Comment number	Comments	Responses

Comments on the
Draft Environmental Impact Statement
L-Reactor Operation
Savannah River Plant

Prepared for
Energy Research Foundation
Columbia, S.C.

by
Yaron M. Sternberg, Ph.D.
November 14, 1983

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
	My name is Yaron M. Sternberg, Ph.D., and I am a professor of Civil Engineering at the University of Maryland, College Park, Maryland. My area of expertise is groundwater hydrology with emphasis on migration of contaminants in groundwater. My professional experience includes a number of hydrogeological investigations of solid waste and hazardous waste sites as well as remedial action feasibility studies.	
	The following comments on the Draft Environmental Impact Statement (EIS) on L-Reactor Operation, Savannah River Plant (SRP) are restricted to groundwater issues and are based on a review of the Draft EIS as well as a number of other publications referenced in the Draft EIS. The primary goal of the review was to assess the evaluation in the Draft EIS of the impact on groundwater quality as a result of the proposed	
EN-42	startup of the L-Reactor. Groundwater contamination has already been detected in a number of areas within the SRP boundaries. In particular, serious groundwater quality degradation has occurred in the vicinity of the M-area settling basin and the old TNX basin. Reportedly, groundwater monitoring, mathematical modeling, and pilot operations for remedial action have been conducted in suspected contaminated areas. The Draft EIS contains only limited information on the status of the corrective action taken to protect and/or restore the groundwater quality at SRP.	The SRP ground-water concerns, including M-Area and old TNX basin, will be the subject of a separate NEPA process as noted in Section 6.1.6 of this final EIS. See also the response to comment AJ-1.
EN-43	A serious flaw in the Draft EIS is the lack of hydrogeological data for the immediate vicinity of the L-Reactor. In contrast, the F and H areas have been the subjects of intensive hydrogeological studies. The stratigraphy of the aquifers present at those locations as well as the piezometric head data in the various geological units are available. Areas F and H are approximately 10 km north of the L-Reactor area. The Draft EIS suggests that the geological and hydrogeological conditions at the L-Reactor site are similar to those in the F and H areas. However, there are no data to substantiate this claim. The closest piezometer screened in the Tuscaloosa formation is about 7.5 km east of the L-Reactor (P54) and apparently there are no piezometers in the Congaree formation. Water table contours in the vicinity of the L-Reactor area, given in Figure F-24, are based on a 1973 report; apparently, more recent data	See the response to comment EN-23.

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	are not available. The conclusion that can be drawn based on the data presented is that only sparse data are available for the L-Reactor area. The Final EIS must include sufficient data to delineate in detail the geology and, the groundwater regime at the site and should explain variations, if any, between previous and present groundwater conditions.	
EN-44	The Draft EIS relies to a large extent on data presented by Siple (1967). In particular, seepage velocities computed for each of the major stratigraphic units are based on limited hydraulic conductivity and gradients data, and assumed effective porosities. The velocity values are used to compute radioactive decay rates, and travel time of groundwater to discharge points in surface streams. Groundwater velocities are rarely constant in time or space and it is not uncommon to observe velocities in the field that are an order of magnitude higher than computed values. The report does not indicate whether the estimated velocities have been verified in areas where a large amount of data is available, i.e., F, H, and M. In order to evaluate the actual velocities under field conditions, tracer studies should be conducted in the vicinity of L-Reactor area and the results compared with the computed values.	The ground-water travel times from F- and H-Area seepage basins to Four Mile Creek were calculated from measured flow rate values presented in the draft report "Technical Summary of Groundwater Quality Protection Program at Savannah River Plant; Volume 1 - Site Geohydrology, and Solid and Hazardous Waste" (DPST-83-829). A conservative travel time of 4.4 years was assumed for tritium transport from the L-Reactor seepage basin to Steel Creek. As the L-Reactor seepage basin will not receive continuous, large volume discharges of low pH wastewater (as is the case for F- and H-Area basins), a travel time of at least 4 times this value is actually expected from the L-Area seepage basin to Steel Creek. Sections 4.1.2.2 and F.2.10 have been revised to reflect this information.
EN-45	The Draft EIS suggests that it is unlikely for pollutants in the L-Reactor area to contaminate the Tuscaloosa aquifer because the hydraulic head of this aquifer at this location is higher than that in the Congaree Formation. The location of areas where there is a head reversal between the above two formations is given in Figure F-29. The map suggests that the head in the Congaree is higher than that in the Tuscaloosa only around the M-area and in the vicinity of Par Pond. The report states that "the map is constructed by subtracting two piezometric maps for which data are somewhat sparse." However, no information is given in the Draft EIS on (1) what data was used in developing the above figure, and (2) what is the future anticipated head difference in view of the continuous decrease of piezometric head in the Tuscaloosa formation, and future increases in pumping rates. In recent years water use for irrigation has increased rapidly near SRP. Most of the increase has occurred in Allendale and Barnwell Counties from wells in	Information on development of the Tuscaloosa-Congaree head difference map is presented in Appendix F and DPST-83-829. Also see the response to comment EN-24 on head differential. Groundwater flow directions in the Congaree and Tuscaloosa Formations have been plotted on the maps identifying the major offsite groundwater users. These maps show that the flow in these formations will be under the SRP to the Savannah River and will not reach offsite users in Barnwell and Allendale Counties. Also see the responses to comments AJ-1, DA-4, DA-5, and DA-8 regarding groundwater contamination and the barriers aforded by key clay units to the downward migration of contaminants.

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	the Tuscaloosa Formation. If this trend, coupled with anticipated increase in groundwater use at the SRP facility, continues, the present head difference of about 12 feet at the L-Reactor area may decrease and likely be reversed. The consequences of possible piezometric head reversal must be addressed in the Final EIS.	
EN-46	A numerical model to assess the impact of groundwater withdrawals from the Tuscaloosa aquifer on water levels in the aquifer was proposed by Marine and Routt (1974). The sensitivity of the model depended on the accuracy of the piezometric head. Based on an accuracy of 3 and 5 feet head difference between nodes, the estimated flux was about 65 cfs (105 m^3/min) and 30 cfs (48 m^3/min), respectively. An error greater than 5 feet was considered to be not probable. Groundwater usage from the Tuscaloosa aquifer at SRP is projected to be 35.7 m^3/min based on present (1982) rate of 24.3 m^3/min plus 11.4 m^3/min due to the increased use at L-Reactor. The total withdrawal rate from the Tuscaloosa aquifer is estimated at 70 m^3/min, excluding any increases from municipalities, industries, or other heavy users in the area. If the actual flux is 105 m^3/min, then present discharges amount to 70% of the estimated flux. However, if the flux is less than 100 m^3/min, which is quite likely based on the above model, then piezometric levels in the Tuscaloosa aquifer will continue to decline. The fact that levels have been declining suggests that the estimated flux of 100 m^3/min may not be accurate. Because the Tuscaloosa aquifer is an important source of water, a detailed investigation of this formation is essential particularly in view of the fact that in one area this aquifer has already been contaminated.	See the response to comment FK-14.
EN-47	Because of the importance of groundwater as a source of freshwater, information is needed on both the relative impact of the various activities (planned and accidental) in order to make a complete and accurate environmental assessment. The present state-of-the-art of mathematical modeling has this capability but requires accurate and detailed data base. Such a data base for the L-Reactor area is lacking and, therefore, only qualitative analysis or a highly simplistic quantitative	The EIS provides extensive discussion of potential impacts to the ground waters beneath the SRP from operation of L-Reactor including potential impacts from a cooling lake that could be used to mitigate direct thermal discharges. Analysis is based on empirical models developed from SRP study data. The predicted impacts are very small, thus there is no need for more sophisticated modeling analyses in L-Area. In addition, alternatives to the use of the L-Reactor seepage basin are presented in Section 4.4.3. As noted in response to comment EN-24, the impacts to public health and safety would be very small from L-Reactor seepage basin contaminants that might migrate to ground waters in units beneath the McBean Formation.

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
	one can be performed. Mathematical models such as FEMWATER and FEMWASTE, developed at Oak Ridge National Laboratories, should be employed to assess localized head reversal at pumping centers, horizontal and vertical potential migration patters, and to provide an accurate picture on the groundwater flow regime in the vicinity of L-Reactor area.	
EN-48	The L-Reactor oil and chemical basin reportedly received in excess of 1×10^6 gallons of waste water through 1979. The chemical composition of the waste discharged to the basin is not stated and must be disclosed in the Final EIS. Although the Draft EIS states that present and future contamination of the shallow groundwater between the L-Reactor area seepage basin and Steel Creek is expected (tritium and strontium 90) no monitoring data is available; monitoring wells have only recently been installed. A detailed quantitative analysis of the present contamination in the vicinity of the L-Reactor area should be addressed in the Final EIS. Such an analysis should include water quality, contaminant plume delineation, migration rates, proposed preventative and remedial action, etc.	See the response to comment DA-11.
EN-49	The Draft EIS states that during operation of the L-Reactor, radioactive materials will be discharged to a seepage basin and "these discharges will cause contamination of the uppermost layer of the water table aquifer (Barnwell Formation)." The Draft EIS concludes that the "subsurface contamination migration is controlled by the rate and direction of groundwater flow, the adsorptive capabilities of the sediments and hydrodynamic dispersion. The sediments of the SRP exhibit greater horizontal than vertical hydraulic conductivities, enhancing lateral movement. Thus radioactive contaminants entering the water table are expected to flow to a point of outcrop on Steel Creek." The above statements are qualitative in nature and are not substantiated anywhere within the Draft EIS. Expecting the groundwater to flow from one point to another in a given time is indicative of the present serious uncertainty in the data base. All of the above statements should be substantiated by developing an extensive data base and conducting simulation studies using a verifiable mathematical model.	A detailed ground-water table elevation map for the L-Area is presented in the EIS (Section 3.4.2.1). This establishes the direction of flow and gradient along the flow path (490 meters long) from the seepage basin to Steel Creek within the Hawthorn and Barnwell Formations. Based on the ground-water elevation map, the contaminant plume will follow the water table surface. The F- and H-Area seepage basin and SRP Burial Ground plumes provide existing physical models for the L-Reactor seepage basin plume (see Du Pont, 1983; DPST-83-829 for additional details). The SRP has discharged contaminated wastewater to seepage basins in the central part of the plantsite, including L-Area basins, since the mid-1950s. The movement of radioactive materials with ground water has been studied, monitored, and modeled extensively to determine movement pattern/rate. To date, no contamination of the Tuscaloosa Aquifer in this area has occurred.

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
EN-50	Large volumes of liquids containing nonradioactive hazardous materials and low levls of radioactive waste have been discharged to the F and H seepage basin since 1954 and 1955, respectively. The groundwater is contaminated to a reported depth of 20 meters throughout most of the distance between the basins and the seepline springs. The contamination consists of radioactive elements, mercury, and nitrate. The Draft EIS provides little monitoring data and no information is given on whether remedial action is proposed and, if so, what is the status of the investigation. Serious contamination has been detected in the vicinity of M-area and significant concentrations of organics have been detected in soils at a depth of about 200 feet. (1000 ppb of Trichloroethylene at the Silverton Road waste site.) The volatile organics in the groundwater in the vicinity of the M-area settling basin are estimated at 27,000 kg with additional 24,000 kg residing in the unsaturated soil. It should be pointed out that these estimates, given in the Draft EIS, are preliminary, and the total weight may be significantly larger. Based on the above documented contamination, it is obvious that adding waste to the F, H, and M-areas as a result of the startup of the L-Reactor would contribute to further contamination and aggravation of the problem. The above areas should not receive any additional waste loads. Instead, remedial measures should be taken to restore the quality of the groundwater. Furthermore, seepage basins should not be used anywhere at the SRP for the disposal of any hazardous material because such activity poses a potential serious health hazard to users of the groundwater.	See Sections F.5 and F.6, Du Pont (1983; DPST-83-829) and the response to comment DA-2. Section F.5 provides ground-water monitoring data. Also see the response to to comment DA-2 on incremental analyses of L-Reactor support facilities impacts, the response to comment DA-3 on separate NEPA review for the SRP ground-water protection program, and the responses to comments DA-6 through DA-8 regarding hazardous material disposal at SRP.
EN-51	It should be noted that the issue of nonaqueous phase liquids (NAPLS) is not discussed in the Draft EIS. Most halogenated organic compounds such as trichloethylene are denser than water and will sink to deeper units. The direction of movement of such NAPLS does not necessarily coincide with that of the native groundwater. The presence of NAPLS and their effect on the groundwater supply should be addressed in the Final EIS.	Sections 5.1.1.2, and F.5.4 have been expanded to discuss chlorinated hydrocarbon contamination in M-Area, protection of public health, and planned remedial actions.

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
EN-52	In conclusion, the Draft EIS fails to properly address the groundwater issue, i.e., what is the potential for a serious health hazard to groundwater users. The EIS addresses the hydrogeology of the L-Reactor area from a rather simplistic quantitative point of view. This treatment is a result of a significant lack of data on the geology and groundwater hydrology at the L-Reactor area. An explicit data base for this area should be collected and used as an input to a mathematical model to be used for predicting the probable outcome of various planned and accidental activities. Such state-of-the-art models are commonly used in siting of hazardous waste facilities and should be employed in the preparation of the Final EIS on L-Reactor operation.	See the responses to comments AJ-1, EN-23, EN-47, and EN-49.

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses

SAVANNAH RIVER LABORATORY
TECHNICAL DIVISION

DPST-83-643

DISTRIBUTION

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D. R. JOHNSON
I. M. MACAFEE
F. J. MCCROSSON
W. R. MCDONELL
G. F. O'NEILL
SRL RECORDS (14)

MEMORANDUM

JUNE 29, 1983

TO: P. L. ROGGENKAMP

FROM: D. E. HOSTETLER

ALTERNATIVES TO L STARTUP: NEW PRODUCTION REACTOR

INTRODUCTION

An alternative to renewed operation of L-Reactor for increased production of nuclear materials would be the construction and operation of a New Production Reactor (NPR).

This report describes a conceptual design for a low temperature heavy water reactor with no electricity generation (LTHWR-NE) to be built as a new production reactor at the Savannah River Plant (SRP). The reactor design is based on the proven SRP reactor design with enhancements and state-of-the-art equipment. Aluminum cladding temperatures would be the same as with current operations.

The power and productivity of the new reactor would be greater than L-Reactor by about 30%. However, the estimated time from authorization to startup is 10 years. Thus an NPR could not contribute to material production until late 1993 at the earliest.

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses

SUMMARY

A preliminary conceptual design for a low-temperature heavy water reactor with no electricity generation is described which is patterned closely after the current SRP reactor design; however, several enhancements have been included. These include:

- Full containment systems
- D_2O detritiation systems
- ECCS recirculation system
- Cooling water recirculation (cooling towers)
- Improved cooling for assemblies during discharge
- Modernized control rooms

The reactor is designed to operate at 3150 MWt. The reactor contains 696 fuel assemblies which could be either of the type designed for tritium production or for plutonium production. The reactor would also be capable of producing a variety of different isotopes, a feature which has been proven by the current SRP reactors.

I. FACILITY DESCRIPTION

A. Site

An NPR would be located on an unused parcel of land of approximately 100 acres probably in the vicinity of Par Pond. The site would be cleared to provide space for the reactor, and administrative building, cooling towers along with cleared areas inside and outside fences to provide for adequate security surveillance. A site layout is shown in Figure 1.

B. Schedule

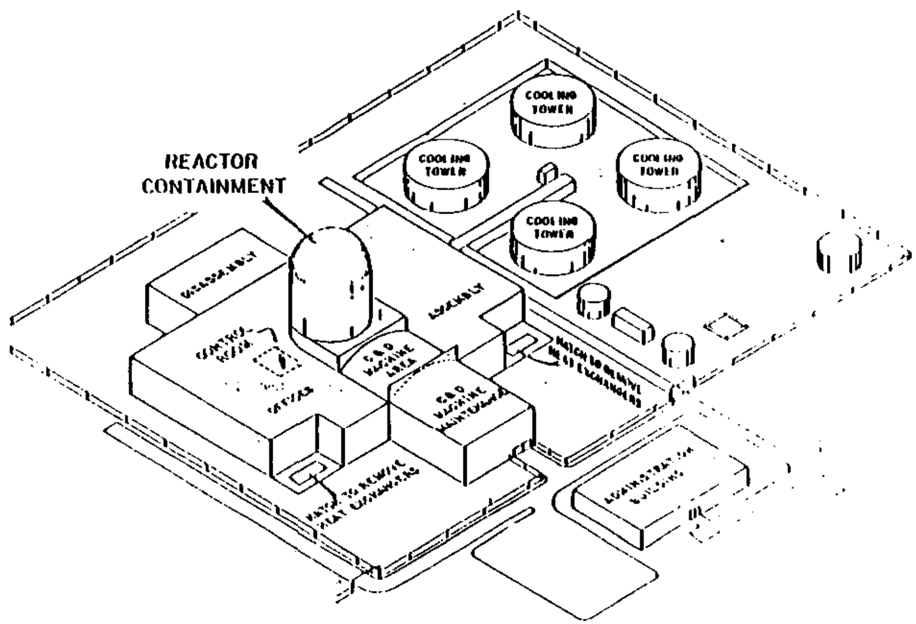
Construction of an NPR at SRP would require preliminary studies and analyses as well as final project design and construction.

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
	The estimated time from project authorization to startup is nearly 10 years. Thus, if the project were authorized at the beginning of FY 1984, startup would be no earlier than FY 1993. The probable project schedule and milestones are shown in Figure 2. The project steps are listed below with comments on selected items. (1) Technical Data Summary (TDS) The TDS would provide the data necessary for the complete specification of the reactor system with particular emphasis on systems which would be different from existing SRP reactors. (2) Environmental Impact Statement The sump is placed below the reactor to catch the core in the unlikely event of a core meltdown. The following descriptions of systems and components are preliminary because they represent minimum safety requirements. Additional redundancy may be expected in some systems in the final design. G.1 Containment Building The primary function of the containment building is to provide an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment. This building is a seismic Category I reinforced-concrete rectangular underground structure with a hemispherical dome. Figure 3 is a side view of the containment building and the above ground building which surrounds the containment dome. Figure 4 shows the side view of the containment building which includes the disassembly basin and C&D equipment and area. Above ground level, only the cylindrical shell and dome covering this shell is considered a part of the containment building. The majority of the containment building is below ground level.	

Comment number	Comments	Responses

FIGURE 1. Schematic of Proposed LTHWR-NE with Cooling Towers



Comment number	Comments	Responses
	The -20 ft and -40 ft levels are shown to scale in Figure 8 and 9. The arrangement of the primary loop heat exchangers and reactor tank is similar to the P-Reactor layout. The primary loop heat exchangers can be replaced by moving them onto the railways on either side of the -20 ft level and sliding them to the lower end of the railways. A sealed opening is provided at this point. The openings are shown in Figure 1 at the two corners of the containment building. In Figures 8 and 9, the ECCS systems and main circulating pump motors are placed such that a concrete shield is between them and the reactor. The shielding is such that personnel would be able to work in these areas during actual reactor operation. In Figures 8 and 9, P indicates a pump and PM a pump motor. The upright cylindrical portion of the containment has an outside diameter of 80 feet, measures 150 ft from ground level, and has a minimum wall thickness of 3-ft. The dome portion is a hemispherical-shaped head having an inside height of 37-ft and a 3-ft thickness of reinforced concrete. The interior surface of the containment structure is lined with 1/4-in. stainless steel plates. A calculation of the containment pressure following a LOCA indicates a conservative peak value of approximately 23 psia (8 psig). Assumptions used in calculating this pressure were: o The containment spray system is inoperable. o No heat is transferred to the containment structure or containment heat removal system. o The free volume of the containment building is 1198 x 10^6 cubic feet. o The temperature of the coolant is at 90°C.	

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	The estimate of the peak containment pressure is significantly less than those calculated for typical LWR's (about 50 psig). Because the design pressure is relatively low for a containment building, design of the reinforced concrete structure does not require unusual methods to provide resistance. The flat portion of the ground level roof in Figure 3 will be supported on girders and columns of reasonable sizes such that sufficiently large spans (up to 50 ft) can be designed without difficulty. Conventional methods of anchoring the reinforcing steels of the high rise tower are applicable, since the uplift force due to internal pressure is less than 20% of the weight of the tower. The auxiliary building on top of the containment has the structural effects of supporting the tower as bracings and the flat containment roof as trusses. The thickness of the containment enclosure is limited by requirements of biological shielding and tornado missile protection rather than the overpressure due to accidental steam generation.	
	G.2 Containment Spray System (CSS)	
	The CSS is designed to preserve the integrity of the containment building by removing thermal energy from the containment in the event of a LOCA and remove iodine from the containment atmosphere if core damage occurs. This system comprises two redundant trains (or subsystems), each of 100% capacity. Each train consists of a spray pump (4000-gpm capacity), a 360-degree spray head located in the containment building at the +60-ft level, spray heads in the -20 ft and -40 ft levels, and a heat exchanger (shared with the SDCS), and associated piping and valves. Each train draws independently from a demineralized water tank containing 200,000 gallons of borated light water. In addition, a sodium hydroxide storage tank containing 9000 gallons of 20% NaOH solution and two independent mixing systems are provided for iodine removal. The NaOH solution mixes with 10% of the containment spray flow in an eductor located in a side stream from the pump discharge, and the mixture is injected into the pump suction. The spray eductor mixes the solution and meters for proper pH control.	

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses

STATEMENT OF WILLIAM A. LOCHSTET, PH.D.

The Pennsylvania State University
104 Davey Laboratory
University Park, Pennsylvania 16802

College of Science
Department of Physics

11 November 1983

Mr. M. J. Sires, III
Assistant Manager for Health,
Safety and Environment
U.S. Department of Energy
Savannah River Operations Off.
P.O. Box A
Aiken, S.C., 29801

Dear Mr. Sires:

Enclosed are my comments on the Draft Environmental Impact Statement on L-Reactor Operation at Savannah River Plant, DOE/EIS-0108D. Please note that the opinions and calculations presented do not necessarily reflect the position of the Pennsylvania State University.

I will be looking forward to the Final Environmental Impact Statement. Would you also please send me a copy of that Final EIS when it is available.

Sincerely,

Wm. A. Lochstet, Ph.D.

Comment number	Comments	Responses
	Some Environmental Consequences of L Reactor Operation by William A. Lochstet, Ph.D. The Pennsylvania State University* November 1983	
	The Department of Energy (DOE) has prepared a Draft Environmental Impact Statement on the resumption of operation of the L-Reactor at the Savannah River Plant, DOE/EIS-0108D (Ref. 1). The L Reactor operated from 1954 until 1968 for the purpose of producing special nuclear materials (plutonium) for	
EO-1	nuclear weapons (Ref. 1, P. 2-7). Thus, the design of this reactor is over 30 years old, and does not reflect the learning that has been achieved since. In particular, water is pumped into the reactor vessel at the top and out thru connections at the bottom. In the case of the break of an exit pipe, the cooling water would simply run out. Modern reactors deflect the exiting water to connections near the top.	The design of the L-Reactor, as that of all other SRP reactors, has been upgraded since initial startup in 1954 and currently reflects the lessons learned during the long period of SRP reactor operation as noted on p. 4-42 of the draft EIS and in Appendix J. In case of a pipe break, the ECS is designed to provide adequate core cooling, no matter where the break occurs, i.e., also in the case of an exit pipe rupture.
EO-2	The power of the L reactor is quoted as 650 to 2915 MW (T), with a typical operation at 2350 MW(T) (Ref. 1, PP.G-11, 2-14). This is similar to the rate of heat production in modern commercial reactors. For example, the heat production rate at Three Mile Island unit 2 had a maximum rate of 2772 MW. If the L reactor were to operate continuously for one year at its "typical" rate of 2350 MW, it would fission 1300 lb (600 kg) of uranium - 235 (U-235). Since natural uranium usually contains 0.71% of the isotope U-235, it will be necessary to obtain at least 85 metric tons (long tons) of uranium metal to fuel this reactor for one year. Since the average uranium mill operates at 96% efficiency, at least 88 metric tons of uranium will have to be mined. The uranium mill will leave 4%, or 3.5 metric tons of the uranium in the mill tails which are discarded. These tails will also contain 1.5 kg of thorium-230.	The environmental effects of uranium fuel requirements for light-water power reactors (including those effects postulated by Pohl) have been examined extensively in a number of public proceedings conducted by the NRC. In each instance, the hearing board has reaffirmed that radon releases associated with such requirements are "...a minute fraction of the radon that is released into the atmosphere from other sources...." and that the "... incremental health risk to the population stemming from the fuel cycle emissions (if indeed there is any) is vanishingly small...." (USNRC, Atomic Licensing & Appeal Board, ALAB-701, November 19, 1982). The uranium fuel requirements for L-Reactor are significantly less than those of a nominal light-water power reactor.

*Affiliation for identification purposes only.

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	In 1976 Pohl pointed out that the thorium decays to radium-226, which in turn decays to radon-222, which is a health hazard (Ref. 2). The uranium-238 in the mill tailings decays thru several steps to radon-222 and should be considered, as was noted by the NRC in GESMO (Ref. 3). The total decay of this 3.5 metric tons of U-238 and 1.5 kg of thorium-230 will yield 5.1×10^{11} curies of radon-222. Because radon-222 has a half life of only 3.8 days, some radon-222 atoms decay before escaping from the tailings pile into the atmosphere. At present some recent mill tailings piles have two feet of dirt covering. In this case, the EPA estimate (Ref. 4) is that about 1/20 of the radon produced escapes to the air. Thus, only about 2.5×10^{10} curies of radon escape to the air. The population at risk is taken to be the United States, stabilized at its present number and distribution. This is similar to recent estimates taken by the NRC (Ref. 5). Further, the NRC has suggested that a release of 4,800 curies of radon-222 from a western mine site, would result in 0.023 excess deaths in the present population. This provides a ratio of 4.8×10^{-6} deaths per curie released (Ref. 6). Applying this factor to the 2.5×10^{10} curies of radon released, results in 121,000 deaths. It should be recognized that these deaths occur over a long time, governed by the 4.5 billion year half life of U-238. This is also a minimum estimate, due to the need for greater amounts of uranium than are indicated here. This estimate also assumes that the U.S. population is not decimated by a nuclear war. In this case, the impact of L reactor operation would be quite different.	
EO-3	To consider nuclear war, it is necessary to estimate the contribution of L reactor production to that war. For the moment, assume that the breeding ratio of the L reactor is 1.0. Then, in each year of operation, 1300 lb (600 kg) of plutonium will be produced. Since each nuclear bomb contains about 10 kg of plutonium (Ref. 7, P. 182) this means 60 warheads for each year of production. Since typical targets in a nuclear war have populations of 50,000 or more, consider an	The national policy on nuclear weapons, their deployment, and the need for increased weapons is beyond the scope of this EIS.

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
	average population of 100,000. Thus, one year's production of the L reactor would destroy 60 communities and six million people. This reactor would enable the death of six million civilians for each year of operation. That is the same as the number of people killed within Germany (i.e. Jews) during WW II. This holocaust was treated harshly at the Nuremberg trials of war criminals after that war. The principle established there, is that each person is responsible for their own actions, and it is not enough to claim that one is simply following orders. This principle of international law should be applied here.	
EO-4	The National Environmental Policy Act of 1969 (NEPA) requires a comparison of the costs and benefits of a federal project. In this case, it has been shown that the costs of one year of operation is 121,000 deaths. Ten year's operation would result in over a million deaths. This is to be compared with the benefits. The benefits are six million deaths for each year of operation, or sixty million (60,000,000) deaths for ten years of operation. 60,000,000 deaths is not a benefit. There is no benefit. NEPA requires no operation of the L reactor. The decision to restart the L reactor in January 1984 is contrary to NEPA. It is necessary to perform a cost/benefit assessment fully and in good faith as required by the court in Calvert Cliffs Coordinating Committee v. USAEC 449 F. 2nd 1109 (D.C. Circ., 1971): We conclude, then that Section 102 of NEPA mandates a particular sort of careful and informed decision-making process and creates judicially enforcable duties.... But if the decision was reached procedurally without individualized consideration and balancing of environmental factors--conducted fully and in good faith--it is the responsibility of the courts to reverse. Thus the decision of DOE must satisfy NEPA rather than the FY 1983-1988 Nuclear Weapons Stockpile Memorandum of the president (Ref. 1., P. S-2).	See the responses to comments AB-4 and AB-5 regarding the discussion of costs vs. benefits and the discussion of need in this EIS.

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
EO-5	It is suggested that restart of the L reactor with its present cooling method would result in the discharge of water at 70°C (158°F) to 80°C (176°F), at the reactor outfall. It is further suggested that this water would enter the swamp at 40°C (104°F) to 45°C (112°F) (Ref. 1, P. 4-8). This would be a clear violation of the Clean Water Act. Such operation must not be considered, even temporarily.	See the responses to comments AA-1 and AB-13 regarding cooling-water mitigation alternatives.
EO-6	Section 8.2 lists irretrievable commitments of resources for L reactor operation. The discussion does not indicate the uses of these resources. In particular, energy is used to enrich the fuel uranium (Ref. 1, P. G-11), and the electricity used in the enrichment process should be included as a committed resource.	NRC has presented the annual electrical energy requirements for enrichment of the fuel for a nominal 1000 Mwe LWR [10 CFR 51.20(e) - Table 5-3] as 323,000 Mw-hrs. As indicated in the response to comment EO-2, the enrichment requirements for L-Reactor would be less.
EO-7	Prior to the accident at Three Mile Island in 1979 the NRC considered accidents with 100% fuel failure as being too improbable to consider. DOE should, must, consider 100% fuel failure accidents in this case. In particular, it is unlikely that a large fuel failure accident would be contained. The emergency cooling system can supply water at 53,000 liters per minute (Ref. 1, P. G-42). However, the building sumps are pumped into tanks with 2.1 million liter total capacity (2,100,000 liter) (Ref. 1, P. G-43). These tanks will fill up in 40 minutes. After that time water would flow to a 190,000,000 liter excavated basin (Ref. 1, P. G-43). Such flow would release very large quantities of radioactivity to the environment. That may have been considered acceptable as reactor safety when the plant was designed in the early days, but is clearly unacceptable today. In particular, the letter of Arthur H. Dexter which appears in the Draft (Ref. 1, PP K-74 to K-79) provides a very direct discussion of accidents which must be addressed. It is not (after TMI) credible to merely say that an accident with 100% failure is too low in probability. The 100% fuel failure accident must be contained. It did happen at one large reactor in 1979 and may happen again, although by an entirely different initiation scenario. Since the events that led to the TMI accident are so well known, it is clear that that exact sequence will be properly handled when it happens. Further, as DOE indicates, the L reactor design is rather different, so that exact sequence is meaningless at the L reactor.	See the responses to comments BL-2, BL-3, and BL-4 regarding analysis of accidents involving 100 percent fuel-melting. As noted in Section G.5.6 of the EIS, no fuel melting is expected in any probable loss-of-coolant accident. In the unlikely event of fuel melting, only minimal quantities of fission products and other contamination would be expected to be carried to the 190-million-liter earthen basin for the reasons discussed in Section G.5.6. Several sections of the EIS were specifically written to address Mr. Dexter's comments. See also the responses to additional comments made by Mr. Dexter in comment letter CW in this appendix. See the response to comment BF-7 regarding design differences that make SRP reactors less susceptible to accidents resulting from inadequate cooling (TMI type of accident) than commercial power reactors.

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
EO-8	This draft EIS is deficient in many aspects. There is no discussion of the operations required to supply fuel to the reactor. In particular, it is shown here that the mining of uranium for one year's fuel supply will lead to at least 121,000 deaths. There is no consideration of the environmental impact of the product (plutonium), or of its possible use in warfare. The proposed method of once-thru reactor cooling does not protect the environment. And, finally, the discussion of loss of coolant accident is totally inadequate. This Draft does not satisfy NEPA. Further, the proposed action to restart the L reactor does not satisfy NEPA and other requirements, including the Clean Water Act. I hope that these issues are addressed in a substantive way in the Final EIS, and in the Secretary's decision on restart.	See the responses to comments EO-1 through EO-7.

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses

References

1 Draft Environmental Impact Statement, L-Reactor Operation, Savannah River Plant, Aiken, S.C.; DOE/EIS-0108D, Draft, DOE, September 1983.

2 R. O. Pohl, "Health Effects of Radon-222 from Uranium Mining," Search, 7 (5), 345-350 (August 1976).

3 "Final Generic Environmental Statement on the Use of Recycled Plutonium in Mixed Oxide Fuel in Light Water Cooled Reactors," GESMO, NUREG-0002, NRC (August 1976).

4 "Environmental Analysis of the Uranium Fuel Cycle, Part I - Fuel Supply," EPA-520/9-73-003-B, EPA (October 1973).

5 Draft Environmental Statement Related to the Operation of the Shearon Harris Nuclear Power Plant, Units 1 and 2; NUREG-0972, Draft, NRC, April 1983, Page C-3.

6 Health Effects Attributable to Coal and Nuclear Fuel Cycle Alternatives; NUREG-0332, Draft, NRC (September 1977).

7 "Nuclear Energy - Its Physics and Social Challenge;" David Rittenhouse Inglis, Addison-Wesley, 1973.

Comment number	Comments	Responses
	STATEMENT OF JOHN H. MACLEAN November 11, 1983 Mr. M. J. Sires, III Department of Energy Savannah River Operations Office P.O. Box A Aiken, S.C. 29801 Re: L-Reactor Dear Mr. Sires: There are several points in the draft EIS that should be clarified: 1. On page 2-2 of Volume 1 of the draft EIS it is stated that although theoretically weapon materials, i.e., Plutonium 238 could be produced directly from existing spent fuel from commercial light-water reactors, this is not a practical alternative as the Atomic Energy Act prohibits the use of fuel produced in commercial reactors for the production of weapons.	
EP-1	This statement is misleading. The production of weapons materials from commercial reactors is not theoretically possible - it is possible. Second, commercial spent fuel is just a nicer name for nuclear waste composed in part of plutonium 238 and 240. The L-Reactor will not produce any electricity. *It's only purpose is to produce nuclear waste composed of this* same plutonium 238 and 240. This waste will then be chemically separated so that the 238 becomes concentrated with a low percentage of 240 remaining. Technically, the only difference between the two wastes - those produced by commercial reactors and those produced by L-Reactor is that the L-Reactor waste will have a lower amount of 240 prior to chemical separation.	See the response to comment BY-2 regarding the use of spent fuel as a source of plutonium.

Comment number	Comments	Responses
	Commercial waste is readily available. At the moment, no one in government or business has a solution to the problem of permanent disposition of this waste. At the moment, the waste is being buried on the plant site of commercial nuclear reactors. Since they are not designed for this, their lack of land space will force some of them to shut down in the not too distant future. A limited part of the waste is going to Barnwell where the uranium is chemically separated from the plutonium and is re-used. This existing Barnwell operation is almost identical to that contemplated at L-Reactor with the only real difference that legal title to L-Reactor nuclear waste is in the name of the Department of Energy while the other is in the name of Georgia Power, Duke Power, etc. Using commercial waste would mean that the plutonium 238 could be produced without any delay due to problems with containment domes, cooling towers, cesium in drinking water or destruction of 1000 acres of marshland since no re-start of L-Reactor would be necessary. Using commercial waste would mean that commercial reactors would not have to bury their waste on site and possibly have to close down as space runs out. Instead, it can be shipped to Savannah River Plant or Barnwell for separation. The bottom line is that it will save everyone money by using commercial waste. It will save the power user as commercial reactors will have a longer life. It will save the government money by not having to pay for restart construction, possibly cooling tower or containment dome. Certainly it will save money as far as holding public hearings and writing environmental studies ad nauseam. The only people who might lose money is DuPont. Finally, it will save the people of Beaufort, Port Wentworth, Savannah and Augusta their peace of mind and maybe their health. Your response that the law forbids it cannot go unanswered however. At page S-1 of volume I of the Draft EIS you quote President Reagan to wit: "As a matter of policy, national security requirements, not arbitrary constraints on nuclear availability...shall be the limiting factor in the nuclear force structure."	

Comment number	Comments	Responses
	Running throughout the EIS is the theme that there can be no delay as to start up of the L-Reactor for our national security is at stake. If this is true, I can see no opposition from President Reagan (not from Congress considering their vote on the military budget) for an amendment to the Atomic Energy Act allowing commercial waste to be reprocessed so as to separate out plutonium 238. If our national security was at stake in 1980 surely it was worth a try to amend the Act, since if successful, no delay in upgrading our weapons would have occurred. As it is, the DOE's proposal to restart L-Reactor has resulted in a delay of weapons upgrading from 1980 to 1984 - the projected starting date of the L-Reactor. Please comment on the above as well as what efforts have been made to allow commercial waste to be used in weapons material production.	
EP-2	2. Another point that needs classification is the number of cancer deaths and genetic defects that will result because of the L-Reactor. At one point in the EIS it is mentioned that there will be 4 per thousand cancer deaths per year and 7 per thousand genetic defects. (page 5-17) At other places these figures are mentioned as excess deaths. If the figures are really based on per thousand population you can't be asking 400 Savannahians to die a year and 700 babies to have defects because of the L-Reactor? You must mean the percentages are based on existing cancer deaths and defects. You need to clarify in the final EIS exactly how many cancer deaths and defects can be expected in the population from Augusta to the coast. Also explain the different figures on pages 5-17 and 5-19 for these.	See the response to comment CT-1.
EP-3	3. Your main reason for not building a cooling tower is that it will delay L-Reactor startup, i.e., national security considerations. You do not deny that a cooling tower will mean lower amounts of water being pulled from the Savannah River, or that Steel Creek will be less affected with the consequence that the cesium in the bed will not be flushed out into the Savannah River. I can find no reason for the cooling tower not being built. You state in the EIS that it could be built in 18 months and then simply cut into the L-Reactor system. Thus,	See the responses to comments AA-1 and AB-13 regarding cooling-water mitigation alternatives. NUS Corporation did not "recommend" cooling towers as a preferred alternative. The preliminary presentation to DOE-SR prepared by NUS and as acknowledged by NUS used engineering and environmental factors that were treated with equal weight. The fact that cooling towers ranked higher was an output of the rating system employed and was not a sufficient basis for a

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
	you could have no delay in the startup and 18 months from now you could simply cut it in. This would protect Beaufort and Port Wentworth's drinking water. The 39 million cost is negligible considering the cost of startup and the protection a cooling tower would give. Furthermore, your own consultants (NUS) recommended it.	recommendation. Since the NUS presentation additional alternative cooling-water systems have been analyzed. Also see the response to comment AA-1 regarding cooling-water alternatives.
EP-4	4. You have not adequately explained how the cesium got into Steel Creek. Obviously there have been leaks from the primary coolant to the secondary coolant to Steel Creek. Why not have a third loop in the cooling system and have monitors in the secondary and third cooling loops to detect leaks? A cooling tower would also help in this regard as it could serve as a last resort holding tank before Steel Creek in case of a major leak.	Discussions on the cesium-137 releases from P- and L-Areas to Steel Creek are provided in Sections 3.7.2.1 and D.1.1. As contained in these sections, these discharges resulted from leaking reactor fuel elements with cladding failures that exposed the underlying fuel to the spent fuel storage and disassembly basin water, and not from leaks between primary and secondary cooling-water systems.
EP-5	5. Nowhere in your EIS do you explain what has been done to the L-Reactor. As I understand it, the pipes were rusting and pigeons were nesting in the reactor. Certainly there had to be metal fatigue from the 12 years of operation. Please explain what parts of the L-Reactor were refurbished or replaced for startup, as it bears on the safety aspect of the system.	See the response to comment CF-3 regarding the scope of L-Area restoration and safety improvements, and the response to comment CU-3 concerning metal fatigue and effects of neutron radiation upon the reactor tank.
EP-6	6. Nowhere in the EIS do you explain why plutonium from the old bombs and missiles you seek to replace cannot be reused rather than making new plutonium. This needs to be addressed.	See the response to comment BL-19 regarding use of material from retired weapons. Additional information on this subject has been included in Section 1.1 of this EIS.
EP-7	7. Prior to the refurbishing of the L-Reactor, the monitors for alpha and other radiation were TLD's which are inadequate as they take a cumulative measurement, not an instantaneous one. Furthermore, they were located on the perimeter, not in the stock area. From now on you are going to use gamma spectrometers which are more accurate. However, are not your figures in the EIS for radiation dosage based on the inaccurate TLD measurements of past years and thus, unreliable?	The TLD's referred to are used in the environmental radiological monitoring program. This program is designed to monitor concentrations of radioactivity in the environment (air, water, soil, vegetation, and animals) outside SRP facilities and associated gamma radiation levels, and will be continued to be used in this manner. The results of the monitoring program are reported annually, as in the 1982 annual report, DPSPU 83-30-1, entitled Environmental Monitoring in the Vicinity of the Savannah River Plant. The environmental radiological monitoring program is different from the radioactive effluent monitoring program. The latter is designed to characterize and quantify airborne and liquid radioactive releases from SRP facilities. The radioactive

Comment number	Comments	Responses
		effluent monitoring program is described in Section G.3.1.5 of the EIS. Included in this program are continuous in-stack monitors for gaseous radioactive releases, using gamma spectrometry and for tritium using ion chambers. Particulate releases that would include alpha emitters are monitored based on the analysis of periodic filter samples drawn from the stack. The radioactive effluent monitoring program planned for L-Reactor is similar to that used for all SRP reactors in the past. The estimated releases reported in the EIS are based on actual reactor experience in the past at SRP using reliable measurements.
EP-8	8. Your EIS states in essence that security at the SRP is adequate. The enclosed article from the Georgia Gazette of November 3, 1983 says otherwise. Is Representative John Dingell correct that the DOE's own report of January 1983 concluded that safeguards were "a shambles?" Why does the EIS say otherwise?	DOE is in compliance with the agency's orders regarding safeguards and security. This topic is discussed briefly in the EIS to inform the reader that appropriate measures are being followed.
EP-9	9. The final EIS should contain the list of radiation doses considered safe by the NRC in 10 CFR 20. Although the EIS virtually drowns the reader in figures, they are meaningless without a guide as to how many rems are considered safe. You should put the NRC's tables in the EIS and also state how DOE differs from those and why you are following DOE's safety standards, not NRC's. Also, a definitional section would be very helpful for the public to understand rad, rem, curie, etc. As it stands now the EIS is unreadable as it consists of mostly chart after chart with little explanation. You should gear the final EIS to layman's level even if it takes a dozen volumes to do it. I enclose copies of 10 CFR 20 which I think should be included.	The DOE radiation protection guides (DOE Order 5480.1A, Chapter 11) are comparable to the NRC dose limits contained in 10 CFR 20 for a production facility. Also see the responses to comments BF-6 through BF-8 regarding radiation protection standards and differences between SRP and commercial light-water reactors. Volume 1 of this EIS contains a glossary of technical terms used in this EIS. The summary, located in the front of this EIS, has been revised in an attempt to provide a more readable summation for the lay reader.
EP-10	10. Nowhere in the EIS does it mention what result the L-Reactor will have on the industries down river. Many industries such as Savannah Foods and Union Camp use this water in production. If cesium radiation is a concern to the	The same detection of liquid radioactive releases to the Savannah River assumed for evaluating downstream drinking water concentrations would apply to water used for industrial purposes downstream. Since the resulting concentrations of

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
	communities drinking from the Savannah River is it not also a concern of industry. What effects will the radiation have on industrial water use?	radionuclides are well below EPA drinking water standards and associated radiation doses are low, L-Reactor startup and operation will not affect the suitability of the water for industrial use.
EP-11	11. Doesn't thermal discharges contemplated because of the L-Reactor exceed limits for class B streams currently set by the S.C. Department of Health and Environmental Control? How are you going to get around this in order to get a permit?	See the response to comment AA-1 regarding issuance of an NPDES permit for thermal discharge.
EP-12	12. Doesn't the effects of a meltdown at L-Reactor exceed those permitted by NRC in 10 CFR 100? Why not comply with NRC's figures even though you are not required? Also, doesn't the cumulative radiation dose following startup exceed by a factor of 2 NRC standards? Again, why not comply?	See the responses to comments BL-2 and BL-11 for L-Reactor's ability to meet dose criteria of 10 CFR 100. See the responses to comments BF-6 through BF-8 regarding the comparability of DOE and NRC radiation protection standards.
EP-13	13. The final EIS should explain in its "Accidents which have happened" section how the SRP released 479,000 curies of tritium into the atmosphere in 1974, the largest of any nuclear facility in history. How did it happen and what prevents it from happening again?	See the responses to comments AB-10 and BA-4 regarding tritium releases.
EP-14	14. Please give details in the final EIS of where you will be drawing your operators from and the experience and training they will have. The TMI accident was compounded by operator error because of inadequate training. L-Reactor cannot afford that.	The program to staff and train sufficient operating personnel was initiated in 1980 along with the program to refurbish the reactor. All supervisors and operators that will be responsible for operating L-Reactor will have been fully trained and certified in accordance with SRP's formal training program. All will have on-the-job operating experience obtained at the operating SRP reactors along with special training on the minor differences between L-Reactor and the other three SRP reactors.
EP-15	15. Would you consider making available a guided public tour through the L-Reactor on specific dates as the concerns of those at the hearings might be calmed by actually viewing the safety systems?	Tours of the SRP facilities (including L-Reactor) are restricted due to security requirements. DOE, will provide lectures to interested persons, groups, and organizations on request.

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
EP-16	16. Finally, the real problem, with the startup of the L-Reactor is that the L-Reactor is not the problem. Instead, it is the millions of gallons for high and low level radioactive waste that are stored in the ground. You should just move it to some salt mine in Nevada and get it away from population centers and the Tuscaloosa acquifer. It doesn't matter how careful you are, danger exists of a leak and subsequent poisoning of the aquifer. The result will be to turn coastal Georgia and South Carolina into a desert. Already toxic chemicals from the M-area seepage basin have contaminated the aquifer (Vol. III, page D-83, EIS) and wells have been closed in towns near SRP (Sav. Morning News, 5/8/83). Very truly yours, John H. Maclean JHM/ah cc: Sen. Mack Mattingly	As discussed in Section 5.1.2.8 of the EIS, operation of L-Reactor will produce 380-760 cubic meters of concentrated high-level waste each year. The Defense Waste Processing Facility, now under construction is scheduled to commence processing this waste into borosilicate glass beginning in 1989-90 for eventual disposal in a Federal geologic repository. No liquid low-level waste is expected to result from L-Reactor operation. No wells have been closed in any towns near SRP due to contamination from SRP, nor has there been any evidence of such contamination. See the response to comment AJ-1 regarding ground-water contamination.

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses

STATEMENT OF JOHN M. CROOM

QUANTITATIVE APPLICATIONS
Environmental and Statistical Sciences
1000 Montreal Rd. 55A
Clarkston, Ga. 30021

November 14, 1983

Mr. M. J. Sires, III
Health, Safety and Environment (DOE)
Savannah River Operations Office
PO Box A
Aiken SC 29801

Dear Mr. Sires:

I am pleased to submit these comments prepared for Energy Research Foundation on the DEIS for L-Reactor, Savannah River Plant. These comments are in addition to my comments on Appendix D submitted directly by Energy Research Foundation. These comments pertain to impacts to fish populations and focus on portions of Volume 1: Sections 3 and 5.

I have a Ph. D. in biology and have worked in radiation ecology, population modeling and environmental impact assessment as a consultant for the last seven years. I have served as a technical witness before EPA and FERC and have considerable experience in preparation and review of environmental impact statements. I hope that my comments are of use to you in preparation of the EIS for L-Reactor operation.

Sincerely,

John M. Croom

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
	Comments to DEIS L-Reactor	
EQ-1	Population impacts to Savannah River fish species includes those killed directly (entrainment and impingement) and population reduction resulting from habitat destruction and concomitant reduction in biological energy input (allochthonous detritus). The DEIS does not estimate total impact as it fails to take into account habitat destruction and impingement, and the effects each has on the size of fish populations in the Savannah River. Only entrainment is estimated as a percentage impact on upper Savannah River fish species (19% for C-, K- and L-Reactors inclusive).	The cumulative impact of impingement on Savannah River fishes due to L-Reactor operation is described in Section 5.2.5.3 of the EIS. The impact of direct discharge on the fishes of Steel Creek and swamp are discussed in Section 4.4.2 and 5.2.5.1. The determination of the total size of the fish population in the Savannah River is beyond the intended scope of the extensive fishery studies being conducted by both the DOE and the Georgia Department of Natural Resources. However, Section 6.1.3 of the EIS describes the 2-year comprehensive cooling-water study which will assess the entrainment, impingement, and thermal impacts of SRP operations on river fish populations from Augusta downstream to the area of salt water intrusion (River Mile 40). The State of South Carolina, the State of Georgia, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers are participating in this study.
EQ-2	Currently, approximately 1400 acres of SRP wetlands are thermally impacted as a result of once through cooling; operation of L-Reactor as proposed will increase this to a total of approximately 2100 acres or 10% of all SRP wetlands with access to the Savannah River. SRP wetlands are essentially the uppermost wetlands of the Savannah River as (1) Hartwell Reservoir is only approximately 40 km upstream from which little organic matter is contributed to the Savannah River, and (2) the 40 km of the Savannah River above SRP has little wetlands because it is in the piedmont (most wetlands occur in the coastal plain). Wetlands serve as primary processors of allochthonous detritus and breeding, nursery and feeding areas for native and migratory fish species of the Savannah River. Destruction of wetlands must be taken into account in the EIS as an impact to Savannah River fish populations; in the DEIS, wetland destruction is not related to fish populations.	The impacts of wetland losses as related to river fish populations due to the operation of L-Reactor are described in Chapters 4 and 5 and Appendices C and I of the EIS. Also see the responses to comments DR-1 through DR-3 regarding wetlands and fishery impacts.

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
EQ-3	Total fish population impact of L-Reactor operation must include all impacts associated with water withdrawal from the Savannah River; the DEIS only addresses entrainment in a way that results in a quantitative estimate of population impact. The DEIS provides an estimate of total fish (by species) expected to be impinged at L-Reactor and a total for all reactors but fails to relate total impingement to fish population impact. Fish surveys during 1982 and 1983 included unit-area electro-fishing and hoop net collection. Hoop net collections could have been used for a mark/recapture program but, if it was not done, it is too late now. Population estimates of fish species can be obtained by scaling up the numbers of each species collected in unit-area electro-fishing. While such population estimates may be inaccurate due to collection method, the estimate could be used to estimate impingement impact and would be better than nothing. If extrapolation from electro-fishing collections is considered imprudent because of method shortcomings, impingement impact can be estimated as a ratio of impingement/entrainment from studies in similar rivers or southeastern US cooling reservoirs. It is essential that fish population impact be assessed as "total expected population reduction" from all causes. Adding impingement and habitat destruction to the 19% entrainment impact may result in a total population reduction as high as 30%. Such an impact would be dangerous to the viability of upper Savannah River fish populations. Impacts less than this possible impact have resulted in decisions to obviate the impact through construction of cooling towers or other alternatives to once-through cooling.	A mark-recapture program was included in the adult fish surveys for both 1982 and 1983 using hoop nets and electrofishing. However, sufficient numbers of recaptures were not achieved to provide a statistically valid estimate of the adult fish population. Furthermore, in an open system such as the Savannah River, mark-recapture techniques for estimating fish populations are extremely difficult because they are often biased, inconclusive, and unrepresentative. Therefore, it was not possible to evaluate impingement impact on the total fish population in the Savannah River. Fish impingement at the SRP, however, is very low, rarely exceeding 1-2 pounds per day. Also see the responses to comments AA-1, AB-13, and EQ-1 (above).

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
	Department of the Army Savannah District Corps of Engineers P.O. Box 889 Savannah, Georgia 31402 November 14, 1983 Reply to Attention of: Planning Division Mr. M. J. Sires, III Assistant Manager for Health, Safety and the Environment Savannah River Operations Office P.O. Box A Aiken, South Carolina 29801 Dear Mr. Sires: Reference is made to letter from Mr. Richard P. Denise of your office dated September 23, 1983, which was sent to the Office of Chief of Engineers, Washington, D.C. The Savannah District, U.S. Army Corps of Engineers, has reviewed the Draft Environmental Impact Statement (EIS), "L-Reactor Operation, Savannah River Plant, Aiken, South Carolina." The restart of the L-Reactor will not affect any structures or operations within the authority of the Savannah District. The Charleston District is responsible for any permit actions associated with the restart of the L-Reactor. We have no additional comments to make at this time; however, we would like to receive a copy of the Final EIS when it becomes available. Thank you for the opportunity to comment. Sincerely, Charles E. Dominy Colonel, Corps of Engineers Commander	Comments noted.

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
	STATEMENT OF ROBERT ALVAREZ Environmental Policy Institute 317 Pennsylvania Ave., S.E. Washington, D.C. 20003 November 14, 1983 Mr. M. J. SiresSavannah River Plant Department of Energy PO Box A Aiken, South Carolina Dear Mr. Sires: On behalf of the Environmental Policy Institute, a Co-Plaintiff on the L-Reactor lawsuit, I wish to make the following comments relative to the Draft Environmental Impact Statement (EIS) on the L-Reactor start-up at SRP: For the past three years, EPI has been seeking and analyzing environmental radiation mointoring and release data, collected by the E. I. du Pont de Nemours and Co. for the federal government, from pre-plant operations (1951) to the present.	
ES-1	After reviewing the draft EIS for the L-Reactor start-up, we find that the DOE has failed to address the cumulative dose to the public from SRP operations since the 1950's. The draft EIS appears to only address the recent operating history of SRP.	See the response to comment AB-17 regarding documentation of prior radioactive releases and doses.
	EXTERNAL GAMMA RADIATION	
ES-2	Measurements of environmental gamma radiation taken by Du Pont for the federal government covering the period 1956-59 (the first half of SRP's operating history) have been analyzed by EPI. After adjusting for improved monitoring techniques and shielding from buildings the collective gamma dose to residents in the vicinity of SRP during this period ranges from 170,000 to 280,000 person-rems. Without adjusting for shielding, the collective dose is 420,000 person-rems.	External gamma dose measurements made in the SRP site vicinity do not distinguish between sources, but include contributions from all sources. However, the most significant contributor to these external gamma dose rates is natural background radiation consisting of cosmic radiation and terrestrial radiation as discussed in Section 3.7.1.2. The contribution of radioactive releases from SRP facilities to the external gamma dose rates is less than 0.1 percent. Doses due to fallout reported in

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses
	There are three possible explanations for these doses: (a) Releases from SRP facilities; (b) fallout from atmospheric nuclear weapons explosions or; (c) a combination of the two. The evidence, however, suggests that SRP is the principal source of these doses. Integrated external "excess" doses measured around SRP do not agree with weapons test fallout measurements taken at comparable locations leaving more than 85% of the gamma dose around SRP unexplained.(1) Moreover, less than 0.02% of the theoretical annual production of short-lived noble gases in five SRP reactors could have caused this exposure.(2)	the literature are not directly measurable in terms of gamma dose rates. Radioactivity associated with fallout is measured in terms of concentrations in air, water, soil, and vegetation. Doses associated with fallout are then calculated by considering exposure of individuals by the inhalation, ingestion, and external exposure pathways. Most of the doses associated with fallout determined in this manner are due to inhalation and ingestion of radioactive fallout particulates, and not external exposure.
	HEALTH EFFECTS	
ES-3	The health effects from gamma doses measured in the vicinity of SRP can be estimated on the basis of dose-risk relationships established by various scientists and committees. The numbers vary substantially. Underscoring the wide range of uncertainty relative to radiation risk estimates are major contradictions discovered recently in dosimetric (3), cancer incidence(4), and non-cancer data (5) on the Japanese atomic bomb survivors. These contradictions have effectively rendered all BEIR, UNSCEAR, and ICRP risk estimates to be tenuous at best. Moreover, direct observations of humans exposed chronically to low-dose ionizing radiation show higher risks by at least a factor of ten and have raised serious doubts about extrapolating mutational effects from groups who have received tissue destructive-high-doses. Thus it is more appropriate to approach health effects in the context of SRP by examining the range of risks. In this regard, the BEIR II Committee in its 1972 report expresses a value of 360 x 10^{-6} cancers per rem.(6) The 1980 BEIR III report because of a failure to reach consensus does not give a uniform recommendations.(7) K. Z. Morgan derives from the Hanford Survey of Mancuso, Stewart and Kneale a dose-risk relation of 7000 x 10^{6} cancers per rem.(8)	The understanding of the biological effects of ionizing radiation is quite substantial. The subject has received intense review by the National Academy of Sciences and continues to receive intense review. The NAS Committee on the Biological Effect of Ionizing Radiation (BEIR) in the BEIR III report revised donward their earlier assessment of health effects for a given exposure level of radiation in the BEIR II report. From statistical analyses there is no correlation of actual cancer death rates with radiation for regions of the U.S. (Denver, western mountain states) in which the background radiation levels are well in excess of the average radiation exposure in the U.S. Also see the responses to comments AB-12, AB-17, and AV-8 regarding the BEIR III report and the effects of SRP releases.

Comment number	Comments	Responses
ES-4	Under this range of risk coefficients, the lower population dose estimate (170,000 person-rems) is expected to yield 61 to 1000 additional cancer deaths. For the higher population dose estimate (280,000 person-rems), the respective range would be between 100 and 2000 additional fatal cancers. By not adjusting for shielding from buildings (420,000 person-rems) the expected range is 151 to 2940 excess fatal cancers. By contrast, the du Pont Co., based on a recent draft report on crude mortality rates in the vicinity of SRP (9) suggests the average annual collective dose from SRP from environmental exposures to be 225 person-rems; and from fallout to be 2070 person-rems. However, these estimates are not reconciled with Du Pont's own environmental gamma measurements, particularly those taken during the first half of SRP's operating history.	See the responses to comments ES-2 and ES-3.
	OTHER EXPOSURE PATHWAYS	
ES-5	An estimate of the radiation dose due to other radionuclides and exposure pathways, over the entire operating period, is hardly possible because of insufficient information and missing monitoring data in the 1950s. Moreover, continuous milk sampling did not begin at SRP until 1962. However, during the first years of SRP's operations emissions of radioiodine, tritium, and non-volatile beta emitters were substantially higher than they are today. This led to significant contamination of food products from tritium, strontium-90, cesium-137, and radioiodine. (10). This concludes my comments. Sincerely, Robert Alvarez Director, Nuclear Weapons and Power Project	See the response to comment AB-17 regarding documentation of prior SRP releases and effects.

Comment number	Comments	Responses

ENDNOTES:

1. Bernd Franke and Robert Alvarez, "Analysis of External Gamma Radiation Monitoring Around the Savannah River Plant," November 1983, Environmental Policy Institute, Washington, D.C. 20003.

2. Ibid.

3. Eliot Marshall, "New A-Bomb Studies Alter Radiation Estimates," Science, May 1981.

4. Edward Radford, Science, August 7, 1981.

5. Alice M. Stewart, "Delayed Effects of A-Bomb Radiation," British Journal of Epidemiology and Community Health, June 1982. A. M. Stewart, "Non-Cancer Effects of A-Bomb Radiation," Brit. J. Epid., in press.

6. Committee on the Biological Effects of Ionizing Radiation (BEIR); The Effects of Low Levels of Ionizing Radiations, Washington, D.C., National Academy of Sciences (1972).

7. Committee on the Biological Effects of Ionizing Radiation (BEIR); The Effects on Populations from Exposure to Ionizing Radiations," 1980, National Academy Press, Washington, D.C. (1980).

8. Karl Z. Morgan, "Risk of Cancer from Low Levels of Exposure to Ionizing Radiation," Bulletin of Atomic Scientists, September 1978.

9. Herb Sauer et al., "The Risk of Death in Counties near the Savannah River Plant," (Draft) 19, October 1983, prepared for the E. I. du Pont de Nemours Co. (see Table 3.3).

10. Ulrike Dettmer and Bernd Franke, "Analysis of Radiological Monitoring in the Vicinity of the Savannah River Plant, 1955-79, Progress Report," Prepared for the Environmental Policy Institute, Washington, D.C.

Comment number	Comments	Responses

Figure 1. Radiation Background Monitoring Locations

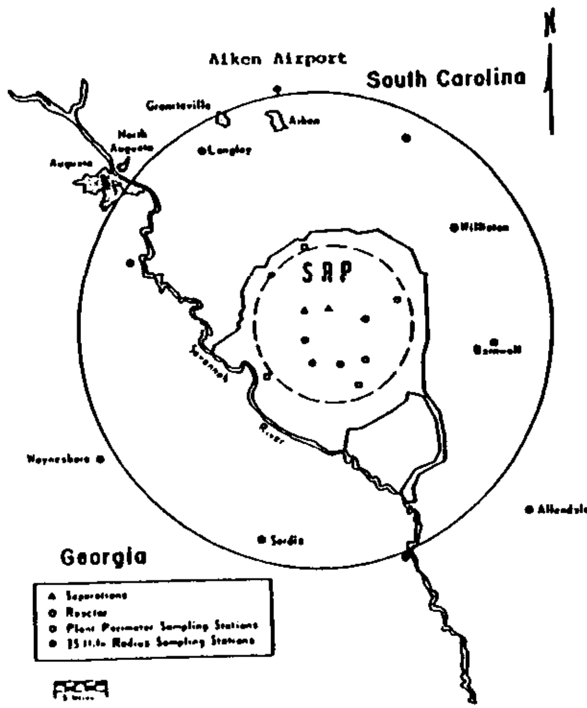


Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses

Table 1. List of Locations for External Gamma Radiation Measurements at the Savannah River Plant

REACTOR AREA

- R-Reactor
- P-Reactor
- L-Reactor
- K-Reactor
- C-Reactor

SEPARATION AREA

- F-inside
- F-outside (1-mi)
- H-inside
- H-outside (1-mi)

PLANT PERIMETER

- Allendale Gate
- A-14
- Barnwell Gate
- D-area (-400 area)
- Dark Horse
- Dunbarton Fire T.
- East Talatha
- Green Pond Church
- Highway 21/167
- Jackson
- Military Recr.Site
- Pattersons Mill
- Talatha Gate
- TC-area
- West Jackson
- Windsor Road
- Williston Gate
- 300/700-area

25 MILE RADIUS

- Aiken Airport
- Aiken State Park
- Allendale
- Augusta
- Barnwell
- Bushfield
- Highway 301
- Langley
- Lees
- Olar
- Perkins
- Sardis
- South Richmond
- Springfield
- Waynesboro
- Williston

100 MILE RADIUS

- Columbia
- Greenville
- Macon
- Savannah

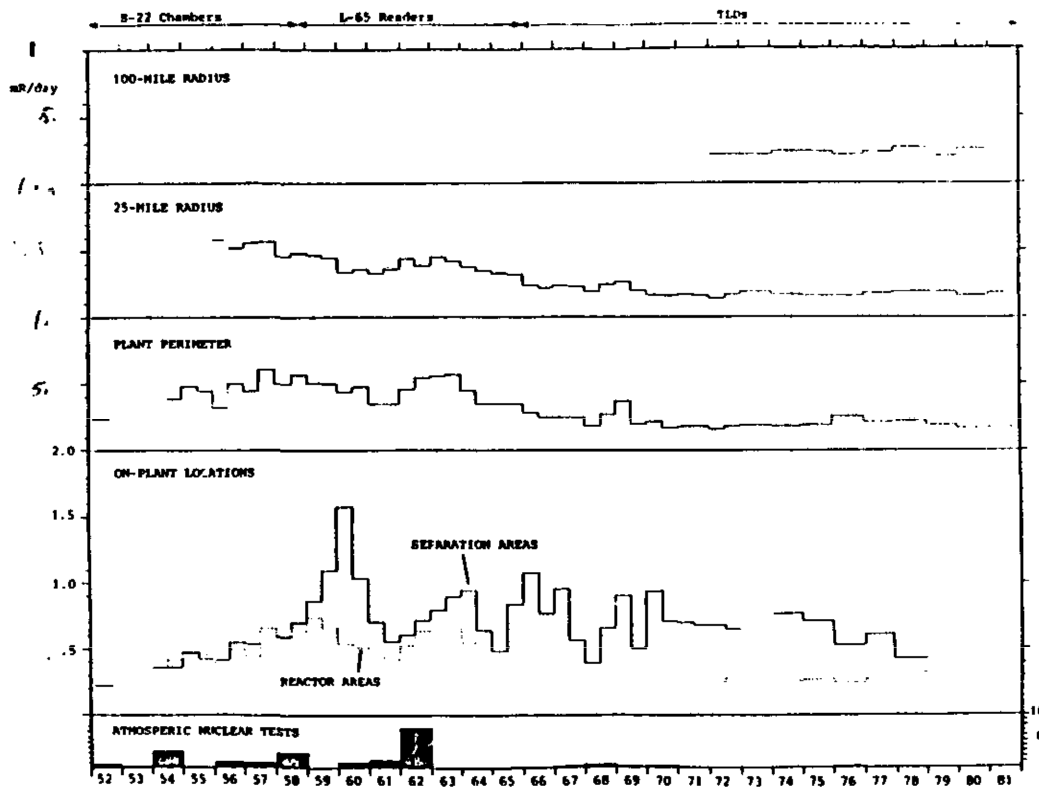
Comment number	Comments	Responses

Table 2. Environmental Gamma-Radiation Levels at the SRP Area

Period	Reactor Areas	Separation Areas	Plant Perimeter	25-mile Radius	100-mile Radius	Reference
Feb-Sept 52	0.22	0.22	0.24	--	--	6
Jan-Jun 53	--	--	--	--	--	-
Jul-Dec 53	--	--	--	--	--	-
Jan-Jun 54	0.37	0.37	--	--	--	7
Jul-Dec 54	0.42	0.37	0.39	--	--	8
Jan-Jun 55	0.48	0.47	0.48	--	--	9
Jul-Dec 55	0.46	0.43	0.45	--	--	10
Jan-Jun 56	0.40	0.42	0.37	--	--	11
Jul-Dec 56	0.50	0.55	0.50	0.52	--	12
Jan-Jun 57	0.45	0.54	0.45	0.56	--	13
Jul-Dec 57	0.66	0.66	0.61	0.57	--	14
Jan-Jul 58	0.60	0.59	0.50	0.46	--	15
Jul-Dec 58	0.64	0.71	0.57	0.48	--	16
Jan-Jun 59	0.74	0.87	0.51	0.47	--	17
Jul-Dec 59	0.66	1.10	0.50	0.45	--	18
Jan-Jun 60	0.54	1.58	0.44	0.34	--	19
Jul-Dec 60	0.52	0.94	0.48	0.36	--	20
Jan-Jun 61	0.49	0.71	0.35	0.33	--	21
Jul-Dec 61	0.43	0.56	0.35	0.36	--	22
Jan-Jun 62	0.53	0.61	0.46	0.44	--	23
Jul-Dec 62	0.64	0.72	0.55	0.39	--	24
Jan-Jun 63	0.66	0.80	0.56	0.45	--	25
Jul-Dec 63	0.69	0.90	0.57	0.42	--	25
Jan-Jun 64	0.55	0.95	0.45	0.38	--	26,39
Jul-Dec 64	--	0.64	0.35	0.35	--	39
Jan-Jun 65	--	0.49	0.35	0.33	--	40
Jul-Dec 65	--	0.84	0.35	0.32	--	40
Jan-Jul 66	--	1.08	0.28	0.24	--	41
Jul-Dec 66	--	0.77	0.25	0.22	--	41
Jan-Jun 67	--	0.96	0.25	0.24	--	42
Jul-Dec 67	--	0.57	0.25	0.23	--	42
Jan-Jun 68	--	0.40	0.19	0.19	--	43
Jul-Dec 68	--	0.66	0.27	0.25	--	43
Jan-Jun 69	--	0.91	0.37	0.27	--	44
Jul-Dec 69	--	0.51	0.20	0.20	--	44
Jan-Jun 70	--	0.94	0.22	0.17	--	45
Jul-Dec 70	--	0.71	0.17	0.16	--	45,38
Jan-Jun 71	--	0.70	0.18	0.17	--	46
Jul-Dec 71	--	0.68	0.18	0.16	--	46
Jan-Jun 72	0.25	0.68	0.16	0.14	0.21	47
Jul-Dec 72	0.28	0.65	0.18	0.17	0.21	47
Jan-Dec 73	--	--	0.19	0.19	0.21	48
Jan-Dec 74	0.26	0.77	0.18	0.17	0.23	49
Jan-Dec 75	0.27	0.71	0.19	0.16	0.23	50
Jan-Dec 76	0.25	0.53	0.25	0.16	0.21	52
Jan-Dec 77	0.27	0.61	0.21	0.18	0.23	53
Jan-Dec 78	0.32	0.43	0.22	0.19	0.26	54
Jan-Dec 79	--	--	0.19	0.19	0.20	64
Jan-Dec 80	--	--	0.16	0.16	0.25	65
Jan-Dec 81	--	--	0.17	0.18	0.21	66

Comment number	Comments	Responses

Figure 2. Summary of Gamma-Radiation Measurements at the Savannah River Plant 1952 - 1981.



Comment number	Comments	Responses

Figure 3. Gamma-radiation from Deposited Fall-out at Grove, UK from 1951 to 1968; from /72/

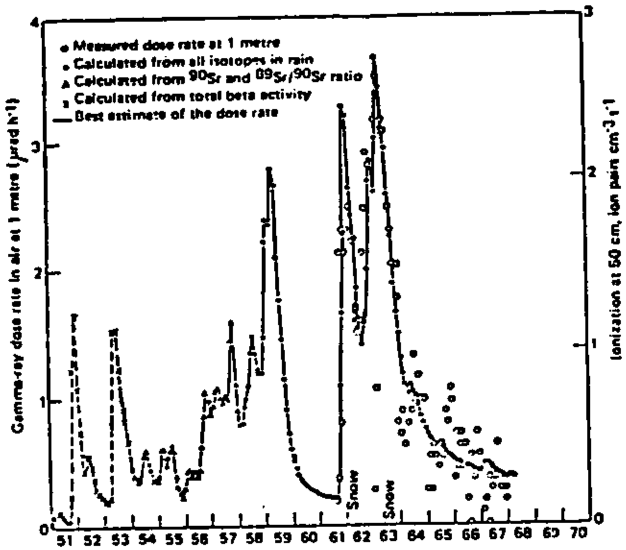


Table 3. External Infinite Gamma-Doses (mrad) Extrapolated from Gummed Film SR-90 Fallout Data /74/

Period	Atlanta, Georgia	Cap Hatteras, N.C.
pre- 1954	3.7	4.8
1954	4.1	3.4
1955	13.2	7.4
1956	8.0	5.5
1957	13.4	11.4
1958	11.9	6.8
1959	13.7	13.1
total	68.0	52.0

Comment number	Comments	Responses

Table 4. Noble Gas Releases by SRP Operation

Year	^{41}Ar	^{85m}Kr	^{85}Kr	^{87}Kr	^{88}Kr	^{131m}Xe	^{133}Xe	^{135}Xe	^{129}I	^{131}I	[illegible]
1971	1.4+5*	3.1+3	6.4+5	--	1.7+3	1.1+3	2.5+4	2.9+3	2.1-1	2.7+1	46
1972	1.7+5	7.3+3	6.0+5	2.5+3	4.2+3	2.9+2	3.9+4	1.1+4	2.1-1	2.7+0	2
1973	1.8+5	6.5+3	7.7+5	2.0+3	7.4+3	5.1+2	2.2+1	9.4+3	2.1-1	1.9+0	58/49
1974	1.1+5	1.3+3	5.0+5	6.4+2	1.4+3	1.4+2	5.5+3	2.2+3	1.7-1	1.9+0	59
1975	6.5+4	3.7+2	5.2+5	1.2+3	8.6+2	5.0+0	1.1+3	7.3+2	1.4-1	1.2-1	60
1976	8.4+4	3.8+2	7.4+5	4.2+2	5.1+2	6.3+2	2.5+1	7.3+2	1.5-1	1.6-1	61
1977	6.5+4	8.4+2	4.4+5	6.0+2	6.7+2	1.2+1	2.3+3	1.5+3	1.4-1	6.1-2	62
1978	5.3+4	8.9+2	5.3+5	5.6+2	8.4+2	7.1+0	2.2+3	1.7+3	1.3-1	6.5-2	63
1979	5.3+4	1.8+3	4.8+5	1.5+3	2.3+3	9.1+0	5.1+3	4.5+3	1.3-1	8.1-2	64
1980	7.0+4	3.2+3	5.8+5	2.8+3	4.0+3	1.9-1	7.8+3	6.4+3	1.6-1	2.0-2	[illegible]
1981	6.2+4	1.3+3	8.4+5	8.7+3	1.5+3	6.1+0	3.9+3	2.5+3	1.6-1	4.7-2	66

Remarks: Data on noble gas releases before 1971 is unavailable

* see 1.4 x 10^5

Comment number	Comments	Responses

Table 5. Potential Radiation Doses due to Short-Lived Noble Gases Produced at SRP Reactors

Nuclide	Production rate per year (Ci) [1]	person-rem per Ci released [2]	theoretical population dose for 100% release (person-rem) [3]
Kr-87	4.5×10^{11}	1.1×10^{-4}	5.0×10^{7}
Kr-88	4.3×10^{11}	4.0×10^{-4}	1.7×10^{8}
Xe-133	2.1×10^{10}	4.2×10^{-5}	8.8×10^{5}
Xe-135	3.6×10^{10}	8.7×10^{-5}	3.1×10^{6}
Total			2.2×10^{8}

1) 5 reactors with 2.150 MWth and 75% capacity each data from /81/

2) data from /64/

3) without radioactive decay

Table M-2. DOE responses to comments on Draft EIS (continued)

Comment number	Comments	Responses

Table 6. Major Sources of Population Exposure

Table 6r FROM: Sauer et al., "The Risk of Death in Counties Near the Savannah River Plant" (Draft) October 1983. Prepared for E.I. du Pont de Nemours and Co.

Major Sources of Population Exposure

Source of Exposure	Dose to Average Individual, mrem/yr[a]	Population Dose, man-rem/yr: 50 Mile Radius	Population Dose, man-rem/yr: Beaufort and Jasper Counties
Natural Background			
Cosmic Radiation	31.5[b]		
External Terrestrial Gamma	33.0[b]		
Internal Terrestrial	28.0		
Total	92.5	41625	5550
Medical			
Diagn X-rays	77.3[c]		
Radiopharmaceuticals	13.6[c]		
Medical and Dental Personnel	0.36[c]		
Total	91.3	41085	5476
Weapons Test Fallout	4.6	2070	276
Consumer and Industrial Products	4.5	2025	270
Air Travel	0.5[c]	225	30
Nuclear Facilities (other than SRP)	0.2[c](0.0)	90	
Savannah River Plant			
Environmental Radioactivity	0.5(0.7)	225	42
Occupational Exposure	4.0[c](0.0)	1800	-
Total	4.5(0.7)	2025	42
TOTAL	198.1(194.1)	89145	11646

a. Values shown generally apply to both the 50-mile radius and the Beaufort-Jasper population groups. Where different, Beaufort-Jasper dose rates are shown in parentheses.
b. Includes a 10% reduction for cosmic radiation and a 40% reduction for terrestrial radiation to account for shielding by buildings and the body.
c. Prorated over the population.

Comment number	Comments	Responses

Table 7. Potential Natural and Radiation-Induced Fatal Cancers within a 50-Mile Radius of SRP

Average Annual Fatal Cancers per Year	Lower Risk (a)	Higher Risk (b)
Natural Occurance (c)	594	594
Radiation-Induced		
Fallout and/or SRP 170,000 person-rems (d)	4.5	88
Fallout and/or SRP 280,000 person-rems (d)	7.5	145
Percentage of Natural Occurance		
SRP and/or fallout 170,000 person-rems	0.7%	15%
SRP and/or Fallout 280,000 person-rems	1%	24%

(a) Based on the BEIR I probability of 360×10^{-6} cancers per rem.

(b) Based on the Hanford Survey of Mancuso, Stewart and Kneale as interpreted by Morgan in the Bulletin of Atomic Scientists, Sep. 1978 (7000×10^{-6} cancers per rem).

(c) Based on 1959-78 average annual cancer death rates for South Carolina and Georgia estimated by Sauer et al. for E.I. du Pont de Nemours Co., Oct. 19, 1983, (Draft).

(d) Based on environmental measurements collected by SRP.