 May 9, 1985

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC
SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
VIRGINIA ELECTRIC AND POWER COMPANY	)	Docket Nos. 50-338/339-OLA-1
	)	
	)	
(North Anna Power Station, Units 1 and 2)	)	

TESTIMONY OF MARVIN L. SMITH (I)

I.

Introduction

My name is Marvin L. Smith. I am a Supervisor, Nuclear Engineering for Virginia Electric and Power Company (Virginia Power). In my present position, I am responsible for: (a) supervising the Nuclear Systems Analysis group responsible for radwaste projects engineering support, coordination of ALARA and ALARA analysis for engineering, radiation shielding analysis, and reliability analysis, (b) managing the Virginia Power/Department of Energy/Electric Power Research Institute Cooperative Agreement Program, described below, on dry cask storage of spent nuclear fuel, (c) serving as Virginia Power's representative to the Edison Electric Institute-sponsored Utility Nuclear Waste Management Group (UNWMG) high level waste working group, and (d) chairing the Electric Power Research Institute (EPRI) external fuel cycle subcommittee, which funds research on nuclear waste issues.

I have been involved in the development and implementation of Virginia Power's plans for interim spent fuel storage since

1981. I am currently responsible for the coordination and implementation of Virginia Power's efforts to provide for interim storage of its spent fuel. This requires staying abreast of our need for additional space, including when such space must be available, and the alternatives Virginia Power has to satisfy those needs. My resume is attached to this testimony as Appendix 1.

In the testimony that follows, I will describe the current status of spent fuel storage space in the Surry Power Station spent fuel pool, Virginia Power's plans for the use of dry casks to store spent fuel, the comparative costs of dry cask storage and Surry-to-North Anna fuel shipments, and the environmental effects of each alternative. I will also explain why Virginia Power believes that it is essential to have the authority to store Surry fuel at North Anna, which we seek in this proceeding, even if it also receives permission to operate a dry cask facility at Surry.

II.

Loss of Full Core Reserve at Surry

A. Storage space in the Surry spent fuel pool

Appendix 2 to this testimony sets out the number of spent fuel assemblies currently stored in the Surry and North Anna spent fuel pools and the projected increases in spent fuel storage needs through 2005. As indicated in this Appendix, Virginia Power will have 886 fuel assemblies (one space is occupied by a canister of fuel rods rather than an intact assembly) stored in the Surry spent fuel pool at the end of 1985.

This is 158 fuel assemblies less than the total capacity - 1044 fuel assemblies - of the Surry spent fuel pool racks.

B. Number of spaces required for a full core discharge

Each of the two Surry reactor cores contains 157 fuel assemblies Thus, if the reactor core from either Surry unit must be discharged in order to perform inspections or maintenance activities, 157 spaces must be available to store the spent fuel. We call these 157 spaces "full core reserve."

C. Importance of maintaining full core reserve

Virginia Power has had to use full core reserve at Surry in the past for steam generator replacement, in-service inspections, and replacement of control rod guide tubes. If we have to remove a full core in the future in order to perform work that is essential to continued operation, and if the full core reserve spaces are not available in the Surry spent fuel pool, an extended, expensive outage will result. Such an outage would require the purchase of replacement power at a cost of approximately $300,000 per day for one Surry unit. The outage would continue until arrangements could be made to provide increased storage capacity. Prudence, therefore, requires that we make every reasonable effort to maintain full core reserve.

The importance of maintaining full core reserve is borne out by a recent Nuclear Regulatory Commission (NRC) finding. Section 135(b)(2) of the Nuclear Waste Policy Act of 1982 requires NRC to determine whether maintenance of full core reserve is necessary for continued orderly operation of civilian nuclear power plants. The Commission recently published its finding on this issue in

the Federal Register (Volume 50, No. 28, Pages 5548 to 5567). The Commission reached a generic finding that maintenance of full core reserve is necessary for continued, orderly operation of a nuclear power plant. This finding was based on economics and prudent management. NRC cited estimated costs of $360,000 to $650,000 per day for replacement power costs.

D. Outage Schedule for Surry

On April 1, 1985, the Company published a new three-year outage schedule for its nuclear units. This schedule, which is Appendix 3 to this testimony, indicates that Virginia Power currently plans to refuel Surry Unit 1 on July 5, 1986. I should explain that this July 5, 1986, date assumes that Surry Unit 1 will be operated beyond its normal end of cycle date in a "coast-down" mode. This extended operation period has been planned in order to provide a three-week interval between the North Anna Unit 2 refueling outage - scheduled to end June 12, 1986 - and the beginning of the Surry Unit 1 outage. This interval, in turn, is desirable because certain repairs required during the North Anna Unit 2 outage could extend that outage, and the Company wants to avoid having North Anna Unit 2 and Surry Unit 1 off line at the same time. It is important to recognize, however, that if Surry Unit 1 were to operate at a higher than anticipated capacity factor prior to the 1986 outage or if an unplanned shutdown occurred during "coastdown," the refueling outage now scheduled for July 5, 1986 could start several weeks before that date.

We plan to discharge 56 fuel assemblies during the 1986 Surry Unit 1 outage, which would leave only 102 spaces (158 minus 56) in the Surry pool. This would be 55 fuel assemblies (157 minus 102) short of full core reserve. Thus, in order to maintain full core reserve, at least 55 fuel assemblies must be removed from the Surry spent fuel pool and stored elsewhere by not later than the end of the 1986 Surry Unit 1 refueling outage. As I shall explain in the following section, these 55 assemblies actually need to be removed before the Surry Unit 1 1986 outage begins.

E. Shipping Windows

Virginia Power prefers to avoid transshipping spent fuel between Surry and North Anna while a refueling outage is in progress at either Station. Refueling outages are periods of intensive activity at a nuclear power station, and any activity that may increase the length of the outage is avoided in order to minimize the outage duration and the replacement power costs. Shipment of spent fuel involves use of facilities in the spent fuel pool that are also needed during outages for core offloading and onloading. In addition, some of the personnel required for spent fuel shipments would have other conflicting responsibilities during a refueling outage. As Appendix 3 shows, outages are scheduled for North Anna Unit 1 for the period November 1 through December 19, 1985, and for North Anna Unit 2 for the period April 25 through June 12, 1986.

In addition, Virginia Power would prefer to avoid planning for spent fuel shipments during the period from mid-December through February because of the higher probability that bad weather would result in delays in the shipment of spent fuel.

This would result in increased cask lease charges and personnel costs.

In summary, Virginia Power needs to remove at least 55 fuel assemblies from the Surry spent fuel pool before the 1986 Surry Unit 1 refueling. The preferred windows for transshipment are limited to September and October, 1985 and March and April, 1986.

III.

Virginia Power's Commitment to Dry Cask Storage

A. Background

In 1979, when it was apparent that additional space would have to be provided for the Surry Power Station spent fuel, Virginia Power undertook a comprehensive study of its spent fuel storage options. Among other things, we assessed the possibility of storing spent fuel in large metal casks (dry casks) that would be stored on site at the Surry Power Station. At that time it was clear that Virginia Power could not rely on dry casks as its principal option. These casks had not been licensed anywhere for the storage of spent fuel and were only in the early stages of development in Germany. It was equally clear, however, that dry casks offered promise for the future.

Thus, while Virginia Power chose as its principal option the expansion of fuel pool storage capacity at North Anna Units 1 and 2 and the transshipment of up to 500 Surry spent fuel assemblies to North Anna, it also continued to pursue dry cask storage. By 1982, dry cask storage had become a more realistic alternative. Considerable development work on this option was being performed in a number of countries, and a basis existed to develop a

facility design and license application for dry cask storage at Surry. In the following two sections of this testimony, I will describe the status of our dry cask efforts.

B. License application for dry cask storage

In October 1982, Virginia Power submitted to NRC a license application under 10 C.F.R. Part 72 for a dry cask storage facility at the Surry Power Station. A conceptual sketch of this facility is provided in Appendix 4. The facility consists of concrete pads and security facilities, which will be built by Virginia Power, and dry storage casks, which will be purchased from cask vendors.

The license application describes the facility and incorporates by reference the topical report for the GNSI CASTOR-V/21 cask. Virginia Power has answered all of the questions received from NRC on its license application except for a request dated March 7, 1985, to have additional information provided by GNSI (the cask vendor) on shielding analyses for the CASTOR-V/21 cask.

The NRC Staff issued its Environmental Assessment of the proposed dry cask storage facility on April 12, 1985. The Environmental Assessment concluded that the proposed facility will have no significant effect on the environment and that no Environmental Impact Statement is required. On April 10, 1985, Virginia Power requested permission from NRC to begin construction of the dry cask facility at Surry (the concrete pads and security facilities). Virginia Power estimates that approximately 10 months will be required to build the dry cask facility.

If Virginia Power receives an early construction authorization from NRC, and a conditional use permit from Surry County, construction could begin as early as June 1985. In that case, the dry cask facility could be ready for operation as soon as April 1986. If we must await issuance of the license before beginning construction and issuance occurs in September, work would begin in late September or October and the facility could be ready in August 1986. Virginia Power has also ordered the first CASTOR-V/21 storage cask for use in the dry cask facility. The cask, which will hold 21 assemblies, is scheduled for delivery in November 1985. We plan to order additional casks, which are expected to have a lead time of 11 months, during May, 1985. We will continue to order additional casks for Surry as often as necessary to maintain full core reserve in the Surry fuel pool.

Once the facility is completed, the first cask is delivered, and personnel training is finished, the 21 assemblies could be loaded into the cask in about a week.

C. The Cooperative Agreement Program with DOE

The Nuclear Waste Policy Act of 1982 authorized the Department of Energy to enter into cooperative agreements with the utility industry to develop alternative technologies for interim storage of spent nuclear fuel. Virginia Power proposed to DOE in September 1983 a program to develop dry cask storage. Virginia Power and DOE signed a Cooperative Agreement (DE-FC06-84RL10531) on March 29, 1984, to conduct a dry cask storage demonstration program.

The program consists of (a) a NRC-licensed demonstration at the Surry Power Station, using the facility described in the preceding section of this testimony, and (b) research and development activities to be conducted by DOE at a Federal site. DOE has assisted Virginia Power in responding to the questions proposed by NRC with respect to its dry cask facility license application and has selected a facility at the Idaho National Engineering Laboratory (INEL) as the Federal site for conduct of its research and development activities under the program.

Pursuant to the Cooperative Agreement, Virginia Power has ordered two storage casks for delivery to the Federal site, a CASTOR-V/21 cask from GNSI (capacity = 21 assemblies), which was delivered in December 1984, and a MC10 cask from Westinghouse Electric Corporation (capacity = 24 assemblies), which is scheduled for delivery in February 1986. Virginia Power is now in the process of ordering another cask, this one from Transnuclear, Inc. (capacity = 24 assemblies). This cask is being fabricated in Japan and should be available for delivery to INEL in September 1985.

The Cooperative Agreement provides that the DOE will test up to four casks at the Federal site using spent fuel provided by Virginia Power from Surry. Two casks will be tested using "intact" fuel and two using "consolidated" spent fuel. A fuel assembly is "intact" if it is stored in the form in which it is removed from the reactor. Fuel assemblies are "consolidated" by removing the individual fuel pins from the grid structures used to make up assemblies and storing the pins side by side in cans.

With consolidation, the fuel pins from two assemblies can be stored in the storage space that would be occupied by one intact fuel assembly. The second and third casks delivered to the Federal facility will probably be loaded with intact assemblies initially and with consolidated fuel at a later date.

DOE will accept title to this fuel at Surry, transport it to INEL and thereafter be responsible for its storage and disposal. The testing of consolidated spent fuel at the Federal site will require DOE to consolidate fuel at INEL.

Virginia Power is, of course, responsible under the Cooperative Agreement for the licensed facility at Surry. We will use five storage casks at Surry in performing our obligations under the Cooperative Agreement Program.

DOE is scheduled to begin receiving Surry spent fuel for the CASTOR-V/21 cask in July 1985. Shipment of this spent fuel will require approximately two months. Shipment of spent fuel for the second cask at INEL could begin in October 1985 and is also estimated to require about two months. If this program is completed on schedule, the number of assemblies that must be removed from the Surry spent fuel pool will be reduced by 45 fuel assemblies (21 assemblies in the CASTOR-V/21 cask and 24 in the Transnuclear cask). These steps alone would leave us 10 spaces (55 minus 45) short of full core reserve after the 1986 refueling at Surry Unit 1.

The shipment of spent fuel for the Westinghouse cask will be scheduled for 1986. These shipments could begin in March or April of 1986. If these shipments can be carried out before the

Surry Unit 1 refueling outage in 1986, full core reserve would be assured, without any shipments to North Anna, for the period immediately following the Surry Unit 1 outage and until the October 17, 1986 outage at Surry Unit 2.

D. Virginia Power's commitment to use dry cask storage

Virginia Power has agreed with Louisa County to pursue the licensing and use of dry cask storage as vigorously and swiftly as it reasonably can. We are committed to use dry cask storage when it becomes available and to forego transshipping to the extent possible. The agreement provides, however, that if shipment of Surry fuel to North Anna is the only way to avoid the loss of full core reserve at Surry at any given outage, then we may ship up to 130 assemblies. And if, contrary to our expectations, dry cask storage remains unavailable to us after we have shipped 130 assemblies, the County and Virginia Power are to negotiate in an effort to agree on an additional number of assemblies that may be shipped if necessary to avoid loss of full core reserve.

IV.

Comparative Costs

A. Estimated costs of transshipment

Costs incurred to date for transshipment amount to $886,000. This includes the cost of the lawsuit challenging a Louisa County ordinance that prohibited storage of Surry spent fuel at North Anna, public information presentations on transshipment, including a seminar prepared by Virginia Power in cooperation with the State of Virginia for emergency response personnel,

preparation for this proceeding and equipment and training required to handle the TN-8L shipping cask at North Anna.

Virginia Power anticipates additional costs for transshipment in 1985 of approximately $235,000 in connection with this proceeding, a study by the Virginia Department of Emergency Services on route alternatives, and security equipment required for spent fuel shipments.

Costs for the actual transshipment of spent fuel from Surry to North Anna are estimated at approximately $15/kgU. (Unit costs are frequently expressed in terms of $/kgU or dollars per kilogram of uranium in the fuel. There are 460 kilograms of uranium in each fuel assembly.) This cost will be in addition to the "start up" costs discussed above. Thus, if 500 spent fuel assemblies were transshipped to North Anna, the estimated costs for the shipments, including start up, would be $4.57 million. As I have said, the amount of transshipment required, if any, will depend on the progress we make on the dry cask storage program.

B. Estimated costs of dry cask storage

Virginia Power's estimated costs for participation in the dry cask storage Cooperative Agreement Program discussed above is $20.6 million. Virginia Power will pay all costs for the facility at the Surry Power Station, for the casks that will be tested at the Federal site, and for shipping Surry spent fuel to the Federal site. DOE and EPRI are expected to pay for all testing activities at the Federal site, including consolidating

the spent fuel and storing it after conclusion of the Program and until a repository is available.

Beyond the DOE Cooperative Agreement Program, which will involve five casks at Surry, Virginia Power will continue to use dry cask storage at Surry to provide for storage of Surry spent fuel until a repository is available.

The costs of providing dry cask storage at Surry, once the facility is licensed and built, consists primarily of the price of the casks. We have received bids from several cask vendors; the prices quoted range from about $70 to $90 per kgU of fuel stored intact. If storage had to be provided for the remaining operating life of the Surry Power Station, which is 23 years, we estimate that the cost of storage would be approximately $41.9 million in addition to the costs of the DOE Program. If the Federal repository should begin accepting spent fuel in 1998 at the rate at which it is generated at Surry, the estimated additional cost of storage would be about $22.1 million. The cost of storage casks for the 500 spent fuel assemblies that are the subject of this proceeding would be about $18.4 million.

There may be a basis for decreasing these sums. As I testified earlier, one purpose of the DOE Program will be to test the storage of consolidated fuel in dry casks. If consolidated storage proves to be feasible and the cost of consolidating fuel from two casks proves to be less than the cost of a second cask, Virginia Power will store consolidated spent fuel at its Surry dry cask facility. For example, some estimates of the cost of consolidation are in the range of $25 per kgU. If this estimate

proved to be correct, the cost of consolidated storage would be $60 to $70 per kgU ((½ x $70) + $25 to (½ x $90) + $25)).

To summarize my testimony to this point, the near-term cost of shipping 500 assemblies from Surry to North Anna would be about $4.57 million. The costs of dry casks to store the same assemblies in dry casks would be about $18.4 million for intact fuel, a sum that could be decreased to some extent if consolidation proves economic.

Of course, if we ship Surry fuel to the North Anna pool, we will decrease on a one-for-one basis the number of spaces available for North Anna fuel. Since North Anna's spent fuel pool, once reracked with neutron-absorbing racks, will have only enough space to last until approximately 1998 if no Surry fuel is transshipped, additional storage capacity would likely be required at North Anna in the future if a significant number of Surry assemblies were transshipped there. We might provide this additional storage, necessitated by the presence of the Surry fuel at North Anna, in one of two ways. First, the North Anna pool has been designed to accommodate consolidated fuel in the fuel racks. If consolidation were indeed to cost $25 per kgU, the total cost of storing consolidated fuel, and thus replacing the space occupied by Surry fuel, would be $50 per kgU (since two assemblies are consolidated to make one additional space available). We add to this the $15 per kgU for transshipping the Surry fuel to North Anna in the first place for a total cost of approximately $65 per kgU. This is similar to the cost of dry

proved to be correct, the cost of consolidated storage would be $60 to $70 per kgU ((½ x $70) + $25 to (½ x $90) + $25)).

To summarize my testimony to this point, the near-term cost of shipping 500 assemblies from Surry to North Anna would be about $4.57 million. The costs of dry casks to store the same assemblies in dry casks would be about $18.4 million for intact fuel, a sum that could be decreased to some extent if consolidation proves economic.

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cask storage ($70-$90 per kgU intact and $60-$70 per kgU consolidated).

Second, if consolidation proved to be uneconomic, we could place dry casks at North Anna, in which event the ultimate cost for shipping the Surry fuel to North Anna would be the $70-$90 per kgU for the casks plus the $15 per kgU for shipping. This, of course, is higher than the cost of retaining the Surry fuel at Surry in dry casks. But it is important to emphasize that if Surry fuel is shipped to North Anna, thus displacing North Anna spent fuel, the preempted space in the North Anna pool will not have to be replaced - and the expenditures will not have to be made - for perhaps 10 years. Storing the fuel in dry casks at Surry, however, requires substantial outlays now. In addition, some observers have estimated the cost of consolidation at $10 per kgU. At that level, transshipment of Surry fuel to North Anna and consolidation in the spent fuel pool there would be significantly less costly than dry cask storage at Surry.

The foregoing cost analysis does not consider the costs already expended to provide the spent fuel pool and fuel racks at North Anna. These costs represent investments already made by Virginia Power to provide facilities required for its operations. In determining the best alternative for insuring the continued operation of Surry and North Anna in the future, sunk costs for construction of facilities should not be considered.

V.

Comparative Environmental Effects

The radiological and non-radiological environmental effects of transportation of spent fuel are examined in WASH-1238, "Environmental Survey of Transportation of Radioactive Materials To and From Nuclear Power Plants," December 1982, and in Supplement 1, NUREG-75/038, April 1975. For use in licensing proceedings, these effects are summarized in Summary Table S-4, "Environmental Impact of Transportation of Fuel and Waste To and From One Light-Water-Cooled Nuclear Power Reactor."

The following is a comparison of (a) the key parameters used in WASH-1238 for calculation of environmental effects through the use of Table S-4 with (b) the parameters for the proposed shipments from Surry to North Anna.

Parameter	WASH-1238	Transshipment	Factor of Reduction in Radiological Impact
Shipments/ Year for Two Reactors	120	40	3
Cooling Time From Discharge to Shipment	150 days	730-3,650 days	2.5-10
Shipment Distance and Duration	1,000 miles 72 hours	160 miles 4½ hours	6

A comparison of the parameters for the proposed shipments from Surry to North Anna with the assumptions used in WASH-1238 reveals that the effects of the proposed shipments from Surry to

North Anna would be well below the postulated effects set out in Table S-4. NRC has concluded that these effects are insignificant. The effects of sabotage, of course, are not reflected in Table S-4, but, as the testimony of Mr. Jefferson in this proceeding indicates, those effects are insignificant. In short, the overall environmental effects of the proposed shipments from Surry to North Anna will be negligible.

Insofar as the use of dry cask storage is concerned, NRC has completed its environmental review of the proposed Surry Independent Spent Fuel Storage Installation described earlier in this testimony. The results are set out in "Environmental Assessment (EA) Related to the Construction and Operation of the Surry Dry Cask Independent Spent Fuel Storage Installation," published April 12, 1985. The NRC's Environmental Assessment concludes that (a) no significant construction impacts are anticipated, (b) the radiological effects from the operation of the proposed facility would fall within the scope of the effects associated with the existing reactor operations, and (c) no significant non-radiological impacts are expected during operation of the facility. Thus, the environmental effects of both shipping and dry cask storage are negligible.

VI.

Authorization to Store Surry Fuel at North Anna is Essential

As this testimony shows, the combination of (a) shipments to a Federal facility for dry cask storage research and (b) operation of our own licensed dry cask storage facility at Surry may reduce

or eliminate for now the need to transship Surry fuel to North Anna. Virginia Power hopes it does. Dry cask storage is our preferred alternative; if both transshipment and dry cask storage were available, Virginia Power would use dry casks for interim storage of Surry spent fuel.

Nevertheless, Virginia Power still needs the authorization required for transshipment. First, of course, is the fact that Virginia Power does not yet have a license for dry cask storage. Although it is possible that a license may be granted in time to allow completion of a dry cask facility at Surry before full core reserve is lost, this is not assured.

In addition, if for any reason dry casks, once authorized, could not be acquired on a timely basis, or if NRC should withdraw the authorization to use dry casks for reasons that we do not now anticipate, we might be faced with a loss of full core reserve shortly thereafter. It would be too late at that point to go back and start over on a proceeding, such as this one, seeking authorization to store Surry fuel at North Anna. Thus, prudence requires that we have more than one interim spent fuel storage option available.

Finally, the Nuclear Waste Policy Act of 1982, in § 111(a)(5), explicitly makes utilities primarily responsible for interim storage of spent nuclear fuel until a Federal repository is available. The Act provides for limited Federal interim storage for utilities, but only if they are unable to provide their own storage through the use of transshipment, dry casks and new fuel pools. Indeed, utilities are required by 10 C.F.R. Part 53 to demonstrate to NRC

that they have "diligently" pursued these options before they can qualify to use Federal interim storage. In the unlikely event that both dry cask storage and transshipment were unavailable to us, we would have to use Federal interim storage. We could only qualify if we could show that we had pursued diligently the authorization we seek in this proceeding. While Federal interim storage might be very expensive (estimates have placed the cost as high as $600 per kgU), it would still be preferable to shutdown of the Surry Power Station at a cost of up to $300 million per year in replacement power costs.

VII.

Summary

In short, Virginia Power is using its best efforts to license and use dry casks for additional spent fuel storage space as quickly as possible. We are committed to doing so. To the extent we can do so and still maintain full core reserve at Surry, we will avoid shipping any Surry fuel to North Anna. Still, we believe it is incumbent upon us, in terms of both prudent operating practice and the requirements of 10 C.F.R. Part 53, to secure approval to store 500 spent fuel assemblies from Surry at North Anna.

Marvin L. Smith
Supervisor, Nuclear Engineering
Power Station Engineering

Education

1972 B.S. Physics, Virginia Polytechnic Institute and State University

1973 M.S. Nuclear Engineering, Virginia Polytechnic and State University

Experience

1973 - Present Virginia Electric and Power Company
Richmond, Virginia

1983 - Present Engineering and Construction Program Manager for Vepco/DOE/EPRI Cooperative Agreement Program on dry cask spent fuel storage.

1982 - 1983 Nuclear Engineering Group, Power Station Engineering

Supervisor of the group responsible for engineering on spent fuel projects, low level radwaste processing systems, ALARA and radiation protection analysis. Projects have included design of both dry cask and pool Independent Spent Fuel Storage Installations, reracking the North Anna Units 1 and 2 Spent Fuel Pool, Licensing Storage of Surry Spent Fuel at North Anna, design of low level radwaste processing systems, and shielding design for the Post Accident Sampling System. Developed Vepco plan for internal spent fuel storage.

1981 - 1982 Nuclear Operations Department

Supervisor of group responsible for coordination of all capital improvement projects for the North Anna Power Station. In addition, provided coordination for all spent fuel related projects for Vepco.

1978 - 1981 Fuel Resources Department

Supervisor of group responsible for development and implementation of analytical engineering models for reload nuclear core design and safety analysis. In addition, served as Technical Manager for the Vepco/DOE Program for demonstration of extended fuel burnup. Developed, improved reload core designs utilizing both 18 month reload cycles and low neutron leakage core designs, and worked on EPRI task force involved with development of the RETRAN system safety analysis computer code.

1973 - 1981 Fuel Resources Department

Engineer responsible for development of Vepco reload core analysis models. Developed a version of the PDQ07 computer code which provided Thermal/Hydraulic feedback, improved computer and user efficiency. Wrote topical report used to obtain NRC approval for this computer code. Designed first 18 month reload core used by a commercial United States PWR.

Publications

M. L. Smith and M. L. Bowling, "Vepco Interim Spent Fuel Storage Program", presented at ANS topical meeting in Savanah, Georgia in October, 1982 and at the Atomic Industrial Annual Fuel Cycle Conference in March, 1983 in Kansas City, Missouri

M. L. Smith, C. B. Franklin. T. W. Schleicher, "Extended Burnup and Extended Cycle Design," TANSAO 34 1-899 (1980), page 389.

M. L. Smith, "The PDQ07 Discrete Model," VEP-FRD-19, (Vepco topical report submitted to the NRC), July, 1976.

M. L. Smith and H. S. McKay, "Onsite Storage of Spent Nuclear Fuel in Metalic Spent Fuel Storage Casks," presented at international Meeting on Spent Fuel Storage in Toronto, Ontario in October, 1984.

SPENT FUEL POOL INVENTORY UPDATE AND FUTURE ESTIMATES BASED ON FUEL MANAGEMENT SCHEME 25B

Year	Surry S1	Surry S2	Surry Yearly Total	Surry Assy Dis.		N Anna N1	N Anna N2	N Anna Yearly Total	N Anna Assy Dis.		Combined Inventory
1974	84		84	84							84
1975	16	84	100	184							184
1976	84	24	108	292							292
1977	-	80	80	372							372
1978	64	-	64	436							436
1979	-	64	64	500		52		52	52		532
1980	76	-	76	576		64		64	116		692
1981	-	68	68	644		-		-	116		760
1982	-	-	-	644		69	52	121	237		881
1983	64	61	125	769		-	56	56	293		1062
1984	56	-	56	825		68	64	132	425		1250
1985	1*	60	61	886		56	-	56	481		1367
1986	56	60	116	1002	(1)	-	64	64	545		1547
1987	-	-	0	1002		68	68	136	681		1683
1988	60	60	120	1122	(2)	68	-	68	749		1871
1989	60	60	120	1242		-	68	68	817		2059
1990	-	-	0	1242		68	68	136	953		2195
1991	60	60	120	1362		68	-	68	1021		2383
1992	60	60	120	1482		-	68	68	1089		2571
1993	-	-	0	1482		68	68	136	1225		2707
1994	60	60	120	1602		68	-	68	1293		2895
1995	60	60	120	1722		-	68	68	1361		3083
1996	-	-	0	1722		68	68	136	1497	(2)	3219
1997	60	60	120	1842		68	-	68	1565		3407
1998	60	60	120	1962		-	68	68	1633	(1)	3595
1999	-	-	0	1962		68	68	136	1769		3731
2000	60	60	120	2082		68	-	68	1837		3919
2001	60	60	120	2202		-	68	68	1905		4107
2002	-	-	0	2202		68	68	136	2041		4243
2003	60	60	120	2322		68	-	68	2109		4431
2004	60	60	120	2442		-	68	68	2177		4619
2005	-	-	0	2442		68	68	136	2313		4755

(*) This is not a fuel assembly but rather the can to hold fuel rods removed from assemblies during the reconstitution program for 1985.

(1) Loss of full core discharge capability, no transshipment, no dry cask storage, reracking at North Anna

(2) Loss of full core discharge capability, 130 transshipped to North Anna, no dry cask storage, reracking at North Anna.

Assumptions: 1. The reracking to be completed at North Anna.
2. Pool capacities: Surry - 1044 assemblies
North Anna - 1737 assemblies (reracked)

THREE YEAR FORECAST
1985-1987 OUTAGE SCHEDULE

YEAR		UNIT	REASON	OFF LINE	ON LINE	OUTAGE DAYS
1985	(1)	N. Anna 1	Refueling	11-01-85	12-19-85	48
		N. Anna 2	No Scheduled Outages			
	(2)	Surry 1	Snubber/Maintenance	6-28-85	7-08-85	10
		Surry 2	Refueling	3-20-85	6-15-85	87
	(3)	Surry 2	Snubber/Maintenance	10-04-85	10-14-85	10
1986		N. Anna 1	No Scheduled Outages			
	(4)	N. Anna 2	Refueling	4-25-86	6-12-86	48
		Surry 1	Refueling	7-05-86	8-22-86	48
	(5)	Surry 2	Snubber/Maintenance	3-28-86	4-07-86	10
	(6)	Surry 2	Refueling	10-17-86	12-14-86	58
1987	(7)	N. Anna 1	Refueling	5-01-87	7-15-87	75
		N. Anna 2	Refueling	9-18-87	11-05-87	48
		Surry 1	No Scheduled Outages			
		Surry 2	No Scheduled Outages			

NOTES:

(1) - Snubber testing must be performed between 6-19-85 and 12-19-85.

(2) - Snubber testing must be performed between 4-30-85 and 7-31-85.

(3) - Snubber testing must be performed between approximately 9-18-85 and 11-19-85.

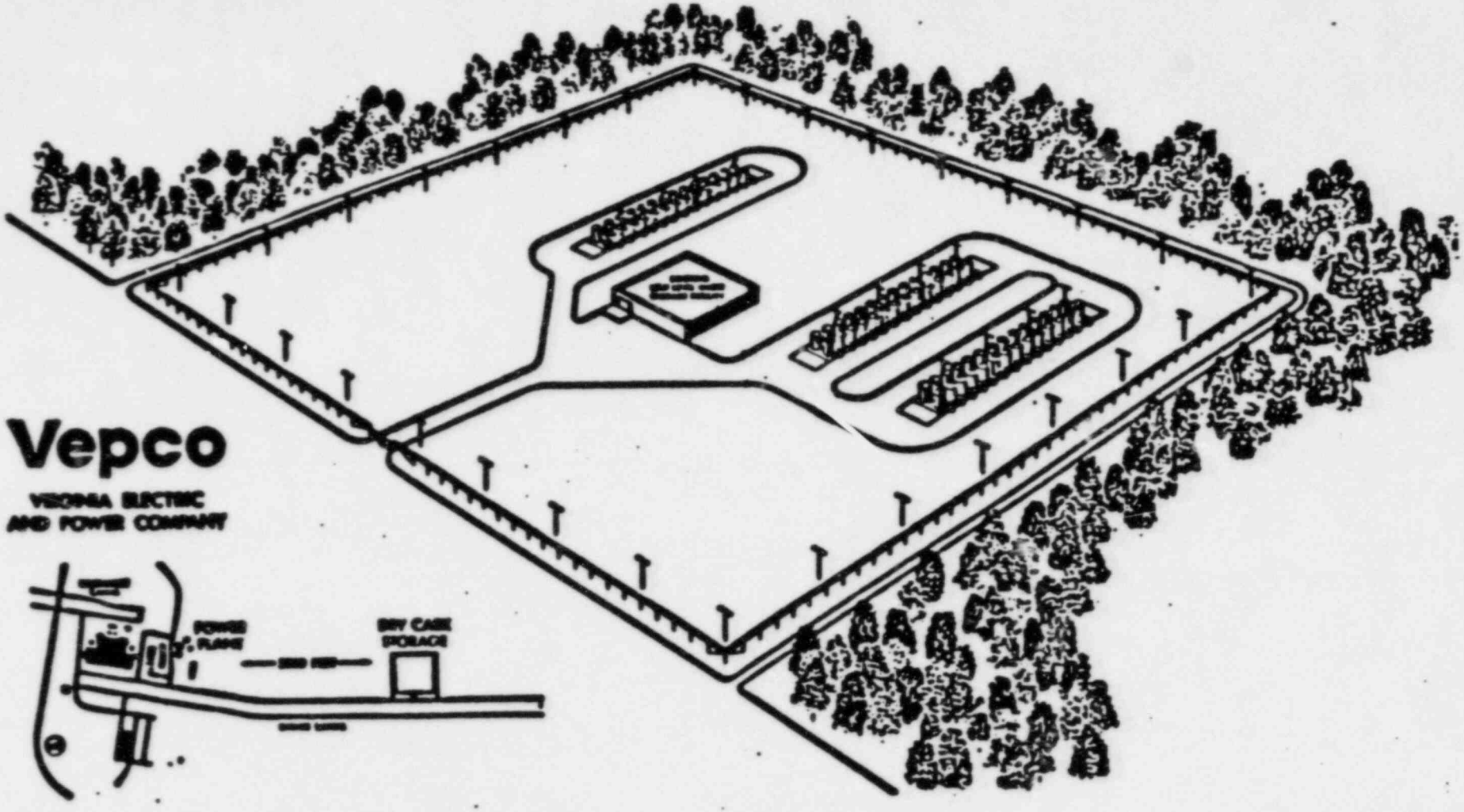
(4) - Snubber testing must be performed between 12-17-85 and 9-17-86.

(5) - Snubber testing must be performed between approximately 3-01-86 and 6-01-86.

(6) - Snubber testing must be performed between approximately 12-12-86 and 6-13-87. Outage length extended to 58 days due to reactor guide tube split-pin replacement.

(7) - Snubber testing must be performed between approximately 2-2-87 and 11-3-87. Outage length extended to 75 days due to 10-year inservice inspection.

Appendix 4



SURRY POWER STATION
DRY CASK INDEPENDENT SPENT FUEL STORAGE INSTALLATION