

VIRGINIA ELECTRIC AND POWER COMPANY  
RICHMOND, VIRGINIA 23261  
November 6, 2002

United States Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, D.C. 20555

Serial No. 02-330  
NAPS: MPW  
Docket Nos. 50-338/339  
License Nos. NPF-4/7

Gentlemen:

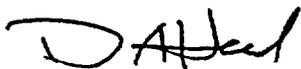
**VIRGINIA ELECTRIC AND POWER COMPANY**  
**NORTH ANNA POWER STATION UNITS 1 & 2**  
**DAM SAFETY AUDIT RESPONSE FOR THE CATEGORY 1**  
**SERVICE WATER RESERVOIR**

We have received your letter dated May 10, 2002, regarding the 2001 dam safety audit performed on the Service Water Reservoir (SWR) and the unresolved recommendations from the 1997 and 1999 dam safety audits. As noted in the report, no conditions were identified that should adversely affect the immediate safety and permanence of the project structures. The report also noted that the issue regarding suspected seepage is not by itself sufficient to suggest immediate concerns regarding the integrity of the SWR dam and associated facilities.

The letter requested that we re-address the potential seepage issue and respond to 1) unresolved recommendations from the 1997 and 1999 FERC Inspection Report, 2) 2001 FERC recommendations, 3) proposed Technical Specification change, 4) the Technical Review dated December 31, 2001, and 5) instrumentation issues identified in the FERC Operation Inspection Report. Responses to your concerns are addressed in the attached report.

Long term stability of the SWR dam is important for continued safe operation of the station and as such is taken very seriously. To date all of the corrective actions and enhancements performed were in support of our program requirements consistent with North Anna's licensing basis. The last three FERC inspections occurred during the months of December, January and February. The visual inspections we performed were during dry periods and indicate that the suspected SWR seepage is ground water and/or precipitation runoff. We suggest the next NRC follow-up inspection be performed during a dry period (e.g., June, July or August). Should you have any questions regarding this letter, please contact us.

Very truly yours,



D. A. Heacock  
Site Vice President

Attachment  
Commitments made in this letter: None

A001

cc: U. S. Nuclear Regulatory Commission  
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Serial No. 02-330  
Docket Nos. 50-338/339  
License Nos. NFP-4/7  
Dam Safety Audit SWR  
Attachment 1

Virginia Electric and Power Company  
Response to  
Results of Dam Safety Audits for the Category 1 Service Water  
Reservoir Dam at North Anna Nuclear Power Plant  
Dated May 10, 2002

## **BACKGROUND**

The Service Water Reservoir (SWR) Monitoring Program is a part of the licensing basis for North Anna as documented in the Updated Final Safety Analysis Report (UFSAR) and Technical Requirements Manual. The surveillance program was established to monitor the settlement of the centerline crest of the SWR dike and groundwater levels at selected locations to determine the long-term steady-state seepage conditions thereby ensuring SWR integrity is maintained. The requirements to fulfill the program were previously a part of the stations Technical Specifications and now reside in the station's Technical Requirements Manual.

A direct measurement of seepage from the SWR is not possible since all normal groundwater would have to be excluded. Piezometers can indicate changes in seepage rates but do not provide a direct means of measuring actual seepage quantities. Leak rates predicted are on the order of 1.5 percent of total expected water losses due to spray evaporation, surface evaporation, and spray drift. This calculated seepage rate is confirmed by analysis<sup>1</sup> that considered outflow both with the liner intact and with a portion of the liner removed. It was estimated that the seepage losses with the liner intact would be approximately 0.36 gpm per 100 feet of effective dike length and that with a 50 foot wide liner strip parallel to the dike removed (representing approximately 18 percent of the SWR area) seepage rates would be approximately 0.60 gpm per 100 feet an increase of 66 percent. However, seepage losses under this postulated severe condition would still total only 2.3 percent of the total expected normal losses, which is insignificant. Seepage in quantities that would threaten either the integrity of the dike or the SWR balance would be detected by visual inspection of the SWR.

## **SERVICE WATER RESERVOIR SEEPAGE**

Wet spot locations have been identified in 1997, 1999, and 2001 FERC Operation Inspection Reports. As noted in the NRC Technical Review dated December 31, 2001, moderate seepage through an earth dam is normal and is seldom catastrophic. Excessive seepage would represent a serious breakdown in design and could lead to failure. There have not been any active springs, evidence of piping or loss of fines around the SWR embankment noted during any of our visual inspections. It was noted in the NRC Technical Review that "piping at the dam toe" is unlikely at the SWR dam. The review notes that quantifying seepage from the SWR using piezometer levels is very often unreliable and can give inaccurate seepage estimates. We understand piezometers do not provide a direct means of measuring actual seepage quantities. Our program requires an evaluation by a licensed civil engineer when piezometer readings indicate groundwater limits are exceeded to determine if there is any substantive cause to believe that any aspect of the SWR, dike, valve or pump houses will not perform their intended functions. On September 13, 1996, groundwater level

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<sup>1</sup> Report on Geotechnical Investigations of Service Water Reservoir, dated December 23, 1975.

limits at piezometer P-22 were exceeded and subsequently an evaluation by a licensed civil engineer was submitted to the NRC. The conclusions of this evaluation noted that the increases in piezometer levels did not indicate a material increase in seepage from the SWR, only an increase in groundwater.

The 1997 FERC Operation Inspection noted that the wet spots and increased piezometer readings indicate significant changes in embankment. The wet spot identified in the 1997 report in area 3 along the lower access road was standing water left from snowmelt. The area in question was subsequently graded thereby eliminating the depression area. Subsequent inspections noted no standing water in this area. Additional wet spots identified in subsequent reports did not identify any standing water. It was suggested in the 1999 FERC Operation Inspection report to perform inspections during dry periods to substantiate the groundwater contention. Our civil engineers performed visual inspections of the SWR during dry periods as required by our station periodic test procedures. Our experience has been that the wet spots appear intermittently with an increase in precipitation. Nine inspections since May 1998 were performed. Results of these inspections noted wetness on two occasions, in October 1998 and May 2000, at the same location. This location collects precipitation runoff from the SWR slope and surrounding area and drains the runoff, as designed via a drainpipe under the access road, to the drainage area on the southeast side below the reservoir. This wet area was noted in the 1999 and 2001 FERC Inspection Reports. The other areas noted as being wet were subsequently dry during our inspections. The drain pipe as specified above is located just above the division line between Zones 1 and 2 as noted on the map of the SWR shown in Figure 1. Figures 3 through 5 are pictures taken during our visual inspections in September 2002. Periodic test inspection results are listed in Figure 6.

Readings of the piezometers were increased from bi-annually to monthly during 1998. Two additional piezometers, P-23 and P-24, were installed to provide additional data points. These were also read at increased frequencies. Piezometer level increases were consistent with precipitation. Likewise, the levels have been trending down for the last three years consistent with the lack of precipitation. (Reference Figures 8 through 11) Additionally, flows from the SWPH drains fluctuate with precipitation patterns. (Reference Figure 12) These flows have also trended down during the drought period being experienced throughout Virginia.

In 1998, electrical conductivity (EC) measurements were taken as a means to determine if the suspected wet spots were actually seepage from the SWR. The NRC Technical Review noted that the data set of only three EC values could not reasonably determine that the SWR was not the source of the seepage. The report recommended using the biocidal substances used to treat the reservoir as a tracer. Water samples around the perimeter of the SWR were taken in 1998 and checked for molybdates, a chemical substance in the SWR. Water samples were taken again in October 2002 and checked for molybdates. In all but one case the sample results were less than

detectable for molybdates. Instrument accuracy's can not detect molybdates less than or equal to .2 ppm. One sample was recorded at .4 ppm for molybdates. We attribute the minute amount of molybdates in this sample to be a result of service water spray drift from the spray arrays. The SWR molybdate concentration is 100 ppm. Sample locations are identified in Figure 2 and the sample results are referenced in Figure 7.

We continue to monitor the SWR for indications of seepage. Based on the chemical sampling and trends for piezometers for the past five years, we do not believe there is a SWR seepage issue.

### **OPEN ISSUES FROM 1997 and 1999 DAM SAFETY AUDITS**

1. Using embankment survey monuments, perform a horizontal movement survey and compare with previous readings. It continues to be our position that this be completed in conjunction with the vertical survey that is scheduled for 2001.

**Response:** The last horizontal survey was conducted in 1989. There is no assurance that a survey today could be reasonably reproduced and compared with the survey conducted in 1989. Survey techniques have changed, personnel have changed, some benchmarks and markers are soil founded, and there is no predefined number for acceptable or unacceptable horizontal creep by the SWR dike.

The vertical surveys performed in 2001 and 2002 continue to show no indication of abnormal or excessive movement. There is no indication of movement or distress that would warrant reactivating alignment survey of the monuments. As noted in the 2001 FERC Operation Inspection report, no movement has occurred since 1991. The requested action of this open item is not considered necessary or justified at the present time.

2. Continue to clear the vicinity around the weir wall of vegetation and obstructions to enable flow measurements. Recommend that a new weir be established and quarterly flow measurement should be implemented.

**Response:** The vicinity around the drainage area on the SE side of the SWR (Zone 2) is being cleared of vegetation on a periodic basis to improve drainage and support visual inspections. The entire drainage area for our warehouses flow to this area along with precipitation runoff from the SWR. There is no piping in the SWR dike that would route seepage to a weir for monitoring. We continue to maintain that constructing a new weir will only provide flow measurements for ground water and precipitation runoff and will not enable us to quantify SWR seepage. Furthermore, our sampling indicates the suspected seepage is not from the SWR. Therefore, we conclude that installation of new weirs for measurement control is not considered necessary or justified at the present time.

3. In the area between the former weir wall and the access road, continue clearing of vegetation for visual observation. Note any wet spots and develop a recording procedure to identify the locations and monitor the extent.

**Response:** The area in question is being cleared of vegetation on a periodic basis to improve drainage and support visual inspections. Walkdowns and inspections of the SW Reservoir are made by civil engineers during dry conditions in accordance with station periodic test procedures. Results of each inspection are recorded in the procedures. (Reference Figure 6)

4. Reactivate weirs for flow measurements. Those that cannot be made functional should be removed and new weirs established.

**Response:** We continue to maintain that constructing a new weir will only provide flow measurements for ground water and precipitation runoff and will not enable us to quantify SWR seepage. (Reference response to Recommendation 2) The request is not considered necessary or justified at the present time.

5. VPC staff indicated that analysis of seepage water could determine whether seepage was from the SWR. From discussion in VPC's letter dated January 28, 1998, we recommend that NRC staff review the water chemistry data and the methodology of the conductivity testing and assess whether additional testing and evaluation is required. Seepage and wet spots at the downstream toe are expected if the sand and gravel filters are functional. However, we do not expect any wet spots or seepage in the areas above the toe.

**Response:** The NRC Technical Review noted that the data from three EC values could not reasonably be used to determine that the SWR was not the source of the seepage. The report recommended using the biocidal substances used to treat the reservoir as a tracer. Water samples around the perimeter of the SWR were taken in 1998 and checked for molybdates, a chemical substance used in the SWR. Water samples were taken again in October 2002 and checked for molybdates. In all but one case the sample results were less than detectable for molybdates. One sample was recorded at .4 ppm for molybdates. We attribute this minute amount of molybdates in this sample to be a result of service water spray drift from the spray arrays. The SWR molybdate concentration is 100 ppm. Sample results table listed in Figure 7.

6. Evaluate the seepage/water accumulation in the area near the upper portion of access road.

**Response:** The wet area near the upper portion of access road has been evaluated by our civil engineers. Subsequent inspections noted this area to be dry and the wet area is considered to be groundwater and/or precipitation runoff. (Reference Figure 6)

7. Conduct quarterly flow measurements for the horizontal drains that extend beneath the SWPH and include a summary of readings in the annual inspection report.

**Response:** Flows from the horizontal drains beneath the SWPH have trended down consistent with the lack of precipitation over the last three years. In all but one instance, in 1997, the clarity of the flows has always been clear. Increasing to quarterly flow measurements is not considered necessary at this time.

8. Due to comments made about the timing of the inspections and potential runoff contributions to wet areas, VPC staff should conduct inspections during dry periods. It is suggested that VPC coordinate a follow-up inspection with NRC staff during appropriate dry period primarily to evaluate the numerous wet areas at and near the North Anna SWR embankment.

**Response:** As noted previously, our periodic test procedures require performance of the inspections during dry conditions. We would suggest that the NRC/FERC perform the next biennial inspection some time between June and August of 2003. These are typically periods of dry weather.

9. The newly installed piezometers should be clearly numbered, i.e. the new P-10 should be renumbered P-10A.

**Response:** Three new standpipe piezometers, P-10, P-23, and P-24, were installed following the 1997 inspection. Each piezometer is identified in the periodic test procedure and clearly marked on the standpipe casing. The pneumatic P-10 piezometer has been abandoned with no plans to re-activate it since the device is considered unreliable. Therefore, there is no need to renumber the standpipe piezometer P-10. Piezometers, P-23 & 24, were added to provide an additional set of data points and are not required by Technical Requirements Manual (TRM). We will continue to monitor P-23 & 24 as part of our periodic test. All three of these piezometers are located in Zone 2 along the south east side at the base of the reservoir.

#### **OPEN ISSUES FROM 2001 DAM SAFETY AUDIT**

1. Continue to monitor all piezometers as long as instruments are operable in order to accurately assess the performance of the embankment.

**Response:** All operable piezometers required by the station Technical Requirements are being monitored. Additionally, piezometers P-23 & 24 installed in 1997, which are not required by the TRM are monitored in conjunction with the required piezometers for additional data points. Pneumatic piezometer P-10 is unreliable and has been abandoned in place.

2. The collection weirs at the SWPH should be cleared of sediment to better enable determination of sediment accumulation.

**Response:** Actions to clear the sediment in SWPH Outflow Gallery Drains have been entered in our station Work Management System. As part of our SWR Visual Inspection procedure the civil engineer looks specifically at the outflow drains and records the results of his inspections.

3. Install an additional piezometer in Zone 1 in the vicinity of wet areas observed in 1997 and 2001 to better acquire information.

**Response:** Reference response to 1997/1999 Recommendation 6. This area has been dry during subsequent inspections conducted by our civil engineers. Our evaluation of these spots concludes that the wetness can be attributed to groundwater and/or precipitation runoff and not seepage. Accordingly, installation of a piezometer in this area is not warranted at this time.

4. Continue tree/brush removal.

**Response:** We will continue tree and brush removal as needed. Inspections for tree and brush growth are part of the SWR Visual Inspections performed by our civil engineers.

5. VPC staff should include a summary of instrumentation data and predicted performance of the embankment in the next Inservice Inspection report, providing copies for NRC review and comment.

**Response:** The next 5 year ISI report is due in 2004. We will submit the inspection results consistent with normal NRC reporting requirements.

6. At the culvert that passes under the lower access road (Zone 2), maintain the upstream and downstream sides clear of vegetation.

**Response:** We continue to maintain the upstream and downstream sides clear of vegetation as needed. Inspections of these areas are part of the SWR Visual Inspections performed by Civil Engineering.

## **PROPOSED TECHNICAL SPECIFICATION CHANGE**

During the 1999 inspection, a copy of a proposed Technical Specification (TS) change regarding SWR Groundwater Elevations was given to the FERC Inspector as a courtesy to keep all parties apprised of related ongoing licensee actions. The change package had already been submitted to the NRC Division of Licensing Project Management, Office of Nuclear Reactor Regulation for review and approval.. On December 29, 1999, the Office of Nuclear Reactor Regulation approved the TS change and issued Amendments 220 & 201 for North Anna Units 1 & 2. We are in compliance with our station license.

## **NRC TECHNICAL REVIEW – DECEMBER 31, 2001**

In the NRC Technical Review dated December 31, 2001, the NRC noted that the information submitted by VPC was insufficient to reasonably determine if the water from the SWR was related chemically to the water from piezometer P-22 and/or surface water below the SWR. A recommendation was made to use the biocidal or other chemical substances used to treat the SWR as a tracer. We followed this recommendation and performed chemical sampling looking for molybdates. As noted previously, all samples were determined to contain less than detectable amounts with one exception. The concentration of the tracer chemical in that one exception was deemed insignificant and likely due to service water spray drift and is not indicative of SWR seepage. (Reference Figure 7)

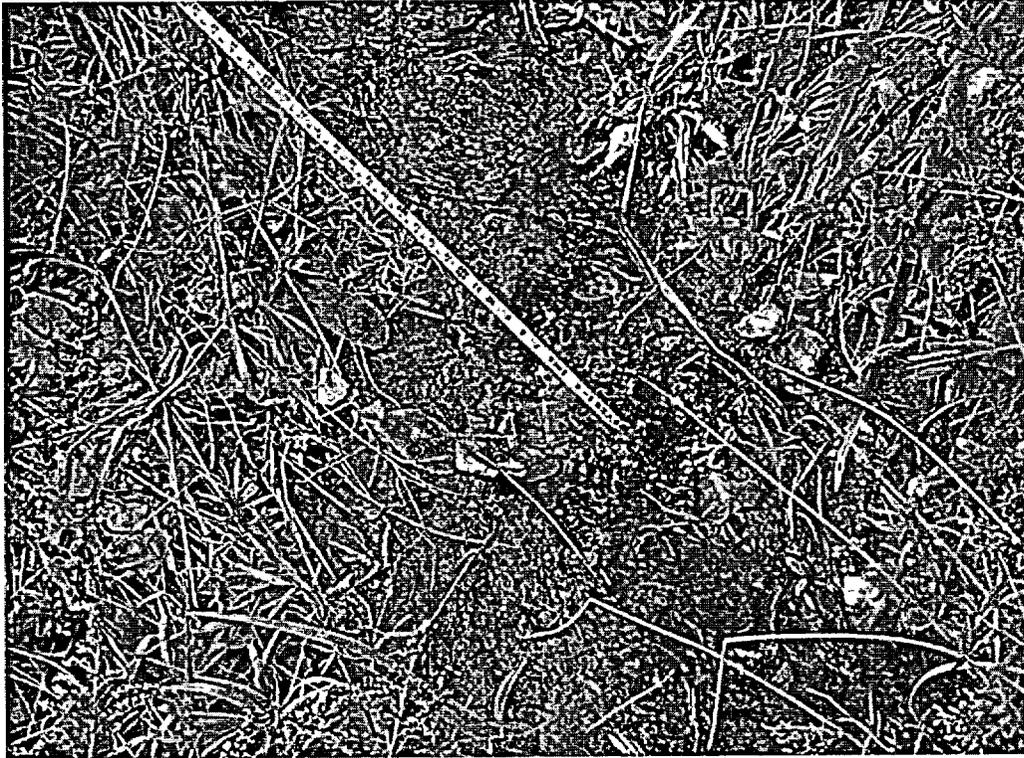
## **INSTRUMENTATION ISSUES**

The 2001 FERC Operation Inspection report identifies the following instrumentation: surface monuments, piezometers, inclinometers, horizontal drains, and weirs. The report did not identify any issues with the surface monuments and inclinometers. Concerns regarding the remaining equipment are not considered significant in terms of SWR integrity as noted previously and consequently changes to the current program are not considered to be justified. The established piezometer and SWPH drain flow trends along with fluctuating precipitation indicate the current monitoring frequency (i.e., every six months) is acceptable. Increased frequency of monitoring could be resumed if the need presents itself. Re-activating weirs and reading on a bi-annual basis as discussed previously is not necessary.



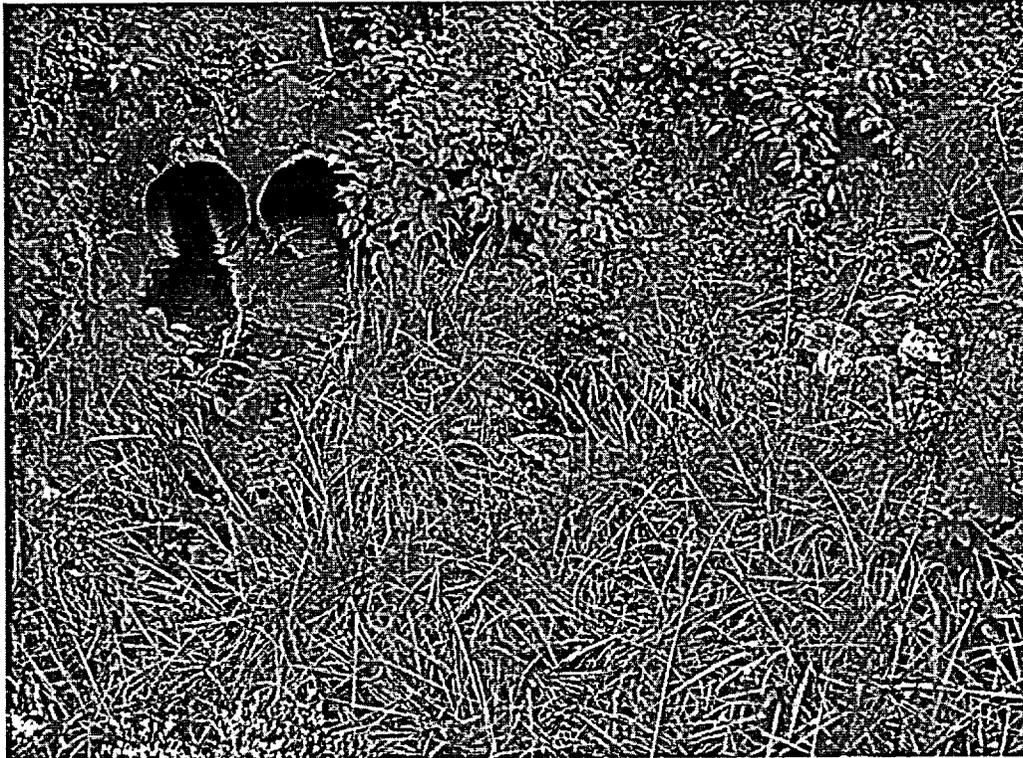


Figure 3  
Downstream of Access Road Culvert



This is the drainage area downstream of the access road culvert adjacent to the abandoned weir wall. (2002 water sample area)

Figure 4  
Downstream Side of Access Road Culvert



The access road culvert is on the right side of the picture. The 2 pipes on the left drain water from the warehouse area. (2002 water sample area)

Figure 5  
Access Road Adjacent to Piezometer 10  
1997 Standing Water Location



The December 1997 inspection report noted standing water beside the road in this area. A water sample was taken in January 1998 in this area. The road was subsequently graded and there has been no standing water since that time.

Figure 6  
Periodic Test 0-PT-75.12  
Visual Inspection of SWR Dike Crest and Toe

Date	Areas	Condition
05/16/02	1 through 6	All Areas Dry
11/31/01	1 through 6	All Areas Dry
04/20/01	1 through 6	All Areas Dry – Specific attention to areas noted by January 24, 2001 FERC Inspection
10/25/00	1 through 6	All Areas Dry
05/05/00	1 through 6	All Areas Dry except Area 3 at inlet to drain pipe under access road is wet
11/15/99	1 through 6	All Areas Dry
05/06/99	1 through 6	All Areas Dry
10/23/98	1 through 6	All Areas Dry except Area 3 at inlet to drain pipe under access road is wet
05/04/98	1 through 6	All Areas Dry

The SWR is divided in to 6 areas for ease of performance of 0-PT-75.12. Area 3 is located in Zone 2 of the SWR Layout in Figure 1.

Figure 7  
Molybdate Sampling

Sample Locations	1998	2002
Original wet spot adjacent to P-10 along access road (Zone 2)	LTD	Not Sampled
Piezometer P-10 (Zone 2)	Not Sampled	LTD
Downstream side of access road culvert (Zone 2)	LTD	LTD
Weir Wall in drainage ditch (Zone 2)	LTD	Not Sampled
Piezometer P-23 (Zone 2)	Not Sampled	LTD
Downstream of access road culvert adjacent to abandoned weir (Zone 2)	Not Sampled	≤ .4 ppm
Piezometer P-24 (Zone 2)	Not Sampled	LTD
Weir No. 1 (Zone 2)	LTD	Not Sampled
NSS Contractor Parking Lot (Control sample location several hundred yards North of the SWR)	Not Sampled	LTD
Laydown area west of SWR (Control sample Area 6)	LTD	Not Sampled

SWR Molybdates 100 ppm  
LTD = Less Than Detectable ≤ .2 ppm

Figure 8

Piezometer 10, SWR  
Toe of SE dike. TRM limit of 280.0.

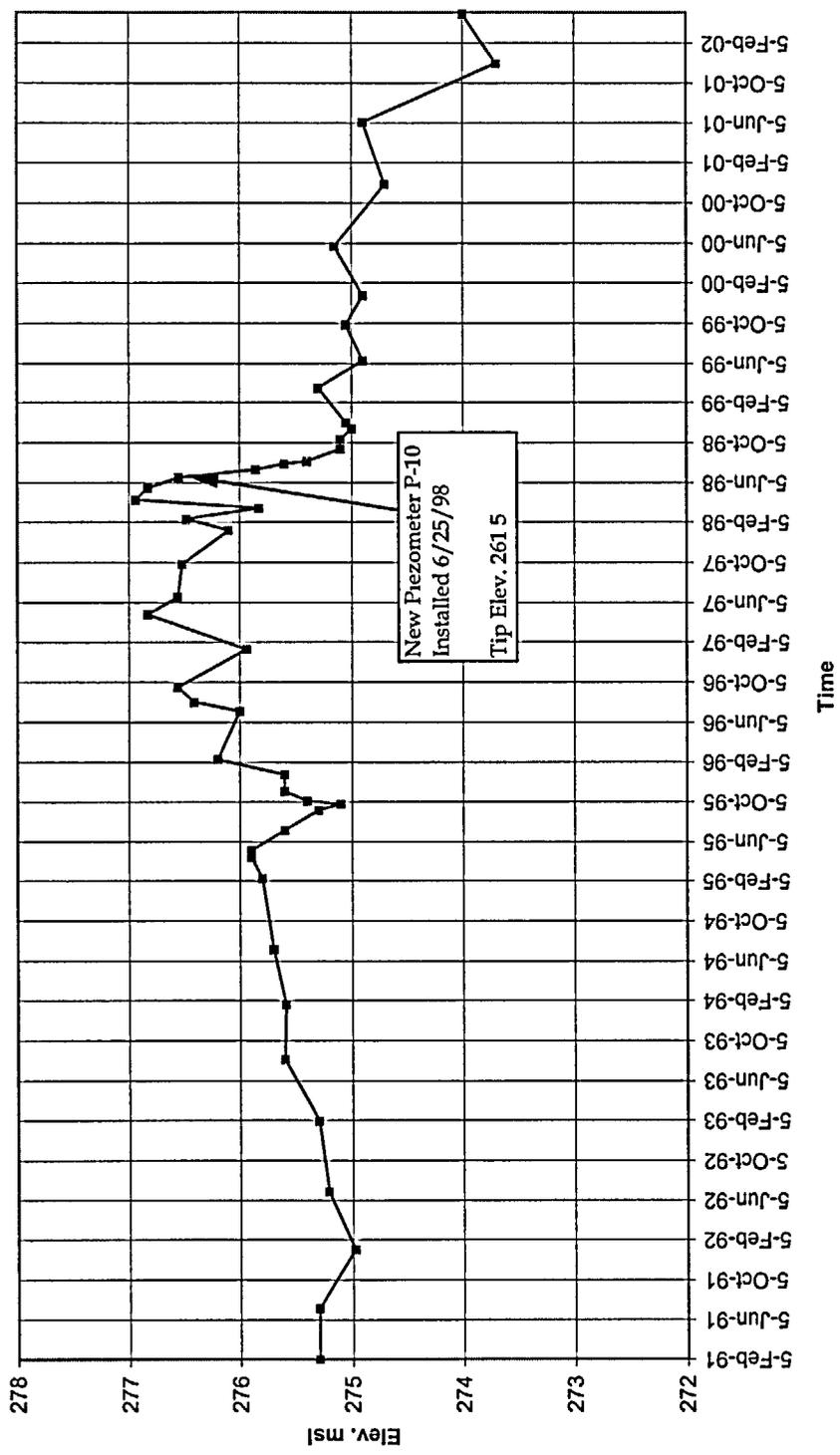


Figure 9

**Piezometer 22, SWR**  
On top of dike, southern tip of SWR. TRM limit is 295.0.

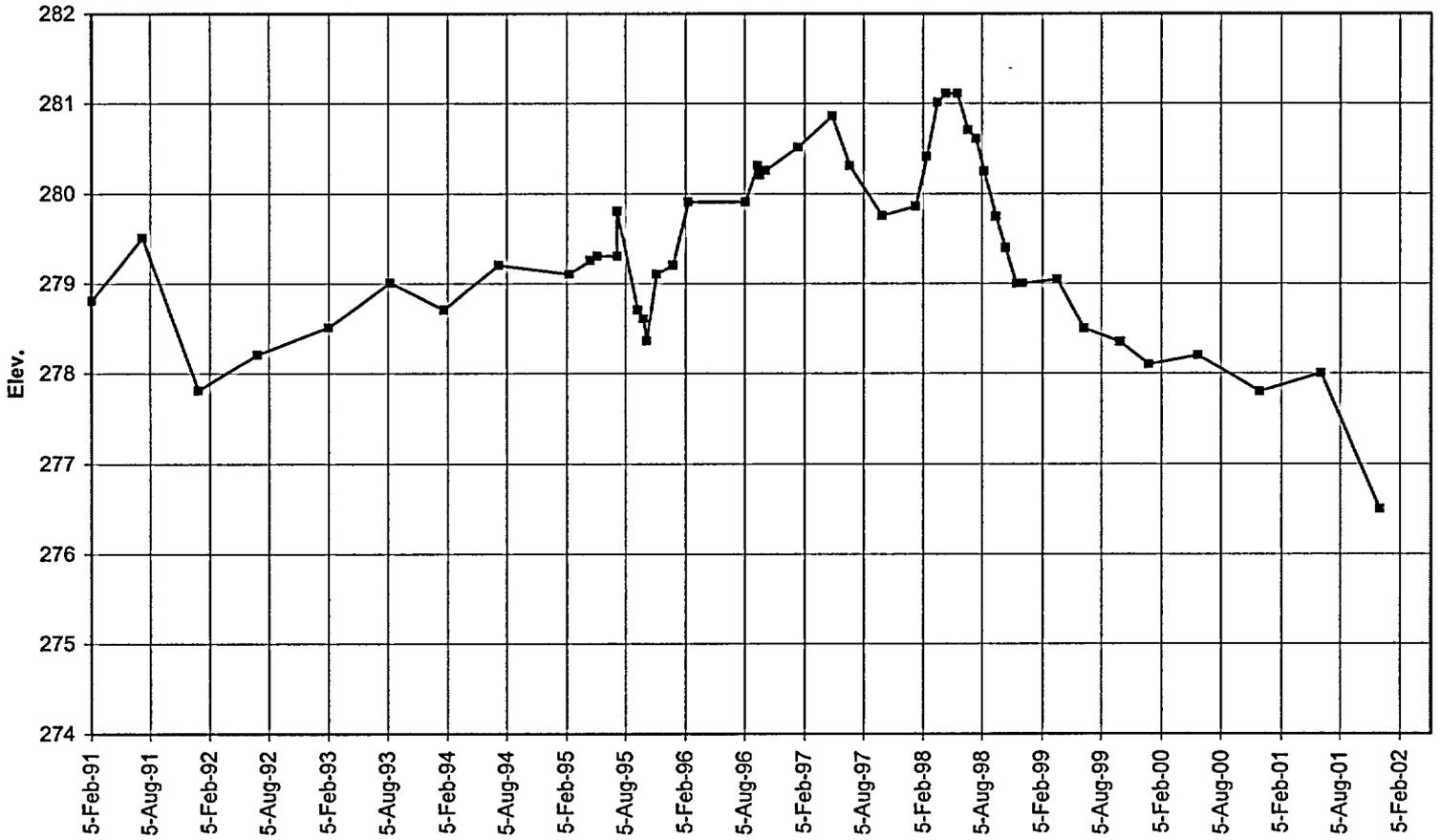


Figure 10

**Piezometer 21, SWR**  
**Top of dike, eastern tip of SWR. TRM limit 295.0.**

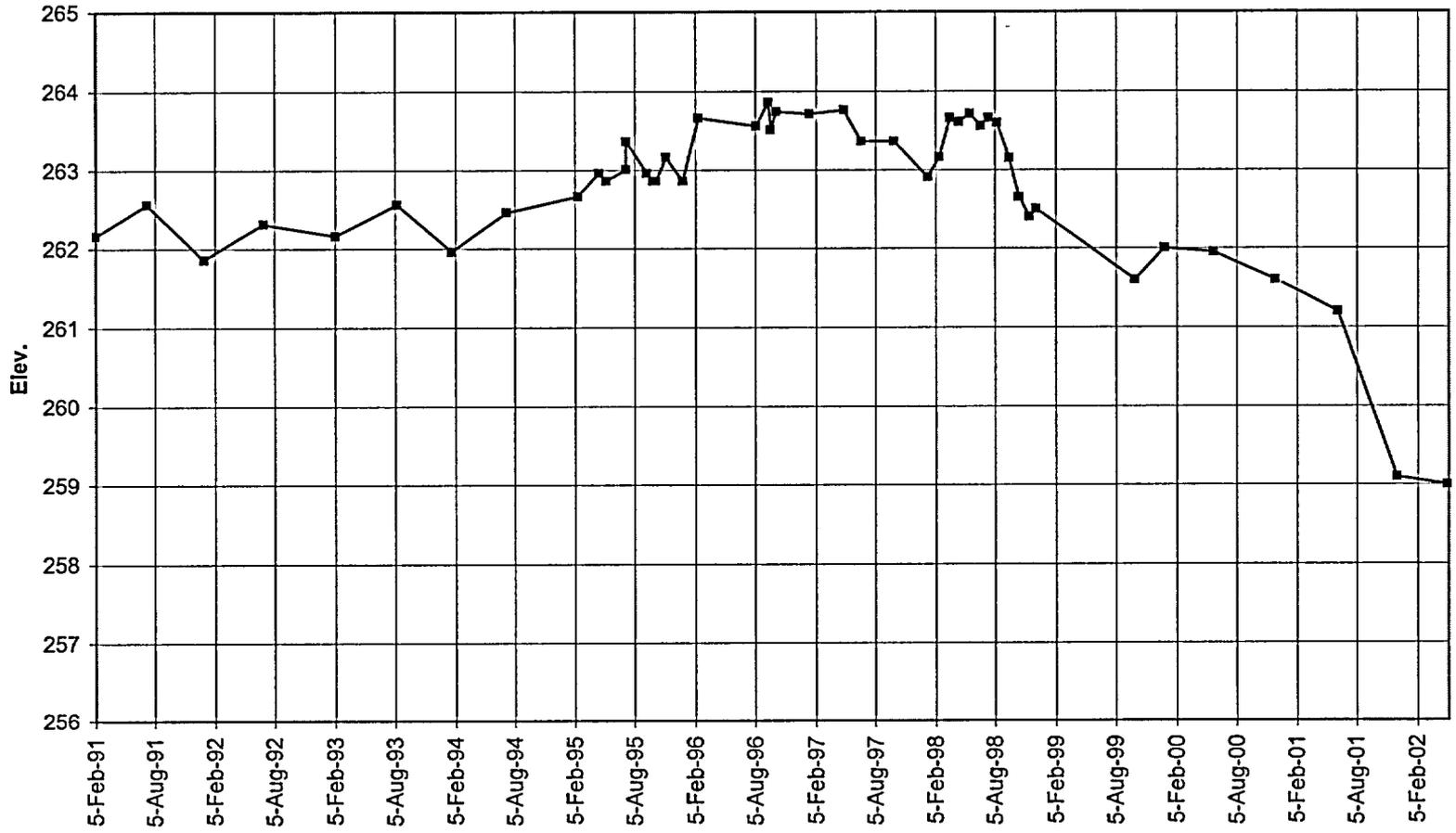


Figure 11

Precipitation in Inches at North Anna Power Station, Louisa  
Precipitation for the 12 months prior to date shown.

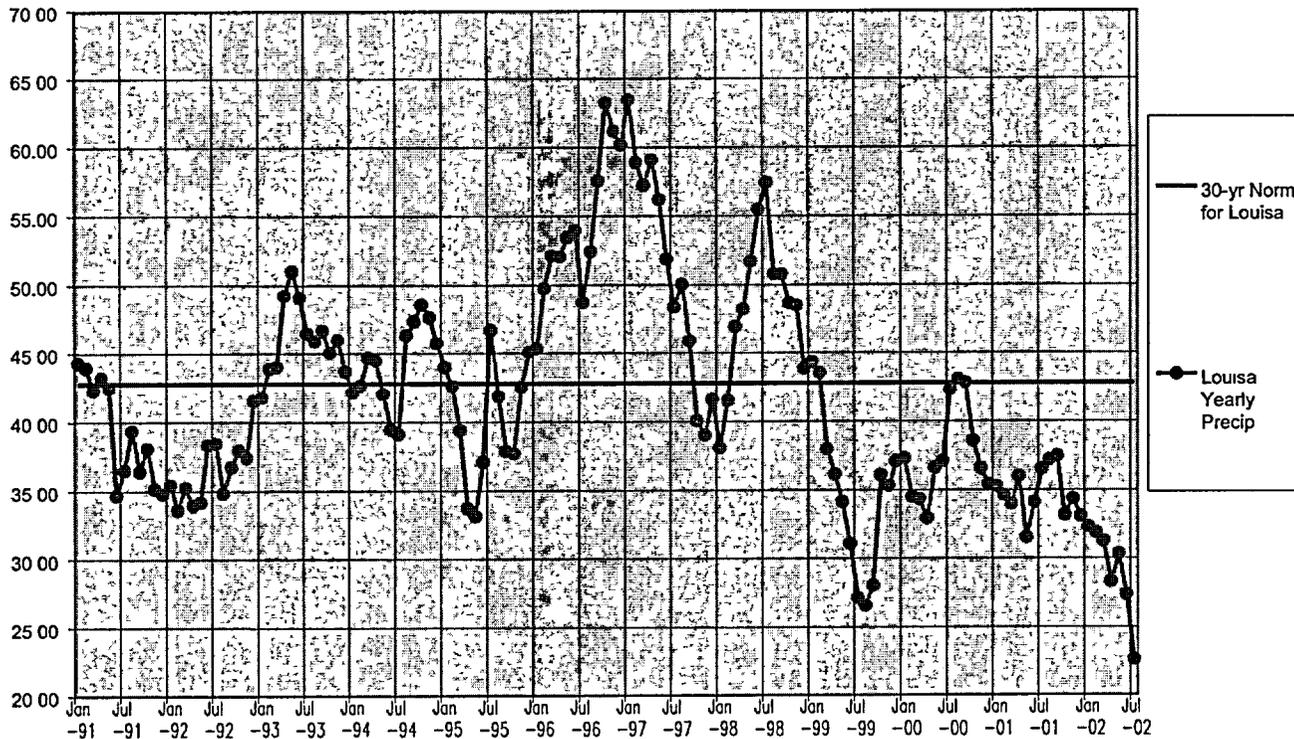


Figure 12  
SWPH Drain Flows  
(6 Outflow Drains)

