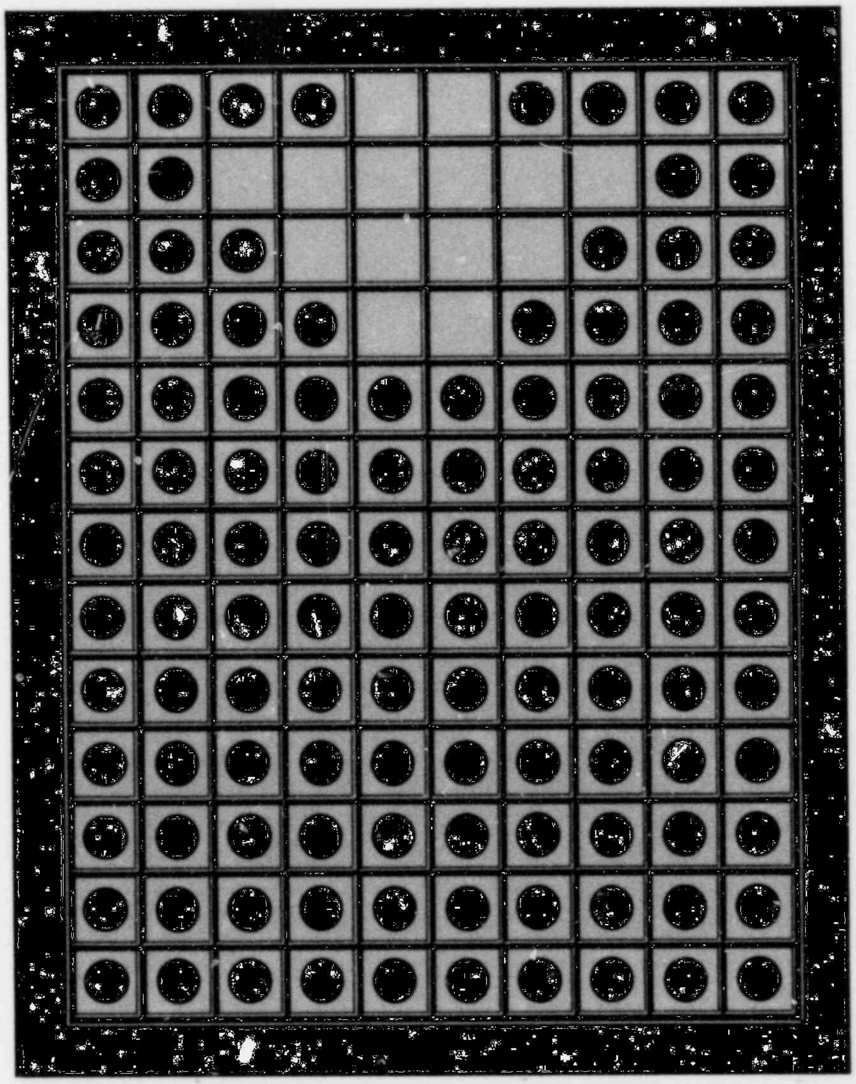
Spent Fuel Storage

A summary of information in support of the storage of Surry Spent Fuel at North Anna Power Station Unit Nos. 1 and 2.



Vepco

SUMMARY OF INFORMATION

IN SUPPORT OF THE STORAGE

OF SURRY SPENT FUEL

AT

NORTH ANNA POWER STATION

UNIT NOS. 1 AND 2

DOCKET NOS. 50-338

50-339

LICENSE NOS. NPF-4

NPF-7

JULY 1982

VIRGINIA ELECTRIC AND POWER COMPANY

PREFACE

The purpose of this document is to summarize the information associated with the proposed action of storing up to 500 spent nuclear fuel assemblies from the Surry Nuclear Power Station in the North Anna Power Station Unit Nos. 1 and 2 spent fuel pool. This document will also describe the Surry spent fuel which is to be stored at North Anna as well as describe the North Anna Power Station Unit Nos. 1 and 2 fuel storage systems which could potentially be affected by the proposed action.

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1.0 INTRODUCTION

Virginia Electric and Power Company's North Anna Power Station, Unit Nos. 1 and 2 (Docket Nos. 50-338 and 50-339 Units 1 and 2 respectively) were issued Operating License Nos. NPF-4 on April 1, 1978 and NPF-7 on August 21, 1980 respectively. The units commenced commercial operation on August 21, 1978 and December 14, 1980 respectively. Both units are licensed to operate at a full power of 2775 megawatts thermal. The net electrical generation of each unit is 907 megawatts. North Anna Unit No. 1 is presently refueling prior to its fourth fuel cycle and will return to service in July 1982. North Anna Unit No. 2 is presently operating in its second fuel cycle.

Virginia Electric and Power Company's Surry Power Station, Units 1 and 2 (Docket Nos. 50-28 and 50-281 respectively) were issued Operating License Nos. DPR-32 on May 25, 1972 and DPR-37 on January 29, 1973, respectively. Both units are licensed to operate at a full power of 2441 megawatts thermal. The net electrical generation of each unit is 788 megawatts electrical. Surry Unit No. 1 is presently operating in the sixth fuel cycle and Unit No. 2 is in the sixth fuel cycle.

Vepco's policy, as well as its legal duty, is to supply reliable electric service to its customers at reasonable rates. Fulfilling this duty requires that the Company's nuclear power stations operate reliably and continuously. To assure continued operation, Vepco must maintain the ability to discharge spent fuel and refuel whenever necessary.

Whenever Vepco refuels one of its reactors, replacing about a third of the fuel assemblies in the reactor core, it must have room to store the spent fuel that is removed from the reactor. For a particular reactor, these refuelings occur at intervals of approximately every 18 months. In addition, Vepco believes that if it is to fulfill its public service obligation it must maintain the ability to discharge the full core in a particular reactor at any time. This "full core discharge" capability is essential wherever inspections or repairs necessary for continued operation require the offloading of the entire core from the reactor.

Vepco has determined that no additional spent fuel may be stored in the Surry spent fuel pool after its present licensed capacity of 1,044 storage locations is used up. As a result, Vepco estimates that it will lose full core discharge capability at Surry as early as the fall of 1984. If after that date continued operation were to depend on making certain repairs that required removing the full core of fuel from a reactor, those repairs could not be made and the reactor would have to be shut down. In addition, both units would be unable to refuel in 1987 because of lack of storage space and would have to shut down.

Vepco has evaluated a broad range of alternatives for providing additional storage space for Surry fuel. It has determined that the storage of up to 500 spent nuclear fuel assemblies from Surry at North Anna provides the most favorable solution. This solution will provide for adequate spent fuel storage capacity at Surry until 1993 and at North Anna until 1993.

The "proposed action" for the purpose of this summary is defined as:

> The storage of up to 500 spent fuel assemblies from the Surry Power Station Unit Nos. 1 and 2 in the spent fuel pool at the North Anna Power Station Unit Nos. 1 and 2 which will require an amendment to the North Anna 1 and 2 operating license to allow the storage of Surry spent fuel.

The license change required would be to modify the Facility Operating Licenses for North Anna Unit Nos. 1 and 2 to read, "The licensee is authorized to receive from the Surry Nuclear Power Station Unit Nos. 1 and 2, possess, and store irradiated Surry fuel assemblies containing special nuclear material, enriched to not more than 4.1% by weight U-235 subject to the following conditions:

a. Surry fuel assemblies may not be placed in the North Anna Power Station Unit Nos. 1 and 2 reactors.

b. Irradiated fuel shipped to North Anna shall have been removed from the Surry reactor no less than 730 days prior to shipment.

c. No more than 500 Surry irradiated fuel assemblies shall be received for storage at the North Anna Units Nos. 1 and 2 spent fuel pool."

It should be noted that at present an ordinance exists in Louisa County, Virginia (location of North Anna Unit Nos. 1 and 2) which was adopted by the Board of Supervisors of Louisa County in September 1978. The ordinance states:

"It shall be unlawful for any person, partnership, corporation or other entity to store or maintain in Louisa County any spent nuclear fuel or any other waste radioactive materials of similar qualities, except such materials as may result from nuclear fu being used in Louisa County.

Anyone violating or causing anyone to violate this ordinance shall be fined not more than $1,000.00; and each day that any such violation continues shall be a separate offense.

If any phrase, clause, sentence, part or portion of this ordinance shall be declared unconstitutional or invalid by any valid judgement or decree of a Court of competent jurisdiction, such unconstitutionality or invalidity shall not affect any of the remaining phrases, clauses, sentences, portions or parts of this ordinance."

This document will describe 1) the necessity for this action, 2) the alternatives to the proposed action that Vepco has considered, 3) description of Vepco's fuel handling and storage facilities, and 4) the implications of the proposal in terms of safety, physical protection, emergency planning, financial requirements and environmental effects.

Vepco will be filing with the Nuclear Regulatory Commission in July, 1982 an application for an amendment to its North Anna operating license authorizing installation of higher density "neutron absorber" spent fuel storage racks in its North Anna Units 1 and 2 spent fuel pool. These racks would increase the storage capacity at North Anna from 966 to 1748 assemblies. Vepco proposes to store Surry spent fuel at North Anna as described in this application regardless of whether the neutron absorber spent fuel racks are approved and installed.

If the proposal to add additional storage capacity to the North Anna spent fuel pool though the use of neutron absorber spent fuel racks were not approved, Vepco would store a lesser number of Surry assemblies i.e., approximately 150 spent fuel assemblies, in the North Anna 1 and 2 spent fuel pool.

In this summary, the proposal to store Surry spent fuel at North Anna will be discussed both on the assumption that higher density "neutron absorber" spent fuel storage racks are installed and on the assumption that they are not.

2.0 NEED FOR STORAGE OF SURRY FUEL AT NORTH ANNA

The basic reason for Vepco's proposed action is to prevent both loss of full core discharge and loss of refueling capability at the Surry Nuclear Power Station.

At present, 644 spent fuel assemblies are being stored in the Surry spent fuel pool.

As early as the fall of 1984, Vepco will lose the ability to remove all of the fuel from either of its reactors at Surry. Full-core discharge capability has been required three times in the past to perform necessary maintenance or repairs at Surry, and will most likely be required in the future.

In 1979, all fuel had to be removed from Surry Unit 2 and stored in the spent fuel pool so that the unit's steam generators could be replaced. The fuel from Surry Unit 1 had to be stored in the spent fuel pool in 1980 while the same work (i.e., replacement of Surry Unit 1 steam generators) was performed. During the most recent outage of Surry Unit 2 in late 1981, full-core discharge was necessary to complete maintenance on the unit's residual heat removal system.

Full-core discharge will be necessary again during the next refueling outage of Surry Unit 2, now scheduled for the late spring of 1983, to perform required in-service inspection of the unit's reactor vessel.

Shutdown of one or both of the Surry units could occur any time after full-core discharge capability is lost in the fall of 1984 because the inability to remove all fuel could prevent repairs and inspections, and thus prevent continued operations.

Both Surry units would have to be shutdown due to the lack of storage space to conduct refueling operations in 1987.

In 1982, and for the next four years, Vepco's nuclear units are expected to produce 43 to 47 percent of Vepco's total annual energy output. The two units at Surry will produce about one half of that percentage. If these units were lost, the replacement power, if available, would have to come from more expensive coal and oil units. The loss of the two Surry units alone would increase customer costs by as much as $350 million a year in terms of 1982 dollars.

Vepco faces this dilemma because of changing National policies concerning the use and disposition of spent nuclear fuel. At the beginning of commercial nuclear power generation, it was believed by the utility industry that spent fuel would be chemically processed to separate and recover the reusable uranium and plutonium. Under regulations adopted by the Atomic Energy Commision based on the Atomic Energy Act of 1954 and 10CFR50 Appendix F, the Federal government assumed responsibility for the permanent disposal of the remaining waste.

Consequently, utilities, including Vepco, built storage facilities at their reactor sites that were designed to hold spent fuel only until it was to be shipped away for reprocessing and to provide full core discharge capability. These on-site storage facilities were originally sized to store spent fuel for only a few years.

The two units at Surry commenced commercial operation in 1972 and 1973, respectively. As part of these units, a single spent fuel pool was built which was capable of holding 464 spent fuel assemblies. This provided enough capacity to maintain full-core discharge capability for both units (a total of 314 assemblies) in case the units had to be unloaded simultaneously to perform maintenance or repairs, plus space for 150 additional assemblies for refueling operations. This was sufficient capacity given the policy that spent fuel would be reprocessed in a timely manner.

To provide for reprocessing, Vepco signed a contract in March 1971 with Allied-General Nuclear Services (AGNS) to ship Surry spent fuel to the AGNS reprocessing plant at Barnwell, South Carolina. Two years later, Vepco signed a contract with General Electric (GE) to ship spent fuel from North Anna Units 1 and 2 to GE's reprocessing plant in Morris, Illinois.

Between 1973 and 1975, however, major problems began to arise with reprocessing. AGNS ran into protracted licensing difficulties which resulted in the Barnwell facility ultimately never receiving a license to operate. General Electric encountered design problems with its reprocessing plant and ultimately concluded that the facility as designed could never be operated. The Atomic Energy Commission subsequently revoked GE's license, and GE terminated its contracts for reprocessing with customers, Vepco included. When it eventually became clear that neither AGNS or GE would be in a position to reprocess spent nuclear fuel in the foreseeable future, Vepco reached a commercial settlement with both companies.

The only other domestic commercial reprocessing plant was operated by Nuclear Fuel Services (NFS) in West Valley, New York. In 1972, while in the midst of an expansion program, NFS suspended reprocessing operations due to increased regulatory requirements. Subsequently, NFS closed the facility.

By 1975, Vepco was faced with the prospect that commercial reprocessing would be delayed significantly and that it would need more spent fuel storage space. Vepco provided additional storage space by expanding the capacity of both its Surry and North Anna spent fuel pools.

Vepco purchased high-density spent fuel storage racks for both North Anna and Surry in the Fall of 1976. Vepco filed a license application with the Nuclear Regulatory Commission in June 1977, and received in April 1978 a license to proceed with the installation of the new racks at Surry. The installation of the new racks was completed by the end of

May 1978, increasing the capacity of the Surry spent fuel pool from 464 to 1,044 spent fuel assemblies. Expanding the capacity of the North Anna Units 1 and 2 spent fuel pool took longer. Vepco filed a license application with the NRC in May 1978. A petition by an intervenor led to a protracted licensing process which was not completed until mid-August 1979, when the NRC issued the necessary license. The spent fuel rack installation was completed by September of 1979, increasing the capacity of the North Anna Units 1 and 2 spent fuel pool from 400 to 966 spent fuel assemblies.

The addition of high density spent fuel storage racks added 7 years of additional storage for Surry Unit Nos. 1 and 2 and 6 years of additional storage for North Anna Unit Nos. 1 and 2.

In April 1977, President Carter's concern over the spread of nuclear weapons and the possible threat of weapons-grade plutonium being stolen from commercial reprocessing plants caused him to "indefinitely defer" commercial reprocessing of spent nuclear fuel in the United States. He proposed instead to provide interim Federal storage capacity for spent nuclear fuel until a permanent Federal repository became available.

The Department of Energy announced in October 1977 that it would provide interim storage space for utilities' spent fuel by buying or leasing some of the fuel pool storage space at the inoperative commercial reprocessing facilities or by building new "away-from-reactor" storage facilities. Congress, however, failed to provide the necessary authorizing legislation or funding.

When Congress had not yet acted after a year's time in response to the Administration's proposal to provide interim Federal storage, Vepco faced the possibility that neither reprocessing nor Federal interim storage would be available in time to meet Vepco's needs.

Between 1979 and late 1981, while the nuclear industry continued to press for government action to provide interim Federal storage capacity for spent nuclear fuel, Vepco investigated other possible storage alternatives.

These alternatives included 1) building another wet storage facility at Surry, North Anna or elsewhere, 2) reracking the Surry and North Anna spent fuel pools a second time, 3) shipping Surry spent fuel to North Anna, 4) dry storage techniques, and 5) redesigning and expanding the storage facility at the North Anna Unit No. 3 which is currently under construction. These alternatives are discussed in more detail in Section 3 of this report.

In March 1981, the Reagan Administration directed that utilities take care of their own interim spent fuel storage problems and eliminated any funding for interim spent fuel storage from the Federal budget. In October 1981, the President also lifted the ban on commercial reprocessing.

The lifting of the commercial reprocessing ban does nothing to diminish Vepco's immediate storage problem. No company has expressed an interest in building or operating a reprocessing plant, and, even if it did, it would likely take a minimum of 10 years to put it into operation.

Currently, Congress is considering several legislative proposals which would provide some limited interim storage capacity for commercial spent fuel on an emergency basis. While Vepco supports these legislative efforts, it is impossible now to say what exact form this legislation might take, or even when or if it will be enacted. In the first place, these proposals face difficult political obstacles. In addition, some of them would deny federal storage space to utilities that can resolve their own storage problems by transhipping from one station to another within their own systems. Therefore, Vepco cannot rely on the availability of federal interim storage space.

In light of the uncertainties surrounding reprocessing, and the availability of federal interim storage space, and the long lead times associated with a permanent repository, Vepco must move swiftly to solve its near term spent fuel storage space problem using its own facilities. Vepco believes that the most prudent course of action is to transfer Surry spent fuel to North Anna for storage in the North Anna Units 1 and 2 fuel pool in accordance with the proposed action described in this document.

3.0 ALTERNATIVES TO THE PROPOSED ACTION

The proposed action has been chosen after an evaluation of alternatives to ameliorate the shortage of spent fuel storage at Surry Power Station Unit Nos. 1 and 2. The following specific alternatives were considered:

1. Ship up to 500 fuel assemblies from Surry to North Anna for storage in the North Anna 1 and 2 spent fuel pool.

2. Increase the storage capacity of the existing spent fuel pool at Surry 1 and 2.

3. Build a new independent spent fuel storage pool at Surry.

4. Utilize dry cask or drywell storage techniques to store spent fuel at Surry.

5. Ship spent fuel from Surry to a reprocessing facility.

6. Ship spent fuel to Federal interim storage facilities.

7. Ship spent fuel to a Federal permanent repository.

8. Improve fuel utilization and thereby reduce the amount of spent fuel generated.

9. Operate Surry at a reduced power level to reduce spent fuel production.

10. Cease reactor operation when spent fuel capacity is expended.

11. Ship spent fuel to other utility pools.

Each of the above alternatives is discussed below:

3.1 Ship Up To 500 Spent Fuel Assemblies from Surry to North Anna for Storage in the North Anna 1 and 2 Spent Fuel Pool

The North Anna Power Station is located about 125 miles northwest of the Surry Power Station. The North Anna Units 1 and 2 spent fuel pool presently has a storage capacity of 966 spent fuel assemblies. As of June 1, 1982, 237 spent fuel assemblies were stored in the pool. Without the storage of Surry fuel and without an increase in storage capacity, the North Anna Units 1 and 2 spent fuel pool would lose full core discharge capability in spring, 1989, and the two units would have to be shut down in 1990 and 1991 respectively.

There are currently plans to increase the spent fuel storage capacity at North Anna to 1,748 storage locations through the use of neutron absorber racks. A license application to install these racks will be filed with the NRC. If the neutron absorber racks are installed and fuel is shipped from Surry for storage at North Anna, North Anna Units 1 and 2 would not lose full core discharge capability until spring, 1991, and the two units would not have to be shut down until spring, 1994 and fall, 1993, respectively.

Shipment of up to 500 Surry spent fuel assemblies from Surry to North Anna would extend the loss of full core discharge capability at Surry Units 1 and 2 until fall, 1990 and would postpone the shut down dates for those units until fall, 1993.

If neutron absorber spent fuel racks were for some reason not installed at North Anna 1 and 2, the number of Surry assemblies to be shipped to North Anna would be decreased to 150. Storage of 150 Surry spent fuel assemblies at North Anna would extend the loss of full core discharge capability until fall, 1987 and would postpone the shutdown dates for the Surry units until spring, 1989.

Vepco is pursuing other alternatives to provide for the storage of Surry Units 1 and 2 and North Anna Units 1 and 2 spent fuel during the period after both the Surry Units 1 and 2 and North Anna Units 1 and 2 pools would be full.

The proposed shipments would begin in 1984. Approximately 10 assemblies will have to be shipped during the first part of that year to ensure the maintenance of full core discharge capability at Surry beyond the Fall of 1984. Thereafter, between 30 and 90 shipments per year would be required on average, depending on the type of shipping cask used.

Shipping Surry fuel to North Anna 1 and 2 is also the most cost-effective of all the options available. It would cost an estimated $3,700,000 in 1982 dollars for 500 Surry spent fuel assemblies to be transferred to and stored in the North Anna Unit Nos. 1 and 2 spent fuel pool.

Once the Surry fuel is at North Anna it can safely be stored in the North Anna spent fuel pool as described in Section 7 and 8 of this document.

Based on economics, operational considerations and the likelihood of ensuring continued operations at Surry, the storage of Surry spent fuel in the North Anna 1 and 2 spent fuel pool is the preferred near term alternative for maintaining adequate spent fuel storage capacity at Surry 1 and 2.

3.2 Increase the Storage Capacity of the Surry 1 and 2 Spent Fuel Pool

Vepco has determined that it cannot store more spent fuel than is presently licensed in the Surry Units 1 and 2 spent fuel pool without exceeding the structural design criteria. Therefore, no additional weight can be allowed in the Surry spent fuel pool. This situation results because the spent fuel pool mat is founded on piles rather than bedrock as at North Anna. As the weight of walls, water and stored fuel is increased, the mat tends to flex slightly, putting the top of the mat in tension. As the weight is increased, a point is reached where the structural design criteria will be exceeded. This point will be reached if any significant addition were made to the presently licensed capacity.

For the above reasons, this is not a viable alternative.

3.3 Build a New Independent Spent Fuel Storage Pool at Surry

Additional spent fuel storage capacity could be made available by building a new spent fuel storage pool, either at Surry or on another site. Like the existing facility, the structure would be a pool built of reinforced concrete with a stainless steel liner and with the same type of support facilities as are presently existing in the Surry and North Anna fuel pools. Present cost estimates for such a facility are in the range of $100,000,000 to $125,000,000 in 1982 dollars. In addition, it would take approximately 8 years to design, license, and construct such a facility, and so it would not help avoid shutdown of the Surry units.

This alternative is inferior to storage of Surry fuel at North Anna in economic terms and because it will not solve Vepco's near-term storage problem.

3.4 Utilize Dry Cask or Drywell Storage Techniques

In the dry cask system, spent fuel would be stored in steel and lead, or cast iron casks similar to those now used for the shipment of spent fuel elements. These casks would be stored in facilities at the plant site. It is estimated that it would cost approximately $18 million in 1982 dollars to store the same number of spent fuel assemblies as would be shipped from Surry to North Anna in the proposed action. Dry storage casks have not been used by any domestic utilities, but have been used in Europe.

Currently, none have been licensed for use in the United States by the NRC but at least one cask type is being reviewed by the NRC. Vepco estimates that the design, licensing, and construction of this type of facility would take approximately 3-5 years.

In the drywell system, spent fuel would be stored in steel canisters buried underground. Cost, schedule, and long term technical feasibility need to be better understood and demonstrated before this option can be further considered.

The dry cask alternative is inferior to the proposed action, both in economic terms and because it is less certain to avoid the loss of full core discharge capability at Surry in the fall of 1984. In addition, in light of the licensing uncertainties involved with dry cask storage, it is less certain that this alternative would avoid shutdown of the first Surry unit in 1987.

3.5 Ship Spent Fuel from Surry to a Reprocessing Facility

There is no operating commercial reprocessing facility in the United States. None are licensed and none are in licensing proceedings. Further, neither government nor private enterprise has expressed any significant interest in building or operating a reprocessing facility. There are, in short, no domestic reprocessing facilities available and no prospect that any such facilities will be available in the foreseeable future.

There are presently foreign reprocessing facilities in operation in the United Kingdom, France, Germany, and Japan. However, the shipment of any domestic spent fuel to any foreign country for storage or disposal is considered to be in conflict with U. S. nonproliferation objectives. Section 82 of the Atomic Energy Act of 1954, as amended by the Nuclear Nonproliferation Policy act of 1978, states that the NRC is authorized to distribute by product material (such as spent fuel) provided that such distribution would not be inimical to the common defense and security of the United States. Under current Administration policies, such distribution would almost definitely be considered inimical to the United States.

Due to conflicts with government policies, shipping spent fuel to a foreign reprocessor is not a viable alternative.

Reprocessing, then, is not a viable alternative.

3.6 Ship Spent Fuel to Federal Storage Facilities

Of all the potential alternatives, Vepco favors interim storage in a federal facility. This is precisely what the Federal government promised in 1977 to provide. But authorizing legislation has not been adopted, and the current administration has now reversed the earlier commitment.

Despite the position of the current Administration that utilities should be responsible for their own interim spent fuel storage, there are several legislative proposals before the Congress that could make Federal interim storage available. It is unlikely, however, that these provisions, if passed, will provide a near-term solution to Vepco's storage problem.

First, any legislative proposal to provide interim federal storage will face serious political obstacles during Congressional consideration. Second, even if the proposals that currently appear to have the best chance of passing should pass, it is unlikely that they would resolve Vepco's problem. While these proposals vary in several respects, they would require a showing by a utility desiring to use federal interim storage space that it was unable to solve its own fuel storage problem by transhipping between its own reactors or building a new storage facility at an existing power station. Thus, the present prospect is that even if legislation is adopted, it is not likely to provide any relief for Vepco. Third, even if the legislation were adopted without any requirement that Vepco exhaust the possibility of transhipment or building a new facility, there simply can be no certainty today that the Federal Government can make the storage space available by the time in 1984 that Vepco needs it. Thus, this alternative is inferior to the proposed action on the ground that its capacity to solve Vepco's problem is far less certain than that of the proposed action.

3.7 Ship Spent Fuel to a Federal Permanent Repository

Current legislative proposals in both houses of Congress would establish schedules for the Federal Government for selecting repository sites and authorizing their construction. These proposals all contemplate construction authorizations in the very late 1980's or early 1990's. Thus, if such legislation were adopted, no Federal permanent repository could be expected to be in place prior to the mid- to late-1990's.

This is not a viable alternative for solving Vepco's near-term storage needs.

3.8 Improvement of Fuel Utilization

Vepco is presently participating in a Department of Energy program to extend the allowable burnup of fuel assemblies at both its North Anna 1 and 2 and Surry 1 and 2 Power Stations. In this program, increased energy is derived from each individual fuel assembly, decreasing the number of spent fuel assemblies discharged. However, the impact of this program on near-term fuel storage requirements is negligible and the present problem of lack of fuel storage capacity remains.

3.9 Operate Surry at a Reduced Power Level to Reduce Spent Fuel Production

The amount of spent fuel generated could be reduced by lowering the unit's output, thereby extending the life of the fuel. The obvious deficiency in this alternative is that the unit could not be operated to the extent possible and the amount of electricity generated would be reduced. This alternative is not viable because it does not effectively use the resources available and would result in significant economic penalties including increased dependence or more costly coal and oil-fired generation of electricity.

3.10 Cease Reactor Operations When Spent Fuel Capacity is Expended

If no action is taken by Vepco, Surry Unit Nos. 1 and 2 would be forced to shutdown in 1987, and could be required to shutdown as early as 1984. This shutdown would be necessary due to full spent fuel pools making further spent fuel discharges impossible. The economic penalty for such action is obviously enormous and unacceptable.

Loss of the two Surry units would increase costs for electricity by approximately $350 million a year in 1982 dollars, based upon present estimates of replacement power costs.

This is clearly not a viable or practical alternative.

3.11 Ship Spent Fuel to Other Utility Spent Fuel Pools

In 1979, Vepco inquired of 10 neighboring utilities as to whether they would be willing to store spent fuel from Surry in their spent fuel storage pools. The utilities that responded uniformly rejected this proposal. That is understandable, since many of the utilities face spent fuel storage space shortages of their own.

As with several of the other alternatives reviewed, this one simply is not realistic.

3.12 Summary

The proposed action offers the greatest certainty that Vepco will be able to resolve its near term spent fuel storage capacity problem at Surry. It is also more economical than any of the other feasible alternatives available at this time.

4.0 PHYSICAL DESCRIPTION OF NORTH ANNA UNIT NOS. 1 AND 2 FUEL HANDLING AND STORAGE FACILITIES

The spent fuel pool for North Anna Unit Nos. 1 and 2 is common to both units and presently has storage capacity for 966 fuel assemblies; if the higher density spent fuel racks are approved and installed they will increase the spent fuel storage capacity to 1748 storage locations. The proposed new spent fuel racks will be described in an application to be filed with the NRC in July, 1982.

4.1 Fuel Building

The fuel building is a Class I seismic structure supported by a reinforced concrete mat on bedrock. The arrangement of the fuel building is shown in figures 4-1 and 4-2.

The fuel building is designed to handle new fuel, spent fuel and a spent fuel cask and related equipment. The building is sized for two units. The structure is approximately 136 ft-0 in. long by 41 ft-0 in. wide. The top of the foundation mat is approximately 21 ft-8 in. below grade. The main roof area is approximately 48 ft-0 in. above finish grade, with the roof of the trolley bay approximately 20 ft higher. The spent fuel storage area has clear inside dimensions approximately 29 ft-3 in. wide by 72 ft-6 in. long by 42 ft-6 in. deep. Narrow canals connect the spent fuel storage areas to the Units 1 and 2 containments. New fuel racks are mounted in the new fuel area above the slab at El. 274.75.

This area is accessible to the platform crane. The lowest level slab supports the fuel pool coolers and cooling pumps. The spent fuel is stored vertically in stainless steel racks, which provide separation to preclude criticality.

The spent fuel pool contains a 3 ft-6 in. reinforced concrete wall, extending from the foundation mat to the top of the pool. This wall separates the spent fuel cask handling area from the spent fuel racks and is designed to prevent a spent fuel cask from impacting the spent fuel storage racks.

The structure is supported by a concrete mat founded on bedrock. The walls of the spent fuel storage pool are 6 ft thick reinforced concrete for biological shielding. Exterior and interior walls enclosing the fuel pool coolers are of concrete for missile shielding. Exterior walls above the concrete work consist of insulated metal siding on structural steel framing. A large tee-shaped rolling steel door permits moving the trolley and spent fuel cask through the door opening. Another similar rolling steel door is provided for bringing new fuel into the structure. Passage doors are hollow metal type.

The superstructure walls and the roof are supported on steel framing. The roof is covered with insulated metal deck and asphalt and gravel roofing. Intermediate platforms in the new fuel area are concrete slabs on steel framing. Stairs have steel framing with grating treads and grating platforms.

Movable gates between the spent fuel pool and each canal permit dewatering the canals for access to the fuel transfer mechanisms without dewatering the entire pool. The interior walls and floor of both the pool and the fuel transfer canals are lined with 1/4 inch stainless steel plate.

Rails embedded in the concrete are provided for operation of the motor driven platform with hoists for transferring fuel.

The spent fuel pool is lined with stainless steel plate, a minimum of 1/4 inch thick, and is designed for the underwater storage of spent fuel assemblies, control rods, and burnable poison rods. The spent fuel is stored in spent fuel storage racks.

The fuel building is also described in the North Anna 1 and 2 FSAR Sections 9.1.2 and 3.8.1.

4.2 Spent Fuel Storage Racks

4.2.1 Presently Installed High Density Spent Fuel Racks

The presently installed spent fuel storage racks provide a storage capacity of 966 spent fuel assemblies. The spent fuel storage racks are classified seismic Category I and are designed to withstand the effects of the Design Basis Earthquake (DBE) and remain functional and maintain subcriticality. Details of the seismic design criteria are presented in Section 3.7 of the North Anna 1 and 2 FSAR.

The presently installed spent fuel storage racks consist of square stainless steel cells of 1/8 in. thick Type 304 austenitic stainless steel. The cells are spaced 14 inches center-to-center by Type 304 stainless steel plates. The plates, which are also 1/8 in. thick, are welded to the sides of the square storage cells at four elevations. The cells are flared at the top to permit easy storage and retrieval of the spent fuel assemblies and to be compatible with the fuel handling equipment. The base of the spent fuel rack serves to support the weight of the spent fuel assemblies and to distribute the load to the spent fuel pool floor. The base, which contains an opening at each fuel assembly location to permit coolant flow, accommodates the fuel assembly bottom nozzle. Natural circulation of pool water flows down between the storage cells and up through the bottom nozzle to remove decay heat. The storage cells are designed to provide lateral support for the Westinghouse 15 x 15 (Surry) or 17 x 17 (North Anna) fuel assembly array design.

Three different rack cell arrays are used to maximize use of the available storage space in the pool. The three arrays are:

18	6 x 6 racks	(36 assemblies)
7	6 x 7 racks	(42 assemblies)
1	6 x 4 rack	(24 assemblies)

The spent fuel racks have been conservatively designed to be able to store either Surry or North Anna fuel assemblies. The present spent fuel racks are also described in the North Anna 1 and 2 FSAR Section 9.1.2.

4.2.2 Proposed Neutron Absorber Spent Fuel Racks

The proposed spent fuel racks will be of a free-standing neutron absorber rack design and will provide 1748 storage locations. The proposed spent fuel racks will consist of a welded assembly of individual storage cells. The storage cells are comprised of double wall Type 304 stainless steel boxes welded to each other with tie plates to maintain the pitch at 10.5 inches. The double wall construction of the storage cells provides four vented (open to the pool water) compartments into which boraflex (B_4C) elements are placed for criticality control. The neutron absorber elements are positioned on each side of the storage cell at an elevation corresponding to the fuel region of an assembly placed within a cell. The top opening of each storage cell is flared to facilitate insertion and removal of fuel assemblies. The bottom of each fuel assembly storage cell is welded to the rack base.

The neutron absorber spent fuel racks will be conservatively designed and analysed to store either Surry or North Anna fuel assemblies.

4.3 Fuel Pool Cooling and Purification System

The spent fuel pool is equipped with a spent fuel pool cooling system to remove decay heat and a purification system for maintaining fuel pool water quality. These systems are shown schematically in figure 4-3.

4.3.1 Design Basis

The Fuel Pool Cooling and Refueling Purification System is designed to:

1. Remove the residual heat produced by one-third of an irradiated core 150 hr after reactor shutdown while maintaining the spent fuel pool water temperature at or below 140° F with two fuel pool coolers and one associated pump.

2. Remove the residual heat produced by one irradiated core 150 hr after shutdown plus one-third irradiated core 45 days after shutdown, while maintaining the spent fuel pool water at a temperature of 170° F or less with two fuel pool coolers and one associated pump.

3. Remove soluble and particulate impurities from the water in the spent fuel pool, either reactor refueling cavity, and either refueling water storage tank, to maintain the reactor cavity and fuel pool water optically clear and radiation levels within acceptable limits.

4. Provide a path for make-up and boration of the spent fuel pool water and both refueling water storage tanks.

5. Maintain a minimum water level in the spent fuel pool to provide adequate radiation protection from irradiated fuel.

4.3.2 System Description

The portion of the Fuel Pool Cooling and Refueling Purification System used to cool the spent fuel pool water has two shell and tube coolers and two circulating pumps, located in the fuel building. The coolers and pumps are arranged for cross-connected operation, if necessary. The coolers are cooled by component cooling water, with service water available as an emergency supply of cooling water.

All fuel pool piping penetrations are located so that at least 24 ft. 1 in. of water would remain above the active portions of the spent fuel assemblies stored in the pool even if the water should drain through the penetrations, thus ensuring adequate shielding for the spent fuel assemblies.

The system also includes three refueling purification pumps, two filters, and an ion exchanger.

Spent fuel pool water can be purified, if required, by pumping a portion of the fuel pool cooling loop flow through the refueling purification filters and ion exchanger with the refueling purification pumps. The refueling purification pumps take suction from the cooling system loop flow downstream of the coolers and return it to the pool. The filters and ion exchanger are operated in series as a filter-ion exhanger-filter arrangement, or either of the filters may be used alone. Flow through the ion exchanger and filters provides adequate purification of the water to permit access to the working area and to maintain optical clarity of the pool water. The refueling purification pumps can be run to purify the pool water independently of the cooling pump operation.

The water surface of the spent fuel pool is maintained free of floating material by two permanently installed skimmers connected to the suction of the spent fuel pool cooling pumps. The fuel pool skimmers are also provided with a pump which allows the skimmers to be operated when the fuel pool cooling pumps are not in operation.

Make-up water, borated and unborated, is supplied to the spent fuel pool and the refueling water storage tanks from the boric acid blender in either of the Chemical and Volume Control Systems. Make-up water can also be supplied to the spent fuel pool from the Fire Protection System.

All parts of equipment and piping in contact with water which has been borated to refueling water concentration are constructed of austenitic stainless steel.

The design data for the Fuel Pool Cooling and Refueling Purification System components are given in the following Table 4-1.

The Fuel Pool Cooling and Refueling Purification System is also described in the North Anna 1 and 2 FSAR in Section 9.1.3.

FUEL POOL COOLING AND REFUELING PURIFICATION

SYSTEM DESIGN DATA

TABLE 4-1

Fuel Pool Coolers

Number		2
Design duty, Btu per hr, each (with tube inlet 210 F and shell inlet 105°F)		56,800,000
	Shell	Tube
Fluid Flowing	Component cooling or service water	Fuel pool water
Design pressure, psig	150	100
Design ter[illegible]ire, °F	150	212

Fuel Pool Coolers (Cont'd)

Operating pressure, psig	110	45
Material	Carbon steel	Stainless Steel, Type 304
Design code	ASME VIII, Div. 1-1968	ASME VIII, Div. 1-1968

Spent Fuel Pool Cooling Pumps

Number	2
Type	Horizontal centrifugal
Motor horsepower, hp	100
Seals	Mechanical
Capacity, gpm, each	2,750
Head at rated capacity, ft	80

Spent Fuel Pool Cooling Pumps (Cont'd)

Design pressure, psig	125
Design Temperature, °F	250
Materials	
Pump casing	Stainless steel, Type 316
Shaft	Stainless steel, Type 316
Impeller	Stainless steel, Type 316

Refueling Purification Pumps

Number	3
Type	Vertical centrifugal
Motor horsepower, hp	20
Pump capacity, gpm, each	400

Refueling Purification Pumps (Cont'd)

Seals	Mechanical
Head at rated capacity, ft	99
Design pressure, psig	185
Design temperature, $^{\circ}F$	200
Materials	
Pump casing	Stainless steel, Type 316
Shaft	Stainless steel, Type 316
Impeller	Stainless steel, Type 316

Refueling Purification Filters

Number	2
Retention size, microns	3
Filter element capacity, gpm at 5 psig, normal/max	400/440
Material	Stainless steel, Type 304
Design pressure, psig	150
Design temperature, °F	250

Refueling Purification Ion Exchanger

Number	1
Active resin volume, cu ft	45
Design pressure, psig	200
Design temperature, °F	250

Refueling Purification Ion Exchanger (Cont'd)

Ion exchange resin	50/50 anion-cation
Material	Stainless steel, Type 316L
Design flow rate, gpm	200
Design code	ASME VIII, Div. 1-1968

Skimmer Assemblies

Number	2
Debris Basket	1/8" x 1/4" openings
Design temperature, $^{\circ}F$	210
Flow rate, gpm (approx.), each	25 (min) to 55 (max)

4.4 Fuel Building Ventilation System

The fuel building is equipped with a ventilation system to provide high-efficiency filtration, heating to inhibit the buildup of condensation, and excess exhaust flow to maintain a negative pressure in the building to prevent outward leakage. The fuel building ventilation system is also described in the North Anna 1 and 2 FSAR in Section 9.4.5.

4.4.1 Description

The fuel building ventilation system has two supply fans, one to serve the spent fuel pool area and one for the remote equipment space at El. 249.33. Both take suction from a common plenum fitted with a combination roll and high-efficiency filter (95 percent atmospheric dust spot efficiency) and steam coils for air tempering and space heating. The exhaust fans discharge through the ventilation vent and are arranged for selective bypass through the auxiliary building filter bank. The area of the remote equipment room subject to radioactive contamination is exhausted by a branch from the decontamination building exhaust system.

The design provides (1) sufficient air at a temperature that will inhibit condensation on the overhead structure to avoid water dripping into the pool, (2) high-efficiency supply air filtration and (3) supply air distribution to avoid rippling the surface. The dual exhaust combined with the two-speed supply fan arrangement provides step capacity control and protection against a single failure. The exhaust is continuously vented through the ventilation vent, with the capability to bypass through the auxiliary building iodine filter bank. The exhaust is filtered continuously during irradiated fuel-handling operations to prevent the spread of any possible airborne contamination through the exhaust air system.

The fuel building exhaust also discharges air entering the fuel building from the tunnel between the fuel building and the waste disposal building.

4.5 Fuel Handling Shielding

Fuel handling shielding is designed to facilitate the transfer of spent fuel assemblies from the reactor into the spent fuel storage racks and between the spent fuel storage racks and spent fuel shipping casks. It is designed to protect personnel against the radiation emitted from the spent fuel and control rod assemblies.

The spent fuel pool in the spent fuel building is permanently flooded to provide approximately 9 feet of water above a fuel assembly while it is being transferred. Under these conditions, the dose rate is less than 50 mrem per hour at the water surface. The water height above stored fuel assemblies is a minimum of 26 feet. The sides of the spent fuel pool, three of which also form part of the fuel building exterior walls, are 6 foot thick concrete to ensure a dose rate of no more than 2.5 mrem per hour outside the building.

Fuel building shielding is also discussed in the North Anna 1 and 2 FSAR in Section 12.1.2.5.

4.6 Fuel Building Instrumentation

Instrumentation provided gives local indication in the fuel building and the auxiliary building and remote indications and alarms in the main control room. Unit 1 control board indication and alarms include:

1. Fuel pool temperature indication

2. Spent fuel pool temperature alarms at 140°F and 170°F

3. Spent fuel pool high/low water level alarms with the low-level alarm at 6 inches below normal water level (El. 289.33)

4. Start/stop switch for spent fuel pool cooling pumps with run indication on both Units 1 and 2 main control boards

5. High differential pressure alarm for the refueling purification filters

Local indications in the fuel building include various flows, temperatures, pressures, and differential pressures.

The system instrumentation, including the spent fuel pool level and temperature instrumentation, are calibrated on a periodic basis. Instrumentation associated with the spent fuel pool is also described in the North Anna 1 and 2 FSAR in Section 9.1.3.5.

4.7 Spent Fuel Pool Water Leakage Control

No means exist for completely draining the spent fuel pool using installed systems and equipment. The water level could be lowered to El. 285.75, which is 4 ft-1 in. below the normal water level and 24 ft-1 in. above the fuel by incorrect operation of, or a failure in, the Fuel Pool Cooling and Refueling Purification System. In this instance, an adequate water level would exist over the fuel to provide for cooling and radiation protection.

The spent fuel pool water level could be lowered during refueling to El. 264.33 which is 2 ft-8 in. above the stored fuel, by incorrect operation of the reactor cavity drain and the gate valve on the fuel transfer tube. This tube connects the reactor refueling cavity to the spent fuel pool. The operating procedures used during refueling ensure that the fuel transfer tube gate valve is closed before draining of the reactor refueling cavity commences. In addition, the procedures require placing the bolted blank flange on the fuel transfer tube as soon as the reactor refueling cavity is drained. If the spent fuel pool level were inadvertantly lowered via the reactor refueling cavity drain, this condition would be detected before the level reached El. 264.33 either by excessive refueling water storage tank level if the water level were lowered by pumping, by a containment sump level alarm if the water level were lowered by draining or by a low fuel pool level alarm for either case.

After the completion of refueling t' transfer canal gates and bolted blank flange are in place in addition to the fuel transfer tube gate valve being closed.

The solid rock foundation and reinforced concrete structure of the spent fuel pool will prevent leakage from the pool should a heavy object be dropped into the spent fuel pool, violating the integrity of the stainless steel liner. Water could then enter the channels behind the liner seams which were used for testing during construction. These channels are interconnected in four zones with a 1/2 in. line from each zone to the fuel building sump. If a leak occurs in the fuel pool liner and the sump fills, the event alarm will occur on the Unit No. 1 Control Board. To date no leakage has been detected.

Leakage control for the spent fuel pool is also described in the North anna 1 and 2 FSAR in Section 9.1.3.3.3.

4.8 Fuel Building Cranes

4.8.1 Movable Platform With Hoists

The movable platform with hoists in the fuel building is a wheelmounted motor driven platform with two overhead electric hoists for lifting new and spent fuel assemblies. The platform spans the spent fuel pool and may be maneuvered over the fuel pool, the fuel transfer canals, and the new fuel handling and storage area in the fuel building. The hoist travel and the length of the long fuel handling tool is designed to limit the maximum lift of a spent fuel assembly to ensure that the water above the fuel provides a safe shielding depth. The movable platform is a seismic Class I component. Suitable restraints are provided between the bridge and the rails to prevent derailing during an earthquake. Each hoist is equipped with a load sensing device to detect any binding which may occur during fuel handling.

The movable platform with hoists is also described in the North Anna 1 and 2 FSAR in Section 9.1.4.4.5.

4.8.2 Fuel Building Trolley

The crane for handling the spent fuel cask is a trolley of 125 ton capacity running on fixed rails. The rails span the west end of the spent fuel pool in an area where no spent fuel storage racks are installed. The rails pass outside the fuel building and over the decontamination building and then over the roadway. The fuel building trolley is designed as a Class I seismic component.

Restraints are provided to prevent displacement of the trolley from the rails during the Design Basis Earthquake.

The loaded spent fuel cask is lifted into and out of the spent fuel pool with this trolley. As the cask is being removed from the spent fuel pool, it is hosed down with primary grade water to remove loose contamination. The cask is then transferred to the Decontamination Building through a roof hatchway for radioactivity sampling, testing, and further decontamination, if required. After the cask has been prepared for shipping, it is transferred from the Decontamination Building to the transporting vehicle using the fuel building trolley.

The possibility of the cask falling from the trolley is minimized since the trolley is equipped with eddy current brakes, dual load holding brakes, and "dead man" motor controls. These brakes and controls prevent the cask from falling freely while hanging from the trolley. The cask lifting rig is conservatively designed so that the cask is securely locked to the rig, thereby preventing the cask from slipping from the trolley hook. The fuel building trolley is also described in the North Anna FSAR Section 9.1.4.4.10.

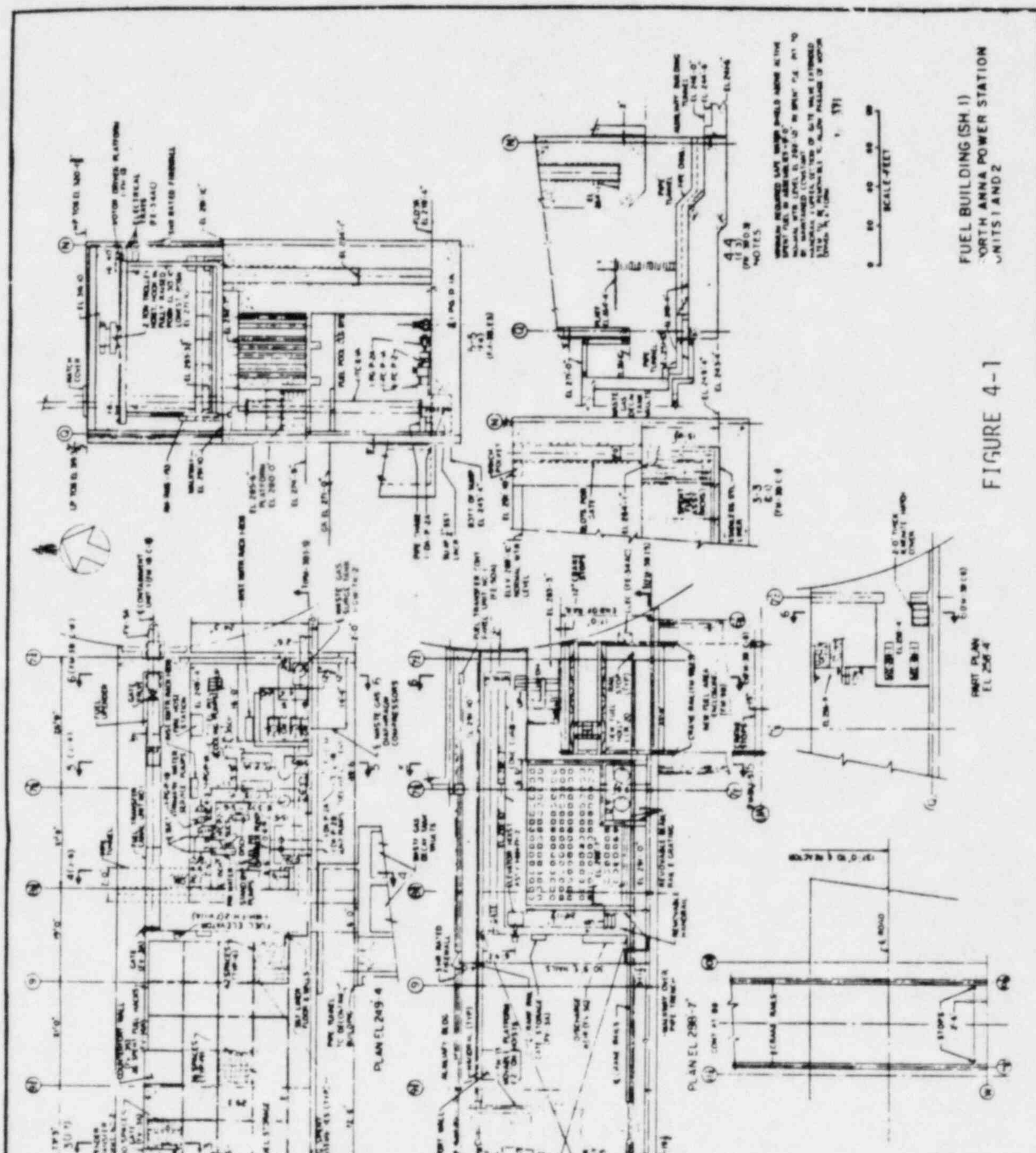
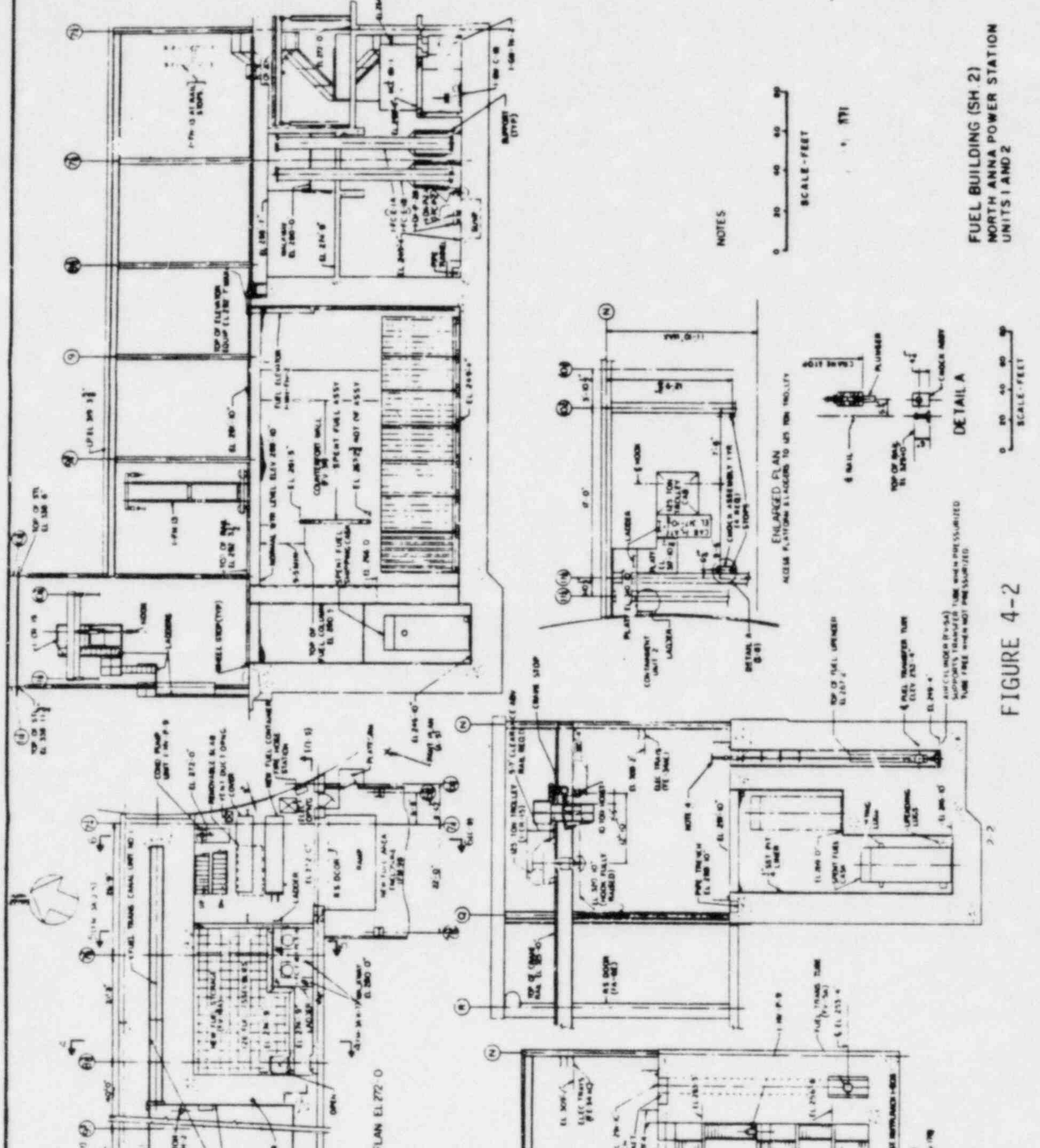


FIGURE 4-1

FUEL BUILDING (SH. 1)
NORTH ANNA POWER STATION
UNITS 1 AND 2



FUEL BUILDING (SH 2)
NORTH ANNA POWER STATION
UNITS 1 AND 2
NOTES
SCALE-FEET
ENLARGED PLAN
DETAIL A
PART PLAN
FLAN EL 272-0

FIGURE 4-2

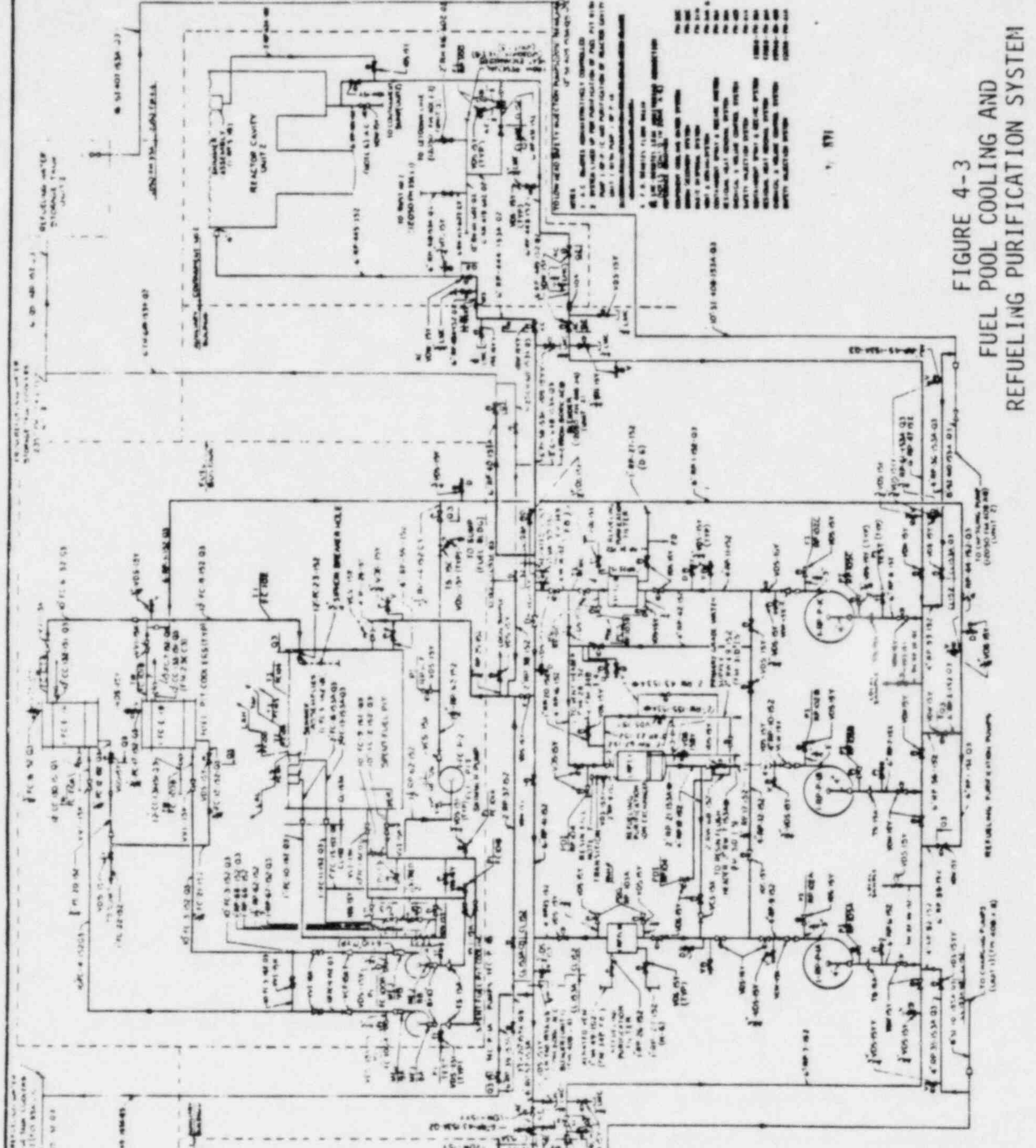


FIGURE 4-3
FUEL POOL COOLING AND
REFUELING PURIFICATION SYSTEM

5.0 SHIPMENT OF SPENT FUEL FROM SURRY TO NORTH ANNA

The spent fuel associated with this proposed action will be shipped via truck cask from Surry to North Anna. The spent fuel cask used will have been approved and certified by the NRC as being suitable for shipment of spent fuel. The shipping route will be reviewed and approved by both the Commonwealth of Virginia and NRC officials. Once approved the route(s) will be listed in NUREG 0725 published by the NRC which lists all approved shipping routes.

6.0 STORAGE OF SURRY FUEL AT NORTH ANNA

The spent fuel assemblies which will be shipped from Surry to North Anna will be stored in the North Anna 1 and 2 spent fuel pool in the spent fuel storage racks. Each fuel assembly is engraved with a unique identification number (based on ANSI/ANS 57.8) and a vendor identification number, which is unique to the site for which the fuel assemblies were fabricated. At both North Anna and Surry the vendor identification number is used to keep track of fuel assemblies on a day to day basis.

At the North Anna Power Station, one set of status boards showing all of the spent fuel locations in the spent fuel pool, with tags bearing both the vendor and ANSI based identification numbers of the spent fuel assemblies, is utilized to identify the location of an individual fuel assembly at any time. A second set of status boards identify the fuel assemblies by the vendor identification number only.

At the Surry Power Station, the tags for the status boards bear the vendor identification numbers. The identity and location of a particular fuel assembly may also be verified through the use of remote underwater television cameras.

The storage of spent fuel at North Anna is presently controlled by written procedures. These procedures will be reviewed to determine if changes are necessary due to the storage of Surry spent fuel. The procedures will be revised where appropriate.

Sections 7 and 8 will consider compatibility, operational considerations and safety implications of the storage of Surry spent fuel at North Anna.

The spent fuel assemblies which will be shipped from Surry to North Anna are 15 x 15 fuel assemblies, manufactured by Westinghouse Electric Corporation (NSSS supplier). In order to assess the impacts of the storage of Surry fuel at North Anna the characteristics of both Surry fuel (15 x 15) and North Anna fuel (17 x 17) have been included in this section as follows:

1. Table 6-1 is a comparison of the physical dimension of 15 x 15 and 17 x 17 fuel.

2. Figure 6-1 illustrates Surry 15 x 15 Fuel

3. Figure 6-2 illustrates North Anna 17 x 17 Fuel

The spent fuel assemblies which will be shipped from Surry to North Anna will have been removed from the reactor to cool in the Surry spent fuel pool a minimum of 2 years prior to being shipped to North Anna.

TABLE 6-1

COMPARISON OF THE PHYSICAL DIMENSIONS

OF 15 X 15 (SURRY) AND 17 X 17 (NORTH ANNA) FUEL

	15 X 15 (SURRY)	17 X 17 (NORTH ANNA)
Overall Length	159.76	159.8
Overall Dimensions	8.426 X 8.426	8.426 X 8.426
UO_2 Rods Per Assembly	204	264
Guide Tubes Per Assembly	20	24
Number of Grids Per Assembly	7	8
Active Fuel Length	144	144
Cladding Material	Zircalloy - 4	Zircalloy - 4
Clad Thickness	0.0243 (Nominal)	0.0225 (Nominal)

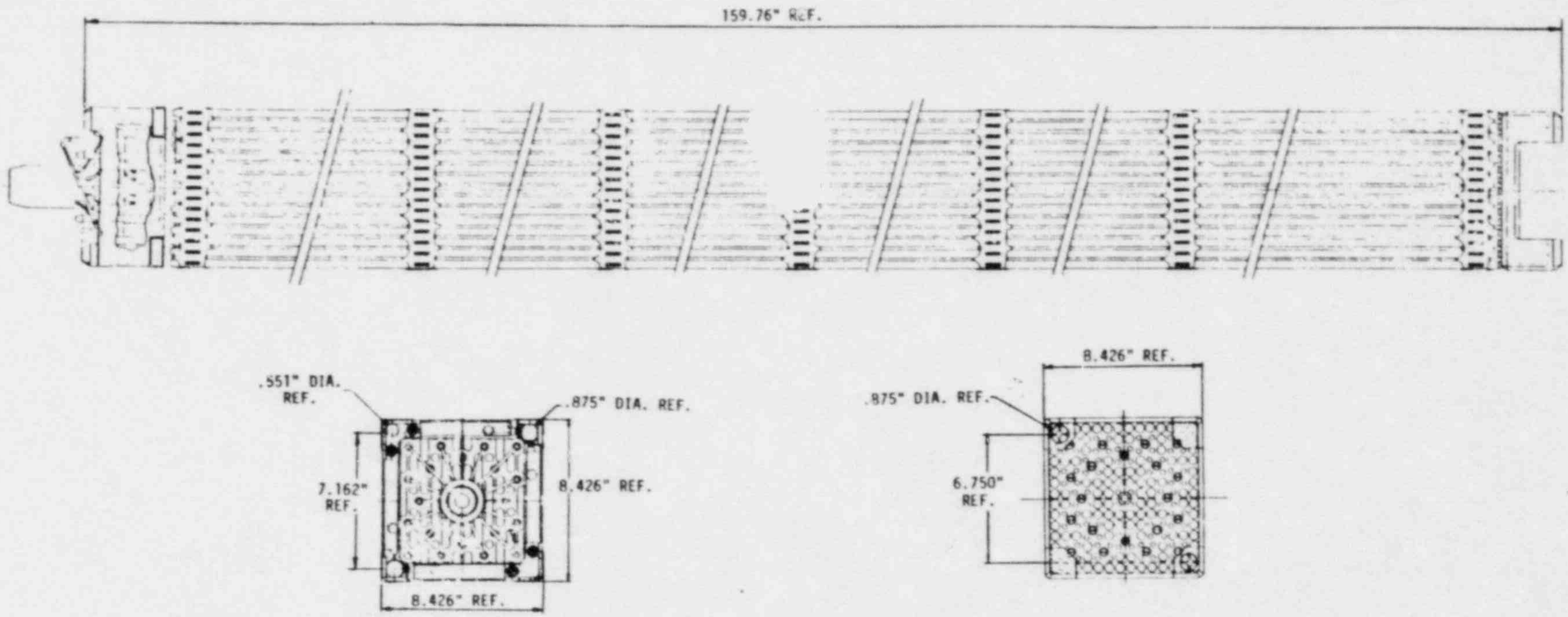


FIGURE 6-1
WESTINGHOUSE 15x15 FUEL ASSEMBLY OUTLINE
SURRY POWER STATION UNIT NOS. 1 AND 2

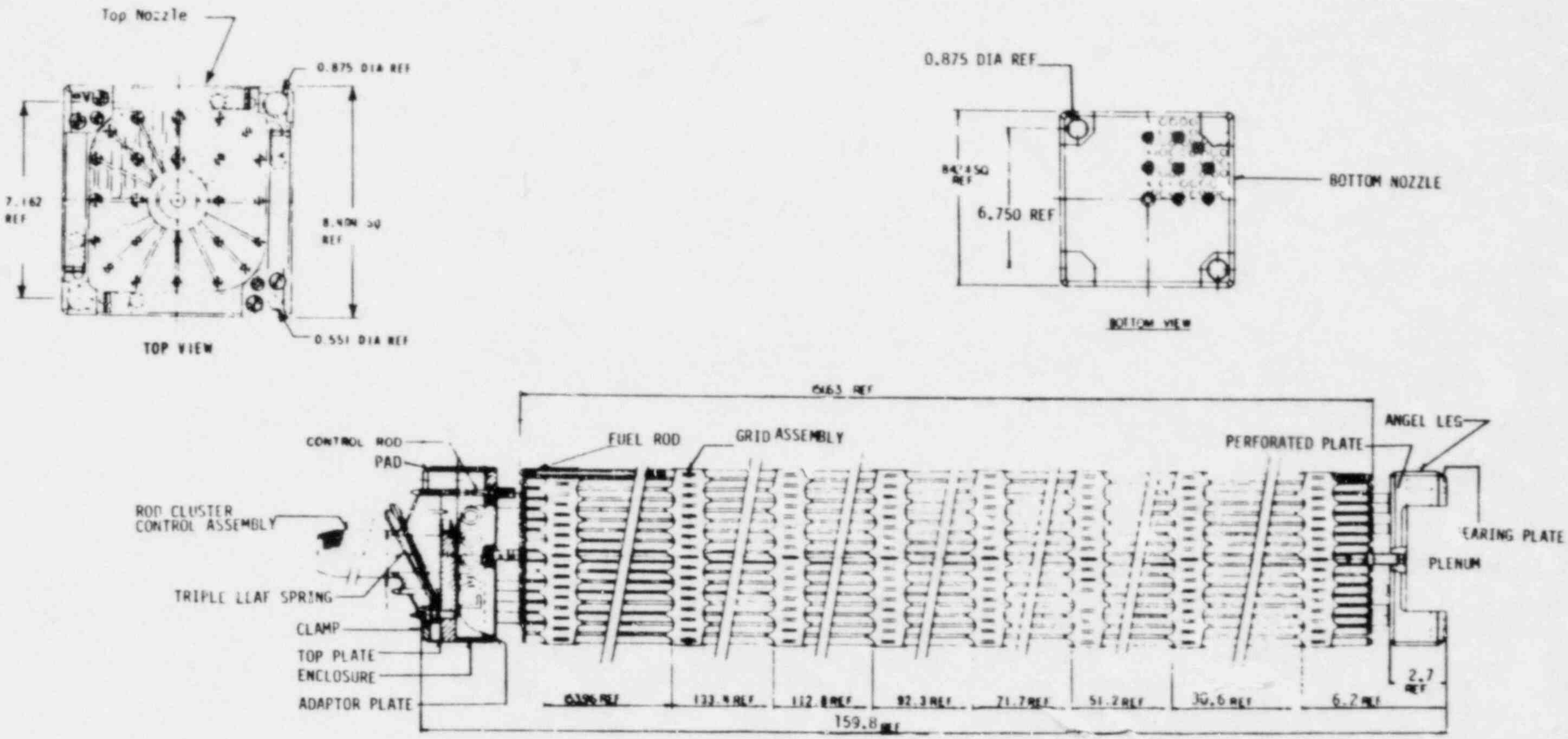


FIGURE 6-2
WESTINGHOUSE 17x17 FUEL ASSEMBLY OUTLINE
NORTH ANNA POWER STATION UNIT NOS. 1 AND 2

7.0 ANALYSIS OF EXISTING FACILITIES AND SYSTEMS AFFECTED BY THE PROPOSED ACTION

The spent fuel storage pools at North Anna and Surry are essentially identical as far as operation, storage of fuel, and designs of support systems. The North Anna spent fuel pool has therefore been reviewed to assure that there are no compatibility problems or adverse operational considerations associated with the storage of Surry spent fuel at North Anna. This section will therefore describe the results of this review for each of the systems described in section 4.0 of this document.

7.1 Fuel Building

The arrangements of the fuel building at Surry and North Anna are very similar, as they were both designed to be compatible with PWR fuel assemblies. For this reason there is no impact on the spent fuel building structure due to the introduction of Surry spent fuel assemblies to the North Anna spent fuel pool.

7.2 Spent Fuel Storage

Vepco designed the spent fuel storage racks presently in the North Anna Units 1 and 2 pool to accommodate either Surry or North Anna fuel. The proposed neutron absorber racks for North Anna Units 1 and 2 will also be designed to accommodate fuel from either Station. In performing the structural/seismic analysis, the thermal hydraulic analysis and the criticality analysis for both the existing and the proposed racks, Vepco has chosen the Surry or North Anna fuel characteristics that would yield the most conservative results. There are therefore no compatibility problems or adverse operational considerations associated with the storage of Surry spent nuclear fuel in either the spent fuel racks presently at North Anna or the proposed neutron absorber racks.

7.3 Fuel Pool Cooling and Purification System

The installed North Anna 1 and 2 spent fuel pool cooling system has been analyzed in view of the Surry spent fuel assemblies which will be shipped to North Anna. Table 7-1 summarizes the cooling system performance for both normal and abnormal (full core discharge) conditions.

The design basis heat load was determined using the following conservative assumptions:

1. The irradiation times used for North Anna fuel were 272, 544, and 816 Effective Full Power Days which correspond to a one, two, and three year fuel cycle, respectively, with a load factor of 85 percent and an annual 45 day refueling outage.

2. The irradiation time used for Surry fuel was 816 Effective Full Power Days which corresponds to a three year fuel cycle with a load factor of 85 percent and an annual 45 day refueling outage.

3. Surry fuel will be cooled for 2 years before being shipped to North Anna.

4. Annual back to back refuelings will occur 45 days apart.

5. The Surry assemblies are assumed to be added 125 at a time over 4 years.

6. Decay heat rates calculated using NRC Branch Technical Position 9-2.

7. All fuel to be moved into the pool is done instantaneously 150 hours after shutdown except for the full core discharge case when fuel is moved from the reactor to the fuel pool at a rate of 20 minutes per assembly starting 150 hours after reactor shutdown.

8. Stretch rating of 2900 MW is used for full power for North Anna.

9. Stretch rating of 2546 MW is used for full power for Surry.

10. Two cases have been considered for maximum storage capacity of the spent fuel pool; 966 storage location for currently installed fuel racks and 1748 storage locations for the proposed neutron absorber spent fuel storage racks.

11. Service water temperature at its design maximum of 110°F.

12. Two discharge schemes have been considered: a) all refuelings are normal refuelings; and b) all refuelings are normal refuelings except the final refueling which is a full core discharge.

The currently installed spent fuel pool cooling system has sufficent cooling capacity to maintain the pool water temperature at or below the FSAR design criteria of 140°F for the normal case and 170°F for the abnormal case if one fuel pool cooling system pump and two coolers are utilized.

These fuel pool temperatures are calculated based on very conservative worst case assumptions and are valid for establishing a design basis for the proposed action.

Actual operating temperatures experienced by both North Anna and Surry have shown maximum temperatures for full core discharge cases to be 103°F and 110°F respectively with one pump and one cooler operating and normal operating temperatures less than 100°F.

There will be no impact on the operation of the spent fuel pool purification system as a result of the storage of Surry spent fuel at North Anna. The maximum load on the spent fuel pool purification system occurs during refueling operations i.e. while fuel assemblies are being moved. Therefore, there will be no significant increase on the purification system load due to the proposed action since the total number of fuel assemblies to be handled in the pool in filling it to its maximum capacity will not be changed.

7.4 Fuel Building Ventilation System

Since the fuel assemblies which are to be shipped from Surry to North Anna will have been cooled a minimum of 2 years prior to shipment, the escape of gaseous or volatile fission products even from any potentially defective fuel assemblies is expected to be negligible. This is because essentially all of the Iodines and the Xenon have decayed after 100 days cooling time. Also since most of the tritium in the pool water is formed primarily as a product of the neutron irradiation of boron in the primary coolant, the contribution of fission product tritium is minor. There is no mechanism for particulate fission products to become airborne. The only significant gaseous fission product remaining in cooled spent fuel is Kr-85 due to its long half life. However the thermal driving force required to cause diffusion in defective fuel is not present. Neither tritium or Kr-85 has ever been detected in the fuel buildings at either North Anna or Surry and they are therefore not expected to cause any problems as a result of the shipment of up to 500 fuel assemblies from Surry to North Anna.

In summary, the storage of up to 500 Surry spent fuel assemblies at North Anna will have no impact on the concentrations of radionuclides in the fuel building air and will therefore have no impact on the fuel building ventilation system.

7.5 Fuel Building Shielding

The Surry spent fuel pool and the North Anna spent fuel pool shielding design are identical. For these reasons, there is no shielding problem associated with the storage of up to 500 Surry spent fuel assemblies in the North Anna 1 and 2 spent fuel pool.

7.6 Fuel Building Instrumentation

The storage of Surry spent fuel in the North Anna 1 and 2 spent fuel pool will have no impact on, nor will it require any changes to be made to, the North Anna 1 and 2 spent fuel pool instrumentation. The spent fuel pools and instrumentation systems at Surry and North Anna are essentially the same and the Surry spent fuel is compatible with both.

7.7 Spent Fuel Pool Water Leakage Control

The storage of Surry spent fuel in the North Anna 1 and 2 spent fuel pool will have no impact on or require any changes to be made to the North Anna 1 and 2 fuel pool leakage control measures. The leakage control methods at both Surry and North Anna are the same.

7.8 Fuel Building Cranes

7.8.1 Movable Platform With Hoists

The storage of Surry spent fuel in the North Anna 1 and 2 spent fuel storage pool will have no impact on, or require any changes to be made to, the movable platform with hoists. The weight of the Surry spent fuel assemblies is comparable to the weight of the North Anna spent fuel assemblies. The spent fuel handling tools at North Anna and Surry have slightly different latching mechanisms and for that reason a Surry type handling tool will be used to handle Surry spent fuel in the North Anna fuel pool. This will be administratively controlled by written procedure.

7.8.2 Fuel Building Trolley

The storage of Surry spent fuel in the North Anna 1 and 2 spent fuel pool will have no impact on or require any changes to the spent fuel trolley. The spent fuel trolley is used to handle shipping casks, and the same shipping casks are used for shipment of either Surry and North Anna fuel.

TABLE 7-1

SPENT FUEL POOL COOLING SYSTEM
HEAT LOAD AND OPERATING TEMPERATURES
WITH STORAGE OF SURRY SPENT FUEL
IN THE NORTH ANNA 1 AND 2 FUEL POOL

	Decay Heat MBTU/HR	Fuel Pool Temperature, °F 1P1C	1P2C	2P2C
No Surry Fuel				
High Density Racks (966)				
Normal	19.4	147.8	135.4	130.4
Abnormal	35.9	176.8	154.2	144.9
No Surry Fuel				
Neutron Absorber Racks (1748)				
Normal	23.1	158.5	138.5	135.0
Abnormal	39.2	193.0	157.0	151.0
Surry Fuel (500)				
High Density Racks (966)				
Normal	20.5	152.5	136.0	132.5
Abnormal	36.3	185.0	153.0	147.5
Surry Fuel (500)				
Neutron Absorber Racks (1748)				
Normal	24.1	160.0	140.0	136.0
Abnormal	40.0	192.5	156.5	151.0

1P1C - 1 Pump 1 Cooler
1P2C - 1 Pump 2 Coolers
2P2C - 2 Pumps 2 Coolers

8.0 ANALYSIS OF THE SAFETY IMPLICATIONS OF THE PROPOSED ACTION

The proposed action will not change the safety analysis which has previously been performed and reported in the Final Safety Analysis Report for the North Anna Power Station Unit Nos. 1 and 2.

The following discussion summarizes the potential effects which the proposed action may have on the safety of the station and the public.

8.1 Loss of Spent Fuel Pool Cooling Capability

As discussed in section 7.3, the proposed action will not alter the ability of the spent fuel pool cooling system to maintain the temperature of the fuel pool below the FSAR design criteria of 140°F for the normal case and 170°F for the abnormal case. In the event that a component of the fuel pool cooling system were to become inoperable, cooling capacity could be quickly restored as indicated in the failure analysis in Table 8-1.

In the unlikely event that the spent fuel pool cooling system became totally inoperable, installed station systems could supply sufficient make-up water to cool the spent fuel and maintain sufficient water shielding over the pool. There are several sources of make-up readily available in the event it is required. The sources are:

1. Primary Grade Water System
2. Fire Protection System

3. Condensate System

4. Domestic Water System

5. Boron Recovery System

6. Refueling Water Storage Tank

These sources could be utilized by either changing valve lineups or implementing temporary measures such as the use of temporary pumps or hoses.

Loss of spent fuel cooling is also discussed in the North Anna 1 and 2 FSAR Section 9.1.3.2.

8.2 Fuel Pool Leakage Control and Shielding

The proposed action will not affect the leakage and shielding requirements contained in the FSAR Sections 9.1.3.3.3 and 12.1.2.5 and as discussed in sections 7.5 and 7.7. The lowest level of a pipe penetration into the spent fuel pool is 24 feet 1 inch above the stored fuel to provide adequate cooling and shielding. Therefore, there are no safety implications associated with spent fuel pool leakage control or shielding.

8.3 Criticality Analyses

The proposed action will not affect the criticality analyses previously performed for the spent fuel storage racks described in FSAR Section 9.1.2. The analysis was performed assuming fresh fuel rather than spent fuel and was performed for both Surry and North Anna fuel. The Surry fuel to be stored at North Anna will be spent fuel and will have a much lower reactivity than fresh fuel.

In summary, the criticality provisions stated in FSAR Section 9.1.2 and the Technical Specifications Section 5.6 are not changed as a result of the proposed action. Therefore, there are no safety implications associated herewith.

8.4 Thermal-Hydraulic Analysis of Stored Fuel

The proposed action will not affect the thermal hydraulic analyses previously performed for the spent fuel storage racks described in FSAR Section 9.1.2 as the analysis was performed for both 17 x 17 and 15 x 15 fuel assemblies assuming the thermal generation rates of North Anna fuel which is greater than Surry fuel. Also the analyses performed assumed fuel had been freshly discharged from the reactor, whereas the Surry fuel to be stored in the North Anna 1 and 2 spent fuel pool will have been cooled for as long as 10 years.

In Summary, the thermal-hydraulic analyses of the spent fuel racks as presented in the FSAR is not changed as a result of the proposed action; therefore there are no associated safety implications.

8.5 Earthquakes and Tornado Protection

The proposed action will not require any structural changes; therefore it will not affect the ability of the structure to withstand the effects of an earthquake or a tornado as stated in the FSAR. The seismic/structural analyses of the spent fuel storage racks have been performed such that they envelope both Surry and North Anna fuel assemblies so that either will be accommodated by the fuel racks during a seismic event.

In summary, the seismic and tornado protection provisions stated in FSAR Section 9.1.2, 3.7, and 3.3 are not changed as a result of the proposed action.

8.6 Fuel Handling Accidents

The proposed action will not change any of the fuel handling and storage methods, but it may have an impact on fuel handling procedures. Accordingly, fuel handling procedures will be reviewed and modified where deemed appropriate, and operator training will be enhanced to assure an appropriate level of safety.

The postulated fuel handling accidents remain unchanged. The accidents postulated in Section 15.4.5 are the same as those postulated in the Surry FSAR in Section 14.4.1. Both FSARs consider freshly discharged fuel in the accident analysis. The

Surry fuel assemblies to be stored in the North Anna Unit Nos. 1 and 2 spent fuel pool will have been cooled a minimum of 2 years prior to being stored at North Anna.

In addition to the analyses in Section 15.4.5 of the FSAR on fuel handling accidents, a generic review of handling of heavy loads been performed by Vepco in conformance with NUREG-0612.

8.7 Personnel Radiation Exposure

The proposed action will not change the amount of personnel exposure due to storage of spent fuel. It is anticipated, however, that there will be personnel exposure associated with the unloading and loading of the spent fuel shipping casks used to transport the Surry spent fuel. It has been estimated to take approximately 0.168 manrem for the unloading and loading of spent fuel casks. It is presently expected that the proposed action will result in 166 to 500 cask shipments, depending upon whether a three-element or single-element cask or both are used. This will result in a total personnel exposure for the proposed action of between approximately 28 and 84.0 manrem spread over an estimated 5-6 year period. The total personnel exposure at North Anna Power Station for the year 1981 was 680 man-rem.

In summary there will be an increase in station personnel exposure as a result of the proposed action which is only a small fraction of the total personel exposure for the station.

8.8 Solid Radioactive Waste

The proposed action will not change the amount of solid radioactive waste generated due to the storage of spent fuel. There will however be solid radioa :ive wastes associated with the unloading and loading of the spent fuel shipping casks used to transport the Surry spent fuel. It has been estimated that approximately 100 cubic feet of solid radioactive waste containing 2 mCi of radioactive material would be generated from the unloading and loading of a spent fuel cask. It is presently expected that the proposed action will result in up to between 166 and 500 cask shipments, depending upon whether a three-fuel assembly or single-fuel assembly cask or both are used. This will result in a total solid waste generation for the proposed action of between approximately 16,600 cubic feet of solid waste containing a total of 332 mCi of radioactive material and 50,000 cubic of solid waste containing a total of 1 Ci of radioactive material spread over a 5-6 year period. The total solid radioactive waste generated at North Anna Power Station for the year 1981 was 10,700 cubic feet containing 2,620 Ci of radioactive material.

In summary, there will be an increase in the volume of solid radioactive waste however the total Curie content of that waste will only be a small percentage of the solid radioactive wastes for 1981 at North Anna Power Station.

TABLE 8-1

FUEL POOL COOLING SYSTEM MALFUNCTION ANALYSIS

Component	Malfunction	Comments and Consequences
Spent Fuel Pool Cooling Pumps	Pump fails to start or fails during operation	The standby pump will be started manually.
Fuel Pool Coolers	Loss of function	The standby exchanger will be used. More than 1 hour exists to realign the piping system because of the slow heatup rate of the pool. The realignment is effected by operating manual valves.
Pumps, Coolers, Piping, Valves and other components	Leaks of any size	A slow leak (less than 100 gpm) will permit over 2 hr to isolate the leak before loss of 1 ft of water in the spent fuel pool. A large leak can only reduce water to the lowest pool penetration which is at a high enough level to assure adequate shielding.

9.0 PHYSICAL PROTECTION

This page is withheld from public disclosure pursuant to 10CFR 2.790 (d) (1).

10.0 EMERGENCY PLANNING

The Vepco Spent Fuel Transportation Emergency Plan will specify procedures that are to be placed into effect in the event a Vepco spent fuel shipment is involved in a transportation accident or other emergency condition in which radiation releases could result.

This emergency plan will be used to initiate prompt assistance by Vepco to civil authorities and the transporter by providing an emergency communications system and other emergency responses to the accident, including radiological surveillance of the spent fuel shipment and evaluation of the extent of physical damage to the cask and vehicle. Information so provided by the Vepco emergency team will be available to civil authorities responsible for determining what action, if any, is required to protect the public. The emergency plan will also provide guidance and identify the resources necessary for cask recovery and site restoration if such work is necessary.

10.1 Emergency Plan Objectives

1. To provide for prompt notification of responsible civil authorities in the event of an emergency.

2. To provide for immediate notification of and response from law enforcement agencies in the event of external interference with a spent fuel shipment.

3. To provide for notification of Vepco officials following a transportation incident and to maintain communications with these officials to keep them informed on all developments concerning such an incident.

4. To provide for prompt response of Vepco with equipment and personnel to the site of an emergency.

5. To make provisions for Vepco to evaluate the radiological status of the cask and assess physical damage to the cask and vehicle in the event of a transportation accident.

6. To make provisions for Vepco to act in an advisory capacity following an accident by providing civil authorities and the transporter with an evaluation of the existing radiological conditions and recommendations on protective action necessary to safeguard the transporter and general public.

7. To provide for assistance in cask recovery and site restoration following an accident.

8. To provide for the request, if necessary, of assistance from other utilities in the event of a transportation accident.

11.0 FINANCIAL PROTECTION REQUIREMENTS AND INDEMNITY

In the proposed action, Vepco proposes to store at its North Anna Unit Nos. 1 and 2 facility up to 500 spent fuel assemblies used or produced at its Surry Unit Nos. 1 and 2 facility. The present indemnity agreement for the North Anna Unit Nos. 1 and 2 facility must be modified to provide financial protection associated with the storage of Surry generated spent fuel at North Anna.

Vepco requests that the indemnity agreement providing indemnity coverage for the North Anna Power Station Unit Nos. 1 and 2 incorporate an appropriate modification to the standard definition of "the radioactive material" contained in 10CFR140.92, Appendix B, Article I, paragraph 9, so as to provide indemnity coverage for storage at North Anna Power Station Unit Nos. 1 and 2 of spent fuel generated by the Surry Unit Nos. 1 and 2 facility.

Vepco suggests the following language:

> "The radioactive material" means source, special nuclear and by-product material which: (1) is used, was used, or will be used in, or is irradiated, was irradiated or will be irradiated by either of, the nuclear reactors licensed under NPF-4 or NPF-7, or (2) was used in, or was irradiated in either of the nuclear reactors licensed under DPR-32 and DPR-37 and subsequently is, or has been transported to the North Anna Power Station Unit Nos. 1 and 2 site for the purpose of storage, or (3) is or has been produced as the result of operation of either of the nuclear

reactors licensed under NPF-4 or NPF-7, or (4) which has been produced in either of the nuclear reactors licensed under DPR-32 or DPR-37, and subsequently is or has been transported to the North Anna Power Station Unit Nos. 1 and 2 facility for the purposes of storage.

Vepco requests that the Commission issue a Notice forthwith pursuant to 10CFR140.9 of its intent to modify the indemnity agreement for the reactors licensed under NPF-4 and NPF-7 along the lines addressed above.

12.0 ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

The only environmental impacts which have been identified for the proposed action are an increase in low level radioactive waste and personel exposure associated with the loading and unloading of spent fuel casks which would be a consequence of the proposed action. The environmental impact associated with the loading of a spent fuel shipping cask and transport of it from Surry is discussed in the Surry Final Environmental Statement in Sections V.G.2, V.G.4 and VI.B.2. The environmental impact of storage of spent fuel in the North Anna 1 and 2 spent fuel is discussed in the North Anna Power Station Final Environmental Statement in Section 5.7.2.

The environmental impact of the proposed action is insignificant. The environmental impact has been reviewed by Vepco in light of the North Anna Power Station Final Environmental Statement, The North Anna Power Station Unit Nos. 1 and 2 FSAR, and 10CFR50. Based on this review Vepco has been concluded that the proposed action will not significantly affect the quality of the human environment.

12.1 Independence of the Action

This licensing action would clearly have a utility that is independent of the utility of other licensing actions designed to ameliorate a possible shortage of spent fuel storage capacity.

As discussed in Section 3.0 under alternatives, an alternate storage facility is not now available. Storage of Surry spent fuel in the North Anna 1 and 2 spent fuel pool is required as an interim solution to allow the two units at Surry to continue to operate beyond 1984, in the event a full core discharge is required, and beyond 1987 if no full core discharge is required before that time.

As a long term solution for spent fuel storage, the Federal Government is committed to providing a repository for spent fuel. While the proposed action may not completely cover the time period until the long term repository is expected to be available, Vepco is actively pursuing ways to alleviate the problems associated with the storage of spent fuel after the benefits of the proposed action have been utilized. These alternatives include:

1. Extending fuel burnups beyond currently licensed limits to decrease the amount of spent fuel generated.

2. Design of independent spent fuel storage installations utilizing dry and wet storage techniques and construction of one or the other.

3. Modification of the North Anna 3 fuel pool design to accommodate additional spent fuel from both Surry 1 and 2 and North Anna 1 and 2.

The proposed action would allow Surry Unit Nos. 1 and 2 to continue to operate until 1989 (with existing spent fuel racks at North Anna) and until 1993 (with the proposed neutron absorber spent fuel racks at North Anna). It would also provide Vepco with additional flexibility, which is desirable even if adequate offsite storage facilities later become available.

Vepco has therefore concluded that a need for storage of Surry spent fuel at North Anna Unit nos. 1 and 2 exists and that the proposed action is independent of the utility of other licensing actions designed to ameliorate a possible shortage of spent fuel storage capacity.

12.2 Commitment of Resources

With respect to the proposed action only two resources have been identified as being utilized. The material resources considered are those utilized to transport spent fuel assemblies from Surry to North Anna, which is proposed to be done with existing, NRC licensed spent fuel shipping casks. The storage of Surry fuel in the North Anna 1 and 2 spent fuel pool has been considered as the utilization of a non-material resource. It has been determined that the proposed action will allow for the continued operation of, and provide operational flexibility for, the Surry Power Station Unit Nos. 1 and 2 and will not affect similar licensing actions at other nuclear power stations.

12.3 Cumulative Environmental Effects

Potential nonradiological and radiological impacts that could result from the transportation of Surry fuel have been considered in the Surry Unit Nos. 1 and 2 Final Environmental Statement. Storage of that spent fuel in the North Anna 1 and 2 spent fuel pool has been considered in this summary. No environmental impacts on the environs outside of the North Anna 1 and 2 spent fuel storage building have been identified. It is therefore concluded that the cumulative environmental impacts associated with the storage of Surry fuel in the North Anna 1 and 2 spent fuel pool will not result in radioactive effluent releases or occupational radiation exposures or offsite personnel exposures that would significantly affect the quality of the human environment during either normal operation or under postulated fuel handling accident conditions.

12.4 Technical Issues

The technical issues associated with the proposed action are addressed in this summary. There is reasonable assurance that the proposed action can be carried out as described herein with no adverse effects on the health and safety of the general public.

12.5 Deferral of the Proposed Action

As discussed in section 3.0, a number of alternatives to the proposed action have been considered. The proposed action represents the most economically feasible alternative to ameliorate the shortage of spent fuel storage capacity at Surry Unit Nos. 1 and 2 with a negligible environmental impact. If the proposed action is not implemented or if it is deferred significantly, more expensive and riskier alternatives will have to be pursued and Surry would have to be shutdown when presently installed storage space is no longer adequate. In the case of shutdown, the additional cost to Vepco's customers is estimated to be approximately $350 million dollars per year (in 1982 dollars) for purchase of alternate power, if available, and maintenance of the station in a shutdown condition. It can therefore be concluded that deferral or severe restriction of the proposed action would result in substantial increase in consumer cost and substantial harm to the public interest.

12.6 Final Environmental Statement

The proposed action will not significantly alter the evaluations contained in the North Anna Power Station Final Environmental Statement. The proposed action will create additional amounts of solid radioactive waste and occupational radiation exposure associated with loading and unloading the spent fuel shipping casks which will be utilized to transport the spent fuel from Surry to North Anna.

12.7 Final Safety Analysis Report

The descriptive information contained herein is intended to supplement the material contained in the North Anna 1 and 2 FSAR. The design criteria specified in the FSAR have been used as the basis for the proposed modification and have been supplemented where appropriate for the proposed action. The proposed action does not substantially change the analyses and descriptions in the FSAR.

13.0 CONCLUSIONS

Based on the information contained herein, Vepco has concluded that:

1. The proposed action is necessary to maintain the capability of a full core discharge and to assure adequate storage space for normal refuelings at Surry Power Station through fall, 1993.

2. The proposed action provides the most economical of the feasible alternatives to ameliorate the potential shortage of storage capacity, and it is the one most certain to avoid the forced shutdown of one or both Surry units.

3. The North Anna Power Station Unit Nos. 1 and 2 spent fuel pool is adequate for the storage of Surry spent fuel without modification.

4. The Surry spent fuel can be stored safely in the North Anna Unit Nos. 1 and 2 spent fuel storage pool.

5. The proposed action will not affect the health and safety of the general public.

6. The proposed action will not significantly affect the quality of the human environment.