RE: NUREG-0813 Draft Environmental Statement related to the operation of Callaway Plant, Unit No. 1 Docket No. 50-483 Union Electric Company

6665 Washington
3-W
St. Louis, MO 631?

11/30/81

To: U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
1717 H. St. NW, Washington, D.C. 20555

#1

In regard to the assessment given in the Draft EIS of annual person-rems to be received within a 50-mile radius of the Callaway Units as a result of their operation, the dose estimates given do not reflect the actual environmental dose to be experienced because they are calculated only for a current year's expected emmissions. The effects of a build-up of radioactivity in the environment due to isotopes released during prior years of operation which have half-lives that do not allow for their dissipation in less than a year's period of time is not included. This oversight was previously commented upon in EPA correspondence listed at the back of the 1975 Environmental Statement prepared by the NRC for the Callaway Plant, p. A-8.

#2

Comments on pp. 5-20 + 21 of the current document still refer to radionuclide emmissions in terms of "average annual releases" when discussing compliance with government regulations. This method of accounting for radionuclide releases may be the accepted practice, but it does not accurately reveal the actual impacts that plant operation may have on local populations, for the reasons stated above, especially after the plant has been in operation for more than a year. Cummulative effects are unavoidable and should be accounted for.

C002
S
1/1

Sincerely,
Kathleen S. Chovan
Kathleen S. Chovan

ENCLOSURE 2

ACCIDENT EVALUATION BRANCH RESPONSE TO COMMENTS ON DES FOR CALLAWAY

REED #5 Table 5.5 on page 5-36 of the DES gives the inventory of radionuclides including the significant daughter products of Kryptons and Xenons. Daughter products of noble gases released to the atmosphere are not significant contributors to the environmental impacts and are neglected.

REED #6 Section 5.9.4 deals with the environmental impacts of accidents only. The Emergency Preparedness for Callaway is discussed in the Appendix F to the staff's Safety Evaluation Report.

REED #7 Although the staff's analysis of the severe accident risks in the Section 5.9.4 is based upon the methodology of the Reactor Safety Study (RSS), the probabilities and the release fraction information was rebaselined as discussed in Appendix E and takes into account the comments made on RSS.

REED #8 Staff's judgement that "it is more likely that the calculated results are overestimates of the consequences rather than underestimates" is based on the fact that the uncertainties in the values of the parameters used in the analysis are overcome by conservative assumptions.

REED #9 Staff disagrees with this comment. Staff's analysis of the probabilistic risk of severe accidents is a detailed analysis. Staff has also presented a detailed plan for Emergency Preparedness in Appendix F of the Safety Evaluation Report.

REED #10 Enrico Fermi Atomic Power Plant Unit No. 1 was a Sodium Cooled fast breeder demonstration reactor, and is not to be confused with Enrico Fermi Atomic Power Plant Unit No. 2,which is a light water reactor currently undergoing a review for an operating license. The statement regarding Fermi Unit 1 reaching full power and completing all phases of its original mission is referenced in the Oak Ridge National Laboratory Report ORNL/NSIC - 176, dated April 1980.

EPA #3 The design basis accidents (DBAs) are postulated for the purpose of the design of the reactor safety systems. They are judged not to be significant contributors to the risks since the safety systems have been designed to mitigate the consequences of such accidents. Therefore, these (DBAs) accidents have not been subjected to the same level of probabilistic analysis as the more severe accidents analyzed in the DES.

SANDLER #1 Section 5.9.4.5 does not conclude that all accidents are unlikely to occur. It states "These (environmental) impacts could be severe, but the likelihood of their occurrence is judged to be small." The NRC regulations require the reporting of unusual occurrences as Licensee Event Reports (LERs). Very few of these LERs report any environmental consequences. Large numbers of LERs do not mean that the probabilities of accidents with severe environmental impacts are high.

SANDLER #2 The paragraph referred to in this comment recognizes that fission products in excess of 100,000 Curies were released, and primarily consisted of Xenons and Kryptons. Third paragraph on page 5-38 quantifies the population exposures, resulting from release of radioactive material following the accident at Three Mile Island, to range from 1000 to 3000 person rems.

SANDLER #3 Incidents mentioned in the comment refer to the accidents of moderate frequency, "i.e., events that can reasonably be expected to occur during a year of operation." The radiological consequences of these incidents are discussed in Section 5.9.3 (See Section 5.9.4.4 of the DES).

SANDLER #4 On page 5-38, it is the staff's judgement regarding past accidents that "None is known to have caused any radiation injury or fatality to any member of the public ------ any significant contamination of the environment." Exposures deduced from Licensee Event Reports are not known to have caused any injury or fatality.

SANDLER #5 As stated in the DES, on page 5-42, the radiological consequences of the events, that could be reasonably be expected to occur during any year of operation, are discussed in Section 5.9.3.

BOLEF #1 The word "also" in the 4th paragraph on page 5-34 has been deleted from the text.

BOLEF #2 Reference to Table 5.5 has been deleted from the text.

BOLEF #3 Staff disagrees with this comment. Staff has performed a realistic analysis of the consequences of severe accidents, and has assumed that should a severe accident occur, the people would take steps to avoid the consequences of such accidents rather than do nothing.

UEC #15 The text has been corrected to reflect the NRC conclusions, regarding emergency preparedness, as stated in Appendix F of Safety Evaluation Report (NUREG-0830) which was issued subsequent to the issuance of DES.

UEC #16. The text has been corrected to show that Columbia is 30 miles from the site.

WINGER #1 Release of radionuclides through the plant waste streams during accidents are included in the incidents of moderate frequency and as stated in Section 5.9.4.4 (page 5-42) of DES, the radiological consequences of these occurrences are discussed in Section 5.9.3 of DES.

ENCLOSURE 3

CHANGES IN DES RESULTING FROM RESPONSE TO COMMENTS gases and iodine, a much smaller tendency to escape from degraded fuel unless the temperature of the fuel becomes quite high. By the same token, such materials, if they escape by volatilization from the fuel, tend to condense quite rapidly to solid form again when transported to a lower temperature region and/or dissolve in water when present. The former mechanism can have the result of producing some solid particles of sufficiently small size to be carried some distance by a moving stream of gas or air. If such particulate materials are dispersed into the atmosphere as a result of failure of the containment barrier, they will tend to be carried downwind and deposit on surface features by gravitational settling or by precipitation (fallout), where they will become "contamination" hazards in the environment.

All of these radioactive materials exhibit the property of radioactive decay with characteristic half-lives ranging from fractions of a second to many days or years ~~(see Table 5.5)~~. Many of them decay through sequence or chain-of-decay processes and all eventually become stable (nonradioactive) materials. The radiation emitted during these decay processes is the reason that they are hazardous materials.

Exposure Pathways

The radiation exposure (hazard) to individuals is determined by their proximity to the radioactive material, the duration of exposure, and factors that act to shield the individual from the radiation. Pathways for the transport of radiation and radioactive materials that lead to radiation exposure hazards to humans are generally the same for accidental as for "normal" releases. These are depicted in Figure 5.2. There are two additional possible pathways that could be significant for accidental releases that are not shown in that figure. One of these is the fallout onto open bodies of water of radioactivity initially carried in the air. The second would be unique to an accident that results in temperatures inside the reactor core sufficiently high to cause melting and subsequent penetration of the basemat underlying the reactor by the molten core debris. This creates the potential for the release of radioactive material into the hydrosphere through contact with groundwater. These pathways may lead to external exposure to radiation, and to internal exposures if radioactivity is inhaled or ingested from contaminated food or water.

It is characteristic of these pathways that during the transport of radioactive material by wind or by water, the material tends to spread and disperse, like a plume of smoke from a smokestack, becoming less concentrated in larger volumes of air or water. The result of these natural processes is to lessen the intensity of exposure to individuals downwind or downstream of the point of release, but they also tend to increase the number of individuals who may be exposed. For a release into the atmosphere, the degree to which dispersion reduces the concentration in the plume at any downwind point is governed by the turbulence characteristics of the atmosphere, which vary considerably with time and from place to place. This fact, taken in conjunction with the variability of wind direction and the presence or absence of precipitation, means that accident consequences are very much dependent on the weather conditions existing at the time.

Health Effects

The cause-and-effect relationships between radiation exposure and adverse health effects are quite complex (Ref. 34, pp. 517-534, and Ref. 35), but these activities will not interfere with normal plant operation, as required by Part 100.

Second, beyond and surrounding the exclusion area is a low-population zone (LPZ), also required by 10 CFR Part 100. This is a circular area with a radius of 4 km (2.5 mi). Within this zone the applicant must assure that there is a reasonable probability that appropriate and effective measures could be taken on behalf of the residents and other members of the public in the event of a serious accident.

Third, Part 100 also requires that the nearest population center of about 25,000 or more persons be no closer than one and one-third times the outer radius of the LPZ. The purpose of this criterion is a recognition that, although accidents of greater potential hazards than those commonly postulated as representing an upper limit are conceivable, but highly improbable, it was considered desirable to add the population-center distance requirement to provide for protection against excessive doses to people in large centers.

No commercial or industrial facilities are located within the LPZ. In 1970, 116 residents lived within it, and the 1980 population has been estimated at 76. There are no sources of seasonal population in the LPZ with the exception of Lost Canyon Lake (a trailer park used seasonally), and the Reform Wildlife Management Area, which attracts hunters and fishermen. There is no working-day concentration that would create a significant transient population. The nearest population center is Jefferson City, Missouri, located about 40 km (25 mi) west-southwest of the plant. The City of Fulton, Missouri, located about 16 km (10 mi) southeast of the plant, had a 1970 population of 12,248. Fulton is not expected to reach a population of 25,000 by 2020. The population-center distance is more than one and one-third times the LPZ, as required by Part 100.

The safety evaluation of the Callaway site has also included a review of potential external hazards, i.e. activities offsite that might adversely affect the operation of the plant and cause an accident. This review encompassed nearby industrial, transportation, and military facilities that might create explosive, missile, toxic gas, or similar hazards. The staff has concluded that the hazards from nearby industrial and military facilities, pipelines, air transportation, waterways, and railways are acceptably low. A more detailed discussion of the site features will be included in the staff's safety evaluation report.

Emergency Preparedness

In the Safety Evaluation Report (NUREG 0830) Appendix F, the staff has concluded that the applicant's emergency plans meet

Emergency-preparedness plans including protective-action measures for the Callaway Plant and environs are complete ~~in an advanced, but not yet fully completed, stage. In accordance with~~ the provisions of 10 CFR Section 50.47 ~~effective 3 November 1980, an operating license will not be issued to the applicant unless~~ a finding is made by the NRC that the ~~state of~~ onsite and offsite emergency preparedness provides reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency. Among the standards that are ~~must be~~ met by these plans are provisions for two Emergency Planning Zones (EPZ). A plume-exposure-pathway EPZ of about 16 km (10 mi) in radius and an ingestion-exposure-pathway EPZ of about 80 km (50 mi) in radius are required. Other standards include appropriate ranges of protective actions for each of these EPZs, provisions for dissemination to the

and the requirements of 10 CFR 50, Appendix E, and public of basic emergency-planning information, provisions for rapid notification of the public during a serious reactor emergency, and methods, systems, and equipment for assessing and monitoring actual or potential offsite consequences in the EPZs of radiological-emergency conditions.

The NRC findings are ~~will be~~ based on a review of the Federal Emergency Management Agency findings and determinations as to whether state and local government emergency plans are adequate and capable of being implemented, and on the NRC assessment as to whether the applicant's onsite plans are adequate and capable of being implemented. Although the presence of adequate and tested emergency plans cannot prevent the occurrence of an accident, it is the judgment of the staff that they can and will substantially mitigate the consequences to the public should one occur.

5.9.4.4 Accident Risk and Impact Assessment

Design-Basis Accidents

As a means of assuring that certain features of the Callaway Units 1 and 2 meet acceptable design and performance criteria, both the applicant and the staff have analyzed the potential consequences of a number of postulated accidents. Some of these could lead to significant releases of radioactive materials to the environment, and calculations have been performed to estimate the potential radiological consequences to persons offsite. For each postulated initiating event, the potential radiological consequences cover a considerable range of values depending on the particular course taken by the accident and the conditions, including wind direction and weather, prevalent during the accident.

In the safety analysis and evaluation of Callaway Units 1 and 2, three categories of accidents have been considered by the applicant and the staff. These categories are based upon their probability of occurrence and include (1) incidents of moderate frequency, i.e. events that can reasonably be expected to occur during any year of operation; (2) infrequent accidents, i.e. events that might occur once during the lifetime of the plant; and (3) limiting faults, i.e. accidents not expected to occur but that have the potential for significant releases of radioactivity. The radiological consequences of incidents in the first category, also called anticipated operational occurrences, are discussed in Section 5.9.3. Initiating events postulated in the second and third categories for the Callaway Units 1 and 2 are shown in Table 5.6. These are designated design-basis accidents in that specific design and operating features as described in Section 5.9.4.3 Design Features are provided to limit their potential radiological consequences. Approximate radiation doses that might be received by a person at the most adverse location along the site boundary (1200 m or 3900 ft from the plant) are also shown in the table, along with a characterization of the time duration of the releases. The staff has used conservative models for calculations to estimate the potential upper bounds for individual exposures summarized in Table 5.6 for the purpose of implementing the provisions of 10 CFR Part 100, "Reactor Site Criteria." For these calculations, pessimistic (conservative or worst case) assumptions are made as to the course taken by the accident and the prevailing conditions. These assumptions include much larger than expected amounts of radioactive material released by the initiating events, additional single the RSS there are substantial uncertainties in these probabilities. This is due, in part, to difficulties associated with the quantification of human error and to inadequacies in the data base on failure rates of individual plant components that were used to calculate the probabilities (Ref. 42) (see Sec. 5.9.4.4 Uncertainties). The probability of accident sequences from the Surry plant were used to give a perspective of the societal risk at Callaway Units 1 and 2 because, although the probabilities of particular accident sequences may be substantially different for Callaway, the overall effect of all sequences taken together is likely to be within the uncertainties (see Sec. 5.9.4.4 Uncertainties).

The magnitudes (curies) of radioactivity releases for each accident sequence or release category are obtained by multiplying the release fractions shown in Table 5.7 by the amounts that would be present in the core at the time of the hypothetical accident. These are shown in Table 5.5 for a Callaway reactor core at the thermal power level of 3636 megawatts.

The potential radiological consequences of these releases have been calculated by the consequence model used in the RSS (Ref. 43) and adapted to apply to a specific site. The essential elements are shown in schematic form in Figure 5.3. Environmental parameters specific to the Callaway site have been used and include the following:

1. One full year of consecutive hourly averages of 1974/1975 meteorological data from the site meteorological-monitoring systems, and precipitation data obtained from Columbia, which is about ~~24~~ 48 km (~~15~~ 30 mi) from the site;

2. Projected population for the year 2000 extending throughout regions of 80- and 560-km (50- and 350-mi) radii from the site;

3. The habitable land fraction within the 560-km (350-mi) radius; and

4. Land-use statistics, on a state-wide basis, including farm land values, farm product values including dairy production, and growing-season information, for the State of Missouri and each surrounding state within the 560-km (350-mi) region.

To obtain a probability distribution of consequences, the calculations are performed assuming the occurrence of each accident release sequence at each of 91 different "start" times throughout a one-year period. Each calculation uses the site-specific hourly meteorological data and seasonal information for the time period following each "start" time. The consequence model also contains provisions for incorporating the consequence-reduction benefits of evacuation and other protective actions. Early evacuation of people would considerably reduce the exposure from the radioactive cloud and the contaminated ground in the wake of the cloud passage. The evacuation model used, as discussed in Appendix F, has been revised from that used in the RSS for better site-specific application. The quantitative characteristics of the evacuation model used for the Callaway site are best-estimate values made by the staff and based on evacuation-time estimates prepared by the applicant. Actual evacuation effectiveness could be greater or less than that characterized, but would not be expected to be very much different.