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NUREG-0692

final environmental statement

related to

STEAM GENERATOR REPAIR

at

**SURRY POWER STATION, UNIT NO. 1
VIRGINIA ELECTRIC AND POWER COMPANY**

JULY 1980

Docket No. 50-280

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U. S. Nuclear Regulatory Commission

Office of Nuclear
Reactor Regulation

This final environmental statement was prepared by the U.S. Nuclear Regulatory Commission staff.

The major issue addressed by this environmental statement was the occupational radiation exposure associated with the proposed Steam Generator Repair Program for Unit 1 of the Surry Power Station.

For further information regarding this environmental review, contact:

Don Neighbors, Project Manager
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555
(301) 492-7037

ABSTRACT

The staff has considered the environmental impacts and economic costs of the proposed steam generator repair at Surry Power Station, Unit 1. In response to a Commission order, the staff has focused this statement on the occupational radiation exposure associated with the proposed Unit 1 repair program and on alternatives to reduce this exposure. The staff has concluded that the proposed repair will not significantly affect the quality of the human environment. Furthermore, any impacts from the repair program are outweighed by its benefits.

SUMMARY

In a letter dated August 17, 1977, Virginia Electric and Power Company (VEPCO) proposed to repair the steam generators in Units 1 and 2 of the Surry Power Station (the Station) (Sect. 2.1). The Nuclear Regulatory Commission staff (the staff) determined that the proposed program would require amending VEPCO's operating licenses for the station, and on October 27, 1977, a Notice of the Proposed Issuance of Amendments to the licenses was published in the Federal Register. The staff issued a Safety Evaluation Report on the proposed program in December 1978 and an Environmental Impact Appraisal and Negative Declaration in January 1979 (Sect. 2.2). Three petitions regarding the program were received and three Director's decisions on these petitions under 10 CFR 2.206 were issued denying the requests. The Nuclear Regulatory Commission (the Commission) reviewed these decisions and issued a memorandum and order directing the Staff to expeditiously prepare and issue an environmental impact statement on the proposed repair at Unit 1 (Sect. 2.3 and Appendix A).

The major issue in this environmental review is the occupational radiation exposure that the Unit 1 repair program will entail (Sect. 2.3).

The staff comparatively evaluated the environmental impacts of the proposed program and the following alternatives to the total program and alternatives within the program:

- (1) Continuation of the present mode of operation
- (2) Shutdown and replacement of the unit with a generating plant of different design
- (3) Decontamination of the steam generators before cutting
- (4) Retubing the existing steam generators
- (5) Complete replacement of the steam generators
- (6) Shorter-term storage of degraded steam generators before removal from site
- (7) Immediate intact shipment offsite
- (8) Immediate cut-up and shipment offsite
- (9) Chemical decontamination followed immediately by cut-up and shipment offsite

The staff found none of the alternatives to be obviously superior to the proposed program. Furthermore, the staff has concluded that the proposed program will not significantly affect the quality of the human environment. The staff has also concluded that any impacts from the proposed repair program are outweighed by its benefits (Sections 4-6).

TABLE OF CONTENTS

SUMMARY

- 1.0 Purpose of this Environmental Statement
 - 2.0 Background
 - 3.0 Description of the Proposed Repair Method
 - 4.0 Environmental Impacts of Steam Generator Repair Project
 - 5.0 Impacts of Alternatives
 - 6.0 Conclusions
 - 7.0 Federal, State, and Local Agencies to Whom this Environmental Statement Was Sent
 - 8.0 Staff Responses to Comments
- APPENDIX A Memorandum and Order by the U.S. Nuclear Regulatory Commission
- APPENDIX B Comments on Draft Environmental Statement

1.0 PURPOSE OF THIS ENVIRONMENTAL STATEMENT

This environmental statement was prepared in response to a Memorandum and Order by the U. S. Nuclear Regulatory Commission, dated March 4, 1980, in the matter of Virginia Electric and Power Company (Surry Power Station, Units 1 and 2). A copy is included in this document as Appendix A.

2.0 BACKGROUND

2.1 HISTORY OF TUBE DEGRADATION IN STEAM GENERATORS

Since the Surry Units began generating power in 1972 and 1973, they have experienced a history of excessive tube degradation in the steam generators, resulting in the condition in which approximately 24 percent of the tubes in Unit 1 and about 21 percent of the tubes in Unit 2 were plugged to prevent the transfer of radioactivity from the primary coolant to the steam system.

The tube degradation is ascribed to a corrosion-related phenomenon called "denting," which involves the buildup of corrosion products in the crevices between the Inconel-600 heat exchanger tubes and the carbon steel tube support plates. As the corrosion product volume expands, the tubes are "dented," and occasionally develop leaks. The plugging of the damaged steam generator tubes affects the thermal and hydraulic performance of the steam generators. Although the Unit 2 steam generators have been repaired, the degradation and resultant plugging of the tubes in the Unit 1 steam generators is continuing, and will soon result in serious and expensive operating restrictions such as derating. Another consequence of the tube degradation is the increased occupational exposure to radiation received by workers during the augmented inspection and plugging operations required on the steam generators because of their degraded condition.

The licensee's proposal to eliminate the tube degradation problem is described in detail in Reference 1, "Steam Generator Repair Program, Surry Power Station, Units 1 and 2," consisting of the original submittal dated August 17, 1977, with revisions dated December 2, 1977; April 21, June 2, June 13, June 30, September 1, October 25, and November 10, 1978.

2.2 THE STAFF'S INITIAL ENVIRONMENTAL REVIEW

In accordance with 10 CFR §50.59 of the Commission's regulations, a licensee seeking to make a change in the Technical Specifications or a change in the facility involving an unreviewed safety question must submit an application for an amendment to the license. On August 17, 1977, VEPCO submitted a request for NRC review and approval required in order to repair the steam generators at the Surry Power Station, Units 1 and 2. It was determined in accordance with 10 CFR §50.59 that such a program would involve an unreviewed safety question and, therefore, would require an amendment of VEPCO's Facility Operating License Nos. DPR-32 and DPR-37 for the Surry plant. In accordance with 10 CFR §2.105, a Notice of the Proposed Issuance of Amendments to the licenses at issue was published in the Federal Register on October 27, 1977 (42 FR 56652). The Notice was also available for public inspection in the Commission's Public Document Room and at the local public document room at the Swem Library, College of William and Mary, Williamsburg, Virginia. This Notice provided an opportunity for interested persons to request a hearing on November 28, 1977. No requests for a hearing were received in response to that Federal Register notice.*

To determine whether an environmental impact statement for the proposed repair program was warranted, the staff prepared an environmental impact appraisal.

In order to provide an independent basis for evaluating the radiological impacts associated with the repair of degraded steam generators at large pressurized water reactors (PWR's) we contracted with Battelle Pacific Northwest Laboratories (PNL) to perform a generic radiological assessment of the steam generator repair and disposal operations. This assessment has been published in an NRC report,² NUREG/CR-0199, "Radiological Assessment of Steam Generator Removal and Replacement."

Information useful to the environmental review was also obtained from the NRC staff's Safety Evaluation Report (SER)³ on the repair project, particularly the sections evaluating (1) the measures to reduce corrosion, (2) the As Low As is Reasonably Achievable (ALARA) considerations, and (3) the radiological consequences of postulated accidents.

*The Atomic Safety and Licensing Board constituted to review requests for a hearing under the October 27, 1977 Federal Register Notice provided the Commonwealth of Virginia the opportunity to file a request for a hearing up to 10 days after issuance of the Staff's Safety Evaluation Report which was issued on December 15, 1978. On December 20, 1978, the Commonwealth stated it would not request a hearing.

Based on the Environmental Impact Appraisal, the staff issued a negative declaration on January 19, 1979, in which it "concluded that an environmental impact statement for this particular action is not warranted because the action will not significantly affect the quality of the human environment."

On the same day, Amendment Nos. 46 and 47 were issued to Facility Operating License Nos. DPR-32 and DPR-37, approving the proposed steam generator repair program, subject to the following conditions:

- (1) All fuel shall be removed from the reactor pressure vessel and stored in the spent fuel pool.
- (2) The temporary containment and ventilation systems shall be operating for all cutting and grinding operations involving components with removable radioactive contamination $>2,000$ DPM per 100 cm^2 .
- (3) The health physics program and procedures which have been established for the steam generator repair program shall be implemented.
- (4) Progress reports shall be provided at 60-day intervals from the start of the repair program and due 30 days after close of the interval with a final report provided within 60 days after completion of the repair. These reports will include:
 - (a) A summary of the occupational exposure expended to date using the format and detail of Table 5.3-1 of the report entitled "Steam Generator Repair Program."
 - (b) An evaluation of the effectiveness of dose reduction techniques as specified in Chapter 6 of the report entitled "Steam Generator Repair Programs" in reducing occupational exposures.
 - (c) An estimate of radioactivity released in both liquid and gaseous effluents.
 - (d) An estimate of the solid radioactive waste generated during the repair effort including volume and radioactive content.

2.3 ACTIONS UNDER 10 CFR 2.206*

By letter dated December 29, 1978, Mrs. June Allen on behalf of the North Anna Environmental Coalition requested that the Nuclear Regulatory Commission prepare an environmental impact statement on the Virginia Electric Power Company's proposed steam generator repair program at the Surry Power Station and hold a Show Cause hearing on this proposed program. This letter was filed pursuant to 10 CFR §2.206 of the Commission's regulations.

In the Director's Decision issued on February 1, 1979, the request was denied.

By letter dated February 20, 1979, the Environmental Policy Institute requested that the Nuclear Regulatory Commission prepare an environmental impact statement on the Virginia Electric Power Company's proposed steam generator repair program at the Surry Power Station and hold a Show Cause hearing on this proposed program. This letter was filed pursuant to 10 CFR §2.206 of the Commission's regulations.

In the Director's Decision issued on April 4, 1979, this request was denied.

By petition dated April 18, 1979, Mr. James B. Dougherty on behalf of four citizen's groups: Potomac Alliance, Citizen's Energy Forum, Inc., the Virginia Sunshine Alliance, and Truth in Power, Inc. requested that:

1. The Commission shall suspend VEPCO's Operating License No. DPR-37 and order that the Surry steam generator replacement project be brought to an immediate halt.
2. The Commission shall direct the Director of Nuclear Reactor Regulation to serve upon VEPCO an Order to Show Cause at a public hearing why Operating License No. DPR-37 should not be suspended pending performance of the environmental studies and other relief described below.
3. The Commission shall direct the NRC staff to prepare an environmental impact statement addressing the Surry project.
4. The Commission shall direct the NRC staff to prepare a programmatic environmental impact statement addressing the cumulative environmental impacts and the long-range policy implications of current and future steam generator replacement and repair projects.

*Article 10 CFR 2.206 states that any person may file a request for the Director of Nuclear Reactor Regulation to institute a proceeding to modify, suspend, or revoke a license, or for such other action as may be proper.

5. The Commission shall prohibit the NRC staff from reinstating Operating License No. DPR-37 or permitting further progress on the Surry steam generator replacement program until it has fully reviewed and satisfied its obligation under the following sections of the regulations, including making available an opportunity for a public hearing:
 - (a) 10 CFR §20.302, requiring NRC approval of proposals to dispose of nuclear waste;
 - (b) 10 CFR §50.82, requiring NRC approval of proposals to dismantle nuclear power plants; and
 - (c) 10 CFR §20.1(c), requiring occupational radiation exposures to be maintained as low as is reasonably achievable.
6. The Commission shall prohibit VEPCO from making any modification to the Surry facility resulting in discharges into navigable waters until it has obtained from the Commonwealth of Virginia an NPDES permit or an amendment to its current NPDES permit for the Surry plant, as required under, e.g., §§301 and 402 of the Federal Water Pollution Control Act, 42 U.S.C. §§1311 and 1342.
7. The Commission shall prohibit the staff from approving any modification of the Surry facility resulting in discharges into navigable waters until it has received from the Commonwealth of Virginia the certification required under §401 of the Federal Water Pollution Control Act, 42 U.S.C. §1341.
8. The Commission shall notify all Atomic Safety and Licensing Boards, as appropriate, of the above actions and shall prohibit the issuance of any permit, license, or amendment thereto allowing the replacement or repair of steam generators pending the completion of the environmental impact statements and other studies described above.

The Secretary of the Commission directed the staff on May 22, 1979, to treat this petition under 10 CFR §2.206 of the Commission's regulations. Notice that the petition was being treated under 10 CFR 2.206 was published in the Federal Register, 44 Fed. Reg. 36522 (June 22, 1979).

In the Director's Decision issued on October 24, 1979,¹⁵ the requests of this petition were denied also.

The Commission conducted a sua sponte review of the three Director's decisions, on the issue of the need for an environmental impact statement regarding the proposed repair. In a Memorandum and Order issued on March 4, 1980, the Commission identified the occupational radiation exposure as the only adverse environmental impact associated with the repair program that might be considered significant, stated that it was unable to determine whether the environmental impact is significant, and therefore directed the staff to expeditiously prepare and issue an environmental impact statement on the proposed repair at Unit 1. (Repairs at Unit 2 are completed.)

2.4 MAJOR ISSUE

The major issue is the occupational radiation exposure associated with the proposed repair of the degraded steam generators of Unit 1.

3.0 DESCRIPTION OF THE PROPOSED REPAIR METHOD

A drawing showing the principal parts of the typical steam generator is presented in Figure 1. Figure 2 shows the regions where the main cuts are proposed to remove the degraded steam generator. It shows also the radiation levels in these regions for Unit 2. A brief description of VEPCO's proposed repair procedure follows.

In preparation for the repair of the steam generators, all of the fuel will be removed from the reactor core and placed in the spent fuel pool. Then one of the three steam generators will be cut out of the reactor system. Present plans are to cut through the inlet and outlet reactor coolant piping, and through the steam line piping and feedwater piping. The steam generator wall will be cut on the transition zone between the lower assembly and the larger diameter upper shell assembly. The upper assembly will be lifted off and stored inside the containment vessel. The lower assembly will be lifted by crane from its support, tipped on its side, and transported out of the containment through the equipment hatch. It will then be transported to the concrete vault where it will be stored until the station is decommissioned. The replacement lower assembly will be transported into the containment and placed on its support. The old upper assembly, after some refurbishment, and the new lower assembly will be welded together in the field. The piping mentioned above will be welded to the repaired steam generator.

The same procedure will be followed for the other two steam generators. It is anticipated that the unit will be out of service for about six months.

A number of changes (see Sections 2.3 through 2.7 of Reference 1) have been made in the materials, the design and the operating procedure for the replacement steam generators to assure that the corrosion and denting problems will not recur. Among the more important of these changes are (1) using All-Volatile-Treatment chemistry control in the secondary system from the beginning of operation, (2) using corrosion resistant SA240 Type 405 ferritic stainless steel rather than carbon steel for the support plate material, (3) thermally treating the Inconel 600 heat exchanger tubes for better corrosion resistance, and (4) using a broached hole pattern with a quatrefoil design in the support plates rather than separately drilled flow holes to minimize the accumulation of corrosion products where the tubes pass through the plates. The staff's review of the expected effects of the proposed changes is presented in detail in the introductory section of the SER3 for the repair project. We have concluded in the SER that the new steam generator design incorporates features to eliminate the potential for the various forms of tube degradation observed to date.

The licensee proposes to store the degraded steam generator lower assemblies for the life of the plant in an above-ground concrete structure with walls about 3 feet thick.* The structure will be sealed against water intrusion, but is provided with an internal sump to collect any water which may get in by means such as condensation. Ventilation to allow for thermal expansion and contraction of the air inside the structure is provided through high efficiency particulate air filters. Several removable 2-inch plugs will be provided to permit the conduct of radiation surveys without entering the structure.

The method of ultimate disposal will be decided when the reactor itself is scheduled for decommissioning.

*One steam generator lower assembly from Unit 2 has been shipped to Hanford for examination and research. The environmental effects of the shipment of that assembly, upon which the repair effort is not dependent, were separately assessed by DOE (DOE/EA-0102 dated March, 1980).

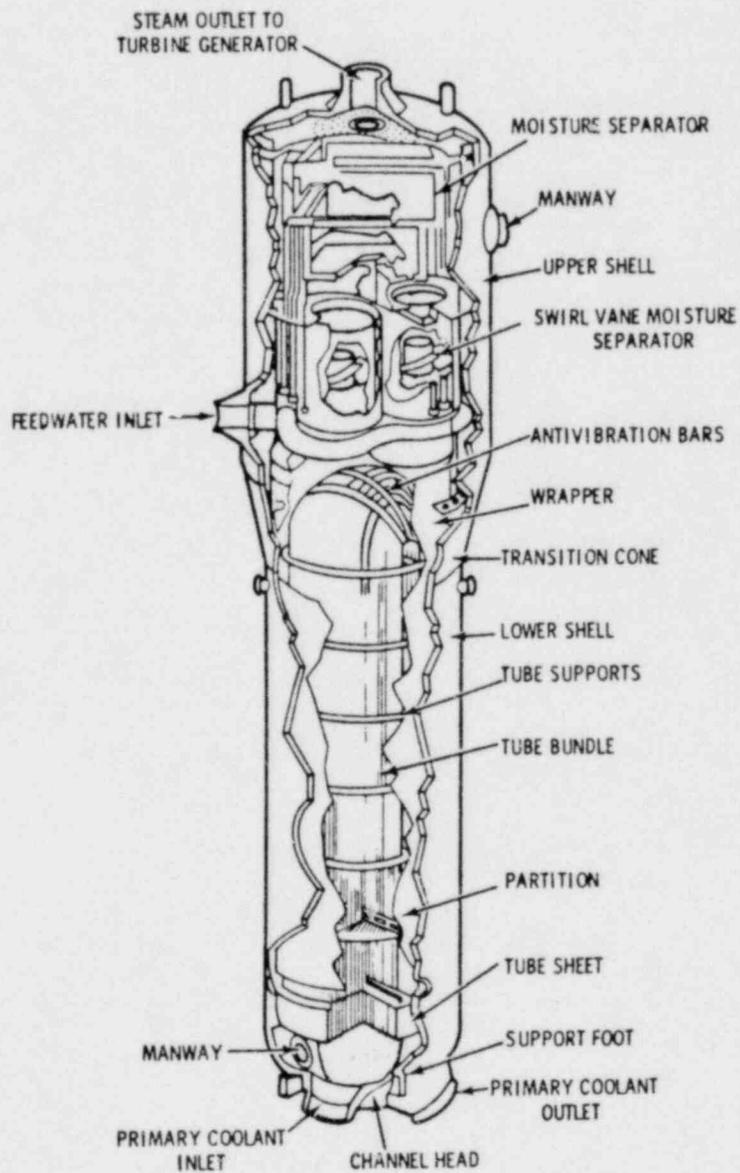


FIGURE 1. Typical Steam Generator

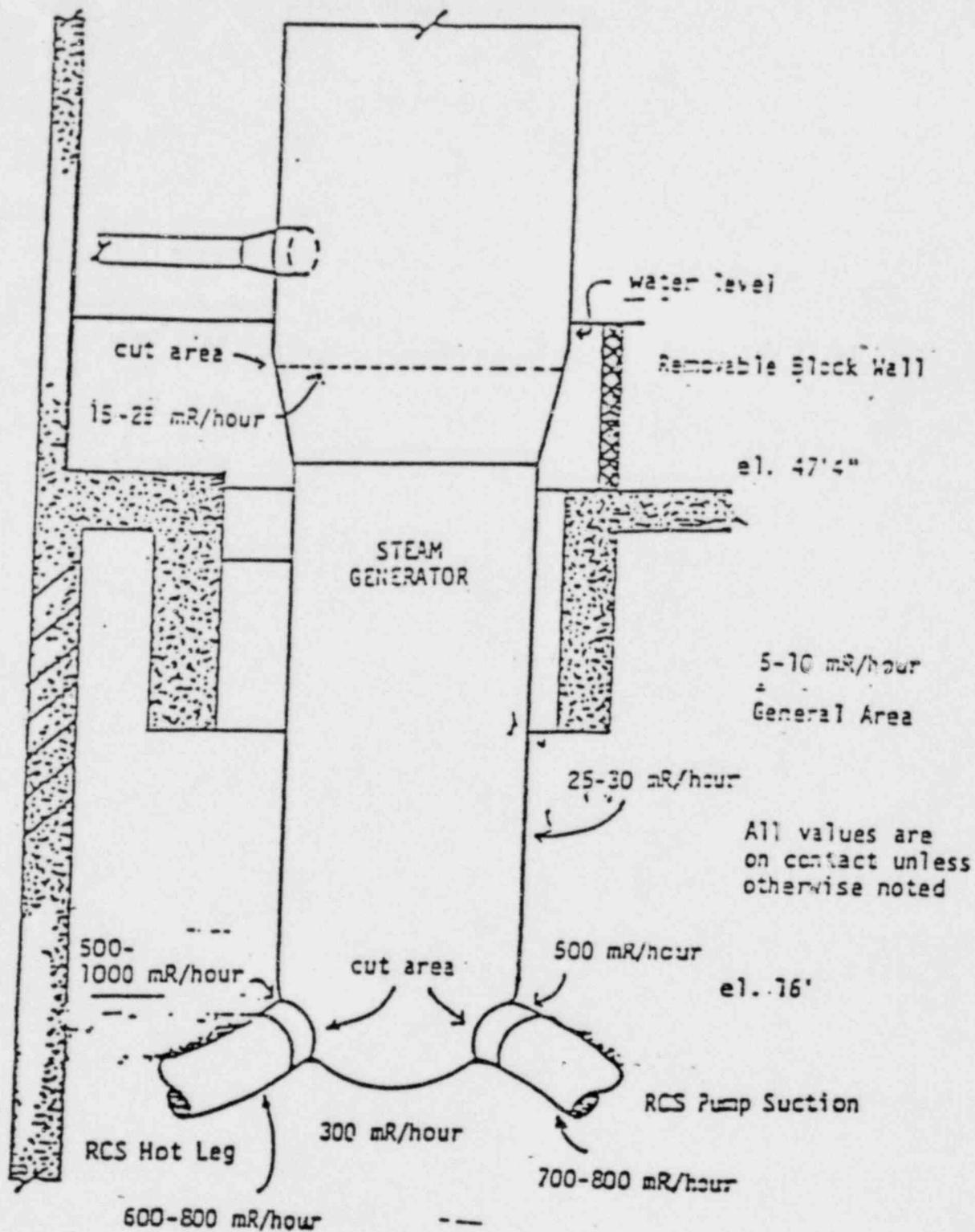


FIGURE 2
 TYPICAL RADIATION LEVELS AROUND STEAM GENERATORS
 WITH PRIMARY SIDE DRAINED AND SECONDARY SIDE AT
 72% LEVEL

4.0 ENVIRONMENTAL IMPACTS OF STEAM GENERATOR REPAIR PROJECT

This assessment of impacts was performed for Surry Power Station Units 1 and 2.

4.1 RADIOLOGICAL ASSESSMENT

4.1.1 Occupational Exposure

The generic radiological assessment of steam generator repair, prepared for the NRC by PNL and reported in NUREG/CR-0199, provides an upper bound estimate of the occupational doses and off-site radiological releases associated with the repair of steam generators at a large PWR. The conservatism in PNL's methods of assessment, described below, provide the opportunity to reduce occupational doses for the repair operations in specific cases considerably below the generic estimates in NUREG/CR-0199.

The PNL generic estimates of occupational exposure (man-rem) were derived by multiplying maintenance activity man-hours by exposure rates (rem/hour) for the repair activities. Maintenance activities were developed by PNL as a composite of the work descriptions for removal and replacement of the steam generators at Surry and Turkey Point as determined by VEPCO and Florida Power and Light Company. Man-hour estimates for each activity were developed by PNL based on prior experience with similar activities, using standard estimating techniques. Exposure rates were based on information from several sources including data from measurements made at several operating PWR's including the Surry Units. PNL usually selected exposure rate values on the high end of the range of values measured at the several plants.

The generic estimate of the total collective occupational whole body dose for the repair of three steam generators* was presented in NUREG/CR-0199 as a range of values, 3380 to 5840 man-rem. Both ends of this range were conservatively estimated and represent upper bound values. The upper value, 5840 man-rem, was estimated assuming no credit for dose saving techniques. The lower value, 3380 man-rem, was estimated taking credit only for three dose reduction methods: (1) shielding by raising the steam generator water level, (2) using a limited amount of remote tooling, and (3) increasing the source-to-receiver distance. VEPCO's total estimate of 2070 man-rem per unit at Surry included not only these dose reduction measures but also measures such as additional temporary lead shielding, local decontamination, pre-job planning and pre-job training. The dose reduction procedures proposed by VEPCO are discussed in more detail in our SER.³

In view of the above discussion, the lower end of the generic range, 3380 man-rem, is the appropriate estimate for comparison with VEPCO's estimate of 2070 man-rem per unit. A summary comparing VEPCO's estimates with our generic estimates in NUREG/CR-0199 for the four main phases of the project is given in Table 4.1.

Table 4.1
Comparison of Occupational Collective Whole Body Dose Estimates

Phase	NRC Generic Estimate Dose, man-rem/unit	VEPCO Estimate Dose, man-rem/unit	Unit 2 Actual Dose, man-rem/unit
Preparation	450-810	599	344
Removal	1100-1700	599	602
Installation	1800-330	877	927
Storage	30	35	5
Additional Task and Personnel Categories			262
Total	3380-5840	2070	2140

The discrepancies between the detailed estimates are accounted for by the same factors discussed above for the total estimates. VEPCO's calculations of doses used commonly accepted practices for calculating doses and took into account the dose reduction measures proposed to maintain doses As Low As Reasonably Achievable (ALARA), including local decontamination, temporary lead shielding, pre-job planning, pre-job training and use of remote tools where practicable. In Section 6 of Reference 1, VEPCO has documented its consideration of the guidance with regard to ALARA issues in Regulatory Guide 8.8, Revision 2.⁴ We have reviewed VEPCO's treatment of ALARA issues in detail in Section 4 of the SER.³ We concluded that VEPCO's efforts to maintain occupational doses ALARA during the repair effort are reasonable.

*Each Surry unit has three steam generators.

In summary, the above discussion shows that the differences between the lower generic estimate (3380 man-rem per unit) and VEPCO's estimate (2070 man-rem per unit) can be reconciled by (1) the use of lower dose rates measured at Surry in the VEPCO estimate and (2) the use of more dose reducing measures by VEPCO than in the generic estimate. We therefore conclude that VEPCO's estimate of 2070 man-rem is a more realistic estimate than 3380 man-rem for the repair of the steam generators in one Surry unit. Consequently, in the remainder of this appraisal, we have used 2070 man-rem per unit as the occupational dose for the steam generator repair work at Surry.

The replacement of the 3 generators in Surry Unit 2 was completed in 37 weeks in 1979. The total occupational dose received by workers at Surry Unit 2 during the repair program was 2140 man-rem. The dose rates at Surry Unit 1 have been 30-40 percent higher than at Unit 2. However, VEPCO believes that their experience from completing the Unit 2 repair program will allow them to do a more effective job of maintaining exposures ALARA on Unit 1. Therefore, VEPCO believes that its original estimate of 2070 man-rem per unit is reasonable for Unit 1. We followed the work at Unit 2 closely and we agree that 2070 man-rem is a reasonable estimate for Unit 1. (Even if Unit 1 doses proved to be 30-40 percent higher than for Unit 2, the basic arguments presented in the following paragraphs would still be valid.)

To put into perspective the occupational doses to be incurred in repairing steam generators, it is helpful to compare these doses (1) with those expected from the normal operation of nuclear plants, (2) with the projected long-term man-rem saving resulting from steam generator repair and (3) with doses received from natural background radiation.

Although the AEC was starting to compile occupational exposure estimates for nuclear power plant operation at the time that the Surry 1 and 2 FES was prepared in 1972, such exposures were not specifically considered in the Surry 1 and 2 FES.

In recent environmental statements for new nuclear power plants, we have provided an estimate of 500 man-rem per reactor unit as the average annual occupational dose. This average is the annual average over the life of the plant (30-40 years). This estimate is based on reported data from operating power reactors; a summary of that data is provided in Table 4.2. That data show that 500 man-rem per reactor unit per year is roughly the average of the wide range of doses incurred at all light water cooled reactor units over several years. The amount of dose incurred at any single reactor unit in a year is highly dependent on the amount of major maintenance performed that year. Every year several units require some items of major maintenance which result in doses for those units well above the average of 500 man-rem. These doses are included in the average and we do not consider them to be significant deviations from the average. Simply put, the steam generator repair program is major maintenance which will result in an annual dose for Unit 1 above the average. However, as Table 4.2 shows, the 2070 man-rem is within the historical range of doses about the average for one unit in a year.

Table 4.2

Occupational Dose at U.S. Light Water Reactors
(man-rem per reactor unit)

<u>Year</u>	<u>Average</u>	<u>Low</u>	<u>High</u>
1975	475	21	2022
1976	499	74	2643
1977	570	87	3142
1978	497	158	1621

Since we consider the impacts of the average annual occupational dose (500 man-rem) over the life of a reactor to be acceptable, we conclude that the one-time occupational dose (2070 man-rem) associated with repair of the steam generators at each Surry unit cannot in itself represent an unacceptable environmental impact.

In 1975, 1976, and 1977, workers at Surry Units 1 and 2 received whole body doses of 638 man-rem,¹ 1287 man-rem¹ and 1410 man-rem,⁶ respectively, during the inspection and plugging of degraded steam generator tubes. The total occupational doses for the two units were 1649 man-rem in 1975, 3163 man-rem in 1976, and 2416 man-rem in 1977.⁶ These doses are higher than the 570 man-rem per year average for U.S. light water reactors in 1977. We concluded in the SER that the proposed repair would eliminate the potential for the kinds of tube degradation observed to date. Based on our experience with plants without severe denting problems and the staff conclusion regarding corrosion reduction, doses due to the inspection and plugging of degraded tubes would be markedly reduced, and we conclude that occupational exposure after the repair will be reduced by hundreds of man-rem per year for the two units. This would result in total occupational exposures at Surry approaching more closely the national average value for light water reactors (500 man-rem per reactor-year). We further conclude that the dose savings of hundreds of man-rem per year would over a period of years tend to offset the immediate one-time dose of 4140 man-rem for repairing the six steam generators in both units.

VEPCO has estimated that the after-repair occupational dose for the inspection and repair of degraded steam generator tubes will be reduced to 25 man-rem per year for the two Surry units. Although the 25 man-rem per year appears to be a reasonable number for Regulatory Guide 1.83 inspections, we have conservatively estimated a higher value of 100 man-rem per year to account for additional inspections which may be performed to check the initial performance of the improved steam generators and to correspond more closely to recent industry experience.

The saving of occupational exposure resulting from the repair effort may be estimated by subtracting the estimated annual dose after repair from the observed annual dose before repair. The doses of 1287 man-rem in 1976 and 1410 man-rem in 1977 are considered representative of exposures related to steam generator operation before repair. The 638 man-rem dose in 1975 is not representative of operation with degraded steam generators because significant tube degradation was not observed in Unit 1 until September 1975 and in Unit 2 until January 1976. Subtracting the after-repair dose of 100 man-rem from the before-repair range of 1287 to 1410 man-rem leads to a saving of 1187 to 1310 man-rem per year. At these rates of saving, the 4140 man-rem cost of the repair would be offset in 3 to 4 years.

Operating experience at the Surry plant over the last three years demonstrates that the steam generators can continue to operate with the degraded tubes plugged, but frequent inspection and plugging as performed during the last three years would be required to assure that the integrity of the steam generators would be maintained. At the current rate of tube plugging, about three percent per year, it is the staff's judgment that, with continued inspections and plugging, Unit 1 could continue to operate for some period and, even if reduced power were required, the economic balance would favor continued operation of the unit, as opposed to decommissioning. On the other hand, continued degradation of the integrity of a major component, such as steam generators, results in continued small reductions in overall safety margins.

This potential has been carefully considered on the basis of the results of each inspection over the past four years. While these margins remain acceptable, any continued degradation would require continued careful assessment to assure that degradation does not become excessive.

The average annual dose to an individual due to natural background radiation in the United States is roughly 0.1 rem. However, there are very broad variations in the average dose due to a number of factors such as altitude above sea level and local geologic formations. As altitude increases, the dose rate from cosmic radiation (radiation from space) increases. Because Denver, Colorado, for example, is at a much higher altitude than Washington, D.C., the average natural background dose in Denver is roughly 0.08 rem per year larger than in Washington. Multiplying 0.08 rem per year times 50 years (a conservative estimate of average lifespan) yields the result that an individual would receive 4 rem more dose from a lifetime of exposure to natural background radiation in Denver than would be received from living in Washington. The estimated Surry repair program dose of 4140 man-rem for both units will be spread over at least 2000 workers over a two-year period (probably between 2500 and 3500 workers). Therefore, the average dose to a worker for this project will be roughly 2 rem - half of the variation in natural background radiation described above.

In a different view, 2000 people living in Denver would receive an aggregate of 8000 more man-rem from their lifetimes of exposure to natural background than 2000 people living in Washington, D.C. Clearly the people of Denver consider their exposure to natural background radiation to be acceptable; if they did not, they would all move away from Denver. Taking this view a step further, it is noted that practically no one would even consider the increase in dose as a negative factor in his decision to move from Washington to Denver. Therefore, we conclude that based on a comparison with doses due to natural background radiation, the estimated dose for the steam generator replacement represents an insignificant and societally acceptable impact.

We calculate that 4140 man-rem, the occupational dose estimate to replace the steam generators at both units, corresponds to a risk of less than one premature fatal cancer. We also calculate that 4140 man-rem corresponds to a risk of one genetic effect to the ensuing five generations. These risks are based on risk estimators derived in the BEIR report¹⁴ from data for the population as a whole. For a selected population such as is likely for the exposed workers involved in the repair program consisting mainly of males in age range from 20 to 40, these risks would tend to be somewhat less. These risks are incremental risks, risks in addition to the normal risks of cancer and genetic effects we all face continuously. For a population of 2000 these normal risks would result in 300-400 cancer deaths and 100-150 genetic effects (genetic effects are genetic diseases or malformations).

In summary, the staff has drawn the following conclusions regarding occupational radiation exposure. VEPCO's estimate of 2070 man-rem per unit for the repair of the steam generators is reasonable. This dose falls within the normal range of annual occupational doses which have been observed in recent years at operating reactors. Our review in the Safety Evaluation Report³ concludes that VEPCO is taking the necessary steps to insure that occupational doses will be maintained ALARA. The renovation of the steam generators will lead to occupational dose reductions of hundreds of man-rem per year. These dose savings over a period of several years will outweigh the immediate large one-time dose resulting from the repair operation.

The doses to the work force as a whole and to the average worker will be within the variations in lifetime doses due to natural background radiation in the U.S.

The individual risks associated with exposures involved in the repair program will be controlled and limited so as not to exceed the limits set forth in 10 CFR Part 20 for occupational exposure. These limits are intended to assure that the hazard to any exposed individual is extremely small.

The additional health risks due to these doses over normal risks are quite small, less than one percent of normal risks to the project work force as a whole.

For the foregoing reasons, the Staff concludes that the environmental effect due to occupational radiation exposure is insignificant and acceptable, and in any case the proposed repair program will reduce occupational exposure in the long run.

4.1.2 Public Radiation Exposure

Before VEPCO began the steam generator replacement work at Surry Unit 2, our analysis of the gaseous and liquid releases of radioactivity from the plant site during the project was based on (1) the generic report,² NUREG/CR-0199, prepared by Pacific Northwest Laboratories (PNL) and (2) estimates made by VEPCO.¹ The PNL estimates were intended to be upper-bound values, based on conservatively high estimates for each type of release. The VEPCO estimates were based on the specific equipment design and procedures to be used at Surry.

Table 4.3 presents the NUREG/CR-0199 estimates² and VEPCO's estimates¹ of the radioactive effluents which will be released as a result of the repair effort. Table 4.3 also presents Surry's reported average radioactive effluent releases for 1976¹² and 1977,⁶ and the annual average radioactive effluent release estimates presented in the Surry FES.⁷ Table 4.3 shows that the releases estimated by VEPCO and the generic report for the repair effort are much lower (except for the airborne particulates) than the Surry 1976 and 1977 releases and the FES annual average estimates. For airborne particulates, the VEPCO estimates of releases are in the same range as or lower than the 1976 and 1977 releases in Table 4.3. The Surry FES⁷ does not present numerical estimates of airborne particulate and tritium releases. However, airborne particulates and tritium are small dose contributors compared to radioiodine and noble gases for the highest dose pathways of exposure to individuals in the general public. Therefore, the conclusions regarding dose consequences presented in the FES are still valid.

The VEPCO estimates of gaseous releases from the repair effort are larger than the NRC generic estimates because the VEPCO values include the releases from fuel unloading and reloading, which are much larger than the gaseous releases from the rest of the repair operation. VEPCO's figures are based mainly on experience at Surry with refueling operations. The refueling releases were not included in the NUREG/CR-0199 estimate, since the utility normally would plan to carry out the steam generator repair during a scheduled shutdown for refueling. For the other gaseous releases such as those from pipe cutting, VEPCO used commonly accepted calculational methods, for example in calculating the kerf for each cut and in assuming that all radioactive material adhering to the inner cut surface would become airborne. In Table 4.3 the estimates for liquid releases of tritium vary widely because VEPCO plans to store the primary reactor coolant water for re-use, whereas the generic (NUREG/CR-0199) estimate assumes that the coolant is discharged after processing for nuclides other than tritium. The VEPCO estimate for the release of mixed fission and activation products is larger than the generic estimate because the latter did not include the releases of the secondary coolant nor the local decontamination solutions. Both estimates included the activities in laundry waste water. VEPCO based its estimates of releases from the laundry waste water and secondary coolant on past measurements of these sources at Surry. VEPCO used commonly accepted methods to calculate the releases from local decontamination solutions. VEPCO's estimates of gaseous and liquid releases were carried out in an acceptable manner and represented reasonable estimates. Therefore, before the work at Unit 2, we concluded that VEPCO's estimates were acceptable and we embraced them as our own best estimates.

Now, as stated above, steam generator repair at Surry Unit 2 has been completed (1979). Table 4.3 shows the actual releases for Unit 2. As expected, all of the releases were lower than they would have been during average normal operation. Except for noble gases and liquid tritium, releases were within or very close to our estimates. The original estimate for noble gases was a "negligible" amount. We did expect some noble gas release and 100 curies is a "negligible" amount in comparison with normal operation. The tritium releases are half of the total for both units; most of the tritium was probably from Unit 1. VEPCO is unable to distinguish liquid tritium from the two units. After reviewing all the available data, we accept the actual Surry Unit 2 releases as our best estimate of releases to be expected at Unit 1.

Our estimates of dose to individuals and to the population as a whole in the area surrounding the Surry site are based on the radioactive effluents which VEPCO estimated for the repair effort (summarized in Table 4.3) and on the calculational methods presented in Regulatory Guide 1.109, 1.111 and 1.113.^{11,9,8} We conclude that offsite individuals will receive doses from the repair effort of the same order or less than the annual dose consequences presented in the FES.⁷ The doses to the population within 50 miles will be less than 5 man-rem to the thyroid or total body from liquid effluents, and less than 2 man-rem to the thyroid or total body from airborne effluents. Every year the same population (about 2 million) will receive a total body dose of more than 100,000 man-rem from the natural background radiation in the vicinity of Surry (0.065 rem per year).¹³ Thus, the population total body dose from the repair effort is less than 0.01 percent of the annual dose due to natural background. On these bases, we conclude that the doses to individuals in unrestricted areas and to the population within 50 miles due to gaseous and liquid effluents from the repair project will not be environmentally significant.

VEPCO has estimated that the repair effort will generate 740 cubic meters of solid waste per unit containing 19 curies of radioactivity.¹ Based on the information presented in NUREG/CR-0199, we estimate that 2300 cubic meters of solid waste containing 37 curies of radioactivity will be generated per unit.² Our estimate is higher than the licensee's estimate because we assumed that all of the radioactivity in the solutions from main coolant pipe decontamination would be solidified. Neither of these estimates include the radioactivity on the inside surfaces of the old steam generators. In 1976 and 1977, Surry generated an annual average of 370 cubic meters

Table 4.3
Radioactive Effluents from Surry Station

Type of Radioactive Effluent	Steam Generator Repair		Actual Surry Unit 2 Releases (Ci/Unit)	Operating Experience		FES Annual Average Release Estimates (Ci/Unit/Yr)
	VEPCO Release Estimates (Ci/Unit)	NUREG/CR-0199 Release Estimates (Ci/Unit)		Surry 1976 Average Releases (Ci/Unit)	Surry 1977 Average Releases (Ci/Unit)	
<u>GASEOUS</u>						
Noble Gases			100	9600	9510	3350
Halogens (Iodines)	0.0045	included in particulates	0.0000069	0.27	0.24	0.92
Particulates	0.0031	0.0001	0.0013	0.041	0.001	-
Tritium	8.5	-	4.3	19	44	-
<u>LIQUID</u>						
Mixed Fission & Activation Products	0.35	0.14	0.5	17	3.8	53
Tritium	0.1	190	8.5	390	204	1000

of solid waste per unit containing 310 curies per unit of radioactivity.^{6,2} The amount of radioactivity in the wastes from the repair effort will be about 10 percent of this average annual production during operation. Since the solid wastes represent an impact which is a small part of the impact from solid wastes from normal operation, we conclude that the radiological impact is not environmentally significant.

Steam generator replacement operations at Unit 2 generated 1600 cubic meters of waste containing 64 curies of radioactivity. Both the volume and radioactive content of the solid radioactive waste generated are comparable to our estimates.

On the basis of long-term onsite storage of the degraded steam generators until the reactors are decommissioned, there will be essentially no radioactive effluents from the generators for 30 years. Final disposal at that time will result in small offsite gaseous and liquid radioactive releases, because a large fraction of the radioactive nuclides in the steam generators will have decayed in 30 years.

The stored steam generators will present a source of direct and scattered radiation. We estimate that each steam generator will contain about 1000 Ci of radioactivity including 720 Ci of Cobalt-60, the principal contributor to direct dose. This is based on the estimate of the contamination of steam generator primary side surfaces given in NUREG/CR-0199.² The staff estimated a dose rate of less than 0.0001 millirem per hour at the nearest site boundary due to this activity. An individual spending an entire year at this location would receive less than 1 millirem of radiation exposure. This dose would be approximately halved every 5 years because of the decay of the principal dose rate contributing activity, Co-60. VEPCO made a similar calculation and reached the same conclusion. Since this dose represents roughly one percent of the annual dose from natural background,¹² the staff concludes that the direct dose impact to the public from the stored generators will be minimal and not environmentally significant.

The repair effort will return the plant to the design condition on which our evaluation in the FES⁷ was based. Therefore, we conclude that the estimate of routine releases of radioactivity and the potential doses to the public from those effluents after the repair should remain as presented in the FES.

Since our estimates of radioactive effluents from Surry during normal operation after the repair effort are about the same or lower than those effluents presented in the FES,⁷ we conclude that the impact on biota other than man will be no greater than that impact presented in the FES.

In summary, the offsite doses resulting from the steam generator repair will be less than those from recent plant operation since the expected releases of radioactive material as a result of the repair effort will be less than the releases from normal operation. These doses are comparable to doses presented in the FES,⁷ and small compared to the annual doses from natural background radiation. Therefore, the radiological impact of the repair project to the public will not significantly affect the human environment.

4.2 ECONOMIC COSTS OF STEAM GENERATOR REPAIR

The following analysis is done in 1977 dollars.

VEPCO has estimated that, over the life of the plant, the proposed steam generator repair project will result in a net dollar savings of at least \$125,000,000 compared with the cost of continued operation of the existing steam generators, with an optimistic assumed scenario of tube plugging and derating. The cost of purchasing and installing the steam generator lower assemblies and associated activities is estimated about \$66,000,000 for the two units.

The cost of removal and disposal of the six degraded lower assemblies is expected to be about \$10,000,000. The estimate for replacement power during the outage for repair is about \$66,000,000. The total project cost is, therefore, about \$142,000,000.

The cost of replacement power during the outage is based on the higher fuel costs of coal, oil and gas-fired units which VEPCO would press into service to replace the power lost by the shutdown of one of the Surry Units. The VEPCO estimate of \$66,000,000 based on differential fuel costs is reasonable in view of the total value of the replacement power: $822,500 \text{ kW} \times 0.6 \text{ capacity factor} \times 360 \text{ days} \times 24 \text{ hours/day} \times \$0.04/\text{kWhr} = \$183,000,000$. VEPCO's estimate of \$66,000,000 corresponds to a fuel differential cost of about \$0.014/kWhr between fossil-fired plants and a nuclear plant. We consider this differential cost estimate reasonable.

The VEPCO estimated net saving of \$125,000,000 is based largely on the cost of replacement power due to derating. We assessed the reasonableness of this estimate by comparing it to the cost of replacement power if both units had to be derated. The cost would be about \$360,000,000 after 10 years of derating at an assumed rate of 3 percent per year (the current rate of tube degradation is greater than 3 percent per year). Therefore, VEPCO's estimate that \$125,000,000 would be saved over the life of the plant even after spending \$142,000,000 for the steam generator repair is conservative.

The VEPCO estimate of \$10,000,000 for removal and disposal of the degraded steam generators assumes onsite storage for 30 years followed by sectioning and shipment to a licensed burial facility for low-level waste. This estimate is not out of line when compared to recent estimates¹⁰ for the decommissioning of complete reactors by dismantlement after a cooling period (about \$30,000,000).

This consideration of costs does not take into account the continuing costs of tube inspection and plugging service, nor the costs of possible future modifications to control corrosion, if the repair is not done. It also does not consider the cost of the current lack of reliability and availability. In 1976, Surry Unit 1 was offline for 36 days and Unit 2 for 139 days for tube inspection and plugging. In 1977, the outage times for tube inspection and plugging were 50 days for Unit 1 and 70 days for Unit 2.

In Section 5, the economic and other impacts of alternative methods of repairing the steam generators will be compared.

4.3 NON-RADIOLOGICAL ENVIRONMENTAL COSTS

The non-radiological impacts of the repair project on the environment are small compared to those of building and operating the reactors. These small costs include the commitment of about one acre of land on the site for the storage of the degraded steam generators for the life of the station. There will be some noise generated by onsite equipment and a small effect on local traffic by approximately 125 construction workers per shift, but these effects will be insignificant.

The material costs of the proposed action will include about 1350 tons of carbon steel, 48 tons of stainless steel, AND 3000 cubic yards of concrete. These quantities are about 2 percent of the quantity of steel and about 8 percent of the concrete used in the original construction of the plant.

4.4 ENVIRONMENTAL IMPACT OF POSTULATED ACCIDENTS

As is discussed in our SER,³ the design and plant operating parameters which are relevant to accident analyses will not change as a result of the steam generator repair effort. Therefore, the assessment of the environmental impact of postulated accidents presented in the final environmental statements for Surry Units 1 and 2 will be unchanged and remain valid. However, there are a few types of accidents which are possible due to the operations involved in the repair effort.

One such postulated accident is the rupture of the Reactor Water Storage Tank by a crane drop. The bounds of the radiological consequences of this accident were discussed in the FES⁷ for Surry Unit 2 under the heading - "Release of liquid waste contents."

A second type of postulated accident related to the repair effort would involve the dropping and rupture of a removed steam generator outside the reactor containment while it was being transported to the storage vault. This accident would involve the rupture of the steel covers which will have been welded over each of the steam generator cuts to prevent the spread of the neutron-activated corrosion products adhering to the inner surfaces. The method used to assess the radiological consequences of a rupture which could release contamination on the primary side surfaces to the atmosphere is described in the SER.³ To obtain a more realistic estimate for the purpose of evaluating the environmental impact, we used an atmospheric dispersion factor of 1.6×10^{-4} seconds per cubic meter. On this basis, we concluded that this accident would result in a dose of 0.06 rem to the lungs of an individual at the site boundary.

The dose consequences of a drop accident inside containment would be lower since the containment ventilation system would reduce the radioactivity released to the environment.

In summary, we concluded that the consequences of postulated accidents from the repair operation would not be environmentally significant.

5.0 IMPACTS OF ALTERNATIVES

The analysis in this section was done for both Surry units.

The basic choices of future action regarding the tube degradation problem are (1) repair of the degraded steam generators, (2) continuation of the present mode of operation, with increasing costs in plant efficiency and occupational exposure, and (3) shutdown of the Surry Units 1 and 2, and replacement by generating plants of different design. VEPCO opted for repairing the degraded steam generators, with changes in design, materials and operating procedures calculated to eliminate the tube denting problem.

In the absence of methods to arrest or greatly reduce denting, the continuation of operation for an extended period in the present mode is impractical. With tube degradation and plugging continuing at the present rate, the units would soon be required to operate at lower power. VEPCO has estimated the cost of replacement power, based on fuel differential costs, to be about \$180,000 per day for the shutdown of a unit. Consequently, the cost of derating the Surry units would be high. Also, the man-rem cost of occupational exposure during inspection and plugging of tubes would continue to be high, resulting in a dose higher than 4140 man-rem in 3 or 4 years. Laboratory test programs on the denting phenomenon are currently underway to define the corrosion process more precisely and to develop preventive measures such as corrosion inhibitors. While the combination of steam generator secondary side cleaning and corrosion inhibitors is being studied by some utilities to combat denting in its early stages, the denting phenomenon at Surry is too advanced for such measures to be practical. Therefore, VEPCO cannot count on a greatly reduced future rate of tube degradation to justify continuing the present mode of operation.

The option of shutting down the Surry station and replacing it with a plant of different design* is easily shown to be much more costly than that of repairing the steam generators. VEPCO estimates (Section 5.5.1.3 of Reference 1) that the capital cost of new nuclear units with improved steam generators would be about \$2.7 billion dollars and would require about 12½ years to build. New fossil units would cost about \$1.2 billion and require about 8 years to build. (We consider the coal estimate low; capital cost for a coal-fired plant is usually about 80 percent of that for a nuclear plant.) Florida Power and Light Company made a similar comparison for repairing the steam generators in Turkey Point Units 3 and 4. Their estimate was about \$77/kW for the proposed steam generator repair operation, compared to \$224/kW for gas turbine units, \$1059/kW for a coal-fired plant, and \$1448/kW for a nuclear plant of improved design. Although the Turkey Point estimates are in different terms, the cost comparison again overwhelmingly favors the repair option. For these reasons, the plant replacement option is not economically feasible. In addition, there would be significant environmental impacts from such a large-scale construction operation. The most practical overall option is, therefore, to repair the degraded steam generators.

In the remainder of this section, we shall consider the radiological and economic costs of several alternative ways of repairing and disposing of the degraded steam generators. An important item in estimating economic costs is the cost of replacement power during unit outage. VEPCO's cost estimate of \$66,000,000 for the power needed during the 180-day outage of each unit corresponds to a replacement power cost of nearly \$200,000 per unit per day of outage.

5.1 DECONTAMINATION

VEPCO has estimated (Section 5.5.2.1 of Reference 1) that chemical decontamination of the steam generators before cutting would result in a net saving of 300 to 400 man-rems per unit in occupational exposure. However, it would cost about 1.5 months in additional outage of each unit. Replacement power for this additional outage would cost about \$9,000,000. In addition, about 200,000 gallons of radioactive waste would be produced.

VEPCO also considered mechanical decontamination of the inner surfaces of the steam generator, but estimated that the occupational exposure during the decontamination operation would exceed the later saving in dose to workers.

Based on our knowledge of the limited experience of the nuclear industry in large-scale, high volume chemical decontamination of reactor coolant systems, we can make the following statements. Most importantly, decontamination would add significant expense and time delays to the repair effort, including the cost of replacement power during those time delays. There is a degree of uncertainty about the compatibility of the decontamination fluid with materials in the coolant system. The research and testing which would be required to provide adequate assurance of material compatibility to obtain our approval to decontaminate would adversely impact on the cost and schedule of this repair effort. While the lower dose rates resulting from decontamination would reduce occupational dose during the repair operations, occupational radiation doses received during the decontamination effort itself would partially offset the dose reduction. Decontamination would not remove the radioactivity inside tubes which are plugged. Large volumes of contaminated fluids would be produced and require processing. That processing would incur further costs and occupational dose. In summary, we conclude that the costs of decontamination, including costs due to time delays, would outweigh the dose savings. Therefore, the use of large-scale decontamination in this repair effort is not a viable option.

5.2 RETUBING OF EXISTING STEAM GENERATORS

The retubing operation would involve (1) removing the upper or dome portion of the steam generator, (2) removing the lower assembly internals and tubes, (3) replacing the latter with state-of-the-art internals and tubes, (4) refurbishing the upper internals, and (5) welding the dome back in place. VEPCO has estimated (Section 5.5.1.2 of Reference 1) that the cost of this operation in both dollars and occupational exposure would be higher than the proposed replacement of the complete lower assembly. VEPCO further points out that shop fabrication of new lower assemblies would provide more positive assurance that the quality of the repaired generators was acceptable.

On the other hand, the staff is aware of recent developments by Westinghouse in the technology of in-place refurbishment which show some promise of reducing unit outage and personnel exposure below the values for VEPCO's proposed repair method. However, at this time we have not made a detailed assessment of the retubing alternative.

In-place retubing may be an alternative for steam generator repairs in the future. However, at present this is not considered to be an available alternative to the proposed action.

5.3 REPLACEMENT OF THE ENTIRE STEAM GENERATOR

For this alternative, a construction opening in the containment wall about 20 feet wide and 40 feet high would be required, since the upper assembly of the steam generator could not pass through the existing equipment hatch. The personnel exposure for this alternative would be about the same as for the proposed repair because essentially the same high-dose operations will be required in each case. Elimination of the cut across the diameter of each steam generator results in only a small saving of radiation exposure. The capital costs are estimated to be about 15 percent higher. The principal cost difference is due to an estimated additional outage of about 100 days per unit for the alternative. This corresponds to an additional requirement of about \$40,000,000 worth of replacement power during the repair of both units, calculated at the rate of about \$180,000 per day of outage per unit. For these reasons, the staff concludes that VEPCO's proposed repair method is preferable.

5.4 ALTERNATE DISPOSAL METHODS

In the appendix to NUREG/CR-0199² the radiological costs of several alternative methods for the disposal of the degraded steam generators are evaluated. The results of this analysis are summarized in Table 5.1.

It is seen that the options involving intact shipment would have the lower radiological costs; but intact shipment is possible only by barge and at present there is no licensed burial ground with facilities for off-loading an entire lower assembly from a barge.

The next best alternative, radiologically, would be long-term storage of the generators onsite until the reactors are decommissioned, followed by sectioning and shipment at that time. This is the plan proposed by VEPCO.

Immediate cut-up and shipment to a burial facility would involve a substantial cost in occupational exposure, even after chemical decontamination. Comparing Tables 5.1 and 4.3, it is seen that the airborne releases from the segmenting operation would be larger than those from the rest of the repair effort.

Table 5.1 Steam Generator Disposal Alternatives

Option	Approximate Man-Rem per Steam Generator	Approximate Airborne Release Ci per Generator
Long-term ^a storage (including surveillance) with intact shipment	10	Negligible ^b
Long-term ^a storage with cut-up and shipment	16	0.005
Shorter-term storage with cut-up - at 5 yr	23 ^c	0.026
- at 15 yr	60	0.015
Immediate intact shipment	2.4 ^c	Negligible ^b
Immediate cut-up and shipment by rail/truck - no decontamination	580	0.042
Immediate cut-up and shipment by rail/truck - with chemical decontamination	270	0.010

^a30 to 40 years

^bSince the steam generator will be sealed before it is removed from containment, no release of radioactive material is expected during the repair operation.

^cEstimates for short-term storage followed by intact shipment would be only slightly larger than this, perhaps 5 man-rem.

The two disposal alternatives considered by VEPCO (Section 5.5.2.2 of Reference 1) were immediate intact barge shipment and near-term sectioning for offsite disposal. The estimated economic and radiological costs are given in Table 5.2 for the disposal of six steam generators.

Table 5.2 Costs of Alternative Disposal Methods (VEPCO)

<u>Method</u>	<u>Cost, dollars</u>	<u>Exposure,^a man-rem</u>
Onsite Storage With Final Disposal at Decommissioning	1,000,000	80
Intact Barge Shipment	1,200,000 to 1,500,000	200
Near-Term Sectioning	1,700,000	1000 to 2000

^aNote that these doses are for six lower assemblies. The estimates in Table 5.1 are for one lower assembly.

According to the VEPCO estimates, the proposed disposal method of onsite storage with final disposition at the time of plant decommissioning should result in the least cost in dollars and in radiation exposure. The staff agrees that the proposed disposal method costs less in radiation exposure than alternatives available at present. The proposed onsite storage leaves open the option of intact barge shipment in the event that a burial ground with adequate off-loading facilities becomes available.

6.0 CONCLUSION

We have reviewed the proposed steam generator repair action and have reached the following conclusions.

- (1) The proposed replacement of the lower assemblies of the steam generators is the best available option, from both the radiological and economic standpoints, for eliminating the tube degradation problem.
- (2) The one-time occupational exposure of 2070 per unit is larger than the average annual occupational exposure associated with the operation of a nuclear power plant. However, such occupational exposures or larger exposures would be incurred in a few years by continued operation at Surry even absent the proposed action. In the long run, the proposed action will cause occupational exposures at an operating Surry facility to be reduced on a long-term cumulative basis as well as on an annual basis. Therefore, it does not appear that there will be a substantial increase in occupational radiation exposure caused by the work authorized.

We have reviewed the dose reduction measures to be used by the licensee and conclude that the doses would be ALARA. We have also considered the health effects resulting from such exposure and concluded that these are not significant.

- (3) The new steam generator design incorporates features which will eliminate the potential for the various forms of tube degradation observed to date.
- (4) The restoration would restore the generators to the condition evaluated in the FES and would result in an occupational dose saving of hundreds of man-rems per year, because there would be a marked reduction in the amount of tube inspection and tube plugging required to keep the generators in acceptable operating condition.
- (5) Offsite doses resulting from the steam generator repair will be less than those from recent plant operations, comparable to doses presented in the FES,⁷ and small compared to the annual doses from natural background radiation. Therefore, the offsite doses will not be significant.

On the basis of the foregoing analysis, the staff concludes that the proposed steam generator repair will not significantly affect the quality of the human environment. Even if it had been concluded that the absolute occupational dose of the proposed repair program would be of significant impact to the human environment, this impact is outweighed by the decrease in the long-term radiological exposure compared to what would be incurred if the facility were to operate without the proposed repairs and by the economic advantage of the proposed repair program, so we would nonetheless conclude that the proposed repair program should be implemented.

7.0 FEDERAL, STATE, AND LOCAL AGENCIES TO WHOM THIS ENVIRONMENTAL STATEMENT WAS SENT

This Final Environmental Statement was sent to the following:

Advisory Council on Historic Preservation
Department of Agriculture
Department of the Army, Corps of Engineer
Department of Commerce
Department of Energy
Department of Health, Education and Welfare
Department of Housing and Urban Development
Department of the Interior
Department of Transportation
Environmental Protection Agency
Commonwealth of Virginia
Surry County
Lynn R. Chong
James B. Dougherty

8.0 STAFF RESPONSES TO COMMENTS

Pursuant to 10 CFR 51.25, the Draft Environmental Statement was transmitted, with a request for comments, to:

Advisory Council on Historic Preservation
Department of Agriculture
Department of the Army, Corps of Engineers
Department of Commerce
Department of Energy
Department of Health, Education and Welfare
Department of Housing and Urban Development
Department of the Interior
Department of Transportation
Environmental Protection Agency
Commonwealth of Virginia
Surry County

Responses were received from:

Federal Energy Regulatory Commission
Environmental Protection Agency, Environmental Research Laboratory
Department of Transportation, Regional Representative of the Secretary
Commonwealth of Virginia
Lynn R. Chong
James B. Dougherty
Department of the Interior

The responses are reproduced in this Statement in Appendix B.

The responses from FERC, EPA, DOT and Commonwealth of Virginia did not provide any significant comments and, therefore, no changes were made to the Statement.

Lynn R. Chong of Iowa City, Iowa, responded (page B-7) with two comments which are answered below:

1. Comment (B-7)

Because it is the occupational radiation exposure that you've determined to be the only adverse environmental impact, and because (p. 4-4) you are willing to accept VEPCO's estimates of gaseous releases in the past, but VEPCO is not an impartial member of the repair proceedings, I would want both the UNION OF CONCERNED SCIENTISTS and THE PHYSICIANS FOR SOCIAL RESPONSIBILITY to review and approve the repair proceedings before they happen.

Response:

It is the sole responsibility of the NRC to approve the Steam Generator Repair Program. However, other organizations had the opportunity to review the repair program and provide comments to the NRC for consideration. Opportunity was provided, as stated in Section 2.2 of the Statement, for other interested parties to request a hearing on the repair program. No requests for a hearing were received. After the licensing action was taken on January 19, 1979, approving the repair program, several parties requested a hearing and an environmental impact statement. As a result of these requests, the Commission ordered the staff to prepare this Environmental Impact Statement. None of the interested parties were the Union of Concerned Scientists and the Physicians for Social Responsibility.

The Commonwealth of Virginia reviewed the Steam Generator Repair Program and the staff's evaluation of the program. No significant comments were made.

2. Comment (B-7)

I must respond to the portion (p. 4-3) that is a rather elaborate, transparent effort to rationalize what amount of exposure to radiation is acceptable. I doubt whether most Americans when choosing to live either in Washington, DC, or Denver, Colorado, yet know enough to make radiation exposure a part of their judgement criteria. Your "therefore, we conclude..." is an insult to the American people. What our society has been accepting for radiation exposure has come out of an ignorance fostered by the nuclear industry. This third-from-last paragraph smacks of barbaric unconcern for the public trust. I demand to know how you would proceed from this point, in the study, without it.

Response:

The point of the discussion on p. 4-3 was to show the insignificance of the impact of the occupational dose associated with the Surry Steam Generator Repair Program. As an example of this insignificance, we stated that no one would forego a move from Washington to Denver to avoid the higher dose rate in Denver. This example is appropriate because the existence of natural background radiation is a known fact. Also, if the dose rate in making a move were significant, knowledgeable persons and organizations would have raised it as an issue.

James B. Dougherty submitted comments on behalf of Potomac Alliance, Citizen's Energy Forum, Inc., Virginia Sunshine Alliance, and Truth-in-Power, Inc. These comments are in addition to those submitted by Mr. Dougherty in his petition dated April 18, 1979, and denied by the Director's Decision on October 24, 1979.¹⁵ Responses to the comments follow:

1. Comments (B-10 and B-14)

Section 1501.7 of the NEPA regulations promulgated by the Council on Environmental Quality (CEQ) require that as soon as practicable after the decision to prepare an EIS has been made (presumably before a draft EIS is prepared), the agency shall invite interested persons to participate in a scoping process in which the scope of the EIS will be decided. To the Petitioners' knowledge, no scoping process was initiated with respect to the Surry DES. As a result, the scope of the document is defective in several material respects.

No "record of decision" was prepared for the Surry project, in violation of 40 CFR §1502.2.

Much of the material cited in the section of the DES headed "REFERENCES" is not readily available to the public, nor are the contents of the referenced documents summarized, in violation of 40 CFR §1502.21.

The DES contains no list of preparers, in violation of 40 CFR §1502.17.

To the knowledge of the Petitioners, notice of the availability of the DES for review has not been made known to the public through local newspapers, local media, or by posting appropriate notices on and off the site of the Surry station, in violation of 40 CFR §§1506(a), 1506(b)(3)(iii), 1506(b)(3)(iv), 1506(b)(3)(v), 1506(b)(3)(vii), 1506(b)(3)(viii), 1506(b)(3)(ix), and 1506(d).

The DES contains no glossary or table of definitions, and consistently uses terminology beyond the ken not only of lay people but of those somewhat familiar with reactor design. See, for example, p. 3-1, where the changes in steam generator design and operations are described as follows:

(1) using All-Volatile-Treatment chemistry control in the secondary system from the beginning of operation, (2) using corrosion resistant SA240 Type 405 ferritic stainless steel rather than carbon steel for support plate material, (3) thermally treating the Inconel 600 heat exchanger tubes for better corrosion resistance, and (4) using a broached hole pattern with a quatrefoil design in the support plates rather than separately drilled flow holes to minimize the accumulation of corrosion products where the tubes pass through the plates.

None of the highlighted terms are defined anywhere in the DES. See Environmental Defense Fund v. Corps of Engineers, 348 F. Supp. 916, (E.D. Miss. 1972) (impact statements must be written in language understandable to nontechnical minds).

Response:

The NRC is an independent agency. Although it is not required to do so, the NRC voluntarily has promulgated proposed new regulations to implement many of CEQ's NEPA regulations. Both CEQ and NRC are in agreement that a sound accommodation can be reached between NRC's independent regulatory responsibilities and CEQ's objective of establishing uniform NEPA procedures. Those new NRC regulations are not yet final, and thus the Commission's regulations as they currently appear in 10 CFR 51 remain operative. This environmental statement was prepared and circulated in accordance with those currently operative regulations.

2. Comment (B-11)

As pointed out in the Petition at pp. 24-25, the Surry project is but one of at least 15-20 similar projects likely to be performed at pressurized water reactors in the next few years. Since the date of filing of the Petition, the Wisconsin Electric Power Co. has encountered severe steam generator degradation at the Point Beach plant and has announced plans to replace the steam generators there. Scientists Institute for Public Information, Inc. v. AEC, 481 F.2d 1979 (D.C. Cir. 1973), directs that where a single action is simply one aspect of an overall program with cumulatively significant environmental effects, a programmatic EIS must be prepared. In this case, a programmatic EIS is required on steam generator repair nationwide.

Case law discussing the programmatic EIS requirement has often arisen in connection with programs with geographically related environmental impacts. See Kleppe v. Sierra Club, 427 U.S. 390 (1976). However, programmatic statements are also required when an agency embarks on a series of actions which have common environmental impacts, alternatives, methods of implementation, media, etc. See 40 CFR §1502.4(c), 1508.25(a). Scientists' Institute for Public Information, supra.

Response:

This comment is the same as the one made by the commenter [see page 2-2 of this Statement] and denied on October 24, 1979, by the Director of NRR (Reference 15). The need for a programmatic environmental impact statement has been considered as indicated in the Director's Decision. Only a few other facilities have proposed repair projects, all several hundred miles apart. In view of the extremely limited offsite effects to be produced by any of these few operations, the staff does not believe that the projects would have produced the radioactive synergy contemplated by the Supreme Court. *Kleppe v. Sierra Club*, 410 U.S. 390 (1976). The completion of the Surry action does not compel the proposal of other similar actions and, therefore, does not involve a decision with wide ramifications.

3. Comment (B-12)

The DES improperly and without justification limits the scope of its analysis to the replacement of the steam generators at Unit 1. This is inconsistent with NEPA. There is no way that the interested public or any other reader of the DES can evaluate the project meaningfully without understanding that the replacement of the steam generators at Unit 1 is part of a larger operation. Indeed, at other points in the DES the cost of the project is projected in terms of the entire project. See DES pp. 4-6, 4-7. And at other points, the total radiation exposures are expressed as a total for both operations. See DES at p. 5-1.

Response:

The staff recognizes that the repair of the steam generator at Unit 1 is part of the larger operation of repairing two units. The Statement makes it clear that the overall project included two units, that Unit 2 work is complete and that the Statement applies to Unit 1. Although some of the cost data is presented for two units, it is a simple matter to determine the cost for one unit. The same is true for radiation exposures.

4. Comment (B-12)

The DES improperly limits the scope of its discussion of environmental effects to the occupational exposures borne by workers at Surry. This is a patent violation of NEPA, which requires that EISs address, "to the fullest extent possible," all environmental effects of proposed actions as well as all irreversible and irretrievable commitments of resources.

Foremost among these impacts and irreversible commitments is the burning of coal and oil to generate electricity to replace that which would be generated at Surry but for the steam generator replacement project. While Unit 2 was down for 39-60 weeks, the use of fossil fuels to produce replacement power certainly had significant impacts upon air quality in regions downwind from the generating plants. In addition, the use of this amount of fossil fuel constituted an irreversible commitment of a vital energy resource which, while perhaps justified, was required to be analyzed within an EIS. Additionally, the Surry project will lead to an irreversible commitment of worker health and allowable worker exposures.

Further, the Surry project will lead to substantial socio-economic effects upon VEPCO ratepayers. As pointed out below, the Surry action cost roughly \$300-350 million, not the \$142 million estimated in the DES. This averages to \$300 per ratepayer, a significant drain upon the after-tax incomes of most ratepayers. Such effects must be examined fully within the Surry DES, because the project entails direct significant environmental effects which are intertwined with the socio-economic effects. See *Image of Greater San Antonio v. Brown*, 570 F.2d 517, (5th Cir. 1978); 40 CFR §1508.14.

Response:

The Commission reviewed the staff's conclusions that an EIS was not required and determined that radiological exposure was the only adverse environmental impact associated with the repair program that might be considered significant. Thus, this sole issue was the scope of the DES.

Concerning the impacts and irreversible impacts, the commenter ignores the impact if the repairs are not performed.

5. Comment (B-14):

Sections 2.1. and 3 of the DES provide a totally inadequate description of the background and need for the action, and of the way in which it will be carried out. For example, the DES does not set forth the dimensions of the steam generators nor does it describe their function in a nuclear reactor. The DES does not permit a lay person to conceptually grasp the nature of the project.

Response:

The steam generator repair program is adequately described.

6. Comment (B-15)

In general, the DES is horrendously out of date, making the calculations and conclusions therein essentially worthless. For example, estimated economic costs are presented in 1977 dollars despite the facts that nuclear power plant construction costs have inflated approximately 50 percent within the last 3 years.

Response:

Since the costs were stated in 1977 dollars, it is a simple matter to escalate the costs as the commenter shows. Escalation costs are adequately documented over the last three years. In any event, the cost differential of the repair and alternatives would remain essentially the same.

7. Comment (B-15)

Section 3.0, "Description of the Proposed Repair Method," is lacking in detail or supporting data. This two-year, multi-million dollar undertaking is described in little more than one paragraph. Statements such as "The old upper assembly, after some refurbishment, and the new lower assembly will be welded together in the field" demonstrate the paucity of information in this section.

VEPCO has gone through this operation once, and has made a 30-minute color movie out of it. This movie should be made available to the public. Still photographs should be included in the DES to illustrate the various stages in the steam generator replacement project. Data regarding occupational exposure and other aspects of the action should be provided. NEPA requires that, "to the fullest extent possible," any factual information in the NRC's possession regarding the repair of Unit 2 be set out in the DES. It must disclose "the history of success and failure of similar projects." Sierra Club v. Morton, 510 F.2d 813 (5th Cir. 1975). "Otherwise, those removed from the decisionmaking process will have no way of knowing the adverse effects that have occurred in similar proposals." Burkey v. Ellis, 483 F. Supp. 897, 911 (N.D. Ala. 1979).

Response:

The repair program is adequately described.

8. Comment (B-16)

On p. 3-1 reference is made to an "above-ground concrete structure with walls about 3 feet thick," but there is no indication whether the structure also has a floor, a ceiling, doors, windows, electrical wiring, security monitoring equipment, or whether it is seismically secure. This structure must be described in detail. As it has apparently already been constructed, photographs should be provided. The means in which steam generators are transported to the structure and placed inside it must be described.

Response:

It is obvious from the same page 3-1 that the building is more than walls. The building is sealed against water intrusion (rain) and ventilated (implying that it is closed).

9. Comment (B-16)

The diagrams provided at pp. 3-2 and 3-3 of the DES are impenetrable. Even the title of Figure 2 uses terms that are not explained, such as "Primary Side Drained and Secondary Side at 72% Level."

Response:

It is the staff's opinion that the figures are adequately labeled and the terms used are not so complex as to be beyond the understanding of persons with some knowledge of steam generators.

10. Comment (B-16)

The estimates of worker exposures in section 4.1.1 are unreasonably low. Given that the estimate made by Batelle Pacific Northwest Laboratories was 3380 to 5840 man-rems, that the measured exposures during the repair of Unit 2 were 2140 man-rems, and exposure rates at Unit 1 have historically run at a level 30-40 percent higher than those at Unit 2, the NRC's adherence to an estimate of 2070 is unsupportable and arbitrary. Indeed, the DES offers no basis for this estimate other than VEPCO's belief that its original estimate is reasonable because of its belief that it learned how to reduce exposures during the replacement of the steam generators at Unit 2.

Response:

The use of experience is valid for predicting future performance. The estimate for Unit 2 was met within 5% which lends some weight to the estimate for Unit 1.

11. Comment (B-17)

The DES's attempt to "put into perspective," i.e., belittle the significance of the man-rem exposures resulting from the action are invalid, misleading, and violative of NEPA. It is shocking that the extreme radiation exposures which have occasionally been measured at nuclear plants are characterized in the DES as "[in]significant deviations from the average" (DES at p. 4-2), considering that they have run as high as 3142 man-rem, or six times the average exposure level. Yet then the DES casts the 2070 man-rem estimate as "within the historical range of doses about the average." This is a transparent attempt to brush these significant exposure levels under the rug rather than acknowledge, much less explain, their significance.

Response:

The DES case is stated as indicated on page 4-2 of this Statement.

12. Comment (B-17)

The prediction that the steam generator replacement project will lead to dose savings of hundreds of man-rem per year is unsupported. The statement made on p. 4-3 that such savings will "offset" the total project exposures of 4140 man-rem is invalid and misleading. The latter figure seems to have no basis.

Response:

The basis for the 4140 man-rem is discussed in detail in the DES and is further supported by the fact that the Unit 2 repairs were performed with a radiological exposure within 5% of the single unit estimate of 2070 man-rem.

13. Comment (B-17)

The DES does not provide data indicating exposures at Surry for 1978 or 1979, nor does it break down its exposure data according to the reactor at which the doses were received.

Response:

The exposure for each reactor should be approximately the same since each had the same steam generator problems. However, since both units are to be repaired, it is appropriate to compare total doses. The data for 1978 indicates exposure of 1734 man-rem for both units. The year 1979 is not a typical year since both units were down for a significant part of the year.

14. Comment (B-18)

The analysis of the deaths and health effects likely to result from the action is invalid because it is based on outmoded scientific information. The "BEIR Report," on which those calculations are based, predates a significant reversal in scientific thinking concerning the dose-response relationship of ionizing radiation. Since then, the linear exposure theory, which holds that no exposure is risk free and that spreading a given dose over a large number of persons does not reduce its adverse effects, has become prevalent. In addition, many experts in the field now believe that the dose-response estimates in the BEIR Report are conservative by a factor of as many as five. Given this substantial divergence in scientific opinion, the DES is defective for failing to present the range of significant opposing scientific views. See The Committee for Nuclear Responsibility, Inc. v. Schlesinger, 404 U.S. 917 (1971) (Remarks of Douglas, J., dissenting; 40 CFR §1502.9(a)).

Response:

The "BEIR Report"¹⁴ is not "outmoded scientific information." The "BEIR II Report"¹⁶ did not alter the health effects estimators or the linear nonthreshold theory - principles on which the draft environmental statement was based. The "BEIR III Report" has not been published in final form yet. However, the staff presently does not expect the risk estimators in "BEIR III" to be significantly different than those in "BEIR I."¹⁴ Also, staff discussions with members of the "BEIR Committee" indicate that the estimate of the health damaging capability of low dose, low dose rate exposure will be reduced in "BEIR III." If the dose-response estimates in "BEIR I"¹⁴ are conservative, then the doses presented in this environmental statement are even less significant than stated. If the estimates in "BEIR I"¹⁴ are non-conservative, then the comparisons of man-rem versus man-rem are still valid.

There have been conflicting theories set forth by researchers such as Mancuso, Stewart, and Kneal. However, the consensus of the experts in the field of health effects from radiation does not support such conflicting theories. "BEIR"¹⁴ is considered to be one of the most up-to-date references on the subject.

15. Comment (B-18)

Although the DES states at p. 4-4 that "our independent analysis of the gaseous and liquid releases of radioactivity from the plant site during the steam generator repair project is based in large part" on NUREG/CR-0199, the fact is that the DES never adopts the estimates therein nor makes its own, independent

estimates. It simply concludes the VEPCO's estimates are reasonable. This is an abdication of the Commission's responsibilities under NEPA. Since measurements of radioactive effluent releases were made during the repair of Unit 2, that data should have been used to formulate revised estimates. In particular, it was purely arbitrary not to revise the predicted releases of noble gases. Incredibly, the basis for failing to revise these estimates is that the environmental impacts of these releases are expected to be less than those stated in the Surry FES, prepared in 1972. DES at p. 4-4.

Response:

The environmental statement has been revised on page 4-4 to reflect the Unit 2 repair experience in the estimates of radioactive effluents.

16. Comment (B-19)

The estimate in Section 4.2 of the DES of the economic costs of the Surry steam generator replacement project is invalid because it is based on 1977 dollars. Standing alone, this defect is sufficient to render the DES invalid under NEPA. See Burkey v. Ellis, 483 F. Supp. 897 (N.D. Ala. 1979).

Response:

See response for Comment No. 6.

17. Comment (B-19)

The economic analysis in the DES is invalid in that it fails to consider the possibility that replacement or repair of the steam generators may be necessary a second time. As the DES reveals, the cause of the steam generator degradation leading to the present action is unknown, and as the Point Beach situation demonstrates, no cure has been found. The DES must, therefore, consider at least the possibility that the action will be necessary a second time and factor the cost of such an operation into its analysis.

Response:

To suggest that the steam generator repair would be necessary for a second time is only speculation. There is no requirement that the Statement consider future actions which may never occur.

18. Comment (B-19)

The prediction of the cost of replacement power during the repair of Unit 1 is invalid because it assumes that the plant will be down for only six months. Since the repair of Unit 2 took between 37 and 60 months, the DES must select a reasonable figure within that range or at least explain why the six month figure remains viable.

Response:

The steam generator repair at Unit 2 took, according to the licensee, about 37 weeks (about 9 months). Although this is about 3 months longer than predicted, the cost benefit would still favor the repair project.

19. Comment (B-20)

The analysis of the economic cost of the action is invalid because it assumes that the cost of replacement power is \$183,000 per day. In fact, the cost of replacement power has increased since 1977 to \$500,000 per day.

Response:

The commenter fails to recognize also that these costs would apply to the cost of permanently shutting the plant down. In this case, the differential costs would still favor the repair project.

20. Comment (B-20)

The estimate of \$142,000,000 as the "total project cost" is invalid. Presumably, this figure refers to the cost of repairing both units, as this is the figure found in the 1979 EIA. If so, the figure is off; the replacement of the steam generators at Unit 2 has already cost more than that amount. If the figure refers to the costs of the Unit 1 repair project it is still seriously low.

Response:

See responses to comments numbered 6, 19, and 22.

21. Comment (B-20)

Section 4.3, headed "Non-Radiological Environmental Costs," is a disgrace to the NEPA process. Even with respect to the environmental impacts that are mentioned summarily in that section, their treatment displays far less than the good faith consideration required under NEPA. The DES must be revised to estimate the amount of noise generated by the project, the quantity of fugitive dust and other air pollutants, the discharge of chemicals into nearby bodies of water to the extent that the impacts are non-radiological. See the attached Petition at pp. 14-18.

Response:

The Surry site is an existing industrial site and as such, the additional noise and/or dust is not a significant factor as discussed on page 4-7. As for the discharge of chemicals into nearby bodies of water, the staff evaluated the discharge of the demineralizer system in the response to the Petition and concluded that the impacts were insignificant.

22. Comment (B-20)

Section 4.3 is inadequate because it fails to estimate the economic effects of the action upon VEPCO ratepayers. Assuming without conceding that Unit 2 was down for only 9 months for steam generator repair, that Unit 1 will be down for the same length of time, and that the other economic estimates in the DES are accurate, the total cost of the action comes to \$346 million (540 days x \$500,000 per day plus \$76 million in other costs). As shown in the Petition at pp. 15-17 such economic impacts must be considered in an EIS when intertwined with other direct effects on the natural environment, as they are in this case.

Response:

The Director's Decision (pp. 20-22) discusses the cost of the economic effects of the action upon VEPCO ratepayers. Although the Director's Decision states that the NRC is not involved in determining rates since concerns about rates are not within the scope of interests sought to be protected by the Atomic Energy Act, the staff did make an estimate of the impact on the ratepayer. It was estimated that a rate increase equals 0.0037% of the Virginia median per family disposable income which could result in a \$52 cost increase per residence. Even if the cost were to double, the cost increase is not significant in relation to existing conditions and considering that tangible benefits result from the repair project.

23. Comment (B-21)

The analysis of alternatives in Section 5.0 is inadequate under NEPA. That it is based on 1977 dollars is alone sufficient to render the entire section essentially useless. See comment 21, p. 12 above.

Response:

See response to Comment No. 6.

24. Comment (B-21)

The alternative of derating the Unit 1 reactor cannot be evaluated on the basis of the DES because the cost of that option is said only to be "high." DES at p. 5-1. For some unexplained reason, the figure of 4140 man-rems is used as reference for evaluating the man-rem exposures that would be experienced under this alternative.

Response:

The cost of derating is discussed on page 4-7. If the unit were derating it would still be necessary to shut the unit down periodically to inspect the degrade steam generators. These inspections would result in additional occupational exposures. The derating, in fact, would be caused by plugging of steam generator tubes during these periodic inspections.

25. Comment (B-21)

The alternative described as using corrosion inhibitors and secondary side cleaning is dismissed much too casually, without explaining exactly what the merit of this alternative is or raising the possibility of deferring action for a short while until it has been studied further.

Response:

As stated on page 5-1, there is no merit for this alternative for Surry because the denting phenomenon at Surry is too advanced for such measures to be practical.

26. Comment (B-21)

The option of shutting down the unit (described for some reason as shutting down the Surry station) is insufficiently examined. For example, the environmental impacts of this alternative are covered in one sentence! Their magnitude: "significant." The economic analysis of this option is woefully inadequate, as the figures given are neither justified nor referenced to credible authorities.

Response:

The staff's discussion of alternatives (See Director's Decision, page 40) contains a reasonably detailed, quantified comparison of the costs and benefits of the relevant options confronting VEPCO and the staff. When considered against the backdrop of an agency decision of limited environmental significance, the consideration of alternatives is more than adequate as it evidences that the staff has considered alternatives to the repair project and informed outsiders as to how it chose among them.

27. Comment (B-22)

The option of retubing, described in Section 5.2, is given inadequate treatment. The nature of the alternative is not presented in a way that is comprehensible to a lay person. The economic "analysis" of the option is based on analyses performed years earlier. While the ES states that the retubing alternative "may be an alternative" in the future, it does not attempt to predict when that day will likely arrive. And above all, the DES reveals the Staff's awareness of "recent developments" which show that the retubing alternative may be far preferable to the proposed action. This is virtually the same remark made in the EIS of 1979. Evidently the staff has made no effort at all to investigate the potential of this important alternative.

Response:

As stated on page 42 of the Director's Decision, the only option available to the NRC in relation to retubing was to refrain from any action and continue to have the units operate in a degraded condition. Retubing is still not an available alternative to the proposed action. Although the staff has begun review of Westinghouse's method, it is expected that it will not complete its review in time to make it a meaningful alternative.

28. Comment (B-22)

The DES is defective for failing to discuss fully the environmental implications of the shipment of one of the Surry steam generators to Hanford, Washington via the Panama Canal. Although the DES states on p. 4-4 that this event "may" happen sometime in the future, the fact is that the shipment has already commenced. The fact that the Department of Energy is assuming principal responsibility for this aspect of the Surry operation does not relieve the NRC of its obligation under NEPA to fully evaluate the resulting environmental effects and risks within the DES. To do otherwise is to "segment" the action in violation of NEPA.

Response:

The shipment of the steam generator is under the responsibility of the DOE. An environmental assessment was performed by DOE and notice was published in the Federal Register on April 2, 1980, of its availability and finding of no significant impact.

The following comments were received from the Department of Interior:

1. Comment (B-24)

The draft is lacking a location map and site plan. We believe reviewers would find these of value in the final environmental impact statement. While the doses in the unrestricted areas are expected to be below normal operating levels during the repair, the final statement should describe a monitoring program to assure the public that the doses do indeed remain within acceptable levels.

Response:

The Final Environmental Statement for Surry Power Station, Unit 1, dated May 1972, provides a location map and site plan. These are also attached as part of this response.

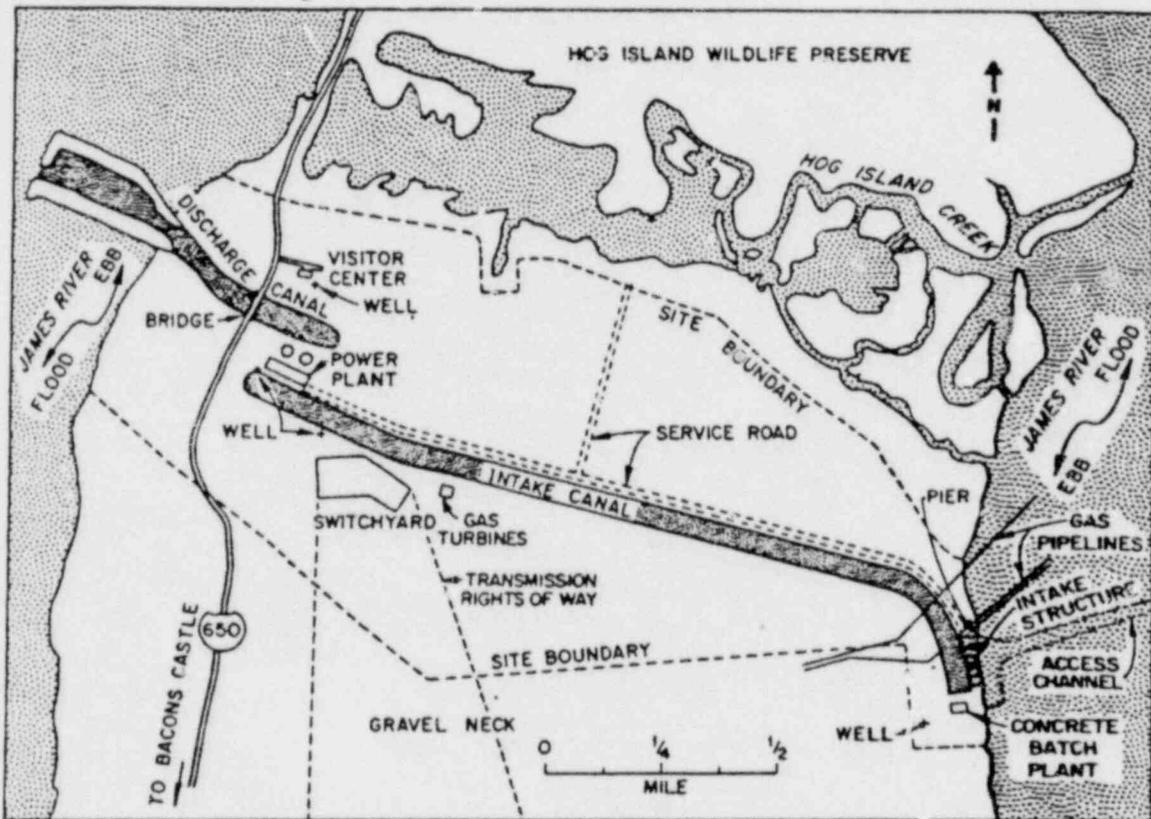
The Surry Station has, as a part of its license, Technical Specifications which include a monitoring program which, as during normal operations, will assure that the public doses remain within acceptable levels. An Effluent Monitoring Program assures that effluents released from the site are within acceptable levels. An Environmental Monitoring Program monitors offsite doses via air samples, water samples, and dosimeters.

Comment (B-24)

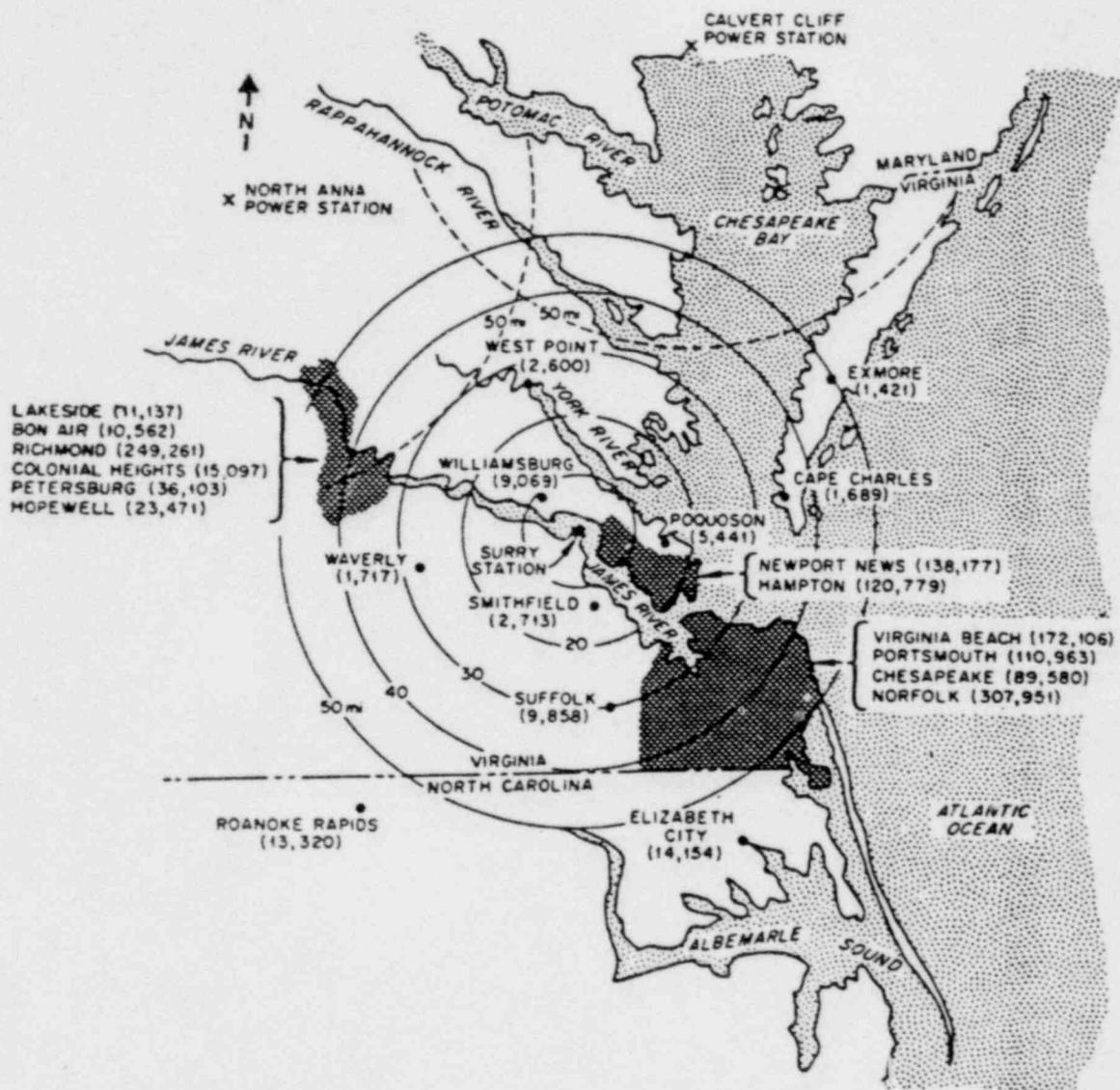
The statement should address the fate of any water collected in the sump of the storage facility for the degraded lower assemblies of the steam generator (see page 3-1).

Response:

No water accumulation is expected in the facility; however, the sump will be checked periodically with a dipstick. Any water that accumulates will be treated as radioactive waste.



Site plan of Surry Power Station.



Location of the Surry Power Station.

REFERENCES

1. Steam Generator Repair Program, Surry Power Station, Unit Nos. 1 and 2, Virginia Electric and Power Company, August 17, 1977, and revisions dated December 2, 1977; April 21, June 2, June 13, June 30, September 1, October 25, and November 10, 1978.
2. NUREG/CR-0199, "Radiological Assessment of Steam Generator Removal and Replacement," G. R. Hoenes, D. A. Waite, and W. D. McCormack, Pacific Northwest Laboratories, June 1978.
3. Safety Evaluation Report for the Surry Power Station Steam Generator Replacement, U.S. Nuclear Regulatory Commission, December 1978.
4. Regulatory Guide 8.8, "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As Is Reasonably Achievable" (Revision 2), U.S. Nuclear Regulatory Commission.
5. NUREG-0482, "Occupational Radiation Exposure at Light-Water-Cooled Power Reactors, 1977," L. J. Peck, U.S. Nuclear Regulatory Commission, November 1978.
6. "Annual Operating Report of Surry Power Station for 1977," Virginia Electric and Power Company.
7. "Final Environment Statement Related to the Operation of Surry Power Station, Unit 2," U.S. Nuclear Regulatory Commission, June 1972.
8. Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," U.S. Nuclear Regulatory Commission.
9. Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors" (Revision 1), U.S. Nuclear Regulatory Commission.
10. NUREG/CR-0130, "Technology, Safety, and Cost of Decommissioning a Reference Pressurized Water Reactor," R. I. Smith, G. J. Konzek, and W. E. Kennedy, Jr., Pacific Northwest Laboratories, June 1978.
11. Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I" (Revision 1), U.S. Nuclear Regulatory Commission.
12. NUREG-0367, "Radioactive Material Released from Nuclear Power Plants (1976)," T. R. Decker, U.S. Nuclear Regulatory Commission, March 1978.
13. NCRP No. 45, "Natural Background Radiation in the United States," National Council on Radiation Protection and Measurements, 1975.
14. "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation" (BEIR Report), National Academy of Sciences, November 1972, Reprinted July 1974.
15. Director's Decision Under 10 CFR §2.206 In the Matter of Virginia Electric and Power Company (Surry Power Station, Units 1 and 2), dated October 24, 1979.
16. Considerations of Health Benefit-Cost Analysis for Activities Involving Ionizing Radiation Exposure and Alternatives", (BEIR II Report), Advisory Committee on the Biological Effects of Ionizing Radiations, National Academy of Sciences, EPA 520/4-77-003.

APPENDIX A

MEMORANDUM AND ORDER

BY THE U.S. NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF

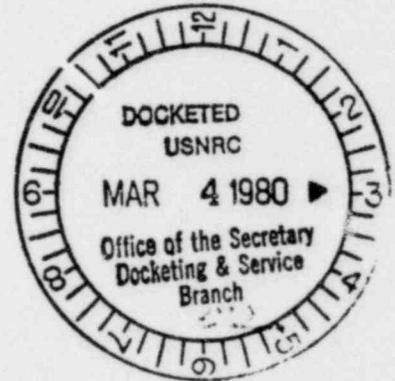
VIRGINIA ELECTRIC AND POWER COMPANY

(SURRY POWER STATION, UNITS 1 AND 2)

UNITED STATES OF AMERICA
 NUCLEAR REGULATORY COMMISSION

COMMISSIONERS:

John F. Ahearne, Chairman
 Victor Gilinsky
 Richard T. Kennedy
 Joseph M. Hendrie
 Peter A. Bradford



Docket Nos. 50-280
 50-281

In the Matter of
 VIRGINIA ELECTRIC POWER CO.
 (Surry Nuclear Power Station,
 Units 1 and 2)
 For Relief Under 10 CFR 2.206

MEMORANDUM AND ORDER

The Commission has before it for sua sponte review three decisions by the Director of the Office of Nuclear Reactor Regulation on petitions^{1/} filed under 10 CFR § 2.206 involving the steam generator repair at the Surry Nuclear Power Station. On January 29, 1980, the Commission, pursuant to 10 CFR § 2.206(c)(1), took review of the three decisions on the issue of the need for an environmental impact statement regarding the proposed repair.

^{1/} The three petitions are from the North Anna Environmental Coalition (filed December 29, 1978; denied February 1, 1979); the Environmental Policy Institute (filed February 20, 1979, denied April 4, 1979); and the Potomac Alliance, Citizens Energy Forum, Inc., Truth in Power, Inc., and the Virginia Sunshine Alliance (filed April 18, 1979, denied October 24, 1979).

The primary issue presented by the repair,^{2/} and the sole issue considered on the merits in this Commission review, is whether the NRC's action in approving the repair is one "significantly affecting the quality of the human environment" for purposes of the National Environmental Policy Act (NEPA),^{3/} and therefore one that requires an environmental impact statement. This admittedly vague test, and the lack of definitive criteria that can be used in applying it, leaves the Commission and its Staff with a difficult decision in many cases. The circumstances of this case presented the Director with just such a difficult decision.

Our review has focused on the occupational radiation exposure that the repair program will entail because we believe that this adverse environmental impact is the only one associated with the repair program that might be considered significant. We have carefully examined the Director's Decisions and the bases therefor, and are unable to determine from the data and arguments presented by the Director whether the occupational radiation exposure involved here is significant. The Director's Decisions rest essentially on a comparison of the impact of the radiation exposure resulting from the repair with the net savings in total occupational exposure resulting from operation using repaired steam generators

^{2/} When this issue first arose, both units at Surry were the subject of the petitions. At this point however, repairs at Unit 2 are essentially completed and the repairs at Unit 1 are scheduled to begin in June of 1980. Hence, the need for an environmental impact statement for the Unit 2 repairs is moot. However, the issue of the need for a statement for the Unit 1 repair is very much alive and is the focus of this Commission review.

^{3/} The National Environmental Policy Act of 1969, Pub. L. No. 91-190, 83 Stat. 852 as amended by Pub. L. 94-83, 89 Stat. 424, 42 U.S.C. §§ 4321 et seq.

instead of defective ones, and a comparison with the incidence of cancer for the worker population due to causes other than the repair at Surry. The first comparison is relevant to the question whether the expected benefits of the action outweigh the environmental costs, which is distinct from the question whether the expected environmental impact of a federal action is sufficiently great to require an impact statement. Even if on balance the result of the Federal action is beneficial, the proper criterion on which to base the decision whether to prepare an EIS is the significance of the action.^{4/} Hence, the fact that the occupational exposure at Surry (2070 man rems for the repair at each unit) is expected to be less than the occupational exposure resulting from continued operation with defective steam generators over a period of four years is a valid consideration in assessing the merits of the repair once the requirements of NEPA have been satisfied, but has no bearing in determining the threshold question of the "significance" of the exposure and the attendant decision whether to prepare an environmental impact statement.

The Director's second basis, comparing the occupational exposures to the number of worker deaths due to cancer from risks unrelated to the repair, necessarily entails a judgment regarding the significance of these other risks. More specifically, it implies the proposition that these other risks are either not significant or that a small percentage of them is not significant. However, nothing in the Director's Decisions establishes this proposition. Thus the comparison, without more, does not enable us to determine whether the exposures here are significant.

^{4/} See Regulations For Implementing The Procedural Provisions of NEPA, 40 CFR 1508.27(b)(1).

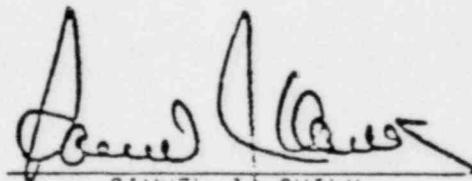
Given this, and given the controversy in the scientific community as to the effects of such exposures, we are unable to determine whether the environmental impacts here are significant. Therefore, we believe that the preferable course of action in the circumstances of this case is to prepare an environmental impact statement on the repair.

Accordingly, we hereby direct the Staff to expeditiously prepare and issue an environmental impact statement on the proposed repair at Unit 1.

Chairman Ahearne and Commissioner Hendrie dissent from this decision.^{5/}

It is so ORDERED.

For the Commission



SAMUEL J. CHILK
Secretary of the Commission

Dated at Washington, D.C.,
this 4th day of March, 1980.

^{5/} Section 201 of the Energy Reorganization Act, 42 U.S.C. § 5841 provides that action of the Commission shall be determined by a "majority vote of the members present." Had Commissioner Gilinsky been present at the meeting he would have voted with the majority. To enable the Commission to proceed with this case without delay, Chairman Ahearne, who was a member of the minority on the question up for decision, did not participate in the formal vote. Accordingly, the formal vote of the Commission was two to one in favor of the decision.

APPENDIX B
COMMENTS ON DRAFT ENVIRONMENTAL STATEMENT

<u>Commenter</u>	<u>Page</u>
Federal Energy Regulatory Commission.....	B-1
Environmental Protection Agency, Environmental Research Laboratory.....	B-2
Department of Transportation, Regional Representative of the Secretary.....	B-3
Commonwealth of Virginia.....	B-4
Lynn R. Chong.....	B-7
James B. Daugherty.....	B-8
Department of Interior.....	B-24

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON 20426

P

IN REPLY REFER TO:

May 1, 1980

Mr. Ronald L. Ballard
Chief, Environmental Project
Branch 1
Division of Site Safety & Environ-
mental Analysis
Nuclear Regulatory Commission
Washington, D. C. 20555

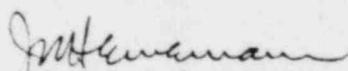
Dear Mr. Ballard:

I am replying to your request of March 18, 1980 to the Federal Energy Regulatory Commission for comments on the Draft Environmental Impact Statement for the Surry Power Station No. 1 - VEPCO. This Draft EIS has been reviewed by appropriate FERC staff components upon whose evaluation this response is based.

The staff concentrates its review of other agencies' environmental impact statements basically on those areas of the electric power, natural gas, and oil pipeline industries for which the Commission has jurisdiction by law, or where staff has special expertise in evaluating environmental impacts involved with the proposed action. It does not appear that there would be any significant impacts in these areas of concern nor serious conflicts with this agency's responsibilities should this action be undertaken.

Thank you for the opportunity to review this statement.

Sincerely,


Jack M. Heinemann
Advisor on Environmental Quality

C002
S
1/0
Add:
R BALLARD



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ENVIRONMENTAL RESEARCH LABORATORY
SOUTH FERRY ROAD
NARRAGANSETT, RHODE ISLAND 02882

April 8, 1980

Docket Nos.: 50-280

Ronald L. Ballard, Chief
Environmental Projects Branch 1
Division of Site Safety and
Environmental Analysis
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Ballard:

ERL-Narragansett declines to review the March, 1980 Draft Environmental Statement Related to Steam Generator Repair at Surry, Unit #1, as it is outside our areas of expertise.

Sincerely,

Jan C. Prager
Chief, Technical Assistance Branch

JCP/gr

0002
SE / 0
ADD:
EPB #1 BC 4 C



U.S. DEPARTMENT OF TRANSPORTATION
REGIONAL REPRESENTATIVE OF THE SECRETARY

434 WALNUT STREET
PHILADELPHIA, PENNSYLVANIA 19106

APR 8 1980

Mr. Ronald L. Ballard, Chief
Environmental Projects Branch 1
Division of Site Safety and
Environmental Analysis

Re: DEIS Steam Generator Repair
Surry Power Station, NUREG-0663

Dear Mr. Ballard:

We have reviewed the subject DEIS recognizing that our area of expertise and interest is the proposal's impact on the transportation system. The proposed recommended action has no apparent effect on the transportation system. However, in the event the final action requires the transport of hazardous materials this Department and the Virginia Department of Highways and Transportation should be consulted.

Sincerely yours,

Ms. Sally Cooper
Regional Representative of
the Secretary

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ADD: LTR Enc
R. Ballard 6 0

D

COMMONWEALTH of VIRGINIA

Council on the Environment

100 N. 14TH STREET OFFICE BUILDING

22100

April 29, 1980

Mr. Ronald L. Ballard, Chief
Environmental Projects Branch 1
Division of Site Safety and
Environmental Analysis
Nuclear Regulatory Commission
Washington D.C. 20555

Dear Mr. Ballard:

The Commonwealth of Virginia has completed its review of the Draft Environmental Impact Statement for steam generator repair at Surry Power Station (Docket No. 50-280). The Council on the Environment is responsible for coordinating the State's review of environmental impact statements and responding to appropriate federal officials on behalf of the Commonwealth. The following agencies took part in the review of this document:

- Commission of Game and Inland Fisheries
- Commission of Outdoor Recreation
- Department of Agriculture and Consumer Services
- Department of Conservation and Economic Development
- Department of Health
- Marine Resources Commission
- State Office of Emergency and Energy Services
- State Water Control Board
- Virginia Institute of Marine Science
- Crater Planning District Commission
- County of Surry

The Commonwealth has no objection to the proposed repair of the steam generator at Surry Power Station, Unit #1, since the repair will reduce the amount of radiation to which the public and VEPCO employees are exposed.

Thank you for the opportunity to review this draft environmental statement.

Sincerely,

A. B. Jackson, Jr.
for A. B. Jackson, Jr.

COO2
5/1
ADD.
R BALLARD

JBjr:CHE/gcj
Enclosure

cc: The Honorable Maurice B. Rowe, Secretary of Commerce and Resources
Mr. Bruce B. Meador, Department of Conservation and Economic Development
Dr. Robert B. Strobe, Department of Health

8. REVIEW INSTRUCTIONS:

- A) Please review the document carefully. If the proposal has been reviewed earlier (e.g., if the current document is a FINAL EIS), please consider previous comments.
- B) Prepare your agency's comments in a form which would be acceptable for responding directly to a project sponsoring agency.
- C) Use the space below for your comments. If additional space is needed, please attach extra sheets.

Return your comments to:

Charles H. Ellis III
 Environmental Impact Statement Coordinator
 Council on the Environment
 903 Ninth Street Office Building
 Richmond, Virginia 23219

Charles H. Ellis III
 CHARLES H. ELLIS III

ENVIRONMENTAL IMPACT STATEMENT COORDINATOR
 In reviewing the Draft Environmental Statement related to Steam Generator Repair at Surry Power Station, Unit No. 1, we find that information is provided showing that public radiation exposure will be less during this repair operation than would be encountered during normal operating conditions. Therefore, it would seem reasonable to proceed with the proposed repairs.

The Division of Parks has no other observations.



DEPT. OF CONSERVATION AND ECONOMIC DEVELOPMENT	
APR 2 1980	
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1	PARKS
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(SIGNED) BB MEADOR 3 Apr 80

(TITLE) DIR.

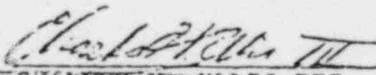
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8. REVIEW INSTRUCTIONS:

- A) Please review the document carefully. If the proposal has been reviewed earlier (e.g., if the current document is a FINAL EIS), please consider previous comments.
- B) Prepare your agency's comments in a form which would be acceptable for responding directly to a project sponsoring agency.
- C) Use the space below for your comments. If additional space is needed, please attach extra sheets.

Return your comments to:

Charles H. Ellis III
Environmental Impact Statement Coordinator
Council on the Environment
903 Ninth Street Office Building
Richmond, Virginia 23219


CHARLES H. ELLIS III
ENVIRONMENTAL IMPACT STATEMENT COORDINATOR

C O M M E N T S

Based on the material presented in the Draft Environmental Statement and on independent monitoring by the Health Department of the generator repair project on Surry Unit #1, the Health Department concludes that we have no objection to the proposal project for Unit #1.

Our findings indicate that the proposed project can be accomplished without significant environmental impact. The steam generator repair project should avoid future occupational exposures to VEPCO personnel that would occur if this equipment is not replaced.

(SIGNED)



(TITLE)

Acting Assistant State Health Commissioner

(AGENCY)

State Health Department

504 S Van Buren
Iowa City, Iowa 52240
May 2, 1980

Director, Division of Site Safety
and Environmental Analysis

US NRC
Washington, DC 20555

Director:

I am writing to respond to NUREG-C663, the draft environmental statement related to STEAM GENERATOR REPAIR at Surry Power Station, Unit No. 1, VEPCO.

- 1) Because it is the occupational radiation exposure that you've determined to be the only adverse environmental impact, and because (p. 4-4) you are willing to accept VEPCO's estimates of gaseous releases in the past, but VEPCO is not an impartial member of the repair proceedings, I would want both the UNION OF CONCERNED SCIENTISTS and THE PHYSICIANS FOR SOCIAL RESPONSIBILITY to review and approve the ~~the~~ repair proceedings before they happen.

- 2) I must respond to the portion (p. 4-3) that is a rather elaborate, transparent effort to rationalize what amount of exposure to radiation is acceptable. I doubt whether most Americans when choosing to live either in Washington, DC, or Denver, Colorado, yet know enough to make radiation exposure a part of their judgement criteria. Your "therefore, we conclude..." is an insult to the American people. What our society has been accepting for radiation exposure has come out of an ignorance fostered by the nuclear industry. This third-from-last paragraph smacks of barbaric unconcern for the public trust. I demand to know how you would proceed from this point, in the study, without it.

c/c Peter Bradford, NRC
Potomac Alliance
UNION OF CONCERNED SCIENTISTS
PHYSICIANS FOR SOCIAL RESPONSIBILITY

Sincerely,
Lynn R. Chong
Lynn R. Chong

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

COMMENTS ON DRAFT ENVIRONMENTAL STATEMENT RELATED
TO STEAM GENERATOR REPAIR AT SURRY POWER STATION,
UNIT 1, VIRGINIA ELECTRIC AND POWER COMPANY (March
1980) (Docket No. 50-280) (NUREG-0663)

Introduction

These comments are submitted on behalf of Potomac Alliance, Citizens' Energy Forum, Inc., Virginia Sunshine Alliance, and Truth-in-Power, Inc. ("Petitioners"). On April 18, 1979, Petitioners presented to the Nuclear Regulatory Commission, pursuant to 10 C.F.R. §2.206, a petition addressing various aspects of the steam generator replacement project at the Surry Power Station. That petition, among other things, (1) identified the salient deficiencies in the environmental impact appraisal (EIA) prepared by the NRC Staff with respect to the project, (2) asserted that under the National Environmental Policy Act (NEPA), 42 U.S.C. §4321 et seq., an environmental impact statement was required for the project and outlined some of the necessary characteristics of such a statement in order to comply with NEPA, and (3) requested that the project be suspended pending compliance with NEPA and the provision of other relief. That petition led to the issuance

of the NRC Memorandum and Order of March 4, 1980 (CLI-80-4), which in turn led to the preparation of the draft environmental statement (DES).

It is evident, however, that the DES is hardly more than a warmed-over EIA, as the two documents are substantively indistinguishable. The DES is opaque and laden with terms that are incomprehensible to anyone save those familiar with the intricacies of nuclear reactor engineering and the jargon of experts in that field. It wholly disregards some of the most significant environmental effects of the Surry project and trivializes those that it mentions. It fails to acknowledge that the significance of some of these impacts is subject to serious scientific controversy. It is misleading in these and many other respects, not the least of which is its conclusion that the project "will not significantly affect the quality of the human environment." DES at ii, 6-1. The deficiencies in the DES render it inadequate under NEPA, and require that it be revised substantially before the Virginia Electric and Power Co. (VEPCO) is permitted to replace the steam generators at Surry Unit #1.

Procedural deficiencies

1. Section 1501.7 of the NEPA regulations promulgated by the Council on Environmental Quality (CEQ) require that as soon as practicable after the decision to prepare an EIS has been made (presumably before a draft EIS is prepared), the agency shall invite interested persons to participate in a scoping process in which the scope of the EIS will be decided. To the Petitioners' knowledge, no scoping process was initiated with respect to the Surry DES. As a result, the scope of the document is defective in several material respects.
2. No "record of decision" was prepared for the Surry project, in violation of 40 C.F.R. §1505.2.
3. Much of the material cited in the section of the DES headed "REFERENCES" is not readily available to the public, nor are the contents of the referenced documents summarized, in violation of 40 C.F.R. §1502.21.
4. The DES contains no list of preparers, in violation of 40 C.F.R. §1502.17.
5. To the knowledge of Petitioners notice of the availability of the DES for review has not been made known to the public through local newspapers, local media, or by posting appropriate notices on and off the site of the Surry station, in violation of 40 C.F.R. §§1506(a), 1506(b)(3)(iii), 1506(b)(3)(iv), 1506(b)(3)(v), 1506(b)(3)(vii), 1506(b)(3)(viii), 1506(b)(3)(ix), and 1506(d).

Substantive deficiencies

Insufficient scope

6. As pointed out in the Petition at pp. 24-25, the Surry project is but one of at least 15-20 similar projects likely to be performed at pressurized water reactors in the next few years. Since the date of filing of the Petition, the Wisconsin Electric Power Co. has encountered severe steam generator degradation at the Point Beach plant and has announced plans to replace the steam generators there. Scientists Institute for Public Information, Inc. v. AEC, 481 F.2d 1979 (D.C. Cir. 1973), directs that where a single action is simply one aspect of an overall program with cumulatively significant environmental effects, a programmatic EIS must be prepared. In this case, a programmatic EIS is required on steam generator repair nationwide.

Case law discussing the programmatic EIS requirement has often arisen in connection with programs with geographically related environmental impacts. See Kleppe v. Sierra Club, 427 U.S. 390 (1976). However, programmatic statements are also required when an agency embarks on a series of actions which have common environmental impacts, alternatives, methods of implementation, media, etc. See 40 C.F.R. §§1502.4(c), 1508.25(a). Scientists' Institute for Public Information, supra.

7. The DES improperly and without justification limits the scope of its analysis to the replacement of the steam generators at Unit 1. This is inconsistent with NEPA. There is no way that the interested public or any other reader of the DES can evaluate the project meaningfully without understanding that the replacement of the steam generators at Unit 1 is part of a larger operation. Indeed, at other points in the DES the cost of the project is projected in terms of the entire project. See DES pp. 4-6, 4-7. And at other points the total radiation exposures are expressed as a total for both operations. See DES at p. 5-1.

8. The DES improperly limits the scope of its discussion of environmental effects to the occupational exposures borne by workers at Surry. This is a patent violation of NEPA, which requires that EISs address, "to the fullest extent possible," all environmental effects of proposed actions as well as all irreversible and irretrievable commitments of resources.

Foremost among these impacts and irreversible commitments is the burning of coal and oil to generate electricity to replace that which would be generated at Surry but for the steam generator replacement project. While Unit 2 was down for 39-60 weeks, the use of fossil fuels to produce replacement power certainly had significant impacts upon air quality in regions downwind from the generating plants. In addition, the use of this amount of

fossil fuel constituted an irreversible commitment of a vital energy resource which, while perhaps justified, was required to be analyzed within an EIS. Additionally, the Surry project will lead to an irreversible commitment of worker health and allowable worker exposures.

Further, the Surry project will lead to substantial socio-economic effects upon VEPCO ratepayers. As pointed out below, the Surry action cost roughly \$300-350 million, not the \$142 million estimated in the DES. This averages to \$300 per ratepayer, a significant drain upon the after-tax incomes of most ratepayers. Such effects must be examined fully within the Surry DES, because the project entails direct significant environmental effects which are intertwined with the socio-economic effects. See Image of Greater San Antonio v. Brown, 570 F.2d 517, (5th Cir. 1978); 40 C.F.R. §1508.14.

General deficiencies

9. The DES contains no glossary or table of definitions, and consistently uses terminology beyond the ken not only of lay people but of those somewhat familiar with reactor design. See, for example, p. 3-1, where the changes in steam generator design and operations are described as follows:

(1) using All-Volatile-Treatment chemistry control in the secondary system from the beginning of operation, (2) using corrosion resistant SA240 Type 405 ferritic stainless steel rather than carbon steel for support plate material, (3) thermally treating the Iconel 600 heat exchanger tubes for better corrosion resistance, and (4) using a broached hole pattern with a quatrefoil design in the support plates rather than separately drilled flow holes to minimize the accumulation of corrosion products where the tubes pass through the plates.

None of the highlighted terms are defined anywhere in the DES. See Environmental Defense Fund v. Corps of Engineers, 348 F. Supp. 916 (E.D. Miss. 1972) (impact statements must be written in language understandable to nontechnical minds).

10. Sections 2.1 and 3 of the DES provide a totally inadequate description of the background and need for the action, and of the way in which it will be carried out. For example, the DES does not set forth the dimensions of the steam generators nor does it describe their function in a nuclear reactor. The DES does not permit a lay person to conceptually grasp the nature of the project.

11. In general, the DES is horrendously out of date, making the calculations and conclusions therein essentially worthless. For example, estimated economic costs are presented in 1977 dollars despite the facts that nuclear power plant construction costs have inflated approximately 50 percent within the last 3 years.

Specific deficiencies

12. Section 3.0, "Description of the Proposed Repair Method," is lacking in detail or supporting data. This two-year, multi-million dollar undertaking is described in little more than one paragraph. Statements such as "The old upper assembly, after some refurbishment, and the new lower assembly will be welded together in the field" demonstrate the paucity of information in this section.

VEPCO has gone through this operation once, and has made a 30-minute color movie out of it. This movie should be made available to the public. Still photographs should be included in the DES to illustrate the various stages in the steam generator replacement project. Data regarding occupational exposure and other aspects of the action should be provided. NEPA requires that, "to the fullest extent possible," any factual information in the NRC's possession regarding the repair of Unit 2 be set out in the DES. It must disclose "the history of success and failure of similar projects." Sierra Club v. Morton, 510 F.2d 813 (5th Cir. 1975). "Otherwise, those removed from the decisionmaking

process will have no way of knowing the adverse effects that have occurred in similar proposals." Burkey v. Ellis, 483 F. Supp. 897, 911 (N.D. Ala. 1979).

13. On p. 3-1 reference is made to an "above-ground concrete structure with walls about 3 feet thick," but there is no indication whether the structure also has a floor, a ceiling, doors, windows, electrical wiring, security monitoring equipment, or whether it is seismically secure. This structure must be described in detail. As it has apparently already been constructed, photographs should be provided. The means in which steam generators are transported to the structure and placed inside it must be described.

14. The diagrams provided at pp. 3-2 and 3-3 of the DES are impenetrable. Even the title of Figure 2 uses terms that are not explained, such as "Primary Side Drained and Secondary Side at 72% Level."

15. The estimates of worker exposures in section 4.1.1 are unreasonably low. Given that the estimate made by Batelle Pacific Northwest Laboratories was 3380 to 5840 man-rem, that the measured exposures during the repair of Unit 2 were 2140 man-rem, and exposure rates at Unit 1 have historically run at a level 30-40 percent higher than those at Unit 2, the NRC's adherence to an estimate of 2070

is unsupportable and arbitrary. Indeed, the DES offers no basis for this estimate other than VEPCO's belief that its original estimate is reasonable because of its belief that it learned how to reduce exposures during the replacement of the steam generators at Unit 2.

16. The DES's attempt to "put into perspective," i.e., belittle the significance of the man-rem exposures resulting from the action are invalid, misleading, and violative of NEPA. It is shocking that the extreme radiation exposures which have occasionally been measured at nuclear plants are characterized in the DES as "[in]significant deviations from the average" (DES at p. 4-2), considering that they have run as high as 3142 man-rems, or six times the average exposure level. Yet then the DES casts the 2070 man-rem estimate as "within the historical range of doses about the average." This is a transparent attempt to brush these significant exposure levels under the rug rather than acknowledge, much less explain, their significance.

17. The prediction that the steam generator replacement project will lead to dose savings of hundreds of man-rems per year is unsupported. The statement made on p. 4-3 that such savings will "offset" the total project exposures of 4140 man-rems is invalid and misleading. The latter figure seems to have no basis.

18. The DES does not provide data indicating exposures at Surry for 1978 or 1979, nor does it break down its exposure data according to the reactor at which the doses were received.

19. The analysis of the deaths and health effects likely to result from the action is invalid because it is based on outmoded scientific information. The "BEIR Report," on which those calculations are based, predates a significant reversal in scientific thinking concerning the dose-response relationship of ionizing radiation. Since then, the linear exposure theory, which holds that no exposure is risk free and that spreading a given dose over a large number of persons does not reduce its adverse effects, has become prevalent. In addition, many experts in the field now believe that the dose-response estimates in the BEIR Report are conservative by a factor of as many as five. Given this substantial divergence in scientific opinion, the DES is defective for failing to present the range of significant opposing scientific views. See The Committee for Nuclear Responsibility, Inc. v. Schlesinger, 404 U.S. 917 (1971) (remarks of Douglas, J., dissenting); 40 C.F.R. §1502.9(a).

20. Although the DES states at p. 4-4 that "our independent analysis of the gaseous and liquid releases of radioactivity from the plant site during the steam generator repair project is based in large part" on NUREG/CR-0199, the fact is that the DES never adopts the estimates therein nor makes its own, independent estimates. It simply concludes that VEPCO's estimates are reasonable. This is an abdication of the Commission's responsibilities under NEPA. Since measurements of radioactive effluent releases were made during the repair of Unit 2, that data should have been used to formulate revised estimates. In particular, it was purely

arbitrary not to revise the predicted releases of noble gases. Incredibly, the basis for failing to revise these estimates is that the environmental impacts of these releases are expected to be less than those stated in the Surry FES, prepared in 1972. DES at p. 4-4.

21. The estimate in section 4.2 of the DES of the economic costs of the Surry steam generator replacement project is invalid because it is based on 1977 dollars. Standing alone, this defect is sufficient to render the DES invalid under NEPA. See Burkey v. Ellis, 483 F. Supp. 897 (N.D. Ala. 1979).

22. The economic analysis in the DES is invalid in that it fails to consider the possibility that replacement or repair of the steam generators may be necessary a second time. As the DES reveals, the cause of the steam generator degradation leading to the present action is unknown, and as the Point Beach situation demonstrates, no cure has been found. The DES must, therefore, consider at least the possibility that the action will be necessary a second time and factor the cost of such an operation into its analysis.

23. The prediction of the cost of replacement power during the repair of Unit 1 is invalid because it assumes that the plant will be down for only six months. Since the repair of Unit 2 took between 37 and 60 months, the DES must select a reasonable figure within that range or at least explain why the six month figure remains viable.

24. The analysis of the economic cost of the action is invalid because it assumes that the cost of replacement power is \$183,000 per day. In fact, the cost of replacement power has increased since 1977 to \$500,000 per day.

25. The estimate of \$142,000,000 as the "total project cost" is invalid. Presumably, this figure refers to the cost of repairing both units, as this is the figure found in the 1979 EIA. If so, the figure is off; the replacement of the steam generators at Unit 2 has already cost more than that amount. If the figure refers to the costs of the Unit 1 repair project it is still seriously low.

26. Section 4.3, headed "Non-Radiological Environmental Costs," is a disgrace to the NEPA process. Even with respect to the environmental impacts that are mentioned summarily in that section, their treatment displays far less than the good faith consideration required under NEPA. The DES must be revised to estimate the amount of noise generated by the project, the quantity of fugitive dust and other air pollutants, the discharge of chemicals into nearby bodies of water to the extent that the impacts are non-radiological. See the attached Petition at pp. 14-18.

26. Section 4.3 is inadequate because it fails to estimate the economic effects of the action upon VEPCO ratepayers. Assuming without conceding that Unit 2 was down for only 9 months for steam generator repair, that Unit 1 will be down for the same length of time, and that the other economic estimates in the DES are accurate, the total cost of the action comes to \$346 million (540 days X \$500,000 per day

plus \$76 million in other costs. As shown in the Petition at pp. 15-17 such economic impacts must be considered in an EIS when intertwined with other direct effects on the natural environment, as they are in this case.

27. The analysis of alternatives in section 5.0 is inadequate under NEPA. That it is based on 1977 dollars is alone sufficient to render the entire section essentially useless.

See comment 21, p. 12, above.

28. The alternative of derating the Unit 1 reactor cannot be evaluated on the basis of the DES because the cost of that option is said only to be "high." DES at p. 5-1. For some unexplained reason, the figure of 4140 man-rems is used as reference for evaluating the man-rem exposures that would be experienced under this alternative.

29. The alternative described as using corrosion inhibitors and secondary side cleaning is dismissed much too casually, without explaining exactly what the merit of this alternative is or raising the possibility of deferring action for a short while until it has been studied further.

30. The option of shutting down the unit (described for some reason as shutting down the Surry station) is insufficiently examined. For example, the environmental impacts of this alternative are covered in one sentence! Their magnitude: "significant." The economic analysis of this option is woefully inadequate, as the figures given are neither justified nor referenced to credible authorities.

31. The option of retubing, described in section 5.2, is given inadequate treatment. The nature of the alternative is not presented in a way that is comprehensible to a lay person. The economic "analysis" of the option is based on analyses performed years earlier. While the DES states that the retubing alternative "may be an alternative" in the future, it does not attempt to predict when that day will likely arrive. And above all, the DES reveals the Staff's awareness of "recent developments" which show that the retubing alternative may be far preferable to the proposed action. This is virtually the same remark made in the EIS of 1979. Evidently the Staff has made no effort at all to investigate the potential of this important alternative.

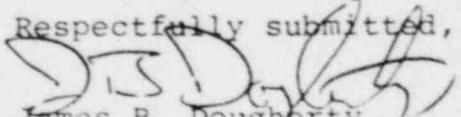
32. The DES is defective for failing to discuss fully the environmental implications of the shipment of one of the Surry steam generators to Hanford, Washington via the Panama Canal. Although the DES states on p. 4-4 that this event "may" happen sometime in the future, the fact is that the shipment has already commenced. The fact that the Department of Energy is assuming principal responsibility for this aspect of the Surry operation does not relieve the NRC of its obligation under NEPA to fully evaluate the resulting environmental effects and risks within the DES. To do otherwise is to "segment" the action in violation of NEPA.

Conclusion

These comments cannot do justice to the DES for the Surry steam generator replacement project. The document is virtually incomprehensible to lay persons. It is rife with faulty economic calculations which in turn are based on assumptions that insult the intelligence of the reader. The DES exhibits casual disregard for the fact that the action will expose thousands of human beings to upwards of 4000 man-rems, and instead characterizes the action as leading to man-rem "savings." The estimates of man-rem exposures are subject to simple errors in arithmetic. The DES completely ignores some of the principal environmental impacts of the action, notably the burning of fossil fuels to produce power for approximately a year and a half, and the economic impacts of the action upon VEPCO ratepayers.

The DES is so inadequate that it precludes meaningful analysis of either it or the action it addresses. In such cases, the statement must be revised and recirculated in draft. In order to comply with NEPA, the Commission must rework and expand large sections, if not all of the DES. If Petitioners are to be given their right to comment under NEPA, they must be given another opportunity to comment upon the statement before it is used as the basis for permitting the Surry action to proceed.

Dated: May 5, 1980

Respectfully submitted,

James B. Dougherty
1416 S St., NW
Washington DC 20009

Counsel for Petitioners



United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER-80/237

MAY 9 1980

Mr. Ronald L. Ballard, Chief
Environmental Projects Branch 1
Division of Site Safety and
Environmental Analysis
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Ballard:

Thank you for your letter of March 18, 1980, requesting our views and comments on the draft environmental statement related to Steam Generator Repair at Surry Power Station, Unit 1, Surry County, Virginia. We have the following comments.

The draft environmental statement identifies occupational radiation exposure as the major issue in the proposed program for Unit 1 repair. It concludes "that the doses to individuals in unrestricted areas and to the population within 50 miles due to gaseous and liquid effluents from the repair project will not be environmentally significant." Units of the National Park System that are within the 50-mile radius are Colonial National Historical Park, Petersburg National Battlefield, and Richmond National Battlefield Park. Colonial is within 5 miles of the site.

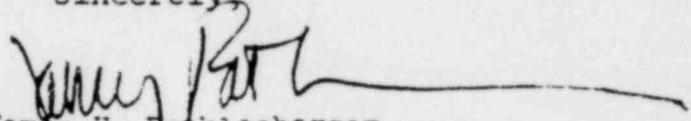
The draft is lacking a location map and site plan. We believe reviewers would find these of value in the final environmental impact statement. While the doses in the unrestricted areas are expected to be below normal operating levels during the repair, the final statement should describe a monitoring program to assure the public that the doses do indeed remain within acceptable levels.

The statement should address the fate of any water collected in the sump of the storage facility for the degraded lower assemblies of the steam generator (see page 3-1).

COOZ
5/10

We hope these comments will be of assistance to you.

Sincerely,

A handwritten signature in dark ink, appearing to read "James H. Mathlesberger", with a long horizontal flourish extending to the right.

James H. Mathlesberger
Special Assistant to
Assistant SECRETARY

RC FORM 335 77)		U.S. NUCLEAR REGULATORY COMMISSION BIBLIOGRAPHIC DATA SHEET		1. REPORT NUMBER (Assigned by DDC) NUREG-0692	
TITLE AND SUBTITLE (Add Volume No., if appropriate) Final Environmental Statement related to Steam Generator Repair at Surry Power Station, Unit No. 1 Virginia Electric and Power Company, Docket 50-280				2. (Leave blank)	
AUTHOR(S)				3. RECIPIENT'S ACCESSION NO.	
PERFORMING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code) S. Nuclear Regulatory Commission Office of Nuclear Reactor Regulation Washington, D. C. 20555				5. DATE REPORT COMPLETED MONTH YEAR July 1980	
SPONSORING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code) S. Nuclear Regulatory Commission Office of Nuclear Reactor Regulation Washington, D. C. 20555				DATE REPORT ISSUED MONTH YEAR July 1980	
TYPE OF REPORT Final Environmental Statement				6. (Leave blank)	
PERIOD COVERED (Inclusive dates)				8. (Leave blank)	
SUPPLEMENTARY NOTES This report pertains to Docket No. 50-280				10. PROJECT/TASK/WORK UNIT NO.	
ABSTRACT (200 words or less) Final Environmental Statement for the Surry Power Station Unit No. 1 Steam Generator Repair Program has been prepared by the Office of Nuclear Reactor Regulation. This Statement considers the environmental impacts and economic costs of the proposed steam generator repair at Surry Power Station Unit 1. The Statement focuses on the occupational radiation exposure associated with the proposed Unit 1 repair program and on alterna- tives to reduce this exposure. It concludes that the proposed repair will not significantly affect the quality of the human environment. Furthermore, any impacts from the repair program are outweighed by its benefits. Also included are comments from Federal, State and local governmental agencies and certain non-governmental organiza- tions and individuals.				11. CONTRACT NO.	
KEY WORDS AND DOCUMENT ANALYSIS				17a. DESCRIPTORS	
18. IDENTIFIERS/OPEN-ENDED TERMS					
AVAILABILITY STATEMENT Available to the public. Available at NTIS and through GPO Program.				19. SECURITY CLASS (This report) Unclassified	
20. SECURITY CLASS (This page) Unclassified				21. NO. OF PAGES	
22. PRICE \$				23. PRICE \$	