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June 28, 1983

Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Limerick Generating Station, Units 1&2
Information for Auxiliary Systems Branch (ASB)

Reference: Meeting Between ASB and Philadelphia Electric Company, June 23, 1983 in Bethesda, Md.

File: GOVT 1-1 (NRC)

Dear Mr. Schwencer:

Attachment A is a listing of open issues which were discussed with ASB at the referenced meeting. Also attached are FSAR page changes being made in response to the issues as indicated below:

Issue No.	FSAR Change
1.	A revised response to Question 410.76 and 410.78.
2.	A revised response to Question 410.10.
3.	A change to FSAR Section 3.5.1.4 and FSAR Table 3.5.4 and a revised response to Question 410.12.
4.	A revised response to Question 410.16.
5.	A revised response to Question 410.19.
6.	A change to FSAR Section 5.2.5.2.1.5.
7.	A revised response to Question 410.37.
8.	Addressed by the changes being made in response to Issue 3. above.
9.	A revised response to Question 410.74.
10.	Addressed by the changes being made in response to Issue 3. above.
11.	A revised response to Question 410.89.

B001
1/1

With these changes, all the open items should be closed out except for Issue 3. Also attached is a revision response to Question 410.5.

The information contained on these draft page changes will be incorporated into the FSAR exactly as it appears on the attachments, the revision scheduled for August, 1983.

Sincerely,

Eugene J. Bradley

HDH/gra/72

Copy to: See Attached Service List

cc: Judge Lawrence Brenner	(w/o enclosure)
Judge Richard F. Cole	(w/o enclosure)
Judge Peter A. Morris	(w/o enclosure)
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Atomic Safety and Licensing Appeal Board	(w/o enclosure)
Atomic Safety and Licensing Board Panel	(w/o enclosure)
Docket and Service Section	(w/o enclosure)

Attachment (A)

6/23/83

LIMERICK GENERATING STATION

LIST OF OPEN SER ISSUES - AUXILIARY SYSTEMS BRANCH

1. The applicant has not provided a complete discussion of the protection of safety-related equipment from internal flooding (SRP Sections 3.4.1 and 9.3.3).

2. The applicant has not provided an adequate discussion of the protection from internally generated missiles (SRP Sections 3.5.1.1 and 3.5.1.2).

3. The applicant does not have a tornado and tornado missile protected ultimate heat sink and emergency cooling system (SRP Sections 3.5.1.4, 3.5.2, and 9.2.5).

4. The applicant has not provided the results of a complete pipe break analysis (SRP Section 3.6.1).

5. The applicant has not provided an acceptable response to the AEOD generic letter dated May 5, 1981, "Safety Concerns Associated with a Pipe Break in the BWR Scram System" (SRP Section 4.6).

6. The applicant has not provided drawings of the Primary Coolant Pressure Boundary Leakage Detection System (SRP Section 5.2.5).

7. The applicant has not provided the results of a light load drop accident (SRP Section 9.1.4).

8. The applicant has not provided an acceptable response which verifies that the spray pond pump house can withstand the impact loads of tornado missiles (SRP Section 9.2.1).

9. The applicant has not provided a commitment to perform air quality testing on the primary containment air gas system after each initiation of the backup air system at the next refueling outage (SRP Section 9.3.1).

10. The applicant has not provided the results of an analysis which verifies that the air intake and exhaust louvers, manholes covering safety-related equipment, and doors with safety-related equipment behind them can withstand the impact loadings of tornado missiles (SRP Sections 9.4.1 and 9.4.5).

11. The applicant has not provided the results of an analysis which demonstrates that the main steam piping up to and including the turbine stop valve will not fail as the result of a safe shutdown earthquake (SRP Section 10.3.1).

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QUESTION 410.76 (Section 9.3.3)

DRAFT

In accordance with Standard Review Plan Section 9.3.3, Part III, demonstrate that a failure of the non-seismic Category I, non-safety grade portion of the equipment and floor drain system (EFDS) will not compromise the capability for safe shutdown because of failure of more than one redundant safety related train due to flooding for the following reasons:

a. Failure of the EFDS to remove the flood water from an enclosure containing safety related equipment. Consider flooding caused by a high energy pipe break, moderate energy pipe crack, and rupture of non-seismic Category I piping vessel or tanks;

b. Backflow in the EFDS due to check valve or other failure causing flooding of one safety related enclosure from equipment or piping failure outside of this enclosure.

RESPONSE ATTACHED:

DRAFT

Response to 410.76

a. The EFDS will not fail to remove flood water from enclosures containing safety related equipment such that the capability to achieve safe shutdown would be compromised. Flooding due to a high energy line break or moderate energy line break is addressed in Section 3.6.1.
The loss of integrity of all non-seismic Category I piping, equipment and instrumentation due to a Safe Shutdown Earthquake is not credible and therefore the flooding which may accompany this type of failure is not explicitly included in the design basis for Limerick. Studies have indicated that earthquakes do not cause significant piping failures [Reference 1].

All non-seismic Category I piping, equipment, and instrumentation in the ECCS compartments, including check valves and drain lines, have been assessed for SSE loads to verify that their integrity will be retained.

Although it is not expected that any materials in the ECCS compartments could cause the drains to become plugged, plugging of any single ECCS Compartment drain would not impact safe shutdown. Flooding of any single

DRAFT

ECCS compartment will not cause the failure of more than one redundant safety related train. To prevent flooding in one ECCS compartment from spreading to other ECCS compartments, the walls, floor and doors of these compartments are designed to be watertight. In the event of drain line plugging in other areas of the plant, flood waters would be drained to the lower elevations of the plant via stairwells, elevator shafts and equipment hatches.

b. As discussed above, significant flooding due to the failure of piping, equipment and instrumentation in the Reactor enclosure is not expected. However, in the event that significant quantities of water are conveyed to the sumps at elevation 177 feet, backflow into the ECCS compartments is prevented by the inclusion of a check valve where the dedicated drain line from each ECCS compartment (2 per RHR compartment) terminates in the sump. Each ECCS compartment is provided with separate drain lines from the compartment to the sump. Thus, failure of any check valve will not result in flooding of more than one ECCS compartment. An assessment has been performed to verify the ability of the check valves to remain functional following an SSE.

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All non-seismic Category I piping, equipment, and instrumentation in the Reactor enclosure (including the check valves in the sump) have had 10 CFR 50 Appendix B Quality Assurance criteria applied to them commensurate with their importance to safety:

- each item has been assessed to verify that it will retain its integrity during and following an SSE.
- the check valves have been designed to remain operable for an SSE.
- installation was performed by the same craftsmen and qualified welders as those installing Q systems
- quality control inspections of the installation were conducted in accordance with criteria similar to the criteria for inspections of Q systems.

The check valves on the ends of the ECCS compartment drain lines and the portions of the ECCS compartment drain lines between the sump pit wall and the check valves will be placed on the Project Q-List to assure that maintenance activities and any modifications will be performed in accordance with the applicable requirements of 10 CFR 50 Appendix B.

DRAFT

The seismic Category II A drain lines which run thru the ECCS compartments will be identified in an appendix to the Project Q-List to assure that any maintenance of or modifications to these drain lines will employ the level of quality assurance necessary to retain their Seismic Category II A classification.

Reference 1. "Seismic Performance of Piping in Past Earthquakes", ASCE Conference Report; R.L. Cloud Assoc., Inc; 1980

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DRAFT

QUESTION 410.78 (Section 9.3.3)

The FSAR states that level instrumentation is installed in the ECCS compartments to alarm on high water level and thereby notify the operator. During a safe shutdown earthquake all non-seismic Category I piping, equipment and instrumentation is assumed to fail, thus providing the potential to flood safety-related equipment. Provide the basis for not having flooding after a safe shutdown earthquake.

RESPONSE ATTACHED:

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DRAFT

Response to 410.78

Credit is not taken for the operability of any non-seismic Category I piping, equipment and instrumentation in assuring the safe shutdown of the plant, mitigating the consequences of an accident, or assuring that offsite doses do not exceed 10 CFR Part 100 limits.

The loss of integrity of all non-seismic Category I piping, equipment and instrumentation due to a Safe Shutdown Earthquake (SSE) is not credible and therefore the flooding which may accompany this type of failure is not explicitly included in the design basis for Limerick. Studies have indicated that earthquakes do not cause significant piping failures (Reference 1).

There are no non-seismic Category I piping, equipment, and instrumentation in the ECCS compartments which are fluid filled during normal operations. Even so, all non-seismic Category I piping, equipment, and instrumentation in the ECCS compartments, including drain lines, have been assessed for SSE loads to verify that their integrity will be retained.

All non-seismic Category I piping, equipment and instrumentation in the ECCS compartments

has had 10CFR 50 Appendix B Quality Assurance criteria applied to them commensurate with their importance to safety:

- each item has been assessed to verify that it will retain its integrity during and following a SSE.
- installation was performed by the same craftsmen and qualified welders as those installing Q systems.
- quality control inspections of the installations were conducted in accordance with criteria similar to the criteria for inspections of Q systems.

The check valves on the ends of the ECCS compartment drain lines and the portions of the ECCS compartment drain lines between the sump pit wall and the check valves will be placed on the Project Q-List to assure that maintenance activities and any modifications will be performed in accordance with the applicable requirements of 10 CFR 50 Appendix B.

The seismic Category II A drain lines which run thru the ECCS Compartments will be identified in an appendix ~~to~~ the Project Q-List to assure that any maintenance of or modifications, to these drain lines will employ the level of

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DRAFT

quality assurance necessary to retain their seismic Category IIA classification.

Reference 1. "Seismic Performance of Piping in Past Earthquakes", ASCE Conference Report; R. L. Cloud Assoc., Inc.; 1980

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DRAFT

QUESTION 410.10 (Section 3.5.1)

Provide a discussion of an analysis for each rotating component which verifies that if an internally generated missile were generated, the casing would be capable of retaining the missile. For each rotating component whose casing cannot retain the internally generated missile and the missile could damage safety-related equipment, provide (1) a discussion of the methods used to protect the safety-related train and its redundant train and other safety-related structure, systems and components in the path of the missile and (2) a drawing showing the component, missile paths, means of protection for other equipment, and the redundant safety-related train. This applies to both inside and outside containment.

1. Verify that no secondary missiles will be generated from any internally generated missile.

2. Verify that any internally generated missile from safety-related equipment will not affect the redundant safety-related train.

3. Provide the basis for concluding that "...other rotating components..., such as fans, do not have sufficient energy to (be)...considered missile hazards."

RESPONSE

1. The bases for considering it unlikely for rotating components, other than those identified in Section 3.5.1, to break through their casings and adversely impact safety-related equipment are the following:

A review of event reports on file at Small the Nuclear Safety Information Center, Oak Ridge National Laboratory, concerning failures of fans and missile generation indicated that no fan failures have resulted in generation of missiles in safety-related areas of a nuclear facility. Pump failures resulting in generation of missiles, are considered more improbable than fan failures resulting in generation of missiles because pump casings are generally thicker than fan casings and pump speeds are generally lower than fan speeds. Even in the unlikely event that a rotating component does break through its casing, much of the component's kinetic energy would be dissipated in moving through the casing, thereby decreasing the probability of the component adversely damaging a safety-

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DRAFT

related component. Therefore, generation of secondary missiles from the internally generated missiles described above is not considered credible. It is an even lower probability that a rotating component would adversely affect redundant safety-related systems because redundant equipment is generally located in different areas or separated by barriers.

Protection for potential missiles from large pumps is discussed in Section 3.5.1. Potential missile sources identified outside primary containment are the residual heat removal and core spray pumps whose impeller sections are surrounded by concrete, and the HPCI and RCIC turbines whose missiles would be contained by their concrete compartment walls. These compartment walls would also retain any secondary generated missiles. Failure of the recirculation pump or motor (located inside containment) would not result in damage to the containment or vital equipment, as discussed in Section 3.5.1.2. Other rotating components inside containment are unlikely to produce missiles capable of penetrating their casing.

2. As discussed in Section 3.5.1, the internally generated missiles described above will not affect the redundant safety-related train.

3. The bases for concluding that "... other rotating components ..., such as fans, do not have sufficient energy to (be) ... considered missile hazards," are the reasons discussed in Item 1 above and as described below.

Insert A

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Insert A

DRAFT

The possibility that any pump or fan, other than those identified in Section 3.5.1, will fail at Limerick and generate a missile which has sufficient energy to penetrate a component casing is remote. A review of the analyses of internally generated missiles PERFORMED for Palo Verde and San Onofre verified that postulated missiles from pumps and fans (e.g., a pump impeller or fan blade) typically do not have sufficient energy to penetrate the component casings. Since Limerick uses pumps and fans which are generally designed and constructed in accordance with the same recognized industry codes and standards as those installed at Palo Verde and San Onofre, results of the rigorous analyses conducted for those plants are indicative OF THE STRUCTURAL INTEGRITY OF LIMERICK EQUIPMENT.

It was further verified that no internally generated missiles will cause loss of function of any system required for safe shutdown. The plant arrangement was reviewed to ensure that all essential systems or components are either remote from or separated by adequate barriers from potential missile sources. In any case where a direct path exists between a potential missile source

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and equipment required for safe shutdown,
potential missiles cannot impact more than a single component; therefore redundant equipment will be available to effect safe shutdown.

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Insert A. Continued

All HVAC fans located in safety-related enclosures are listed in Table 410.10-1, along with the reason why they are not credible missiles which could adversely affect redundant equipment needed for safe shutdown. For many fans, there are barriers which separate the potential fan blade missiles from essential systems. These barriers consist of walls, floors and ceilings which totally enclose the potential missile and are sufficiently thick to prevent spalling. All redundant fans needed for safe shutdown are separated by adequate barriers.

The only fan blades which have the potential for damaging redundant components needed for safe shutdown, if they escape through their casing, are the drywell area unit cooler fans. A study was performed for these fans which demonstrated that the fan blades do not have sufficient kinetic energy to penetrate their casings.

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Table 410.10-1

Potential HVAC Fan Missiles

Fan #	Description	Area	El	Comment
OAV-109	Standby gas treatment exhaust	8	350	(b)
OAV-127	Control room emergency fresh air supply	8	304	(a)
OCV-126	toilet room exhaust air fan	8	322	(b)
1AV-206	Reactor encl. equip. comp. air exhaust	15, 16	313	(b)
OAV-132	Drywell purge gas exhaust	3	350	(b)
OAV-131	Standby gas treatment room gas exhaust	8	350	(b)
1AV-213	Reactor encl. air recirc.	15	313	(b)
OAV-120	Aux equip. room air return	8	304	(b)
OAV-121	Control room a/c return exhaust fans	8	304	(b)
1AV-512	Diesel gen encl. vent air exhst	DG Bldg		
1AV-201	Refueling floor air supply	15	313	(b)
1AV-202	Reactor encl. air supply	16	313	(b)
1AV-204	Refueling floor air exhaust	16	313	(b)
1AV-205	Reactor encl. air exhaust	16	331	(b)
OAV-124	Battery room air exhaust	8	304	(b)
OAV-114	Aux equip rm air supply	8	304	(b)
OAV-116	CR air supply	8	313	(b)
OAV-118	Emer. SWGR and battery rm	8	217	(b)
1AV-208	RCIC pump rm unit cooler	15	177	(c)
1AV-209	HPCI pump rm unit cooler	15	177	(c)
1AV-210	RHR pump rm unit cooler	15	177	(c)
1HV-211	Core spray pump rm unit cooler	11, 12	177	(c)
1HV-212	Drywell area unit cooler	15C	246	(d)
OAV-140	SGTS room unit cooler	8	332	(b)
OAV-141	SGTS room access area unit cooler	8	332	(b)
OAV-542	Spray pond pump structure air supply	Spray pond		(c)

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Table 410.10-1 (cont.)

Notes:

(a) These potential missiles are only used during accident situations. They are not considered credible potential missiles because internal missile generation is not postulated to occur concurrently with other accidents.

(b) These potential missiles are either remote from or separated by adequate barriers from all essential systems. Therefore, essential systems are protected from these potential missiles.

(c) The potential missiles cannot impact on more than a single component of a redundant system.

(d) The casing thickness is sufficient to prevent penetration by a loose blade.

and assessment of structures and openings

is 4.11 x 10^{-10} per year, which is well below the acceptable value of 10^{-7}, demonstrates that Limerick conforms with the intent of the guide.

3.5.1.4 Missiles Generated by Natural Phenomena

Only tornado-generated missiles have been considered. Missiles used in the design are listed in Table 3.5-4. The structures designed for these tornado missiles and the systems protected are listed in Table 3.3-2. Table 3.5-8 provides information on the characteristics of these barriers. Additionally, emergency service water and RHR service water systems yard piping is protected by burial and separation of redundant loops.

The spray pond system is not provided with tornado missile protection per se; however, it is designed to accommodate postulated multiple failures during tornado events. Limerick has four 50% capacity networks that are independent and can be individually damage-isolated. Only two networks are needed for a safe shutdown of both units. Missile failure of one network with a single active failure of another or (multiple) missile failure of two networks still permits safe shutdown. Furthermore, the only single active failure that can cause the loss of a spray network is the failure of a network valve to open due to valve operator failure. This is only a temporary loss, since the valve can be manually opened so that, in reality, two spray networks can be lost by tornado missiles as well as by the single active failure of the valve motor operator without affecting the ability of the ultimate heat sink to perform its safety function.

Limerick is in conformance with Regulatory Guide 1.117, "Tornado Design Classification," regarding systems to be protected from tornado missiles except as discussed above where unacceptable damage to unprotected spray networks is not considered credible.

3.5.1.5 Missiles Generated by Events Near the Site

The nearest possible train explosion accident and its consequent missiles are considered to be the most severe missile-generating event that could occur near the site. The postulated missiles resulting from such an accident considered in the design of structures protecting safety-related systems are listed in Table 3.5-5. Missiles resulting from truck, industrial, and pipeline explosions would be less severe and therefore are not considered. As demonstrated in Section 2.2, there is no potential for missiles from ship or barge explosions or military installations. Descriptions of the railroad, its location relative to the plant, the railroad explosion, and explosions from other sources are given in Section 2.2.

410.12

DRAFT

TABLE 3.5-4

TORNADO-GENERATED MISSILE PARAMETERS

	MISSILE	WEIGHT (lb)	IMPACT AREA (ft²)	VELOCITY (mph)/(ft/sec)	KINETIC ENERGY (ft-lbs)
1.	Wood plank (4 in. x 12 in. x 12 ft)	200	0.333	300/440	6.01×10^5
2.	Steel pipe (3 in. dia x 10 ft, schedule 40)	78	0.063	100/147	2.62×10^4
3.	Automobile ~~(not more than 25 ft above ground)~~ (See Note 2)	4000	20	50/73.5	3.36×10^5
4.	Steel rod (1 in. dia x 3 ft)	8	0.007	216/317	1.25×10^4
5.	Utility pole (13-1/2 in. dia x 35 ft, not more than 30 ft above all grade elevations within one-half mile of the plant)	1490	1.266	144/211	1.03×10^6
6.	Steel pipe (6 in. dia x 15 ft, schedule 40)	285	.239	144/211	1.97×10^5
7.	Steel pipe (12 in. dia x 15 ft, schedule 40)	743	.886	144/211	5.14×10^5

Notes:

1. The design basis for Limerick included only missiles 1, 2, 3, 4, and 5. All safety related structures and openings in structures have been assessed for the effects of missiles 6 and 7.
2. Limerick was originally designed for a postulated auto missile not more than 25' above grade for all safety-related structures. All safety-related structures have been reassessed for the effect of the automobile at elevations up to 30' above all grade levels within one-half mile of the plant.

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DRAFT

QUESTION 410.12 (Section 3.5.1)

Your tornado missile spectrum does not conform to the guidelines of the standard review plan (NUREG-0800 July 1981) Section 3.5.1.4 nor does it conform to the guidelines of standard review plant (NUREG-75/087, May 1980) Section 3.5.1.4. Revise the FSAR to include the following tornado missiles at all elevations:

1. steel rod, 1 inch diamter x 3 feet long, weight 8 pounds (velocity = .6 x total tornado velocity);

2. steel pipe, 6 inch diameter x 15 feet long, schedule 40, weight 285 pounds (velocity = .4 x total tornado velocity);

3. steel pipe, 12 inch diameter x 15 feet long, schedule 40, weight 743 pounds (velocity = .4 x total velocity);

and to include the following tornado missiles at all elevations up to 30 feet above all grade elevations within 0.5 miles of the facility structures;

4. utility pole, 13.5 inch diameter x 35 feet long, weight 1490 pounds (velocity = .4 x total tornado velocity); and

5. Automobile, frontal area 20 square feet, weight 4000 pounds (velocity = .2 x total tornado velocity)

RESPONSE

Limerick was originally designed for the three tornado missiles listed below: wood plank (4 in. x 12 in. x 12 ft), steel pipe (3 in. diameter x 10 ft, schedule 40), and an automobile (not more than 25 feet above ground). This design basis was accepted by the NRC at the construction permit stage, June 1974. ← Insert 1

The exterior walls and roof thicknesses have been evaluated for the tornado-resistant enclosures listed in Table 3.3-2 and are capable of withstanding all of the missiles listed in ~~the above~~ Table 3.5-4 ~~question~~. The 4000 psi strength concrete walls and roofs have minimum thicknesses of 24 inches and 18 inches, respectively (Table 3.5-8). This exceeds the minimum acceptable missile barrier thickness requirements specified in Table 1 of Standard Review Plan (NUREG-0800, July 1981) section 3.5.3.

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DRAFT

Q 410.12

Insert 1

The design basis was subsequently updated, as shown in Revision 17 of the FSAR, to include the five missiles listed above. The spectrum of missles for which LGS has been assessed is now expanded to 7 missiles as shown in revised table 3.5-4.

ISSUE 3 - 5/7

DRAFT

Insert 2

~~Where necessary to protect safety-related components, the doors in these enclosures have been designed to withstand the 1-inch steel rod and utility pole in addition to the original three design basis missiles. Table 3.5-4 has been changed to include these additional two missiles. This design is in accordance with the November 1975 version of the Standard Review Plan (NUREG 75/087), section 3.5.1.4.~~

Insert A →

~~For the following cases of the doors not analyzed for 6-inch or 12-inch diameter steel pipes, certain openings in the tornado-resistant enclosures not analyzed for tornado missiles (e.g. blowout panels), certain yard structures (e.g., manhole covers, valve pit roofs) not analyzed for tornado missiles, the probability of tornado missiles going through any of these features, adversely impacting safety-related components, and preventing safe shutdown is considered sufficiently low for the following reasons:~~

a. The total area of the nontornado-resistant features that have safety-related components located behind them is extremely small compared to the total area of the tornado-resistant portions of the enclosures.

b. To penetrate a nontornado-resistant feature and travel a sufficient distance to impact a safety-related component, a missile would need to strike the feature at a perpendicular angle.

c. Much of the missile's kinetic energy would be dissipated in breaking through the nontornado-resistant feature, which reduces the possibility of the missile adversely damaging a safety-related component even if it strikes one.

d. Redundant safety-related components are normally located in different areas of the plant or yard or are separated by walls so that a single tornado missile would not damage both redundant systems.

Insert B →

ISSUE 3 -6/7

DRAFT

Q410.12

Insert 2

Where necessary to protect safety related components, the doors in these enclosures have been designed to withstand the 1-inch steel rod, the utility pole, the 6-inch steel pipe and the 12-inch pipe in addition to the original three design basis missiles. This design is in accordance with the standard review plan (NUREG-0800 July 1981).

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410.12

DRAFT

INSERT "A"

The probability of any of the above tornado missiles penetrating any of the openings and structures (not specifically designed to be resistant to the above missiles) and then adversely impacting safety-related components, such that safe shutdown is prevented, is considered low for the following reasons:-

INSERT "B"

Evaluations have been carried out considering all SEVEN (7) tornado missiles listed IN TABLE 3.5-4 ~~above~~ and their penetration / impact on the openings and non-tornado designed structures of the plant including manhole covers and valve pit roofs. Our findings ARE that, even though some singular safety-related components may be affected, damage would not occur to all redundant systems and safe shutdown could be achieved, even when assuming an additional single active failure. △2

ISSUE 4 -1/5

DRAFT

QUESTION 410.16 (Section 3.6.1)

Provide drawings of typical high energy piping which shows all anchors, jet impingement barriers, postulated break locations, wall penetrations, and references to general arrangement drawings which show the location of each section of piping. Provide isometric drawings if they are available. Provide the missing FSAR tables referenced in Section 3.6.1 of the FSAR.

RESPONSE

Drawings showing typical high energy piping for the HPCI steam supply (portion outside primary containment) and the RCIC steam supply (portion outside primary containment) are presented in Figures 3.6-22 and 3.6-26, respectively. These typical high energy piping drawings show all anchors, wall penetrations, and postulated break locations. These two systems do not have any jet impingement barriers. The HPCI steam supply piping stress levels and pipe break data are listed in Table 3.6-14, and the RCIC steam supply piping stress levels and pipe break data are listed in Table 3.6-16. The general arrangement drawings that show the location of piping are referenced in Section 3.6.1. The general arrangement drawings for the HPCI steam supply line and for the RCIC steam supply line are referenced in Sections 3.6.1.2.1.7 and 3.6.1.2.18, respectively.

The tables and figures provided with Revision 20 are listed as follows, along with the schedule for completion of the remainder of the missing tables and figures.

INSERT ①

NOTE: The listing shown on pages 410.16-2 thru 410.16-5 remains a part of this response.

INSERT ① DRAFT

The tabulation below lists the attachments to this response that are being provided so that a detailed review of a typical pipe break analysis can be performed, in accordance with SRP 3.6.1 and Branch Technical Postion ASB 3-1. The pipe break chosen, is a break of the HPCI steam supply line in the HPCI compartment.

Attachments:

1. Environmental conditions and compartment dimensions (FIGURE Q410.16-1).
2. Temperature profile of the HPCI compartment following the break (FIG. Q410.16-2).
3. Pressure profile of the HPCI compartment following the break (FIG. Q410.16-3).

This information supplements that which is contained in section 3.6.1 of the LGS FSAR.

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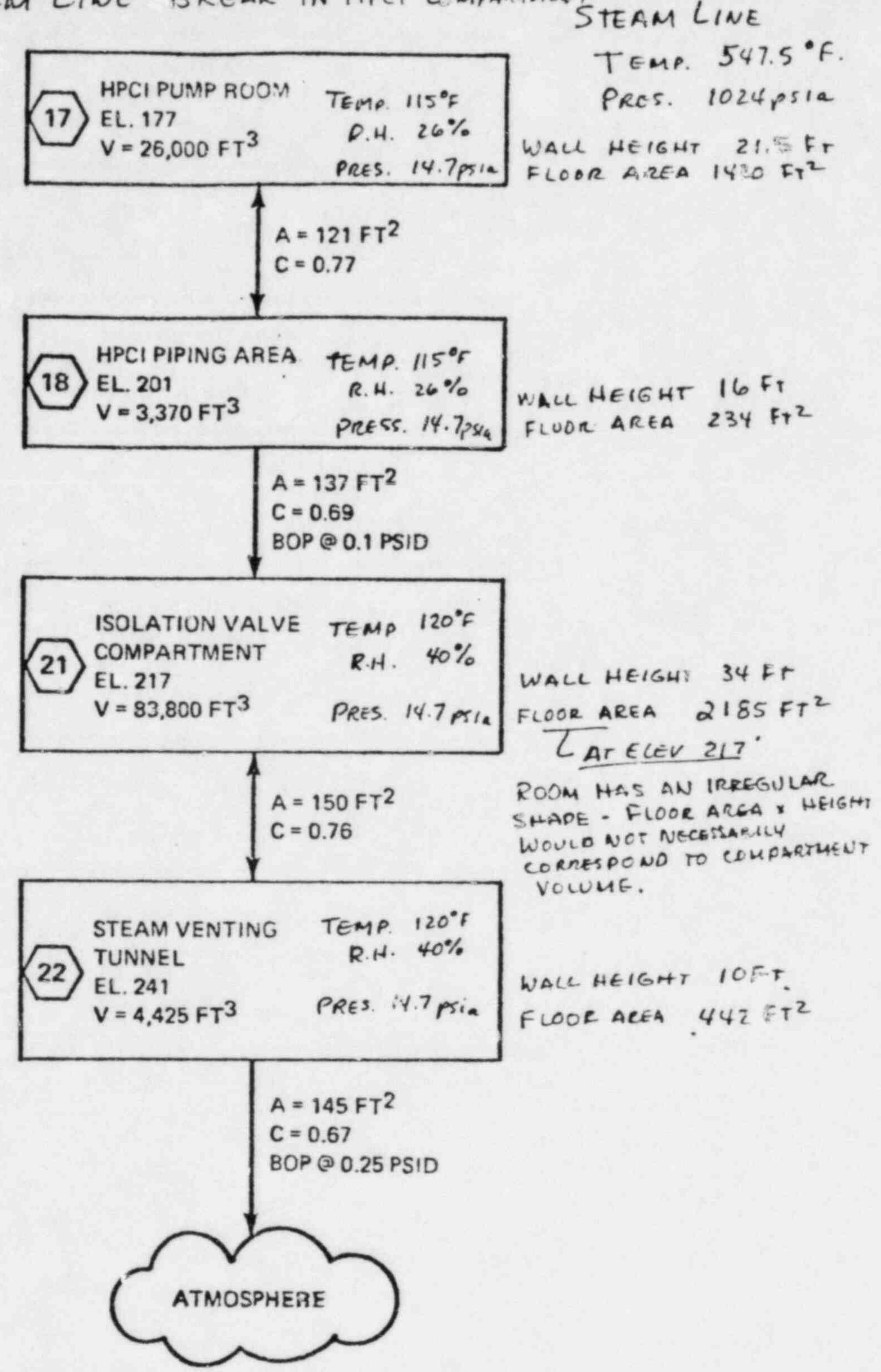
HPCI STEAM LINE BREAK IN HPCI COMPARTMENT

DRAFT



A = VENT AREA
C = FLOW COEFFICIENT
V = FREE VOLUME
BOP = BLOWOUT PANEL

LIMERICK GENERATING STATION
UNITS 1 AND 2
FINAL SAFETY ANALYSIS REPORT

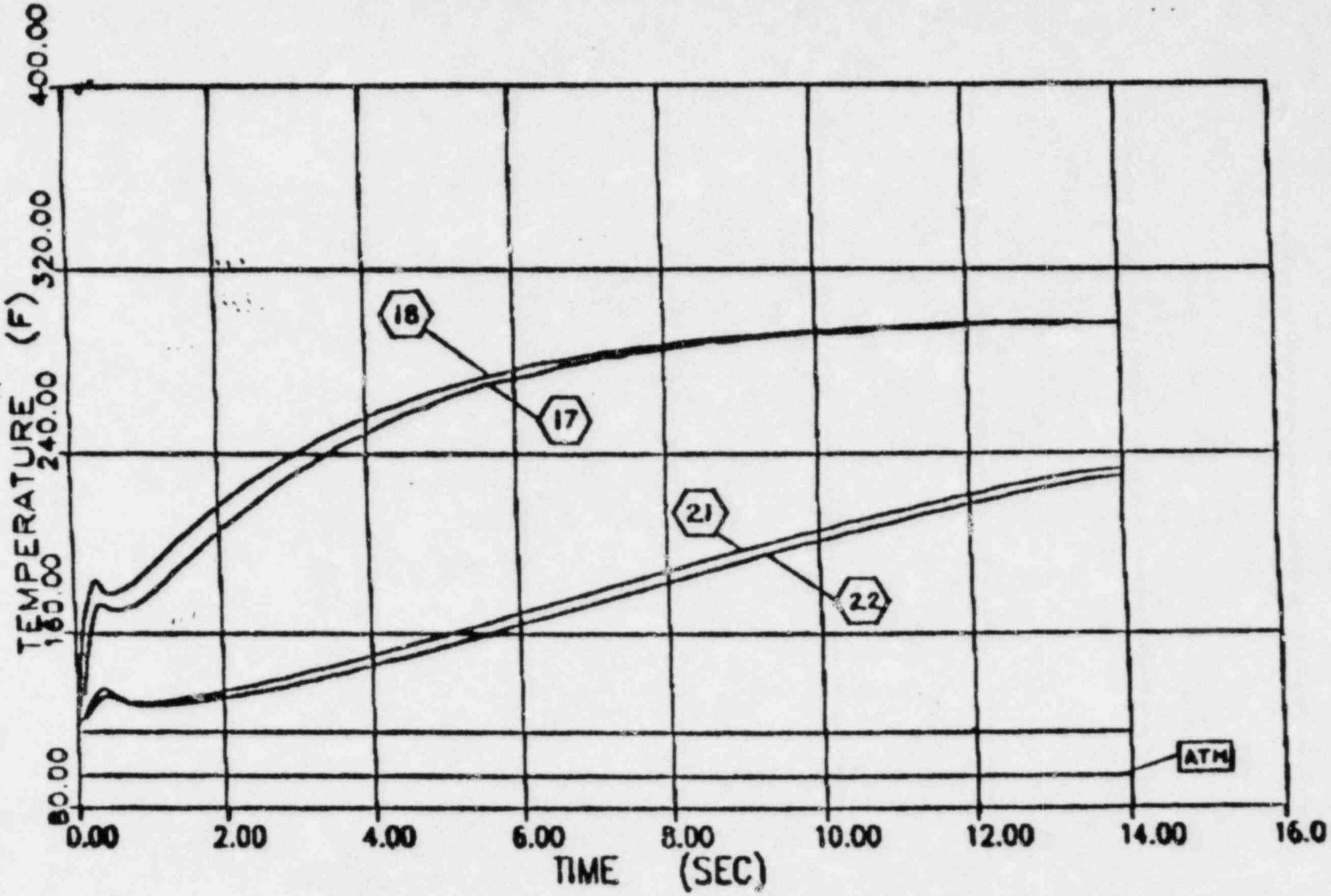
ENVIRONMENTAL CONDITIONS AND COMPARTMENT DIMENSIONS FOR HPCI STEAM SUPPLY LINE BREAK

FIGURE ~~3.6-25~~ Q410.16-1

LGS FIG. Q410.16-2

HPCI STEAM SUPPLY LINE BREAK IN HPCI COMPARTMENT

TEMPERATURE TRANSIENT



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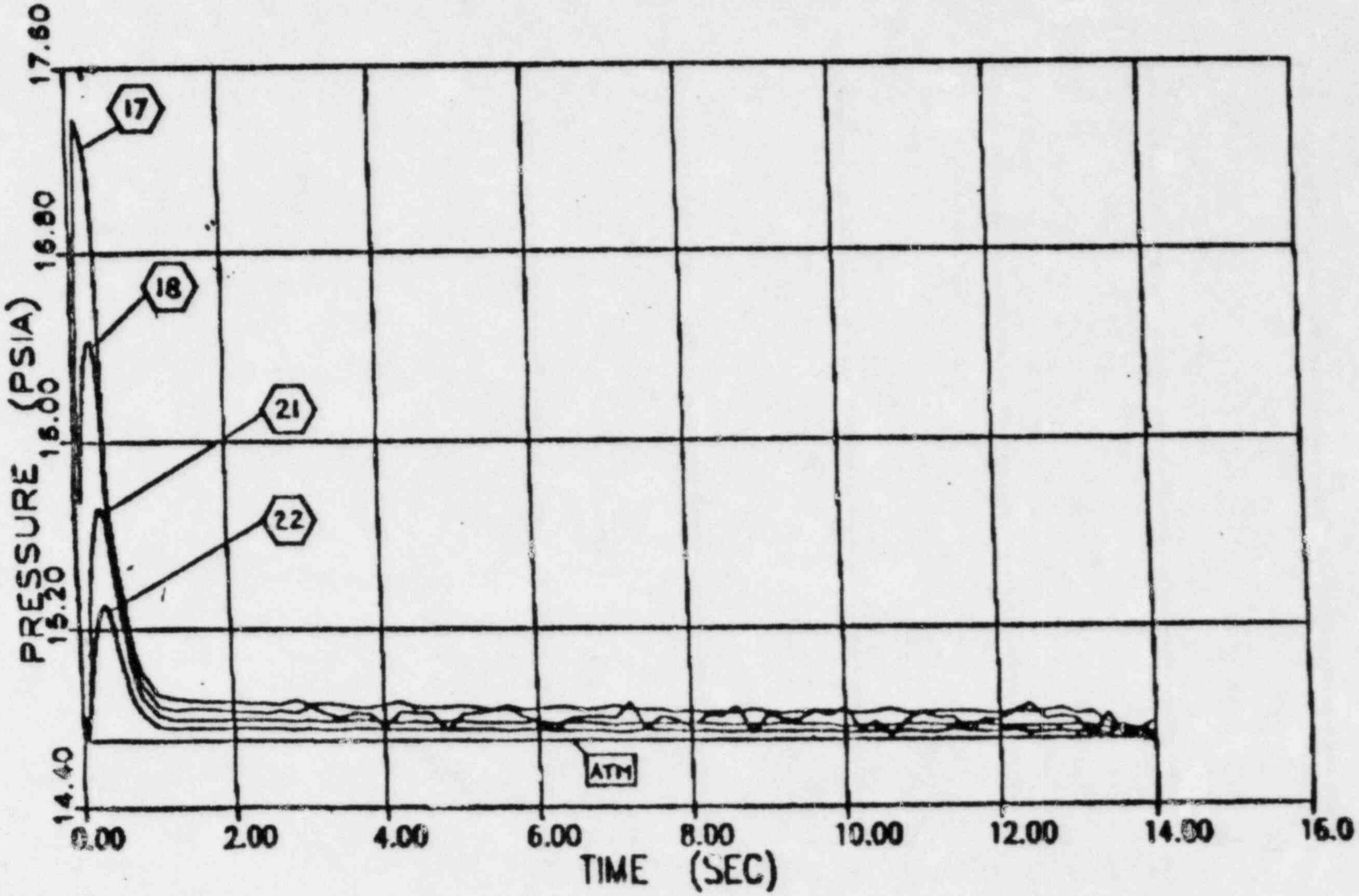
LGS FIG Q410.16-3

HPCI STEAM SUPPLY LINE BREAK IN HPCI COMPARTMENT

PRESSURE TRANSIENT



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QUESTION 410.19 (Section 4.6)

Provide the information requested in our generic letter dated May 5, 1981 regarding the AEOD report entitled, "Safety Concerns Associated with a Pipe Break in the BWR Scram System."

RESPONSE

A response to the AEOD report entitled "Safety Concerns Associated with a Pipe Break in the BWR Scram Systems" NUREG-0785 and the superseding NUREG-0803 was given by a letter from J.S. Kemper (PECo) to R.L. Tedesco (NRC) dated February 8, 1982. ~~In addition,~~ PECo participated in the BWR Owner's Group subcommittee on this subject and endorses the report of that subcommittee, submitted to the NRC as GE topical report NEDO-22209.

PECo will adopt the resolution to be agreed upon between the NRC and the BWR Owner's Group on this subject and, will implement any actions or modifications, as a result of the resolution, at the first refueling outage scheduled 12 months after the agreement has been established.

area 16. Air flow through the monitoring system is assured by the suction created by a vacuum pump. The air sample is surveyed by the Geiger-Mueller tubes in the sampling chamber for its radioactivity content. The air sample is returned to the drywell through the same containment penetration. The level of radioactivity is recorded in the main control room in counts per minute. The range is from 10 cpm to 10^6 cpm. The corresponding concentration is 10^{-6} to 10^{-1} μCi/cc. Particulate and iodine monitors are not provided due to the substantial limitations of their usefulness as described below.

The noble gas monitoring equipment is shown in Figure 11.5-1. It is not designed to be operable following an SSE.

Radioactivity level indication and alarms for loss of sample flow, high radiation, and downscale are provided locally and in the main control room. Activity level indication in the control room is provided on a strip-chart recorder to provide trend information.

The operability of the sensor and the electronic circuitry can be verified during operations from the auxiliary equipment room. A check source is supplied with the monitor. Sample connections are also provided to facilitate additional sampling for laboratory analysis. INSERT ① BELOW

The radiation monitor will be calibrated in accordance with Technical Specifications requirements (Chapter 16).

The reliability, sensitivity, and response times of radiation monitors to detect 1 gpm in one hour of reactor coolant pressure boundary (RCPB) leakage will depend on many complex factors. The major limiting factors are discussed below.

5.2.5.2.1.5.1 Source of Leakage

a. Location of Leakage -- The amount of activity that would become airborne following a 1 gpm leak from the RCPB will vary depending on the leak location and the coolant temperature and pressure. For example, a feedwater pipe leak may have concentration factors of 100 to 1000 lower than a recirculation line leak. A steam line leak may be a factor of 50 to 100 lower in iodine and particulate concentrations than the recirculation line leak, but the noble gas concentrations may be comparable. An RWCU leak upstream of the demineralizers and heat exchangers may be a factor of 10 to 100 higher than downstream, except for noble gases. Differing coolant temperatures and pressures will affect the flashing fraction and partition factor for iodines and particulates. Thus, an airborne concentration cannot be directly correlated to

INSERT ① .. is capable of being calibrated during power operation and ...

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QUESTION 410.37 (Section 9.1.2, 9.1.4)

Verify that the maximum potential kinetic energy resulting from dropping each object of less weight than a spent fuel assembly and its handling tool, which will be handled over spent fuel, will not exceed the effects of the fuel handling accident described in Section 15.7.4 of the FSAR. Provide a list of all objects considered and a discussion of the analysis.

RESPONSE

As noted in the discussion of the design basis fuel handling accident in Section 15.7.4, the maximum kinetic energy of a dropped fuel bundle is 17,000 ft-lbs. A review has been made to determine whether there are any potential drops of loads lighter than a fuel bundle which could have a higher kinetic energy due to a higher carrying height. The following conclusions have been reached:

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- No load which weighs less than 200 lbs can develop a higher kinetic energy than a fuel bundle if dropped over spent fuel. This value is based on a potential energy of 17,000 ft-lbs with the load at the maximum lift height of the reactor enclosure crane and relative to the reactor core (worst case). The majority of light loads carried over spent fuel weigh less than 200 lbs.

(Insert A)

- The 'light' loads listed in Table Q410.37-1 may develop a higher kinetic energy than a dropped fuel bundle. The approximate potential energies at normal and maximum load carrying heights are listed, relative to the elevation of the top of the spent fuel in the core or in the spent fuel pool as appropriate.

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With the exception of those items listed in Table Q410.37-1, the potential energy of the remaining few light loads which weigh more than 200 pounds is less than 17,000 ft-lbs because their maximum drop heights are less than the worst case. These lower drop heights occur for one or more of the following reasons:

1) The load is carried only by the refueling platform hoist.

2) The load is carried only over the spent fuel pool.

3) The load is very long (ie. the bottom of the load is close to the top of the fuel).

(1)

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TABLE Q410.37-1

LOAD	APPROX. COMBINED WT., HANDLING TOOL PLUS LOAD, LBS.	POTENTIAL ENERGY, FT-LBS NORMAL HEIGHT	MAX. HEIGHT
(1) NEW FUEL BUNDLE OR DUMMY BUNDLE [Reactor Enclosure crane relative to spent fuel pool]	700	21,000	29,000
(2) IN-VESSEL STORAGE RACK [Refueling platform hoist relative to core]	600	21,000	33,000
(3) STEAM LINE PLUG & INSTALLING TOOL [Reactor Enclosure crane relative to core]	450	16,000	33 000

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- It is reasonable to assume that the consequences of a light load drop will be no worse than those of the design basis fuel bundle drop for the following reasons:

  (1) The actual kinetic energy developed during the drop of the light loads above will be less than their maximum potential energy due to bouyancy and drag of the water over the fuel. While no calculations have been made, reductions in kinetic energy due to drag should be significant for steam line plug and the in-vessel ~~storage~~ rack due to their relatively large surface areas.

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(2) The loads will usually be carried at less than maximum height (i.e. the bottom of the load will normally be near the refueling floor or bottom of the reactor well, as applicable).

(3) As discussed in Section 15.7.4 all of the fuel rods in the dropped spent fuel bundle are assumed to fail, representing fully 50% of the resulting fission product release. Since no fission products are released from a dropped light load (including an unirradiated new fuel bundle) all releases must come from the impacted spent fuel. Thus, for the case of a light

load drop, the impacted fuel can absorb more energy without exceeding the releases calculated for the spent fuel bundle drop.

(4) Some of the impact energy would be absorbed by components other than the spent fuel or the dropped load (e.g. the fuel storage rack, core top guide or other impacted items) which would further reduce the energy available to cause fuel failure.

Insert B

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Insert B

in Table Q410.37-1

The three "light" loads listed ↑ will be treated as heavy loads per the guidelines of NUREG 0612 until calculations are performed which demonstrate that the effects of dropping these objects will not exceed the effects of the fuel handling accident described in Section 15.7.4 of the FSAR.

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QUESTION 410.74 (Section 9.3.1)

Provide a discussion of the maintenance and periodic testing program for each instrument air system to assure compliance with the requirements of ANSI MC11.1-1976. Specify the maximum time between testing of the compressed air system in the discussion.

RESPONSE

Limerick is in compliance with the requirements of ANSI MC11.1-1976 as discussed in the response to Question 410.73.

The primary containment instrument gas (PCIG) system is shown in Figure 9.3-2. The refrigerated dryers located downstream of the moisture separators cool the gas to a dew point of 34°F at 105 psig. The outlet filter is a coalescing type designed to remove 99.99% of all particles 0.03 micron in diameter and larger (oil, water vapor and solids). All piping and equipment downstream of these filters is copper, bronze, or stainless steel. Periodic monitoring of the dryer outlet temperature will ensure proper air quality. Particulate levels will be verified to be less than 3.0 microns at the point of use during preoperational testing

The instrument air system is shown in Figure 9.3-1. In addition to supplying instrument air to various plant equipment, this system also serves as a backup to the primary containment instrument gas system. (1) [insert] The instrument air system is provided with desiccant dryers that dry the gas to a -40°F dew point at 105 psig and filters that remove 100% of all particles larger than 0.9 micron in diameter. The filters will be switched to the parallel set of filters every six months and the elements will be replaced yearly. The need for desiccant replacement is indicated when the local visual moisture indicating gel turns from blue to pink. In addition, excessive dryer outlet moisture is alarmed both locally and in the main control room. (2) [insert] ~~The instrument air system will be tested once each refueling cycle to verify air quality compliance with ANSI MC11.1-1976.~~

(1) Filters capable of providing filtration of particulate greater than 3.0 microns will be provided at the interconnection of the PCIG system with the instrument air system.

(2) Safety-related Instrument air users will be provided with air limited to appropriate levels of particulate as defined by equipment suppliers or engineering analysis. This will be . .

accomplished through the use of in-line filters, as required. The quality of air at individual safety-related instrument air users will be periodically verified to meet the dew point and oil content quality specified in ANSI MC11.1-1976. Particulate levels will periodically be verified to be less than the user limits determined as described above. A random sample of points of use will be tested once each refueling cycle.

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QUESTION 410.89 (Section 10.3)

Verify that the structure which contains the main steam piping up to the main stop valves, is seismic Category I. Furthermore, verify that no non-seismic Category I piping or appurtenances are located above the main steam piping and associated valves which could damage the main steam piping and appurtenances during a safe shutdown earthquake.

RESPONSE ATTACHED:

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Response to 410.89

The main steam piping is seismic Category I up to the main stop valves. The main steam lines, up to and including the second isolation valves, are located in a seismic Category I structure. The remainder of the main steam piping, up to the stop valves, is located in the turbine enclosure, which is seismic Category II. However, as described in Sections 3.8.1.4.8 and 10.3.3, those portions of the turbine enclosure that support the main steam lines are designed so that the main steam lines, the turbine stop valves and their supports maintain their integrity under the seismic loading resulting from the SSE.

In addition, all nonseismic Category I systems and components in the vicinity of the main steam lines are designed as seismic Category IIA as discussed in Section 3.2.1 for a safe shutdown earthquake condition.

These seismic Category IIA items will be identified in an Appendix to the Project Q-List to assure that any maintenance of or modification to these items will employ the level of quality assurance necessary to retain their seismic Category IIA classification.

Therefore no nonseismic Category I structures, systems, or components in the vicinity of the main steam lines will damage the main steam line during a safe shutdown earthquake.

QUESTION 410.5 (Section 3.4.1)

For those non-seismic Category I vessels, pipes and tanks located outside of buildings, discuss the effect of failure of these items and any potential flooding of safety related structures, systems and components. Provide a similar discussion for non-tornado protected vessels, tanks and piping.

RESPONSE

The failure of non-seismic Category I and non-tornado protected tanks, vessels, and major pipes located outside buildings (Table 410.5-1) will not adversely affect safety-related structures, systems, and components as discussed below.

Tank Failures

The location of tanks in the yard area is shown in Figure 3.8-58. Failure of the tanks on the west and south sides of the power plant complex (Table 410.5-1, items 1 through 5) will not cause potential flooding of safety-related structures, systems, and components. Any flooding due to a failure of these tanks will be contained within seismic Category IIA earth dikes, which will remain stable under both static and dynamic conditions. The design of the earth dikes is discussed in the responses to Questions 240.4 and 241.14.

The tanks on the north side of the power plant complex (Table 410.5-1, items 6 through 9) do not have seismically designed containments around them. Failure of these tanks could cause local flooding. This flooding would not adversely affect safety-related facilities for the following reasons:

a. Surface drainage in this area will drain water towards the Schuylkill River and Possom Hollow Run before it can reach the power plant complex.

b. Seismic Category I electrical cable and duct banks located in the vicinity of these tanks are adequate, as discussed in the response to Question 410.6.

Insert A

Failure of Cooling Tower Basin Wall (Table 410.5-1, items 10 & 11)

Insert B

~~The power plant complex is protected from flooding due to a break of the cooling tower basin wall by a seismic Category IIA earth dike, which will remain stable under both static and dynamic conditions. In addition, the dike has been determined to be adequate for the design tornado effects. This dike will be~~

constructed to El. 264.0 ft, which is 1.25 feet higher than the normal water elevation in the basin.

This protective dike extends from the west-east centerline of the cooling tower and along the southern boundary as shown in Figures 2.4-5 and 2.4-6.

The runoff pattern of water from the cooling tower basin will be similar to that caused by intense storm precipitation as shown in Figures 2.4-4 and 2.4-5. The flood water from the cooling tower basin will run west towards the Schuylkill River without reaching the power plant complex.

The seismic Category I electrical cables and duct banks located in the vicinity of the cooling tower basin are adequate, as discussed in the response to Question 410.6.

Failure of Circulating Water Conduit (Table 410.5-1, item 12)

Failure of the conduit within the yard area between the cooling tower basin and the turbine enclosure will cause flooding of this area. Water from the damaged conduit will erode the soil cover and flood the yard.

The runoff pattern will be similar to that shown in Figure 2.4-4. The seismic Category I electrical cable and duct banks and valve pits, located in this area are adequate, as discussed in the response to Question 410.6.

In the most severe case, all the water from the cooling tower basin could drain through the damaged conduit into the yard area between the cooling water pumphouse and turbine enclosure and cause flooding of the condenser pit. However, safety-related systems and components would not be damaged, as discussed in Section 10.4.1.3.3. See also the response to Question 410.92.

Failure of Major Yard Piping

Failure of any of the pipes identified in Table 410.5-1, items 13 through 17, may cause local flooding. However, the intensity and volume of water discharge from any of the pipes is less than that of the cooling water conduit failure discussed above and would not cause damage to any safety-related facilities. Soil erosion caused by failure of these pipes is discussed in the response to Question 410.47.

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Insert A

¶ Even if the above dikes were to fail, there would be no impact on other safety-related structures, systems, or components due to site drainage.

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Insert B

The failure of the Cooling Tower Basin wall will not adversely affect safety-related structures, systems, and components as discussed below.

The runoff pattern of water from the cooling tower basin wall failure will be similar to that caused by intense storm precipitation as shown in Figures 2.4-4 and 2.4-5. Most of the flood water from the cooling tower basin would run away from the power plant complex. The worst case flood conditions for the power plant complex would be created by a failure of the south side of the Unit 1 cooling tower basin wall. For this case, a portion of the cooling tower basin water would flow towards the turbine enclosure. Although some limited turbine enclosure flooding may occur, there would be no impact on safety-related components.

The seismic Category I electrical cable and duct banks and valve pits located in the flowpath of the water from the failed cooling tower basin are adequately protected as discussed in the response to Question 410.6.