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LIMERICK GENERATING STATION

OVERHEAD HANDLING SYSTEMS REVIEW

FINAL REPORT

Revision 3
June, 1984

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FINAL REPORT

CONTENTS

1. SUMMARY/CONCLUSIONS

This report on overhead heavy load handling systems at Limerick was prepared in response to Sections 2.2 and 2.3 of Reference 1 (Enclosure 3 to the NRC letter to all licenses dated December 22, 1980). It also includes minor revisions to data previously transmitted to the NRC by Reference 2. The format of Section 2 of this report follows that of Reference 1. Detailed information on each crane and hoist, including hazard evaluations, statistics, load/impact area matricies etc. are included in the Tables and Appendices.

This review focused on cranes and hoists in Unit 1 and the common areas of the Limerick facility and included monorails and lifting beams for which no hoists have been purchased but which may be used occasionally for equipment replacement or repair. Since the Unit 2 design will be similar to Unit 1 the conclusions of this report apply to Unit 2. An as-built review will be performed for both Units to verify that differences in layout for Unit 2 and modifications made subsequent to this report do not affect its conclusions. 2

The reactor enclosure crane is the only load handling system capable of carrying heavy loads which could damage irradiated fuel if dropped. Though the crane itself generally complies with the NUREG 0612 guidelines, its special lifting devices and associated load attachment points do not. This is particularly true for critical loads, where NUREG 0612 recommends twice the normal design safety factor. Since these items have already been fabricated it is proposed to substitute proof load testing in lieu of full compliance with NUREG 0612.

All cranes and hoists were evaluated to determine whether a dropped load could affect the ability to safely shut down the plant and continue to remove decay heat from the reactor and fuel pool. Systems required for safe shutdown and decay heat removal are listed in Appendix A and hazard evaluations are provided in Appendix B. In most cases it was possible to show that, based on separation and redundancy of safety-related systems or other plant-specific considerations, no real hazard exists. In some cases it was found advisable to establish load carrying height restrictions or other administrative controls to eliminate concern about potential damage to safety-related systems. 2

One load-handling situation which cannot be addressed by this report is the case where movement of a heavy load is so infrequent or unexpected that no crane, hoist monorail or lifting beam has been provided. These operations must be treated on a case-by-case basis with the load handling preparations, instructions and equipment based on NUREG 0612 guidelines, to assure that the probability of a load drop is extremely small or that the consequences are acceptable.

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for the

Limerick Generating Station

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*Original prepared September, 1981
Revision 1 prepared March, 1982
Revision 2 prepared March, 1983
Revision 3 prepared June, 1984

INFORMATION REQUESTED IN SECTION 2.1:

This information was previously submitted (see Appendix D) and was based on a general review of the Limerick overhead handling systems. Changes are required as a result of the detailed review which followed. These changes are listed below by paragraph number. 3

Paragraph 2.1-1 Heavy Load Definition 3

NUREG 0612 defines a heavy load as a load whose weight is greater than the combined weight of a single spent fuel assembly and its handling tool. The original Limerick heavy load definition of greater than 700 pounds was based on the weight of a fuel assembly plus the the general purpose grapple. However, fuel assemblies are normally handled by the fuel grapple assembly of the refueling platform. Since this fuel grapple assembly, which consists of the telescoping mast and grapple head, is suspended from the platform hoist cables, it could be considered a handling tool. Therefore a heavy load has been redefined as greater than 1200 pounds to include the weight of the fuel grapple assembly.

Paragraph 2.1-1 Hoist Categorization

The hoists below were not identified during the initial review. They have been incorporated in Table 1 as Items 61 and 62. Item 62 belongs to the group of hoists which carry heavy loads in the vicinity of safety-related equipment. During the detailed review it was determined that other hoists should also be included in this group. These additions are based on a change in the interpretation of the term load path to include areas below grating and hatches, and on more conservative assumptions regarding routing of electrical conduit. Tables 1 and 2 have been revised accordingly. 3

Reactor Enclosure Upper Fan Room Hoists (Item 61)
Reactor Enclosure Lower Fan Room Hoists (Item 62)

Paragraph 2.1-3-a Safe Load Paths 3

Some of the safe load path drawings have been revised to clarify the load path, or to reflect a better understanding of the load handling methods.

Paragraph 2.1-3-c   Load Tabulation

Revisions have been made to Table 2, Load Tabulation, and a hazard elimination category has been assigned to each load/impact area combination (where applicable) as required by Section 2.3-2.

Paragraph 2.1-3-d   Special Lifting Devices

In the list of critical loads the number of fuel pool gates should be "two pair per unit".. Minor changes have been made to Table 3 based on new information.

INFORMATION REQUESTED IN SECTION 2.2:

2.2 "SPECIFIC REQUIREMENTS FOR OVERHEAD HANDLING SYSTEMS OPERATING IN THE REACTOR BUILDING

NUREG 0612, Section 5.1.4, provides guidelines concerning the design and operation of load-handling systems in the vicinity of spent fuel in the reactor vessel or in storage. Information provided in response to this section should demonstrate that adequate measures have been taken to ensure that, in this area, either the likelihood of a load drop which might damage spent fuel is extremely small, or that the estimated consequences of such a drop will not exceed the limits set by the evaluation criteria of NUREG 0612, Section 5.1, Criteria I through III."

Paragraph 2.2-1

"Identify by name, type, capacity, and equipment designator, any cranes physically capable (i.e., ignoring interlocks, moveable mechanical stops, or operating procedures) of carrying loads over spent fuel in the storage pool or in the reactor vessel."

Response

The following cranes are capable of carrying loads over spent fuel:

a. Reactor Enclosure Crane - Overhead bridge crane with 125 ton and 15 ton hoists, equipment number 00H201.

b. Refueling Platform - Gantry crane with one fuel handling grapple hoist and two auxiliary 1000 lb. capacity hoists, equipment number 10S272.

c. Fuel Pool Jib Cranes - 1000 lb. capacity, equipment numbers 0AH208 and 0BH208.

d. Fuel Channel Handling Boom - Jib crane, 500 lb. capacity, equipment number 10H224.

Paragraph 2.2-2

"Justify the exclusion of any cranes in this area from the above category by verifying that they are incapable of carrying heavy loads or are permanently prevented from movement of heavy loads over stored fuel or into any location where, following any failure, such load may drop into the reactor vessel or spent fuel storage pool."

Response

The refueling platform is excluded from the above category since its hoists do not carry heavy loads. All loads are less than or equal to the weight of a fuel bundle. The two auxiliary hoists have load cells with interlocks to prevent them from lifting anything as heavy as a fuel bundle.

The jib cranes are excluded from the above category since do they not carry heavy loads. Their capacity is 1000 lbs. 3

The channel handling boom is excluded from the above category since it does not carry heavy loads. Its capacity is less than the weight of a fuel bundle.

Paragraph 2.2-3

"Identify any cranes listed in 2.2-1, above, which you have evaluated as having sufficient design features to make the likelihood of a load drop extremely small for all loads to be carried and the basis for this evaluation (i.e., complete compliance with NUREG 0612, Section 5.1.6, or partial compliance supplemented by suitable alternative or additional design features). For each crane so evaluated, provide the load-handling-system (i.e., crane-load-combination) information specified in Attachment 1."

Response

The reactor enclosure crane has been evaluated as having sufficient design features to make the likelihood of a load drop extremely small for the loads listed below. The basis for this evaluation was compliance with NUREG 0612, Section 5.1.6, except where noted.

Load Handling System Information

Item 1:

"Provide the name of the manufacturer and the design-rated load (DRL). If the maximum critical load (MCL), as defined in NUREG 0554, is not the same as the DRL, provide this capacity."

Response:

Manufacturer - Harnischfeger Corporation. Design-rated load (DRL) 125/15 tons. Maximum critical load (MCL) - 110/6.75 tons. 3

Item 2:

"Provide a detailed evaluation of the overhead handling system with respect to the features of design, fabrication, inspection, testing and operation as delineated in NUREG 0554 and supplemented by the identifed alternatives specified in NUREG 0612, Appendix C. This evaluation must include a point-by-point comparison for each section of NUREG 0554. If the alternatives of NUREG 0612, Appendix C, are used for certain applications in lieu of complying with the recommendation of NUREG 0554, this should be explicitly stated. If an alternative to any of those contained in NUREG 0554 or NUREG 0612, Appendix C, is proposed, details must be provided on the proposed alternative to demonstrate its equivalency."

Response:

A detailed evaluation of the reactor enclosure crane was made with respect to the requirements of Regulatory Guide 1.104 which preceded NUREG 0554. A point-by-point comparison of the crane features with the sections of the regulatory guide is presented in Table 9.1-12 of the Limerick FSAR. The auxiliary hoisting system does not meet all of the design criteria of either NUREG 0554 or R.G. 1.104. Specifically, the means of load attachment is not of redundant design. As an alternative we propose to reduce the load rating for the auxiliary hoist from 15 tons to 6.75 tons when handling 3
critical loads. This will effectively double the design safety factor and provide an additional margin for wear and dynamic loads.

Item 3:

"With respect to the seismic analysis employed to demonstrate that the overhead handling system can retain the load during a seismic event equal to a safe shutdown earthquake, provide a description of the method of analysis, the assumptions used, and the mathematical model evaluated in the analysis. The description of assumptions should include the basis for selection of trolley and load position."

Response:

Load-bearing members and main hoist equipment of the reactor enclosure crane are designed in accordance with seismic Category I criteria so that the crane can structurally withstand the Safe Shutdown Earthquake (SSE) and maintain the fully rated load in a static position during or following an SSE. The 3
crane was analysed using a 41-node lumped-mass model to determine natural frequencies. To assure that the worst case would be included, three trolley positions were analysed (end of span, 1/4 span and center of the bridge). Highest and lowest positions of the rated load were considered for each trolley position, as

well as a no load condition. Accelerations at the crane supports were determined based on crane natural frequencies and reactor enclosure response spectra. 1% crane damping was assumed for the Operating Basis Earthquake (OBE) and 2% damping was assumed for the SSE. Resulting crane stresses were then calculated based on the worst case seismic loads. Design stresses were limited to 0.9 Fy in bending, 0.85 Fy in tension and 0.5 Fy in shear where Fy equals the material yield stress at the design temperature. Restraints were installed to preclude derailment of the bridge or trolley under seismic loading.

Item 4 & 5:

"Provide an evaluation of the lifting devices for each single-failure-proof handling system with respect to the guidelines of NUREG 0612, Section 5.1.6."

"Provide an evaluation of the interfacing lift points with respect to the guidelines of NUREG 0612, Section 5.1.6."

Response:

We consider lifts of the following loads to meet the criteria of NUREG 0612, Section 5.1.6.

a. Spent Fuel Cask - A spent fuel shipping cask will be purchased or leased in the future. Since licensing under 10CFR71 is not evidence that the spent fuel shipping cask lifting device and lift points meet the requirements of NUREG 0612, the NUREG 0612 requirements will be a basis for selection of shipping casks and their lifting devices for Limerick. Specifically, the design of the lifting devices will conform to ANSI N14.6-1978 and the design of interfacing lift points will conform to Section 5.1.6 of NUREG 0612. 3

b. Refueling Shield - The special lifting device for the refueling shield does not fully meet the requirements of NUREG 0612 Section 5.1.6 (See Table 5). In particular it does not satisfy the ANSI N14.6-1978 recommendation to use twice the normal design safety factor for lifting devices which carry critical loads (see Table 3). We do not believe that an increase in safety factor will produce a proportionate improvement in lifting device reliability and, since this special lifting device has already been fabricated, we take exception to this requirement. As an alternative to full compliance with NUREG 0612, Section 5.1.6, and as a demonstration of design adequacy we propose to perform a load test of the lifting device at 150% of its rated capacity, followed by non-destructive examination of its load bearing welds. 3

   There are four lifting points on the refueling shield itself. They provide a minimum static factor of safety of 4.8 with respect to material ultimate strength. This does not satisfy the NUREG 0612, Section 5.1.6, safety factor requirement. Again, we take exception to this requirement and propose to perform a qualifying load test of the lift points.

c. Fuel Pool Stop Logs - The special lifting device for the fuel pool stop logs does not fully meet the requirements of Section 5.1.6 (See Table 5). In particular it does not satisfy the ANSI N14.6-1978 recommendation to use twice the normal design safety factor for lifting devices which carry critical loads (see Table 3). We do not believe that an increase in safety factor will produce a proportionate improvement in lifting device reliability and, since this special lifting device has already been fabricated, we take exception to this requirement. As an alternative to full compliance with NUREG 0612, Section 5.1.6, and as a demonstration of design adequacy we propose to perform a load test of lifting device at 150% of its rated capacity, followed by nondestructive examination of its load bearing welds. 3

There are two lifting lugs on each fuel pool stop log. They provide a minimum factor of safety of 7.25 with respect to material ultimate strength, plus an additional margin of 25% for dynamic loads. This does not satisfy the NUREG 0612 safety factor requirement. Again, we take exception to this requirement and propose to perform a qualifying load test of the lift points.

d. Fuel Pool Gates - The fuel pool gates are carried using conventional slings. These slings will be selected according to NUREG 0612, Section 5.1.6(1). There are two lift points on each fuel pool gate. They provide a minimum static factor of safety of 9.3 with respect to material ultimate strength. This does not satisfy the NUREG 0612, Section 5.1.6, safety factor requirement. We do not believe that an increase in safety factor will produce a proportionate improvement in lift point reliability and, since this item has already been fabricated, we take exception to this requirement. As an alternative to full compliance with NUREG 0612, Section 5.1.6, and as a demonstration of design adequacy we propose to perform a 150% load test of the fuel pool gate lift points, followed by non-destructive examination of the load bearing welds.

e. Fuel Pool Jib Crane and Channel Handling Boom - These heavy loads are carried near the reactor vessel or spent fuel pool, where a load drop could affect fuel. Conventional slings are used. These slings will be selected according to NUREG 0612, Section 5.1.6(1). In each case there is one lift point on the load which has a minimum static design safety factor of 5 with respect to material ultimate strength. This does not satisfy the NUREG 0612, Section 5.1.6, safety factor requirements. We do not believe that an increase in safety factor will produce a proportionate improvement in lift point reliability and, since these items have already been fabricated, we take exception to this requirement. As an alternative to full compliance with NUREG 0612, Section 5.1.6, and as a demonstration of design adequacy we propose to perform a load test of each lift point at 150% of normal load followed by nondestructive examination of the load bearing welds.

f. Spent Fuel Storage Racks - Empty storage racks may be placed in the Fuel pool when spent fuel is present. The racks are handled using a special lifting device (Module Lifting Fixture) which is attached to either the main or auxiliary hook of the reactor enclosure crane using conventional slings. These slings will be selected according to NUREG 0612, Section 5.1.6(1). The special lifting device does not fully meet the requirements of NUREG 0612 Section 5.1.6 (See Table 5). In particular it does not satisfy the ANSI N14.6-1978 recommendation to use twice the normal design safety factor for lifting devices which carry critical loads (see Table 3). We do not believe that an increase in safety factor will produce a proportionate improvement in lifting device reliability and, since this special lifting device has already been fabricated, we take exception to this requirements. As an alternative to full compliance with NUREG 0612, Section 5.1.6, and as a demonstration of design adequacy we propose to perform a load test of the lifting device at 150% of its rated capacity, followed by non-destructive examination of its load bearing welds.

The special lifting device engages structural members of the fuel rack. The lift points provide a minimum factor of safety of 10 with respect to material ultimate strength, and include a margin for dynamic loads. This satisfies the requirements of NUREG 0612 Section 5.1.6.

g. RPV Service Platform - The special sling for the RPV service platform has been replaced in order to meet the double safety factor requirements of ANSI N14.6-1978 but it does not meet all the requirements of that standard (See Table 5). As ademonstration of design adequacy it will be load tested at 300% of it required capacity. The lifting lugs on the service platform have a safety factor of more than 10, which meets the requirements of NUREG 0612, Section 5.1.6.

3

Paragraph 2.2-4

"For cranes identified in 2.2-1, above, not categorized according to 2.2-3, demonstrate that the criteria of NUREG 0612, Section 5.1, are satisfied. Compliance with Criterion IV will be demonstrated in response to Section [2.3] of this request. With respect to Criteria I through III, provide a discussion of your evaluation of crane operation in the Reactor Building and your determination of compliance. This response should include the following information for each crane:

a. Where reliance is placed on the installation and use of electrical interlocks or mechanical stops, indicate the circumstances under which these protective devices can be removed or bypassed and the administrative procedures invoked to ensure proper authorization of such action. Discuss any related or proposed technical specifications concerning the bypass of such interlocks.

b. Where reliance is placed on the operation of the Stand-by Gas Treatment System, discuss present and/or proposed technical specifications and administrative or physical controls provided to ensure that these assumptions remain valid.

c. Where reliance is placed on other site-specific considerations (e.g., refueling sequencing), provide present or proposed technical specifications, and discuss administrative or physical controls provided to ensure the validity of such considerations.

d. Analyses performed to demonstrate compliance with Criteria I through III should conform to the guidelines of NUREG 0612, Appendix A. Justify any exception taken to these guidelines, and provide the specific information requested in Attachment 2, 3, or 4, as appropriate, for each analysis performed."

Response

The reactor enclosure crane, though single-failure-proof itself, is included in this category when used to carry the following loads. Lifting devices or lifting points which do not meet the single-failure-proof criteria of NUREG 0612, Section 5.1.6, restrict the overall load handling combination to this category for these loads.

Loads Carried Over the Spent Fuel Pool

The reactor enclosure crane is prevented from carrying loads over or near the spent fuel pool by zone travel limit switches on the bridge and trolley. The associated electrical interlock can be bypassed by conscious operator action via a keylocked switch. Administrative procedures will be developed prior to plant operation to control bypassing of the interlock.

Loads which must be carried over the spent fuel pool will be carried by a high-reliability load handling system and are categorized according to Paragraph 2.2-3. Therefore the potential for the load drop over the spent fuel pool is extremely small.

Loads Carried Over the Reactor Vessel

The following loads must be carried over the reactor vessel. None of these loads have lifting devices which meet the single-failure-proof criteria of NUREG 0612, Section 5.1.6. They are therefore evaluated with respect to Criteria I through III of NUREG 0612 Section 5.1.

a. Reactor well shield plugs - The reactor well shield plugs are carried over the reactor vessel only with the RPV head in place. The drop of a shield plug could damage the drywell head, RPV head or seal plate but would be less severe than the drop of the drywell head or the RPV head. Therefore the drop of a shield plug will not damage fuel or cause unacceptable leakage from the reactor vessel.

b. Drywell Head - The drywell head is carried over the reactor vessel while the reactor pressure vessel (RPV) head and insulation support structure are in place. Depending on orientation a drop of the drywell head could damage the insulation support structure, rupture the RPV vent and head spray piping, damage the seal plate and impact the RPV itself. It is assumed that the effect of a drywell head drop on the reactor vessel is no more severe than an RPV head drop which is discussed below. This assumption is based on the fact that though the drywell head weighs about 13% more than the RPV, much of its kinetic

b. energy will be absorbed by the insulation support structure and the seal plate. Therefore a drop of drywell head will not cause fuel damage or unacceptable leakage from the reactor vessel.

c. RPV Head, Steam Dryer, Shroud Head/Separator Assembly - General Electric has analyzed the consequences of a drop of these loads over the reactor vessel. This analysis showed that a drop of the RPV head, steam dryer or shroud head/separator assembly would not cause fuel damage or leakage from the reactor vessel. Thus, evaluation criteria I through III of NUREG 0612, Section 5.1 are satisfied. No credit is taken for electrical interlocks or mechanical stops, Standby Gas Treatment System operation or site specific considerations. A discussion of conformance with the guidelines of NUREG 0612, Appendix A and the information requested in Attachment 4 is provided in Appendix C. 3 3

d. Service Platform Support (including seal surface protector)- The diameter of the service platform support is too large to allow it to fit inside the reactor vessel and it is much lighter than the loads above. A drop of the service platform support will not cause fuel damage or unacceptable leakage from the reactor vessel.

e. Refueling Shield - The refueling shield has been categorized according to Paragraph 2.2-3.

f. Jib Crane - The jib crane has been categorized according to Paragraph 2.2-3.

g. Service Platform - The service platform has been categorized according to Paragraph 2.2-3. 3

h. Other Loads Over the Reactor Vessel - There are no other heavy loads which must be carried over the open reactor vessel. Loads which are carried over the reactor vessel only while the RPV head is on (e.g. the insulation support structure, the head nut rack, the head stud rack and the head stud tensioner) will not cause damage to the fuel if dropped. A drop of these items over the reactor vessel is less severe than a drop of the drywell head or the RPV head itself. Therefore, there would be no unacceptable leakage from the vessel.

Heavy loads which need not be carried over the reactor well are restricted from this area during refueling (See safe load path drawings for the reactor enclosure crane). Administrative procedures will be developed prior to plant operation to control the movement of loads over the reactor well.

INFORMATION REQUESTED IN SECTION 2.3:

"2.3 SPECIFIC REQUIREMENTS FOR OVERHEAD HANDLING SYSTEMS OPERATING IN PLANT AREAS CONTAINING EQUIPMENT REQUIRED FOR REACTOR SHUT DOWN, DECAY HEAT REMOVAL, OR SPENT FUEL POOL COOLING

NUREG 0612, Section 5.1.5, provides guidelines concerning the design and operation of load-handling systems in the vicinity of equipment or components required for safe reactor shutdown and decay heat removal. Information provided in response to this section should be sufficient to demonstrate that adequate measures have been taken to ensure that in these areas, either the likelihood of a load drop which might prevent safe reactor shutdown or prohibit continued decay heat removal is extremely small, or that damage to such equipment from load drops will be limited in order not to result in the loss of these safety-related functions. Cranes which must be evaluated in this section have been previously identified in your response to 2.1-1, and their loads in your response 2.1-3-c."

Paragraph 2.3-1

"Identify any cranes listed in 2.1-1, above, which you have evaluated as having sufficient design features to make the likelihood of a load drop extremely small for all loads to be carried and the basis for this evaluation (i.e., complete compliance with NUREG 0612, Section 5.1.6, or partial compliance supplemented by suitable alternative or additional design features). For each crane so evaluated, provide the load-handling-system (i.e., crane-load-combination) information specified in attachment 1."

Response

There are no cranes in this category except the reactor enclosure crane when it is used to carry the loads listed in the response to Paragraph 2.2-3.

Paragraph 2.3-2

"For any cranes identified in 2.1-1 not designated as single-failure-proof in 2.3-1, a comprehensive hazard evaluation should be provided which includes the following information:"

Subparagraph a

"The presentation in a matrix format of all heavy loads and potential impact areas where damage might occur to safety-related equipment. Heavy loads identification should include designation and weight or cross-reference to information provided 2.1-3-c. Impact areas should be identified by construction zones and elevations or by some other method such that the impact area can be located in the plant general arrangement drawings. Figure 1 provides a typical matrix."

Response

This information is presented in Table 2 entitled 'Load Tabulation'

Subparagraph b

"For each interaction identified, indicate which of the load and impact area combinations can be eliminated because of separation and redundancy of safety-related equipment, mechanical stops and/or electrical interlocks, or other site-specific considerations. Elimination on the basis of the aforementioned consideration should be supplemented by the following specific information:

(1) For load/target combinations eliminated because of separation and redundancy of safety-related equipment, discuss the basis for determining that load drops will not affect continued system operation (i.e., the ability of the system to perform its safety-related function.)

(2) Where mechanical stops or electrical interlocks are to be provided, present details showing the areas where crane travel will be prohibited. Additionally, provide a discussion concerning the procedures that are to be used for authorizing the bypassing of interlocks or removable stops, for verifying that interlocks are functional prior to crane use, and for verifying that interlocks are restored to operability after operations which require bypassing have been completed.

(3) Where load/target combinations are eliminated on the basis of other, site-specific considerations (e.g., maintenance sequencing), provide present and/or proposed technical specifications and discuss administrative procedure or physical constraints invoked to ensure the validity of such considerations."

Response

Table 2 indicates the basis for eliminating each load/area combination from the hazardous category. Code letters used in the table correspond to the following hazard elmination categories:

a. Crane travel for this load/area 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. NUREG 0612, Section 5.1.6, satisfied.)

e. Analysis demonstrates that crane failure and load drop will not damage safety-related equipment.

A detailed evaluation of each crane/hoist which was categorized according to Paragraph 2.1-1 as potentially hazardous is presented in Appendix B. The following method was used to evaluate the consequence of a load drop from these load handling systems:

1) The Limerick Fire Protection Evaluation Report and the separation drawings were used to establish whether there was anything safety-related in the load path or on the next lower elevation. Except for the refueling floor and a few other cases where there were very heavy loads or high lifts, it was assumed that there would be no sequential failure that could affect more than one floor below the load path. The basis of this assumption is that the presence of large quantities of reenforcing bar in the floor will prevent the formation of very large concrete spall fragments which are free to fall to the next floor. Major safety-related items are listed in the Appendix B hazard evaluations.

2) A more detailed study of the separation drawings was made to determine whether there was sufficient separation of safety-related items (as indicated by associated electrical divisions) to establish that, if these safety-related items were required for safe-shutdown or decay heat removal, only one method of safe shutdown or decay heat removal could be affected. If so, no further evaluation was required. Generally, no attempt was made to determine whether or not the safety-related items were actually part of systems required for safe shutdown or decay heat removal.

   Appendix A provides a discussion of safe shutdown methods and lists the systems required for safe shutdown and removal of decay heat from the reactor vessel and spent fuel pool.

3) If there was not sufficient separation of safety-related items in the load path and on the next lower evaluation, note was taken of which electrical divisions were predominant. Safety-related items associated with electrical divisions which were not predominant were identified to see whether they were required for safe shutdown or decay heat removal. For example, if most components in the load path were associated with electrical divisions 1 and 3 (shutdown method 'A'), those components associated with electrical divisions 2 and 4 (shutdown method 'B') were identified to see whether they belong to systems required for safe shutdown or decay heat removal. If not, then only one safe-shutdown or decay heat removal method could potentially be affected, and no further evaluation was required.

4) If Step 3 was inconclusive safety related components associated with all electrical divisions were identified as necessary to establish whether there was sufficient distance between components of the two shutdown or decay heat removal methods to preclude the possibility of a given load drop affecting both methods. If so, no further evaluation was required.

5) If the load handling hazard could not be eliminated by the steps above, necessary adminstrative controls were established. For hazards on the next lower elevation, floor impact strength calculations were performed to establish what load carrying-height restrictions were needed, if any.

6) In some cases, site-specific considerations were used to eliminate the need to consider some load/equipment combinations. For example, since there will be no major maintenance activities in the drywell during reactor operation, only the consequences of load drops which would affect decay heat removal or vessel integrity were considered for the drywell.

Subparagraph c

"For interactions not eliminated by the analysis of 2.3-2-b, above, identify any handling systems for specific loads which you have evaluated as having sufficient design features to make the likelihood of a load drop extremely small and the basis for this evaluation (i.e., complete compliance with NUREG 0612, Section 5.1.6, or partial compliance supplemented by suitable alternative or additional design features). For each so evaluated, provide the load-handling-system (i.e., crane-load-combination) information specified in Attachment 1."

Response

There are no interactions in this category.

Subparagraph d

"For interactions not eliminated in 2.3-2-b or 2.3-2-c, above, demonstrate using appropriate analysis that damage would not preclude operation of sufficient equipment to allow the system to perform its safety function following a load drop (NUREG 0612, Section 5.1, Criterion IV). For each analysis so conducted, the following information should be provided:"

(1) An indication of whether or not, for the specific load being investigated, the overhead crane-handling system is designed and constructed such that the hoisting system will retain its load in the event of seismic accelerations equivalent to those of a safe shutdown earthquake (SSE).

(2) The basis for any exceptions taken to the analytical guidelines of NUREG 0612, Appendix A.

(3) The information requested in Attachment 4.

Response

As discussed in the hazard evaluations of Appendix B analysis was used to show that load drops from the following cranes/hoists would not jeopardize safe shutdown or decay heat removal capability. Of this group only the reactor enclosure crane is designed to retain its load during a safe shutdown earthquake. Item numbers refer to Table 1.

a. HVAC Equipment Hatch Hoist - Item 15

b. Reactor Enclosure Crane - Item 20

c. CRD Platform Hoist - Item 33

d. Containment Hydrogen Recombiner Cover Hoist - Item 36

e. Control Room HVAC Equipment Hoist - Item 58

f. Control Structure Fans Lifting Beam Hoist - Item 60

No exceptions were taken to the analytical guidelines of NUREG 0612, Appendix A.

The information requested by Attachment (4) is presented below:

a. Initial Conditions/Assumptions

   1) Weight of the load is as shown in Table 2.

   2) Impact area of the load is as shown on the load path drawings.

   3) Drop height is based on the maximum lift of the hoist except for the reactor enclosure crane where the purpose of the analysis was to establish maximum drop heights.

   4) No credit was taken for impact limiters or environmental drag forces.

   5) The heavy load is assumed to drop with a zero initial velocity.

   6) The capacity of the slab is based on yield-line theory.

   7) The capacity of the structural steel is based on a simple span, elasto-plastic design

8) Slab stiffness is based on an effective moment of inertia of a reinforced concrete beam.

9) Fixed and simply supported boundary conditions are used in slab analysis.

10) Energy loss due to local deformation of the object at impact is disregarded. Slab and steel framing system are assumed to take the full impact energy with spalling of concrete.

11) The average interface force from the dropped load is assumed to be supported by punching shear capacity of the concrete.

12) Existing dead load is considered insignificant compared to the impact load and is neglected in the evaluation. Seismic load and live load are not considered to be present at instant of load drop.

b. Method of Analysis

1) Structural response of the structural component is computed in terms of deformation limits, resistance functions and dynamic characteristics.

2) Interface forcing function is used in the determination of the applied forces.

3) Analytical and numerical techniques as per Bechtel Power Corporation Design Guide C-2.45 are used.

4) All calculations are done manually without computer assistance.

5) Height of drop is measured from the lowest point of the heavy load to the floor, unless noted otherwise.

c. Conclusion

See the Appendix B hazard evaluations for discussions of the results of these analyses.

3. REFERENCES

1. Enclosure 3 to the NRC letter to all licensees, dated December 22, 1980.

2. Philadelphia Electric Company letter to the NRC, dated June 18, 1981.

3. Limerick Generating Station Final Safety Analysis Report (FSAR) Section 15.7.4, "Fuel Handling Accident." △2

TABLES

TABLE 1

INDEX OF OVERHEAD HANDLING SYSTEMS - UNIT I & COMMON

Item	Crane or Hoist Equip. Number	Name/Service	Area	Elev.	Drwg.	Capacity	Material Req. Number	Max. Vert. Lift	Safety Related Item In Load Path?	Safety Related Item In Load Path: Exclusion Criteria	Safety-Related Item On Next Lower Elevation?	Fire Protection Areas: Load Path / Next Lower Elevation
1	10-H101	Reactor Feed Pump Area Bridge Crane	7	217'	M-111	10-ton	M-28	16'-0"	NO	A	NO	94B,94C,94D / 89A
2	0A-H102 0B-H102	Turbine Bldg. Cranes	1,2,3,4,5	269'	M-113	110/15 ton	M-15	90'-0"	NO	A	NO	114 / 95,96,88A,113B
3	10-H105	Condensate Pump Bridge Crane	2,3	217'	M-111	20-ton	M-28	43'-0"	NO	A	NO	87 / 87
4	10-H107	Condensate Filter-Demineralizer Hoist	6,7	239'	M-112	16-ton	M-38A	38'-6"	NO	A	NO	97 / 89B,94A
5	00-H108	Recombiner Service Hoist	8	200'	M-110 M-125	15-ton	M-38A	27'-0"	NO	C	NO	1H / 1C,1D,1E,1F
6	00-H112	Preheater Removal Hoist	8	180'	M-116	1-1/2 ton	M-38BB	11'-0"	NO	C	N/A	1C / N/A
7	10-H113	Reactor Feed Pump Turbine Lube Oil Pump Hoist	7	200'	M-110	1/2 ton	M-38BB	12'-4	NO	A	N/A	89A / N/A

TABLE 1

INDEX OF OVERHEAD HANDLING SYSTEMS - UNIT I & COMMON

Item	Crane or Hoist Equip. Number	Name/Service	Area	Elev.	Drwg.	Capacity	Material Req. Number	Max. Vert. Lift	Safety Related Item In Load Path?	Exclusion Criteria	Safety-Related Item On Next Lower Elevation?	Fire Protection Areas: Load Path / Next Lower Elevation
8	10-H116	Turbine Enclosure Aux. Equip. Hatch Hoist	6	217'	M-111	5-ton	M-38BA	30'-0"	NO	A	NO	94A / 89A
9	00-H117	Condensate Filter Demineralizer Holding Pumps Hoist	9	217'	M-111	1-ton	M-38BB	22'-9"	NO	A	NO	94A / 89A,89B
10	00-H118	Main Lube Oil Tank Hoist	1	239'	M-112	4-ton	M-38BA	43'-0"	NO	A	NO	95 / 93
11	0A-H119 0B-H119	Recirc. Pump M-G Set Hoist	6,7	269'	M-113	24-ton ea.	M-38BA	25'-0"	NO	A	NO	98A / 88A,88C,88D,97
12	00-H120	Drywell Chiller Hoist	7	302'	M-115	6-ton	M-38BA	10'-3"	NO	A	NO	99A / 98A,98C,98D
13	10-H122	Drywell Chiller Hatch Hoist	7	302'	M-115	6-ton	M-38BA	42'-0"	NO	A	NO	99A / 98A
14	00-H124	RWCU Filter Demineralizer Hoist	11	313'	M-121	5-ton	M-38BC	17'-4"	NO	C	YES	48A / 47A

OVERHEAD HANDLING SYSTEM REVIEW
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TABLE 1

INDEX OF OVERHEAD HANDLING SYSTEMS - UNIT I & COMMON

Item	Crane or Hoist Equip. Number	Name/Service	Area	Elev.	Drwg.	Capacity	Material Req. Number	Max. Vert. Lift	Safety Related Item In Load Path?	Exclusion Criteria	Safety-Related Item On Next Lower Elevation?	Fire Protection Areas: Load Path / Next Lower Elevation
15	00-H126	HVAC Equip. Hatch Hoist	8	350' 304'	M-124	2-ton	M-38BB	53'-9"	YES		YES	28A / 27A
16	0A-H127 0B-H127 0C-H127	Hot Machine Shop Mono-rail Hoists	Admin. Bldg.	217'	A-7001 Sht. 1	2-ton	M-38BB	10'-11"	NO	A	NO	N/A / N/A
17	00-H129 00-H130	Control Rm. Chiller Hoists	8	200'	M-110 M-125	5-ton 4-ton	M-38BB	26'-0" 7'-4"	YES		NO	1L,1M / 1A,B,J,K,G,H
18	10-H131	Reactor Encl. Equip. Hatch Hoist	16	313'	M-121	6-ton	M-38BC	106'-6"	NO	C	YES	48A / 47A
19	*	Control Room HVAC Lift Beams	8	217'	M-111 M-126	3-ton	M-38BC	~15'	YES		YES	2 / 1L
20	00-H201	Reactor Bldg. Overhead Crane	11-16	352'	M-122	125/15 ton	M-16	165'-6"	YES		YES	78A,B,C / 48A,B,C,78A,30A
21	1A-H203 1B-H203	Recirculation Pump Motor Hoists	Drywell	253'	M-119	24-ton ea.	M-38A	41'-0"	YES		YES	30A / 29A
22	0A-H208 0B-H208	Fuel Pool Jib Cranes	12	352'	M-122	1/2-ton	M-1 (GE)	50'	N/A	B	N/A	78A / 78A

* Hoist to be borrowed from another location when needed.

TABLE 1

INDEX OF OVERHEAD HANDLING SYSTEMS - UNIT I & COMMON

Item	Crane or Hoist Equip. Number	Name/Service	Area	Elev.	Drwg.	Capacity	Material Req. Number	Max. Vert. Lift	Safety Related Item In Load Path?	Safety Related Exclusion Criteria	Safety-Related Item On Next Lower Elevation?	Fire Protection Areas: Load Path / Next Lower Elevation
23	00-H213	CRD Pump Hoist	6	200'	M-110	5-ton	M-38A	7'-2"	NO	A	N/A	89A / N/A
24	10-H215	HPCI/RCIC Equip. Hoist	11,15	217'	M-118	10-1/2 ton	M-38BC	56'-0"	YES		YES	44 / 42A
25	10-H216	Core Spray Pumps Hoist	11	217'	M-118	5-ton	M-38BA	59'-3"	YES		YES	44 / 42A,42B
26	10-H217	Core Spray Pump Hoist	12	217'	M-118	5-ton	M-38BA	59'-3"	YES		YES	44 / 41
27	1AH218 1BH218	Reactor Encl. Cooling Water HX & Core Spray Pump Hoist	12,16	217'	M-118	12-1/2 ton ea.	M-38BC	32'-0" 56'-0"	YES		YES	44 / 41
28	10-H219	RHR Pumps Hoist	15,16	217'	M-118	10-ton	M-38BA	55'-9"	YES		YES	44 / 31,32,42A
29	10-H220	Containment Equip. Door Hoist	11	253'	M-119	6-ton	M-38BA	16'-0"	YES		YES	45A / 44
30	1A-H221 1B-H221	Personnel Lock Hoist	16	253'	M-119	20-ton ea.	M-38BC	16'-6"	NO	C	YES	45A / 43,44

TABLE 1

INDEX OF OVERHEAD HANDLING SYSTEMS - UNIT I & COMMON

Item	Crane or Hoist Equip. Number	Name/Service	Area	Elev.	Drwg.	Capacity	Material Req. Number	Max. Vert. Lift	Safety Related Item In Load Path?	Exclusion Criteria	Safety-Related Item On Next Lower Elevation?	Fire Protection Areas: Load Path / Next Lower Elevation
31	00-H223	RWCU Heat Exchanger Hoist	15	283'	M-119	8-ton	M-38BA	12'-7"	YES		YES	47,H,J,K,L / 45A,45C
32	10-H224	Fuel Channel Handling Boom	12	352'	M-122	500 lb.	M-38BC	10'-3"	N/A	B	N/A	78A / 78A
33	10-H229	CRD Platform Hoist	15	253'	M-119	1-ton	M-38	20'-0"	YES		YES	30A / 29A
34	1AH233,* 234,235, 1BH233, 234,235, 10H230, 232	MSRV Service Hoists MSRV Removal Hoists	11,12, 15,16	273' 286'	M-234	1-ton 2-ton	M-38BA M-38BB	8'-0" 50'-0"	YES		YES	30A / 29A
35	10-H236	Disposal Cask Cart Removal Hoist	15	253'	M-119	1-ton	M-38BC	20'-7"	NO	C	YES	30A / 29A
36	10-H237	Containment Hydrogen Recombiner Cover Hoist	11,16	283'	M-120	1-ton	M-38BB	10'-8"	YES		YES	47A / 45A
37	10-H238	Equipment Hatch Bridge Crane	16	283'	M-120	25-ton	M-28	74'-0"	NO	C	YES	47A / 45A

* Hoist trolleys to be used with come-alongs

TABLE 1

INDEX OF OVERHEAD HANDLING SYSTEMS - UNIT I & COMMON

Item	Crane or Hoist Equip. Number	Name/Service	Area	Elev.	Drwg.	Capacity	Material Req. Number	Max. Vert. Lift	Safety Related Item In Load Path?	Safety Related: Exclusion Criteria	Safety-Related Item On Next Lower Elevation?	Fire Protection Areas: Load Path / Next Lower Elevation
38	10-H239	CRD Maintenance Area Crane	15	253'	M-119	1-ton	M-38BA	14'-0"	NO	C	YES	45C / 44
39	00-H302	Radwaste Handling Crane	22	237'	M-143	20-ton	M-87	23'-0"	NO	A	NO	120N / 120N
40	00-H306	Product Cylinder/Pipeway Hoist	19	195'	M-141	4-ton	M-38BC	22'-6"	NO	A	NO	119A / 117
41	00-H307	Radwaste Building HVAC Hoist	20	257'	M-143	2-ton	M-38BA	51'-0"	NO	A	NO	121H / 121A
42	00-H308	Radwaste Equip. Hatch Hoist	22	257'	M-143	2-ton	M-38B	50'-1"	NO	A	NO	121M / 121A,120N
43	00-H310	Radwaste Demineralizer & Equip. Hoist	20,22	217	M-142	4-ton	M-38BB	66'-0"	NO	A	NO	120L / 118Q-X
44	1A-H501 1B-H501 1C-H501 1D-H501	Diesel Generator Enclosure Cranes	D.G. Enclosure	217'	M-145	15-ton	M-28	20'-9"	YES		N/A	79-82 / N/A
45	00-H502	Machine Shop Bridge Crane	Admin. Bldg.	217'	A-7001 Sht. 1	15-ton	M-28	20'-0"	NO	A	N/A	N/A

TABLE 1

INDEX OF OVERHEAD HANDLING SYSTEMS - UNIT I & COMMON

Item	Crane or Hoist Equip. Number	Name/Service	Area	Elev.	Drwg.	Capacity	Material Req. Number	Max. Vert. Lift	Safety Related Item In Load Path?	Exclusion Criteria	Safety-Related Item On Next Lower Elevation?	Fire Protection Areas: Load Path / Next Lower Elevation
46	00-H503	Circulating Water Bldg. Bridge Crane	CWB	217'	M-5101 M-5102 M-5103	30-ton	M-28	40'-0"	NO	A	NO	N/A
47	00-H508	Machine Shop Decon. Area Bridge Crane	Admin. Bldg.	217'	A-7001 Sht. 1	5-ton	M-28	20'-0"	NO	A	N/A	N/A
48	00-H510	Auxiliary Boiler Bldg. Hoist	A.B. Bldg.	217'	M-1290	2-ton	M-38A	30'-0"	NO	A	N/A	N/A
49	00-H511 00-H513	Spray Pond Pump House Hoists	Spray Pond Pump House	268'	M-388	3-ton ea.	M-38B	12'-4"	YES		YES	122A,D,123A,D / 122B,E,123B,E
50	00-H514	Control Room Chiller Portable Gantry Hoist	8	200'	M-110 M-125	3-ton	Field	15'	YES		NO	1L,1M,1N,115D / 1A-1K
51	00-H521	HEPA Filter Hoist	19	191'	M-141	15-ton	M-38B	14'-0"	NO	A	NO	119A / 117
52	00-H530	Schuylkill River Bulkhead Hoist	S.R.P.H.	147'	M-4302	5-ton	M-38BA	48'-0"	NO	A	NO	N/A

OVERHEAD HANDLING SYSTEM REVIEW

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TABLE 1

INDEX OF OVERHEAD HANDLING SYSTEMS - UNIT I & COMMON

Item	Crane or Hoist Equip. Number	Name/Service	Area	Elev.	Drwg.	Capacity	Material Req. Number	Max. Vert. Lift	Safety Related Item In Load Path?	Exclusion Criteria	Safety-Related Item On Next Lower Elevation?	Fire Protection Areas: Load Path / Next Lower Elevation
53	*	Steam Tunnel Monorail Hoists	11,12	280'	M-234	*	*	35'	YES		NO	46, 47B / 97
54	8031-M-1-F19-E003	Refueling Platform Grapple & Hoists	11-18	352'	M-122	1200 lb. 1000 lb.	M-1 (GE)	50'	N/A	B	N/A	78A / 48B,C,78A,30A
55	*	Spray Pond RHRSW & ESW Pumps Yard Crane	Spray Pond Pump House	268'	M-388	*	N/A	*	YES		YES	N/A / 122A,D 123A,D
56	*	Feedwater Heater Tube Bundle Hoist	2	239'	M-112	*	*	25'	NO	A	NO	88A / 86A
57	*	Turbine Encl. M-G Set Area Supply Air Cooling Coils Hoist	7	302'	M-115	1-ton	*	20'	NO	A	NO	99A / 98A,98C
58	00H133	Control Room HVAC Equip. Hoist	8	304'	M-115 M-130	3-ton	M-38BC	17'	YES		YES	27 / 25A
59	*	Wetwell Monorail Hoist	11,12, 15,16	217'	M-118	2-ton	*	50'	YES		N/A	29A /

*Hoist/Crane to be borrowed from other locations when needed

TABLE 1

INDEX OF OVERHEAD HANDLING SYSTEMS - UNIT I AND COMMON

Item	Crane or Hoist Equip. Number	Name/Service	Area	Elev.	Drwg.	Capacity	Material Req. or Sub. Number	Max. Vert. Lift	Safety Related Item In Load Path?	Exclusion Criteria	Safety Related Item On Next Lower Elevation	Fire Protection Areas: Loat Path / Next Lower Elevation
60	*	Control Struc. Fans Lifting Beam Hoists	8	321'	M-124	2-ton	*	16'	YES		YES	27 / 24A
61	*	Reactor Enclosure Upper Fan Room Hoists	15,16	331'	M-121	2-ton	*	~20'	YES		YES	50,51 / 48A,49
62	*	Reactor Enclosure Lower Fan Room Hoists	15,16	313'	M-121	1-ton 2-ton	*	~16'	YES		YES	48A,49 / 47

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TABLE 2

LOAD TABULATION

This table provides a load/impact area matrix for each crane and hoist. Hazard elimination categories are indicated by letters which correspond to the list below. Detailed hazard evaluations for each load handling system can be found in Appendix B.

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 NUREG 0612 satisfied).

e. Analysis demonstrates that crane failure and load drop will not damage safety-related equipment.

(3) Deleted P. 42 of table (Item 63, North Stack Dumbwaiter)

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Reactor Enclosure Overhead Crane (00-H201)*

Location	Reactor Enclosure - Unit 1					
Impact Area / Loads	Refueling Floor - Elevation 321' Columns 15.5-23, D-J			Refueling Hoistway - Elevation 217' Columns 22.5 - 23.5, D-F		
	Elevation	**Safety-Related Equipment**	Hazard Elimination Category	**Elevation**	**Safety-Related Equipment**	Hazard Elimination Category
Reactor Well Shield Plugs (Up to 90 tons)	352'-0"	Irradiated Fuel	a,c	217'	None	N/A
Strongback I	Below 352' Slab	Recirculation System; Electrical Components; Fuel Pool Cooling	b,e	Below 217' Slab	N/A	N/A
Drywell Head (104 tons)	↓	↓	a,e	↓	↓	↓
	↓	↓	b,e	↓	↓	↓
Reactor Vessel Head (92 tons)	↓	↓	a,e	↓	↓	↓
RPV Head Strongback	↓	↓	b,e	↓	↓	↓

*Table 1 - Item 20

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Reactor Enclosure Overhead Crane (00-H201)*

Location	Reactor Enclosure - Unit 1					
Impact Area / Loads	Refueling Floor - Elevation 353' Columns 15.5-23, D-J			Refueling Hoistway - Elevation 217' Columns 22.5 - 23.5, D-F		
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category	**Elevation**	Safety-Related **Equipment**	Hazard Elimination Category
Steam Dryer (40 tons) Dryer/Separator Sling	352'-0"	Irradiated Fuel	a, e	217'	None	N/A
	Below 352' Slab	Recirculation System; Electrical Components; Fuel Pool Cooling	b, e	Below 217' Slab	N/A	N/A
Steam Separator (74 tons) Dryer/Separator Sling	↓	↓	a,e	↓	↓	↓
	↓	↓	b,e	↓	↓	↓
Fuel Pool Stop Logs (35 tons) Lifting Assembly II	↓	↓	d	↓	↓	↓
	↓	↓	d	↓	↓	↓

*Table 1 - Item 20

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Reactor Enclosure Overhead Crane (00-H201)*

Location	Reactor Enclosure - Unit 1					
Impact Area / **Loads**	Refueling Floor - Elevation 352' Columns 15.5-23, D-J			Refueling Hoistway - Elevation 217' Columns 22.5 - 23.5, D-F		
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category	**Elevation**	Safety-Related **Equipment**	Hazard Elimination Category
Dryer/Separator Storage Pit Canal Plugs (45 tons)	352'-0"	Irradiated Fuel	a,c	217'	None	N/A
Strongback II	Below 352' Slab	Recirculation System; Electrical Components; Fuel Pool Cooling	b,e	Below 217' Slab	N/A	N/A
Fuel Pool Gates (~3 tons each)	↓	↓	d	↓	↓	↓
	↓	↓	d	↓	↓	↓
Refueling Shield (22 tons)	↓	↓	d	↓	↓	↓
Refueling Shield Lift Rig	↓	↓	d	↓	↓	↓

*Table 1 - Item 20

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Reactor Enclosure Overhead Crane (00-H201)*

Location	Reactor Enclosure - Unit 1					
Impact Area	Refueling Floor - Elevation 352' Columns 15.5-23, D-J			Refueling Hoistway Columns 22.5-23.5, D-F		
Loads	**Elevation**	Safety-Related **Equipment**	Hazard Elimination Category	**Elevation**	Safety-Related **Equipment**	Hazard Elimination Category
Spent Fuel Shipping Cask (100 tons)	352'-0"	Irradiated Fuel	a,d	217'-0"	None	N/A
Cask Yoke	Below 352' Slab	Recirculation System' Electrical Components; Fuel Pool Cooling	d	Below 217' Slab	N/A	N/A
Service Platform (5 tons)	↓	↓	d	↓	↓	↓
Service Platform Sling	↓	↓	d	↓	↓	↓
RPV Head Insulation (9 tons)	↓	↓	a, c	↓	↓	↓
	↓	↓	b, e	↓	↓	↓

3 (revision marker beside Service Platform rows)

*Table 1 - Item 20

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Reactor Enclosure Overhead Crane (00-H201)*

Location	Reactor Enclosure - Unit 1					
Impact Area / **Loads**	Refueling Floor - Elevation 352' Columns 15.5-23, D-J			Refueling Hoistway - Elevation 217' Columns 22.5 - 23.5, D-F		
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category	**Elevation**	Safety-Related **Equipment**	Hazard Elimination Category
Head Stud Tensioner	352'-0"	Irradiated Fuel	a,c	217'	None	N/A
	Below 352' Slab	Recirculation System; Electrical Components; Fuel Pool Cooling	b,e	Below 217' Slab	N/A	N/A
(3) Head Stud Rack (1-1/2 tons)	↓	↓	a,c	↓	↓	↓
	↓	↓	b,e	↓	↓	↓
Service Platform Support Including Seal Surface Protector 950 lbs.	↓	↓	a,c	↓	↓	↓
	↓	↓	b,e	↓	↓	↓

*Table 1 - Item 20

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Reactor Enclosure Overhead Crane (00H201)*

Location	Reactor Enclosure - Unit 1					
Impact Area / **Loads**	Refueling Floor - Elevation 352' Columns 15.5-23, D-J			Refueling Hoistway - Elevation 217' Columns 22.5 - 23.5, D-F		
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category	**Elevation**	Safety-Related **Equipment**	Hazard Elimination Category
Crane Load Block (5 tons)	352'-0"	Irradiated Fuel	d	217'	None	N/A
	Below 352' Slab	Recirculation System; Electrical Components; Fuel Pool Cooling	d	Below 217' Slab	N/A	N/A
Fuel Pool & Service Platform Jib Cranes (2.2 tons)	↓	↓	d	↓	↓	↓
	↓	↓	d	↓	↓	↓
Fuel Channel Handling Boom (~3/4 tons)	↓	↓	d	↓	↓	↓
	↓	↓	d	↓	↓	↓

*Table 1 - Item 20

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Recombiner Service Hoist (00-H108)*

Location	Control Structure - Common					
Impact Area / **Loads**	Area 8, Elevation 200' Columns 20-26.5, M-N					
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category			
[Hoist Capacity: 15 tons] Hatch Plugs	200'	None	N/A			
	Below 200' Slab	None	↓			
Recombiner Cover	200'	None	↓			
	Below 200' Slab	None	↓			
Catalyst	200'	None	↓			
	Below 200' slab	None	↓			

*Table 1 - Item 5

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TABLE 2 - LOAD TABULATION

CRANE/HOIST: Preheater Removal Hoist (00-H112)*

Location	Control Structure - Common					
Impact Area / **Loads**	Area 8 - Elevation 180' Columns 22-23, M-N 24-25, M-N					
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category			
[Hoist Capacity: 1-1/2 ton] Preheater	180'	None	N/A			
	Below 180' Slab	N/A	N/A			

*Table 1 - Item 6

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Reactor Water Cleanup Filter/Demineralizer Hoist (00-H124)*

Location	Reactor Enclosure - Unit 1					
Impact Area / **Loads**	Area 11, Elevation 313' Columns 15-18, H					
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category			
[Hoist Capacity: 5 ton] Filter/Demin. Vessel Installation	313'	None	N/A			
	Below 313' Slab	Electrical Conduit	b			
Hatch Plugs (3 ton)	313'	None	N/A			
	Below 313' Slab	Electrical conduit	b			

*Table 1 - Item 14

TABLE 2 - LOAD TABULATION

CRANE/HOIST: HVAC Equipment Hatch Hoist (00-H126)*

Location	Control Structure - Common					
Impact Area / Loads	Area 8, Elevation 350' Columns 19-21, M			Area 8, Elevation 304' Below Hatchway		
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category	**Elevation**	Safety-Related **Equipment**	Hazard Elimination Category
Hoist Capacity: 2 ton Fans and Miscellaneous	332'	None	N/A	304'	None	N/A
	Below 332' Slab	Electrical Conduit	b	Below 304' Slab	Later	Later

*Table 1 - Item 15

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Control Room Chiller Hoists (00-H129/00-H130)*

Location	Control Structure - Common					
Impact Area / **Loads**	Area 8, Elevation 200' Columns 20.5-25.5, K-M					
	Elevation	**Safe-Shutdown Equipment**	Hazard Elimination Category			
[Hoist Capacities: 5-ton/4-ton] Chillers	200'	Control Room Chiller Piping; Electrical conduit	b			
	Below 200' Slab	None	N/A			

*Table 1 - Item 17

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Reactor Enclosure Equipment Hatch Hoist (10-H131)

Location	Reactor Enclosure - Unit 1					
Impact Area / **Loads**	Area 16, Elevation 313' Columns 21.5-22.5, D-E_f			Area 16, Elevation 217' Below Hatchway		
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category	**Elevation**	Safety-Related **Equipment**	Hazard Elimination Category
[Hoist Capacity: 6 ton] Misc. Loads	313'	None	N/A	217'	None	N/A
	Below 313' Slab	Electrical Conduit	b	Below 217' Slab	Electrical, Instr., & ESW Piping	b
				Below 201' Slab	None	N/A
Hatch Plugs (5-1/4 ton ea.)	313'	None	N/A	217'	None	N/A
	Below 313' Slab	Electrical conduit	b	Below 217' Slab	Electrical, Instr., & ESW Piping	b
				Below 201' Slab	None	N/A

*Table 1 - Item 18

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Control Room HVAC Lift Beams*

Location	Control Structure - Common					
Impact Area / Loads	Area 8, Elevation 217' Columns 22-24, K-M					
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category			
[Hoist Capacity: 3 ton] Fans & Cooling Coil Assemblies	217'	Chilled water piping; Electrical conduit	b			
	Below 217' Slab	Control Rm.Chillers; Electrical conduit	b			

* Table 1 - Item 19

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Recirculation Pump Motor Hoists (1A-H203, 1B-H203)*

Location	Reactor Enclosure (Drywell) - Unit 1					
Impact Area / **Loads**	Drywell, Elevation 253', Area 11 (Hoist 1AH203)			Drywell, Elevation 253', Area 16 (Hoist 1BH203)		
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category	**Elevation**	Safety-Related **Equipment**	Hazard Elimination Category
[Hoist Capacity: 24 ton each] Recirc. Pump Motor (23 ton)	253' & 238'	Recirculation, MSRV piping; Electrical conduit; Unit cooler	b,c	254' & 238'	Recirculation, MSRV, RCIC & S/D cooling piping; Unit cooler; Electrical conduit	b,c
	Below 238' Slab	Containment Vacuum Reliefs; Suppression pool temp. sensors	b	Below 238' Slab	Containment Vacuum reliefs; Suppression pool temp. sensors	b
Recirculation Pump (13-3/4 ton)	253' & 238'	Recirculation, MSRV piping; Electrical conduit; Unit cooler	b,c	253' & 238'	Recirculation, MSRV, RCIC & S/D cooling piping; Unit cooler; Electrical conduit	b,c
	Below 238' Slab	Containment Vacuum Reliefs; suppression pool temp. sensors	b	Below 238' Slab	Containment Vacuum reliefs; Suppression pool temp. sensors	b

*Table 1 - Item 21

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Fuel Pool Jib Cranes (0A-H208, 0B-H208)*

Location	Reactor Enclosure - Unit 1					
Impact Area / **Loads**	Refueling Floor, Elevation 352'					
	Elevation	**Safe-Shutdown Equipment**	Hazard Elimination Category			
[Hoist Capacity: 1/2 ton ea.] Fuel Bundle (700 lbs.)	352'	Irradiated Fuel	N/A			

* Table 1 - Item 22

TABLE 2 - LOAD TABULATION

CRANE/HOIST: HPCI/RCIC Equipment Hoist (10-H215)*

Location						
Impact Area / **Loads**	Areas 11, 15 - Elevation 217 Columns 14-15, D-H			Areas 11, 15 - Elevation 177' (Below Hatchway)		
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category	**Elevation**	Safety-Related **Equipment**	Hazard Elimination Category
[Hoist Capacity: 10-1/2 ton] HPCI Turbine (10-1/2 ton) HPCI Pump (8 - 1/4 ton)	217'	Electrical cable; RHR, Recirculation components	b	177'	HPCI/RCIC & Core Spray	b
	Below 217' Slab	Electrical cable; RHR, HPCI & RCIC components	b	Below 177' Slab	N/A	N/A
RCIC Turbine (2-1/2 ton) RCIC Pump (3-1/4 ton)	217'	Electrical cable; RHR, Recirculation components	b	177'	HPCI/RCIC & Core Spray	b
	Below 217' Slab	Electrical cable; RHR, HPCI & RCIC components	b	Below 177' Slab	N/A	N/A
Hatch Covers (9-1/4, 8-1/2 tons)	217'	Electrical cable; RHR, Recirculation components	b	177'	HPCI/RCIC & Core Spray	b
	Below 217' Slab	Electrical cable; RHR, HPCI & RCIC components	b	Below 177' Slab	N/A	N/A

*Table 1 - Item 24

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Core Spray Pumps Hoist (10-H216)*

Location	Reactor Enclosure - Unit 1						
Impact Area / **Loads**	Area 11, Elevation 217' Columns 15-17, G-J				Area 11, Elevation 177' (Below Hatchway)		
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category		**Elevation**	Safety-Related **Equipment**	Hazard Elimination Category
[Hoist Capacity: 5 ton] Core Spray Pump (3-1/2 ton)	217'	RHR, Recirculation, HPCI & Core Spray Components	b		177'	HPCI, RCIC & Core Spray	b
	Below 217' Slab	HPCI, RCIC, RHR, ESW System components	b		Below 177' Slab	N/A	N/A
Core Spray Pump Motor (3-1/4 ton)	217'	RHR, Recirculation, HPCI & Core Spray components	b		177'	HPCI, RCIC & Core Spray	b
	Below 217' Slab	HPCI, RCIC, RHR, ESW system components	b		Below 177' Slab	N/A	N/A
Hatch Plugs (4-3/4 ton)	Below 217' Slab	RHR, Recirculation, HPCI & Core Spray components	b		177'	HPCI, RCIC & Core Spray	b
	Below 217' Slab	HPCI, RCIC, RHR, ESW System components	b		Below 177' Slab	N/A	N/A

*Table 1 - Item 25

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Core Spray Pump Hoist (10-H217)*

Location	Reactor Enclosure - Unit 1					
Impact Area / **Loads**	Area 12, Elevation 217' Columns 20-23, H-J			Area 12, Elevation 177' (Below Hatchway)		
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category	**Elevation**	Safety-Related **Equipment**	Hazard Elimination Category
[Hoist Capacity: 5 ton] Core Spray Pump (3-1/2 ton)	217'	Core Spray and Recirculation piping, Instrumentation & Electrical	b	177'	Core Spray System	b
	Below 217' Slab	Radwaste & ESW Valves, piping and electrical	b	Below 177' Slab	N/A	N/a
Core Spray Pump Motor (3-1/4 ton)	217'	Core Spray and Recirculation piping, instrumentation & electrical	b	177'	Core Spray System	b
	Below 217' Slab	Radwaste & ESW Valves, piping and electrical	b	Below 177' Slab	N/A	N/A
Hatch Plug (5-1/2 ton)	217'	Core Spray and Recirculation piping; Electrical &Instrumentation	b	177'	Core Spray System	b
	Below 217' Slab	Radwaste & ESW valves, piping & electrical	b	Below 177' Slab	N/A	N/A

*Table 1 - Item 26

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Cooling Water HX & Core Spray Pump Hoist (1AH218, 1BH218) △3

Location	Reactor Enclosure - Unit 1					
Impact Area / **Loads**	Area 12, 16 - Elevation 217' Columns 22, E-H			Areas 12, 16 - Elevation 177' (Below Hatchway)		
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category	**Elevation**	Safety-Related **Equipment**	Hazard Elimination Category
[Hoist Capacity: 12-1/2 ton ea.] Cooling Water Heat Exchanger (24-1/2 ton)	217'	RHR, Recirculation, RCIC & Main Steam instrumentation & electrical	b	177'	Core Spray System	b
	Below 217' Slab	ESW & Radwaste piping, valves & instrumentation	b	Below 177' Slab	N/A	N/A
Core Spray Pump Motor (3-1/3 ton) (3-1/4 ton)	217'	RHR, Recirculation, RCIC & Main Steam instrumentation & electrical	b	177'	Core Spray System	b
	Below 217' Slab	ESW & Radwaste piping, valves & instrumentation	b	Below 177' Slab	N/A	N/A
Hatch Plugs (8-1/4 ton)	217'	RHR, Recirculation, RCIC & Main Steam instrumentation & electrical	b	177'	Core Spray System	b
	Below 217' Slab	ESW & Radwaste piping, valves & instrumentation	b	Below 177' Slab	N/A	N/A

*Table 1 - Item 27

TABLE 2 - LOAD TABULATION

CRANE/HOIST: RHR Pumps Hoist (10-H219)*

Location	Reactor Enclosure - Unit 1					
Impact Area / **Loads**	Areas 15, 16 - Elevation 217' Columns 14-22, D-E			Areas 15, 16 - Elevation 177' (Below Hatchway)		
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category	**Elevation**	Safety-Related **Equipment**	Hazard Elimination Category
Hoist Capacity: 10 ton RHR Pump (9-1/2 ton)	217'	Electrical conduit & MCC's	b	177'	RHR System	b
	Below 217' Slab	RHR, ESW valves; Electrical	b	Below 177' Slab	N/A	N/A
RHR Pump Motor (7 ton)	217'	Electrical conduit & MCC's	b	177'	RHR System	b
	Below 217' Slab	RHR, ESW valves; Electrical	b	Below 177' Slab	N/A	N/A
Hatch Plugs (8-1/4 ton) (9-1/2 ton)	217'	Electrical conduit & MCC's	b	177'	RHR System	b
	Below 217' Slab	RHR, ESW valves; Electrical	b	Below 177' Slab	N/A	N/A

*Table 1 - Item 28

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Containment Equipment Door Hoist (10-H220)*

Location	Reactor Enclosure - Unit 1					
Impact Area / Loads	Area 11, Elevation 253' Columns 15.5-17, H-J					
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category			
[Hoist Capacity: 6 ton] Containment Equip. Door	253'	Electrical conduit; core spray piping	b			
	Below 253' Slab	Electrical components	b			

*Table 1 - Item 29

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Personnel Lock Hoist (1A-H221/1B-H221)*

Location	Reactor Enclosure - Unit 1					
Impact Area / **Loads**	Area 16, Elevation 253' Columns 20-21.5, D-F					
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category		**Equipment**	
[Hoist Capacity: 20 ton ea.] Personnel Airlock	253'	None	N/A			
	Below 253' Slab	Electrical conduit; RHR system	b,c			

*Table 1 - Item 30

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Reactor Water Cleanup HX Hoist (00-H223)* △3

Location	Reactor Enclosure -Unit 1					
Impact Area / Loads	Area 12, Elevation 283' Columns 14-17, D-F					
	Elevation	Safety-related **Equipment**	Hazard Elimination Category			
[Hoist Capacity: 8 ton] RWCU Non-Regenerative Heat Exchanger Tube Bundles	283'	Electrical conduit	b			
	Below 283' Slab	Electrical; Containment Atmos. Control System	b			
RWCU Regenerative Heat Exchanger Tube Bundles	283'	Electrical Conduit	b			
	Below 283' Slab	Electrical; Containment Atmos. Control Sys.	b			

*Table 1 - Item 31

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Fuel Channel Handling Boom (10-H224)*

Location	Reactor Enclosure - Unit 1					
Impact Area / **Loads**	Refueling Floor - Elevation 352'					
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category			
[Hoist Capacity: 500 lbs.] Fuel Channel	352'	Irradiated Fuel	N/A			

*Table 1 - Item 32

TABLE 2 - LOAD TABULATION

CRANE/HOIST: CRD Platform Hoist (10-H229)*

Location	Reactor Enclosure (Drywell) - Unit 1					
Impact Area / Loads	Area 15 (Drywell), Elev. 253'					
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category			
[Hoist Capacity: 1 ton]	253'	RHR Shutdown Cooling line	e			
CRD Removal Platform (~1350 lbs. w/CRD)	Below 238' Slab	Suppression Pool Temp. Sensors; Vacuum Reliefs	b,c			

*Table 1 - Item 33

TABLE 2 - LOAD TABULATION (1A-H233,234,235 / 1B-H233,234,235 / 10-H230, 232)*

CRANE/HOIST: MSRV Service/Removal Hoists

Location	Reactor Enclosure - Unit 1					
Impact Area / **Loads**	Drywell, Elevation 273' 286'					
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category			
Hoist Capacity: 1 ton/2 ton Main Steam Relief Valves (1200 lbs. ea.)	238' to 286'	Main Steam; ECCS piping; Unit coolers	b,c			
	Below 238' Slab	Suppression Pool Temp. Sensors; Vacuum reliefs	b			

*Table 1 - Item 34

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Disposal Cask Cart Removal Hoist (10-H236)*

Location	Reactor Enclosure-Unit 1					
Impact Area / Loads	Drywell, Elevation 253'					
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category			
[Hoist Capacity: 1 ton]	253'	None	N/A			
Disposal Cask Cart	Below 238' Slab	Suppression Pool Temp. Sensors; Vacuum reliefs	b			

*Table 1 - Item 35

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Containment Hydrogen Recombiner Cover Hoist (10-H237)*

Location	Reactor Enclosure - Unit 1					
Impact Area / Loads	Areas 11 - Elevation 283' Columns 15-17,H-J			Area 16 - Elevation 283' Columns 20-21, F-G		
	Elevation	Safety-Related **Equipment**	Hazard Elimination Category	Elevation	Safety-Related Equipment	Hazard Elimination Category
[Hoist Capacity: 1 ton] H_2 Recombiner Cover	283'	Electrical; Hydrogen Recombiner	b	283'	Electrical; Hydrogen Recombiner	b
	Below 283' Slab	Electrical conduit	b	Below 283' slab	Electrical conduit; CRD hydraulics	e

*Table 1 - Item 36

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Equipment Hatch Bridge Crane (10-H238)*

Location	Reactor Enclosure - Unit 1					
Impact Area / Loads	Area 15 - Elevation 253' Columns 21.5 - 22.5, D-F			Area 15 - Elevation 217' (Below hatchway)		
	Elevation	Safety-Related Equipment	Hazard Elimination Category	Elevation	Safety-Related Equipment	Hazard Elimination Category
[Hoist Capacity: 25 ton]	283'	None	N/A	217'	None	N/A
Miscellaneous Loads	Below 283' slab	Electrical conduit	b	Below 217' Slab	Electrical; RHR Instrumentation; ESW piping	b

*Table 1 - Item 37

TABLE 2 - LOAD TABULATION

CRANE/HOIST: CRD Maintenance Area Crane (10-H239)*

Location	Reactor Enclosure - Unit 1					
Impact Area / Loads	Area 15, Elevation 253' Columns 14.1 - 15.5, D-F					
	Elevation	Safety-Related Equipment	Hazard Elimination Category			
[Hoist Capacity: 1 ton] Control Rod Drive	253'	None	N/A			
	Below 253' Slab	Electrical conduit	b			

*Table 1 - Item 38

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Diesel Generator Bridge Cranes (1A-H501, 1B-H501, 1C-501, 1D-501)*

Location	Diesel Generator Rooms - Unit 1					
Impact Area / Loads	Elevation 217' Columns 15.5-21.5, South of Reactor Enclosure					
	Elevation	**Safety-Related Equipment**	Hazard Elimination Category			
[Hoist Capacity: 15 ton] Diesel Gen. Parts	217'	Diesel Generators & Auxiliaries	b			
	Below 217' Slab	N/A	N/A			

*Table 1 - Item 44

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Spray Pond Pump Hoists (00-H511, 00-H513)*

Location	Spray Pond Pump House - Common					
Impact Area / Loads	Columns 1-3.5,B-C (00-H511)			Columns 3.5-6, B-C (00-H513)		
	Elevation	Safety-Related Equipment	Hazard Elimination Category	Elevation	Safety-Related Equipment	Hazard Elimination Category
[Hoist Capacity: 3 ton ea.]	268'	Safety-related Electrical	b	268'	Safety-related Electrical	b
RHR Service Water and ESW Valves	Below 268' Slab	RHRSW & ESW Valves (Loops A,C)	b	Below 268' Slab	RHRSW & ESW Valves (Loops B,D)	b

*Table 1 - Item 49

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Control Room Chiller Portable Gantry Hoist (00-H514)*

Location	Control Structure - Common					
Impact Area / Loads	Area 8, Elevation 200' Columns 19-27, J-N					
	Elevation	Safety-Related Equipment	Hazard Elimination Category			
[Hoist Capacity: 3 ton] Miscellaneous Loads	200'	Control Room Chillers; Electrical	b			
	Below 200' Slab	None	N/A			

*Table 1 - Item 50

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Steam Tunnel Monorail Hoists*

Location	Reactor Enclosure - Unit 1					
Impact Area / Loads	Areas 11, 12 - Elevation 279'-6" Columns 17.5-19.5,H-J					
	Elevation	Safety-Related Equipment	Hazard Elimination Category			
Main Steam Isolation Valves; Misc. Valves	253' to ~290'	MSIV's; RCIC piping; MSIV Leakage Control	b			
	Below 253' slab	None	N/A			

*Table 1 - Item 53

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Refueling Platform Grapple & Hoists*

Location	Reactor Enclosure - Unit 1					
Impact Area / Loads	Area 11-18, Elevation 352' Columns 14.5-23, F-H					
	Elevation	Safety-Related Equipment	Hazard Elimination Category			
Hoists Capacity: 1200 lb. 1000 lb. Misc. loads ≤ Wt. of fuel bundle plus handling tool	352'	Irradiated Fuel	N/A			

*Table 1 - Item 54

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Spray Pond RHRSW/ESW Pumps Removal Crane*

Location	Spray Pond Pump House - Common					
Impact Area / Loads	Columns 1-3.5, B-C			Columns 3.5-6, B-C		
	Elevation	Safety-Related Equipment	Hazard Elimination Category	Elevation	Safety-Related Equipment	Hazard Elimination Category
RHRSW & ESW Pumps	268'	RHRSW/ESW pumps; Electrical items	b	268'	RHRSW/ESW pumps; Electrical items	b
	Below 268' Slab	RHRSW & ESW A & C Valves	b	Below 268' Slab	RHRSW & ESW B & D Valves	b

*Table 1 - Item 55

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Control Room HVAC Equipment Hoist (00-H124)*

Location	Control Structure - Common					
Impact Area / Loads	Area 8, Elevation 302' Columns 20.5-26, K-M					
	Elevation	Safety-Related Equipment	Hazard Elimination Category			
[Hoists Capacity: 2 ton/3 ton] Misc. HVAC Equipment	304'	Safety-related Electrical	b			
	Below 304' Slab	Safety-related Electrical; PGCC's	e			

*Table 1 - Item 58

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Wetwell Monorail Hoist*

Location	Reactor Enclosure - Unit 1					
Impact Area / Loads	Areas 11, 12, 15, 16 - Elev. 217' Columns 16-21, E-J					
	Elevation	**Safety-Related Equipment**	Hazard Elimination Category			
Hoist Capacity: 2 ton Vacuum Relief Valve Assemblies PSV-57-137A,B,C,D	182' to ~230'	Vacuum relief valves; Supp. pool Temp. sensors	b			
	Below 182' slab	N/A	N/A			

*Table 1 - Item 59

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Control Structure Fans Lifting Beam Hoist*

Location	Control Structure - Unit 1					
Impact Area / Loads	Area 8, Elevation 321' Columns 21-24.5, K-M					
	Elevation	Safety-Related Equipment	Hazard Elimination Category			
Hoist Capacity: 2 ton Control Room HVAC Fans	304' to 321'	Electrical conduit	b			
	Below 304' Slab	Electrical conduit; PGCC's	e			

*Table 1 - Item 60

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Reactor Enclosure Upper Fan Room Hoists*

Location	Reactor Enclosure - Unit 1					
Impact Area / Loads	Areas 15, 16 - Elevation 331' Column 14-23, D-E			Area 15 - Elevation 313' (Below Hatchway)		
	Elevation	Safety-Related Equipment	Hazard Elimination Category	Elevation	Safety-Related Equipment	Hazard Elimination Category
HVAC Fans & Miscellaneous	331'	Electrical conduit	b	313'	None	N/A
	Below 331' Slab	Electrical conduit	b	Below 313' Slab	None	N/A

*Table 1 - Item 61

TABLE 2 - LOAD TABULATION

CRANE/HOIST: Reactor Enclosure Lower Fan Room Hoist*

Location	Reactor Enclosure - Unit 1					
Impact Area / Loads	Areas 15, 16 - Elevation 313' Columns 14-23, D-E					
	Elevation	Safety-Related Equipment	Hazard Elimination Category			
HVAC Fans & Miscellaneous	313'	Electrical conduit	b			
	Below 313' Slab	Standby Liquid Control; Electrical Items	b			

*Table 1 - Item 62

TABLE 3

LIMERICK SPECIAL LIFTING DEVICES

Item	Special Lifting Device	Load Weight, W	Design Safety Factor*	Complies with ANSI N14.6 -1978?
1	Dryer & Separator Sling (GE-F19-E008)	40/74 tons	5 x W	No
2	RPV Head Strongback (GE-F19-E009)	92 tons	5 x W	No
3	Head Nut & Washer Rack Sling (GE-F21-E001)	1200 lbs.	5 x W	N/A**
4	Service Platform Rack Sling (GE-F21-E001)	5 tons	10 x W	No
5	General Purpose Grapple and Sling (GE-F21-E001)	≤1000 lbs.	5 x W	N/A**
6	Refueling Shield Lift Rig (Bechtel 8031-C-90)	22 tons	3 x W	No
7	Reactor Well Shield Plugs & Dryer/Separator Canal Plug Strongback I (Bechtel)	Up to 90 tons	4.5(W+25%)	No
8	Dryer/Separator Canal Plugs Strongback II (Bechtel)	45 tons	4.5(W+25%)	No
9	Refueling Slot Shield Plugs Lifting Ass'y I (Bechtel)	16 tons	4.5(W+25%)	No
10	Fuel Pool Stops Logs Lifting Ass'y II (Bechtel)	35 tons	4.5(W+25%)	No
11	Spent Fuel Cask Yoke	100 tons	See P.5	See P.5
12	Module Lifting Fixture for Spent Fuel Storage Racks (PAR, Programmed & Remote Systems)	6.67 tons	3 X W	No
13	Lifting Rig for New Fuel containers (PECo)	3.5 tons	Per ANSI N14.6-1978	Yes

*GE design safety factors based on material ultimate strength. Bechtel and PAR design safety factors are conservative estimates based on minimum ASTM material yield strengths. Actual design stresses are based on American Institute of Steel Construction (AISC) recommended allowables which vary with type of stress and component shape.
**Not a heavy load.

3

TABLE 4
(Sheet 1 of 3)

REFUELING FLOOR HEAVY LOAD HEIGHT RESTRICTIONS
(in feet and inches from floor to bottom of load - Note 10)

Load	Weight (tons)	Floor Zone		
		A(4)	B(7)	C
Drywell Head	104T	3'-0	3'-0	3'-0
RPV Head	92T	3'-0	3'-0	2'-0
Shield Plug #11 or #12	12T	4'-0	3'-0	3'-0
Stop Log #13 or #14	59T	3'-0 (8)	3'-0	1'-9
Shield Plugs #1 thru #10	≤85T	5'-0	3'-0	2'-0
Steam Dryer	40T	[illegible]'-0 (9)	5'-0	3'-0
Steam Separator	74T	20'-0 (9)	5'-0	2'-6
RPV Head Insulation	9T	7'-0	7'-0	7'-0
Miscellaneous Loads:(6)				
25T and smaller loads	25T	5'-0	5'-0	2'-6
10T and smaller loads	10T	5'-6	5'-0	3'-6
5T and smaller loads	5T	6'-0	6'-0	6'-0
2T and smaller loads	2T	7'-0	7'-0	7'-0
1T and smaller loads	1T	7'-0	7'-0	7'-0

Notes:

1) Only heavy loads which must be carried over reactor wells are allowed in this area, up to elevations corresponding to limits for adjacent floor (Exception: The RPV head may be lifted to only plant elevation 353'-9", while its center of gravity is over the reactor well).

2) No heavy loads allowed over the spent fuel pools except for specific loads discussed in this report.

3) No height limits over the hatchway (hatch cover assumed to fail on impact).

4) Zone A heights are measured from the bottom of the pit or canal (a heavy load drop will cause floor grating to fail).

TABLE 4
(Sheet 2 of 3)

Notes, Cont'd:

5) Height limits are based on allowing concrete spalling and yielding of reinforcing and structural steel.

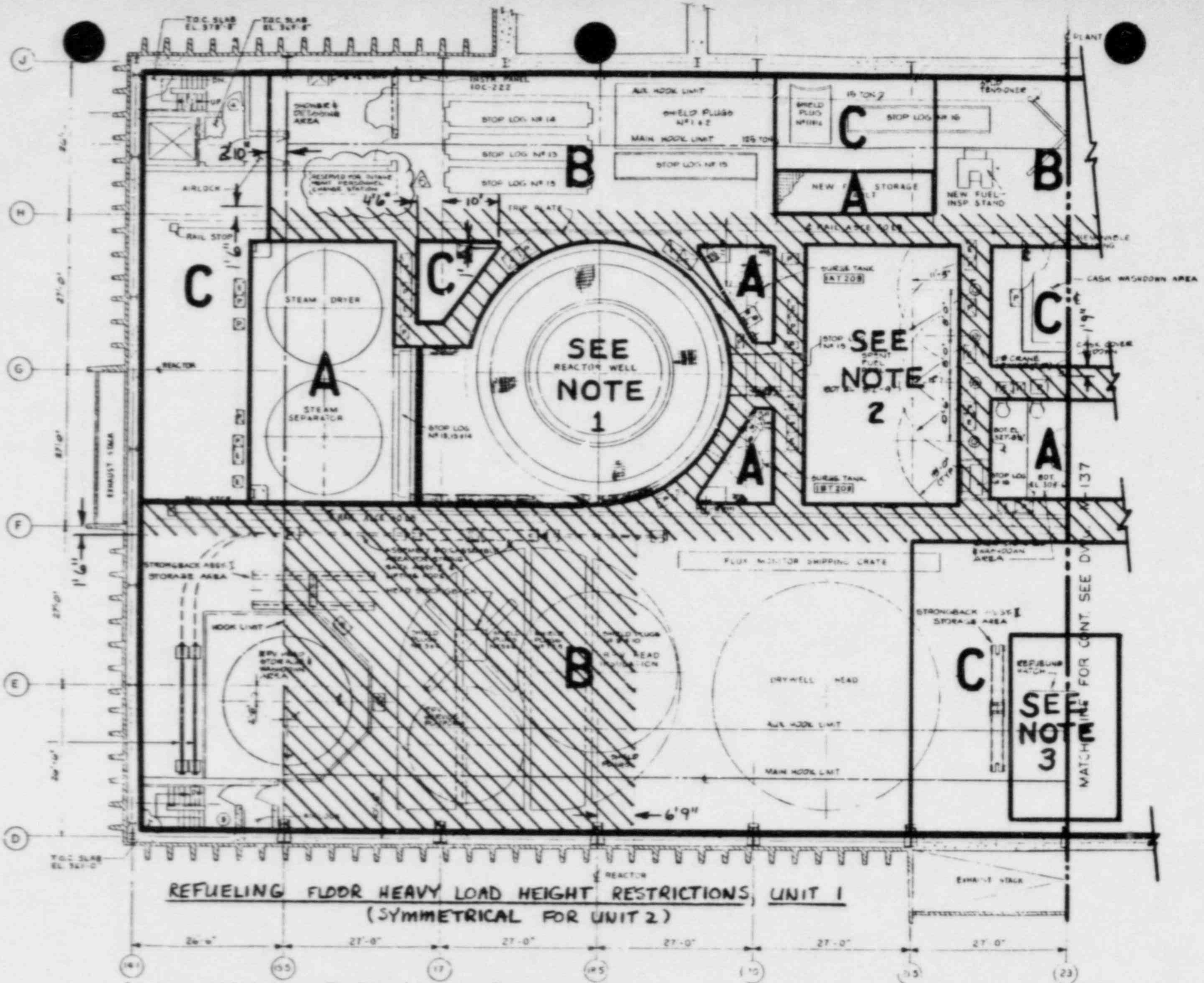
6) Height limits are based on calculations for solid steel cylinders (length = 2 x diameter) and are assumed to be conservative for most miscellaneous loads.

7) Hatched areas of Zone B are no longer of significance.

8) When the reactor is in cold shutdown, the Zone A height limits for stop logs 13 and 14 over the associated dryer/separator pool may be increased to an elevation equivalent to the height limit for the adjacent floor area.

9) Applicable to the dryer/separator pool only, when the reactor for that Unit is in cold shutdown.

10) The height limits may also be measured from the top of objects located on the floor if these objects would break the fall of a dropped load. For example dunnage may be used to provide an intermediate "platform" so that the RPV head may be moved in a stepwise fashion onto its washdown supports. Material or objects used for such a purpose must be located such that they will stop the acceleration of a dropped load rather than just deflect it.



REFUELING FLOOR HEAVY LOAD HEIGHT RESTRICTIONS, UNIT 1
(SYMMETRICAL FOR UNIT 2)

DRAWING BACKGROUND BASED ON DRAWING BOH-M-122, REV. 6

TABLE 4
(SHEET 3 OF 3)

3

TABLE 5
Compliance with ANSI 14.6-1978 for Special Lifting Devices

This appendix describes the extent of compliance of several special lifting devices with the design, fabrication and testing requirements of ANSI N14.6-1978. The special lifting devices included are those for which the likelihood of a load drop is considered to be extremely low. (Yes-general conformance; No-general non-conformance; NA-not applicable; ND-not determined, information not readily available.)

Special Lifting Device for:

ANSI N14.6-1978 Paragraph Number	Refueling Shield	Fuel Pool Stop Logs	Spent Fuel Storage Racks	RPV Service Platform
3.1.1	Yes (1)	Yes (1)	Yes (1)	Yes
3.1.2	No	No	No	Yes
3.1.3	Yes (2)	Yes (2)	Yes (2)	Yes
3.1.4	Yes	Yes	Yes	Yes
3.2.1.1	Yes	Yes	Yes	Yes
3.2.1.2	Yes	Yes	Yes	Yes
3.2.2	Yes	Yes	Yes	ND
3.2.3	Yes	Yes	Yes	NA
3.2.4	Yes	Yes	NA	Yes
3.2.5	NA	NA	Yes	Yes (3)
3.2.6	No	No	No	NA
3.3.1	Yes	Yes	Yes	Yes
3.3.2	ND	ND	No	ND
3.3.3	Yes	NA	Yes	NA
3.3.4	Yes	Yes	Yes	Yes
3.3.5	Yes	Yes	Yes	Yes
3.3.6	NA	NA	Yes	NA
3.3.7	No	NA	No	NA
3.3.8	No	No	No	No
3.4.1	NA	NA (4)	Yes	NA (4)
3.4.2	No	No	No	NA (4)
3.4.3	No	No	No	NA (4)
3.4.4	No	Yes	Yes	NA (4)
3.4.5	ND	ND	ND	NA (4)
3.4.6	NA	NA	NA	NA (4)
3.5.1	NA	NA	Yes	Yes
3.5.2	NA	NA	NA	NA
3.5.3	Yes	NA (5)	No	NA
3.5.4	Yes	ND	ND	NA
3.5.5	Yes	ND	ND	NA

TABLE 5
Compliance with ANSI 14.6-1978 for Special Lifting Devices
Cont'd

Special Lifting Device for:

ANSI N14.6-1978 Paragraph Number	Refueling Shield	Fuel Pool Stop Logs	Spent Fuel Storage Racks	RPV Service Platform
3.5.6	Yes	ND	Yes	ND
3.5.7	Yes	ND	Yes	NA
3.5.8	Yes	ND	ND	NA
3.5.9	Yes	NA	ND	NA
3.5.10	ND	ND	ND	Yes
3.6.1	Yes	NA	Yes	NA
3.6.2	NA	NA	NA	NA
3.6.3	NA	NA	NA	NA
4.1.1	Yes	Yes	Yes	Yes
4.1.2	Yes	Yes	ND	Yes
4.1.3	Yes	Yes	ND	Yes
4.1.4	Yes	Yes	Yes	Yes
4.1.5	Yes	Yes	Yes	ND
4.1.6	Yes	Yes	Yes	Yes
4.1.7	Yes	Yes	ND	Yes
4.1.8	Yes	Yes	Yes	ND
4.1.9	Yes	Yes	ND	Yes
4.1.10	No	No	No	ND
4.1.11	Yes	Yes	Yes	Yes
4.1.12	Yes	Yes	Yes	Yes
4.2.1	Yes	Yes	ND	ND
4.2.2	NA	NA	ND	ND
4.2.3	Yes	Yes	Yes	ND
4.2.4	Yes	Yes	Yes	ND
4.2.5	Yes	Yes	Yes	ND
4.3.1	ND	ND	ND	ND
4.3.2	NA	NA	Yes	ND
4.3.3	NA	NA	ND	ND
5.1.1	Yes	Yes	Yes	ND
5.1.2	Yes	Yes	Yes	ND
5.1.3	ND	ND	ND	ND
5.1.4	ND	ND	Yes	ND
5.1.5.1	Yes	Yes	Yes	NA
5.1.5.2	No	No	No	No
5.1.6	ND	ND	ND	ND
5.1.7	Yes	Yes	Yes	Yes
5.1.8	ND	ND	ND	ND
5.2.1	Yes	Yes	Yes	Yes
5.2.2	NA	NA	NA	NA
5.2.3	NA	NA	Yes	NA

TABLE 5
Compliance with ANSI 14.6-1978 for Special Lifting Devices
Cont'd

Special Lifting Device for:

Paragraph Number	Refueling Shield	Fuel Pool Stop Logs	Spent Fuel Storage Racks	RPV Service Platform
5.3.1	ND	ND	ND	ND
5.3.2	ND	ND	ND	ND
5.3.3	ND	ND	ND	ND
5.3.4	ND	ND	ND	ND
5.3.5	ND	ND	ND	ND
5.3.6	ND	ND	ND	ND
5.3.7	ND	ND	ND	ND
5.3.8	ND	ND	ND	ND
5.4.1	ND	ND	ND	ND
5.4.2	Yes	Yes	Yes	ND
5.5.1	Yes	Yes	ND	ND
5.5.2	Yes	Yes	ND	ND
6.1	No	No	No	Yes
6.2.1	No	No	No	Yes
6.2.2	No	No	No	No
6.2.3	NA	NA	NA	NA
6.2.4	NA	NA	NA	NA
6.2.5	NA	NA	NA	NA
6.2.6	Yes	Yes	Yes	Yes
6.3.1	No	No	No	ND
6.3.2	Yes	Yes	Yes	NA

Notes:

(1) Design requirements for the lifting device are covered in the design specification for the shipping container.

(2) Except that the margin of safety does not meet the requirements of this standard.

(3) Not proof load tested by supplier as required per Section 9.2.3 of ANSI B30.9 but will be load tested by owner.

(4) Not required to be submerged into the pool.

(5) Coated with either (1) Carbon Zinc II (Carboline Company), (2) Dimecote 6 (Ameron Corrosion Control Division) or (3) Mobil Zinc (Mobil Chemical).

APPENDIX A

SYSTEMS REQUIRED FOR

SAFE SHUTDOWN

&

DECAY HEAT REMOVAL

APPENDIX A

SYSTEMS REQUIRED FOR SAFE SHUTDOWN

AND DECAY HEAT REMOVAL

The lists of systems required to achieve safe shutdown of the reactor and to remove decay heat are based on the "Analysis of Capability to Achieve Safe Shutdown", Chapter 5 of the Limerick Fire Protection Evaluation Report. The following specific assumptions were made for the overhead handling systems review:

1. Offsite power is assumed to be unavailable.

2. A single active component failure is not assumed to occur at the same time as the heavy load drop.

3. Plant accidents and severe natural phenomena are not assumed to occur at the same time as the load drop. The control room is assumed to remain habitable.

The following paragraphs provide descriptions of methods that can be used for reactor shutdown and cooldown from the control room without offsite power. Each of these methods includes a system by which makeup water can be added to the reactor vessel, a system by which energy can be removed from the reactor vessel, and any support systems needed to accomodate energy removal to an ultimate heat sink or to return water to its supply source.

Although the safe shutdown analysis places primary emphasis on achievement of reactor shutdown using the methods described below, many alternative shutdown methods would be available. Use of safety-related and nonsafety-related systems not addressed in the safe shutdown analysis, plus manual operation of certain equipment and controls, would provide numerous combinations of systems with adequate capability to safely shut the plant down.

For the purposes of this safe shutdown analysis, two methods of shutdown that are operable without offsite power were selected for detailed study. Shutdown method A requires Class IE power from Divisions 1 and 3 (both ac and dc) in order to be operable. Shutdown method B requires Class 1E power from divisions 2 and 4 (both ac and dc) plus dc power from either Division 1 or Division 3 for ADS valve actuation in order to be operable. The two methods are described below.

Method A

After insertion of the control rods and closure of the main steam isolation valves, the RCIC system is used to supply makeup water to the reactor vessel from the suppression chamber. The operation of the RCIC system also removes energy from the reactor in the form of steam used to drive the RCIC turbine. During the period in which steam is generated at a rate greater than the consumption of the RCIC system, steam is relieved to the suppression pool by the automatic actuation of the main steam relief valves, which open when reactor pressure reaches the valve setpoint. Heat is removed from the suppression pool by operating one loop of the RHR system in the suppression pool cooling mode. In this mode, water from the suppression pool is circulated through an RHR heat exchanger and then returned to the suppression pool. In order to initiate operation of the shutdown cooling cooling mode of the RHR system, it is necessary to depressurize the reactor below a nominal pressure 75 psig. This is accomplished by using the ADS valves to discharge steam to the suppression pool. When the reactor has been depressurized below 75 psig, operation of the RCIC system is terminated and the RHR system is switched from the suppression pool cooling mode to the shutdown cooling mode. In both of these modes, heat is removed from the RHR heat exchanger by the RHRSW system, which in turn dissipates heat at the spray pond. The shutdown cooling mode of RHR will maintain the reactor in a cold shutdown condition.

The items of equipment that are required for this shutdown method include the following:

a. Main steam relief valves (self-actuated mode only) and main steam isolation valves.

b. ADS valves (If a compressed gas supply is needed in addition to that stored in the ADS accumulators, the compressed gas cylinders of the primary containment instrument gas system will provide the necessary gas. If the outboard containment isolation valve on the gas supply line cannot be opened by its motor operator, the valve will be opened manually.)

c. RCIC pump and associated valves.

d. RHR heat exchanger "A"

e. RHR pump "A" and associated valves (The outboard isolation valve on the shutdown cooling return line is a motor-operated valve powered from the Division 2 switchgear; this valve will be operated manually at the valve location if Division 2 power is not available.)

f. RHR shutdown cooling suction isolation valves (The outboard valve is a motor-operated valve powered from the Division 2 switchgear; this valve will be operated manually at the valve location if Division 2 power is not available.)

g. RHRSW pump "A" and associated valves (for Unit 1); RHRSW pump "C" and associated valves (for Unit 2)

h. ESW pump "A" and associated valves (for Unit 1); ESW pump "C" and associated valves (for Unit 2)

i. RHR compartment unit cooler "A"

j. RCIC compartment unit cooler "A"

k. Spray pond pump structure fan "A"

l. Diesel-generator enclosure fans "A", "C", "E", and "G"

m. Reactor vessel pressure and level recorder "A"

n. Suppression Pool Temperature Instrumentation

o. Standby diesel-generators "A" and "C"

p. Class IE AC Power Distribution System, Divisions 1 & 3.

q. Class IE DC Power Distribution System, Divisions 1 & 3.

r. Reactor Enclosure Equipment Compartment Ventilation.

s. Spray Pond Pump Structure Ventilation

t. Diesel Generator Enclosure Ventilation

u. Control Structure Ventilation

v. Control Structure Chilled Water

w. Control Rod Drive hydraulic control units

Method B

After insertion of the control rods and closure of the main steam isolation valves, the HPCI system is used to supply makeup water to the reactor vessel from the suppression chamber. The operation of the HCPI system also removes energy from the reactor in the form of steam used to drive the HPCI turbine. During the period in which steam is generated at a rate greater than the consumption of the HPCI system, steam is relieved to the suppression pool by the automatic actuation of the main steam relief valves, which open when reactor pressure reaches the valve setpoint. Heat is removed from the suppression pool by operating one loop of the RHR system in the suppression pool cooling mode. In this mode, water from the suppression pool is circulated through an RHR heat exchanger and then returned to the suppression pool. In order to initiate operation of the shutdown cooling mode of the RHR system, it is necessary to depressurize the reactor below a nominal pressure of 75 psig. This is accomplished by using the ADS valves to discharge steam to the suppression pool. When the reactor has been depressurized below 75 psig, the RHR system is switched from the suppression pool cooling mode to the shutdown cooling mode. Heat is removed from the RHR heat exchanger by the RHRSW system, which in turn dissipates heat at the spray pond. The shutdown cooling mode of RHR will maintain the reactor in a cold shutdown condition.

The items of equipment that are required for this shutdown method include the following:

a. Main steam relief valves (self-actuated mode only) and main steam isolation valves.

b. ADS valves (If a compressed gas supply is needed in addition to that stored in the ADS accumulators, the compressed gas cylinders of the primary containment instrument gas system will provide the necessary gas. If the outboard containment isolation valve on the gas supply line cannot be opened by its motor operator, the valve will be opened manually.)

c. HPCI pump and associated valves

d. RHR heat exchanger "B"

e. RHR pump "B" and associated valves

f. RHR shutdown cooling suction isolation valves (The inboard valve is a motor-operated valve powered from the Division 1 switchgear; this valve will be operated manually at the valve location if Division 1 power is not available.)

g. RHRSW pump "B" and associated valves (for Unit 1); RHRSW pump "D" and associated valves (for Unit 2)

h. ESW pump "B" and associated valves (for Unit 1); ESW pump "D" and associated valves (for Unit 2)

i. RHR compartment unit cooler "B"

j. HPCI compartment unit cooler "A"

k. Spray pond pump structure fan "B"

l. Diesel-generator enclosure fans "B", "D", "F", and "H"

m. Reactor vessel pressure and level recorder "B"

n. Suppression Pool Temperature Instrumention

o. Standby diesel-generators "B" and "D"

p. Class IE AC Power Distribution System, Divisions 2 & 4.

q. Class IE DC Power Distribution System, Division 2 & 4 plus 1 or 3.

r. Reactor Enclosure Equipment Compartment Ventilation

s. Spray Pond Pump Structure Ventilation

t. Diesel Generator Enclosure Ventilation

u. Control Structure Ventilation

v. Control Structure Chilled Water System

w. Control Rod Drive hydraulic control units

The above safe shutdown analysis includes systems required for decay heat removal from the reactor vessel. Decay heat removal from the spent fuel pool is normally accomplished by the fuel pool cooling and cleanup system (FPCC). Since this is not a safety-related system and does not appear on the separation drawings no general attempt was made to see whether the FPCC system would be affected by a load drop. If the system is disabled by a load drop the fuel pool can be cooled using the RHR 'B' pump and heat exchanger as described in Section 9.1 of the Limerick FSAR. The supply piping from the RHR system to the fuel pool and the return piping from the skimmer surge tank to the RHR pump suction was included in this review.

In cases where components of the RHR system which are required for backup fuel pool cooling could be damaged by a load drop, credit is taken for FPCC system operation. A review of the area was then made to verify that the same load drop could not disable the FPCC system as well. The FPCC system is available after a loss of offsite power.

APPENDIX B

HAZARD EVALUATIONS

This appendix contains detailed hazard evaluations for each crane and hoist. Major safety-related items located in the load path or on the next lower elevation are listed. A description of the effect of a load drop on systems required for safe shutdown or decay heat removal is provided, followed by a conclusion. Unless otherwise noted, safe shutdown capability also includes the ability to establish or maintain a means of decay heat removal from the reactor vessel and the spent fuel pool. A discussion of shutdown methods A and B is included in Appendix A. Shutdown method A requires the availability of electrical divisions 1 and 3. Shutdown method B requires the availability of electrical divisions 2 and 4, plus DC power from division 1 or division 3 for ADS valve actuation. Where hazard evaluations conclude that electrical divisions 2 and 4 will remain available following a load drop, a review has been made to assure that the necessary DC power is also available.

RWCU FILTER DEMINERALIZER HOIST
(Item 14, Equipment Number 00-H124)

This monorail hoist is used to remove hatch plugs and filter demineralizer elements from compartments on elevation 313' of the reactor enclosure. The safe load path is defined on the Item 14 load path drawing.

Major safety-related items in the load path:

None

Major safety-related items on the next lower elevation:

(1) Electrical conduit (Divisions 1, 2, 3 and 4)

Effect of a load drop on safe-shutdown or decay heat removal capability:

There are no safety-related items in the load path. All items on the next lower elevation are associated with electrical divisions 1 and 3 except for a few conduit associated with divisions 2 and 4. None of the division 2 and 4 electrical cabling is required for safe shutdown. Therefore, at a minimum, shutdown method B will remain available for safe shutdown of the plant.

Conclusion:

Based on separation and redundancy of safety-related sytems, a load drop by the RWCU filter demineralizer hoist will not jeopardize safe shutdown or decay heat removal capability.

HVAC EQUIPMENT HATCH HOIST

(Item 15, Equipment Number OOH126)

This monorail hoist is used to carry HVAC fans and miscellaneous equipment between elevations 304' and 350' in the control structure. The safe load path for this hoist is defined by the Item 15 load path drawing for elevation 332' and above and by the Item 58 load path drawing for elevation 304'.

Major safety-related items in the load path:

(1) Electrical conduit (Divisions 1, 3 and 4)

Major safety-related items on the next lower elevation:

(Below 304' floor slab)

(1) Remote shutdown panels, 10C201 and 20C201
(2) Electrical cable trays and conduit associated with the remote shudown panels (Divisions 1, 2, 3 & 4)

Effect of a load drop on safe-shutdown or decay heat removal capability:

All safety-related items in the load path (including conduit embedded in the elevation 304' floor slab) are associated with electrical divisions 1 and 3, except for one division 4 conduit which does not carry cable required for safe shutdown. Therefore, at a minimum, shutdown method B will remain available following a load drop to safely shut down the plant. Calculations show that the elevation 304' slab cannot sustain a potential heavy load drop without spalling. The remote shutdown panel, and safety-related cable tray and conduit associated with all electrical divisions and both safe shutdown methods, are located below the 304' floor slab. It is possible that both safe shutdown methods could be affected by a heavy load drop from the HVAC equipment hatch hoist.

Conclusion:

It is not possible to show by analysis that both safe shutdown methods could not be affected by a heavy load drop from the HVAC equipment hatch hoist. Therefore energy absorbing material will be used to pad the floor directly below the hoist or a redundant load bearing path will be provided when using this hoist to carry heavy loads. These administrative procedures will be developed prior to plant operation to assure that failure of the HVAC equipment hatch hoist will not jeopardize safe shutdown or decay heat removal capability.

CONTROL ROOM CHILLER HOISTS
(Item 17, Equipment Numbers, OOH129, OOH130)

These monorail hoists will be used to service control room chiller OAK112 and handle the equipment hatch plugs on elevation 200' of the control structure. [A portable gantry hoist (Item 50) will service control room chiller OBK112]. The safe load path is defined by the Item 17 load path drawing.

Major safety-related items in the load path:

(1) Chiller OAK112 & associated piping/instrumentation
(2) Electrical conduit (Divisions 1, 2 and 3)

Major safety-related items on the next lower elevation:

None

Effect of a load drop on safe-shutdown or decay heat removal capability:

All safety-related items which are necessary for safe shutdown are associated with shutdown method A. Therefore should a load drop occur shutdown method B will still be available to safely shut down the plant.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the control room chiller hoists will not jeopardize safe shutdown or decay heat removal capability.

REACTOR ENCLOSURE EQUIPMENT HATCH HOIST
(Item 18, Equipment Number 10H131)

This monorail hoist is used to lift items between elevations 217' and 313' of area 16 of the reactor enclosure. The safe load path is defined on the Item 18 load path drawing.

Major safety-related items in the load path:

None

Major safety-related items on the next lower elevation:

(Below 313 slab)

(1) Electrical conduit (Division 4)

(Below 217' slab)

(1) Emergency Service Water Piping (Division 2)
(2) Electrical Conduit (Divisions 2, 3 and 4)
(3) Instrumentation (Divisions 2 & 4)

(Below 201' Slab)

None

Effect of a load drop on safe-shutdown or decay heat removal capability:

There are no safety-related items in the load path. All components below the floor slabs at elevation 313' and 217' are associated with electrical divisions 2 and 4 except for three conduit. These conduit are associated with Division 3 but are not required for safe shutdown. Therefore a load drop could affect only shutdown method B. Shutdown method A will remain available to safely shut down the plant.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the reactor enclosure equipment hatch hoist will not jeopardize safe shutdown or decay heat removal capability.

CONTROL ROOM HVAC LIFTING BEAM HOISTS
(Item 19)

These hoists are used to carry HVAC fans and cooling coils between elevations 217' and 229'-8" in the control structure. The safe load path is defined on the Item 19 load path drawing.

Major safety-related items in the load path:

(1) Chilled water piping for HVAC coils (Division 1 & 2)
(2) Electrical conduit (Divisions 2, 3 & 4)

Major safety-related items on the next lower elevation:

(Below 217' slab)

(1) Control room chillers OAK112 & OBK112 and associated instrumentation and piping (Divisions 1 & 2)
(2) Electrical conduit (Divisions 3 & 4)

Effect of a load drop on safe-shutdown or decay heat removal capability:

The chilled water piping is at the same elevation and beside the hoist load and therefore cannot be affected by a load drop. Of the conduit in the load path, only the Division 2 conduit is required for safe shutdown. Since this conduit passes vertically through the load path a load cannot be carried over it. Therefore neither shutdown method would be affected by a load drop.

On the elevation below the 217' slab there is strict separation of Division 1, 3 and Division 2, 4 equipment by a wall, except for some Division 4 conduit which is not required for safe shutdown. Therefore, at least one shutdown method would remain available after a load drop to safely shut down the plant.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the control room HVAC lifting beam hoists will not jeopardize safe shutdown or decay heat removal capability.

Reactor Enclosure Crane
(Item 20, Equipment Number OOH201)

The reactor enclosure crane carries a variety of heavy loads over the refueling floor at elevation 352', and to and from grade elevation 217' through the refueling hoistway. The Item 20 load path drawings define the safe load paths.

Major safety-related items in the load path:

(1) Reactor vessel and fuel

Major safety-related items on the next lower elevation:

(Below 352' slab on elevations 313' and 331')

(1) Reactor enclosure recirculation system fans, 1AV213 & 1BV213
(2) Load center 10B201 (Division 1) and associated conduit
(3) Load center 10B202 (Division 2) and associated conduit
(4) Recirculation system valves/instrumentation and associated electrical cabling (Divisions 2, 3 and 4)
(5) Motor control center 10B219
(6) Motor control center 10B220
(7) Rigid steel conduits containing cables associated with the following:

   (a) Motor control center OOB132 (Division 4)
   (b) Safeguard pump room unit cooler control panel 1DC208 (Division 4)
   (c) Control room HVAC (Divisions 2 and 4)
   (d) Diesel Generator HVAC control panel (Divisions 3 and 4)

(8) Fuel Pool Cooling Piping

(Below 217' slab)

None. There is a solid concrete pedestal below the refueling hoistway which is structurally isolated from the reactor enclosure.

Effect of a load drop on safe-shutdown or decay heat removal capability:

Heavy load handling in the vicinity of spent fuel and the reactor vessel is discussed elsewhere in this report. For new fuel, stored in the spent fuel pool, there is no potential for criticality due to a load drop for the reasons discussed in NUREG 0612, Section 2.2.4. 2

A load drop into the reactor well could not affect safe shutdown capability since the well is only open when the reactor is shut down. Decay heat removal capability could be threatened only by a load large enough to damage the seal plate. Failure of the seal plate would not allow the large, heavy loads to fall into the drywell because their size is greater than the space between the RPV and the drywell. The reactor well and the drywell are lined with steel plate which will retain any concrete which is fragmented by swinging or falling loads. It is doubtful that other debris large enough to damage shutdown cooling piping could fall through the labyrinth of intervening piping and structural steel. However, in the event that one shutdown cooling loop were disabled the other loop can maintain decay heat removal. Similarly, if debris from the load drop were able to cause leakage from exposed reactor vessel piping, makeup water could be supplied by any of a number of RHR and core spray injection lines until the leak could be repaired. Therefore, the drop of a heavy load into the reactor well would not affect decay heat removal capability.

Loads carried over the refueling floor weigh up to 104 tons. Calculations show that maximum load carrying heights must be established to limit damage to the floor due to a load drop, in order to prevent a sequential failure which may ultimately jeopardize safe shutdown capability. As a basis for calculating these heights, concrete failure and bending of the floor support beams is allowed. No failure which could cause damage to equipment on elevations other than those immediately below the refueling floor (331' & 313') is allowed. Refueling floor load height restrictions are described in Table 4. Administrative procedures to implement these restrictions will be developed prior to plant operation.

The only components on the elevations below the load path that are associated with shutdown methods A and B are two load centers (10B201 and 10B202), their associated transformers and some electrical conduit. The two load centers are separated by a distance of more than 35 feet. All cabling which is associated with these load centers and is needed for safe shutdown enters the load centers from below, and is not exposed. Therefore spalling from a single load drop would not disable both load centers. All conduit associated with shutdown method B is located in the immediate vicinity of the 'B' load center and there is no conduit associated with shutdown method 'A' in the same area. Therefore a load drop on the refueling floor could cause damage to only one shutdown method. The other method would remain available to safely shut down the plant.

An analysis was made to determine whether fuel pool decay heat removal capability could be affected by a load drop on the refueling floor. A common line from the skimmer surge tanks (16" HCC-106) to the fuel pool cooling system pumps (and to the RHR system intertie) is located below elevation 352'. It was concluded that, by observing the Table 4 load height restrictions, a load drop on the floor area above the fuel pool cooling pumps suction line would produce minimal spalling. The spalled concrete would be contained by the steel decking and would not damage the fuel pool cooling pumps suction line.

In order to permit removal and replacement of stop logs between the reactor well and the dryer/separator storage pool, height limits for these areas were raised. A load drop of a stop log onto the three-foot-thick reinforced concrete slab at the bottom of the dryer/separator pool (or adjacent to the reactor well) would result in severe local damage to the concrete and spalling of the slab. If water were present in the pool it would seep through the cracked slab and flood elevation 313' below. No attempt has been made to calculate the resulting water flow rate but it is judged to be less than the worst case moderate energy line break flow for that elevation (which is more than 300 gpm). This evaluation has also been used as a basis for raising the storage pool height restrictions for the dryer and separator to permit their passage over the canal threshold, and for extending the boundary of the reactor well to include the dryer/separator canal, which will permit handling of certain loads like canal shield plugs. For conservatism the higher height limits for the stop logs are restricted to use during cold shutdown only. 3

Conclusion:

Based on separation and redundancy of safety-related systems, analysis of floor impact strength and the use of administrative procedures to control load height, a load drop by the reactor enclosure crane in areas other than the reactor vessel and the spent fuel pool* will not jeopardize safe shutdown or decay heat removal capability.

* Heavy load handling over the reactor vessel and over the spent fuel pool is discussed elsewhere in this report.

RECIRCULATION PUMP & MOTOR HOISTS
(Item 21, Equipment Numbers 1AH203, 1BH203)

These monorail hoists are used for removal of the recirculation pumps and motors, inside the drywell at elevation 253'. The Item 21 load path drawing defines the safe load paths.

Major safety-related items in the load path:

(Hoist 1AH203)

(1) Electrical conduit (Divisions 1 & 3)
(2) Recirculation system piping (Loop 'A')
(3) MSRV discharge piping
(4) Drywell unit cooler 1GV212 (Division 1 & 3)

(Hoist 1BH203)

(1) Electrical conduit (Divisions 2 & 4)
(2) Recirculation system piping (Loop 'B')
(3) MSRV discharge piping
(4) Drywell unit cooler 1HV212 (Division 2 & 4)
(5) Shutdown cooling supply piping, 12" DCA-104 (Loop 'B')
(6) RCIC turbine steam supply piping, 4" DBA-107

Major safety-related items on the next lower elevation:

(1) Primary containment vacuum relief valve assemblies
(2) Suppression pool temperature sensors

Effect of a load drop on safe-shutdown or decay heat removal capability:

The reactor must be in cold shutdown prior to removal of the recirculation pump or motor. During cold shutdown the primary safety concern is the removal of residual decay heat. A drop of the recirculation motor or pump could cause rupture of the recirculation piping or shutdown cooling loop 'B' supply piping. In this event RHR shutdown cooling loop 'A' and any one of several combinations of RHR and core spray injection loops would be available to maintain core cooling and supply makeup water until the leak could be repaired. If suppression pool water were needed for makeup, pool temperature indication would still be available due to redundancy and separation of the sensors.

Conclusion:

Based on separation and redundancy of safety-related systems, and the fact that load handling can be done only with the reactor in cold shutdown, a load drop by the recirculation pump and motor hoists will not jeopardize safe shutdown or decay heat removal capability.

HPCI/RCIC EQUIPMENT HOIST
(Item 24, Equipment Numbers 10H215)

This monorail hoist is used to carry HPCI, RCIC and core spray system equipment on elevation 217' of the reactor enclosure, and to and from elevation 177' via hatchways. The Item 24 load path drawing defines the safe load path.

Major safety-related items in the load path:

(1) Electrical conduit and cable trays (Divisions 1, 2, 3 & 4)
(2) RHR piping and instrumentation (Divisions 1 & 2)
(3) Main steam & recirculation instrumentation (Divisions 1,2 & 3)
(4) Motor control centers 10B211 & 10D201 (Divisions 2 & 4)

Major safety-related items on the next lower elevation:

(Below 217' slab)

(1) Electrical conduit and cable trays (Divisions 1, 2, 3 & 4)
(2) HPCI ESW piping
(3) RHR, HPCI & RCIC instrumentation
(4) Motor control center 10B217 (Division 2)

(Below hatchway @ 177')

(1) Core spray, HPCI & RCIC system components

Effect of a load drop on safe-shutdown or decay heat removal capability:

Of the various safety-related systems that have components located in and below the load path only the HPCI system is associated with shutdown method B. Therefore, the remaining systems associated with shutdown method B can be used to shut the reactor down, and full shutdown capability will be retained if a system other than HPCI is available to depressurize the reactor. This depressurization function can be provided by manual actuation of the automatic depressurization system (ADS). When shutting down the reactor without the aid of either the RCIC system or the HPCI system, the ADS serves to permit the operation of a low pressure core cooling system, rather than just allowing initiation of the shutdown cooling mode of the RHR system. With this scheme of operation, two RHR pumps will need to be operated simultaneously, in which case the following components must be available in addition to those listed under "Method B" in Appendix A.

(1) RHR pump "D" and associated valves
(2) RHR compartment unit cooler "D"

Since none of the above components (or their associated cabling) is located in or below the load path their availability is assured.

Safe shutdown of the plant using shutdown method B modified as described above would be accomplished in the following manner. After closure of the main steam isolation valves, the reactor is depressurized by manually controlling the valves of the automatic depressurization system. The opening of these valves allows reactor steam to be discharged to the suppression pool. Makeup water is supplied to the reactor vessel from the suppression pool by operating one loop of the RHR system in the LPCI mode after reactor pressure has decreased to a nominal 295 psig. Heat is removed from the suppression pool by operating a different loop of the RHR system in the suppression pool cooling mode. In this mode, water from the suppression pool is circulated through an RHR heat exchanger and then returned to the suppression pool. When the reactor has been depressurized below a nominal 75 psig, the RHR loop operating in the suppression pool cooling mode is switched to the shutdown cooling mode. In both of these modes, heat is removed from the RHR heat exchanger by the RHRSW system, which in turn dissipates heat at the spray pond. The shutdown cooling mode of RHR will maintain the reactor in a cold shutdown condition.

<u>Conclusion</u>:

Based on separation and redundancy of safety-related systems, a load drop by the HPCI/RCIC equipment hoist will not jeopardize safe shutdown or decay heat removal capability.

CORE SPRAY PUMP HOIST
(Item 25, Equipment Number 10H216)

This monorail hoist is used to carry Core Spray System Pumps, motors and other components on elevation 217' of the reactor enclosure, and to and from elevation 177' via hatchways. The Item 25 load path drawing defines the safe load path.

Major safety-related items in the load path:

(1) Electrical conduit (Divisions 1, 2, 3 and 4)
(2) Main steam, Recirculation, Core Spray and HPCI system instrumentation (Divisions 1, 2, 3 and 4)
(3) RHR/Core Spray Piping (loops A &C)
(4) Motor Control Centers 10B215 and 10D201 (Divisions 2 & 4)

Major safety-related items on the next lower elevation:

(Below 217' slab)

(1) Electrical Conduit & Cable trays (Divisions 1, 2, 3 & 4)
(2) Liquid Radwaste System Valves (Division 1 & 2)
(3) Emergency Service Water, HPCI, RCIC, and Containment Atmospheric Control Sytems Valves and Piping

(Below hatchway @ elevation 177')

(1) Core Spray, HPCI and RCIC System Components

Effect of a load drop on safe-shutdown or decay heat removal capability:

The effect of a load drop is the same as for the HPCI/RCIC equipment hoist.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the Core Spray Pump Hoist (Item 25) will not jeopardize safe shutdown or decay heat removal capability.

CORE SPRAY PUMP HOIST
(Item 26, Equipment Number 10H217)

This monorail hoist is used to carry Core Spray system pump, motor and other components on elevation 217' of the reactor enclosure, and to and from elevation 177' via a hatchway. The Item 26 load path drawing defines the safe load path.

Major safety-related items in the load path:

(1) Electrical Conduit and Cable Tray (Divisions 1, 2, 3 & 4)
(2) Core Spray, Main Steam, Recirculation and Containment Atmospheric Control System Piping and Instrumentation (Divisions 1, 2, 3 & 4)
(3) Motor Control Center 10B212 (Division 2)

Major safety-related items on the next lower elevation:

(Below 217' slab)

(1) Electrical Conduit and Cable Trays (Divisions 1, 2, 3 & 4)
(2) Emergency Service Water Valves & Piping (Divisions 2 & 4)
(3) Liquid Radwaste Valves and Instrumentation (Divisions 1 & 2)

(Below hatchway at 177')

(1) Core Spray System Components (Divisions 2 & 4)

Effect of a load drop on safe-shutdown or decay heat removal capability:

Most safety-related items in and below the load path are associated with electrical divisions 2 and 4. None of the components associated with electrical divisions 1 & 3 are required for safe shutdown. Therefore shutdown method A will remain available to safely shut down the plant.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the Core spray pump hoist (Item 26) will not jeopardize safe shut down or decay heat removal capability.

CORE SPRAY PUMP HOIST & REACTOR ENCLOSURE COOLING HX HOIST
(Item 27, Equipment Numbers 1AH218, 1BH218)

These monorail hoists are used to carry core spray system components and heat exchanger tube bundles on elevation 217' of the reactor enclosure, and to and from elevation 177' via hatchways.

Major safety-related items in the load path:

(1) Electrical Conduit and Cable Trays (Divisions 1, 2, 3 & 4)
(2) RHR Piping & Instrumentation (Division 2)
(3) Main Steam and Recirculation instrumentation (Divisions 1,2,3 & 4)
(4) RCIC Instrumentation (Division 1 & 3)

Major safety-related items on the next lower elevation:

(Below 217' slab)

(1) Electrical conduit & cable trays (Divisions 1,2,3 & 4)
(2) ESW Valves & Piping (Divisions 2 & 4)
(3) Liquid Radwaste System Valves & Instrumentation (Divisions 1 & 2)
(4) Containment Atmospheric Control System valves & piping (Divisions 1 & 2)

(Below hatchways at 177')

(1) Core Spray System Components (Divisions 2 & 4)
(2) RHR Instrumentation (Division 2)
(3) HPCI Instrumentation (Division 2)

Effect of a load drop on safe-shutdown or decay heat removal capability:

There are safety-related items in the load path associated with shutdown methods A and B. There is a minimum horizontal separation of 16 feet between any component of shutdown method A and any component of shutdown method B. There is similar (and corresponding) separation below the floor slab. Therefore only one shutdown method would be affected by a load drop and the remaining shutdown method would remain available to safely shutdown the plant. If a load were dropped through a hatch to elevation 177' only shutdown method B would be affected and method A would remain available.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the core spray & reactor enclosure cooling HX hoist will not jeopardize safe shutdown or decay heat removal capability.

RHR PUMPS HOIST
(Item 28, Equipment Number 10H219)

This monorail hoist is used to carry RHR pumps & motors, HPCI, RCIC and Core Spray System components on elevation 217' of the reactor enclosure, and to and from elevation 177' via hatchways.

Major safety-related items in the load path:

(1) Electrical conduit and cable trays (Divisions 1, 2, 3 & 4)
(2) Motor control centers 10B222, 10D202 (Division 2)

Major safety-related items on the next lower elevation:

(Below 217' slab)

(1) Electrical conduit and cable trays (Divisions 1, 2, 3, & 4)
(2) RHR valves and instrumentation (Divisions 1 & 2)
(3) ESW valves (Division 3)

(Below hatchways @ 177')

(1) RHR system (Divisions 1 & 2)

Effect of a load drop on safe-shutdown or decay heat removal capability:

There is an boundary between Division 1 & 3 safety related items (west) and Division 2 & 4 items (east) at about the column 17 line, with a minimum horizontal distance of five feet between components associated with shutdown methods A and B.

Below the 217' slab on elevations 201' and 177' there is strict separation between the electrical divisions (and shutdown method components) which is provided by a wall at the Column 18.5 line. There are a few items which are exceptions to this separation, however none of these items are required for safe shutdown.

The only potential hazard is that a load could be dropped between column lines 17 and 18.5, causing damage to a method B component on elevation 217' and spalling which could affect a method A component below the slab. This possibility is discounted for the following reason. All method B components are on the extreme south edge of the load path, at least 10 feet away from the hoist monorail (MCC 10D202 and cable trays above it). Loads which could affect these components must be those which are tall and could topple over (i.e. the ECCS pumps). Since these tall loads must of necessity be carried close to the floor (because the lift of the hoist above the floor is not much more than the length of the pumps) no significant spalling can occur due to initial impact if they are dropped (& if the pump falls on the MCC there will be little energy left for a secondary floor impact).

Therefore only one shutdown method can be affected by a load drop and the remaining method will be available to safely shut down the plant.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the RHR pumps hoist will not jeopardize safe shutdown or decay heat removal capability.

CONTAINMENT EQUIPMENT DOOR HOIST
(Item 29, Equipment Number 10H220)

This monorail hoist is used to remove and replace the drywell equipment access door on elevation 253'. The safe load path is defined on the Item 29 load path drawing.

Major safety-related items in the load path:

(1) Electrical conduit (Divisions 1 & 3)
(2) Core spray piping (associated with Division 2)

Major safety-related items on the next lower elevation:

(Below 253' slab)

(1) Electrical conduit and cable trays (Division 1, 2 & 3)
(2) Motor control center 10B215 (Division 1)

Effect of a load drop on safe-shutdown or decay heat removal capability:

Most safety-related components in and below the load path are associated with electrical divisions 1 and 3. Those which are not, are not required for safe shutdown. Therefore only shutdown method A could be affected by a load drop and, at a minimum, shut down method B will remain available to safely shut down the plant.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the containment equipment door hoist will not jeopardize safe shutdown or decay heat removal capability.

PERSONNEL LOCK HOIST
(Item 30, Equipment Numbers 1AH221, 1BH221)

This monorail hoist is used to remove and replace the personnel lock/equipment access door assembly on elevation 253' of the reactor enclosure. The Item 30 load path drawing defines the safe load path.

Major safety-related items in the load path:

None

Major safety-related items on the next lower elevation:

(Below 253' slab)

(1) Electrical conduit and cable trays (Divisions 1, 2, 3 & 4)
(2) RHR 'B' piping and instrumentation

Effect of a load drop on safe-shutdown or decay heat removal capability:

There are no safety-related items in the load path. On the next lower elevation most safety-related items are associated with electrical divisions 2 and 4. Of the items associated with electrical divisions 1 and 3 only a few are required for safe-shutdown and these are part of the RCIC system. Since the personnel lock assembly is part of the primary containment boundary it cannot be removed unless the reactor is shutdown. Therefore only reactor decay heat removal is of concern. The RHR 'B' shutdown cooling loop could potentially be affected by spalling of the 253' slab but the RHR 'A' shutdown cooling loop would remain available for decay heat removal.

Conclusion

Based on separation and redundancy of safety-related systems, a load drop by the personnel lock hoist will not jeopardize safe shutdown or decay heat removal capability.

REACTOR WATER CLEANUP HEAT EXCHANGER HOIST
(Item 31, Equipment Number OOH223)

This monorail hoist is used for removal and replacement of heat exchanger tube bundles on elevation 283' of the reactor enclosure. The Item 31 load path drawing defines the safe load path.

Major safety-related items in the load path:

(1) Electrical conduit and cable tray (Divisions 1, 2, 3 & 4)

Major safety-related items on the next lower elevation:

(Below 283' slab)

(1) Electrical conduit (Divisions 1, 2, 3 & 4)
(2) Containment atmospheric control valves and instrumentation (Divisions 1 & 3)

Effect of a load drop on safe-shutdown or decay heat removal capability:

Most safety-related items in and below the load path are associated with electrical divisions 1 and 3. Those items associated with divisions 2 and 4 are not required for safe-shutdown. Therefore only shutdown method A could potentially be affected by a load drop and, at a minimum, shutdown method B will remain available to safely shut down the plant.

Conclusion

Based on separation and redundancy of safety-related systems, a load drop by the RWCU heat exchanger hoist will not jeopardize safe shutdown or decay heat removal capability.

CONTROL ROD DRIVE PLATFORM HOIST
(Item 33, Equipment Number 10H229)

This hoist is used to raise and lower the free end of the hinged CRD removal platform, located in the drywell at elevation 253'. The Item 33 load path drawing defines the safe load path.

Major safety-related items in the load path:

(1) RHR shutdown cooling suction line, 20" DCA-105
(2) Drywell unit cooler ducting

Major safety-related items on the next lower elevation:

(Below 238' slab)

(1) Primary Containment vacuum relief valves assemblies
(2) Suppression pool temperature sensors

Effect of a load drop on safe-shutdown or decay heat removal capability:

If the hoist were to fail, the free end of the CRD removal platform would fall about six feet and strike its support. Analysis shows that, with a loaded CRD removal cask on the platform, the impact would cause the support to fail and allow the platform to strike the shutdown cooling suction line which passes underneath. However, the line would not rupture or be seriously deformed by the impact and shutdown cooling flow would not be interrupted. Damage to suppression pool temperature sensors could occur due to spalling of the elevation 238' slab but there is sufficient redundancy and separation of sensors to prevent loss of temperature indication.

Conclusion

Based on separation and redundancy of safety-related systems and on impact analysis, a load drop by the CRD platform hoist would not jeopardize safe shutdown or decay heat removal capability.

MAIN STEAM RELIEF VALVES SERVICE/REMOVAL HOISTS
(Item 34, Equipment Numbers 1AH233, 234, 235; 1BH233,234, 235; 10H230; 10H232)

These monorail hoists, or come-alongs installed on the hoist trolleys, are used to carry main steam relief valves (MSRV's) and other valves on monorails at elevations 273' and 286' in the drywell, and to and from elevation 253' via hatchways. The Item 34 load path drawing defines the safe load path.

Major safety-related items in the load path and below floor grating:

(1) Main steam relief and isolation valves
(2) ECCS system piping (including RHR shutdown cooling)
(3) Drywell unit coolers
(4) Containment isolation valves

Major safety-related items on the next lower elevation:

(Below 238' slab)

(1) Suppression pool temperature sensors
(2) Primary containment vacuum relief valves

Effect of a load drop on safe-shutdown or decay heat removal capability:

In order to remove valves in the drywell the reactor must be in cold shutdown. During cold shutdown decay heat removal is the primary safety concern. Calculations show that floor grating will not withstand the impact of a falling valve from any height. If a valve is dropped at specific locations in the drywell, damage to one shutdown cooling loop can be postulated but the other loop will remain available to continue decay heat removal. In the remote event that a dropped valve damaged shutdown cooling supply piping (between isolation valves and reactor vessel) or recirculation piping, makeup water can be supplied by the RHR or core spray systems until the leak can be repaired. There is sufficient redundancy and separation of suppression pool temperature sensors to prevent loss of pool temperature indication due to spalling of the elevation 238' slab.

Conclusion:

Based on separation and redundancy of safety-related systems, and the fact that load handling will only be done with the reactor in cold shutdown, a load drop by the main steam relief valves service/removal hoists will not jeopardize safe shutdown or decay heat removal capability.

DISPOSAL CASK CART REMOVAL HOIST
(Item 35, Equipment Number 10H236)

This monorail hoist handles the cart for the cask used for disposal of source and intermediate range detectors. It is located in the drywell between elevations 248' and 258', approximately. The Item 35 load path drawing defines the safe load path.

Major safety-related items in the load path:

None

Major safety-related items on the next lower elevation:

(Below grating)

(1) Electrical conduit (Divisions 1, 3 & 4)

(Below 238' slab)

(1) Suppression pool temperature monitors
(2) Primary containment vacuum relief valves

Effect of a load drop on safe-shutdown or decay heat removal capability:

Safety-related conduit below load path floor grating is not required for safe-shutdown. There is sufficient redundancy and separation of suppression pool temperature sensors so that damage resulting from possible spalling of the elevation 238' slab would not cause a loss of pool temperature indication.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the disposal cask cart removal hoist will not jeopardize safe shutdown or decay heat removal capability.

CONTAINMENT HYDROGEN RECOMBINER COVER HOIST
(Item 36, Equipment Number 10H237)

This monorail hoist is used to remove and replace the hatch covers over the hydrogen recombiners at two locations on elevation 283' of the reactor enclosure. The Item 36 load path drawing defines the safe load path.

Major safety-related items in the load path:

(Area 11)

(1) Electrical conduit (Divisions 1, 3 and 4)
(2) Hydrogen Recombiner

(Area 16)

(1) Electrical conduit (Divisions 2, 3 and 4)
(2) Hydrogen Recombiner

Major safety-related items on the next lower elevation:

(Area 11, below 283' slab)

(1) Electrical conduit and cable trays (Divisions 1, 2 and 3)

(Area 16, below 283' slab)

(1) Electrical conduit (Divisions 1, 2 and 3)
(2) Reactor Vessel Instrumentation Panels (Divisions 2 & 4)
(3) Control Rod Drive Hydraulic Control Units

Effect of a load drop on safe-shutdown or decay heat removal capability:

(Area 11)

Most safety-related items in and below the load path are associated with electrical divisions 1 and 3. Those items associated with electrical divisions 2 and 4 are not required for safe shutdown. Therefore only shutdown method A could potentially be affected by a load drop. Shutdown method B would remain available to safely shut down the plant.

(Area 16)

Most safety-related items in and below the load path are associated with electrical dvisions 2 and 4. Of the items associated with electrical divisions 1 and 3, one conduit located below the floor slab contains cable required for safe-shutdown. CRD piping also traverses the area below the floor. Analysis has shown that a drop of the hydrogen recombiner cover from the maximum hoist height of 8 feet will cause minor local damage to the elevation 283' floor slab but items below the floor will not be damaged.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the Area 11 hydrogen recombiner cover hoist will not jeopardize safe shutdown or decay heat removal capability.
Based on separation and redundancy of safety-related systems and on analysis of the floor impact strength, a load drop by the Area 16 hydrogen recombiner cover hoist will not jeopardize safe shutdown or decay heat removal capability.

EQUIPMENT HATCH BRIDGE CRANE
(Item 37, Equipment Number 10H238)

This crane is used to carry miscellaneous loads between elevations 217' and 283' of the reactor enclosure. The Item 37 load path drawing defines the safe load path.

Major safety-related items in the load path:

None

Major safety-related items on the next lower elevation:

(Below 283' slab)

(1) Electrical conduit (Divisions 2 & 4)

(Below 217' slab)

(1) Electrical conduit (Divisions 2, 3 & 4)
(2) RHR Instrumentation (Division 2)
(3) Emergency Service Water Piping & Valves (Associated w/Division 2)

Effect of a load drop on safe-shutdown or decay heat removal capability:

There are no safety-related items in the load path. All safety-related items below the load path are associated with electrical divisions 2 and 4, except for one division 3 conduit which is not required for safe-shutdown. Therefore a load could potentially affect only shutdown method B. Shutdown method A will remain available to safely shut down the plant.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the equipment hatch bridge crane will not jeopardize safe shutdown or decay heat removal capability.

CONTROL ROD DRIVE MAINTENANCE AREA CRANE
(Item 38, Equipment Number 10H239)

This crane handles control rod drives in the CRD maintenance area on elevation 253' of the reactor enclosure. The Item 38 load path drawing defines the safe load path.

Major safety-related items in the load path:

None

Major safety-related items on the next lower elevation:

(Below 253' slab)

(1) Electrical conduit and cable trays (Divisions 1 & 3)

Effect of a load drop on safe-shutdown or decay heat removal capability:

There are no safety-related items in the load path. All safety-related items below the load path are associated with electrical divisions 1 and 3. Therefore a load drop could potentially affect only shutdown method A. Shutdown method B will remain available to safely shut down the plant.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the control rod drive maintenance area crane will not jeopardize safe shutdown or decay heat removal capability.

DIESEL GENERATOR ENCLOSURE CRANES
(Item 44, Equipment Numbers 1AH501, 1BH501, 1CH501, 1DH501)

These cranes handle diesel generator parts and miscellaneous loads. There is a separate crane for each diesel generator enclosure. The Item 44 load path drawing defines the safe load paths.

Major safety-related items in each load path:

(1) Diesel generator and auxiliaries
(2) Emergency service water supply/return valves
(3) Diesel generator air exhaust fans
(4) Diesel generator controls & power distribution panel
(5) Electrical cable and motor control center

Major safety-related items on the next lower elevation:

Not applicable

Effect of a load drop on safe-shutdown or decay heat removal capability:

There is strict separation of safety-related items in the diesel generator enclosures. The diesel generator 'A' enclosure contains only items associated with electrical division 1, the diesel generator 'B' enclosure contains only items associated with electrical division 2, etc. Therefore a load drop in any one enclosure will affect only one shutdown method. The other shutdown method will remain available to safely shut down the plant.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by a diesel generator enclosure crane will not jeopardize safe shutdown or decay heat removal capability.

SPRAY POND PUMP HOUSE HOISTS
(Item 49, Equipment Numbers OOH511, OOH513)

These monorail hoists are used for handling of RHR service water and emergency service water system valves on elevation 268' of the spray pond pump house, and to and from elevation 251' via hatchways. The Item 49 load path drawing defines the safe load paths.

Major safety-related items in the load path:

(1) Electrical conduit

Major safety-related items on the next lower elevation:

(Below 268' slab)

(1) RHR service water valves
(2) Emergency service water valves

Effect of a load drop on safe-shutdown or decay heat removal capability:

There is strict separation of safety-related items in the spray pond pump house. Safety-related items on the west side of the pump house are associated only with electrical divisions 1 and 3. Those on the east side are associated only with electrical divisions 2 and 4. A concrete wall separates the two halves of the building. Therefore a load drop could affect only one shutdown method. The other shutdown method would remain available to safely shut down the plant.

Conclusion

Based on separation and redundancy of safety-related systems, a load drop by the spray pond pump house hoists will not jeopardize safe shutdown or decay heat removal capability.

CONTROL ROOM CHILLER PORTABLE GANTRY HOIST
(Item 50, Equipment Number 00H514)

This hoist will be used primarily to service control room chiller OBK112 but can be used anywhere on elevation 200' of the control structure. The Item 50 load path drawing defines the safe load path.

Major safety-related items in the load path:

(1) Control room chillers OAK112 & OBK112 and associated piping & instrumentation
(2) Electrical conduit (Divisions 1, 2, 3 & 4)

Major safety-related items on the next lower elevation:

None

Effect of a load drop on safe-shutdown or decay heat removal capability:

There is a dividing wall on elevation 200' of the control structure. On the east side of the wall safety-related components are associated only with electrical divisions 2 and 4. On the west side of the wall safety-related components are associated only with electrical divisions 1 and 3, except for a few division 4 conduit which are located against the south wall and are out of reach of the portable gantry crane. Therefore a load drop can affect only one shutdown method. The other shutdown method will remain available to safely shut down the plant.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the control room chiller portable gantry crane will not jeopardize safe shutdown or decay heat removal capability.

MAIN STEAM TUNNEL MONORAIL HOISTS
(Item 53)

Monorail hoists will be borrowed from other locations for removal and replacement of main steam isolation valves or other valves and operators located in the main steam tunnel of the reactor enclosure (elevations 253' to 290'). The Item 53 load path drawing defines the safe load path.

Major safety-related items in the load path:

(1) Main steam isolation valves (MSIV's)
(2) RCIC system piping and valves
(3) MSIV leakage control system components

Major safety-related items on the next lower elevation:

(Below 253' slab)

None

Effect of a load drop on safe-shutdown or decay heat removal capability:

Heavy loads in the steam tunnel (valves and operators) can only be removed from their systems with the reactor in cold shutdown. During cold shutdown the primary safety concern is to provide decay heat removal. A load drop in the main steam tunnel will not affect the shutdown cooling loop of either shutdown method. Decay heat removal capability will not be affected.

Conclusion:

Based on separation and redundancy of safety-related systems, and the fact that load handling will be done only with the reactor in cold shutdown, a load drop by the main steam tunnel monorail hoists will not jeopardize safe shutdown or decay heat removal capability.

SPRAY POND RHRSW AND ESW PUMPS YARD CRANE
(Item 55)

A mobile yard crane will be used for removal and replacement of RHR service water (RHRSW) and Emergency Service Water (ESW) pumps through roof hatches in the spray pond pump house. The Item 55 load path drawing defines the safe load path.

Major safety-related items in the load path:

(1) RHRSW pumps and valves
(2) ESW pumps and valves
(3) Spray pond pump structure supply air fans
(4) Motor control centers
(5) Electrical conduit

Major safety-related items on the next lower elevation:

(Below 268' slab)

(1) RHRSW valves
(2) ESW valves

Effect of a load drop on safe-shutdown or decay heat removal capability:

There is strict separation of safety-related items in the spray pond pump house. Safety-related items on the west side of the pump house are associated only with electrical divisions 1 and 3. Those on the east side are associated only with electrical divisions 2 and 4. A concrete wall separates the two halves of the building. Therefore a load drop could affect only one shutdown method. The other shutdown method will remain available to safely shut down the plant.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the spray pond RHRSW and ESW pumps yard crane will not jeopardize safe shutdown or decay heat removal capability.

CONTROL ROOM HVAC EQUIPMENT HOIST
(Item 58, Equipment Number 00H133)

This monorail hoist is used for handling of HVAC fans on elevation 313' of the control structure and to and from elevation 304' via hatchways. The Item 58 load path drawings defines the safe load path.

Major safety-related items in the load path:

(1) Electrical conduit (Divisions 1, 2, 3 & 4)

Major safety-related items on the next lower elevation:

(Below 304' slab)

(1) Electrical conduit and cable trays (Divisions 1, 2, 3 & 4)
(2) Power generation control complexes (PGCC's) for Unit 1 and Unit 2

Effect of a load drop on safe-shutdown or decay heat removal capability:

A load drop by this hoist in any area of its load path will affect cabling associated with only one shutdown method. This includes electrical cable embedded in the 304' floor slab. The other shutdown method would remain available to safely shut down the plant. Analysis shows that, since the fan loads are small and the maximum drop height is just 9 feet, the safety-related items below the floor slab will not be affected by a load drop.

Conclusion:

Based on separation and redundancy of safety-related systems and analysis of the elevation 304' floor slab, a load drop by the control room HVAC equipment hoist will not jeopardize safe shutdown or decay heat removal capability.

WETWELL MONORAIL HOIST
(Item 59)

This monorail hoist is used for maintenance activities in the wetwell of the primary containment. The Item 59 load path drawing defines the safe load path.

Major safety-related items in each load path:

(1) Primary containment vacuum relief valve assemblies
(2) Suppression pool temperature sensors

Major safety-related items on the next lower evaluation:

Not applicable

Effect of a load drop on safe-shutdown or decay heat removal capability:

Only the suppression pool temperature sensors are required for safe shutdown. There is sufficient separation and redundancy of sensors so that a load drop would not result in a loss of suppression pool temperature indication.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the wetwell monorail hoist will not jeopardize safe shutdown or decay heat removal capability. 3

CONTROL STRUCTURE FANS LIFTING BEAMS HOISTS
(Item 60)

Hoists will be borrowed from other locations to carry HVAC fans between elevations 304' and 322' of the control structure. The Item 60 load path drawings define the safe load path.

Major safety-related items in the load path:

(1) Electrical conduit (Division 1, 2, 3 & 4)

Major safety-related items on the next lower elevation:

(Below 304' Slab)

(1) Electrical conduit and cable trays (Divisions 1, 2, 3 & 4)
(2) Power generation control complexes (PGCC's) for Unit 1 and Unit 2

Effect of a load drop on safe-shutdown or decay heat removal capability:

A load drop by this hoist in any area of its load path will affect cabling associated with only one shutdown method. This includes cable embedded in the 304' floor slab. The other shutdown method would remain available to safely shut down the plant. Analysis shows that, since the fan loads are small and the maximum drop height is just 18 feet, the safety-related items below the floor slab will not be affected by a load drop.

Conclusion:

Based on separation and redundancy of safety-related systems and analysis of the elevation 304' floor slab, a load drop by the control structure fans lifting beam hoists will not jeopardize safe shutdown or decay heat removal capability.

REACTOR ENCLOSURE UPPER FAN ROOM HOIST
(Item 61)

Monorail hoists will be borrowed from other locations for handling of fans and other HVAC items on elevation 331' of the reactor enclosure, and to and from elevation 313' via a hatchway.

Major safety-related items in the load path:

(1) Electrical conduit (Divisions 1 and 2)

Major safety-related items on the next lower elevation:

(Below 331' Slab)

(1) Electrical conduit (Divisions 1, 2, 3 & 4)

(Below 313' Slab under hatchway)

None

Effect of a load drop on safe-shutdown or decay heat removal capability:

None of the safety-related items in the load path are required for safe-shutdown. On the elevation below the load path most items on the west side (Area 15) are associated with electrical divisions 1 and 3 and most items on the east side (Area 16) are associated with electrical division 4. The items which are exceptions to this rule are not required for safe shutdown. Therefore only one shutdown method could potentially be affected by a load drop. The other shutdown method will remain available to safely shut down the plant.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the reactor enclosure upper fan room hoist will not jeopardize safe shutdown or decay heat removal capability.

REACTOR ENCLOSURE LOWER FAN ROOM HOIST
(Item 62)

Monorail hoists will be borrowed from other locations for handling of fans and other HVAC items on elevation 313' of the reactor enclosure. The Item 62 load path drawing defines the safe load path.

Major safety-related items in the load path:

(1) Electrical conduit (Divisions 1, 2, 3 & 4)

Major safety-related items on the next lower elevation:

(Below 313' slab)

(1) Electrical conduit (Divisions 1, 2, 3 & 4)
(2) Standby liquid control system components
(3) Load center 10B204
(4) Motor control center 10B225

Effect of a load drop on safe-shutdown or decay heat removal capability:

Safety-related items in and below the western portion of the load path (Area 15) are generally associated with electrical divisions 1 and 3. Safety-related items in and below the eastern portion of the load path are generally associated with electrical divisions 2 and 4. Items which are exceptions to this pattern are not required for safe shutdown. Therefore a load drop could potentially affect just one shutdown method. The other shutdown method will remain to safely shut down the plant.

Conclusion:

Based on separation and redundancy of safety-related systems, a load drop by the reactor enclosure lower fan room hoist will not jeopardize safe shutdown or decay heat removal capability.

APPENDIX C

ASSUMPTIONS AND DATA FOR POSTULATED LOAD DROPS OF THE REACTOR PRESSURE VESSEL HEAD, STEAM DRYER AND SHROUD HEAD/SEPARATOR

3

NUREG 0612 Appendix A conformance:

The applicable guidelines of Appendix A were followed except that the weight of the crane load block was not always included in the total load, since reactor enclosure crane is single failure proof. The weight of the lifting device (strongback or sling) was included.

Information requested by Attachment 4:

Initial Conditions/Assumptions

	RPV Head	Steam Dryer	Shroud/ Separator
Load weight, tons	111.6	40	75.8
Impact area	Point	(1) Distributed	(1) Distributed
Drop height, feet	25.5	(1) N/A	(1) N/A
Drop location	Over open Reactor Vessel		
Credit for impact limiters?	No	No	No
Thickness of walls/ slabs	N/A	N/A	N/A
Drag Forces	None	(1) Water	(1) Water
Load combinations	RPV Dead Wt.	None	None
Material properties (Steel, yield strength)	70 Ksi	30 Ksi	30 Ksi

3

(1) The RPV is assumed to be flooded up to the top flange. The steam dryer and shroud head/separator achieve terminal velocity prior to impact on the upper flange of the top guide shroud.

Additional Assumptions:

- For the RPV head drop the dynamic stress in the RPV support skirt is assumed to be uniform around the circumference of the skirt.

- Potential load drops of the steam dryer or shroud head/ separator onto the RPV flange (rather than into the vessel) are enveloped by the RPV head drop. 3

- The impact of the steam dryer is assumed to be absorbed by the shroud head/separator support structure. No credit is taken for energy absorbed by the steam dryer support brackets or the shroud head/separator.

3

APPENDIX D

INFORMATION REQUESTED IN SECTION 2.1

(Text of enclosure to letter from J. S. Kemper to D. G. Eisenhut dated June 18, 1981. Tables mentioned in this appendix refer to and are superceded by the tables in this report)

Philadelphia Electric Company

Limerick Atomic Power Station

Docket Nos. 50-352 and 50-353

Information Requested in Section 2.1 of Enclosure 3 to NRC Letter dated December 22, 1980 regarding compliance with NUREG-0612, "Control of Heavy Loads at Nuclear Plants Resolution of TAP A-36"

Enclosure 3

Item 2.1.1

"Report the results of your review of plant arrangements to identify all overhead handling systems from which a load drop may result in damage to any system required for plant shutdown or decay heat removal (taking no credit for any interlocks, technical specifications, operating procedures, or detailed structural analysis)."

Response

The following overhead handling systems were identified as potentially hazardous in that a load dropped from them might damage fuel or systems required for safe shutdown or decay heat removal (Item numbers refer to Table 1 titled Index of Overhead Handling Systems, copy attached):

1) Crane/hoists which carry heavy loads over reactor fuel: For Limerick, a heavy load is defined as a load greater than 700 pounds.

   a. Reactor Enclosure Crane (Item 20)

2) Cranes/hoists which carry heavy loads over systems or components required for safe shutdown or decay heat removal; (hatches under load paths are assumed to be either open or incapable of stopping the fall of a heavy load):

   a. Diesel Generator Building Bridge Cranes (Item 44-Diesel generators and auxiliaries are under the load path).

   b. Spray Pond Pump House Hoists (Item 49-RHR Service Water valves and under the load path).

   c. Spray Pond RHR and ESW Pump Yard Crane (Item 61-RHR and ESW pumps are under the load path).

3) Cranes/hoists which may carry heavy loads in the vicinity of safety-related electrical circuits or instrumentation.

   a. Control Room HVAC Lift Beams (Item 19)

   b. Recirculation Pump Motor Hoists (Item 21)

   c. Core Spray Pump Hoist 10-H215 (Item 25)

   d. Core Spray Pump Hoist 10-H-216 (Item 26)

   e. Containment Equipment Door Hoist (Item 29)

   f. CRD Removal Platform Hoist (Item 33)

   g. MSRV Service and Removal Hoists (Item 34)

   h. Containment Hydrogen Recombiner Cover Hoists (Item 36)

   i. Control Room HVAC Equipment Hoist (Item 58)

4) Table 1 (Index of Overhead Handling Systems) identifies cranes and hoists where safety-related equipment has been identified on the next elevation below the elevation of the load path. It is assumed that a load dropped from these overhead handling systems will not penetrate the floor, but may cause spalling of the concrete below, which could affect the safety-related equipment.

Enclosure 3

Item 2.1.2

"Justify the exclusion of any overhead handling system from the above category by verifying that there is sufficient physical separation from any load-impact point and any safety-related component to permit a determination by inspection that no heavy load drop can result in damage to any system or component required for plant shutdown or decay heat removal."

Response

Exclusion Criteria

Cranes and hoists which are not listed in the response to item 2.1.1 above do not carry heavy loads in the vicinity of fuel or systems required for safe shutdown or decay heat removal. Specific reasons for exclusion of these overhead handling systems are given below. Exclusion criteria for each crane or hoist are listed in Table 1 (Index of Overhead Handling Systems).

Criterion A: The crane or hoist is located in a structure which does not contain systems or equipment required for safe shutdown or decay heat removal. Structures included are the Turbine Enclosure, the Radwaste Enclosure, the Administration Building, the Auxiliary Boiler Building the Circulating Water Pump House, and the Schuylkill River Pump House. This designation is based on the Limerick Fire Protection Evaluation Report which identifies safety-related equipment in each fire area and evaluates the affect of the loss of this equipment on plant safe shutdown capability (including decay heat removal).

Criterion B: The load carried by this crane or hoist is not greater than 700 pounds. Therefore, it is not a heavy load.

Criterion C: For these cranes and hoists there is no equipment required for safe shutdown or decay heat removal located in the load path. Absence of safe shutdown equipment was determined by review of the Fire Protection Evaluation Report and the results of the Separation Program. Load paths are defined on the drawings attached to this report. Except where limited by walls or other barriers load paths are at least twice as wide as the widest load or hatch opening Thus, the load will still land in the load path if swinging occurs before it is dropped. For a load whose height is more than twice its width, it is assumed that the load can tip over in any direction from an impact point below the centerline of the normal or crane hoist. In these cases the load will also land within the load path. Therefore, dropped loads cannot damage safe-shutdown or decay heat removal systems or components.

Enclosure 3

Item 2.1.3:

"With respect to the design and operation of heavy-load-handling systems in the reactor building and those load-handling systems identified in 2.1-1, above, provide your evaluation concerning compliance with the guidelines of NUREG-0612, Section 5.1.1. The following specific information should be included in your reply":

Item 2.1.3.a

"Drawings or sketches sufficient to clearly identify the location of safe load paths, spent fuel, and safety-related equipment."

Response

Safe Load Paths

Equipment location drawings which identify recommended safe load paths and locations of fuel and safety-related equipment are attached to this report. These drawings identify each crane or hoist by the equipment item number used in Table 1.

Item 2.1.3.b

"A discussion of measures taken to ensure that load-handling operations remain within safe load paths, including procedures, if any, for deviation from these paths".

Response

This information is not currently available but will be considered in the development of load handling procedures.

Item 2.1.3.c

"A tabulation of heavy loads to be handled by each crane which includes the load identification, load weight, its designated lifting device, and verification that the handling of such load is governed by a written procedure containing, as a minimum, the information identified in NUREG-0612, Section 5.1.1(2)".

Response

1) Load Tabulation

A load tabulation for each crane or hoist, including load identification, load weight and special lifting device (if any), is included in Table 2 titled Load Tabulation.

2) Lifting Device Design

For purposes of this review a lifting device is defined as the load carrying connection between the crane or hoist hook and the load. A special lifting device is a lifting device specifically designed to handle a particular load. Special lifting devices to be used at Limerick are identified in Table 3 titled Limerick Special Lifting Devices.

3) Verification that the handling of such load is governed by a written procedure in accordance with NUREG-0612. Section 5.1.1(2) will be available prior to fuel load.

Item 2.1.3.d

"Verification that lifting devices identified in 2.1.3-c, above comply with the requirements of ANSI N14.6-1978, or ANSI B30.9-1971 as appropriate. For lifting devices where these standards, as supplemented by NUREG-0612, Section 5.1.1(4) or 5.1.1(5), are not met, describe any proposed alternatives and demonstrate their equivalency in terms of load-handling reliability."

Response

The special handling devices in Table 3 titled Limerick Special Lifting Devices are not certified to ANSI N-14.6 1978 as supplemented by NUREG-0612. Shipping cask yokes are designed to be single failure proof, which is superior to meeting the ANSI specification directly.

Current requirements for slings utilized by Construction and Maintenance Division for Q-listed equipment will meet ANSI N45.2 - 1972.

Please refer to our response to item 3 of the cover letter to this document for further discussion.

Item 2.1.3.e

"Verification that ANSI B30.2-1976, Chapter 2-2 has been invoked with respect to crane inspection, testing and maintenance. Where any exception is taken to this standard, sufficient information should be provided to demonstrate the equivalency of proposed alternatives."

Response

The Limerick facility is still being constructed. ANSI B30.2, 1976, will be considered in the preparation of the crane inspection, testing and maintenance procedures at the time the cranes and hoists are turned over for plant use.

Item 2.1.3.f

"Verification that crane design complies with the guidelines of CMAA Specification 70 and Chapter 2-1 of ANSI B30.2-1976, including the demonstration of equivalency of actual design requirements for instances where specific compliance with these standards is not provided".

Response

The procurement specifications for cranes identified in 2.1.1 require compliance with all specifications and standards issued by the Crane Manufacturers Association of America (CMAA) and the American National Standards Institute (ANSI) which were in effect prior to the date of the purchase order. The reactor enclosure crane was purchased in 1973 and therefore was designed to CMAA Specification 70 and an earlier version (1967) of ANSI B30.2. The diesel generator cranes were purchased in 1972 and designed to the same standards as the reactor enclosure crane.

The cranes were designed according to Chapter 2-1 of ANSI B30.2-1967. NUREG-0612 requires verification of compliance with Chapter 2-1 of ANSI B30.2-1976. The two editions of ANSI B30.2 were compared. Based on this comparison and review of the crane technical specifications and manufacturers' data it is concluded that the cranes above generally comply with the applicable requirements of Chapter 2-1 of ANSI B30.2-1976, with the following exceptions (listed by ANSI B30.2-1976 Section number):

2-1.4.1 Welded Construction - The cranes welding procedures conform to AWS D2.0-66 rather than AWS D1.1.

2-1.5.2 d & 2-1.7.3 Design of guard rails and toe boards complies with USAS A12-1932 rather than ANSI A12.1.

2-1.8.3.a.1 Trolley bumpers designed with energy absorbing capacity for 40% of rated trolley speed rather than 50%.

2-1.10.1 Wiring and equipment complies with USAS C1-1965 rather than Article 610 of National Electrical Code, ANSI C-1 (NFPA 70).

We do not consider the above differences to be significant with respect to safe operation of the cranes. Crane design should be considered to be in compliance with the guidelines of ANSI B30.2-1976.

WJA/cmv

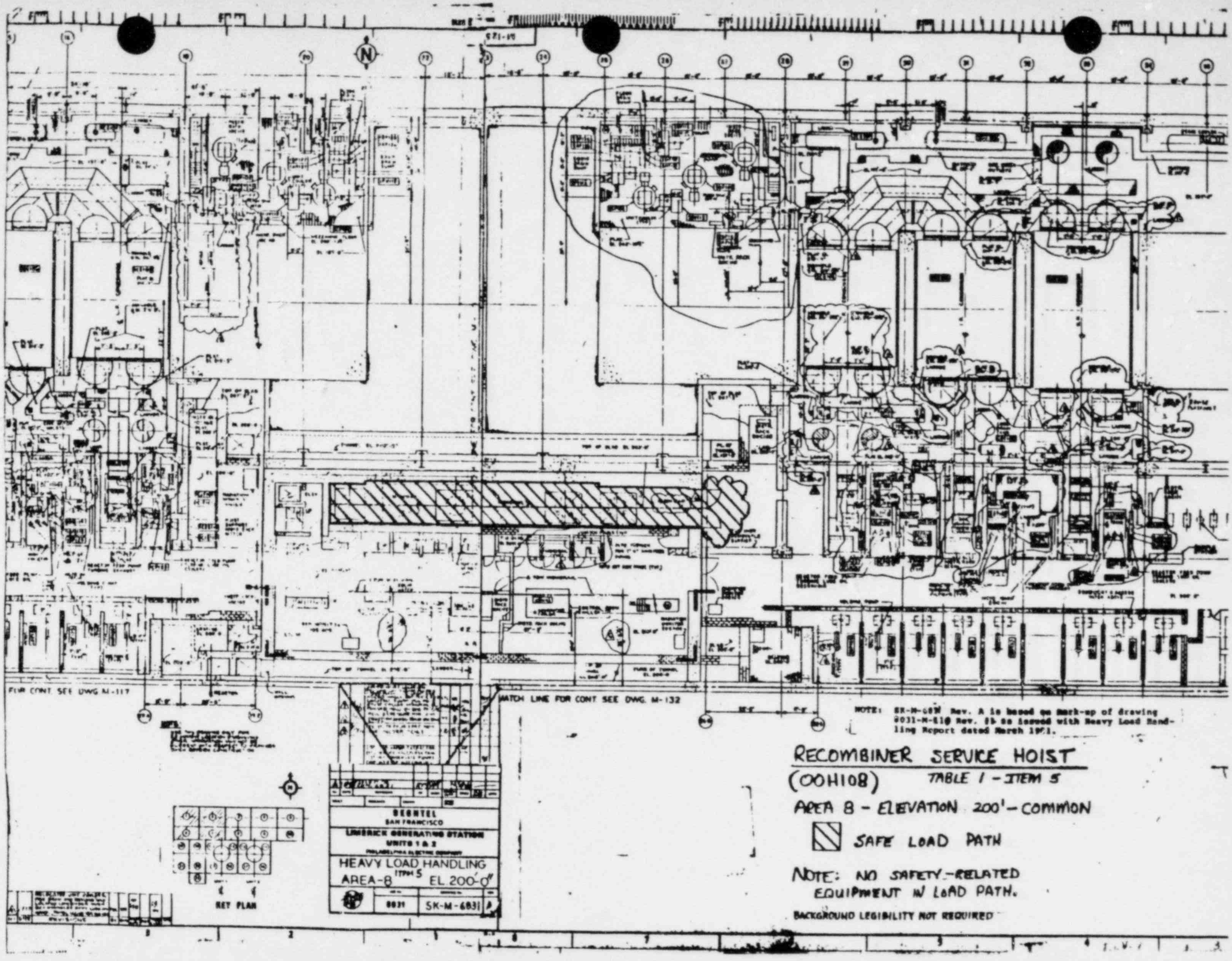
SAFE LOAD PATH DRAWINGS,

an Attachment to the

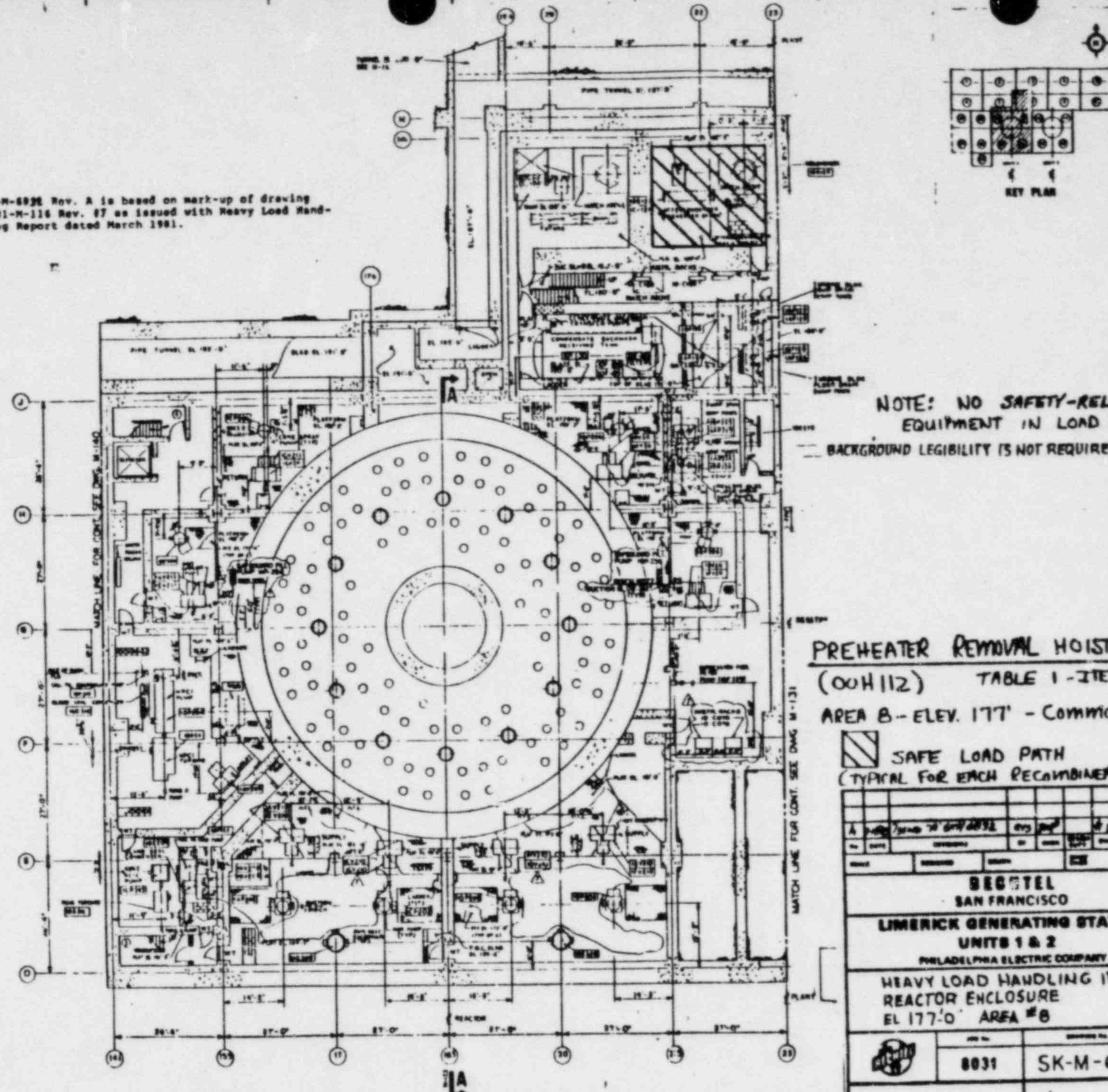
Limerick Generating Station Overhead

Handling Systems Review

Final Report


FOR CONT SEE DWG M-117
MATCH LINE FOR CONT SEE DWG. M-132
NOTE: SK-M-6831 Rev. A is based on mark-up of drawing 8031-M-110 Rev. 15 as issued with Heavy Load Handling Report dated March 1981.
RECOMBINER SERVICE HOIST
(00H108) TABLE 1 - ITEM 5
AREA 8 - ELEVATION 200' - COMMON
SAFE LOAD PATH
NOTE: NO SAFETY-RELATED EQUIPMENT IN LOAD PATH.
BACKGROUND LEGIBILITY NOT REQUIRED
KEY PLAN
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY
HEAVY LOAD HANDLING
AREA-8 ITEM 5 EL. 200'-0"
8031
SK-M-6831

NOTE: SK-M-6832 Rev. A is based on mark-up of drawing 8031-M-116 Rev. 87 as issued with Heavy Load Handling Report dated March 1981.



NOTE: NO SAFETY-RELATED EQUIPMENT IN LOAD PATH.

BACKGROUND LEGIBILITY IS NOT REQUIRED

PREHEATER REMOVAL HOIST

(00H112) TABLE 1 - ITEM 6

AREA 8 - ELEV. 177' - COMMON

SAFE LOAD PATH (TYPICAL FOR EACH RECOMBINER COMPT.)

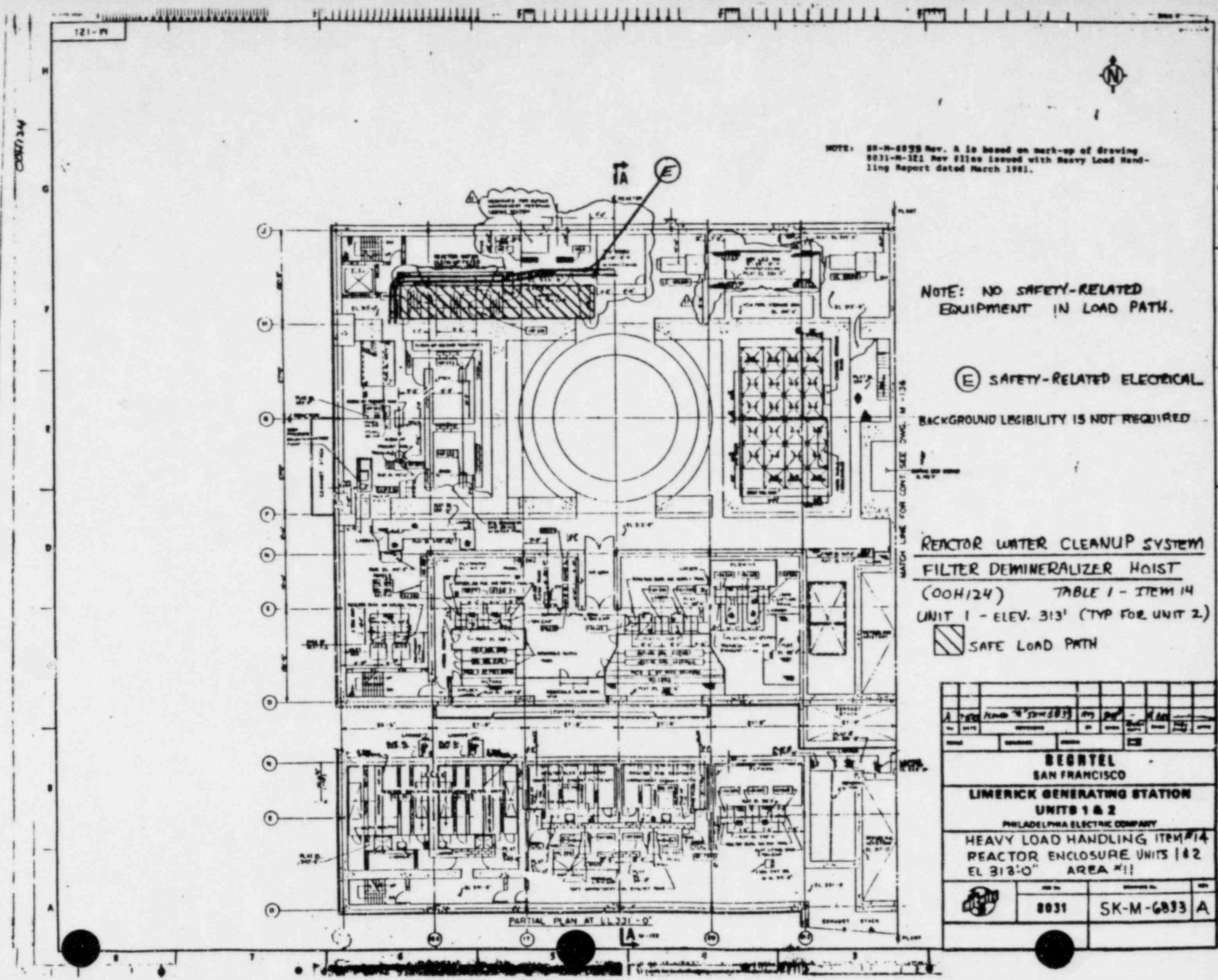
A — ISSUED W/ SK-M-6832

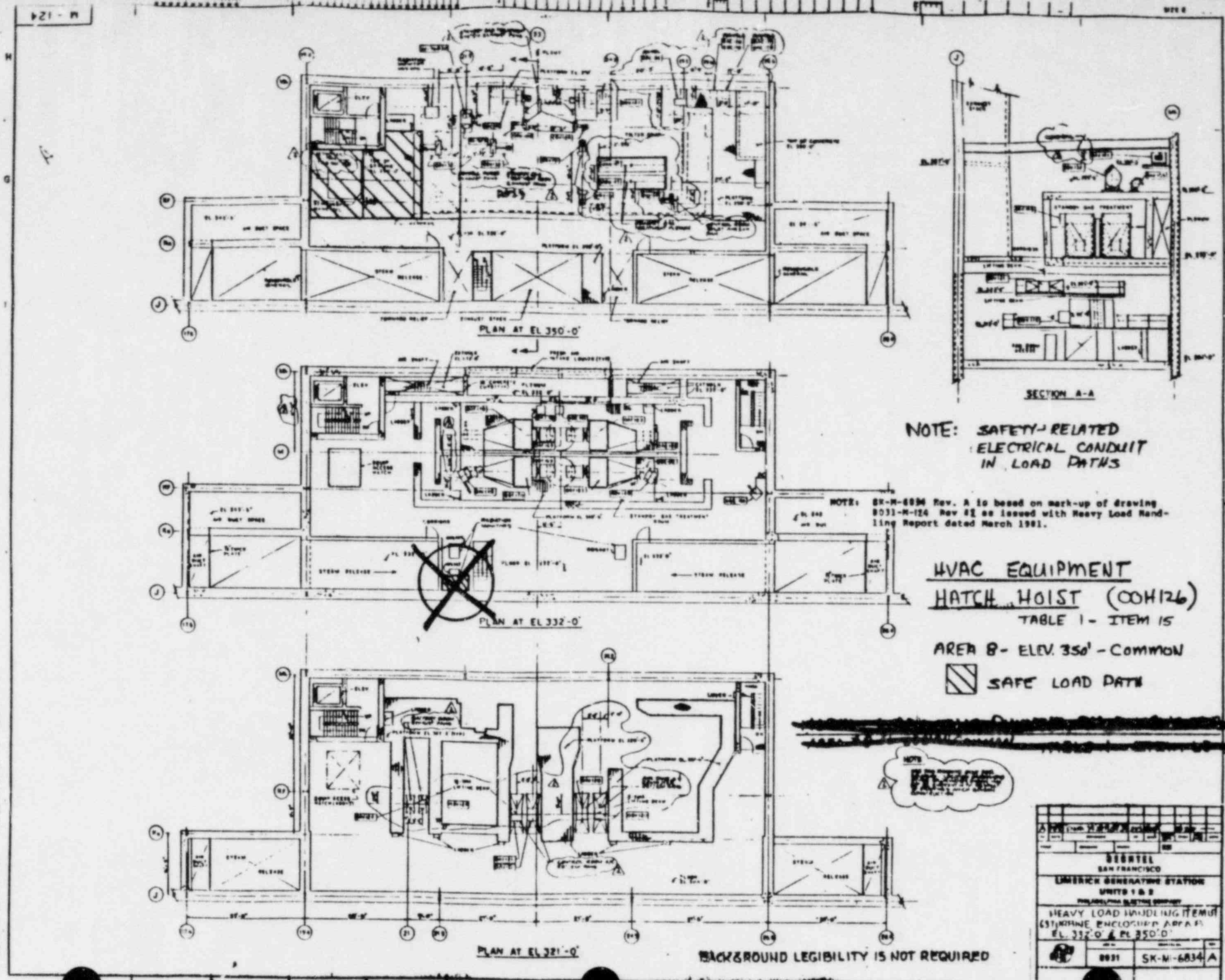
BECHTEL
SAN FRANCISCO

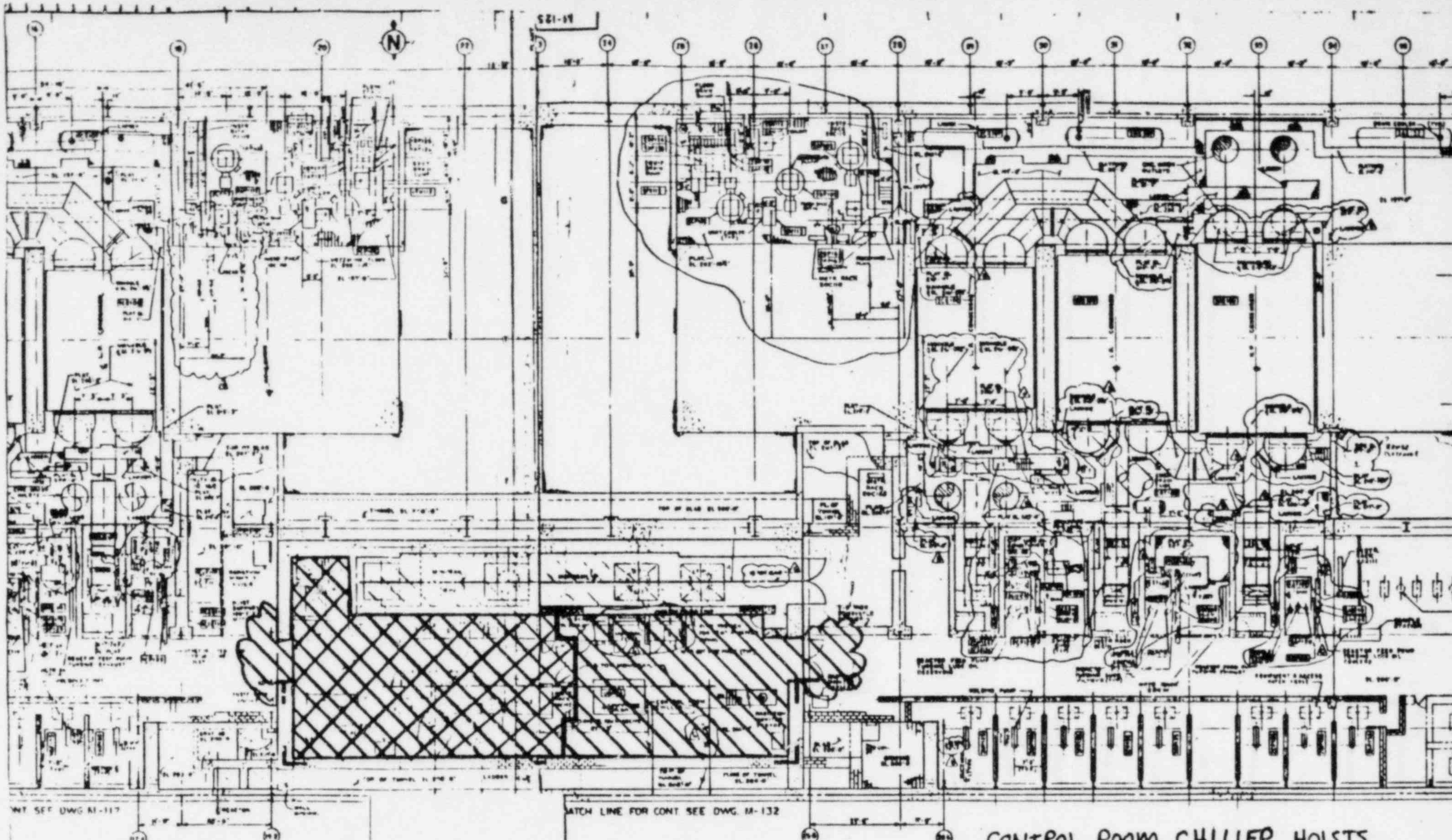
LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY

HEAVY LOAD HANDLING ITEM #6
REACTOR ENCLOSURE
EL 177'-0" AREA #8

8031 | SK-M-6832 | A


NOTE: SK-M-6833 Rev. A is based on mark-up of drawing 8031-M-121 Rev ... issued with Heavy Load Handling Report dated March 1981.
NOTE: NO SAFETY-RELATED EQUIPMENT IN LOAD PATH.
E SAFETY-RELATED ELECTRICAL
BACKGROUND LEGIBILITY IS NOT REQUIRED
REACTOR WATER CLEANUP SYSTEM
FILTER DEMINERALIZER HOIST
(00H124) TABLE I - ITEM 14
UNIT 1 - ELEV. 313' (TYP FOR UNIT 2)
SAFE LOAD PATH
MATCH LINE FOR CONT SEE DWG. M-136
PARTIAL PLAN AT EL 331'-0"
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY
HEAVY LOAD HANDLING ITEM #14
REACTOR ENCLOSURE UNITS 1 & 2
EL 313'-0" AREA #11
8031
SK-M-6833
A
121-M


M - 124
PLAN AT EL 350-0'
PLAN AT EL 332-0'
PLAN AT EL 321-0'
SECTION A-A
NOTE: SAFETY-RELATED ELECTRICAL CONDUIT IN LOAD PATHS
NOTE: SK-M-6834 Rev. A is based on mark-up of drawing 8031-M-124 Rev #1 as issued with Heavy Load Handling Report dated March 1981.
HVAC EQUIPMENT
HATCH HOIST (OOH126)
TABLE 1 - ITEM 15
AREA 8 - ELEV. 350' - COMMON
SAFE LOAD PATH
BACKGROUND LEGIBILITY IS NOT REQUIRED
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
HEAVY LOAD HANDLING ITEMS
TURBINE ENCLOSURE AREA 8
EL. 332'-0" & EL 350'-0"
8031
SK-M-6834 A



CONTROL ROOM CHILLER HOISTS
(00H129, 00H130) TABLE 1 - ITEM 17

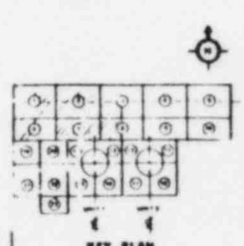
CONTROL ROOM CHILLER PORTABLE GANTRY HOIST
(00H514) TABLE 1 - ITEM 50

AREA 8 - ELEVATION 200' - COMMON

NOTE: CONTROL ROOM CHILLERS & SAFETY-RELATED ELECTRICAL CONDUIT IN LOAD PATHS.

BACKGROUND LEGIBILITY IS NOT REQUIRED

NOTE: SK-M-6835 Rev. A is based on mark-up of drawing 8031-M-110 Rev. 19 as issued with Heavy Load Handling Report dated March 1981.



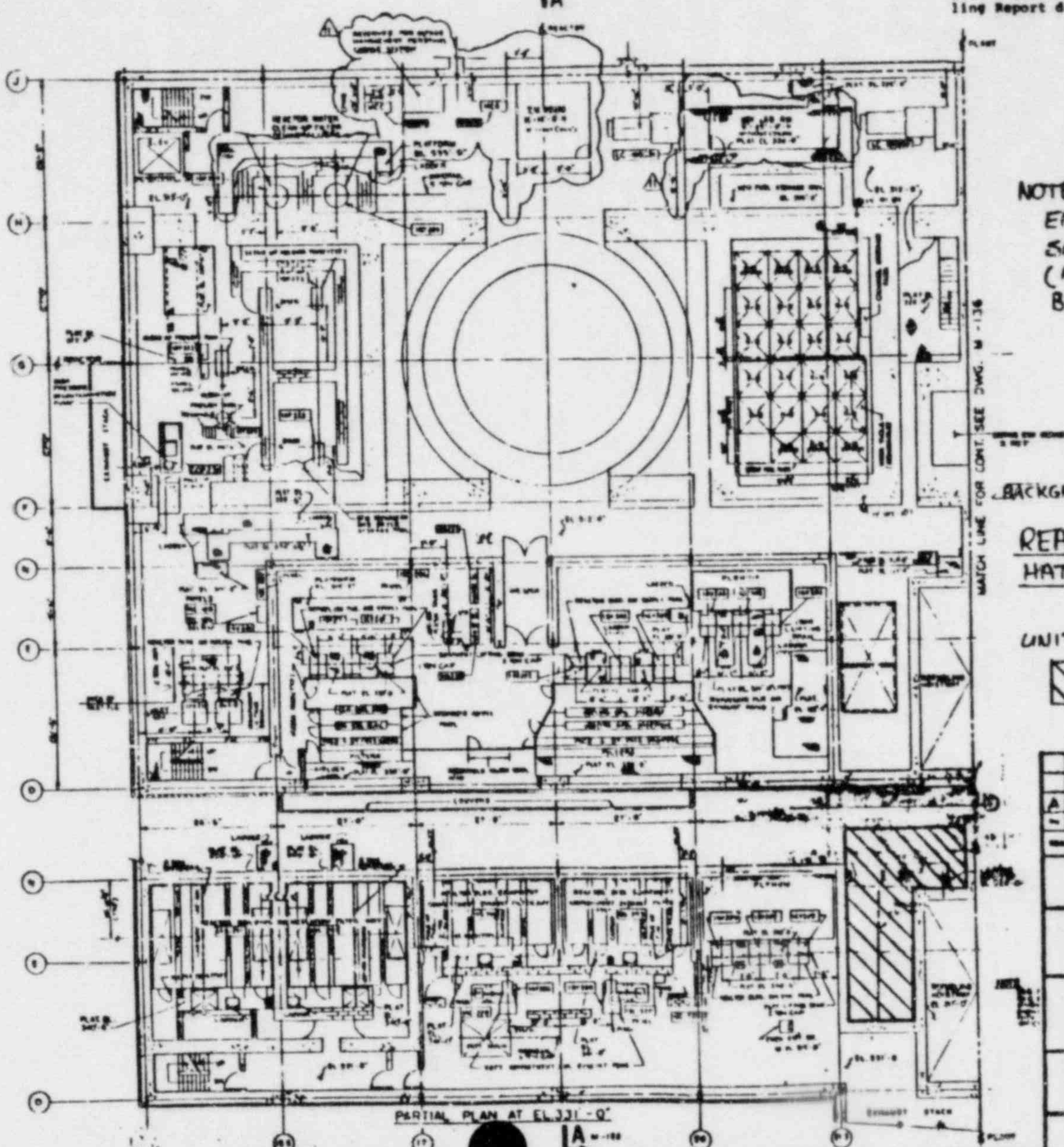
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY
HEAVY LOAD HANDLING ITEM 17 TURBINE ENCLOSURE AREA 8 PLAN AT EL 200'-0 ITEM 50

8031	SK-M-6835	A

1-17-50

121-M

NOTE: SK-M-6836 Rev. A is based on mark-up of drawing 8031-M-121 Rev. 8 issued with Heavy Load Handling Report dated March 1981.



NOTE: NO SAFETY-RELATED / EQUIPMENT IN LOAD PATH. SAFETY-RELATED EQUIP. (RHR, ESW, ELECTRICAL) BELOW 217' FLOOR SLAB.

BACKGROUND LEGIBILITY IS NOT REQUIRED

REACTOR ENCLOSURE EQUIP.

HATCH HOIST (10H131)

TABLE 1 - ITEM 18

UNIT 1 - ELEV 313' (TYP FOR UNIT 2)

SAFE LOAD PATH

A | ISSUED A SK-M-6836

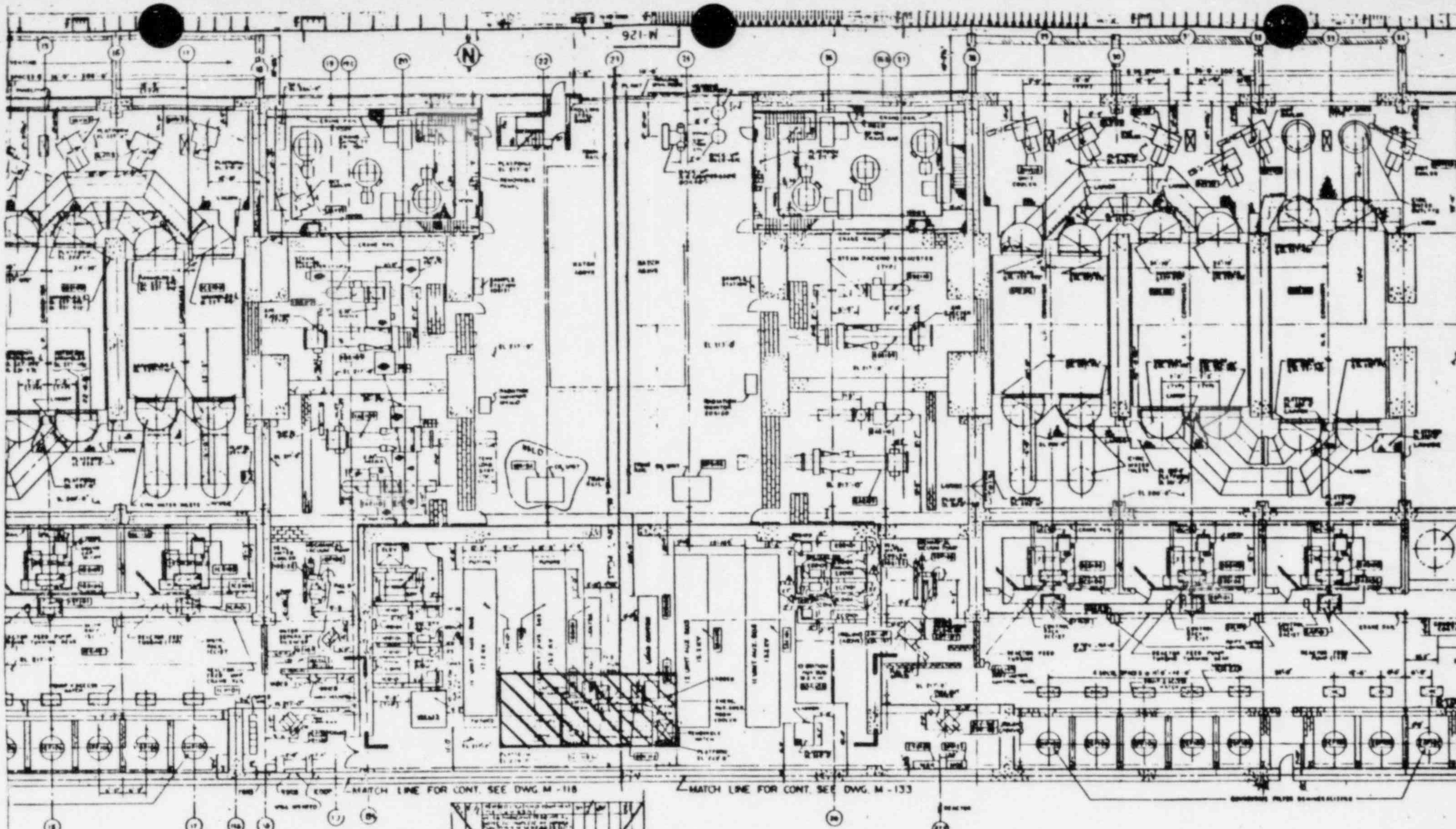
BECHTEL
SAN FRANCISCO

LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY

HEAVY LOAD HANDLING ITEM #18
REACTOR ENCLOSURE UNIT #1
PLAN AT EL 313'-0" AREA #16

8031 | SK-M-6836 | A

18



CONTROL ROOM HVAC LIFT BEAMS

(00H133) TABLE 1 - ITEM 19

AREA 8 - ELEV. 217' - COMMON

[hatched box] SAFE LOAD PATH

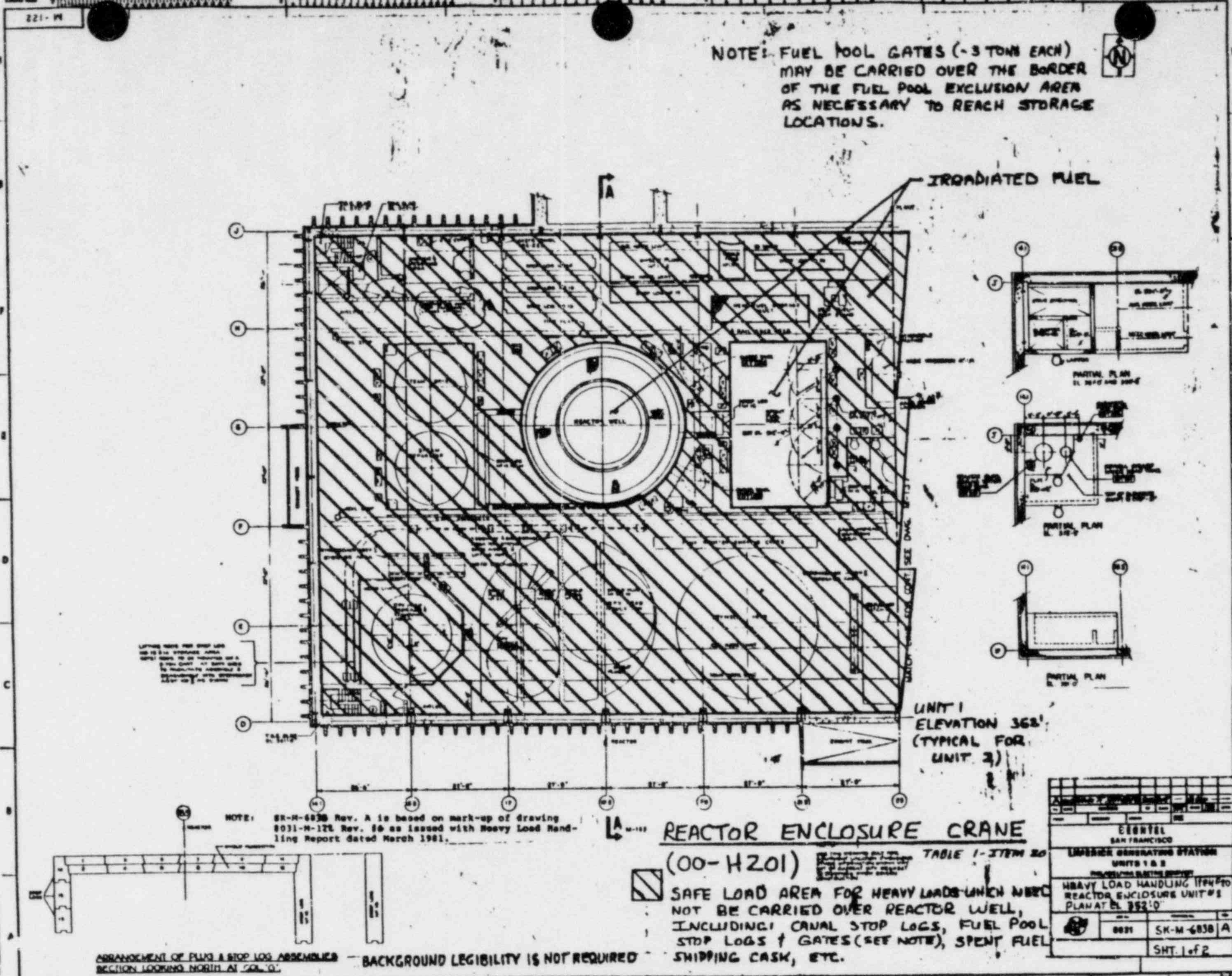
NOTE: SK-M-6837 Rev. A is based on mark-up of drawing 8031-M-111 Rev 18 as issued with Heavy Load Handling Report dated March 1981.

NOTE: SAFETY-RELATED CHILLED WATER PIPING & ELECTRICAL LOCATED IN LOAD PATH

BACKGROUND LEGIBILITY IS NOT REQUIRED

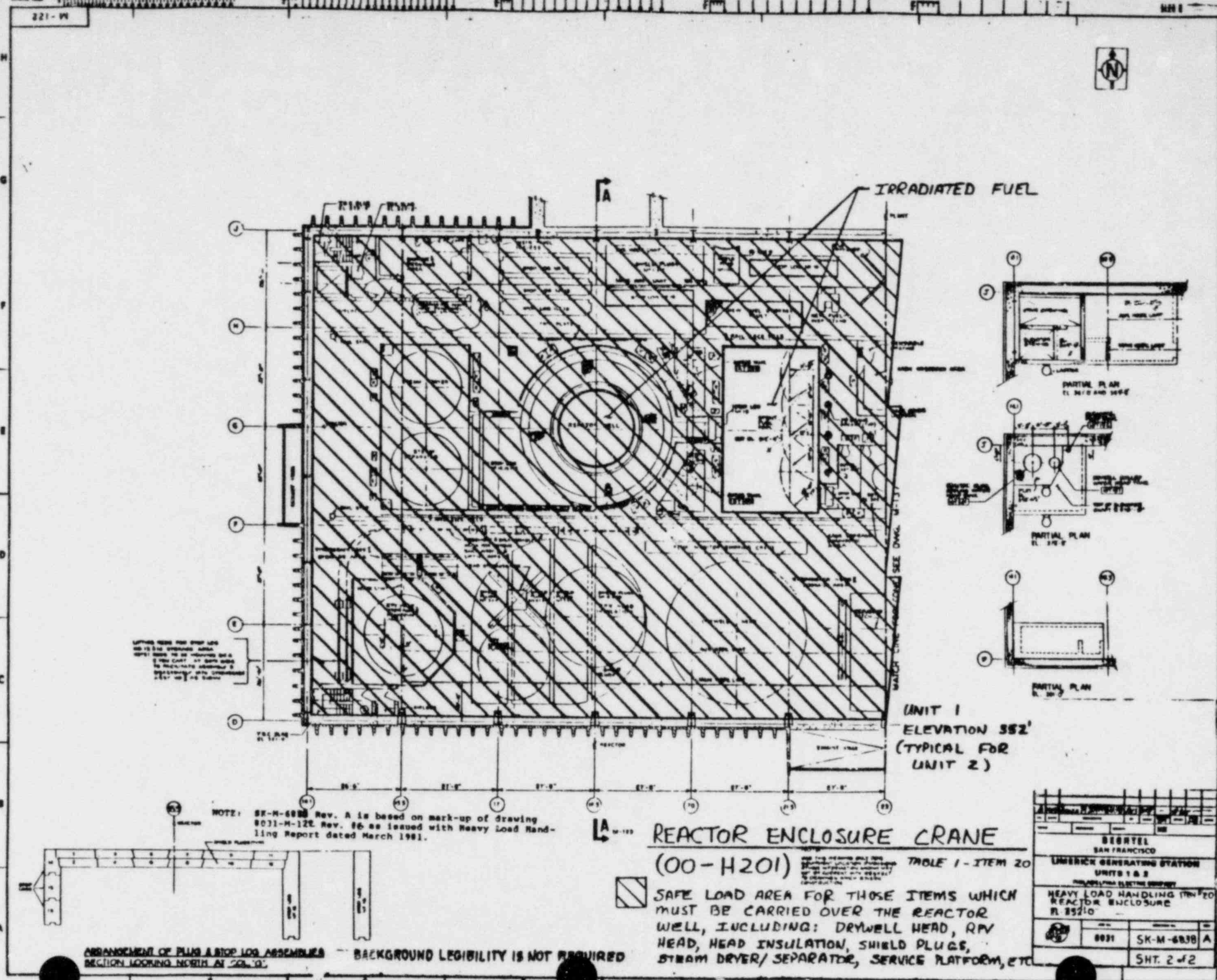
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY
HEAVY LOAD HANDLING ITEM 19
TURBINE ENCLOSURE AREA 8
EL. 217'-0" COMMON

8031	SK-M-6837	A

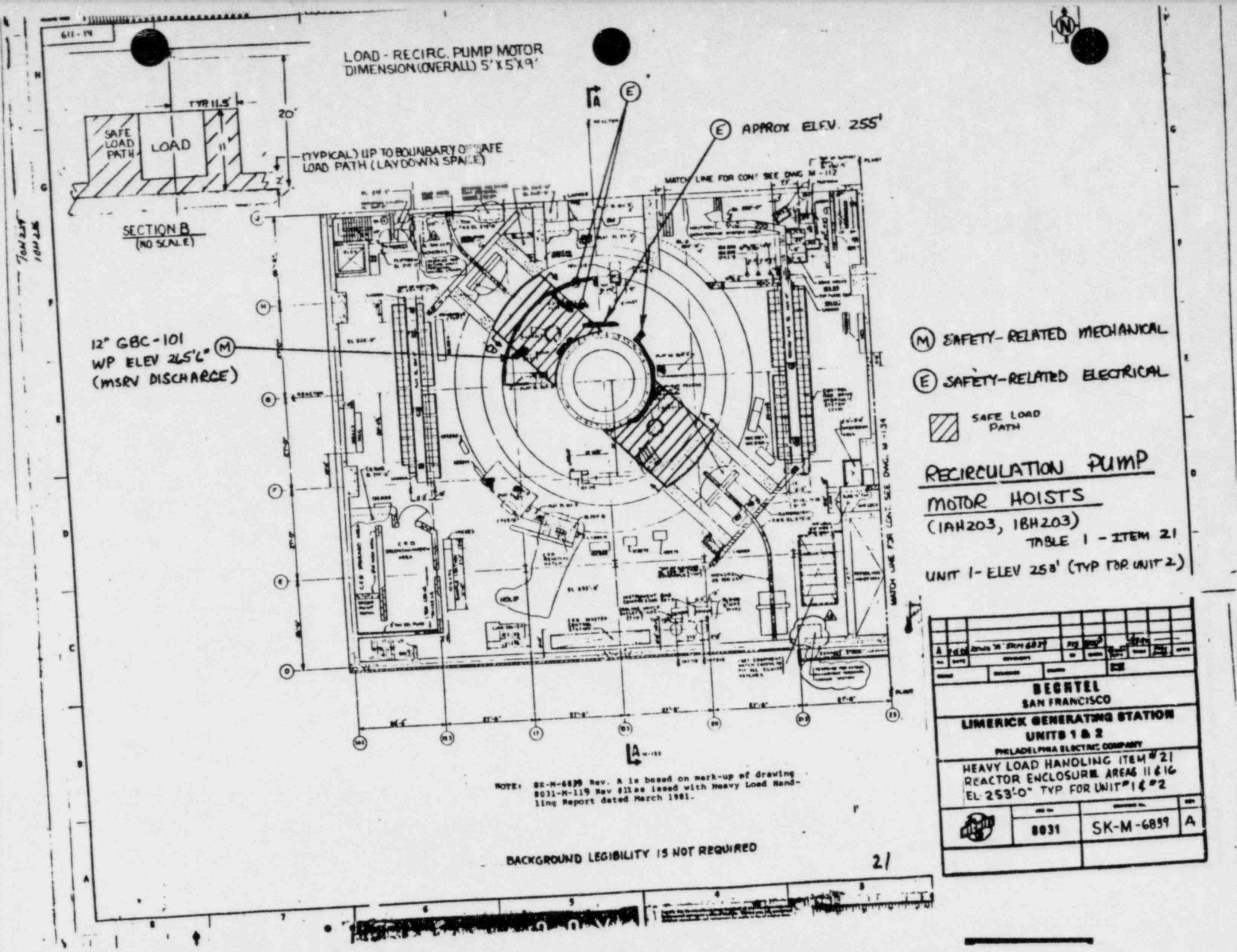


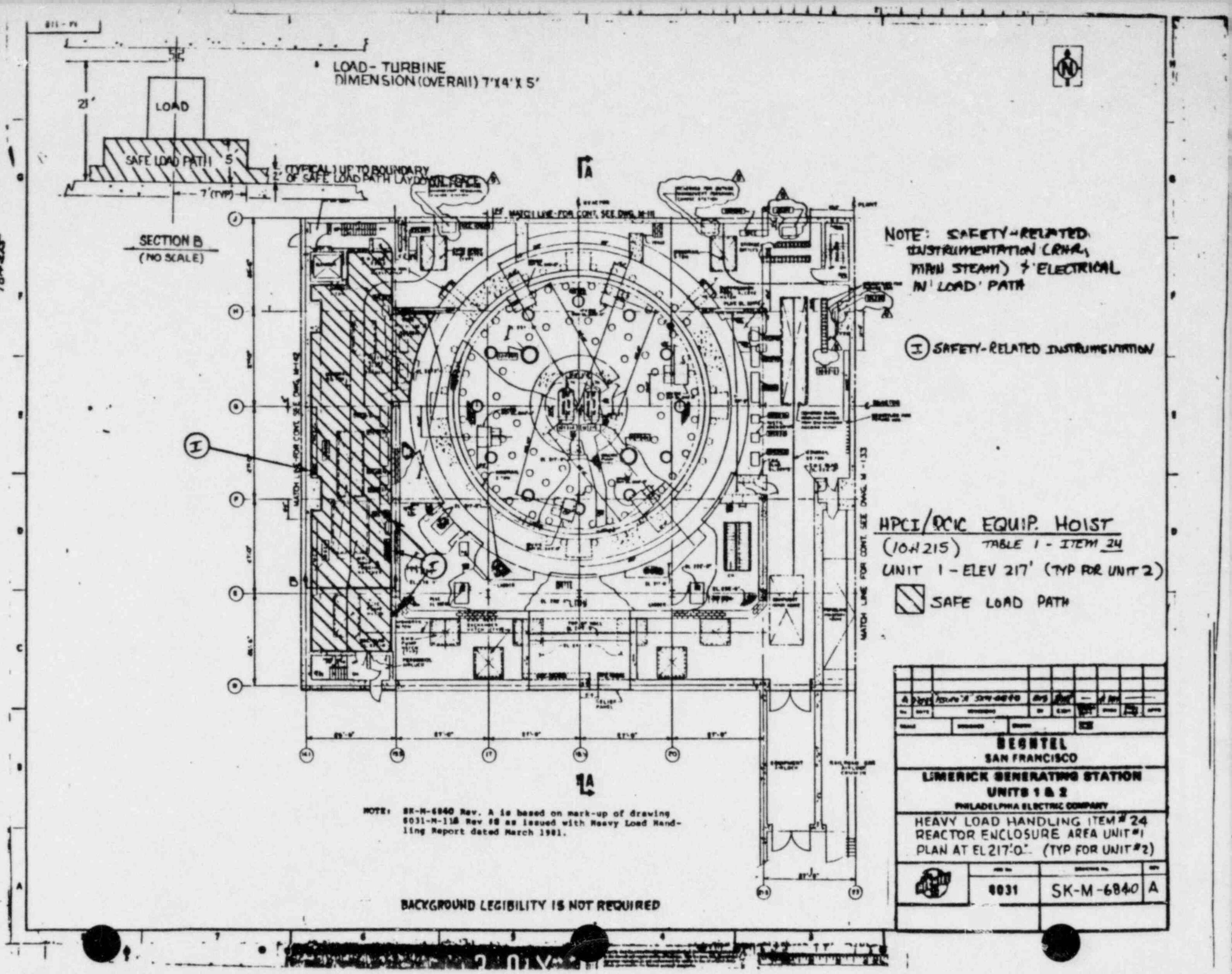
NOTE: FUEL POOL GATES (~3 TONS EACH) MAY BE CARRIED OVER THE BORDER OF THE FUEL POOL EXCLUSION AREA AS NECESSARY TO REACH STORAGE LOCATIONS.
IRRADIATED FUEL
REACTOR WELL
PARTIAL PLAN
UNIT 1 ELEVATION 352' (TYPICAL FOR UNIT 2)
NOTE: SK-M-6838 Rev. A is based on mark-up of drawing 8031-M-121 Rev. 10 as issued with Heavy Load Handling Report dated March 1981.
ARRANGEMENT OF PLUG & STOP LOG ASSEMBLIES SECTION LOOKING NORTH AT "COL. 0"
BACKGROUND LEGIBILITY IS NOT REQUIRED
REACTOR ENCLOSURE CRANE
(00-H201)
TABLE 1-ITEM 20
SAFE LOAD AREA FOR HEAVY LOADS WHICH NEED NOT BE CARRIED OVER REACTOR WELL, INCLUDING: CANAL STOP LOGS, FUEL POOL STOP LOGS & GATES (SEE NOTE), SPENT FUEL SHIPPING CASK, ETC.
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
HEAVY LOAD HANDLING ITEM 20 REACTOR ENCLOSURE UNIT #1 PLAN AT EL 352'0"
SK-M-6838 A
SHT. 1 of 2

20

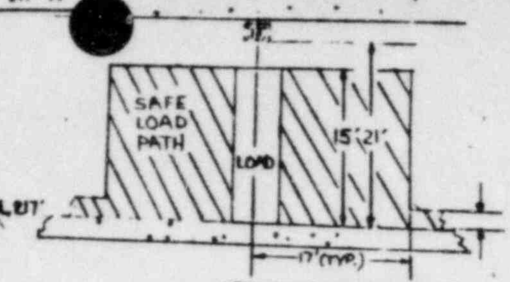


IRRADIATED FUEL
UNIT 1
ELEVATION 352'
(TYPICAL FOR
UNIT 2)
PARTIAL PLAN
PARTIAL PLAN
PARTIAL PLAN
NOTE: SK-M-6838 Rev. A is based on mark-up of drawing 8031-M-122 Rev. 16 as issued with Heavy Load Handling Report dated March 1981.
REACTOR ENCLOSURE CRANE
(00-H201)
TABLE 1 - ITEM 20
SAFE LOAD AREA FOR THOSE ITEMS WHICH MUST BE CARRIED OVER THE REACTOR WELL, INCLUDING: DRYWELL HEAD, RPV HEAD, HEAD INSULATION, SHIELD PLUGS, STEAM DRYER/ SEPARATOR, SERVICE PLATFORM, ETC.
ARRANGEMENT OF PLUG & STOP LOG ASSEMBLIES
SECTION LOOKING NORTH AT "COL. 0"
BACKGROUND LEGIBILITY IS NOT REQUIRED
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
HEAVY LOAD HANDLING ITEM 20
REACTOR ENCLOSURE
EL 352'0"
8031
SK-M-6838
A
SHT. 2 of 2

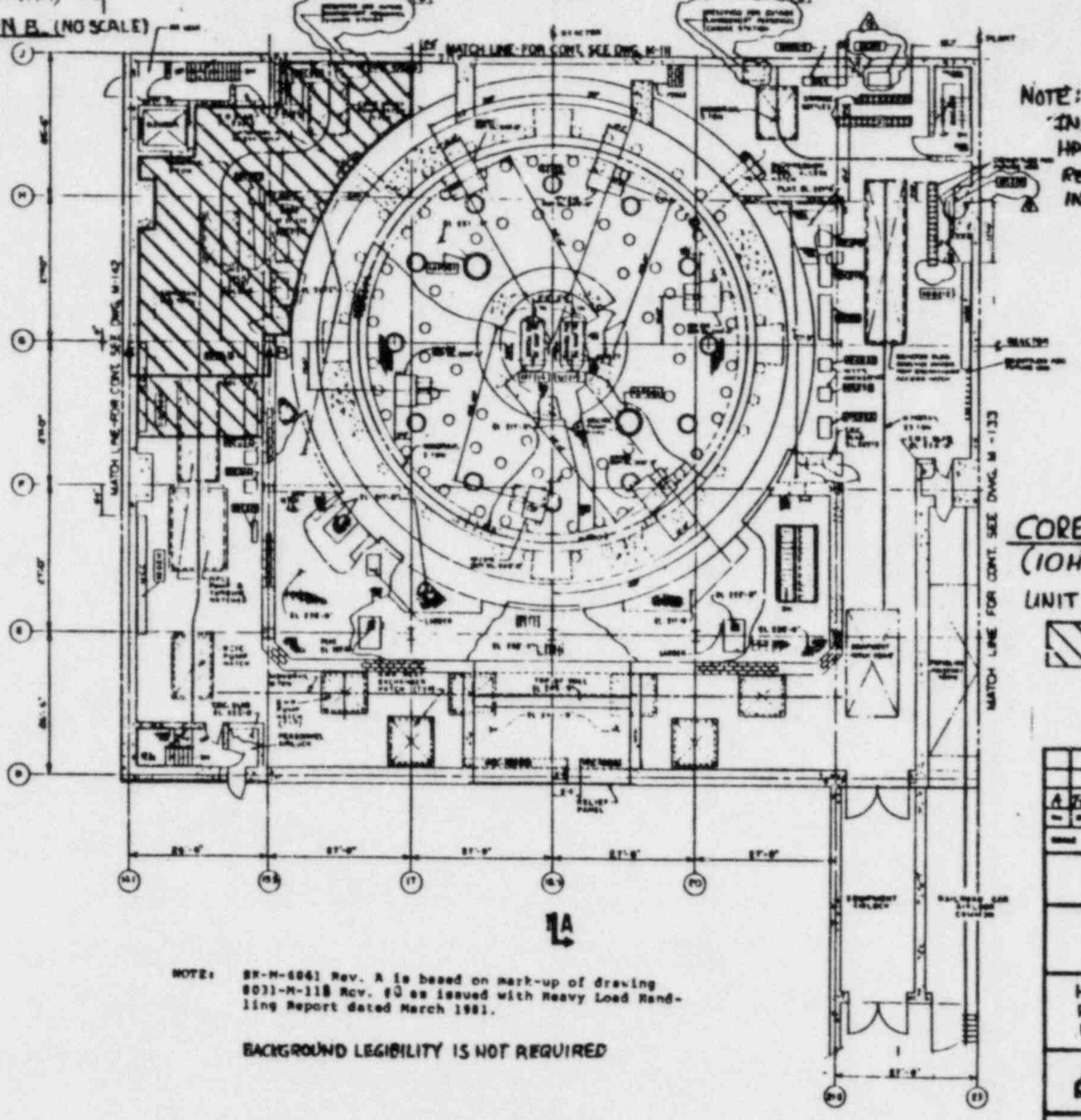

611-14
LOAD - RECIRC. PUMP MOTOR
DIMENSION (OVERALL) 5'X5'X9'
SAFE LOAD PATH
LOAD
TYP 11.5'
20'
(TYPICAL) UP TO BOUNDARY OF SAFE LOAD PATH (LAYDOWN SPACE)
SECTION B
(NO SCALE)
E
APPROX ELEV. 255'
12" GBC-101
WP ELEV 265'6"
(MSRV DISCHARGE)
M
MATCH LINE FOR CONT SEE DWG M-112
MATCH LINE FOR CONT SEE DWG M-134
M SAFETY-RELATED MECHANICAL
E SAFETY-RELATED ELECTRICAL
SAFE LOAD PATH
RECIRCULATION PUMP
MOTOR HOISTS
(1AH203, 1BH203)
TABLE 1 - ITEM 21
UNIT 1- ELEV 253' (TYP FOR UNIT 2)
NOTE: SK-M-6839 Rev. A is based on mark-up of drawing 8031-M-119 Rev 011as issued with Heavy Load Handling Report dated March 1981.
BACKGROUND LEGIBILITY IS NOT REQUIRED
21
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY
HEAVY LOAD HANDLING ITEM #21
REACTOR ENCLOSURE AREAS 11 & 16
EL 253'-0" TYP FOR UNIT #1 & #2
8031
SK-M-6839
A



LOAD- TURBINE
DIMENSION (OVERALL) 7'X4' X 5'
LOAD
21'
SAFE LOAD PATH
5'
(TYPICAL) UP TO BOUNDARY
2' OF SAFE LOAD PATH
7' (TYP)
SECTION B
(NO SCALE)
A
A
B
NOTE: SAFETY-RELATED INSTRUMENTATION (RHR, MAIN STEAM) & ELECTRICAL IN LOAD PATH
(I) SAFETY-RELATED INSTRUMENTATION
HPCI/RCIC EQUIP. HOIST
(10H215) TABLE 1 - ITEM 24
UNIT 1 - ELEV 217' (TYP FOR UNIT 2)
SAFE LOAD PATH
MATCH LINE FOR CONT. SEE DWG. M-112
MATCH LINE FOR CONT. SEE DWG. M-133
NOTE: SK-M-6840 Rev. A is based on mark-up of drawing 8031-M-118 Rev 8 as issued with Heavy Load Handling Report dated March 1981.
BACKGROUND LEGIBILITY IS NOT REQUIRED
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY
HEAVY LOAD HANDLING ITEM # 24
REACTOR ENCLOSURE AREA UNIT #1
PLAN AT EL 217'-0" (TYP FOR UNIT #2)
8031
SK-M-6840
A



SECTION B (NO SCALE)



NOTE: SAFETY-RELATED PIPING, INSTRUMENTATION (CORE SPRAY, HPCI, MAIN STEAM & RECIRCULATION) & ELECTRICAL IN LOAD PATH

CORE SPRAY PUMPS HOIST

(10H216) TABLE 1 - ITEM 25

UNIT 1 - ELEV. 217' (TYP FOR UNIT 2)

▧ SAFE LOAD PATH

NOTE: SK-M-6841 Rev. A is based on mark-up of drawing 8031-M-118 Rev. 10 as issued with Heavy Load Handling Report dated March 1981.

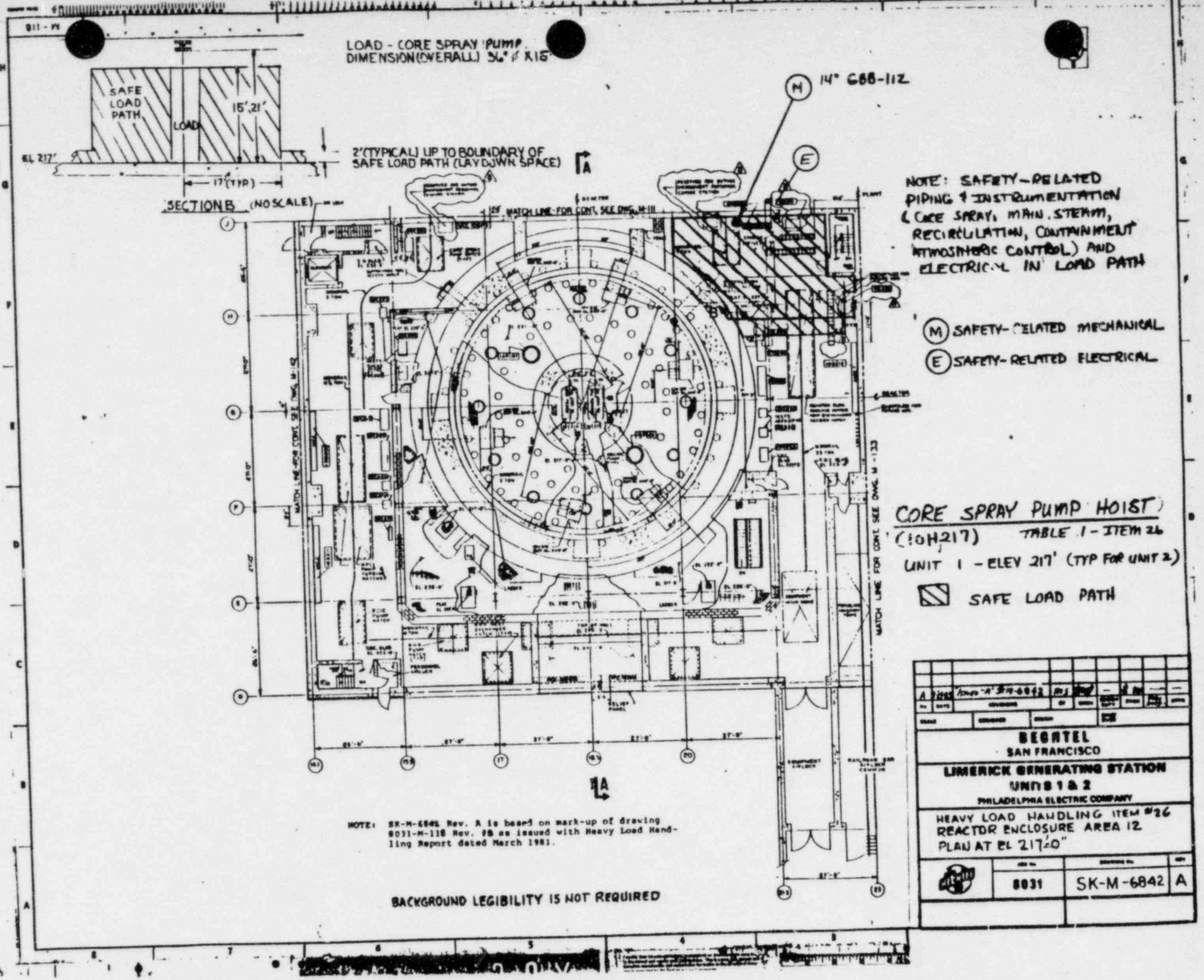
BACKGROUND LEGIBILITY IS NOT REQUIRED

BECHTEL
SAN FRANCISCO

LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY

HEAVY LOAD HANDLING ITEM #25
REACTOR ENCLOSURE AREA II
PLAN AT EL 217'-0" (TYP FOR UNIT 2)

JOB No.	DRAWING No.	REV
8031	SK-M-6841	A

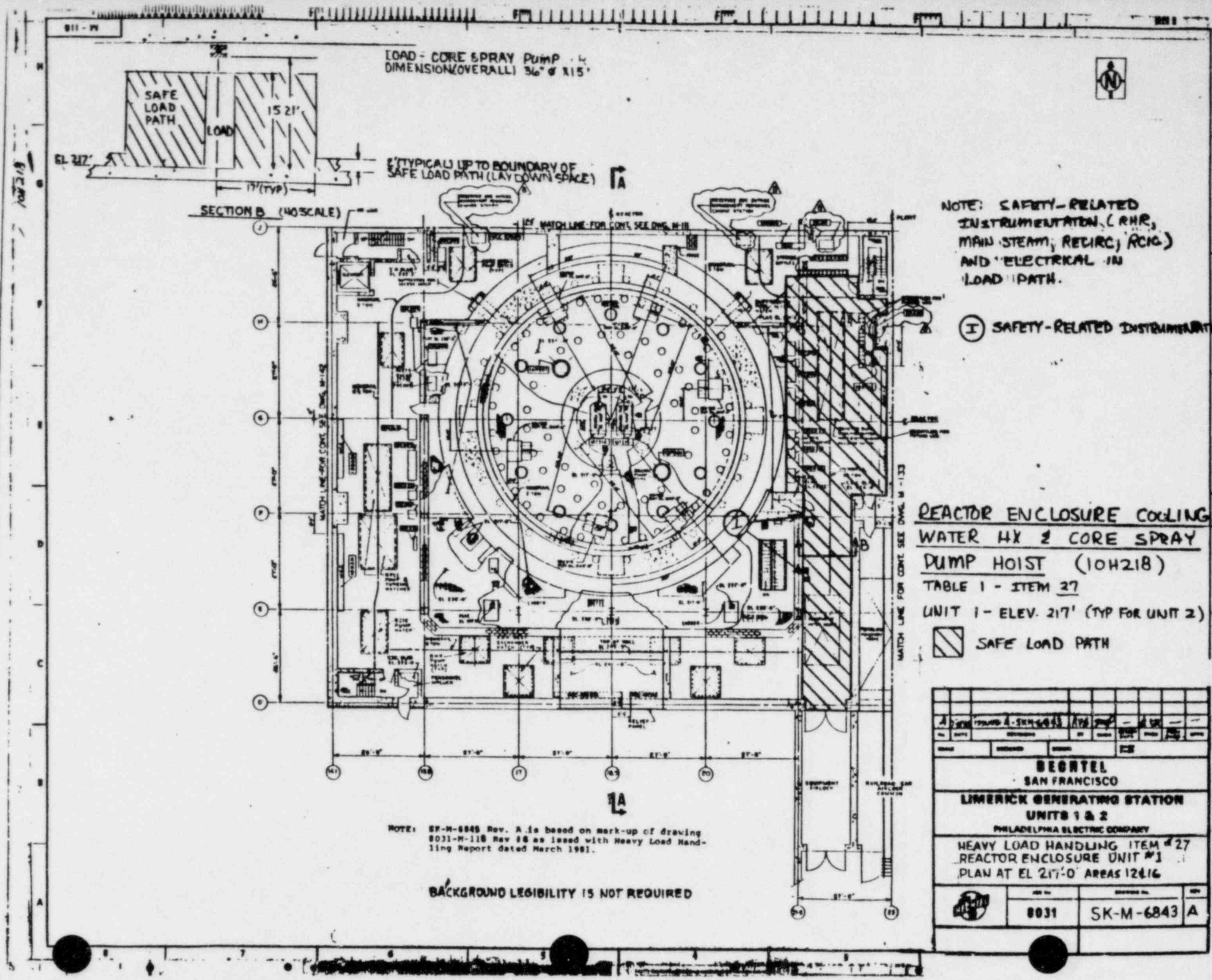


BECHTEL
SAN FRANCISCO

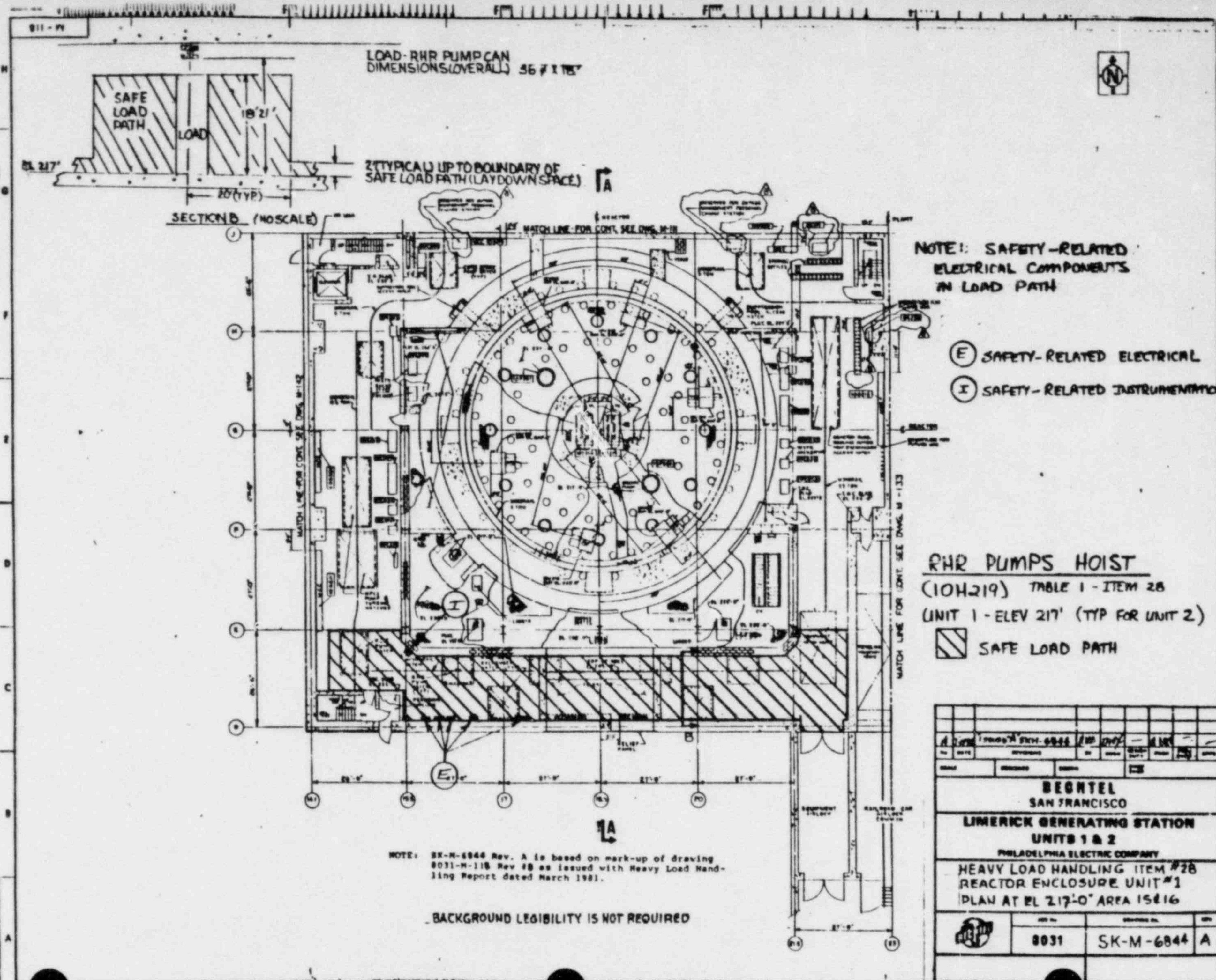
LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY

HEAVY LOAD HANDLING ITEM #26
REACTOR ENCLOSURE AREA 12
PLAN AT EL 217'-0"

8031 SK-M-6842 A

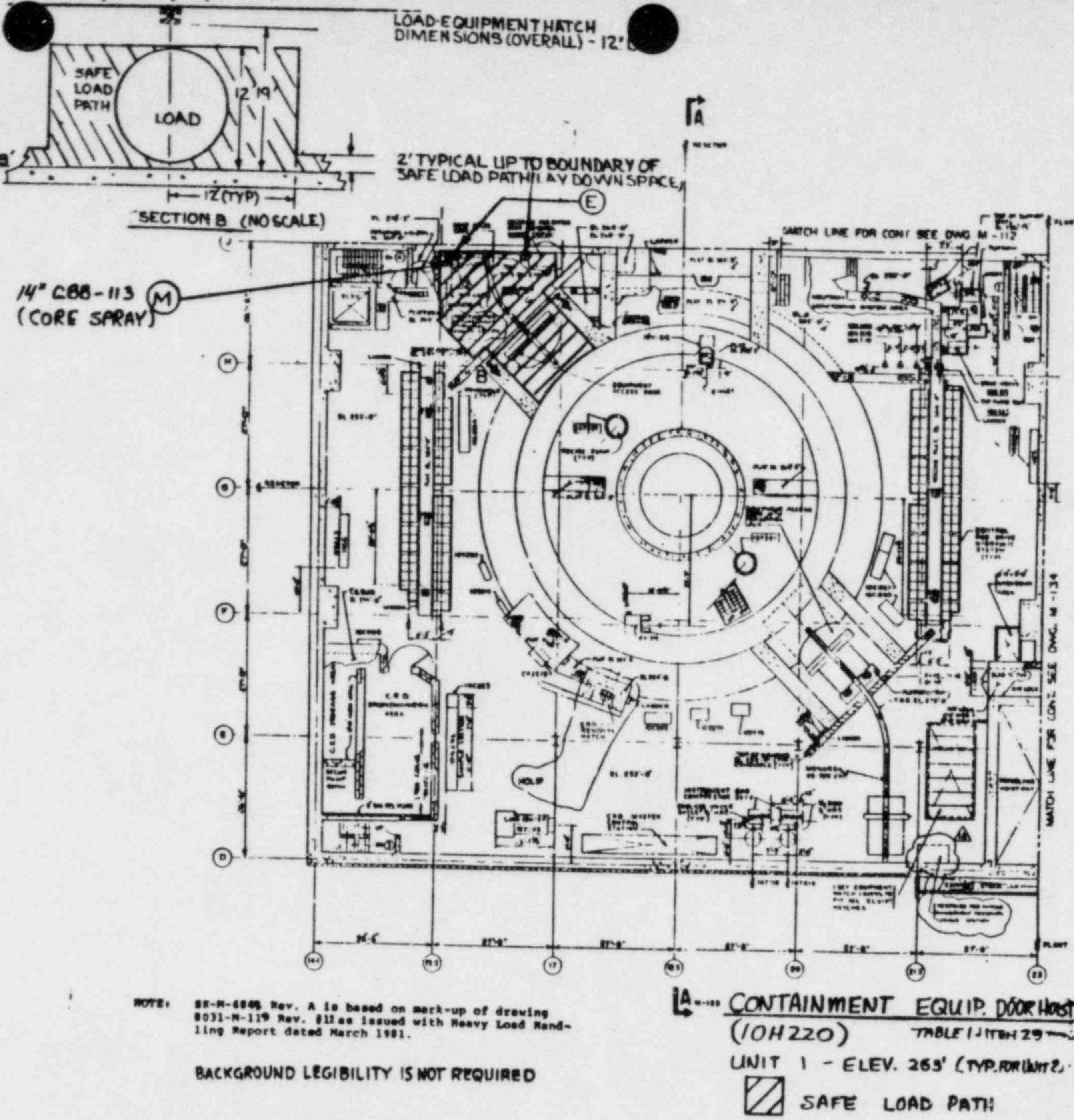


LOAD - CORE SPRAY PUMP
DIMENSION(OVERALL) 36" Ø X15'
SAFE LOAD PATH
LOAD
15 21'
EL 217'
2'(TYPICAL) UP TO BOUNDARY OF SAFE LOAD PATH (LAY DOWN SPACE)
17'(TYP)
SECTION B (NO SCALE)
A
NOTE: SAFETY-RELATED INSTRUMENTATION (RHR, MAIN STEAM, RECIRC, RCIC) AND ELECTRICAL IN LOAD PATH.
(I) SAFETY-RELATED INSTRUMENTATION
REACTOR ENCLOSURE COOLING WATER HX & CORE SPRAY PUMP HOIST (10H218)
TABLE 1 - ITEM 27
UNIT 1 - ELEV. 217' (TYP FOR UNIT 2)
SAFE LOAD PATH
NOTE: SK-M-6843 Rev. A is based on mark-up of drawing 8031-M-118 Rev 8 as issued with Heavy Load Handling Report dated March 1981.
BACKGROUND LEGIBILITY IS NOT REQUIRED
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY
HEAVY LOAD HANDLING ITEM #27
REACTOR ENCLOSURE UNIT #1
PLAN AT EL 217'-0" AREAS 12&16
8031
SK-M-6843
A



LOAD - RHR PUMP CAN
DIMENSIONS (OVERALL) 56 ⌀ X 18'
SAFE LOAD PATH
LOAD
18'2 1/2'
EL 217'
2' (TYPICAL) UP TO BOUNDARY OF SAFE LOAD PATH (LAYDOWN SPACE)
20' (TYP)
SECTION B (NO SCALE)
MATCH LINE FOR CONT. SEE DWG. M-133
NOTE: SAFETY-RELATED ELECTRICAL COMPONENTS IN LOAD PATH
E SAFETY-RELATED ELECTRICAL
I SAFETY-RELATED INSTRUMENTATION
RHR PUMPS HOIST
(10H219) TABLE 1 - ITEM 28
UNIT 1 - ELEV 217' (TYP FOR UNIT 2)
SAFE LOAD PATH
NOTE: SK-M-6844 Rev. A is based on mark-up of drawing 8031-M-118 Rev 18 as issued with Heavy Load Handling Report dated March 1981.
BACKGROUND LEGIBILITY IS NOT REQUIRED
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY
HEAVY LOAD HANDLING ITEM #28
REACTOR ENCLOSURE UNIT #1
PLAN AT EL 217'-0" AREA 15&16
8031
SK-M-6844
A

10H219



NOTE: SAFETY-RELATED PIPING (CORE SPRAY) & ELECTRICAL CONDUIT IN LOAD PATH.

(M) SAFETY-RELATED MECHANICAL

(E) SAFETY-RELATED ELECTRICAL

NOTE: SK-M-6845 Rev. A is based on mark-up of drawing 8031-M-119 Rev. 11 as issued with Heavy Load Handling Report dated March 1981.

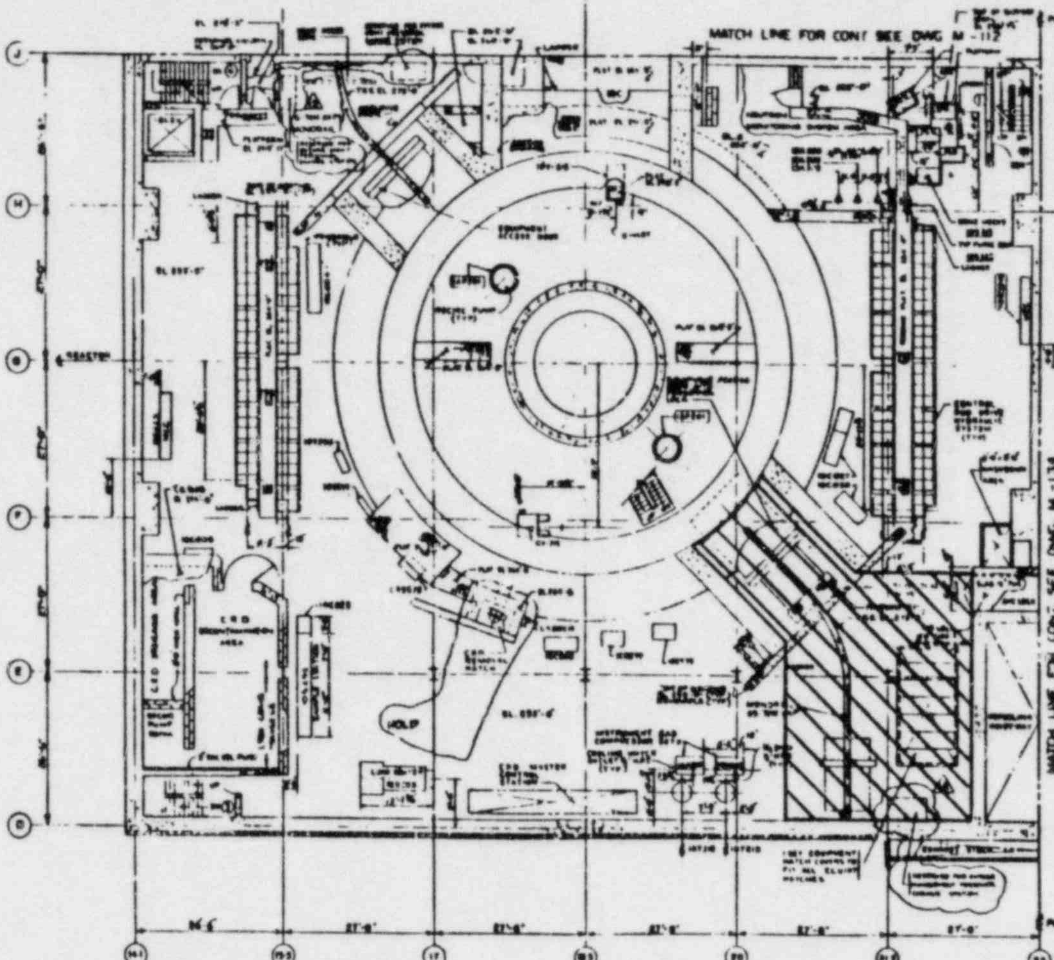
BACKGROUND LEGIBILITY IS NOT REQUIRED

BECHTEL
SAN FRANCISCO

LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY

HEAVY LOAD HANDLING ITEM 29
REACTOR ENCLOSURE UNIT #1
PLAN AT EL 253'-0" AREA #11

8031 SK-M-6845 A



NOTE: NO SAFETY-RELATED EQUIPMENT IN LOAD PATH

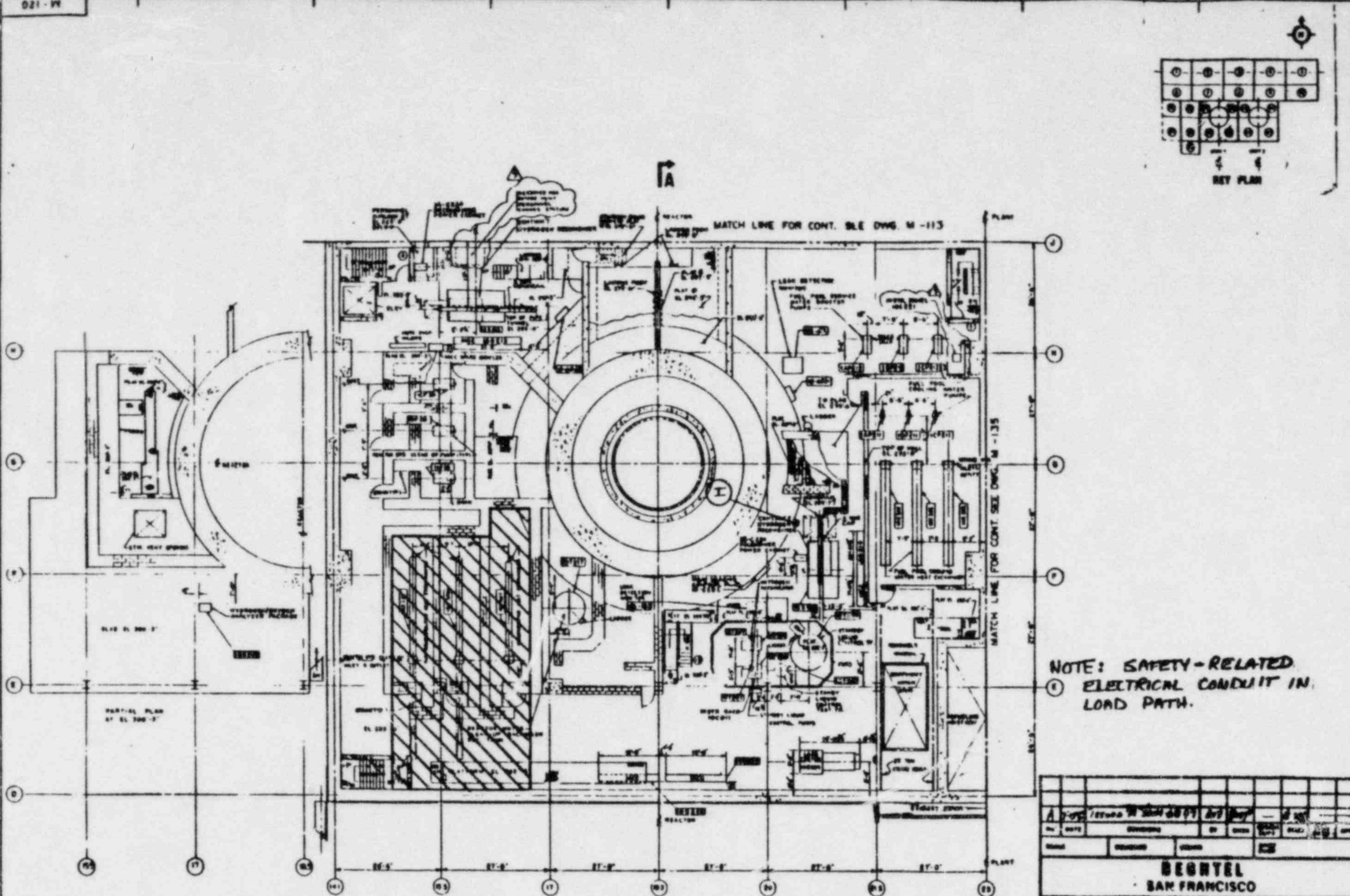
PERSONNEL LOCK HOIST
(1AH221/1BH221) TABLE 1 - ITEM 30
UNIT 1 - ELEV. 253' (TYP FOR UNIT 2)

SAFE LOAD PATH

NOTE: SK-M-6846 Rev. A is based on mark-up of drawing 8031-M-119 Rev. 8 issued with Heavy Load Handling Report dated March 1981.

BACKGROUND LEGIBILITY IS NOT REQUIRED

BECHTEL	SAN FRANCISCO
LIMERICK GENERATING STATION	UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY	
HEAVY LOAD HANDLING ITEM #30	REACTOR ENCLOSURE UNIT #1 PLAN AT EL 253'-0" AREA #16
JOB No. 8031	DRAWING No. SK-M-6846 REV. A



NOTE: SAFETY-RELATED ELECTRICAL CONDUIT IN LOAD PATH.

NOTE: SK-M-6847 Rev. A is based on mark-up of drawing 8031-M-120 Rev 19 as issued with Heavy Load Handling Report dated March 1981.

BACKGROUND LEGIBILITY IS NOT REQUIRED

IA - REACTOR WATER CLEAUP SYS.
HEAT EXCHANGER HOIST
(10H223) TABLE 1 - ITEM 31
UNIT 1 - ELEV 283' (TYP. FOR UNIT 2)

SAFE LOAD PATH

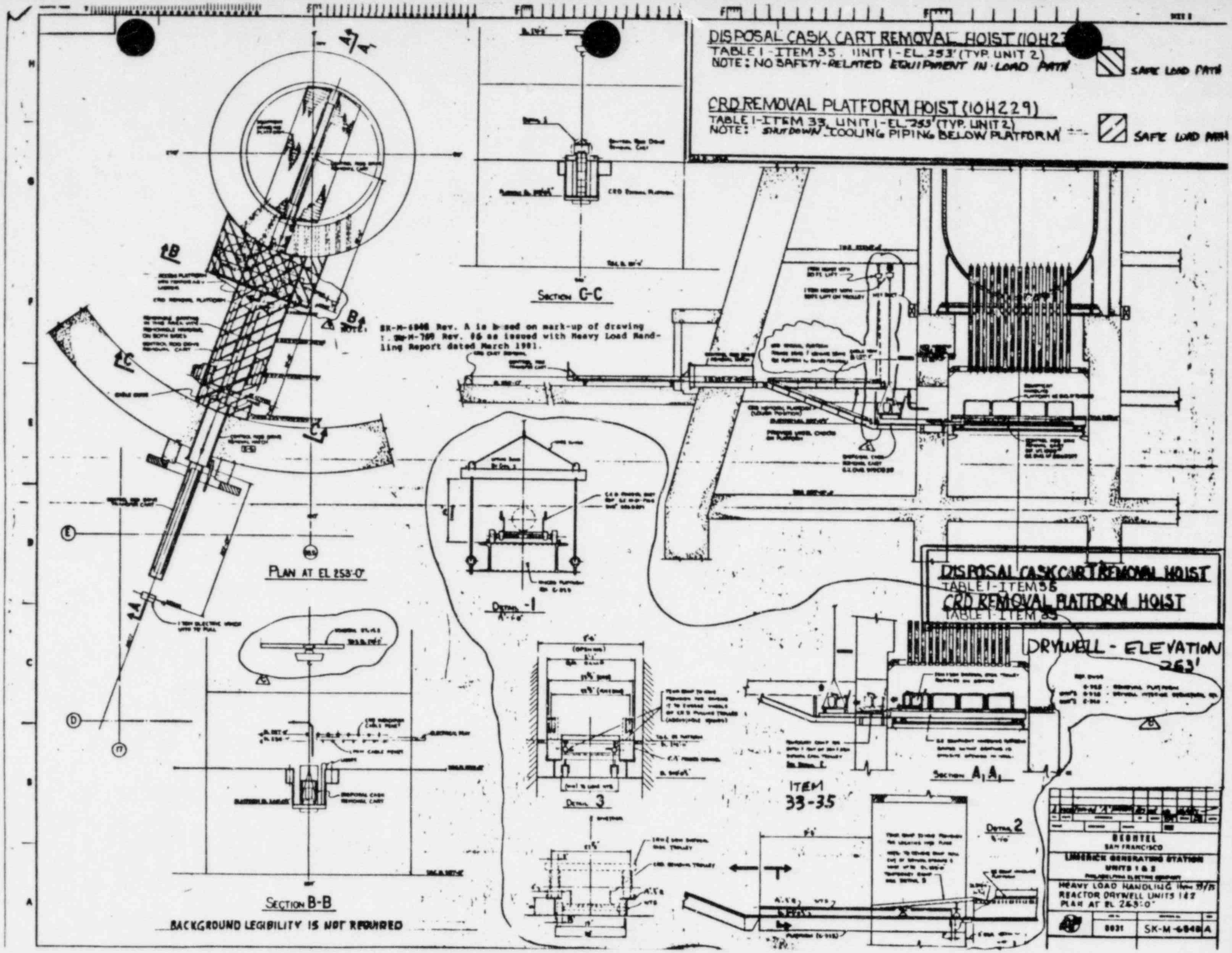
A	[illegible]	ISSUED [illegible]	[illegible]	[illegible]	[illegible]	[illegible]

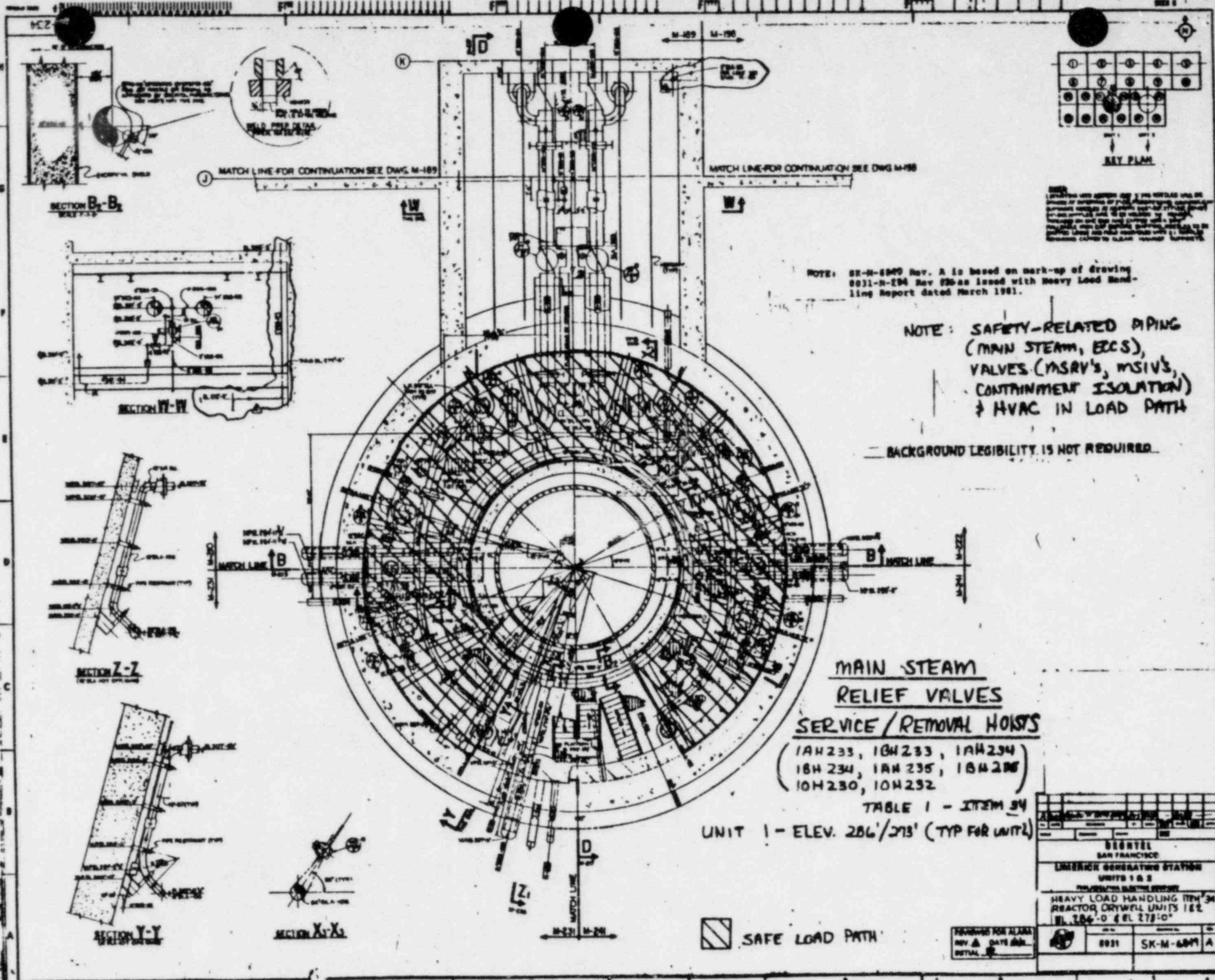
BECHTEL
SAN FRANCISCO

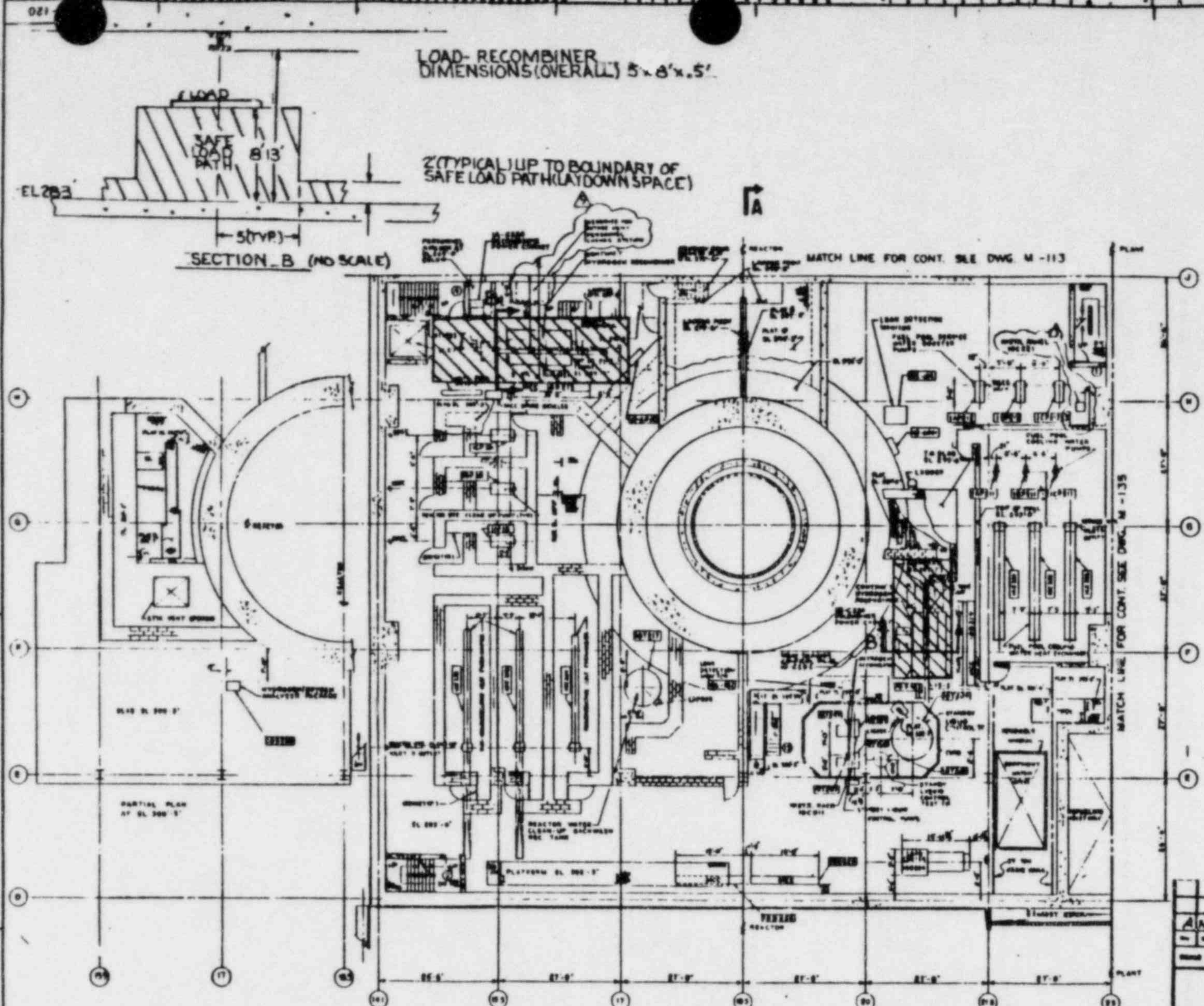
LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY

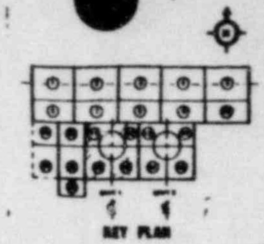
HEAVY LOAD HANDLING ITEM #31
REACTOR ENCLOSURE UNIT #1
PLAN AT EL 283'-0" AREA 15

JOB No.	DRAWING No.	REV.
8031	SK-M-6847	A


DISPOSAL CASK CART REMOVAL HOIST (10H2
TABLE I - ITEM 35, UNIT I - EL. 253' (TYP. UNIT 2)
NOTE: NO SAFETY-RELATED EQUIPMENT IN LOAD PATH
SAFE LOAD PATH
CRD REMOVAL PLATFORM HOIST (10H229)
TABLE I - ITEM 33, UNIT I - EL. 253' (TYP. UNIT 2)
NOTE: SHUTDOWN COOLING PIPING BELOW PLATFORM
SAFE LOAD PATH
SECTION G-C
SK-M-6848 Rev. A is based on mark-up of drawing M-769 Rev. 06 as issued with Heavy Load Handling Report dated March 1981.
PLAN AT EL 253'-0"
DETAIL 1
DISPOSAL CASK CART REMOVAL HOIST
TABLE I - ITEM 35
CRD REMOVAL PLATFORM HOIST
TABLE I - ITEM 33
DRYWELL - ELEVATION 253'
SECTION B-B
BACKGROUND LEGIBILITY IS NOT REQUIRED
DETAIL 3
ITEM 33-35
SECTION A1 A1
DETAIL 2
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
HEAVY LOAD HANDLING
REACTOR DRYWELL UNITS 1 & 2
PLAN AT EL 253'-0"
SK-M-6848 A


MATCH LINE-FOR CONTINUATION SEE DWG. M-189
MATCH LINE-FOR CONTINUATION SEE DWG M-198
SECTION B2-B2
SECTION W-W
SECTION Z-Z
SECTION Y-Y
SECTION X1-X1
KEY PLAN
NOTE: SK-M-6849 Rev. A is based on mark-up of drawing 8031-M-194 Rev 23 as issued with Heavy Load Handling Report dated March 1981.
NOTE: SAFETY-RELATED PIPING (MAIN STEAM, ECCS), VALVES (MSRV'S, MSIV'S, CONTAINMENT ISOLATION) & HVAC IN LOAD PATH
BACKGROUND LEGIBILITY IS NOT REQUIRED
MAIN STEAM RELIEF VALVES SERVICE/REMOVAL HOISTS
(1AH233, 1BH233, 1AH234, 1BH234, 1AH235, 1BH235, 10H230, 10H232)
TABLE 1 - ITEM 34
UNIT 1 - ELEV. 286'/273' (TYP FOR UNIT 2)
SAFE LOAD PATH
MATCH LINE
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
HEAVY LOAD HANDLING ITEM 34
REACTOR DRYWELL UNITS 1 & 2
EL 286'-0" & EL 273'-0"
8031
SK-M-6849
A
34





NOTE: "SAFETY-RELATED" ELECTRICAL CONDUIT & CONTAINMENT H_2 RECOMBINERS IN LOAD PATH.

NOTE: SK-M-6850 Rev. A is based on mark-up of drawing 8031-M-120 Rev. 19 as issued with Heavy Load Handling Report dated March 1981.

BACKGROUND LEGIBILITY IS NOT REQUIRED

A — CONTAINMENT HYDROGEN RECOMBINER COVER HOIST (10-H237)

TABLE 1 - ITEM 36

UNIT 1 ELEV. 283' (TYP FOR UNIT 2)

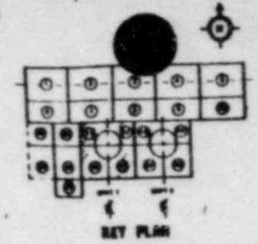
▧ SAFE LOAD PATHS

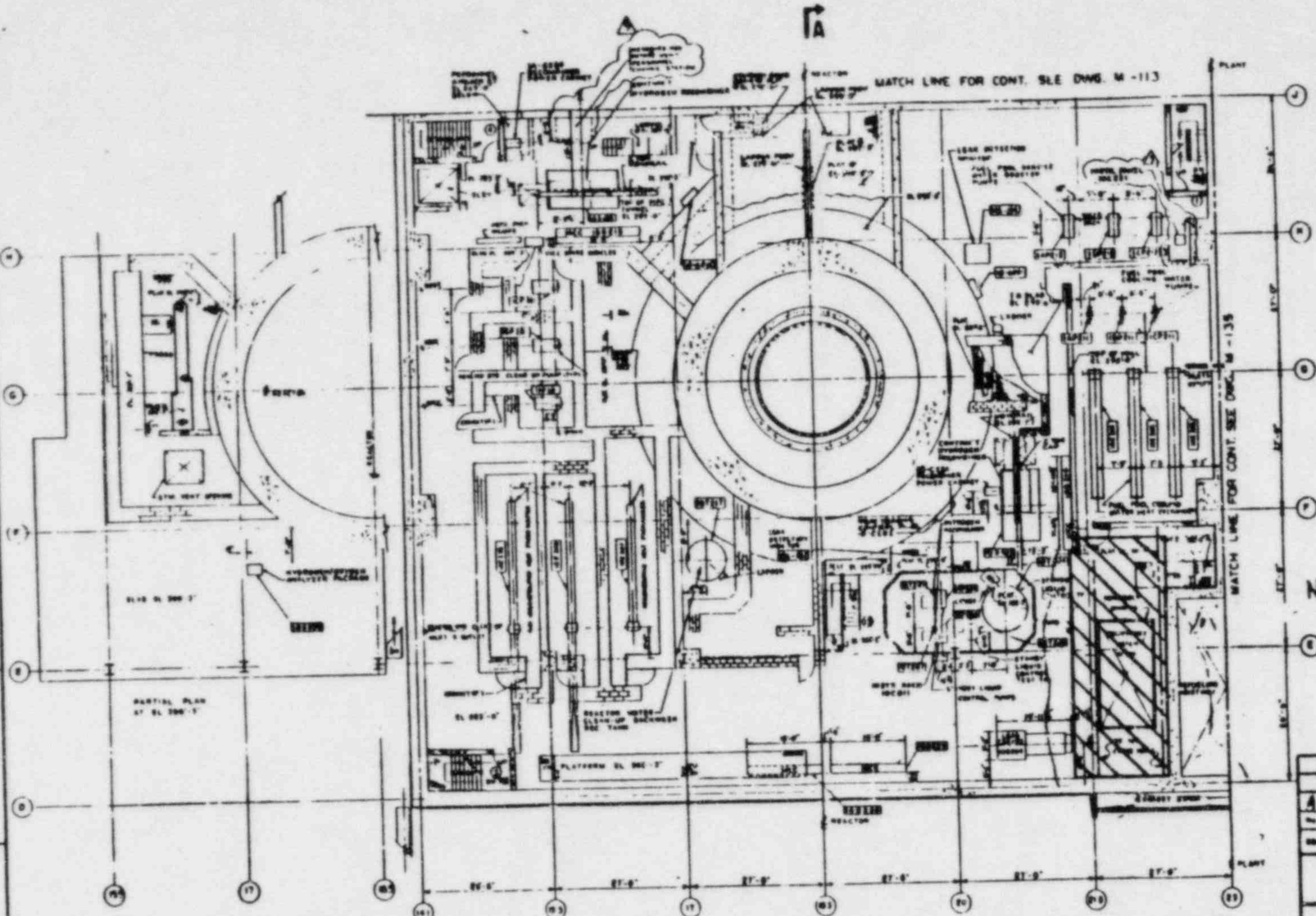
BECHTEL
SAN FRANCISCO

LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY

HEAVY LOAD HANDLING ITEM # 36
REACTOR ENCLOSURE UNIT #1
PLAN AT EL 283'-0" AREA #16 & #11

Job No.	Drawing No.	Rev.
8031	SK-M-6850	A





NOTE: NO SAFETY-RELATED ITEMS IN LOAD PATH.

NOTE: SK-M-6851 Rev. A is based on mark-up of drawing 8031-M-120 Rev. #9 as issued with Heavy Load Handling Report dated March 1981.

BACKGROUND LEGIBILITY IS NOT REQUIRED

A (M-113)

EQUIPMENT HATCH BRIDGE CRANE

(10-H238) TABLE 1 - ITEM 37

UNIT 1 ELEV. 283' (TYP FOR UNIT 2)

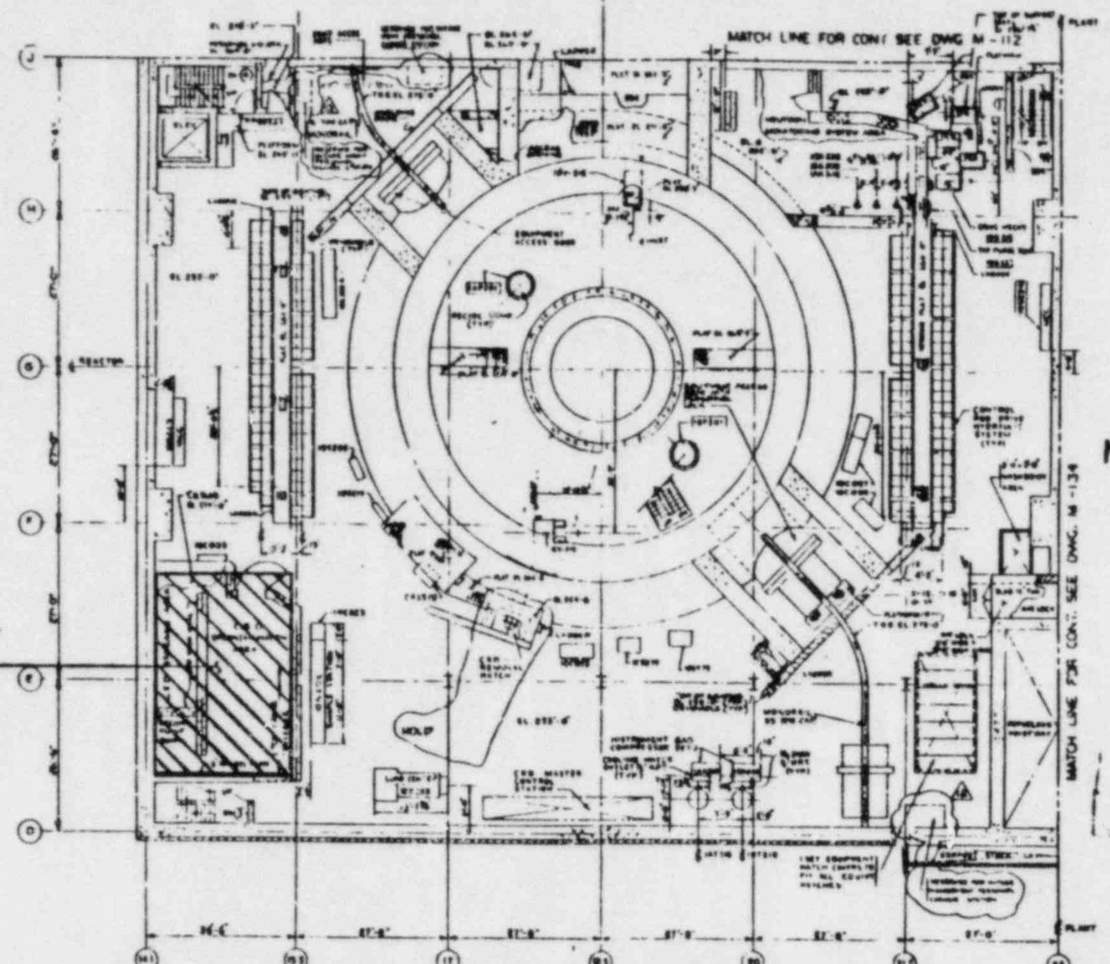
▨ SAFE LOAD PATH

BECHTEL
SAN FRANCISCO

LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY

HEAVY LOAD HANDLING ITEM #37
REACTOR ENCLOSURE UNIT #1
PLAN AT EL. 283'-0 AREA #16

JOB No.	DRAWING No.	REV.
8031	SK-M-6851	A



NOTE: NO SAFETY-RELATED ITEMS IN LOAD PATH.

A — CRD MAINTENANCE AREA CRANE (10-H239) TABLE 1 ITEM 38

UNIT 1, ELEVATION 253' (TYPICAL FOR UNIT 2)

SAFE LOAD PATH

NOTE: SK-M-6852 Rev. A is based on mark-up of drawing 8031-M-112 Rev 11 as issued with Heavy Load Handling Report dated March 1981.

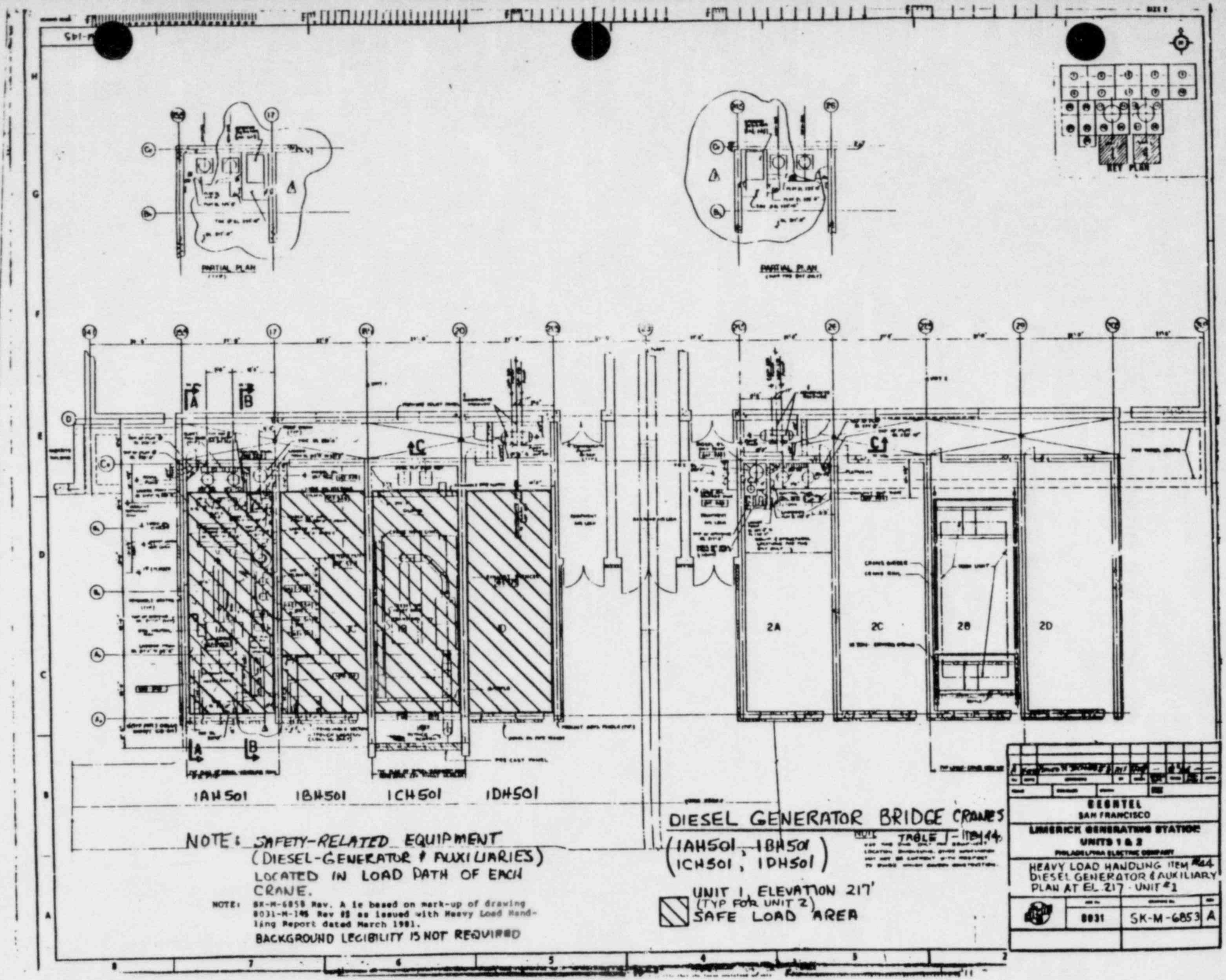
BACKGROUND LEGIBILITY IS NOT REQUIRED

BECHTEL
SAN FRANCISCO

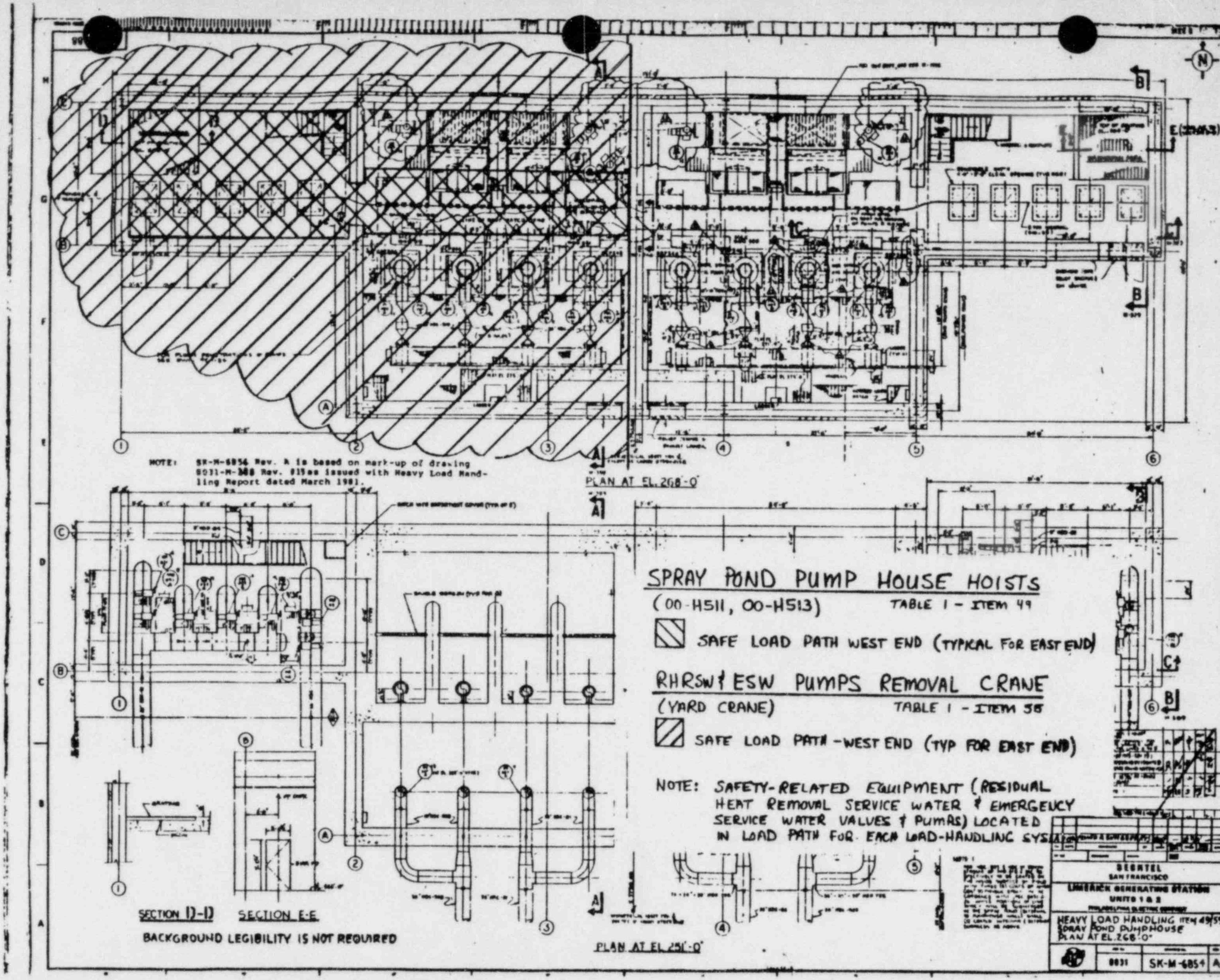
LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY

HEAVY LOAD HANDLING ITEM #38
REACTOR ENCLOSURE UNIT #1
PLAN AT EL. 253'-0" AREA #15

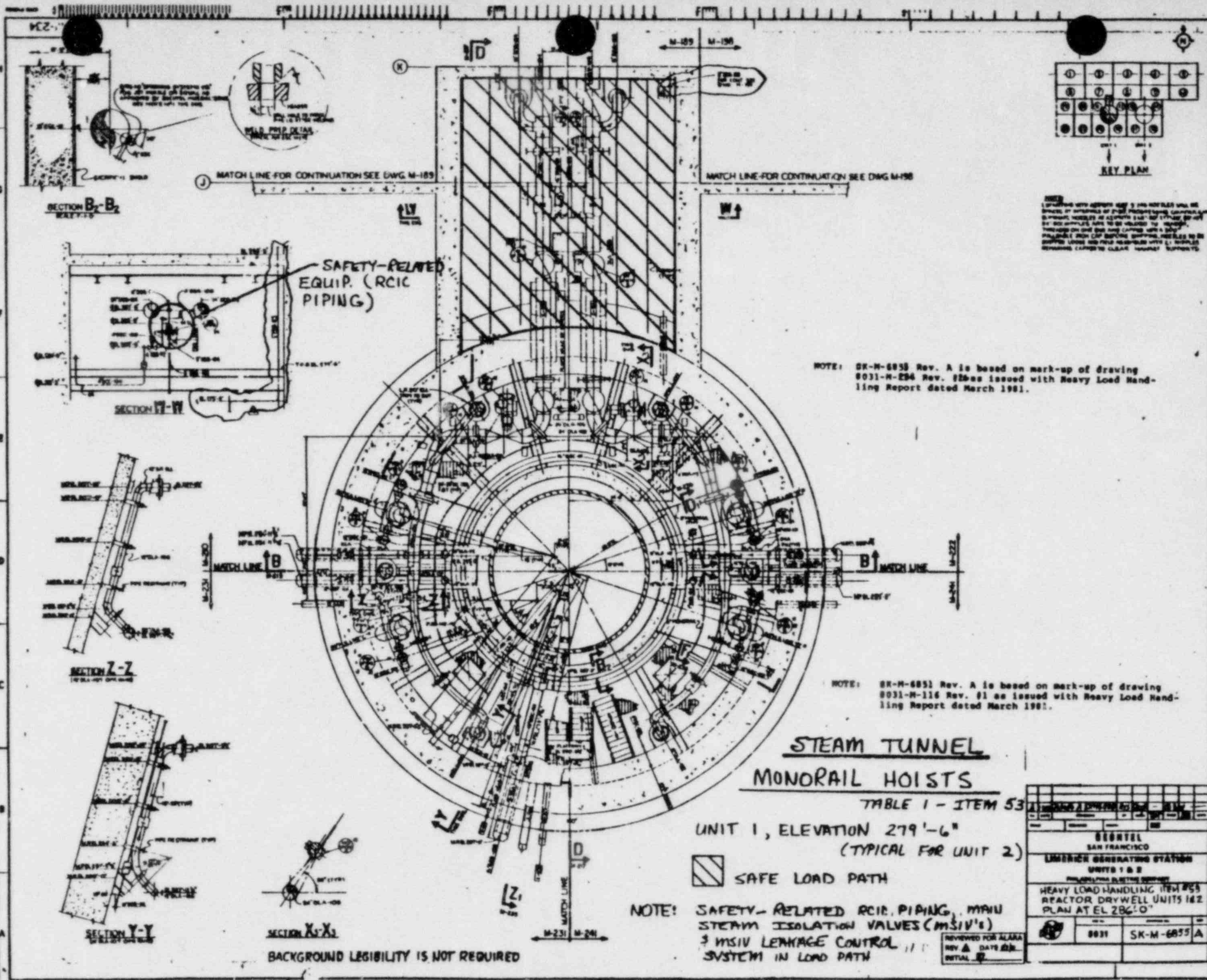
8031	SK-M-6852	A



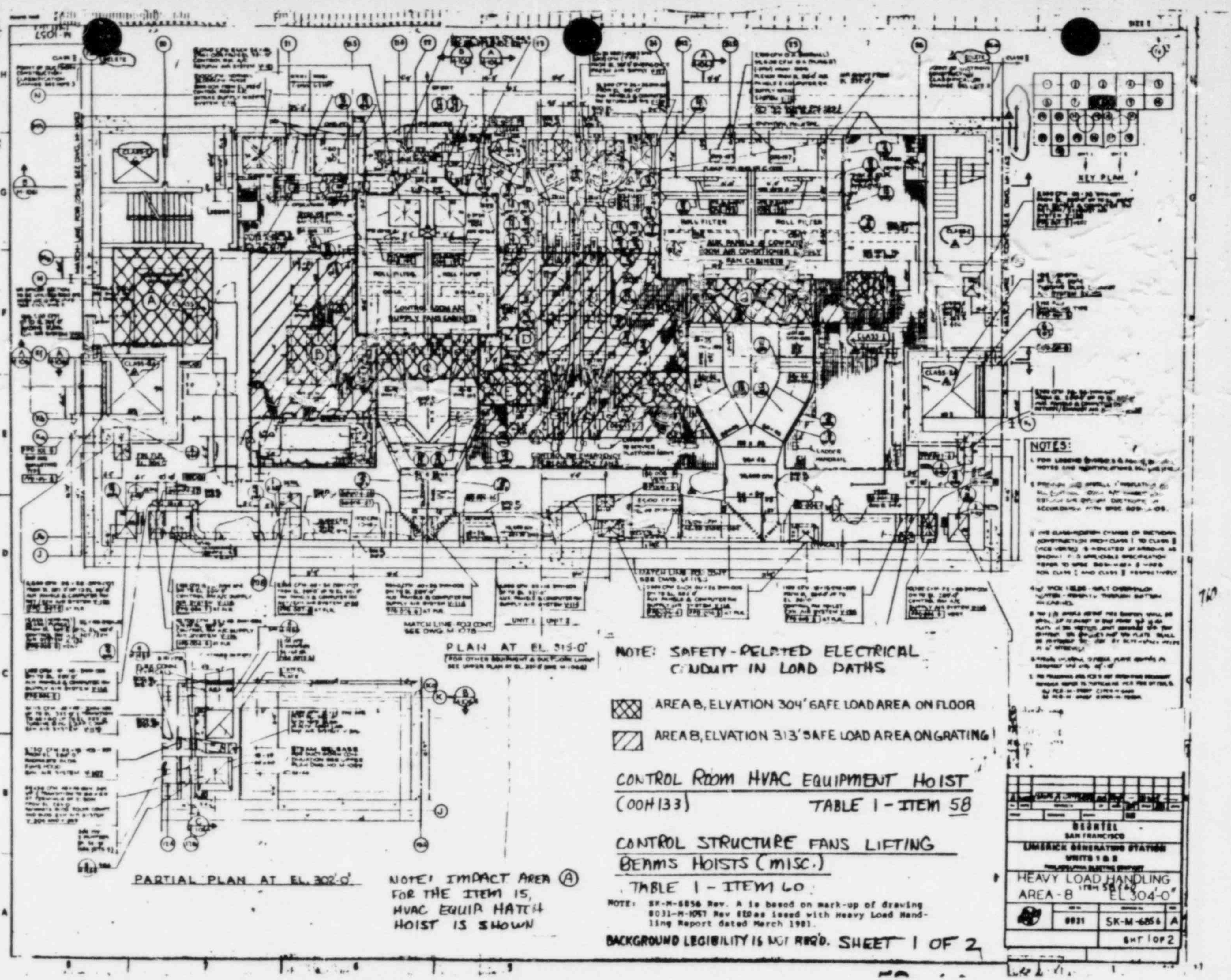
PARTIAL PLAN
PARTIAL PLAN
KEY PLAN
2A
2C
2B
2D
1AH501
1BH501
1CH501
1DH501
NOTE: SAFETY-RELATED EQUIPMENT (DIESEL-GENERATOR & AUXILIARIES) LOCATED IN LOAD PATH OF EACH CRANE.
NOTE: SK-M-6853 Rev. A is based on mark-up of drawing 8031-M-145 Rev 8 as issued with Heavy Load Handling Report dated March 1981.
BACKGROUND LEGIBILITY IS NOT REQUIRED
DIESEL GENERATOR BRIDGE CRANES
(1AH501, 1BH501
1CH501, 1DH501)
TABLE J - ITEM 44
UNIT 1, ELEVATION 217'
(TYP FOR UNIT 2)
SAFE LOAD AREA
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY
HEAVY LOAD HANDLING ITEM #44
DIESEL GENERATOR & AUXILIARY
PLAN AT EL 217 - UNIT #1
8031
SK-M-6853
A

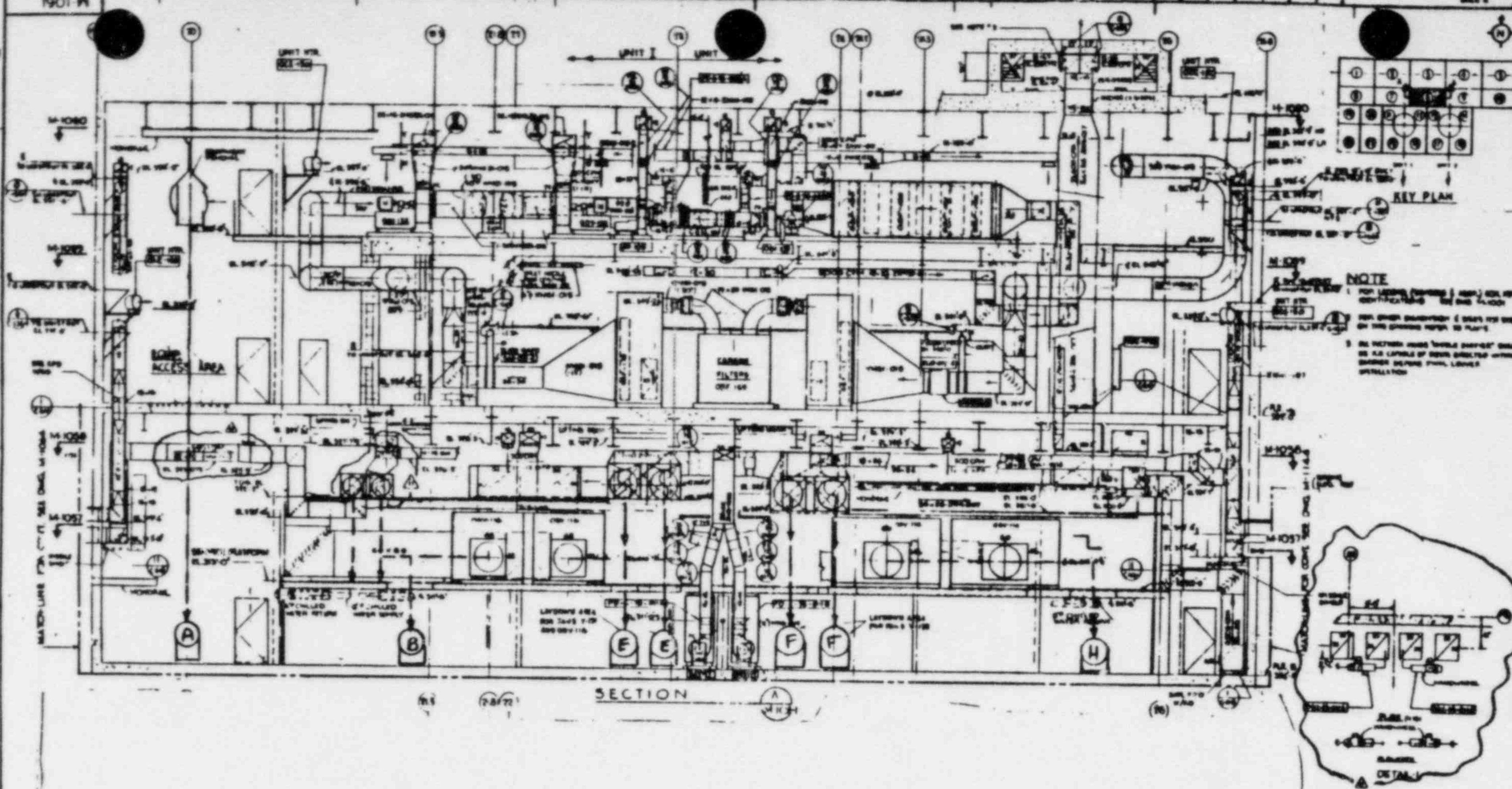


NOTE: SK-M-6856 Rev. A is based on mark-up of drawing 8031-M-388 Rev. 8 as issued with Heavy Load Handling Report dated March 1981.
PLAN AT EL. 268'-0"
SPRAY POND PUMP HOUSE HOISTS
(00-H511, 00-H513) TABLE 1 - ITEM 49
SAFE LOAD PATH WEST END (TYPICAL FOR EAST END)
RHRSW & ESW PUMPS REMOVAL CRANE
(YARD CRANE) TABLE 1 - ITEM 58
SAFE LOAD PATH - WEST END (TYP FOR EAST END)
NOTE: SAFETY-RELATED EQUIPMENT (RESIDUAL HEAT REMOVAL SERVICE WATER & EMERGENCY SERVICE WATER VALVES & PUMPS) LOCATED IN LOAD PATH FOR EACH LOAD-HANDLING SYSTEM
SECTION D-D
SECTION E-E
BACKGROUND LEGIBILITY IS NOT REQUIRED
PLAN AT EL 251'-0"
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
HEAVY LOAD HANDLING ITEM 49/55
SPRAY POND PUMPHOUSE
PLAN AT EL. 268'-0"
8031
SK-M-6854
A



SECTION B2-B2
MATCH LINE-FOR CONTINUATION SEE DWG M-189
MATCH LINE-FOR CONTINUATION SEE DWG M-190
KEY PLAN
SAFETY-RELATED EQUIP. (RCIC PIPING)
SECTION W-W
SECTION Z-Z
SECTION Y-Y
SECTION X1-X1
MATCH LINE
NOTE: SK-M-6858 Rev. A is based on mark-up of drawing 8031-M-284 Rev. as issued with Heavy Load Handling Report dated March 1981.
NOTE: SK-M-6851 Rev. A is based on mark-up of drawing 8031-M-116 Rev. 1 as issued with Heavy Load Handling Report dated March 1981.
STEAM TUNNEL
MONORAIL HOISTS
TABLE 1 - ITEM 53
UNIT 1, ELEVATION 279'-6"
(TYPICAL FOR UNIT 2)
SAFE LOAD PATH
NOTE! SAFETY-RELATED RCIC PIPING, MAIN STEAM ISOLATION VALVES (MSIV'S) & MSIV LEAKAGE CONTROL SYSTEM IN LOAD PATH
BACKGROUND LEGIBILITY IS NOT REQUIRED
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
HEAVY LOAD HANDLING ITEM #53
REACTOR DRYWELL UNITS 1&2
PLAN AT EL 286'-0"
8031
SK-M-6855
A
REVIEWED FOR ALARA


PLAN AT EL. 313'-0"
PARTIAL PLAN AT EL. 302'-0"
KEY PLAN
NOTES:
NOTE: SAFETY-RELATED ELECTRICAL CONDUIT IN LOAD PATHS
AREA B, ELVATION 304' SAFE LOAD AREA ON FLOOR
AREA B, ELVATION 313' SAFE LOAD AREA ON GRATING
CONTROL ROOM HVAC EQUIPMENT HOIST
(00H133) TABLE 1 - ITEM 58
CONTROL STRUCTURE FANS LIFTING
BEAMS HOISTS (MISC.)
TABLE 1 - ITEM 60
NOTE! IMPACT AREA (A) FOR THE ITEM IS, HVAC EQUIP HATCH HOIST IS SHOWN
NOTE: SK-M-6856 Rev. A is based on mark-up of drawing 8031-M-1057 Rev 12 as issued with Heavy Load Handling Report dated March 1981.
BACKGROUND LEGIBILITY IS NOT REQ'D.
SHEET 1 OF 2
BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
HEAVY LOAD HANDLING
AREA-B EL 304'-0"
8031
SK-M-6856 A
SHT 1 OF 2



CONTROL ROOM HVAC EQUIPMENT HOIST
(00H133) TABLE 1 - ITEM 68

CONTROL STRUCTURE FANS LIFTING
BEAMS HOISTS . TABLE 1 - ITEM 60.

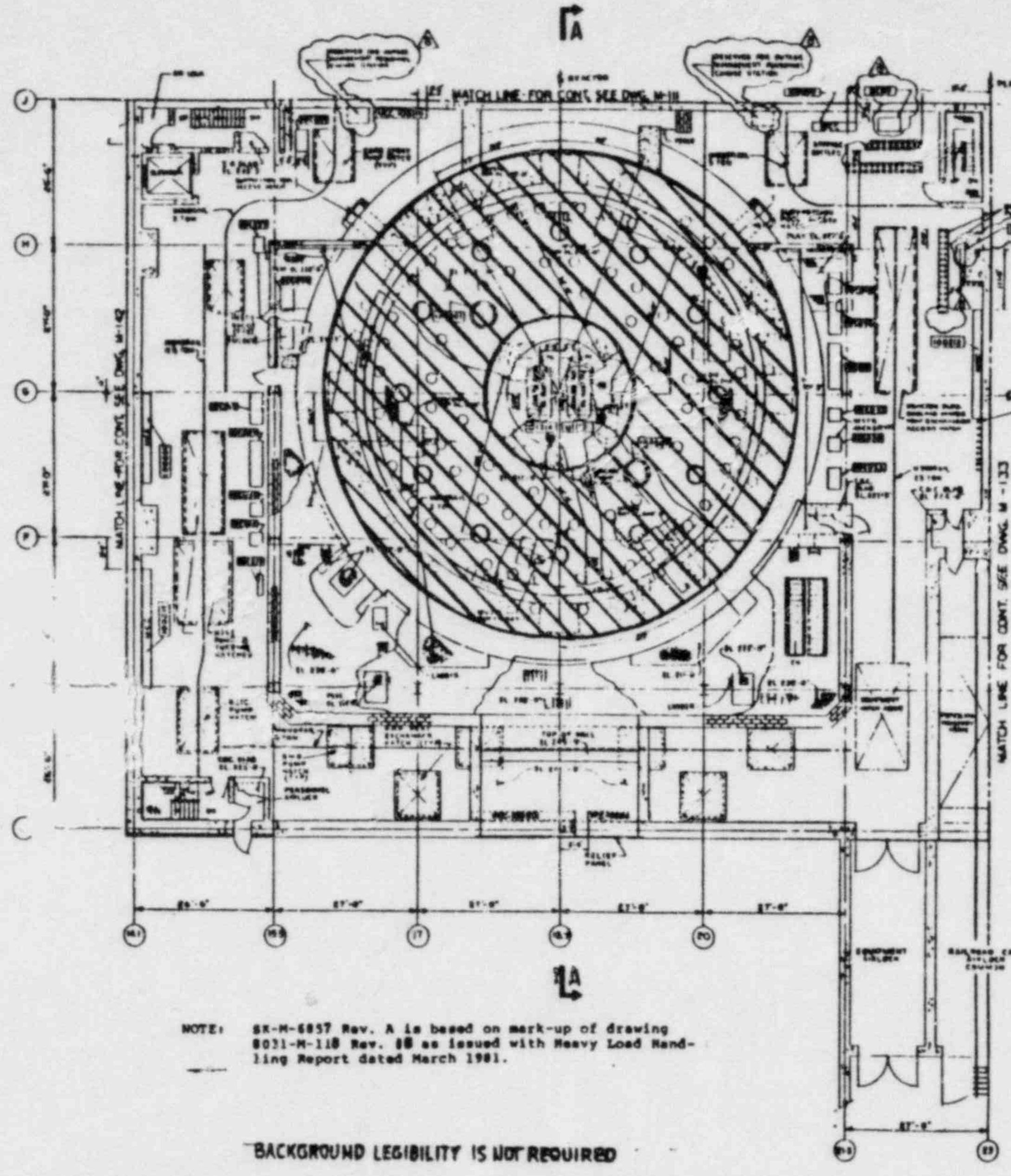
TYPICAL LOAD PATHS SHOWN

NOTE: SK-M-6856 Rev. A is based on mark-up of drawing 8031-M-1064 Rev. 17 as issued with Heavy Load Handling Report dated March 1981.

BACKGROUND LEGIBILITY IS NOT REQUIRED

SHEET 2 OF 2

BECHTEL
SAN FRANCISCO
LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY
HEAVY LOAD HANDLING ITEM 58/60 CONTROL STRUCTURE AREA 8 SECTION "A"
8031 | SK-M-6856 | A
SHT 2 OF 2



NOTE: SAFETY-RELATED VACUUM RELIEF VALVES AND SUPPRESSION POOL TEMPERATURE ELEMENTS IN LOAD PATH.

WETWELL MONORAIL HOIST

TABLE 1 - ITEM 59

UNIT 1 - ELEV. 217' (TYP FOR UNIT 2)

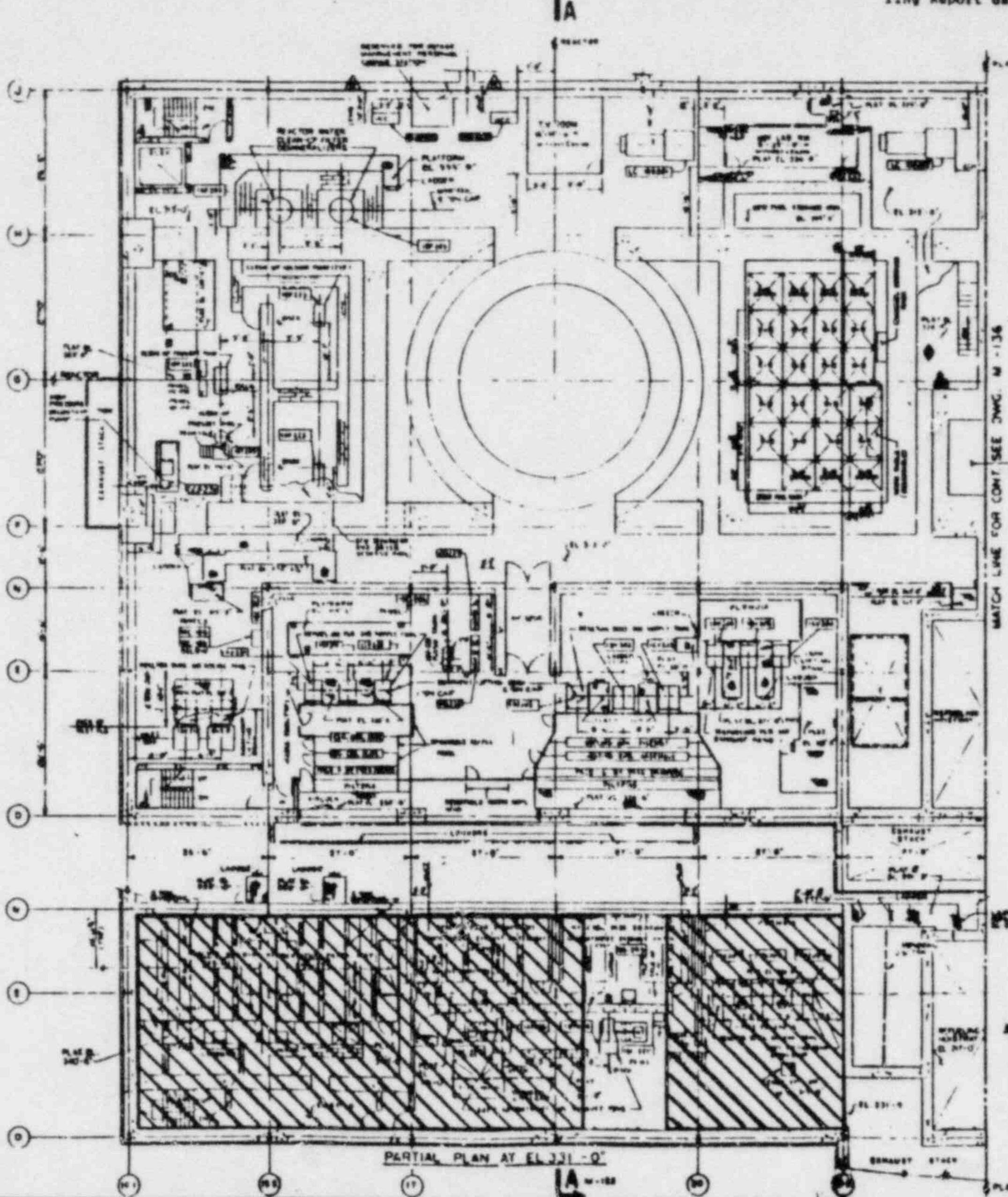
SAFE LOAD PATH

NOTE: SK-M-6857 Rev. A is based on mark-up of drawing 8031-M-118 Rev. 8 as issued with Heavy Load Handling Report dated March 1981.

BACKGROUND LEGIBILITY IS NOT REQUIRED

BECHTEL SAN FRANCISCO
LIMERICK GENERATING STATION UNITS 1 & 2 PHILADELPHIA ELECTRIC COMPANY
HEAVY LOAD HANDLING ITEM #59 REACTOR ENCLOSURE UNIT #1 PLAN AT EL 217'-0"
8031 | SK-M-6857 | A

NOTE: SK-M-6858 Rev. A is based on mark-up of drawing 8031-M-121 Rev. 8 as issued with Heavy Load Handling Report dated March 1981.



NOTE: SAFETY-RELATED ELECTRICAL CONDUIT IN LOAD PATH

BACKGROUND LEGIBILITY IS NOT REQUIRED

SAFE LOAD PATH

REACTOR ENCLOSURE
UPPER FAN ROOM HOISTS

TABLE 1 - ITEM 61

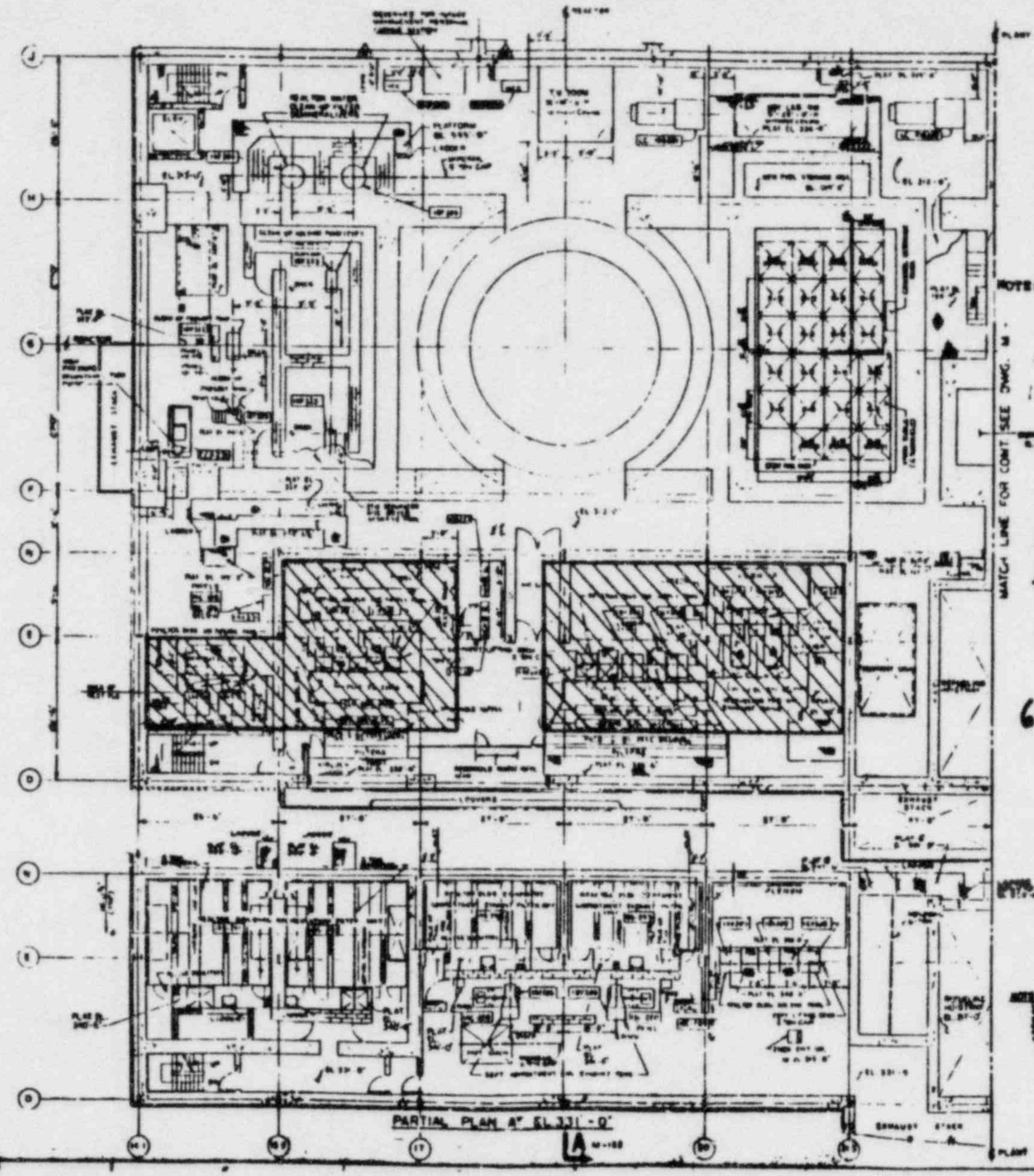
UNIT 1 - ELEV 331' (TYP FOR UNIT 2)

BECHTEL
SAN FRANCISCO

LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY

HEAVY LOAD HANDLING ITEM #61
REACTOR ENCLOSURE UNIT #1
PLAN AT EL 331'-0" AREAS 15 & 16

8031 | SK-M-6858 | A



NOTE: SAFETY-RELATED ELECTRICAL CONDUIT IN LOAD PATH

NOTE: SK-M-6859 Rev. A is based on mark-up of drawing 8031-M-121 Rev 11 as issued with Heavy Load Handling Report dated March 1981.

BACKGROUND LEGIBILITY NOT REQUIRED

REACTOR ENCLOSURE
LOWER FAN ROOM HOISTS

TABLE 1 - ITEM 62

UNIT 1 - ELEV. 313' (TYP FOR UNIT 2)

▨ SAFE LOAD PATH

62

BECHTEL
SAN FRANCISCO

LIMERICK GENERATING STATION
UNITS 1 & 2
PHILADELPHIA ELECTRIC COMPANY

HEAVY LOAD HANDLING ITEM #62
REACTOR ENCLOSURE UNIT #1
PLAN AT EL 313'-0" AREAS 15 & 16

JOB NO.	DRAWING NO.	REV.
8031	SK-M-6859	A

Limerick Overhead Handlings Systems Final Report

Revision 3 Changes

The report has been revised primarily to incorporate the following changes:

1. (Page 1) Revised the heavy load definition to greater than 1200 pounds to include the weight of the refueling platform fuel grapple assembly. The FSAR Chapter 15 fuel-handling accident analysis is being revised to be consistent with this new definition.

2. (Page 1, Tables 1 & 2, Appendix B) Deleted the North Stack Instrument Room Dumbwaiter since it is no longer included in the Limerick design.

3. (Page 4) Changed the load rating for the auxiliary hoist of the reactor enclosure crane (when handling critical loads) from 6 tons to 6.75 tons, to permit handling of the spent fuel storage racks as discussed in the revised response to Paragraph 2.2-3 items 4 and 5.

4. (Page 5) Clarified the intended design of the spent fuel cask lifting device and the cask interfacing lift points per comment in the Phase II Draft Technical Evaluation Report [Reference letter from A. Schwencer (NRC) to E. G. Bauer, Jr. (PECo), dated February 6, 1984].

5. (Page 7) Added a discussion of spent fuel storage rack and RPV service platform handling. A drop of the service platform was previously analysed and judged to be acceptable based on the use of administrative controls, as discussed in Revision 2 of the report. However, it was subsequently decided to replace the service platform sling with one which has a higher factor of safety and reclassify the service platform lift as one in which the likelihood of a load drop is extremely small.

6. (Page 8) Revised the discussion of the reactor well shield plug handling to indicate that the RPV head rather than the drywell head would always be in place. On rare occasions during maintenance operations the shield plugs may be reinstalled while the drywell head is removed.

7. (Table 3) Added the special lifting devices for the spent fuel storage racks and the new fuel containers, and made minor load weight and editorial changes.

8. (Table 4) Revised to include height restrictions for all reactor well shield plugs. Revised most height restrictions based on less conservative impact analysis assumptions. Revised notes and figure.

9. (Table 5) Added Table 5, Special Lifting Device Compliance with ANSI N14.6-1978, in response to a comment in the Phase II Draft Technical Evaluation Report. This table indicates the extent of compliance for the special lifting devices associated with the refueling shield, the fuel pool stop logs, the spent fuel storage racks and the RPV service platform.

10. (Appendix B) Revised the hazard evaluation for the reactor enclosure crane to address the higher height limits over the dryer/separator storage pool.

11. (Appendix D) Added Appendix D, Information Requested in Section 2.1 (of Enclosure 3 to the NRC letter to all licenses dated 12/22/81), for reference.

Comments on the Draft Technical Evaluation Report on the Control of Heavy Loads, Phase II

Reference: Letter from A. Schwencer (NRC) to E. G. Bauer, Jr. (PECo), dated February 6, 1984

The draft Technical Evaluation Report (TER) for Limerick was prepared by EG & G, Idaho, Inc. for the NRC. The following comments and clarifications are offered to correct minor errors contained in the draft.

1. Table 2.1 lists most, but not all Limerick overhead handling systems which are subject to NUREG 0612 criteria. See Appendix B of the Overhead Handling Systems Review final report for a complete listing.

2. Section 2.3.1.A states that, among other cases, the applicant has conducted analyses for postulated load drops of the reactor well shield plugs and the drywell head into the reactor vessel. This is not quite correct. Specific analyses were performed for load drops over the refueling floor but not over the reactor vessel. Rather, an evaluation concluded that these loads drops were bounded by the RPV head drop analysis.

3. In the list of analyzed load drops it should be noted that specific analyses were performed for the RPV head, steam dryer, shroud head/separator and service platform only. Also, the refueling shield should not be included in this list since it is categorized as a highly reliable lift per NUREG 0612 Section 5.1.6.

4. Section 2.3.3.B incorrectly implies that load drop "tests" were conducted for certain load handling systems. Analyses or evaluations were made but no tests were conducted.