercially generated irradiated fuel by truck in the U.S. by over 50 percent.