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SECRETARY
OF SERVICE

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of)	
)	
COMMONWEALTH EDISON CO.,)	Docket Nos. STN
)	
Byron Station)	50-454 and 50-455
)	
(Units No. 1 and No. 2))	<u>Operating License</u>

ANSWERS OF LEAGUE OF WOMEN VOTERS OF ROCKFORD, ILLINOIS
TO NRC STAFF'S AMENDED FIRST SET OF INTERROGATORIES

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Interrogatory No. 39:

39-1. Specify which radionuclide/sediment transport models allegedly have not been field-verified and which are allegedly not acceptable to determine the effects of sediment and aquifer materials on radionuclide transport. Describe in detail what would be acceptable field verification.

Answer to 39-1:

In order to apply a radionuclide transport model to a surface or groundwater system it is necessary that the system be completely characterized both physically and chemically. It has, for example, been demonstrated that radionuclide transport in a fractured aquifer proceeds at a much faster rate than in a porous medium of similar void density. Determination of transport rates in fractured rocks such as those underlying the Byron site is still at an experimental stage (see, for example, the study by Neretnieks and others, Water Resources Research, Vol. 18, pp. 849-858 [1982]) and has not yet been field-verified. Thus it is unlikely that CECO can place realistic bounds on velocities of radionuclide migration through the aquifer system underlying the Byron site, both because of the absence of data bearing on the physical nature of the aquifer system and because of the lack of a theoretical understanding of migration through fissured media.

An acceptable field verification of radionuclide migration at this site would, at the very least, involve the following elements:

- (a) detailed potentiometric maps for all aquifers;
- (b) measurements of permeabilities and transmissivities of each aquifer at several different locations;
- (c) injection of nonreactive tracers into wells on the site and determination of travel times to neighboring wells situated in the directions of flow and dispersion;
- (d) field and laboratory determinations of relative velocities of nonreactive (e.g., Cl^-) and reacting (e.g., Cs^+ and Sr^{++}) ions relevant to the radionuclide inventories on the site.

CECO has not performed a study of this type at Byron and is thus unable to determine the effects of radionuclide releases to the groundwater system.

39-2: Is a model the only method to determine or envelope the effects of sediment and aquifer materials on the radionuclide transport through the hydrosphere? If the answer is affirmative, provide in detail the bases for the judgment, i.e., list all other methods and the specific reasons they are unacceptable.

Answer to 39-2:

In the context of Contention 39, any method of estimating the consequences of an accidental leakage of radioactivity would be a model. A simple equation or a very complex computer program would both be models since they both embody assumptions about the nature of the hydrologic system. The kind of model which is required, however, is one which incorporates measured physical and chemical properties of the ground and surface water systems and which is verified and defensible through its matching field test data.

The only alternative to a model is to perform the event which is being modeled and to observe the consequences. This is impractical for many accidents and certainly for those of a Class 9 level because of the resulting danger to human life. Since it appears that no appropriate model has been created and field tested for the Byron site, the required finding of 10 CFR 50.57(a)(3)(i) and 50.57(a)(6) cannot be made.

39-3: Describe in detail the "proper NEPA analysis" referred to in Contention 39.

Answer to 39-3: An adequate cost-benefit analysis for the operation of the Byron plant cannot yet be performed because the implications

of accidental leakages of radioactivity cannot be determined. This situation exists because the data obtained by CECO are inadequate to characterize the ground and surface water systems in the neighborhood of the site. The data required to perform such an analysis are discussed in the answer to Interrogatory 39-1.

39-4: What specific provisions of Regulatory Guide 4.2, any other Regulatory Guide, 10 CFR Secs. 50.57(a)(3)(i) and 50.57(a)(6) have allegedly not been fulfilled at the Byron site with respect to field verification of radionuclide/sediment transport?

Answer to 39-4:

No allegation was made in Contention 39 that provisions of Regulatory Guide 4.2 were violated. However, CECO is unable to comply with the provisions of 10 CFR Secs. 50.57(a)(3)(i) and 50.57(a)(6) because it has not adequately characterized the ground and surface water hydrology as discussed in the answer to Interrogatory 39-1. Thus it can not prove that the plant can be operated without endangering human life.

39-5: What specific Byron facilities are the source of the radionuclides which are of concern in Contention 39.

Answer to 39-5:

The primary concern involved in Contention 39 is the release into the water pathways of radiation following a Class 9 accident involving a core melt. Consequently, the main Byron facility which would release radionuclides into the hydrosphere in such a situation would be the reactor itself.

39-6: Explain in detail the extent to which experience gained in a laboratory on the ion exchange and transport of radioactivity, as field verified at other sites, is not applicable at the Byron site as alleged in Contention 39.

Answer to 39-6:

Field application of laboratory data bearing on the migration of radionuclides requires complete characterization of the physical (including porosity, fracture-density and orientation, permeability, etc.) and chemical properties of the rocks underlying the sites as indicated in the response to Interrogatory 39-1. It also requires a careful matching of laboratory data to observed migration paths and velocities. The "other sites" referred to in the NRC's Interrogatory where field verification and history matching of radionuclide migration have been performed are limited to one. The study in question was performed by Robertson (USGS Open File Report, 1974) on radionuclide migration in basalts of the Snake River plane in Idaho. These rocks have little chemical, physical or geological similarity to those underlying the Byron site and the results of Robertson's study are not applicable to the Byron area.

39-7: Define specifically what is meant by "a radionuclide/sediment transport model."

Answer to 39-7:

A radionuclide-sediment transport model is a set of equations which describes the migration of radionuclides through the ground and surface water system.

39-8: Describe in detail what would constitute proper field-verification of such a model.

Answer to 39-8:

The field studies required to prove the applicability of a transport model are described in detail in the answer to Interrogatory 39-1.

39-9: Define in detail the term "hydrosphere" as used in the first sentence of Contention 39.

Answer to 39-9:

In the context of Contention 39 the term "hydrosphere" is taken to refer to any part of the environment in which liquid water is a dominant component. It thus refers to rivers and streams in the neighborhood of the Byron plant as well as to all aquifers and sources of surface and ground water.

39-10: Define in detail the term "effect" as used in the first sentence of Contention 39.

Answer to 39-10:

In the context of Contention 39, the "effect of sediment and aquifer materials on radionuclide transport through the hydrosphere" relates to the extent to which the velocities of migration of radionuclides differs from those of molecules of water in the same environment. Thus, an appropriate radionuclide transport model must take explicit account of mechanisms by which radionuclides are slowed or accelerated relative to water during transport. These mechanisms would include surface sorption, precipitation, sedimentation, colloidal-transport and the effects of streaming potential.

39-11: State over what specific time periods the "effect of sediment and aquifer materials on radionuclide transport through the hydrosphere" is allegedly expected to be manifested.

Answer to 39-11:

The specific time periods involved in Contention 39 are those time periods between the time of release of radioactivity to the environment and the times at which the nuclide of concern will have decayed to negligible amounts. Since half-life is nuclide-specific the time period of concern will depend on

which nuclides are released. For a significant release of Sr⁹⁰ this would be on the order of six hundred years. If Pu²³⁹ were released in significant quantities, five hundred thousand years would be a more appropriate period of concern.

Interrogatory No. 109:

109-1: Describe with particularity the "recent events [which] indicate that C.E. has not complied with its commitments" as referred to in the first sentence of Contention 109.

Answer to 109-1:

See the League's response to Interrogatory 19(b) of Commonwealth Edison Company's Amended Second Round of Interrogatories.

109-2: Describe the specific existing legal and regulatory requirements regarding the hydrological impacts which you allege in Contention 109 are not and cannot be met.

Answer to 109-2:

The unsatisfied legal and regulatory requirements resulting from the failure of CECO and/or the Staff to do a proper, thorough, site-specific and safety related evaluation of the consequences of, and available mitigating actions for, radioactive releases into waterpathways include, but are not limited to: 10 C.F.R. Secs. 50.34(b)(4); 50.40(c); 50.57(a)(3)(i); 50.57(a)(3); 100.10(a)(4); 100.10(c)(3); 100.10(c)(4); and NEPA. As the League's investigation and the discovery process continue, additional violations and noncompliances may become apparent and will be identified in Supplemental Answers.

109-3: Describe with particularity the "new facts" regarding hydrology which you allege in Contention 109 have become known since the construction permit decision.

Answer to 109-3:

See once again the League's answer to Interrogatory 19(b) of CECO's Amended Second Round of Interrogatories.

109-4: Provide a list of the specific Byron Nuclear Plant Construction License commitments (related to hydrology) with which C.E. has not complied.

Answer to 109-4:

See the League's response to Interrogatory 19(c) of CECO's Amended Second Round of Interrogatories.

109-5: Provide clarification of the NUREG-0440 (NRC Liquid Pathway Generic Study) reference. The number and title are not consistent.

Answer to 109-5:

The NRC liquid pathway reference is to NUREG-0440 (Liquid Pathway Generic Study) as cited in the Byron FES at p. 5.56.

109-6: What precedents, as alleged in Contention 109(a), have identified specific hazards to the health and safety of the public from normal releases of radioactivity from existing or proposed power plants and actual or potential radioactive contamination of surface or groundwater supplies to the extent that they exceed the limitations of 10 CFR Part 20?

Answer to 109-6:

The thrust of Contention 109, part (a) is that there are no available studies of the effects of long-term buildup of radionuclides in the environment around operating nuclear power plants. The deleterious effects of gradual buildup in the Rock River sediments or in groundwater supplies may not be immediately observable but need to be considered before committing the impact to future generations. The release limits of 10 CFR 20 do not take account either explicitly or implicitly of the potential effects of gradual radionuclide buildup in the environment.

109-7: Describe in detail the other areas that Intervenor indicates are not listed in Contention 109 and related to the Byron Nuclear Plant which are implicitly raised by Contention 109. State in detail the basis for your assertion that these areas are of concern.

Answer to 109-7:

A number of related areas of concern regarding Contention 109 have been addressed in the Affidavit of Richard B. Hubbard and Gregory C. Minor, November 12, 1980, at pp. 40-52, and in the League's answers to the Staff's and CECO's Interrogatories dealing with Contentions 8, 28, 39, 62 and 63. As the discovery process continues, including the answering of the League's Interrogatories and the examination by the League's experts of the CECO documents which have been produced, additional concerns may surface and will be provided in Supplemental Answers.

109-8: Describe in detail the difference between the issues raised in Contentions 39 and 109(a).

Answer to 109-8:

Contention 39 is concerned with the general aqueous environment, both surface and subsurface, around the Byron plant. Contention 109(a) refers specifically to the Rock River adjacent to and downstream from the plant.

109-9: Identify by author, title, publication date and publisher the reference for a Rock River withdrawal rate of 30 mgd stated in Contention 109(b). What is the location of withdrawal? How much of the withdrawal is returned to the river? .

Answer to 109-9:

On page 4-4 of the FES (NUREG-0848) it is stated that the evaporative consumption of surface water by the station will average 46.7 cfs. This water consumption, supplied by the Rock River, corresponds to a net withdrawal of 30,000,000 gallons per day.

109-10: What radioactive liquid releases (by nuclide rate and volume) do you contend could be made to the Rock River during:

- (a) routine operation?
- (b) "design base" (sic) conditions?
- (c) Class 9 accidents?

State in detail the basis for your assertions in this regard.

Answer to 109-10:

Some releases of radionuclides to the Rock River will take place during routine operations (FES-CP, pp. 5-13) and potentially during design base or Class 9 accidents (FES, pp. 5-57). We are currently unable to determine the magnitudes or rates of such accidental releases because of the uncharacterized nature of the ground and surface water systems surrounding the site. The types of study required to characterize these systems fully are discussed in the response to Interrogatory 39-1.

109-11: Identify the source of assumed radionuclide infiltration into groundwater supplies and wells along the Rock River as alleged in Contention 109(c) and provide the bases for your assertion of infiltration from these areas.

Answer to 109-11:

Routine operations (FES-CP, pp. 5-13) as well as possible accidents (FES pp. 5-57) both provide potential sources of radionuclide contamination of the Rock River. The magnitudes of release and time periods concerned can not be deduced without adequate information on the nature of the aquifer system underlying the Byron site.

109-12 Identify the specific locations along the Rock River Valley at which you allege infiltration will occur.

Answer to 109-12:

The form of the potentiometric surface for the water table aquifer which is shown in the FES (NUREG-0848, fig. 4.7) indicates a general tendency of flow to the west and northwest away from the center of the Byron site. Flow of radionuclide-bearing water in such directions could result in discharge at several points along the Rock River. In view of the numerous potential flow paths it is not appropriate at this time to identify any specific points along the river as being loci of discharge.

109-13: What specific effects on the use and supply of water and what specific location(s) are of concern in Contention 109(c)?

Answer to 109-13:

The specific effects of ground and surface water contamination cannot be estimated until CECO obtains the data required to properly characterize the hydrologic system around the Byron site. The requisite data were described in the response to Interrogatory No. 39-1.

109-14: What groundwater models and from which specific sections of the FSAR, environmental report, safety evaluation report, and environmental impact statement are of concern in Contention 109(d)? As to each model and report section identified, state in detail your concerns and the bases for each concern.

Answer to 109-14:

The radiological consequences of releases to the groundwater environment were dealt with only in a cursory manner in section 5.9.4.5(5) of the FES. As stated in detail above, this analysis was based on inadequate assumptions concerning (a) the amounts of radioactivity released, and (b) travel times through the ground and surface water systems to the Rock River. These assumptions cannot be substantiated because the groundwater system is inadequately characterized in both the FES and SER.

109-15: Explain in detail why the alleged omission of a groundwater model is a basis for inadequacy as stated in Contention 109(d).

Answer to 109-15:

The consequences of radionuclide releases to the aquifer system cannot be determined without an adequate physical and mathematical description of the properties of the system in the neighborhood of the site. These inadequacies were described in the response to Interrogatory 39-1. The inadequacy results from the fact that these consequences must be accounted for to properly make the required regulatory findings.

109-16: From which specific facilities do you postulate blockage in Contention 109(e)?

Answer to 109-16:

The thrust of Contention 109(e) is that there are no contingency plans for blocking migration of radionuclides through the hydrosphere in the event of a serious accident such as a core melt down. This deficiency continues despite the results of a recent study by Sandia National Laboratory, which reached the following conclusions, among others:

- (a) the largest releases in the event of a melt down would be to the hydrosphere; and
- (b) interdictive measures to block radionuclide migration through the hydrosphere can mitigate the effects of a melt down.

109-17: Define in detail the meaning of "Plum River applicability" as used in Contention 109(e).

Answer to 109-17:

The "Plum River applicability" refers to the fact that there may be a substantial, active geologic fault in proximity to the Byron plant site.

109-18: Explain in detail why the "Plum River applicability" is of concern at Byron.

Answer to 109-18:

The "Plum River applicability" is a matter of concern because of the possibility it presents of a significant seismic event which could severely damage or destroy the Byron plant, thus resulting in radioactive releases to both the air and the water pathways. One major point of concern regarding this matter is the fact that so little geological analysis has been done concerning the status of not only the Plum River Fault, but of the entire Illinois-Wisconsin area, so that it cannot be known with sufficient assurance either that no seismic event will occur which will affect Byron or that Byron equipment, components, structures, and systems have been sufficiently qualified to safely withstand such a seismic event or to be safely shut down following such an event.

109-19: If contaminants were blocked as alleged in 109(e), specify what contaminants would exist in terms of their chemical and radiological composition and volume?

Answer to 109-19:

The extent of groundwater contamination in the event of a serious accident will depend on the exact nature of the accident. The points of Contention 109 are:

- (a) the ground and surface water systems in the region of the Byron site are not well understood; and
- (b) there are no contingency plans to block radionuclide migration through these systems in the event of an accident.

109-20: Define in detail the "quake potential" of the site as referred to in Contention 109(e). State in detail the basis for your assertion that such "quake potential" exists.

Answer to 109-20:

The "quake potential" of the Byron site is discussed at some length in the League's response to Interrogatory 18 of CECO's Amended Second Round of Interrogatories.

109-21: If contaminants were blocked as alleged in 109(e), what would be the eventual disposition of contaminants?

Answer to 109-21:

If measures, such as a field of production wells, were taken to remove radionuclides from the groundwater system, then the eventual disposition of contaminants could be in sedimentation tanks and ion exchange columns. In the absence of such contingency plans, however, the eventual disposition of contaminants will no doubt be throughout the hydrosphere and biosphere.

CERTIFICATE OF SERVICE

I certify that the foregoing Intervenor Rockford League of Women Voters' Answers to NRC Staff Amended First Set of Interrogatories was served upon all parties of record herein, by postage prepaid properly addressed mail, this 25th day of October, 1982.


