Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

April 23, 1979

Director of Operating Reactors
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Dresden Station Units 2 and 3
Quad Cities Station Units 1 and 2
Response to request for additional information on Inter-Station Transfer of Spent Fuel
NRC Docket Nos. 50-237/249 and 50-254/265

Dear Sir:

Attachment 1 to this letter provides information in reply to a verbal request of the NRC Staff.

The information contained deals with the Transnuclear, Inc. TN-9 shipping cask. The TN-9 cask is the most likely cask to be used for shipping of fuel. However, Commonwealth Edison has availability to four types of licensed casks for both rail and truck shipping and anticipates that it could use any one of these. The four types of cask are the Transnuclear, Inc. TN-9 truck/rail cask with a capacity of 7 BWR assemblies, the General Electric IF-300 truck/rail cask with a capacity of 18 BWR assemblies, the Nuclear Assurance Corporation NAC-1 (NFS-4) truck cask with a capacity of 22 BWR assemblies or the National Lead NL-1024 rail cask with a capacity of 24 BWR assemblies. All four casks are licensed and as such meet the requirements under 10CFR71, WASH-1238 and NUREG 0170.

Commonwealth Edison in reviewing the TN-9 cask information and the requirements for licensing has concluded that the impact from shipping with any licensed cask will be negligible.

Please address any questions you may have concerning this matter to this office.

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One (1) signed original and fifty-nine (59) copies of this transmittal are provided for your use.

Very truly yours,

Robert F. Janecek

Robert F. Janecek
Nuclear Licensing Administrator
Boiling Water Reactors

Commonwealth Edison Company
NRC Docket Nos. 50-237/249 and 50-254/265

Attachment 1

Additional Information Concerning

Inter-Station Transfer of Spent Fuel

Dresden Units 2 & 3, Quad Cities Units 1 & 2

Truck Casks For Shipment of Fuel

It is intended to use a TN-9 cask, owned by Commonwealth Edison, for transhipment of fuel between the Dresden and Quad Cities Stations. The TN-9 cask, manufactured by Transnuclear, Inc., is an air cooled lead, steel and resin shielded shipping cask weighing approximately 34,500 Kg. (2) The cask approximates a right circular cylinder 1735 MM in diameter and 5757 MM long. The cavity is 474 MM in diameter by 4520 MM long providing capacity for 7 BWR assemblies. The main shielding consists of 105 MM of lead, 26 MM of steel and 150 MM of resin. A wet cement layer is located between the lead and the outer shell. Radial copper cooling fins are welded to the outer shell and cover the surface of the cask between each end drum.

The lid is a welded stainless stell shell containing lead and resin shields. The pressure vessel is closed and sealed by sixteen (16) 1-¼ inch diameter bolts and two O-rings located within recessed grooves on the top flange. Each extremity of the cask is surrounded by circular stainless steel drums reinforced by radial gusset plates and filled with balsa wood. A disc shaped impact limiter constructed of carbon steel and balsa wood, is fastened to each drum with eight (8) 1-¼ inch bolts. The vent and drain lines which penetrate the inner cavity are equipped with positive closures. In addition, all access ports are protected by the impact limiters.

Heat rejection is by convention through the air coolant in the cavity to the inner wall, conduction to the neutron shield and copper cooling fins, and convection plus radiation to the atmosphere. Maximum decay heat load is 24.4 kilowatts and 3.5 kilowatts per assembly. Maximum design conditions for the inner cavity during normal transport are 307°C (585°F) and an internal pressure of 2.2 atm (32.3 psig). The primary cavity is designed to withstand temperature and pressure conditions of 451°C (844°F) and 2.6 atm (38.2 psig) under the fire accident condition (½ hr. at a temperature of 802°C (1475°F)).

The TN-9 cask intended to be used to transport Dresden and Quad Cities Stations spent fuel meets the Commission's requirements as set forth in 10CFR Part 71. The NRC certificate of compliance is 9016.

SABOTAGE OF SPENT FUEL

Transport

Spent fuel in transit is considered to be neither an attractive nor a practical target for sabotage and is specifically exempt from the physical protection requirements of 10CFR Part 73. Massive, durable containers (casks) weighing 25 to 100 tons are used for transport of the spent fuel assemblies.

Criminal acts involving the intentional opening of these packages would require an appreciable amount of time, elaborate planning, shielding and handling facilities. Spent fuel cask covers cannot be removed by hand because of their bulk and weight. Overhead cranes would have to be employed for the uprighting of the cask (which in itself is a difficult operation) and the removal of the cover which would have to be performed remotely, usually underwater, because of the high radiation levels experienced upon opening the cask.

The design features that enable the shipping container to withstand severe transportation accidents (e.g., multiplicity of heavy steel shells, thick dense shields, and neutron-absorbing jackets) also enable the containers to withstand attack by small arms fire and other small scale attacks. Based on the results to date of studies and tests conducted on obsolete fuel casks and scale models, it has been concluded that the worst case damage and subsequent radioactive release might be caused by large amounts of high expolsives, expertly employed.* In one test conducted on an obsolete cask, a several thousand pound charge was detonated immediately adjacent to the cask. Although the cask was severely deformed, it was determined that no radioactive release would have occurred. Other tests were conducted using fixed position shape charges, platter charges and saddle charges. The results indicated that it was essentially impossible to rupture the cask on a large scale. However, it was demonstrated that with sufficient quantities of certain explosives, expert knowledge and proper design and placement of the charge, a hole could be blown completely through the cask releasing the radioactive gases (krypton) and a portion of the solid and volatile invendory. These tests indicated that the practical limit of solid inventory released to the atmosphere in the form of a respirable aerosol would be approximately 1%. Other tests and calculations show that less than 1% of the volatile inventory (primarily cesium) would be vented out and only after the cavity temperature exceeded 1000°F.**

The potential radiological consequences stemming from such an occurence have been analyzed and are discussed in the NRC Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes (NUREG-0170). The results presented in the referenced FES are based on an environment generally applicable to the area along the proposed routing, and movements of spent fuel by road and rail. The specific case chosen for analysis involved sabotage of overweitht truck shipment containing 3 PWR elements and an assumed population density of 2000 people per square mile.*** The staff has determined based on the great difficulties associated with a successful sabotage of spent fuel in transit resulting in a significant radiological release, that the risks are sufficiently small as to constitute no major adverse impact on the environment.(3)

* The tests have included high-speed impacts by trains and trucks, free drops from aircraft and large-scale explosive attacks.

** It has been estimated that under very severe accident conditions involving loss of primary coolant and rupture of 50% of the fuel rods, less than 0.01% of the cesium inventory and none of the tellurium would be vented to the environment. The cesium release associated with sabotage would be a factor of two higher (since rupture of 100% of the fuel rods is assumed), but in no case more than the 0.6% of the cask inventory of cesium that is present in the void space.(1)

*** An interim report prepared by Sandia Laboratories, "Transport of Radionuclides in Urban Environs: A Working Draft Assessment" (Sand 77-1927) considers the consequences of sabotage in urban areas having a high population density. This report has not yet been accredited by the NRC.

Radiological Impacts on Drivers

On each 260 km (160 mi) trip, two drivers would probably not spend more than 5 hours in the truck cab. In addition, about 1 hour would be spent outside the truck visually checking safety-related items, at an average distance of 1 m (3 ft.) from the cask. Based on DOT Regulations, radiation levels 2 m (6 ft.) from the package will not exceed 10 mrem/hr. Although a radiation level of 2 mrem/hr is permitted in a truck cab, the level based on actual experience is unlikely to exceed 0.2 mrem/hr, owing to the distance from the cask and shielding provided by intervening material.[1] Under these conditions, each truck driver could receive about 26 mrem during each shipment. Shipping a total of 509 Dresden spent fuel elements to Quad Cities would result in a cumulative exposure to the drivers of about 4 man-rem. This cumulative exposure would be distributed among several drivers. Operating experience has indicated that the calculations tend to overestimate actual cumulative exposure.[1]

Radiological Impacts on the Public

Members of the general public are excluded from loading and unloading operations, but some exposures might occur at enroute truck stops. A member of the general public who spends 3 min. at an average distance of 1 m (3 ft.) from the cask might receive a dose of 1.3 mrem. If 10 persons, on the average, were exposed during each shipment, the cumulative dose to such onlookers for 73 shipments would be about 1 man-rem.

Approximately 34,000 persons (who live within 0.8 km (.5 mi) of the route over which Dresden spent fuel will be transported) might receive a cumulative dose of about 0.013 man-rem from 73 shipments, which is equivalent to 0.0002% of the dose received annually from naturally occurring sources. The maximum individual (defined as a person who is 30 m (100 ft.).[1] from the roadway as each of the 73 shipments pass) would receive a dose of 0.0045 mrem from the 73 shipments, which is equivalent to 0.0025% of the dose received annually from naturally occurring sources.

The dose rate of 10 mrem/hr at 2 m (6 ft.) from the vehicle was used to calculate the integrated dose to persons in an area between 30 m (100ft.) and 800 m (2600 ft.) on both sides of the shipping route.[1] It was assumed the shipment would travel the 260 km (160 mi) in 6 hours. The average population density along the route (1980 estimate) was calculated to be 81 persons/km^2 (210 persons/mi^2) based on demographic data from the Quad Cities Nuclear Station and Dresden Nuclear Station Environmental Impact Statements and Final Safety Analysis Reports.

Two additional considerations for exposure of the public in non-accident situations involve 1) a traffic jam holding the truck and associated cask in a congested area for up to 3 hours, and 2) a vehicle closely following the cask over a major portion of the route.

Assuming a traffic jam occurs in an area with a population of 104 persons per square mile, uniformly distributed, and the truck remains in the same location for 3 hours, the population dose would be less than 0.2 man-rem and the maximum exposed individual 3 m from the cask would receive 15 mrem. The regulation limit of 10 mrem/hour at 2 m from the vehicle was used to calculate the above doses.

If a car is assumed to travel directly behind the truck carrying the cask for four hours at a distance of 30 m (100 ft.). The dose is calculated to be 0.16 mrem to each occupant. This dose is less than 0.2% of the annual dose received from naturally occurring sources. If the same individual were to follow each of the 73 shipments at the same separation distance, the total dose would be 12 mrem.

Nonradiological Impacts of Transportation

The quantity of heat released to the environment from the transport of Dresden spent fuel assemblies would be small. A 150-day-old fuel assembly generates on the average 6.5 MJ per hour (6.2×10^3 BTU/Hr) of excess heat. A TN-9 cask can accommodate fuel assemblies with a minimum of 150 days cooling time. Fully loaded with 7 BWR assemblies 45.5 MJ (4.3×10^4 BTU/Hr.) of excess heat would be generated and dissipated to the atmosphere. If the average speed of the truck transporting seven 150-day-old fuel assemblies were 50 km/hr (30mph), approximately 1.5 MJ/Mi (1430 BTU/mi) of excess heat would be dissipated. This release would amount to an addition of about 24% to the environmental heat load, produced by the estimated 6.3 MJ/mi (6,000 BTU/mi) of waste heat from the truck engine. The truck estimate is based on a 100-horsepower engine.(1) The heat that would be released to the environment as a result of transport of fuel assemblies is not considered to be significant when compared to heat generated by other traffic.

ALTERNATIVES CONSIDERED

The following is a list of alternatives to the proposed action of storing Dresden spent fuel at Quad Cities:

- shipment of spent fuel to a reprocessing facility
- construction of an independent spent fuel storage installation by the applicant
- expansion of Dresden spent fuel storage capacity
- The alternative of no action

These alternatives are discussed in the following sections.

SHIPMENT OF SPENT FUEL TO A REPROCESSING FACILITY

On April 7, 1977, President Carter issued a policy statement concerning commercial reprocessing of spent nuclear fuel. On October 18, 1977, the Department of Energy accepted ultimate responsibility for storing spent nuclear fuel. On December 23, 1977, the Commission made the decision to defer hearings on the Generic Environmental Impact Statement on the Use of Mixed Oxide Fuels in Light Water Cooled Reactors (GESMO). These actions stopped indefinitely progress toward reprocessing of spent nuclear fuel. While these events occurred after the decisions to cease operation of the Nuclear Fuel Services Facility and Midwest Fuel Recovery Plant, they have affected licensing actions at the Allied General Nuclear Services, Barnwell Facility, and progress toward development of reprocessing facilities in general.

The first of these facilities, the Nuclear Fuel Services (NFS) plant at West Valley, New York, was shut down in 1972 for alterations and expansions; on September 22, 1976, NFS informed the Commission that it was withdrawing from the nuclear fuel reprocessing business. Although not licensed for reprocessing fuel, the storage pool at West Valley, New York, (on land owned by the state of New York and leased to NFS through 1980) is licensed to store spent fuel. The storage pool at West Valley is not full, but NFS is presently not accepting any additional spent fuel for commercial storage.

The General Electric Company's (GE) Midwest Fuel Recovery Plant in Morris, Illinois, now referred to as Morris Operation (MO), is in a decommissioned condition. General Electric is primarily operating the MO facility to store either fuel owned by GE (which had been leased to utilities on an energy basis) or fuel that GE had previously contracted to reprocess. Present GE policy is not to accept spent fuel for storage, except fuel for which GE has a previous commitment. General Electric has applied for an amendment to its license to allow expansion of spent fuel storage at MO from 750 to 1850 metric tons. Possible use of these expanded facilities (which would take years to complete) to store Dresden fuel would not meet the needs of Commonwealth Edison Company.

Construction of the AGNS Barnwell Fuel Receiving and Storage Station (FRSS) has been completed. Concurrent with the review of the licensing action relating to the fuel reprocessing facility, AGNS had applied for a license to receive and store irradiated fuel assemblies in the storage pool at Barnwell.

Review of this licensing action has been stopped as a result of the postponement of proceedings for the FRSS hearing. AGNS does not consider continuing this action to be an economically prudent risk at this time. Shipping spent fuel to AGNS is, therefore, not presently possible and is not a sufficiently dependable option for the applicant to rely upon.

CONSTRUCTION OF AN INDEPENDENT SPENT FUEL STORAGE INSTALLATION BY THE APPLICANT

Construction of such an installation was considered by the applicant as an alternative to the proposed action. These facilities could probably be built at Dresden Nuclear Station and Quad Cities Nuclear Station. Spent fuel could not be received at the ISFI's until 1984 because it takes approximately 5 years for approval and completion of an ISFSI. This estimate assumes 1 year for preliminary design; 1 year for preparation of the license application environmental report, and licensing review in parallel with 1 year for detail design; and 2 ½ years for plant construction, equipment testing, and startup. The earliest an ISFSI could be built by the applicant is 1984; well beyond the date when storage shortage at Dresden will cause loss of full core discharge capability. In addition, both the environmental impacts and economic costs of such a project are greater than transshipping the spent fuel between Dresden and Quad Cities.

Therefore, while this option would meet the future need for spent fuel storage, it would not aid in solving the immediate problem.

Expansion of Dresden and Quad Cities Storage Capacity

Commonwealth Edison Company currently has a licensing application pending for the installation of high density neutron absorbing racks at Dresden. The Company is considering applying for a license to install similar racks at Quad Cities. Once installed, such absorber racks would postpone loss of full core discharge capacity at Dresden and Quad Cities until approximately the late 1990's. The Attorney General of the State of Illinois has intervened in the NRC licensing proceedings in opposition to Commonwealth Edison's absorber rack proposal. It now appears that contested hearings will be necessary prior to issuance of the requested license.

Because there is no certainty that licenses for absorber racks can be obtained from the NRC, and because the duration of contested hearings involving these absorber rack applications is uncertain, Commonwealth Edison believes it is prudent to pursue both the options of transshipment and absorber racks at this time.

The Alternative of No Action

If the licenses requested in these proceedings are not granted and no other action is taken to ensure adequate spent fuel storage capacity for Dresden and Quad Cities, the Company and its ratepayers risk substantial economic penalties due to unnecessarily lengthened shut downs of these nuclear stations.

Replacement power from Commonwealth's fossil fuel plants for either of the larger units at Dresden and for either of the units at Quad Cities averages about $175,000 per day, assuming that power is available. If replacement power is purchased outside the Commonwealth Edison Company system, such costs can be even greater. Therefore, minimizing any periods of time during which Dresden and Quad Cities are shut down for repairs, maintenance, or refueling is very important.

If no action is taken to alleviate the spent fuel storage situation, Dresden Units 2 and 3 will lose full core discharge capability in 1979 and 1980, respectively. Quad Cities will not lose full core discharge capability until 1983.[1] Loss of full core discharge capability is not a safety concern, because nuclear reactors are designed to shut down and safely store the fuel in their cores for indefinite periods of time. Nevertheless, unless a reactor can discharge its full core of fuel, repairs and maintenance on reactor internals cannot be carried out, and if these become necessary the reactor must shut down and remain in that condition until sufficient discharge space becomes available. Moreover, it has been determined at Dresden and Quad Cities that for some refueling operations, involving control rod drive work and fuel sipping it is economical to discharge the entire core because this saves time. Therefore is is economically prudent for Commonwealth to maintain full core discharge capability at each of its nuclear units as long as possible.

By shipping 509 Dresden spent fuel assemblies to Quad Cities, full core discharge capability at each of the Dresden units could be prolonged approximately three years.[2] Storage of these Dresden assemblies at Quad Cities would bring loss of full core discharge capacity at that station closer by approximately one year, to September 1982. The proposed transshipment of Dresden spent fuel to Quad Cities would make the best use of total existing storage capacity for the two stations, because the risk of a prolonged outage at any individual unit due to lack of full core discharge capacity would be minimized.

1/ The dates given in this discussion for Quad Cities assume that the interim racks for which Commonwealth Edison already has authority will be installed in the storage pools. These interim racks, which do not contain neutron absorbing materials, have already been installed at Dresden but may not be installed at Quad Cities if a license for absorber racks is issued in a timely fashion.

2/ Until 1983, space could be made for the discharge of one full core (724 assemblies) from either of the larger units at Dresden by shifting the stored spent fuel assemblies among the three Dresden storage pools. However, on the average only 12 fuel assemblies can be moved in this fashion per day, and thus any unscheduled outage could be prolonged by weeks, if not months, while this was done. Therefore shifting stored assemblies among the three Dresden pools after unscheduled outages occur is not an acceptable substitute for the proposed inter-station transfer, which maintains full core discharge capacity at each reactor pool.

SUMMARY

Based on the need for storage of Dresden fuel, the most viable action is shipment of Dresden fuel to Quad Cities for storage. The bases for this conclusion are:

- Spent fuel storage at reprocessing facilities, is not possible at present

- Construction of an ISFSI by the applicant would require a minimum of 5 years and would offer no solution to the short-term problem.

Due to the licensing environment and outside intervention it is prudent for Commonwealth Edison to pursue both expansion and transshipment as temporary solutions to short-term spent fuel storage problems.

-Ceasing reactor operations would result in an unacceptable economic penalty due to the cost of replacement power and plant maintenance. Transshipment minimizes the risk of this occurring by maximizing spent fuel storage capacity at Dresden and Quad Cities.

COST - BENEFIT BALANCE

Alternative	Cost	Benefit
Reprocessing of Spent Fuel	-----	None. This alternative is not available now or in the forseeable future due to administrative policy.
Construction of an independent spent fuel storage installation by Commonwealth Edison 10 Core Facility-Dresden 10 Core Facility-Quad Cities	Estimated to be \$10,500/assembly	Continued operation of Dresden 1, 2 & 3 and Quad Cities 1 & 2 and production of electrical energy. This option is not available for at least 5 years, and will not preserve full core discharge capacity in this interim.
Expansion of storage capacity of Dresden and Quad Cities spent fuel storage pools.	\$1200/assembly Exposure of 100 man-rem	Continued operation of Dresden 1, 2 & 3 and Quad Cities 1 & 2 and production of electrical energy. Licensing approval is pending for Dresden 2 & 3, but may be delayed or rejected in contested licensing proceedings.
Reactor Shutdown	$\$10^8$/year	Possible reduction in site specific invironmental impacts at Dresden and Quad Cities. Possibly increased environmental impacts at other locations as fossil units generate replacement power.
Storage at other nuclear stations owned by Commonwealth Edison	\$2000/assembly for shipping	Continued operation of Dresden 1, 2 & 3 and Quad Cities 1 & 2 and production of electrical energy. This option allows 1 FCDC at each station until at least late 1982.

REFERENCES

1. Atomic Energy Commission, Environmental Survey of Transportation of Radioactive Materials to and From Nuclear Power Plants. WASH 1238,

2. Transnuclear, Inc., Safety Analysis Report TN 8/9 Vol. I and II, and Certificate of Compliance 9016.

3. U.S. Nuclear Regulatory Commission, Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes. NUREG-0170, Docket No. PR-71, 73 (40 FR 23768), December 1977.