TESTIMONY OF

SCOTT C. PEDIGO

RELATED TO

CONTROL OF HEAVY LOADS

AT

DRESDEN NUCLEAR POWER STATION

May 4, 1981

A. BACKGROUND

My name is Scott C. Pedigo and I am employed by Commonwealth Edison Company at the Dresden Nuclear Power Station near Morris, Illinois. I received a Bachelor of Science degree in Nuclear Engineering from Purdue University in 1979. This course of study included courses in mechanical engineering, strength of materials, and physics. From May 1979 to December 1979 I took part in Commonwealth Edison's Graduate Development Program, the purpose of which is to become familiar with various aspects of the Company's operations. From January 1980 until the present I have been assigned to the Technical Staff of Dresden Nuclear Station as a member of the Special Projects Group. My responsibilities involve following modifications to the plant and I am cognizant engineer at the Station for the spent fuel pool modification. In response to the Board's Question No. 2, I have reviewed NUREG-0612 and the crane handling system at Dresden Station Units 2 and 3 which will be used for the proposed reracking operation. As a result of my training and work experience and this review I believe I am qualified to answer Board Question No. 2 with respect to spent fuel pool modification of heavy loads at Dresden Station Units 2 and 3.

B. INTRODUCTION

The Nuclear Regulatory Commission has identified the handling of heavy loads at nuclear power plants as a generic safety issue. The principal concerns are the possible effect of dropping a heavy object onto spent fuel, either in the spent fuel pool or in the reactor (with a resultant airborne radioactive release or criticality) or onto equipment needed for safe shutdown of the reactor. The NRC has completed its review of load handling operations at nuclear power plants and issued the results of this review as NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants - Resolution of TAP A-36." As stated in the Affidavit of Karl Kniel, this unresolved generic safety issue has been technically resolved by NUREG-0612. NUREG-0612 and accompanying NRC Staff letters to "ALL LICENSEES" dated December 22, 1980 and February 3, 1981 contain interim and long-term recommendations to be implemented by all licensees and applicants to ensure the safe handling of heavy loads.

C. APPLICABILITY TO MODIFICATION

In the generic issue of heavy load handling, certain areas of concern are indeed relevant to the spent fuel pool modification. The movement of racks in close proximity to spent fuel necessitates that precautions be taken to minimize the potential for damaging the fuel. Certain guidelines in

NUREG-0612 that deal with heavy load handling in a general sense (such as those for crane maintenance, operator training, etc.) are applicable for all heavy load handling operations, including the spent fuel pool modification, while others that deal with specific equipment or loads unrelated to the spent fuel pool modification (such as separate procedures for handling loads in reactor buildings at PWR's and in turbine buildings at PWR's and BWR's) are not applicable.

Edison will, of course, comply with the interim and long-term requirements of NUREG-0612 (which will be further discussed in the following sections) and is, in fact, in substantial compliance already. The prepared testimony of Terry Pickens, which was submitted to the Licensing Board at the hearings in this case in November, summarizes the previous reviews of heavy load operations which have been carried out at Dresden Units 2 and 3 (Pickens, prepared testimony at pp. 23-26, following Tr. 94). As stated in Mr. Pickens' testimony the Dresden reactor building overhead crane handling system already meets the requirements of NUREG-0554, "Single Failure Proof Cranes for Nuclear Power Plants." The NRC Staff's testimony confirms this. (Wohl, supplemental testimony at p. 2; Wohl, Tr. 674-677; NRC Staff Ex. 1, Safety Evaluations at p. 10, Environmental Impact Appraisal at pp. 8-9.)

D. MEETING SPECIFIC GUIDELINES OF NUREG-0612

INTERIM ACTIONS: NUREG-0612 and the accompanying letters from the NRC Staff dated December 22, 1980 and February 3, 1981 require all the licensees to take certain interim actions by May 15, 1981. These interim actions require the definition of safe load paths, implementing heavy load handling procedures, training crane operators, and inspection, testing, and maintenance of cranes. In addition, a review of handling of loads over the reactor core is required. Dresden Station Units 2 and 3 meet these interim requirements insofar as they relate to the proposed spent fuel pool modification as follows:

1. Safe Load Paths

Safe load paths for re-racking operation will vary as the installation progresses and fuel is shuffled in the pool. Painting the floor for this modification is not a viable precaution; however, paths can and will be marked with tape to show the crane operator where to bring a rack over the side of the pool. Racks will not be carried over spent fuel at any time.

2. Procedures

Special procedures will be written to govern load handling operations for the re-racking operation. Some approved procedures already exist, such as those for uprighting and unloading a high density rack from its sling (for example, upon receipt at the Station) and for removing old racks from the pool. The procedure

for setting the high density racks into the pool will be written and approved by the Station prior to the re-racking operation.

3. Crane Operator Training

A special training course for crane operators is already in use at the Station which meets all of the applicable standards except one--in the past, a written or oral exam has not been required. This will be instituted prior to the start of the re-racking operation.

4. Inspection, Testing and Maintenance

All applicable standards in these areas are already being met.

5. The review of handling of loads over the core does not relate to the proposed spent fuel pool reracking. This review is underway at the Dresden Station in accordance with the NRC Staff's request.

LONG-TERM REQUIREMENTS: NUREG-0612 and the NRC Staff letters dated December 22, 1980 and February 3, 1981 also require all licensees to take certain long-term actions to improve the safety of heavy load handling operations at their respective facilities. In general, these long-term guidelines can be satisfied by ensuring that the potential for heavy load drops is extremely small or by ensuring by analysis that the consequences of various load

drops are acceptable--that is, certain criteria are satisfied (such as K effective less than or equal to .95 in the spent fuel pool). Commonwealth Edison has elected to pursue the first option, by establishing that its heavy load handling system at Dresden Units 2 and 3 complies with the long-term requirements of NUREG-0612. The long-term guidelines basically relate to three different areas:

1. The crane should be designed, inspected and maintained in accordance with applicable standards (Ch. 2-1 ANSI B30.2-1976 and CMAA-70, and Ch. 2-2 ANSI B30.2-1976).

2. Lifting devices must satisfy applicable ANSI Standards (ANSI B30.9-1971, "Slings").

3. Special lift devices must satisfy applicable ANSI Standards (ANSI N14.16-1978).

Dresden Station Units 2 and 3 will comply with these long-term requirements for purposes of the spent fuel pool modification as follows:

1. The 125 ton overhead crane on the refueling floor which will be used to move racks during the proposed spent fuel pool modification has already been reviewed by the NRC Staff in 1976 and found to meet NUREG-0554, "Single Failure Proof Cranes for Nuclear Power Plants." (It should be noted that although crane handling systems meeting these NRC requirements are commonly referred to as "Single Failure Proof", in

fact, some components, such as the main hook, need not be redundant. The reason this is acceptable is that because of their high safety factors and frequent inspection and maintenance these components have a very small likelihood of failure.

2. A study is underway at Dresden Station to determine if the rigging being used at this time meets the requirements set forth in NUREG-0612. For a lifting device not designed for a specific load the applicable requirement is that there be a safety factor of 10 (for ultimate strength) for non-redundant rigging such as that used at Dresden. Dresden Station will employ rigging which meets this long-term requirement in the proposed spent fuel pool modification.

3. A special lift device will be used in the proposed reracking operation as an interface between the proposed racks and the rest of the rigging. The design of this special lift device has been reviewed to verify that it meets ANSI Standard N14.6-1978, which calls for safety factors of 3 (for yield strength) and 5 (for ultimate strength). In computing these safety factors, NUREG-0612 directs that the dynamic load as well as the static load be considered. The special lifting device can withstand a load of approximately 72000 lb_f[1/] before yielding. (Yielding

1/ lb_f = pound force. 1 lb_f = 1 $\frac{slug\ ft}{sec^2}$ = 32.2 $\frac{lb_m\ ft}{sec^2}$ lb_m = pound mass. 1 g = 32.2 $\frac{ft}{sec^2}$ = acceleration at earth's surface due to gravity.

in this sense does not mean failure, but rather a limited inelastic deformation, or stretching of the members.) The maximum static plus dynamic load that the device can be subjected to, to maintain a safety factor of 3 for yield strength, is one-third of the yield load or 24000 lb_f. The special lift device can withstand a load of approximately 101000 lb_f before exceeding its ultimate strength. The maximum static plus dynamic load allowed while maintaining a safety factor of 5 for the ultimate strength is one-fifth of this, or about 20,200 lb_f. The ultimate strength, then is the limiting factor in meeting this NUREG-0612 requirement. Subtracting the static load which is the weight of a rack, 18000 lb_f, leaves 2200 lb_f for the allowable dynamic load. The actual dynamic load incurred will depend on the acceleration that the rack is subjected to. The maximum allowable acceleration is approximately .12 g, calculated as follows:

$$2200\ lb_f = 70840\ \frac{lb_m ft}{sec^2};$$

$$\text{acceleration} = 70840\ \frac{lb_m ft}{sec^2} \div \text{mass of rack } (= 18000\ lb_m)$$

$$= 3.9\ \frac{ft}{sec^2} = .121\ g.$$

The design of the crane precludes such a relatively large acceleration. An experiment was conducted at Dresden Station in which a dynamometer measured the

dynamic force produced by the reactor building overhead crane lifting an 1100 pound weight. The crane's lifting speed was set on "fast" (which appears extremely slow to the naked eye) and the crane operator was trying to jerk the load. The maximum dynamic force measured was less than 10 pounds, or less than .01 g. Therefore, the special lifting device clearly meets the requirements of NUREG-0612.

E. CONCLUSION

Based on my review of the use and maintenance of the 125 ton reactor building crane at Dresden and of the proposed reracking operation, I conclude that the objectives of NUREG-0612 will be satisfied for the spent fuel pool modification and that the proposed reracking operation will be carried out safely.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket Nos. 50-237-SP
COMMONWEALTH EDISON COMPANY	)	50-249-SP
	)	(Spent Fuel Pool
(Dresden Station, Units 2 & 3))		Modification)

STATE OF ILLINOIS)
) SS.
COUNTY OF C O O K)

AFFIDAVIT OF SCOTT C. PEDIGO

I, Scott C. Pedigo, being first duly sworn on oath, state that the attached testimony is true and correct to the best of my knowledge and belief.

Scott C. Pedigo
Scott C. Pedigo

SUBSCRIBED AND SWORN TO
before me this 14th day
of May, 1981.

Notary Public