ITEM 240.1C Figure 2.1-3 does not show the location of the inlet nor pipeline (as indicated in the second paragraph of section 2.4.1.1). Revise that figure or provide another figure to show the location as discussed in the text.

RESPONSE See FSAR Section 2.4.1.1.

ITEM 240.2C Figure 2.1-4 does not show the location of the UHS retention pond (as indicated in the fourth paragraph of section 2.4.1.1). Revise that figure or provide another figure showing the retention pond as discussed in the text.

RESPONSE See FSAR Section 2.4.1.1.

ITEM 240.3C	The U.S. Army Corps of Engineers hypothetical flood studies for the Missouri River (1979) cited in section 2.4.3 does not appear in the list of references. Provide the complete title and other pertinent information. If the reference is to a written communication from the Corps of Engineers, please provide a copy of the communication.
RESPONSE	See FSAR Section 2.4.3; the written communication in question is attached in the hardcopy.

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO
LMSED-HE

2 July 1979

Mr. Gary Lake
Dames and Moore Consulting Engineers
605 Parfet Street
Denver, Colorado 80215

Dear Mr. Lake:

Reference is made to your telephone conversation on 20 June 1979 with Mr. Gary Dyhouse, Chief, Hydrologic Engineering Section, this office, concerning hypothetical flood information on the Lower Missouri and Mississippi Rivers for use in Callaway Nuclear Power Plant Siting at Mile 115, Missouri River. This letter is intended to supplement that conversation.

This office is not aware of any specific, detailed studies which have been made to identify either a standard project or probable maximum flood on the Lower Missouri or Middle Mississippi Rivers. The Kansas City District is responsible for the Missouri River and should also be contacted on this subject. Various hypothetical floods were analyzed during the 1950's to define and/or compare design discharges for levee grade establishment along the Middle and Lower Mississippi River. The hypothetical flood giving the greatest discharge on the Middle Mississippi River (mouth of the Missouri to mouth of the Ohio River) was designated as Hypothetical Flood 52-A. This flood is the result of a combination of actual large storm events and was developed by Corps of Engineers' studies. Hypothetical Flood 52-A was developed from the combination of the 7-11 May 1943 storm transposed over the Missouri and Upper Mississippi Basins, but with the rainfall decreased 20 percent, followed three days later by the actual 15-20 May 1943 storm over all drainage areas above the latitude of Red River landing, and two days later by the actual 28-30 June 1928 storm over all areas above Cairo, Illinois.

The design floods eventually adopted for the Middle Mississippi River levee system were a 50-year and 200-year event for agricultural and urban areas, respectively, unmodified by reservoirs. Hypothetical Flood 52-A was thus used primarily as a comparison with the levee design event.

The comparison was made by using the Mississippi River Basin physical model (MBM) at Clinton, Mississippi. The flood hydrograph from Hypothetical Flood 52A was introduced at St. Louis and downstream peak water surface elevations would be obtained from model measurements. The effects of various combinations of reservoirs on Mississippi River discharges were to be estimated as well. These tests, incorporating many actual and hypothetical floods to be analyzed for the Mississippi Basin, were initiated in 1959 and conducted through 1969. After initial testing was underway, it was decided to incorporate portions of the Missouri and Mississippi Rivers upstream of St. Louis. In particular, water surface elevations for hypothetical events on the Missouri River from Sioux City, Iowa, to the mouth were now required. Upon introducing the 52-A hydrographs at the upstream end of the model and at tributary outflow points to the Missouri River and routing flows using the MBM, it was found that a significantly reduced hydrograph resulted at St. Louis as compared to the results using simplified techniques.

The original test data input, from which the Hypothetical Flood 52-A hydrograph was obtained at St. Louis, was developed through the techniques available at that time - rather simplified hydrologic routing methods computed and routed by hand to the St. Louis Gage. It was felt that this difference in hydrographs at St. Louis was due to the inadequacy of the hydrologic routing techniques performed during the 1950's to develop the hypothetical flood hydrograph at St. Louis. To differentiate between these two conditions, the hypothetical flood 52-A (simplified hydrologic routings) was redesignated as M 52-A (routing with MBM).

At meetings the with Lower Mississippi Valley Division, Missouri River Division, and St. Louis District personnel, it was determined that Hypothetical Flood M 52-A was the more accurate estimate of the discharges that could be expected from an actual occurrence of this rare flood event. Consequently, the adopted discharges from the hypothetical flood would be those derived from M 52-A. There is no frequency associated with this hypothetical flood; however, it is felt that it is a reasonable representation of discharges which might be experienced from storms of standard project proportions over the Missouri and Upper Mississippi River Basins. Discharge values for Hypothetical Floods 52-A and M 52-A, along with the flood of record information, are given in the accompanying table. The results for different combinations of possible reservoir conditions are also shown.

2 July 1979

LMSED-HE
Mr. Gary Lake

I trust the above information will be suitable for your needs. Any further questions should be directed to Mr. Gary Dyhouse at (314) 263-5849.

Sincerely,

JACK R. NIEMI
Chief, Engineering Division

1 Incl
As stated

HYPOTHETICAL FLOODS

LOCATION	FLOOD	E	EN	END
Mississippi River at St. Louis, MO	52-A	1,900,000	1,670,000	1,585,000
Mississippi River at St. Louis, MO	M 52-A	1,380,000	1,180,000	1,080,000
Missouri River at Hermann, MO	M 52-A	980,000	790,000	700,000

Group E (Existing) - Reservoirs that were existing and under construction in 1959, at the start of model testing.

Group N (Near future) - Reservoirs scheduled for construction and expected to be operable by 1970, based on study and construction schedules available in the late 1950's.

Group D (Distant future) - Reservoirs that are expected to become operable after 1970 that will complete the ultimate system of reservoirs. Reservoirs in Group D were estimated in the late 1950's, based on upcoming planning studies.

Group EN is considered to best represent the current condition of the Mississippi River. The actual reservoirs in operation today include a few from the D group. Some reservoirs in the N group have not been constructed.

FLOODS OF RECORD

LOCATION	YEAR	DISCHARGE (C.F.S.)
Mississippi River at St. Louis, MO	1844	1,300,000
Mississippi River at Alton, IL	1973	535,000
Missouri River at Hermann, MO	1844	892,000

The 1844 values were estimated in the early 1900's based on measurements from the 1903 flood at Chester and Thebes, Illinois. The values at St. Louis and at Hermann are considered to be rough estimates at best and may be conservative. The highest discharge measured by modern gaging techniques at these two points occurred in 1973 at St. Louis (852,000 c.f.s.) and in 1951 at Hermann (618,000 c.f.s.).

ITEM 240.4C

a) Your analysis of forces on the UHS retention pond safety related structures is based upon thermal expansion of an ice layer with a thickness that has a recurrence interval of 100 years (1 percent chance per year). This is not an adequate design basis for safety related structures with respect to natural phenomena as required by General Design Criterion 2 of 10 CFR 50 Appendix A and does not meet Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Power Plants." Also, no basis for the assumed temperature rate of rise at 5°F per hour is provided.

Provide an analysis to determine the upper limit of ice thrust forces that could be exerted on safety related structures in the UHS retention pond. Provide all historical data (and their source) used in your analysis. Provide details of any frequency analyses performed and describe any joint probability considerations between ice layer thickness and rate of temperature rise. If the mechanical and/or heat transfer properties of the ice layer are used to limit the thrush forces, provide the basis for all coefficients assumed.

b) If all safety related structures in the UHS retention pond cannot be shown to withstand the upper limit of ice thrust forces determined in response to a) above, discuss procedures to be included in the plant technical specifications to limit the thrust forces, protect the structures, or shut the plant down during times of ice buildup.

RESPONSE

a) Use of the 100 year ice thickness is considered to be an adequately conservative design condition. The forces associated with the 100 year ice condition have been used as normal live loads (see Section 3.8.4.3.1) and have been combined separately with extreme environmental loads (see Table 3.8-2) such as PMP, SSE, etc., to demonstrate that the design is conservative. To design for conditions more severe than the 100 year ice condition in combination with extreme environmental events would not significantly add to the conservatisms already included in the design and is therefore not justified. The 100 year ice condition is adequately conservative such that the design is in compliance with the requirements of General Design Criterion 2 and the recommendations of Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Power Plants."

The assumed temperature rate of rise of 5°F per hour for ice thrust is based on the recommendations of Cold Regions Research and Engineering Laboratory (Ref. 1). The reference states that in most cold regions the mean rise of air temperature rarely exceeds 5°F per hour for extended periods of time. Some extremes in temperature rises are reported in the literature but because of their very short durations they are not representative of the temperature fluctuations inside the ice sheet itself which has a great thermal inertia.

b) All safety related structures in the UHS retention pond are designed to withstand the ice thrust force as described above.

REFERENCE: 1. Michael, B., "Ice Pressure on Engineering Structures." Cold Regions Science and Engineering Monograph III-B1 b, June, 1970.

ITEM 240.5C

Provide the basis for the wind speeds used in the computation of drag forces on the ice surface in the ultimate heat sink retention pond. Justify that the severity meets the intent of General Design Criterion 2 and Position 2 of Regulatory Guide 1.27. Provide the drag coefficient used and the thrust forces calculated. Discuss the impact forces that would result if the pond was only partially covered by ice and ice sheets were driven by wind in the ESWS pumphouse. Provide the basis for all assumptions used in your analysis.

RESPONSE

The drag force due to wind acting on the ice surface in the Ultimate Heat Sink Retention pond is determined considering the different winter wind speeds at the site. Based on climatological data collected at Columbia, Missouri during the years 1931 through 1960 and 1970 through 1973, the fastest wind speeds for the months of December, January, and February are 58, 56, and 45 mph, respectively (based on 1 minute maximum duration) (FSAR Table 2.3-7). The mean monthly wind speeds for these months are 10.7, 10.7, and 11.9 mph, respectively.

The drag coefficient is evaluated considering turbulent flow over ice (smooth surface) and using the figures given in Schlicting (Ref. 1) and Vennard (Ref. 2). The average drag coefficient is 0.002. The drag force computations assume that the entire pond surface is covered with ice and that the entire thrust force is transmitted to the pumphouse, with a frontal contact width of 31.5 ft. The wind drag forces on the retention pond outlet structure are based on a contact with 7 ft. of concrete at the normal operating water level of 836 ft.

The actual wind drag forces exerted on the pumphouse and outlet structure due to a 40 mph wind acting on a two foot thick layer of ice are 24 and 99 lbs/ft, respectively. The Callaway FSAR Site Addendum describes the method by which the wind induced ice force is combined with other forces to determine the structure section strength required to resist design loads. This information is in Section 3.8.4.3.1 and Table 3.8-2. Because the magnitude of the wind induced ice force is very small compared to the other forces, more severe wind conditions were not evaluated.

The effect of impact forces on the pumphouse and outlet structure due to wind driven ice or ice sheets has never been considered as a design basis. However, the pumphouse and outlet structures have been designed for etc. The design of these structures is conservative with respect to the SSE and tornado missiles and therefore is expected to withstand the effects of the wind driven ice.

REFERENCES:

1. Schlicting, H., "Boundary Layer Theory," McGraw Hill Book Company, 1968.
2. Vennard, J.K., "Elementary Fluid Mechanics," John Wiley and Sons, Inc., 1961.

ITEM 240.6C Provide additional details regarding the determination of the probable maximum wind for determination of wave action on the UHS retention pond. Describe the origin of the data used in the analysis and show the maximum likelihood frequency estimate and 95% confidence interval. Discuss the effect of recent regional windspeed data (collected since Thom's report) on the frequency estimate.

RESPONSE See FSAR Section 2.4.8.2.2.1.

ITEM 240.7C

a) Provide details of your transient analyses of temperature and water supply for the UHS cooling tower system during the critical 30-day period as discussed in Position 1 of Regulatory Guide 1.27.

b) Discuss a pre-operational testing program and the analysis of the resulting data to be used to verify the conservation of estimates made in response to part a) above.

RESPONSE

a) See FSAR Section 9.2.5.2.2.

b) See Chapter 14 of the FSAR Standard Plant.

ITEM 240.8C Discuss provisions to replace make-up water in the UHS retention pond in the event that the Missouri River intake and pumping system should remain inoperable after 30 days.

RESPONSE Section 9.2.5.3 has been revised to describe provisions for trucking in make-up water should the Missouri River intake and pumping system remain inoperable after 30 days.

ITEM 240.9C State whether any permanent underdrain or ground water dewatering systems are installed, being constructed or planned at the plant site. If so, provide the information called for in Branch Technical Position HMB/GSB-1, "Safety-Related Permanent Dewatering Systems."

RESPONSE See FSAR Section 2.4.13.5.

.

ITEM 241.1C (2.5.4.5) — Identify the extent and location of areas where Category I Granular Structural Fill and Backfill were used as a substitute for Category I Cohesive Fill. Provide the design criteria for the fill originally planned to be placed in these areas and explain how the substituted fill material meets these criteria.

RESPONSE — See FSAR Section 2.5.4.5.4.1.2.6.

.

ITEM 241.2C (2.5.4.6 and 2.5.5.1)

In section 2.6 of the Callaway Safety Evaluation Report dated August 1975, it is stated that theside slopes and bottom of the ultimate heat sink retention pond will be sealed with a compacted clay liner. In Sections 2.5.4.6 and 2.5.5.1 of the Callaway FSAR, it is indicated that you consider it unnecessary to seal the pond side slopes and bottom with an impervious blanket. To justify this change, provide the following information:

(i) Any new information that indicates that impervious seal is not required.

(ii) The data base and procedure used to estimate the magnitude and rate of potential seepage loss through side and bottom boundaries of the pond. Provide the results of this analysis.

(iii) The extent, location and classification of any pervious sand or silt lenses encountered along the perimeter of the pond during excavation.

(iv) The procedure used for any field permeability tests performed to evaluate the need for an impervious seal around the sides and bottom of the pond, and the results.

RESPONSE

See FSAR Sections 2.5.4.6 and 2.5.5.1.1.

.

ITEM 241.3C (2.5.4.10) Provide time vs. settlement plots of up-to-date settlement data obtained for all Category I structures where settlements are being monitored. Show comparisons of the measured data with anticipated settlements assumed in the analysis of these structures and their appurtenances, and evaluate the impact of any differences between the measured and anticipated settlements on the design and construction of these structures and appurtenances.

RESPONSE See FSAR Section 2.5.4.10.2.2.

ITEM 241.4C (2.5.4.10)

You indicate that the connections between structures and important utilities will be made toward the end of construction. Indicate if these connections have been made. If so, how much settlement of the structures has occurred since the connections were made. Evaluate the effect of the past and anticipated future settlement of structures on safety related utility connections.

RESPONSE

See FSAR Section 2.5.4.10.2.1.

.

ITEM 241.5C (2.5.4.10)

In Section 2.5.4.10 of the Callaway FSAR you indicate that the rigid subsurface walls were designed to resist static at rest lateral earth pressures. What value of the coefficient of earth pressure at rest for compacted backfill was used in these calculations?

Describe any conservatism involved in your earth pressure computations. Provide a plot of earth pressure vs. depth needed to design subsurface walls under static and dynamic loads.

RESPONSE

See FSAR Section 2.5.4.10.3.

.

ITEM 241.6C (2.5.5.1)

In the second paragraph of Section 2.5.5.1.1 you indicate that the Riprap details are given in Section 2.4.5.3. This section number is incorrect. Provide the correct reference.

RESPONSE

The correct section reference is 2.4.8.2.2.2 as indicated in FSAR Section 2.5.5.1.1.

ITEM 241.7C In the FSAR you have not provided sufficient information to define the soil conditions beneath the foundations of the Class 1E electrical duct banks and the Category I essential service water system (ESWS) pipelines. We request that you provide the following information in sufficient detail for an independent Staff review of the adequacy of these materials.

(a) Provide plot(s) drawn to scale showing the following information.

(i) Location and routing from one end of the ESWS pipelines and electrical duct banks to the other, clearly identifying the lines.

(ii) Locations and identifications of the borings along the route of the pipelines and duct banks. Indicate the spacing between the borings.

(b) Provide plot(s) drawn to scale showing the following information.

(i) The pertinent boring logs needed to prepare soil profiles along the routes of the duct banks and pipelines. Indicate the height of fill above the ESWS pipelines and electrical duct banks and draw the original and finished grade surfaces. Provide the soil classification and SPT blow count information on the logs.

(ii) Soil stratification, design water table and top of Graydon chert conglomerate on the profile(s).

(iii) Draw the invert and top of ESWS pipelines and electrical duct banks on the profile(s).

(c) Indicate the static soil parameters used in designing the ESWS pipelines and duct banks. Describe how these parameters were obtained and provide the values of these parameters.

(d) In section 2.5.4.7 of the FSAR, you mention that dynamic analysis of buried pipelines and duct banks is described in Section 6.0 of BC-TOP-4A. Tabulate the dynamic soil parameters that were used in the analyses and then describe the method used for obtaining the soil data. Provide the values of these soil parameters and indicate how the variability of the soil parameters was accounted for in your analyses. In section 2.5.4.7 of the FSAR figures 2.5-451 through 2.5-460 were used in the design of buried pipelines and duct banks. Describe how the data given in these figures were utilized.

(e) In the Callaway FSAR site addendum you have not provided Section 3.7.3.12, "Buried Seismic Category I Piping Systems and Tunnels." Provide the necessary information in this section of the FSAR. Include the site specific soils related information for this section as outlined in Regulatory Guide 1.70.

RESPONSES: See FSAR Section 2.5.4.7.

Items	260.1, 260.2, 260.3, 260.4, 260.5, 260.6, 260.7, 260.8, 260.9, 260.10, 260.11, 260.12, 260.13, 260.14, 260.15, 260.16, 260.17, 260.18, 260.19, 260.20, 260.21, 260.22, 260.23, 260.24, 260.25, 260.26, 260.27, 260.28, 260.29, 260.30, 260.31, 260.32, 260.33, 260.34, 260.35, 260.36, 260.37, 260.38, 260.39, 260.40, 260.41, 260.42, 260.43, 260.44, 260.45, 260.46, 260.47, 260.48, 260.49, 260.50, 260.51, 260.52C, 260.53C, 260.54C, 260.55C, 260.56C, 260.57C, 260.58C, 260.59C, 260.60C, 260.61C, 260.62C, 260.63C, 260.64C, 260.65C, 260.66C, 260.67C, 260.68C, 260.69C, 260.70C, 260.71C, 260.72, 260.73, 260.74, 260.75, 260.76, 260.77, 260.78, 260.79, 260.80, 260.81, 260.82, 260.83, 260.84, 260.85, 260.86, 260.87, 260.88, 260.89, 260.90, 260.91, 260.92, 260.93, 260.94, 260.95, 260.96, 260.97.
RESPONSE	Union Electric responses to the above listed Items have been incorporated into the Operational QA Program which is maintained in the Union Electric Company Operational Quality Assurance Manual.

ITEM 282.2 (10.3.5)

Provide the following on your secondary water chemistry control and monitoring program:

1. Sampling schedule for the critical parameters and of control points for these parameters for the cold startup mode of operation;
2. Procedures used to measure the values of the critical parameters;
3. Procedures for recording and management of data;
4. Procedures defining corrective actions* for off-control point chemistry conditions; and
5. A procedures identifying (a) the authority responsible for the interpretation of the data and (b) the sequence and timing of administrative events required to initiate corrective action.

Verify that the steam generator secondary water chemistry control program incorporates technical recommendations of the NSSS. Any significant deviations from NSSS recommendations should be noted and justified technically.

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*Branch Technical Position MTEB 5-3 describes the acceptable means for monitoring secondary side water chemistry in PWR steam generators, including corrective actions for off-control point chemistry conditions. However, the Staff is amenable to alternatives, particularly to Branch Technical Position B.3.b(9) of MTEB 5-3 (96 - hour time limit to repair or plug confirmed condenser tube leaks).

RESPONSE

Refer to the listed FSAR sections which address each of the requested items:

1. See FSAR Section 10.3.5.1
2. See FSAR SA Section 13.5.2.2.4
3. See FSAR SA Section 13.5.2.2.4
4. See FSAR SA Section 13.5.1
5. See FSAR SA Section 13.5.1

ITEM 310.01 Discuss the mineral rights for all land within the Callaway exclusion area.

RESPONSE See FSAR Section 2.1.2.1.

ITEM 310.02 Discuss any recreational areas within the Callaway site boundary.

RESPONSE See FSAR Section 2.1.2.2.

ITEM 310.03 Explain the statement in Section 2.1.1.3.1 which reads "Future developments may include public attractions without entry restrictions".

RESPONSE The statement means that the general public will be allowed to enter the restricted area to take advantage of public attractions as described in the response to item 310.02, without security restrictions.

ITEM 310.04 Discuss the projections of industrial growth (2.2.2.6).

RESPONSE See FSAR Section 2.1.3.7.

ITEM 310.05 Discuss chlorine storage including volumes and location at the Callaway site.

RESPONSE No gaseous or liquid chlorine is stored or used at the Callaway site. Sodium hypochlorite solution is added to the Circulating and Service Water Systems to prevent the systems from fouling with organic growths.

The sodium hypochlorite is produced on-site using a packaged electrolytic generation system. The hypochlorite generation system, along with other chemical feed equipment, is located in the Cooling Water Chemical Control System Building which is near the Circulating and Service Water Pumphouse adjacent to the natural draft cooling tower. Rock salt is used as a raw material to produce a 0.8% sodium hypochlorite solution. Approximately 17,500 lb/day of rock salt will be used at maximum system capacity, which is 5,000 lb/day of equivalent available chlorine. Rock salt is stored in two brinemaking tanks. The upper portion of each tank provides dry salt storage. Water is introduced in the lower portion to produce a saturated brine solution. The brine is diluted with softened water before entering the electrolytic cell, where the conversion to sodium hypochlorite occurs. The hypochlorite solution is pumped from the cell to three 25,000-gallon vertical storage tanks. Centrifugal pumps feed the hypochlorite to the circulating and service water pump intake bays. The hypochlorite circulates through the system being treated and the cooling tower before entering the blowdown discharge stream.

..

ITEM 311.1 (2.1) | Your response to FSAR question 310.2 discusses land use (as does Sections 2.1.1.2 and 2.1.3.3.4 of the ER) and indicated that land on the site not directly preempted for power production process is being made available for various levels of public use or development including research. Please provide a more explicit list of activities contemplated and those activities which will be excluded.

RESPONSE | See FSAR Section 2.1.3.3.

ITEM 311.2 (2.1.2)	Section 2.1.1.2.1.3 (Page 2.1-4 to 2.1-6) identifies tracts of land within the plant corridor area that are not owned. Please clearly indicate these on Figure 2.1-2. Please correct first paragraph on page 2.1-6 which states: "1 1/2 acres being one acre wide. . .".
RESPONSE	All land described in FSAR Section 2.1.1.2.1.3 is owned by Union Electric Company. The exceptions noted in that description are not corridor and are not owned by UE. See revised FSAR Section 2.1.1.2.1.3. You will note that we have added three additional tracts of land which were acquired after the original section was prepared and submitted. The areas on Figure 2.1-2 entitled Plant Site Area, Plant Corridor Area and Plant Site Peripheral Area are owned by Union Electric.

ITEM 311.3 (2.1.3)

Section 2.1.3.3, page 2.1-10 (and ER Section 2.1.2.3, Page 2.1-6) states "Lost Canyon Lakes is a recreational vehicle and trailer park development approximately 2.2 miles north of the site. The development has approximately 800 sites currently in use, and its developers hope to sell an additional 500 to 600 sites by September, 1980. No permanent residential structures are allowed within Lost Canyon Lakes."

"Current average summer weekend use of Lost Canyon Lakes is estimated to be around 400 persons with usage on peak holiday weekends approaching 1,000 persons (Utley, 1979)." Please update this information and include:

a. Projected total number of sites at completion of project, and

b. Projected end of project usage on seasonal, weekday, and weekend basis if significantly different.

RESPONSE

See FSAR Section 2.1.3.3.

ITEM 311.4 (2.2) Please identify the shipping routes and maximum single shipment quantity of explosives discussed in Section 2.2.1.2.4 (Page 2.2-6). Please confirm that explosives are not shipped via County Roads 335 and 337 through the Exclusion Area.

RESPONSE Section 2.2.1.4 of the FSAR contains the following paragraph regarding explosives shipments in the area.

"The most hazardous materials that may be shipped by highway are labeled Class A explosives and include such materials as dynamite, blasting caps, bombs, and other high explosives. The maximum amount of explosives that may be shipped by truck is 42,000 to 48,000 pounds. These shipments are routed through less populated areas to their destination. The closest route to the plant site that would be used by firms shipping such materials would be U.S. Highway 94. U.S. Highway 94 is located approximately 3.7 miles from the plant site at its closest point. The amount of explosives shipped along U.S. Highway 94 is unknown. There are no federal, state, or local agencies that are required by law to keep records of transportation of hazardous materials and no data are available (Doyle, 1978)."

Hence, no records exist that would indicate that explosives are shipped via County Roads 355 and 337.

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ITEM 311.5C (Table 2.1-4) (Fig. 2.1-9)

Please explain the apparent discrepancies in population values between Table 2.1-4 and Figure 2.1-9

		Table 2.1-4	Figure 2.1-9
0-1 mile	1970	25	25
	1980	0	80
0-2 mile	1970	62	62
	1980	52	120

Also, please provide your projection through end of plant life, of the population within the LPZ (2.5 mile radius from the plant).

RESPONSE

See FSAR Section 2.1.3.2.

ITEM 311.6C (Table 2.2-4) (2.2.1.4)

Section 2.2.1.4 discusses land transportation in the plant vicinity (generally within 5 miles) and the potential hazards to the plant. Table 2.2-4 identifies hazardous materials transported on the Missouri-Kansas-Texas railroad between Jefferson City and St. Louis, Missouri in 1978. Please provide your analysis of the probability of a toxic hazard to the plant in accordance with Reg. Guide 1.78. Please specifically include your toxicity assumptions for each material including "Warfare Gas" identified in Table 2.2-4. Also provide the origin and destination of this above mentioned material along with more complete identification of the agent.

RESPONSE

See FSAR Section 2.2.3.1.

ITEM 311.7C (Table 2.2-3) (Fig. 2.2-3) (2.2.1.4) (2.1.1.1) (2.2.3.1.2)	Section 2.2.1.4 identifies County Roads 335 and 337 as the roads nearest the plant (1900 and 2400 feet, respectively). Figure 2.2-3 indicates that County Road 335 is further from the plant than County Road 337. Table 2.2-3 indicates that State Route CC is 0.3 miles (1584 feet) north of the plant. Figure 2.2-3 indicates that State Route CC is approximately 0.6 miles NW of the site. Please explain or correct these apparent discrepancies. The latitude given in Section 2.1.1.1 for Unit 1 is 38 degrees - 46' - 40.7" and the latitude given for Unit 2 is 38 degrees - 45' - 43.8". This indicates that the two units are about 1 mile apart. This is incompatible with other data (i.e., Figure 2.1-3). Please confirm the site coordinates. Please provide the closes distance these roads come to vital plant structures. In accordance with Reg. Guide 1.91 please provide your analysis and conclusion regarding potential explosive hazard from all roads within 1 mile of the plant (if the distances used in 2.2.3.1.2 are correct and include all hazards, please confirm).
RESPONSE	See FSAR Sections 2.2.1.4 and 2.2.3.1.2.

ITEM 311.8C Please identify the location of the nearest military facility.

RESPONSE See FSAR Section 2.2.1.1.

ITEM 331.1C (13.1.3.2)

In accordance with the recommendations of Regulatory Guide 1.8, the Assistant Superintendent, Engineering - Radiochemistry does not qualify as a radiation Protection Manager (RPM) since he does not presently have the three years of professional experience dealing with radiological problems in applied radiation protection encountered at an operating nuclear power station or equivalent. Therefore, please justify the selection of the individual delineated for this position based on his training and experience as shown in Section 13.1.3.2 and specify, as required, how he will achieve the aforementioned experience, prior to the plant being licensed, to qualify as the RPM.

RESPONSE

As described in Section 13.1 of the Callaway FSAR Site Addendum, the current organizational position equivalent to the Radiation Protection Manager is held by personnel who satisfy Union Electric commitments to Regulatory Guide 1.8. The original response to this question is contained in the FSAR on record as of the receipt of the Callaway Operating License No. NPF-30 on October 18, 1984. The original response may be provided upon request from the Union Electric Licensing Department.

ITEM 331.2C (13.1.2.1)

Based on information in the draft document "Criteria for Utility management and Technical Competence" it is our position that the Radiation Protection Group be a separate organization from the Chemistry Group. Your station organization chart (Figure 13.1-3) shows these groups combined. Additionally, in accordance with Regulatory Guide 8.8, it is our position that the Radiation Protection Manager (RPM) should have access to the Assistant Plant Superintendent in radiation protection matters. In matters relating to radiological health and safety, the RPM has direct responsibility to both employees and management that can best be fulfilled if he is independent of station divisions, such as operations, maintenance or technical support, whose prime responsibility is continuity or improvement of station operability. Your FSAR and proposed Technical Specifications should be revised to reflect how your planned radiation protection program reflects this position.

RESPONSE

Section 13.1 of the Callaway FSAR Site Addendum describes the Radwaste, Chemistry, and Radiation Protection organizations. As indicated in Figure 13.1-3 of the FSAR Site Addendum, the Radiation Protection Manager has a direct communication path to the Director Plant Operations.

The original response to this question is contained in the FSAR on record as of the receipt of the Callaway Operating License No. NPF-30 on October 18, 1984. The original response may be provided upon request from the Union Electric Licensing Department.

Refer to Section 13 of the Callaway FSAR Site Addendum for current position titles and organization structure.

ITEM 331.3C (13.1.2.1)

Concurrent to the change request in 331.2 above. Figure 13.1-3 should also show that Health Physics technicians and Chemistry technicians become separate groups, be qualified separately as Chemistry and Radiation Protection Technicians, and each report directly to their respective Radiation Protection and Chemistry group managers. This change request is also in accordance with the aforementioned draft document.

RESPONSE

Refer to the response of question 331.2C.

ITEM 331.4C (13.1.2.1)

Please describe your plan to provide backup coverage in the event of the absence of the RPM and outline the qualifications of the individual who will act as the backup. The December 1979 revision of ANSI 3.1 specifies that the temporary replacement for an RPM should have a BS degree in science or engineering, 2 years experience in radiation protection, 1 year of which should be nuclear power plant experience, 6 months of which should be on-site.

RESPONSE

The backup Radiation Protection Manager position is described in Chapter 13 of the Site Addendum.

The original response to this question is contained in the FSAR on record as of the receipt of the Callaway Operating License No. NPF-30 on October 18, 1984. The original response may be provided upon request from the Union Electric Licensing Department.

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ITEM 331.5C (13.1.2.3)

Section 13.1.2.3 specifying shift crew composition does not state that an H.P. technician will be on-site at all times (e.g., including backshifts and weekends). NUREG-0654 "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparation in Support of Nuclear Power Plants" requires that a radiation protection technician, whose qualifications are described in ANSI 18.1, shall be on-site at all times. Section 13.1.2.3, as written, would allow a designated member of the shift crew (e.g., reactor operator) to act as a health physics technician if he is qualified to implement radiation protection procedures. It should be noted that his qualification is no longer acceptable to the staff after the reactor is at power. Only an assigned health physics technician will be acceptable based on new staff requirements. Therefore, Section 13.1.2.3 should be revised accordingly.

RESPONSE

The response to this question has been incorporated in Section 13.1.2.3 of the Callaway FSAR Site Addendum.

The original response to this question is contained in the FSAR on record as of the receipt of the Callaway Operating License No. NPF-30 on October 18, 1984. The original response may be provided upon request from the Union Electric Licensing Department.

ITEM 331.6C (12.5.3.1.3)

In accordance with Section 12.5.3.1.3 Airborne Radioactivity Surveys, please discuss your radiation protection provisions for installation of temporary flexible ducting and monitoring at the site of maintenance operation and repair activity, if a high potential for airborne radioactivity exists, to assure that 10 CFR Part 20 limits are not exceeded and that exposures are maintained as low as is reasonably achievable during the operation.

RESPONSE

See FSAR Section 12.5.3.1.3.

ITEM 331.7C (Table 12.5-2)

Although Table 12.5-2 lists 4 portal monitors in the Health Physics instrument inventory, the table does not include monitoring devices for hands, shoes and self monitoring equipment normally used when leaving radiation areas. Please describe the monitoring equipment and procedure used for hands, shoes, clothing and skin (e.g., face) monitoring when leaving potentially contaminated areas and entering unrestricted areas.

RESPONSE

Personnel exiting potentially contaminated areas and entering unrestricted areas will pass through stand in Eberline Personnel Contamination Monitors (PCM1b) or equivalent monitors. Stand in Personnel Contamination Monitors have separate detectors to monitor each region of the body.

When personnel contamination monitors are inoperable, whole body frisk with instrumentation using Geiger-Muller pancake detectors or equivalent will be used.

When whole body frisking with Geiger-Muller detectors are used to exit into unrestricted areas, Radiation Protection personnel will monitor the frisking evolution to ensure proper frisking methodology is used.

Portal walk through monitors in the security building may be used in conjunction with stand in personnel contamination monitors at the controlled area access points to the radiological controlled area.

ITEM 331.8C (12.5.3.1)

In accordance with Section 12.5.3.1, the radiochemist section provides services normally provided for by health physics personnel. Please justify using chemists to perform this service as compared to qualified health physics technicians that are trained and experienced in their specialty in accordance with ANSI 3.1 (1978). Your response should be coordinated with question 331.3.

RESPONSE

See FSAR Section 12.5.1.3.

ITEM 360.1C (15.7.3, 2.4.13)	Section 2.4.13.3 of the SNUPPS/Callaway Site Addendum discusses accident effects of postulated tank ruptures. Table 2.4-28 lists those tanks which were chosen for the tank failure analysis and the curie content for important radionuclides. Supply information on the methodology that is used to determine the fraction of the radioactivity expected to remain on the resin and the fraction expected to go into the liquid.
RESPONSE	See FSAR Section 2.4.13.3.

ITEM 430.2 (8.3)

Provide a detail discussion (or plan) of the level of training proposed for your operators, maintenance crew, quality assurance, and supervisory personnel responsible for the operation and maintenance of the emergency diesel generators. Identify the number and type of personnel that will be dedicated to the operations and maintenance of the emergency diesel generators and the number and type that will be assigned from your general plant operations and maintenance groups to assist when needed.

In your discussion, identify the amount and kind of training that will be received by each of the above categories and the type of ongoing training program planned to assure optimum availability of the emergency generators.

Also, discuss the level of education and minimum experience requirements for the various categories of operations and maintenance personnel associated with the emergency diesel generators.

RESPONSE

Specific personnel are not dedicated for the operation and maintenance of emergency diesel generators. The personnel in the following categories will be trained to the stated levels.

A. Operating Supervisors and Reactor Operators

1. These operators receive training on remote operation of the EDGs during Phase III simulator training and subsequent retraining yearly.

2. They receive detailed system training during Phase II and Phase V on the diesel generators. Additionally, each operator will qualify on operating the diesel generators while in startup testing and will complete a qualification card which lists the performance requirements necessary to qualify as an EDG operator. Training equivalent to that offered by the manufacturer will be included.

B. Operations Technicians and Assistant Operations Technicians

1. Same as item (A-2).

C. Maintenance Personnel

The receive detailed system training during Phase II on the EDGs.

Electricians, machinists and pipefitters will receive a maintenance Phase III training on construction and maintenance of the emergency diesels including technical specifications and plant surveillance procedures. Phase III retraining on construction and maintenance of the emergency diesels will be completed biennially.

Training equivalent to that offered by the manufacturer will be included.

D. Quality Assurance Personnel

There will not be any special training of Quality Assurance personnel with regard to diesel generator operation or maintenance.

The education level and experience requirements for the various categories of operations and maintenance personnel are detailed in Section 13.1.3 of Callaway Plant Site Addendum.

ITEM 430.3
(8.3)
RSP

Periodic testing and test leading of an emergency diesel generator in a nuclear power plant is a necessary function to demonstrate the operability, capability and availability of the unit on demand. Periodic testing coupled with good preventive maintenance practices will assure optimum equipment readiness and availability on demand. This is the desired goal.

To achieve this optimum equipment readiness status the following requirements should be met:

1. The equipment should be tested with a minimum loading of 25 percent of rated load. No load or light load operation will cause incomplete combustion of fuel resulting in the formation of gum and varnish deposits on the cylinder walls, intake and exhaust valves, pistons and piston rings, etc., and accumulation of unburned fuel in the turbocharger and exhaust system. The consequences of no load or light load operation are potential equipment failure due to the gum and varnish deposits and firm in the engine exhaust system.

2. Periodic surveillance testing should be performed in accordance with the applicable NRC guidelines (R.g. 1.108), and with the recommendations of the engine manufacturer. Conflicts between any such recommendations and the NRC guidelines, particularly with respect to test frequency, loading and duration, should be identified and justified.

3. Preventive maintenance should go beyond the normal routine adjustments, servicing and repair of components when a malfunction occurs. Preventive maintenance should encompass investigative testing of components which have a history of repeated malfunctioning and require constant attention and repair. In such cases consideration should be given to replacement of those components with other products which have a record of demonstrated reliability, rather than repetitive repair and maintenance of the existing components. Testing of the unit after adjustments of repairs have been made only confirm that the equipment is operable and does not necessarily mean that the root cause of the problem has been eliminated or alleviated.

4. Upon completion of repairs or maintenances and prior to an actual start, run, and load test a final equipment check should be made to assure that all electrical circuits are functional, i.e., fuses are in place, switches and circuit breakers are in their proper position, no loose wires, and test loads have been removed, and all valves are in the proper position to permit a manual start of the equipment. After the unit has been satisfactorily started and load tested, return the unit to ready automatic standby service and under the control of the control room operator.

Provide a discussion of how the above requirements have been implemented in the emergency diesel generator system design and how they will be considered when the plant is in commercial operation, i.e., by what means will the above requirements be enforced.

RESPONSE

For responses to Item 430.3.1 and 430.3.2, refer to Standard Plant Responses.

3. The Callaway approach to Emergency Diesel Maintenance will adequately cover these concerns.

   Administratively, maintenance results of all safety-related components will be approved by the Superintendent, Maintenance, or his designee. In addition, it is intended that completion documents of significant maintenance activities (and certainly Emergency Diesel Maintenance is significant) be reviewed by cognizant engineers. The two individuals are responsible to take any action necessary to ensure optimum operability. Files will be built containing history of repairs.

   This will ensure that if a component malfunctions repeatedly, the proper corrective action will be taken.

4. Maintenance Procedures will provide for a final equipment check upon completion of repairs or maintenance.

ITEM 430.15 (9.5.4)

You state in section 9.5.4.3 that diesel oil is normally delivered to the site by tanker truck and if road transportation is unavailable, it can be delivered onsite by railroad tanker. Discuss per sources where diesel quality fuel oil will be available and the distances required to be traveled from the source to the plant. Also discuss how fuel oil will be delivered onsite under extremely unfavorable environmental conditions including maximum probable flood conditions.

RESPONSE

The source of fuel oil has not been contracted at this time. However, there are multiple access routes to the site. The Callaway Plant is sited above the PMF level, and it is not anticipated that all access routes would be blocked for an extended period of time to preclude fuel delivery as needed. Some possible source of fuel oil for the Callaway Plant and the distances to these sources are as follows:

J. D. Frame Oil Co.
Fulton, Missouri
14 miles

Tri-County Oil Co.
Jefferson City, Missouri
34 miles

MFA Oil Co.
Columbia, Missouri
40 miles

Note: Delivery onsite by railroad tanker is no longer available.

ITEM 450.00 In your description of the Control Room Habitability System, include the provisions for emergency food, water, and medical supplies.

RESPONSE See Section 6.4 of the Standard Plant FSAR.

ITEM 450.03 In your analysis of toxic gas protection for Control Room personnel, provide the number and type of respiratory devices, the type of operator training for respiratory use, the estimated time for donning or deploying the equipment, the length of time the equipment can be used, the equipment testing and maintenance provisions.

RESPONSE See Section 6.4 of the Standard Plant FSAR.

ITEM 451.1C The frequency of lightning strikes is not presented in the discussion of severe weather and extreme meteorological conditions in Section 2.3.1 of the FSAR. Provide seasonal and annual estimates of lightning strikes to safety-related structures at the site considering the "attractive area" of the structures. A suggested reference for this type of analysis is J. L. Marshall, Lightning Protection, 1973. See also Section 2.3.1 of the Wolf Creek FSAR for a discussion of expected lightning strikes to ground as a function of number of thunderstorms.

RESPONSE See FSAR Section 2.3.1.2.14.

ITEM 451.2C The tornado statistics presented in Section 2.3.1.2.6 are based on a regional data base that ended in 1971. Identify any tornadoes that have occurred in the vicinity of the site since 1971, and provide estimates of the intensity (maximum wind speed) and path area of each. Compare the annual tornado strike probability for this period with strike probabilities determined for previous periods of record (see pages 2.3-6 and 2.3-7).

RESPONSE See FSAR Section 2.3.1.2.6.1.

ITEM 451.3C Describe the procedures used for determining the meteorological conditions which would result in the minimum heat transfer rates (Table 2.3-13 and 2.3-14) and the greatest evaporation from the retention pond (Table 2.3-15) for design of the ultimate heat sink.

RESPONSE See FSAR Section 2.3.1.2.13.

ITEM 451.4C Table 2.3-37 of the FSAR indicates that moderately stable (Pasquill Type F) and extremely stable (Pasquill Type G) conditions have persisted for 20- and 19-hour periods, respectively, at the Callaway Site during the period May 1973 - May 1975. Persistence of these stability classes for periods greater than 12 hours is very unusual. Discuss the causes of persistent stability conditions for greater than 12 hours for Classes F and G. Identify the synoptic conditions during the observed periods of persistent F and G stability classes for periods greater than 12 hours, and discuss the possibility of instrument malfunction.

RESPONSE See FSAR Section 2.3.2.1.6.2.

ITEM 451.5C In the discussion of the potential influence of the plant and its facilities on local meteorology (Section 2.3.2.2), two somewhat different sets of design parameters for the natural draft cooling towers are presented (see pages 2.3-23 and 2.3-31). Clarify the design characteristics for the natural draft cooling towers, particularly for the exit diameter and heat rejection rate.

RESPONSE See FSAR Sections 2.3.2.2.2.1 and 2.3.2.2.3.1.

ITEM 451.6C

In the calculation of cooling system impacts, wind speed and wind direction measurements at the 60m level were used to determine conditions representative of the top of the cooling tower (at about 170m above the surface). Discuss the rationale for using measurements from the 60m level when similar measurements were available from the 90m level. Also discuss the validity of use of the wind speed power law described on pages 2.3-25 and 2.3-26 to extrapolate from measurements at 60m to represent conditions at 170m.

RESPONSE

See FSAR Section 2.3.2.2.2.2 and 2.3.2.2.2.2.1.

ITEM 451.7C The discussion of data recovery on page 2.3-49 indicates that data from other levels and intervals were substituted to enhance the data recovery for the primary measurements, i.e., wind speed and wind direction at the 10m level and temperature difference between 10m and 60m. Preliminary analysis of the hour-by-hour meteorological data provided on magnetic tape suggests that about 23% of the primary data for the combined three-year period (5/73 - 5/75 and 3/78 - 3/79) had to be substituted for the primary measurements. Discuss the problems with the data collection program which necessitated such a large fraction of substituted data, and indicate what modifications will be made to the operational program to enhance data recovery of the primary meteorological measurements. Also discuss the difficulties in measuring precipitation at the site which necessitated use of precipitation data from Columbia, and indicate the real-time representativeness of Columbia precipitation data for use at the Callaway site.

RESPONSE See FSAR Section 2.3.3.1.8.8.

ITEM 451.8C Describe the status of the on-site meteorological measurements program since March 1979.

RESPONSE See FSAR Section 2.3.3.1.8.8.

ITEM 451.9C

Tables 2.3-66, 2.3-67, and 2.3-68 present terrain/recirculation correction factors to be applied to a straight-line Gaussian dispersion model to better characterize temporal variations in meteorological conditions. These correction factors were estimated based on the results of a variable-trajectory puff advection model using one year of hour-by-hour meteorological data from the Callaway site. Substantial reductions (up to a factor of 100 lower than the straight-line model) are suggested for distances approaching 50 miles. Discuss the reasonableness and appropriateness of correction factors for receptors at distances greater than about 5 miles from the source developed by use of a variable-trajectory model with only a single source of meteorological data as input. Also discuss the use of site-specific wind speed profiles for this analysis when standard wind speed profiles are assumed for data substitution and cooling tower impact assessments.

RESPONSE

See FSAR Section 2.3.5.2.1.2.

ITEM 640.1C

Subsection 14.2.2.4 refers to Section 13.1 regarding the qualifications of key personnel involved in the initial testing program. Section 13.1 references NASI/ANS 3.1-1978. Our current position is that the individuals involved in preoperational or startup testing should hold the qualifications stated in Regulatory Position 3 of proposed Revision 2 to Regulatory Guide 1.8, February 1979 (issued for comment). State that your minimum qualification requirements will be in accordance with this regulatory position or provide justification for requiring any lesser qualifications.

ITEM 640.2C

Appendix 3A states in the section on Regulatory Guide 1.58 that an alternative method for qualifying nuclear plant power plant inspection, examination, and testing personnel will be used. Insufficient detail is available to determine whether or not the alternative qualification program provides the same quality training. Expand the description of the alternative qualification method in Appendix 3A or delete this exception to Regulatory Guide 1.58. Note: Regulatory Positions C.5, 6, 7, 9, and 10 of Regulatory Guide 1.58 (Rev. 1, 9/80) apply to the Callaway nuclear station.

ITEM 640.3C

For SNUPPS-C, list all tests that will only be performed on Unit 1. In addition, cite the criteria that will be used during the Unit 2 testing program to ensure that the second unit performs in an identical manner regarding those tests to be deleted.

ITEM 640.4C

Certain terminology used in the individual test descriptions does not clearly indicate the source of the acceptance criteria to be used in determining test adequacy. An acceptable format for providing acceptance criteria for test results includes any of the following:

Referencing technical specifications

Referencing specific sections of the FSAR

Referencing vendor technical manuals

Referencing specific quantitive bounds (only if the information cannot be provided in any of the above ways).

Modify the individual test description subsection presented or, if applicable add a paragraph to 14.2.16 that provides an acceptable description of each of the unclear terms.

1. Within design specification

   14.2.12.1.1
   1.2

2. In Accordance with system design

   14.2.12.1.1
   2.2

3. Responds properly, properly respond, function correctly properly

   14.2.12.1.2
   1.3
   2.1
   2.2
   2.2

4. Adequate

   14.2.12.2.1
   2.3

5. Specified

   14.2.12.2.1
   2.2
   2.3

ITEM 640.5C Describe the status of the power supplies between Unit 1 and Unit 2 to ensure independence during power distribution testing. The descriptions should address both normal and emergency A.C. and D.C. power distribution systems. Provide assurance that cross-ties will not exist which could cause loss of emergency bus power to one unit due to testing of the other unit.

ITEM 640.6C

If Callaway's electrical distribution system has the capability of using one unit's startup transformer as an emergency source of power to another unit, verify by testing or analytical extrapolation of normal loads that each startup transformer can supply emergency loads on one unit while supplying a maximum load of plant auxiliaries on the remaining unit.

ITEM 640.7C

Verify that the ultimate heat sink retention pond pumps (Subsection 9.2.5) are tested to demonstrate adequate NPSH and the absence of vortexing over range of basin level from maximum to the minimum calculated 30 days following LOCA.

ITEM 640.8C

Table 14.2-1 (Sheet 4) of SNUPPS lists S-X3GD01 (Essential Service Water Pump House HVAC) as one of the test abstracts that will be included in the site addendum. Include S-U3GD01 as a safety-related preoperational test procedure in SNUPPS-C, or provide an explanation for the deletion of that test.

RESPONSE

The original responses to questions 640.1C through 640.8C are contained in the FSAR on record as of the receipt of the Callaway Operating License No. NPF-30 on October 18, 1984. The original responses may be provided upon request from the Union Electric Licensing Department.