(DRAFT)

TECHNICAL EVALUATION REPORT

CONTROL OF HEAVY LOADS — PHASE II

COMMONWEALTH EDISON COMPANY

DRESDEN NUCLEAR POWER STATION UNITS 2 AND 3

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FOREWORD

This Technical Evaluation Report was prepared by Franklin Research Center under a contract with the U.S. Nuclear Regulatory Commission (Office of Nuclear Reactor Regulation, Division of Operating Reactors) for technical assistance in support of NRC operating reactor licensing actions. The technical evaluation was conducted in accordance with criteria established by the NRC.

Mr. I. H. Sargent contributed to the technical preparation of this report through a subcontract with WESTEC Services, Inc.

1. INTRODUCTION

1.1 PURPOSE

This technical evaluation report documents a review of load handling equipment operated in the vicinity of spent fuel and equipment employed for reactor shutdown and fuel element decay heat removal at the Dresden Nuclear Power Station Units 2 and 3. This review constitutes the second phase of a two-phase review instituted to resolve a generic issue pertaining to the safe handling of heavy loads at nuclear power plants.

1.2 GENERIC BACKGROUND

Generic Technical Activity Task A-36 was established by the Nuclear Regulatory Commission (NRC) staff to systematically examine staff licensing criteria and the adequacy of measures in effect at operating nuclear power plants to ensure the safe handling of heavy loads and to recommend necessary changes in these measures. This activity was initiated by a letter issued by the NRC staff on May 17, 1978 [1] to all power reactor licensees, requesting information concerning the control of heavy loads near spent fuel.

The results of Task A-36 were reported in NUREG-0612 [2]. The staff concluded from this evaluation that existing measures to control the handling of heavy loads at operating plants provide protection from certain potential problems but do not adequately cover the major causes of load handling accidents and should be upgraded.

To upgrade measures for the control of heavy loads, the staff developed a series of guidelines to implement a two-part objective. The first part of the objective, to be achieved through the implementation of a set of general guidelines expressed in NUREG-0612, Section 5.1.1, was to ensure that all load handling systems at nuclear power plants have been designed and are operated so that their probability of failure is appropriately small for the critical tasks in which they are employed. The results of the reviews associated with this part of the staff's overall objective were provided in a series of technical evaluation reports identified as Phase I reports. The second part

of the staff's objective, and the subject of this report, was to be achieved through guidelines expressed in NUREG-0612, Sections 5.1.2 through 5.1.5. The purpose of these guidelines was to ensure that, in the case of specific load handling systems used in areas where their failure might result in significant consequences, either (1) features have been provided, in addition to those required for all load handling systems, to make the potential for a damaging load drop extremely small or (2) conservative evaluations of load handling accidents indicate that the potential consequences of a load drop are acceptably small.

1.3 PLANT-SPECIFIC BACKGROUND

On December 22, 1980, the NRC issued a letter [3] to Commonwealth Edison Company (CEC), the Licensee for Dresden Station, requesting the review of provisions for handling and control of heavy loads, the evaluation of these provisions with respect to the guidelines of NUREG-0612, and the provision of certain additional information to be used for an independent determination of conformance to these guidelines. The results of this independent evaluation with respect to general load handling equipment and procedures (Phase I) were provided on June 8, 1983 [4]. On September 22, 1981, CEC provided an initial Phase II report [5] concerning conformance with staff guidelines for specific load handling systems operated in areas where a load drop might result in significant consequences. This report was followed by further responses [6-9] on the same subject. The information in References 5 through 9 provided the basis for this technical evaluation report.

2. EVALUATION

This section presents an evaluation of critical load handling areas at Dresden Station Units 2 and 3. Separate subsections are provided to identify the criteria used in this evaluation and each of the plant areas considered. For each such area, relevant load handling systems are identified, Licensee provided information related to the evaluation criteria or proposed alternatives is summarized and evaluated, and a conclusion as to the extent of compliance, including recommended additional action or requirements for additional information, as appropriate, is provided.

2.1 EVALUATION CRITERIA

The objective of this review was to determine if plant arrangements and load handling equipment design were such that either the likelihood of a load handling accident that could damage spent fuel or equipment used in reactor shutdown or fuel element decay heat removal is extremely small or that the consequences of such damage, should it occur, will be acceptable. Guidance contained in NUREG-0612, Sections 5.1.2, 5.1.3, and 5.1.5 (for pressurized water reactors) and in 5.1.4 and 5.1.5 (for boiling water reactors) forms the basis for the conclusions reached in this section and is briefly summarized as follows.

For a determination that the likelihood of damage is extremely small:

- The design of the load handling system (i.e., crane or hoist and underhook lifting devices) is consistent with, or equivalent to, the NRC staff criteria for single-failure-proof cranes identified in NUREG-0554 [10], or

- The plant physical arrangement is such that a crane operated in the vicinity of spent fuel or safety-related equipment is prevented from traveling to a position from which a load drop can be expected to damage such equipment.

For a determination that the potential consequences of damage following a load drop will be acceptable:

- In the case of potential damage to spent fuel, calculations have been provided to demonstrate that potential radiological doses at the site

boundary will not exceed 25% of the limits specified in 10CFR100 and that the post-accident configuration of the fuel will not result in a K_{eff} larger than 0.95.

- In the case of damage to the reactor vessel or spent fuel pool, it can be demonstrated that this damage will be limited to the extent that the fuel will not become uncovered.

- In the case of damage to equipment or components employed for reactor shutdown or fuel element decay heat removal, it can be demonstrated that the safety-related function of the affected system will not be lost consequent to a load drop.

2.2 OVERHEAD HANDLING SYSTEMS

2.2.1 Summary of Licensee Statements and Conclusions

The Licensee identified [5] the following handling systems to be subject to the Phase II criteria of NUREG-0612:

Units 2 and 3 reactor building overhead crane
Unit 2 refuel floor hatchway jib crane
Unit 3 refuel floor hatchway jib crane
Unit 2 refuel platform hoist
Unit 3 refuel platform hoist
Units 2 and 3 new fuel storage vault jib crane
Unit 2 reactor building hatchway jib crane
Units 2 and 3 reactor service platform jib crane
Unit 2 turbine building overhead crane
Unit 3 turbine building overhead crane.

2.2.2 Evaluation and Conclusion

The Licensee's evaluation of load handling systems subject to compliance with Phase II of NUREG-0612 is consistent with the conclusions of Reference 4.

2.3 SPENT FUEL POOL AREA

2.3.1 Summary of Licensee Statements and Conclusions

The Licensee stated that the following cranes are capable of carrying loads over the spent fuel pool area:

Units 2 and 3 reactor building overhead crane
Units 2 and 3 refuel platform hoists
Units 2 and 3 new fuel storage vault jib crane.

The reactor building overhead crane handling system consists of an overhead bridge-type crane with a main hoist rated at 125 tons and an auxiliary hoist rated at 9 tons. The Licensee stated that the 125-ton main hoist meets the criteria of NUREG-0554, therefore qualifying as a single-failure-proof crane.

Significant safety features that characterize this system are as follows [11]:

- dual load paths to provide load retention
- minimized load motions in the event of a failure of any single hoist component
- built-in redundancy in hoist and brakes, the spent fuel cask lifting devices, and crane control components.

The Licensee stated that all crane parts equal or exceed design criteria as established by CMAA Specification 70 and are compatible with the requirements of ANSI B30.2.0. Additional design features are detailed by the Licensee in Reference 11. The Dresden FSAR [12] designates the overhead crane as Class II equipment and states that the crane will not derail in a design basis earthquake.

The heaviest load borne by the reactor building crane over the spent fuel pool is the spent fuel shipping cask, used for shipping spent fuel to offsite locations.

The Licensee performed an analysis based on a 100-ton cask load (the actual cask weighs about 85 tons) dropped from the maximum height that the cask could be raised above the pool. The results of this analysis showed that there would not be a catastrophic failure of the concrete floor (6 ft, 3 in thickness). The leakage rate through crack paths as a result of such an accident was deemed to be well within the limits of the sump capacity and normal makeup capability.

Although the main hook of the reactor building crane has been identified as single-failure-proof, there is no such statement regarding the 9-ton auxiliary hook. Indeed, the Licensee designated the reactor vessel and spent fuel pool as restricted areas for the 9-ton auxiliary hook [4, 13].

In adjacent areas, lifts are limited to 7 ft. The Licensee performed a 9-ton 7-ft load drop analysis to show that the refueling floor can survive such a drop without scabbing damage.

The Units 2 and 3 refuel platform hoists can be positioned for servicing the reactor cavity or the fuel storage pool. The Licensee stated [14] that although the capacity of these hoists is in excess of the weight of a single fuel assembly, neither of these hoists is used to lift or carry items heavier than a single fuel assembly.

The new fuel storage vault jib crane, also part of the refueling platform equipment, is used primarily for transferring new fuel to the storage pool prior to refueling. In this operation, entry into the storage pool is through side gates.

The Licensee stated [14] that although the capacity of this crane may be greater than the weight of a single fuel assembly, this crane does not carry any load greater than that of a single fuel assembly.

The Licensee stated [8] that its maintenance procedures prohibit handling of loads over fuel in the spent fuel pool or over the open reactor cavity when fuel is in the reactor unless a specific written procedure directs or permits such action. Rigging criteria are also included in the procedures.

The coverage of the reactor building overhead crane and that of the new fuel storage vault jib crane is shown on drawings submitted by the Licensee [13]. Coverage of the refuel platform hoists is not shown.

2.3.2 Evaluation

The main hook of the reactor building overhead crane has been identified as single-failure-proof, and is listed in Table 3.2-1 in NUREG-0612 as meeting single-failure-proof criteria.

The Licensee [15] provided a detailed account of the proposed modifications to this crane and the cask yoke assembly for compliance with single-failure-proof criteria. These are summarized briefly in Section 2.3.1. After the modifications were accomplished, the NRC [11] found them acceptable.

NUREG-0612 also requires that associated lifting devices meet single-failure-proof criteria. Table 3.1 (page 3-7) lists all the lifting devices associated with the main hook of the overhead crane. Compliance for these devices has been adequately documented. The Licensee [15] described the cask lifting yoke and showed a schematic layout of its redundancy features. The NRC [11] stated its acceptance. In the Phase I TER [4], it was concluded that the reactor head strongback, the moisture separator hook box, and the dryer/separator lifting rig are consistent with the intent of ANSI N14.6-1978 for special lifting devices; it further concluded that the remaining lifting devices (not specially designed) met the intent of ANSI B30.9-1971.

Thus, it is concluded that the Dresden overhead crane main hook, along with all associated lifting devices, meets the single-failure-proof criteria of NUREG-0612. However, NUREG-0612 also requires that all load attachment points conform to the single-failure-proof criteria of NUREG-0612 [2], Section 5.1.6 (3), (a) and (b) on interfacing lift points. The Licensee has not addressed the design capability of any of the attachment points of the loads listed in Table 3.1.

In addition, the NRC recently issued generic letter 83-42 [16], which provided an additional evaluation criterion not specifically stated in NUREG-0554. This letter notes that it will be the staff's policy to require a demonstration that no single failure in the crane electric power/control system will cause a load drop. This issue has not been addressed in available Dresden submittals.

The Licensee did not state that the auxiliary hook of the main reactor building crane met single-failure-proof criteria. From this non-statement, inferences from other Licensee statements, and from Reference 4, it is concluded that the 9-ton hook is not single-failure-proof.

The Licensee stated that the spent fuel pool is a restricted area for the 9-ton auxiliary hook. However, these restrictions appear to be by procedural control only, since no mention is made of any interlocks or mechanical stops. In view of the heavy loads carried by the hook (e.g., the 5.5-ton new fuel

storage vault blocks), the Licensee should provide more detailed information on the existence of interlocks or information which would lead to the conclusion that a drop into the spent fuel pool is impossible or highly inprobable, thus satisfying the intent of NUREG-0612, Section 5.1(1).

Crane movements in adjacent areas appear to be adequately covered. The Licensee performed a 9-ton load drop analysis from 7 ft showing no scabbing damage to the refueling floor. This ensures that there will be no damage to equipment located below the refueling floor. However, the Licensee should provide assurance that the Dresden procedures which limit 9-ton lifts to a height of 7 ft are properly implemented and enforceable.

Buildings 2 and 3 refuel platform hoists can be positioned to service the fuel storage pool. The refuel hoists are never used in lifting or carrying items heavier than a single fuel assembly [14].

Movements of the new fuel storage vault jib crane in fuel transfer operation make the likelihood of a drop over spent fuel extremely low. Further, the Licensee stated that the largest load carried by this crane is 680 lb [14]. However, the Licensee should provide assurance that this crane, as well as the refuel platform hoists, will not be used for loads heavier than a single fuel element (e.g., formally derating the hoist, revising the label plate, procedural warnings, etc).

2.3.3 Conclusion

The Dresden 125-ton main hook and associated lifting devices have been designated as single-failure-proof. However, the subjects of load attachment points and the power failure condition described in Section 2.3.2 have not been addressed by the Licensee.

The new fuel storage vault jib crane and the refuel platform hoists carry no loads heavier than a single fuel element. Thus, the operation of these cranes will be consistent with the staff's overall objectives concerning the reduction of risk associated with load handling as developed in NUREG-0612,

subject to assurance by the Licensee that the weight of a fuel element is the maximum load that these cranes handle.

The 9-ton auxiliary hook appears to be limited to areas outside of the spent fuel pool and to heights of 7 ft by procedural controls only. The Licensee should provide assurance that these procedures are properly implemented and enforceable.

2.4 REACTOR VESSEL AREA

2.4.1 Summary of Licensee Statements and Conclusions

From the information supplied by the Licensee, the following cranes are capable of carrying loads over the reactor vessel area:

Units 2 and 3 reactor building overhead crane
Units 2 and 3 refuel platform hoist
Units 2 and 3 new fuel storage vault jib crane
Units 2 and 3 reactor service platform jib crane.

The reactor building crane is used to hoist new fuel (brought in through the equipment entrance of the reactor building) to the new fuel vault serving Units 2 and 3 and located on the upper floor.

Prior to refueling, new fuel is transferred either by the reactor building crane or by the new fuel jib to the spent fuel pool and from there through the passage leading to the refueling cavity above the reactor vessel. This passage is equipped with two double-sealed gates to permit leak detection and repair in the event of leakage.

The refueling platform is equipped with a refueling grapple and two 1/2-ton auxiliary hoists [12] that are used for servicing the reactor cavity. The loading operation is performed by lowering one fuel assembly at a time into the reactor. The same equipment and the same procedures, in reverse, are used when assemblies are removed from the reactor and transported to the spent fuel storage pool.

An additional crane, the reactor service platform jib crane, which does not have access to the spent fuel pool, is used for necessary in-vessel repair or inspection [5].

The following Dresden procedures apply to crane movement over the reactor vessel and to refueling operations in general:

1. Heavy loads over the reactor vessel are prohibited unless a specific procedure has been written and approved [8].

2. All cranes involved in refueling operations are inspected and tested before commencement of that operation.

3. The refuel hoists are never used in lifting or carrying items heavier than a single fuel assembly.

The coverage areas of the reactor building overhead crane (main hook and auxiliary hook) and that of the new fuel storage vault jib crane are shown on drawings supplied by the Licensee [13]. Coverage areas for the refuel platform hoists and of the reactor service platform jib are not shown.

The design features of the main hook of the reactor building overhead crane have been briefly enumerated in Section 2.3.1 and in great detail in Reference 15.

The auxiliary 9-ton hook has coverage of the entire reactor building and carries miscellaneous loads, including hardware associated with new and spent fuel storage; however, it is not involved in refueling operations per se, and Dresden procedures designate the reactor vessel as a restricted area for this crane.

Although Reference 13 does not indicate any restricted areas for the new fuel storage vault jib crane, the crane's primary function appears to be the transfer of new fuel to the spent fuel storage pool, where entry is by a side gate. (This operation may also be performed by the reactor building 125-ton crane.)

The role of the refuel platform hoists in refueling operations has already been discussed.

Regarding the new fuel storage vault jib crane and the refuel platform hoists, the Licensee stated that although the capacity of each crane is greater than the weight of a single fuel assembly, these cranes never handle any load greater than the weight of a single fuel assembly.

As stated earlier, the reactor service platform crane is used for necessary in-vessel repair or inspection. The Licensee stated [5] that this crane may be removed from further consideration in view of the following:

1. core is completely unloaded during repairs
2. effective load movement procedures
3. low probability of crane-load failure.

2.4.2 Evaluation

The 125-ton main hook and associated lifting devices have been identified as single-failure-proof since they satisfy the evaluation criteria of NUREG-0612, Section 5.1 by qualifying under Section 5.1.6(1). However, the subjects of load attachment points and the power failure condition described in Section 2.3.2 have not been addressed by the Licensee.

For the 9-ton auxiliary hoist, the concern is similar to that in the spent fuel pool, area i.e., the area of the reactor vessel appears to be restricted by procedural control only, since there is no mention of interlocks or mechanical stops. In view of the heavy loads carried by this crane, the Licensee should provide assurance that these procedures are properly implemented and enforceable.

The new fuel storage vault jib crane is used primarily in the transfer of new fuel to the fuel storage pool. The Licensee stated that the heaviest load carried by the crane is 680 lb.

Operation of the reactor service platform crane is considered to be consistent with the staff's objective on the basis of Licensee statements regarding procedures during load movement and during reactor vessel repair. Also, Reference 4 concludes that the limited area covered by this crane is adequately controlled by procedures.

2.4.3 Conclusion

The Dresden 125-ton main hook and associated lifting devices have been designated as single-failure-proof. However, the subjects of load attachment

points and the power failure condition described in Section 2.3.2 have not been addressed by the Licensee.

The new fuel storage vault jib crane and the refuel platform hoists carry no loads heavier than a single fuel element. Thus, the operation of these cranes will be consistent with the staff's overall objectives concerning the reduction of risk associated with load handling as developed in NUREG-0612, subject to assurance by the Licensee that the weight of a fuel element is the maximum load that these cranes handle.

The 9-ton auxiliary hook appears to be limited to areas outside of the reactor vessel and to heights of 7 ft by procedural controls only. The Licensee should provide assurance that these procedures are properly implemented and enforceable.

2.5 OVERHEAD HANDLING SYSTEMS IN AREAS CONTAINING SAFE SHUTDOWN EQUIPMENT

2.5.1 Summary of Licensee Statements and Conclusions

The Licensee identified [14] the following overhead handling systems from which a load drop may result in damage to any system required for plant shutdown or decay heat removal.

Unit 2 and 3 Reactor Building:

Units 2 and 3 reactor building overhead crane (125-ton/9-ton)
Unit 2 refuel floor hatchway jib crane (2-ton)
Unit 3 refuel floor hatchway jib crane (2-ton)
Unit 2 refuel platform hoist (1/2-ton)
Unit 3 refuel platform hoist (1/2-ton)
Units 2 and 3 new fuel storage vault jib crane (1-ton)
Unit 2 reactor building hatchway jib crane, 545-ft el. (5-ton)
Units 2 and 3 reactor service platform jib crane (5-ton)

Units 2 and 3 Turbine Building:

Unit 2 turbine building overhead crane (125-ton/10-ton)
Unit 3 turbine building overhead crane (175-ton/25-ton).

The Licensee provided Table 1 [Table 2.3.2-1, Reference 5], a matrix of the above listed cranes, their location, elevation, loads carried, potential

impact area, safety-related equipment, and hazard elimination category. The Licensee also provided Table 2 [Table 3-1, Reference 14], a matrix of all cranes, identifying loads carried and approximate weights, lifting devices, and procedural controls.

The 125-ton main hook of the reactor building overhead crane has been discussed in earlier sections.

The 9-ton auxiliary hook can have an interaction with the standby liquid control system. The Licensee designated the hazard elimination category for this interaction as (d) (Table 1). This category is in compliance with NUREG-0612, Section 5.1.6 on single-failure-proof systems. However, as stated in Section 2.3, there is no clear-cut statement by the Licensee that the auxiliary hook is single-failure-proof.

The Units 2 and 3 refuel floor hatchway jib cranes and the Unit 2 hatchway jib crane cover very limited areas which are identified in Reference 13. The hazard areas are the 20 ft x 18 ft reactor building equipment hatches. The Licensee stated that there is a possibility of an interaction with the torus at a floor elevation of 476 ft 6 in. The Licensee also stated that heavy loads are rarely moved at these hatches while the reactors are in operation and that the probability of failure of the crane-load combination is very low [5]. Thus, the Licensee believes that these interactions should be removed from further consideration [5].

However, the hazard elimination category for all three cranes is given as (e) and (f). Category (e) suggests that an analysis has been performed to show that a load drop will not damage safety-related equipment, although no such analysis has been cited by the Licensee. The procedures governing load movements have been referenced in Table 2. Reference 18 states that the entire reactor building refueling floor area, except for the spent fuel pool and the reactor cavity, is considered a safe load path zone.

The Units 2 and 3 reactor service platform crane handles miscellaneous reactor vessel internals and is used for in-vessel repair or inspection [5]. Further, as stated by the Licensee, Dresden practice is to completely unload the core during repair work. Based upon the applicable load configuration and

Table 1. Heavy Load/Impact Area Matrix, Dresden Units 2 and 3

CRANE	LOCATION	ELEVATION	LOAD	HAZARD AREA	SAFETY RELATED EQUIPMENT	HAZARD ELIMINATION CATEGORY
Unit 2/3 overhead crane Main Hook	Reactor Building	613'-0"	Drywell Head	M-N/39-42	Isolation Condenser flr. el 589'	(d)
		613'-0"	Drywell Head	M-N/46-49	Isolation Condenser flr. el 589'	(d)
		613'-0"	IF 300 Fuel Cask	Fuel Storage pool	Spent Fuel pit	(d)
Auxiliary Hook	Reactor Building	613'-0"	Refuel Slot Plug	H-J/46-47 H-J/41-42	Standby Liquid Control System flr. el 589'	(d) (d)
Unit 2 Refuel Floor Hatchway Jib Crane	Reactor Building	613'-0"	2 ton	Equipment Hatch	Torus flr. el 476'-6"	(e) and (f)
Unit 2 Hatchway Jib Crane	Reactor Building	545'-6"	5 ton	Equipment Hatch	Torus flr. el 476'-6"	(e) and (f)
Unit 2/3 Reactor Service Platform Jib Crane	Reactor Building	613'-0"	5 ton	Reactor well	Reactor	(c) and (f)
Unit 3 Refuel Floor Hatchway Jib Crane	Reactor Building	613'-0"	2 ton	Equipment Hatch	Torus flr. el 476'-6"	(e) and (f)

Table 1 (Cont.)

CRANE	LOCATION	ELEVATION	LOAD	HAZARD AREA	SAFETY RELATED EQUIPMENT	HAZARD ELIMINATION CATEGORY
T.B. Unit 2 overhead crane	Turbine Building Unit 2 F-G/33-34	517'-6"	Turbine Rotor	Hatch/ Railroad tracks F-G/55-56 flr. el 517'-6"	Cable tunnel flr. el 502'-6"	(e) and (f)
T.B. Unit 3 overhead crane	Turbine Building Unit 3 F-G/55-56	517'-6"	Turbine Rotor	Hatch/ Railroad tracks F-G/33-34 flr. el 517'-6"	Cable tunnel flr. el 502-6"	(e) and (f)
T.B. Unit 2 Overhead Crane	Turbine Building Unit 2 F-G/44-45	560'-6"	Turbine Parts	Main Floor F-G/44-45 flr. el 560'-6"	Standby Gas Treatment System flr. el 534'	(f)
T.B. Unit 3 Overhead Crane	Turbine Building Unit 3 F-G/43-44	560'-6"	Turbine Parts	Main Floor F-G/43-44 flr. el 560'-6"	Standby Gas Treatment System flr. el 534'	(f)

Hazard Elimination Categories:

a. Crane travel for this area/load combination prohibited by electrical interlocks or mechanical stops.
b. System redundancy and separation precludes loss of capability of system to perform its safety-related function following this load drop in this area.
c. Site-specific considerations eliminate the need to consider load/equipment combination.
d. Likelihood of handling system failure for this load is extremely small (i.e., Section 5.1.6 of NUREG-0612 satisfied, Table 3.2-1).
e. Analysis demonstrates that crane failure and load drop will not damage safety-related equipment.
f. Station special procedures for heavy loads.

Table 2. Cranes and Hoists, Dresden Units 2 and 3

3-1.1 UNITS 2&3 REACTOR BUILDING CRANE MAIN HOOK (125 TON) (DRAWING MS-197, SHEET 3)

LOAD IDENTIFICATION	APPROX. WEIGHT	LIFTING DEVICE	PROCEDURAL CONTROL
DRYWELL SHIELD PLUGS	100 TONS	3 - 2 3/4" CABLES	DMP 5800-3
DRYWELL COVER	65 TONS	REACTOR HEAD LIFTING RIG	DMP 1600-4 DMP 1600-5
VESSEL HEAD INSULATION	6 TONS	REACTOR HEAD LIFTING RIG	DMP 200-17 DMP 200-18
DRYER SEPARATOR PIT BLOCKS	40 TONS	2 - 2 3/4" CABLES	DMP 5800-3
REACTOR VESSEL HEAD	100 TONS	REACTOR HEAD LIFTING RIG	DMP 200-17 DMP 200-18
STEAM DRYER	32 TONS	HOOK BOX, 4 - 2" CABLES, DRYER Separator LIFTING RIG	DMP 200-13 DMP 200-14
STEAM SEPARATOR	72 TONS	HOOK BOX, 4 - 2" CABLES, DRYER SEPARATOR LIFTING RIG	DMP 200-11 DMP 200-12
REFUELING "CATTLE CHUTE"	12 TONS	2 - 1 1/8" CABLES	DFP 800-11 DMP 800-3
FUEL CASK (IF-300)	100 TONS	REDUNDANT LIFTING YOKE	DFP 800-26
NEW HIGH-DENSITY FUEL RACKS	9 TONS	FUEL RACK SHIPPING RIG & 4 - 7/8" CABLES	DFP 800-19
MISC. EQUIPMENT	VARIES	AS REQUIRED	DMP 5800-3

Table 2 (Cont.)

3-1.2 UNITS 2&3 REACTOR BUILDING CRANE AUX HOOK (9TON) (DRAWING MS-197, SHEET 1)

LOAD IDENTIFICATION	APPROX. WEIGHT	LIFTING DEVICE	PROCEDURAL CONTROL
FUEL POOL GATES	2 1/2 TONS 2 TONS	2 - 7/16" CABLES	DFP 800-6
REFUEL SLOT PLUGS	7 TONS	1 - 1" CABLE	DMP 5800-3
SERVICE PLATFORM	5 TONS	1 - 1" CABLE, 2 - 3 TON CHAINFALL	DMP 800-4
LEAD SHIELDED IN-VESSEL WORK SKIFF	7 TONS	4 - 1" CABLES	DMP 5800-3
NEW FUEL STORAGE VAULT BLOCKS	5 1/2 TONS	4 - 5/8" CABLES	DMP 5800-3
REACTOR STUD BOX	1 3/4 TONS	1 - 1/2" CABLE (BASKET)	DMP 200-17 DMP 200-18
MISC. EQUIPMENT	VARIES	AS REQUIRED	DMP 5800-3

Table 2 (Cont.)

3-1.3 UNITS 2&3 TURBINE BUILDING MAIN/AUX CRANES (125/10 TON, 175/25 TON) (DRAWING MS-197, SHEET 4)

LOAD IDENTIFICATION	APPROX. WEIGHT	LIFTING DEVICE	PROCEDURAL CONTROL
LOW PRESSURE TURBINE INNER CASINGS	51 TONS	4 - 1" CABLES	GE DWG. 125C9864
UPPER/LOWER DIAPHRAGMS	9 TONS	2 - 1" CABLES	GE DWGS. 199A5803 199A5804 199A5805
HIGH PRESSURE TURBINE CASING	72 TONS	4 - 1 1/8" CABLES	GE DWG. 125C9862
LOW PRESSURE ROTOR	114 TONS	4 - 2" CABLES, LIFT BEAM 158D881	GE DWGS. 125C9866 125C9867
HIGH PRESSURE ROTOR	59 TONS	2 - 1 3/8" CABLES, 2 - 2" CABLES, LIFT BEAM 158D881	GE DWG. 125C9865
GENERATOR ROTOR	175 TONS	2 - 8 X 1 1/8" BRAIDED CABLES (ROTOR), 1 - 2 1/4" CABLE (END BELLS)	GE DWG. 734E781
LOW PRESSURE TURBINE OUTER CASINGS	28 TONS	3 - 1" CABLES	GE DWG. 125C9863
MISC. POWER PLANT EQUIPMENT	VARIES	WIRE ROPE OR NYLON SLINGS	DMP 5800-3

Table 2 (Cont.)

3-1.4 UNIT 2 REFUEL FLOOR HATCHWAY JIB CRANES, (DRAWING MS197, SHEET 1)
UNIT 2 REACTOR BUILDING HATCHWAY JIB CRANE (EL.545) (DRAWING MS-197, SHEET 5)

LOAD IDENTIFICATION	APPROX. WEIGHT	LIFTING DEVICE	PROCEDURAL CONTROL
MISC. POWER PLANT EQUIP.	VARIES	WIRE ROPE OR NYLON SLINGS	DMP 5800-3

3-1.5 UNITS 2&3 REFUEL PLATFORM HOISTS

LOAD IDENTIFICATION	APPROX. WEIGHT	LIFTING DEVICE	PROCEDURAL CONTROL
MISC. REFUELING TOOLS AND REACTOR SERVICING EQUIP.	VARIES	DIRECT ATTACHMENT OR SLINGS	DFP 800-27 (U-1) DFP 800-1 APP. A DFP 800-21

3-1.6 UNITS 2&3 REACTOR SERVICE PLATFORM JIB CRANE

LOAD IDENTIFICATION	APPROX. WEIGHT	LIFTING DEVICE	PROCEDURAL CONTROL
MISC. REACTOR VESSEL INTERNALS DURING REPAIR WORK (JET PUMPS)	VARIES	DIRECT ATTACHMENT VIA HOOK OR SLINGS	DMP 200-19, DMP 200-20 OR SPECIFIC PROCEDURE FOR THE REPAIR

3-1.7 UNIT 2&3 NEW FUEL STORAGE VAULT JIB CRANE (DRAWING MS-197, SHEET 1)

LOAD IDENTIFICATION	APPROX. WEIGHT	LIFTING DEVICE	PROCEDURAL CONTROL
NEW FUEL	680 POUNDS	DIRECT ATTACHMENT	DFP 800-4
CONTROL ROD BLADE	235 POUNDS	DIRECT ATTACHMENT	DFP 800-1 APP. A

Table 2 (Cont.)

3-1.8 UNIT 1 REFUEL FLOOR HATCHWAY JIB CRANES

LOAD IDENTIFICATION	APPROX. WEIGHT	LIFTING DEVICE	PROCEDURAL CONTROL
MISC. POWER PLANT EQUIP.	VARIES	WIRE ROPE OR NYLON SLINGS	DMP 5800-3

3-1.9 UNIT 1 REFUEL PLATFORM HOISTS

LOAD IDENTIFICATION	APPROX. WEIGHT	LIFTING DEVICE	PROCEDURAL CONTROL
MISC. REFUELING TOOLS AND REACTOR SERVICING EQUIP.	VARIES	DIRECT ATTACHMENT OR SLINGS	DFP 800-27 (Unit 1) DFP 800-1 APP. A DFP 800-21

3-1.10 UNIT 1 FUEL BUILDING OVERHEAD CRANE

LOAD IDENTIFICATION	APPROX. WEIGHT	LIFTING DEVICE	PROCEDURAL CONTROL
FUEL CASK (NFS-4)	25 TONS	YOKE	DFP 800-32 (UNIT 1)
LOADED FUEL BASKET	4 TONS	SPECIAL AIR-OPERATED RIG ATTACHED TO AUX HOOK	DFP 800-4 (UNIT 1)
NEW FUEL IN SHIPPING	1 1/2 TONS	SLING/SPREADER BEAM	DFP 800-33 (UNIT 1)

3-1.11 UNIT 1 FUEL STORAGE VAULT BRIDGE

LOAD IDENTIFICATION	APPROX. WEIGHT	LIFTING DEVICE	PROCEDURAL CONTROL
NEW FUEL	380 POUNDS	DIRECT ATTACHMENT	DFP 800-11 (UNIT 1)

heavy load movement procedures, and the low probability of crane-load failure, the Licensee concluded that this interaction should be removed from further consideration. The Licensee indicated hazard elimination categories of (c) and (f), which state that site-specific consideration and station procedures eliminate the need for further consideration.

The turbine building hatches are a hazard area due to the proximity of the cable tunnels. A turbine rotor could drop on the ground floor above the Unit 3 cable tunnel and possibly reduce the capacity of Unit 3. However, the Licensee stated three points [6] which would lessen the chances of such an accident:

1. very low frequency of rotor movement
2. very low probability of crane failure
3. cable tunnel is marked on floor to aid in avoiding the floor area over the tunnel during heavy load movements.

Based on the above considerations, the Licensee concluded that this interaction should be removed from further consideration. Hazard elimination categories of (e) and (f) have been indicated for this interaction. No reference has been cited for analyzing a load drop.

The cranes serving the main floor could interact with the standby gas treatment system. However, the Licensee stated that this system is not required for safe shutdown of the plant. The hazard elimination category of (f), procedures, and the low probability of crane-load failure leads the Licensee to conclude that this interaction should be removed from further consideration. The coverage of the turbine building cranes is shown in Reference 13.

2.5.2 Evaluation

The 125-ton main hook and associated lifting devices of the reactor building overhead crane have been identified as single-failure-proof, in compliance with NUREG-0612, Section 5.1.6. However, the subjects of load attachment points and the power failure condition described in Section 2.3.2 have not been addressed by the Licensee.

The 9-ton auxiliary hook can, with a load drop, interact with the standby liquid control system. However, the Licensee has not demonstrated that the auxiliary hook meets single-failure-proof criteria, and has not provided the 9-ton load drop analysis indicated in Table 1.

The likelihood of interaction of a load drop from the Units 2 and 3 refuel floor hatchway jib cranes or the Unit 2 hatchway jib crane with the torus would appear to be very low based on the following Licensee contentions [5]:

a. low frequency of heavy load movement at the hatches when reactors are in operation

b. low probability of crane-load failure

c. analyzed load drop (hazard elimination category e).

The Licensee has not furnished the analysis performed which was the basis for the hazard elimination.

Although the coverage area of the Units 2 and 3 reactor service platform crane is not shown in Reference 13, this crane clearly has a limited coverage area and is used solely for internal reactor vessel repairs. Further, the latter is performed only with the core unloaded. Given the duty of this crane and the procedural controls governing it, the Licensee's exemption of this crane from further consideration is reasonable. The intent of NUREG-0612 is satisfied.

The possible interaction between the turbine building cranes and the cable tunnels is seen by the Licensee to have a low probability due to low frequency of movement, low probability of failure, definition of safe load path, and analysis of a load drop in that area.

The Licensee has not provided the above-mentioned analysis.

Since the standby gas treatment system is not required for safe shutdown of the plant, the possible interaction with the turbine building cranes serving the main floor need not be considered.

2.5.3 Conclusions and Recommendations

The following cranes and their interactions with safety-related equipment are in compliance (or partial compliance as stated) with NUREG-0612.

Units 2 and 3 reactor building overhead crane (125-ton hook) and associated lifting devices
Units 2 and 3 reactor service platform jib crane
Units 2 and 3 turbine building overhead main floor crane.

However, the subjects of load attachment points and the power failure condition described in Section 2.3.2 have not been addressed by the Licensee for the reactor building overhead crane (125-ton hook).

Additional information about the remaining crane-load interactions is required as follows:

Units 2 and 3 reactor building overhead crane (auxiliary 9-ton hook)

One of the following should be provided:

a. demonstrate that this crane meets single-failure-proof criteria

b. the 9-ton load drop analysis and its applicability to the interaction listed in Table 1, satisfying 5.1.5(1)(c) (hazard elimination category e).

Units 2 and 3 refuel floor hatchway jib cranes (torus area)

Unit 2 reactor building hatchway jib crane (torus area)

- the load drop analysis performed which was the basis for the hazard elimination, satisfying Section 5.1.5(1)(c) (hazard elimination category e).

Units 2 and 3 turbine building overhead (hatch area) crane

- the load drop analysis performed which was the basis for the hazard elimination, satisfying Section 5.1.5(1)(c) (hazard elimination category e).

A general comment, applicable to all the foregoing evaluations, is that the Licensee has not taken credit for any redundant components or systems involved in the safe shutdown of the plant. That is, a component critical to safe shutdown damaged by a load drop is acceptable if a redundant working

component is available for service in the event that shutdown is required. This is an acceptable alternative to the various requests detailed above.

The following cranes do not operate in areas where safety-related equipment is located:

Units 2 and 3 refuel platform hoists
Units 2 and 3 new fuel storage vault jib.

3. CONCLUSION

This summary is provided to consolidate the results of crane-specific evaluations presented in Section 2. It is not meant as a substitute for the specific conclusions reached in the various subsections of Section 2. It is provided to allow the reader to focus on the key topics which should be addressed in seeking to resolve issues where the degree of load handling reliability provided by cranes at Dresden Station was not found to meet the objectives of NUREG-0612. This section addresses issues for which the information provided is felt to be inadequate to support a definitive conclusion and issues wherein the information provided has been evaluated as proposing an approach inconsistent with the the guidance of NUREG-0612.

3.1 INFORMATION ISSUES

The information provided by the Licensee has been assessed as insufficient to support an independent conclusion that load handling reliability is consistent with the evaluation criteria of Section 2.1 in the following areas:

Reactor Building Overhead Crane (Main Hook)

Provide assurance that no single failure in the crane electric power/control system will cause a load drop. Also, evaluate all load attachment points for compliance with single-failure-proof criteria [see [2], Section 5.1.6 (3)].

Reactor Building Overhead Crane (Auxiliary Hook)

Area: Spent fuel pool, reactor vessel

The Licensee should furnish information on the existence of stops or interlocks which prevent movement in this area. If reliance is placed entirely (or in part) on administrative procedures and controls, the Licensee should provide assurance that these controls are implemented and enforceable, e.g., the restriction of 9-ton load lifts to a height of 7 ft in areas adjacent to the spent fuel pool and the restriction of the reactor crane auxiliary hook over the reactor vessel and spent fuel pool areas.

Area: Standby liquid control system

The following information should be furnished (one of the two listed below):

1. ~~Since~~ If a single-failure-proof system was claimed as the hazard elimination category for this interaction, furnish evidence that single-failure-proof conditions are met, in compliance with Section 5.1.5(1)(a) of NUREG-0612.

2. the 9-ton load drop analysis and its applicability to the interaction list in Table 1, satisfying Section 5.1.5(1)(c).

Units 2 and 3 new fuel storage vault jib crane

Units 2 and 3 refuel platform hoists

Area: Reactor vessel and spent fuel pool area

- The Licensee should provide assurance that the heaviest load carried by these cranes is the weight of a single fuel element.

Units 2 and 3 refuel floor hatchway jib cranes

Unit 2 reactor building hatchway jib crane

Area: Torus, el. 476 ft 6 in

- the load drop analysis performed which was the basis for the hazard elimination, satisfying Section 5.1.5(1)(c) (hazard elimination category e).

Units 2 and 3 turbine building overhead (hatch area) crane

Area: Cable tunnel, el. 502 ft 6 in

- the load drop analysis performed which was the basis for the hazard elimination, satisfying Section 5.1.5(1)(c) of NUREG-0612.

3.2 APPROACH ISSUES

This review has revealed no issues wherein the approach or position taken by the Licensee, based on information provided thus far, is inconsistent with the staff's objectives as expressed in the evaluation criteria of Section 2.1.

4. REFERENCES

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16. D. G. Eisenhut (NRC)
Letter to all Holders of Operating Licensee, Application for Operating Licensee and Holders of Constructor Permit for Power Reactor (Generic Letter 83-42)
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