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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
Responses to Effluent Treatment Branch

Reference: PECO and NRC Conference Calls dated May 5, 24, and June 8, 1983

File: GOVT 1-1 (NRC)

Dear Mr. Schwencer:

As a result of the discussions in the referenced conference calls with the Effluent Treatment Branch reviewer, we are forwarding the following attached documents.

1) Revised draft response and FSAR page changes to NRC Question 460.5.

2) Additional information related to ESF Filter System Instrumentation.

3) Draft FSAR page changes to Section 11.3 concerning Hydrogen explosions in the gaseous radwaste system.

4) Draft FSAR page change to Section 11.4, Solid Waste Management System, that assures suitability of packed wastes for shipment and burial.

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

Sincerely,

Eugene J. Bradley

RJS/gra/64

Copy to: See Attached Service List

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Effluent Treatment Systems Section

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QUESTION 460.5

Item # 3

Provide sufficient information to meet the guidelines of Regulatory Guide 1.52 in regard to the RERS. Provide the design description including the provision for control of relative humidity, residence time, etc, as was provided for the SGTS and control room emergency fresh air intake systems. We will need this information to evaluate the system per SRP 6.5.1.

RESPONSE

Table 6.5-2 has been changed to show conformance with the guidelines of Regulatory Guide 1.52 in regard to RERS residence times. ~~Humidity control is not necessary for the RERS however, as discussed below. During post-LOCA RERS operation, the maximum calculated long-term relative humidity is below 70 percent. The calculated relative humidity decreases from a maximum normal operation reactor enclosure relative humidity of 77 percent to below 70 percent at the inlet of the RERS filter plenum within 30 minutes. These relative humidities are within the guideline values in ERDA 76-21, Nuclear Air Cleaning Handbook, of 85 percent or less for a charcoal adsorber efficiency of 95 percent. The maximum reactor enclosure relative humidities were calculated based on the rare combination of the following conservative assumptions: an outside relative humidity of 100 percent, a design basis high temperature of 95°F, and no operation of the reactor enclosure HVAC system inlet air cooling coils.~~

SEE ATTACHED

Humidity control is not necessary for the RERS because the environmental conditions at the inlet of the RERS filter plenums will not adversely affect system performance. An analysis was made to calculate the maximum post-loca time period for which the relative humidity at the inlet of the RERS charcoal filters could exceed 70%. It was found that within 15 minutes after isolation of the reactor enclosure secondary containment, the relative humidity will decrease from an initial maximum condition of 76.2% to below 70%. The following conservative rationale was used for this analysis:

1. The Reactor Enclosure Supply Air System uses unconditioned outdoor air to provide once-through ventilation to cool the reactor enclosure during normal plant operation.

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2. On a design basis summer day of 95°F (Db), the reactor enclosure ventilation system is designed to maintain the reactor enclosure at a nominal 104°F. The outdoor air is sensibly heated from 95°F to 104°F as it passes through the reactor enclosure supply fans and from internal reactor enclosure heat loads such as the primary containment, MCC's, LCC's, motors, lights, cable trays and piping.

3. Assuming outdoor air conditions of 95°F Db and 95°F Wb (100% RH) exist, the same air when heated to 104°F Db will have a relative humidity of 76.2%. This is the basis for the initial reactor enclosure RH conditions when isolation occurs due to

a LOCA.

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4. Based on the ASHRAE 1981 Handbook of Fundamentals, less than 1% of the total hours during the months of June through September will exceed a 93°F Db or 77°F Wb in Philadelphia. Therefore the outdoor air conditions used in this analysis are improbable.

5. Other outdoor air conditions at lower drybulb and wetbulb temperatures, which are more probable from a meteorological standpoint, can also result in an initial reactor enclosure RH condition exceeding 70%. However the initial RH for these cases will be less than 76.2% because cooler air contains less moisture and the 9°F temperature rise from operating equipment has a greater effect on lowering the RH.

6. After isolation occurs, an increase in the bulk reactor enclosure temperature from 104°F to 107°F will lower the RH to 70% in accordance with basic psychrometric principles. At lower reactor enclosure temperatures, the initial RH is closer to 70% and a smaller temperature rise after isolation is needed to lower the RH to 70%.

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7. Only internal reactor enclosure heat loads which were determined to exist for the duration of the transient were considered to provide air heat-up. The heat load from seismic class II motors was considered to decay instantly since loss of their internal motor ventilating fans would prevent efficient residual heat removal from the motor casings. The lighting load was also considered to decay to zero instantly since the small mass and therefore residual heat stored in this equipment would be small.

8. The heat loss of the air into the cooler exterior and interior walls and floor slabs of the reactor enclosure was calculated using a conservative heat transfer model

9. The cooling effect of outdoor air inleakage into the reactor enclosure due to SGTS operation was accounted for.

10. Since the bulk reactor enclosure temperature 15 minutes post-LOCA will always exceed any outdoor air temp. by at least 12°F (107°F vs. 95°F for worst case analysis) the relative humidity will not rise above 70% for the duration of RERS operation.

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11. Internal sources of moisture resulting from operation of the MSIV Leakage Control System and ECCS pumps were evaluated. The additional moisture was found to be small and will not have a significant effect on relative humidity.

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The RERS charcoal filter efficiency is not expected to be adversely affected by this temporary condition.

Although the initial relative humidity of the reactor enclosure is 76.2% at the time of the LOCA, the RERS does not operate for the first 3 minutes. Therefore the time period inwhich the relative humidity exceeds 70% and the RERS operates is between 3 and 15 minutes when the average relative humidity (RH) will be approximately 73%. The Nuclear Air Cleaning Handbook (ERDA 76-21) recommends a charcoal efficiency for methyl iodine removal of 95% for relative humidities of 85% and less as a conservative design basis. It also states that "Trapping of elemental radioiodine involves physical adsorption only, and the efficiency of nearly any good grade of activated carbon, impregnated or not will be at least 99% (DF=100) under any combination of temperature and humidity that would be encountered in a nuclear air cleaning system. Evidence that these efficiency values are realistic and conservative have been identified in the following sources

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1. The ANSI N509-1980 activated carbon performance test requirements and acceptance values are more stringent than the ERDA recommended efficiency values. Limerick RERS charcoal is being supplied in accordance with the ANSI N509 requirements.

2. Figure 4.6 in the American Air Filter Topical Report No. AAF-TR-7102 dated Sept. 1, 1972 plots the test results of 65 different methyl iodine penetration tests as a function of relative humidity. In no cases was the penetration found to be greater than 4% when the relative humidity was less than 85%. Figure 4.7 based on 7 different tests indicate a generally low penetration (less than 1%) for elemental iodine for all relative humidity conditions.

QUESTION 460.5

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It was also determined that demisters were not necessary for the RERS. This conclusion is based upon the following analysis of a postulated situation in which water droplets are assumed to be formed from system leakage and the possible migration paths of this leakage to the RERS filters.

The estimated leakage from the drywell/suppression pool to the reactor enclosure is limited by several mechanisms. These are:

a) The limit of 0.5%/day air leakage imposed by the containment leak test technical specification, the periodic Integrated Leak Rate Test and individual valve leak tests.

b) The programs of preventave maintaintence implemented by NUREG 0737 Section III.D.1.1 to minimize system leakage. This program includes helium leak detection for gaseous systems and liquid detection/inspection for liquid containing systems.

c) The postulated passive failure of a RHR pump seal and resulting release of liquid.

These contributions to the DBA/LOCA are considered in the FSAR Section 15.6.5 analysis and in SRP 15.6.5 Appendices A&B.

d) A maximum leakage of 11.5 SCFH per steam line is processed through the MSIVLCS. Heaters within this system eliminate water droplets from the exhaust flow discharged into the secondary containment.

Air Leakage

The 0.5%/day leak rate corresponds to approximately 1.4 cfm, which dictates only pinhole size leak paths. These small leak paths serve to condense out moisture and preclude droplet formation.

Liquid Leakage

The PECO preventative maintainence program will maintain normal plant leaks to low flow dripping type leakages. Any leakages with spraying water droplets will be identified and corrected as part of the maintence program. However, for the purpose of this discussion, a postulated passive failure of a RHR pump seal is assumed (SRP 15.6.5 Appendix B). This assumption results in a 5 gpm leak of suppression water at less than 212 degrees F, (Ref FSAR Fig 6.2-) and may produce water spray into the air. Since the water is below the boiling point, the airborne water will fall to the floor and subsequently into the floor drains with little or no flashing.

Should water be sprayed from the passive failure, it can be shown that any droplets formed travel less than 20 feet; based upon analyses of spray systems where the nozzles are designed to maximize the development of water droplets.[1] These analyses have shown that 1000 micron droplet would travel no more than 20 feet in a horizontal direction with an initial velocity of 3000 ft/sec. The travel distance from the RHR pump seal to the local RERS exhaust vents is a approximately ~~20~~ 29 feet vertically and 10 feet horizontally. No droplets will reach the exhaust duct.

Another factor virtually eliminating the potential for water droplets to travel as far as 20 feet is the effect of the unit coolers in the ECCS rooms. These coolers have flow rates of 9000 to 22000 cfm. The major objective of the unit coolers is to insure cool ambient air in the RHR room and condense excess water vapor. The RHR pump rooms have redundant coolers each operating at 21800 cfm. The unit cooler airflow competes with the 310 cfm RERS exhaust airflow. Over 95% of the moisture in the air will go through the unit coolers and not into the ductwork.

If it is hypothetically and non mechanistically assumed that airborne droplets are available, those 9/9

water droplets entering the exhaust duct must make an immediate 90 degree turn. A 155 foot per minute (1.8 mph) RERS exhaust air velocity is not sufficient to overcome the force of gravity to impart a verical upward velocity to any water droplets. Over 400 feet of RERS ducting containing valves and dampers and numerous bends and turns (at least 15) exist between the exhaust and the prefilters. This tortuous path results in droplets either falling back or impacting on the walls of the ducting where it will evaporate due to the less than 100% humidity in the airflow.

Furthermore, any water droplets suspended in the small airflow (310 cfm) from the RHR room is diluted by 59700 cfm entering the RERS from other parts of the reactor enclosure. Since the calculated maximum humidity is less than 76.2%, water droplets carried with the airstream would be EVAPORATED.

Even if water droplets were to reach the RERS filters, the droplets must first pass through the prefilter and the HEPA filters before impacting the charcoal droplet medium. Both of these filters are more efficient at removing water from air than demisters. Water removed would be evaporated in the air due to the maximum humidity being less than 76.2%.

Given these physical conditions and the lack of a significant source of water droplets, there is no need to install a demister on the RERS.

1. Sprayco Co., Catalog "1713A Nozzle for Nuclear Containment Vessels," Spray Engineering Co., Burlington, Mass., includes: Article from Nuclear Tech. Vol. 1. April 10, 1971. "Drop Size Distribution and Spray Effectiveness," W.F. Pasedag and J.I. Gallagher.

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ATTACHMENT 2)

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Additional Information For The
NRC Related To ESF Filter
System Instrumentation

FSAR Table 6.5.9 provides a detailed comparison of the ESF filter instrumentation designed and installed on the Limerick Plant and the recent guidelines provided in Standard Review Plan Table 6.5.1-1. Per the request of Mr. C. Nichols of the USNRC, we are providing further clarification as to why PECo meets the intent of the guidelines that require the following additional instrumentation in the main control room:

- recorded flow rate indication
- high flow alarm
- recorded pressure drop indication for first HEPA

The controls for the Limerick ESF filter systems were designed prior to the issuance of Reg Guide 1.52, ANSI N509, and SRP 6.5.1. We have provided adequate instrumentation to assure reliable operation of the systems. Although not in strict accordance with SRP guidelines, we feel that we have met Reg Guide 1.52, Position C.2.g by providing alternate system instrumentation, to accomplish the aim of the SRP guidelines.

It should be noted that the ESF Filter systems operate for post accident conditions only, with the exception of the limited SGTS operation for drywell purging. Also, per technical specification requirements, we will be periodically operating each sub-system to evaluate system performance. This will include the monitoring of the filter pressure drops and resultant change out as required, as well as system flow rates.

A. Reactor Enclosure Recirculation System (RERS)

This filtration system is a constant flow (60,000 CFM) clean-up system consisting of two 100% redundant fan/filter trains. It provides for the clean-up and mixing of the post LOCA reactor enclosure secondary containment atmosphere.

We have concluded that recorded flow indication and recorded pressure drop indication of the first HEPA filter in the control room is not necessary. A low flow switch is provided that automatically causes a changeover to the standby RERS and initiates a control room alarm whenever the system flow reduces to approximately 80 to 90% of total system design flow. This alarm is indicative of high filter pressure drop, as well as any other system degradation that would cause a low flow condition. This automatic changeover feature has eliminated the need for the operator to monitor deterioration of system performance (flow and filter pressure drop) and manually change over to the standby RERS.

We have not provided a high flow alarm in the control room. The flow control damper for this system fails closed on loss of power, which would initiate a loss of flow and changeover to the standby RERS.

B. Standby Gas Treatment System (SGTS)

This filtration system is a variable flow clean-up system consisting of two 100% redundant fan/filter trains. The SGTS serves two functions: 1) The safety related function is to drawdown and maintain a negative pressure in a secondary containment zone that is affected by accident conditions. The flow through the SGTS filters for this mode of operation can vary anywhere from approximately 500 CFM up to 3250 CFM (max. fan

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capacity) depending on secondary containment zone leakage, the number of zones simultaneously connected to the SGTS, and the size of the zone. The SGTS fan and fan bypass damper controls constantly adjust the flow rates through the SGTS to meet the changing conditions; 2) The non-safety related function of the SGTS is to filter 11,000 CFM of air being drawn from containment for drywell purging operations.

Recorded flow indication in the control room is not provided for this system, since the flow rates will normally vary to maintain the secondary containment at a negative pressure. A valid measure of SGTS performance is not the flow rate, but it's ability to maintain the secondary containment at the required negative pressure. Secondary containment differential pressure indication and low alarm annunciation is provided in the control room to monitor this condition. SGTS flow rate indication is available in the control room, but it is not a recording indicator. The SGTS controls provide for automatic changeover to the standby SGTS on loss of flow.

We have not provided a high flow alarm for this system in the control room, since it can be normal for the flow rate to match maximum fan capacity (specifically for initial secondary containment drawdown).

A recorded pressure drop indication across the first HEPA filter is not necessary, since the maximum effect of dirty filters result in the inability of the SGTS to maintain the secondary containment differential. This condition is presently indicated and alarmed in the control room. Additionally, it should be noted that there is little potential for any significant increase in HEPA filter ΔP. The HEPA filter bank was sized for the non-safety related purge mode (11,000 CFM) and is, therefore, greatly oversized for the safety related mode of operation (500 - 3250 CFM). In it's long term operation mode relating to a DBA/LOCA Scenario, all air entering the SGTS has already been filtered by the RERS which has two HEPA filters. In effect, the first SGTS HEPA represents the third HEPA in the RERS/SGTS lineup for this accident condition.

C. Control Room Emergency Fresh Air System (CREFAS)

This filtration system is a constant flow (3,000 CFM) clean-up system consisting of two 100% redundant fan/filter trains. There are two specific modes of operation for this system; the control room radiation and toxic chemical/chlorine isolation modes.

In the radiation isolation mode, the CREFAS filters approximately 3,000 CFM of air. Of this flow, a portion is outside air for control room pressurization (525 CFM maximum) and the remainder is recirculated air from the control room main air conditioning system (2475 CFM minimum). Control room pressure differential controls vary the outside air quantity in response to control room pressure.

In the toxic chemical/chlorine isolation mode, no outdoor air is introduced into the control room, so the system handles only recirculated air from the control room main air conditioning system (3,000 CFM). We have taken no credit in the FSAR for the filtration effects of the CREFAS in the toxic chemical/chlorine isolation mode.

We have not provided for recorded flow indication or recorded pressure drop indication or recorded pressure drop indication of the first HEPA

filter in the control room. We have provided for the same automatic changeover/alarm feature when flows reduce to approximately 80 to 90% of total flow, as previously discussed under the RERS Section.

We have provided in the control room a flow indicator which allows monitoring of the recirculation portion of the CREFAS flow. In the radiation isolation mode this is a majority of the total flow rate; in the toxic chemical/chlorine isolation mode it is the total flow rate. The outdoor air quantity required for control room pressurization in the radiation isolation mode varies as a function of control room leakage and can be anywhere from near 0 to 525 CFM. Therefore the real measure of acceptable outside air quantity is not the flow rate, but the control room differential. We have provided a control room differential pressure indicator in the control room for monitoring this condition.

We have not provided a high flow alarm for this system. The system flow control damper fails closed on loss of power, which would initiate a loss of flow alarm and changeover to the standby CREFAS.

D. Demisters.

We concur with the guidelines to add a local pressure drop indicator across any safety related demisters.

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ATTACHMENT 3
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Table 11.3-1 indicates the estimated annual release rate from the offgas system.

All moisture removed from the process stream is returned to the main condenser hot well or clean radwaste (CRW).

11.3.2.1.3 System Design Considerations

11.3.2.1.3.1 Charcoal Holdup Time

The krypton and xenon holdup times are closely approximated by the following equation:

$$T = 0.26 \frac{KM}{V} \qquad (11.3\text{-}1)$$

where:
- T = hold-up time, in hours
- K = dynamic adsorption coefficient, in cm^3/g
- M = mass of charcoal adsorber, in thousands of pounds
- V = gas flowrate, in scfm

Dynamic adsorption coefficients for krypton and xenon used to determine gaseous effluent releases are discussed in Ref 11.3-1, NUREG-0016. The charcoal adsorber beds are designed for a delay time of 35 days for xenon under both of the following conditions:

1. 75 scfm flowrate using manufacturer's guaranteed adsorption coefficients (733 cm^3/g for xenon and 31.8 cm^3/g krypton)

2. BWR GALE code assumptions (NUREG-0016, Rev. 0)

The offgas system is capable of handling changes in noncondensible flowrate between 0 and 215 scfm, without operator attention.

With a condenser air in leakage rate of 30 scfm, the charcoal treatment system provides a design holdup time of 52 hours for krypton and 38.6 days for xenon based upon NUREG-0016 assumptions. Since it is expected that the condenser air inleakage will be below the design value and that the charcoal adsorption coefficients will be higher than the values in NUREG-0016 (see Refs 11.3-3 and 11.3-4), the actual charcoal holdup time should be considerably longer than the design holdup time. Additionally, experience with newer fuel designs (8 x 8 assemblies) indicates that substantially lower source terms than those used for system design may be expected.

see insert

11.3.2.1.3.2 Detonation Resistance

The pressure boundary of the offgas system is designed to withstand and the ... during all anticipated modes of operation. Interlocks are provided to

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~~automatically shut down the system upon loss of dilution steam, since the piping between the second stage SJAEs and the preheater is not designed to withstand a detonation at operating pressure. Although piping from the second stage SJAE to the preheater is not designed to withstand a hydrogen detonation, this piping is protected during all modes of operation by ensuring that sufficient dilution steam exists in this piping to prevent a hydrogen detonation. Protective circuits are provided such that loss of dilution steam will result in automatic system shutdown. Loss of dilution steam is indicated both by low flow and high recombiner outlet temperature. The condenser in the standby SJAE train is maintained at approximately main condenser hotwell pressure in order to limit the accumulation of combustible gases due to leakage from the operating train and to assure detonation resistance. The cooler condenser, guard bed, and the 13 small charcoal adsorbers are designed to withstand the effects of a hydrogen explosion, using the methodology of Reference 11.3 5.~~

11.3.2.1.4 Component Description

The recombiner and associated equipment are located in the lowest level of the control structure. Each recombiner system consists of a preheater, recombiner vessel, and aftercondenser. The materials of construction, design temperatures, and pressures are listed in Table 11.3-3.

11.3.2.1.4.1 Preheater

The preheater is a U-tube parallel heat exchanger. Main steam is used to heat process gas before entering the recombiner. The process gas enters at 280°F and is heated to 380°F. Auxiliary steam is also available for heating the process gas flow, should main steam be unavailable. Condensate from the tube side of the heat exchanger is collected in a drain pot underneath the preheater and is routed back to the condenser or to CRW depending on condenser vacuum.

11.3.2.1.4.2 Recombiner

The hydrogen and oxygen in the gas stream are recombined in the recombiner vessel by a catalyst of platinum-palladium. Electric heaters with automatic temperature control are provided on the shell of each recombiner. The heaters are used for preheating the recombiner during startup and maintaining it in a dry condition during shutdowns.

11.3.2.1.4.3 Aftercondenser

The aftercondenser is a straight tube heat exchanger. Service water is circulated through the aftercondenser tubes to condense the steam in the offgas flow. Noncondensible gases are collected in the aftercondenser, cooled in the air cooler section to 110°F,

TABLE 11.3-3

OFF GAS SYSTEM MAJOR EQUIPMENT DESCRIPTION
(Design Codes and Standards are provided in Table 3.2-1)

EQUIPMENT	EQUIPMENT NUMBERS	TYPE	QTY	MATERIAL	CAPACITY	SIZE	DESIGN PRESSURE TEMP. PSIG/°F
Preheater	10E/20E-131	Shell and U-tube	2	Shell,Channel: CS Tubes, Sheet: SS	681,800 Btu/hr	697 sq. ft. Effective area	Shell side: 350/450 Tube side: 350/450
Aftercondenser	10E/20E-127	Shell and Straight tube	2	Shell, Tube Sheet: SS; Channel: CS	16.3×10^6 Btu/hr	1003 sq. ft.	Shell side: 350/1100 Tube side: 150/440
Recombiner	10S/20S-125	Vertical Cyl.	2	Shell: SS Internals: Catalyst support Assembly (SS) Catalyst: Metal mat coated with precious metals	1600 lbs Catalyst	Vessel: 76" O.D., 102" Catalyst: 51" dia, 35" deep	350/1100 (Vessel)
Holup pipe	EBC-106		2	CS		26" dia x 125 ft. long	600/850
Outlet HEPA filter	10F/20F-371	Vertical Cylinder	2	Vessel: CS Internals: C size filter element	300 SCFM at 0.4 psi	Vessel: 54" high, 14" dia Cartr: 13" high 11.25" dia	445 (~~[illegible]~~)/150
Glycol cooler condenser	10E/20E-377	Shell and straight tube	2	Shell: SS Tubes: SS	86,760 Btu/hr	100.8 sq. ft.	615 (~~[illegible]~~)/150
Guard bed vessel	10S/20S-370	Vertical Cylinder	2	CS		36 (~~[illegible]~~) dia x 36" high	** 375/150
Charcoal absorber vessel Unit 1	1AS/1BS-371 1CS-1GS-371	Vertical Cylinder	2	CS	82,125 lbs Charcoal each	132" dia x 354 high	375/150
			5	CS	31,500 lbs Charcoal each	120" dia x 174" high	250*/150
Charcoal adsorber vessel Unit 2	2AS-371 2BS-2IS-371	Vertical Cylinder	1	CS	78,750 lbs Charcoal	132" dia x 354 high	373/150
			8	CS	30,375 lbs Charcoal each	120" dia x 174" high	250*/150
Charcoal bed Units 1 and 2	----	Sutcliffe Speakman 203C	7	----	Adsorb coeff. At design temp. Xe: 733, Kr: 31.8	Mesh size 8x16	-----
			9	----			

* vessels have been hydrostatically tested at 375 psig

** calculation of code static equivalent pressure based on actual min wall thickness and material properties yields 359 psig

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Insert

11.3.2.1.3.2 Detonation Resistance

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All portions of the Limerick offgas system are designed to withstand the effects of a hydrogen detonation or are provided with protective features to preclude the existence of a detonable mixture of gases.

Design for extremely short duration (micro-second) loadings which accompany hydrogen detonations is outside of the scope of normal industry design codes (i.e. - ANSI B-31.1, ASME Boiler and Pressure Vessel Code, etc.). The industry has developed a methodology for detonation resistant design of offgas system piping, pressure vessels, and other components based on extensive theoretical and experimental work.

The magnitude of pressure pulses accompanying a hydrogen detonation have been shown to be a function of component geometry (i.e. - length/diameter ratio), initial system pressure, and proximity to reflection points (i.e. - pipe elbows, etc.). The basic methodology used in the design of detonation resistant BWR offgas systems is described in Appendix C of ANSI/ANS-55.4-1979. That methodology, with slight variations between the ~~various~~ architect-engineers and industry equipment suppliers has been followed since the early 1970's and was used in the Limerick design. The analytical methods used are best described as "static analyses using dynamic material properties". An appropriate wall thickness is determined using peak dynamic pressure and dynamic material properties. For convenience, this wall thickness is often expressed in terms of its code static pressure equivalent. Application of this methodology provides

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a conservative design without the need for detailed and laborious analysis of the gas dynamics of the system. The methodology has been demonstrated to be adequately conservative by theoretical analysis and operating experience:

- A true dynamic analysis of system pressures will typically require a wall thickness one-half that indicated by this approach.

- No BWR offgas system pressure boundary failures have been observed despite the occurrence of considerably more than 100 system detonations.

An ASME Code Committee (Committee on Air and Gas Treatment, Gas Processing Subcommittee) is currently working towards the codification of the above described industry methodology. The "rule of thumb" guidance provided in SRP 11.3 (i.e. - approximately 20 times operating pressure) has been demonstrated to be non-conservative in many applications.

All offgas system detonation resistant piping and components upstream of the charcoal treatment system have been analyzed using the method of analysis employed by Bechtel Power Corporation. All charcoal treatment system components have been analyzed using the method of analysis employed by the system supplier, [illegible] (reference 11.3-5). Both analytical methods closely parallel that described in ANSI/ANS 55.4 and give approximately equal results.

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The following is a discussion of factors relevant to the detonation resistance of the Limerick offgas treatment system:

a) The steam jet air ejectors (SJAE's) are designed to withstand a hydrogen detonation occurring at normal system operating pressure (3.5 psia). Since leakage into the standby SJAE train could cause a detonation at higher initial pressures, provision has been made to maintain the standby SJAE train at main condenser vacuum.

b) The SJAE's which are utilized do not employ a second stage condenser. Thus, the driving steam from the SJAE second stage provides dilution steam such that a detonable mixture of gases will not exist between the SJAE discharge and the offgas aftercondenser. Protective circuits are provided such the offgas system is automatically shutdown when loss of dilution steam is detected (low system flow or high recombiner outlet temperature).

c) All system valves utilize spark resistant trim.

d) All system piping, valves, vessels, instruments, and other components are designed to withstand the effects of a hydrogen detonation except portions of the piping between the SJAE discharge and the preheater. Detonable mixtures of gases in this piping are precluded as discussed in b) above.

FSAR page change ATTACHMENT 4)

 DRAFT 154980

11.4 SOLID WASTE MANAGEMENT SYSTEM

The applicant is committed to providing a solid waste management system that complies with the intent of Branch Technical Position ETSB 11-3, "Design Guidance for Solid Radioactive Waste Management Systems Installed in Light Water Cooled Nuclear Power Reactor Plants." Insert A

The solid waste management system collects, monitors, processes, packages, and provides temporary storage facilities for radioactive spent bead and powdered resins and dry solid wastes for offsite shipment and permanent disposal. The solid waste management system does not have any safety-related functions. For the purpose of this section, the term "solid waste" is used for spent bead and powdered resins and dry solid waste produced from plant operation.

Process and effluent radiological monitoring systems are discussed in Section 11.5.

11.4.1 DESIGN BASES

a. The design objectives of the solid waste management system are:

   1. Provide collection, processing, packaging, and storage of solid wastes resulting from normal plant operations without limiting the operation or availability of the plant

   2. Provide a reliable means for handling solid wastes and allow system operation with ALARA radiation exposure to plant personnel

   3. Package solid wastes in suitable containers for offsite shipment and burial

   4. Prevent the release of significant quantities of radioactive materials to the environment so as to keep the overall exposure to the public well within 10 CFR Part 20 limits

b. Redundant and backup equipment, alternate routes, and interconnections are designed into the system to provide for operational occurrences such as refueling, abnormal leak rates, decontamination activities, equipment downtime, maintenance, and repair.

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Insert A

A process control program that assures suitability of packaged wastes for shipment and burial in consideration of applicable Federal and State regulations and other requirements will be submitted in conformance with the guidelines of Standard Review Plan 11.4 of NUREG-0800 by November [illegible], 1983. Final process parameter tolerances will be verified during pre-operational testing of the solid radwaste system. Any revision to the submitted program will be identified prior to waste shipment.