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A SCANA COMPANY

July 1, 2003
RC-03-0132

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Sir or Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION (VCSNS)
DOCKET NO. 50/395
OPERATING LICENSE NO. NPF-12
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
LICENSE AMENDMENT REQUEST LAR-02-2767
STEAM GENERATOR INSPECTION FREQUENCY

Reference:
1. SCE&G Letter to NRC (Document Control Desk), RC-03-0007, January 14, 2003, License Amendment Request for One Time Exclusion of Steam Generator Tube Inspection Frequency

2. NRC (K. R. Cotton) Electronic Letter to VCSNS (R. Sweet), May 28, 2003, Request for Additional Information, Virgil C. Summer Nuclear Station License Amendment Request LAR-02-0767 Steam Generator Inspection Frequency

South Carolina Electric & Gas Company (SCE&G) hereby submits the attached response to the referenced request for additional information (RAI) regarding License Amendment Request LAR-02-2767, Steam Generator Inspection Frequency.

This letter offers clarification to Reference 1 concerning the RAI in response to an electronic communication (Reference 2) transmitted to SCE&G by the NRC VCSNS Project Manager, Ms. Karen Cotton.

A001

Should you have any questions, please call Mr. Ron Clary at (803) 345-4757.

Very truly yours,

Stephen A. Byrne

JT/SAB/dr
Attachment

c: N. O. Lorick
N. S. Carns
T. G. Eppink (w/o Attachment)
R. J. White
L. A. Reyes
K. R. Cotton
K. M. Sutton
B. L. Mervak
M. R. Hazel
NRC Resident Inspector
NSRC
RTS (0-C-02-2767)
File (813.20)
DMS (RC-03-0132)

South Carolina Electric & Gas Company (SCE&G)
Virgil C. Summer Nuclear Station (VCSNS)
Response to NRC Request for Additional Information (RAI)
Regarding License Amendment Request LAR-02-2767
Steam Generator Inspection Frequency

The staff requests that the licensee respond to the following questions to permit the staff to complete its review of the request for a one-time inspection frequency extension.

1. **The LAR proposes the following modification for Section 4.4.5.3.a, "A one time inspection interval of once per 58 months is allowed for the inspection performed immediately following refueling outage RF-12." Since RF-12 is not defined in the TS, the staff concludes that this statement must be clarified. This may be done by either specifying the end date of RF-12 in the TS or specifying the end date of the 58-month inspection interval.**

Response RAI Question 1:

The end date of Refuel 12 was March 4, 2001. This date will be added as the start date for the 58-month inspection interval.

2. **In your submittal documenting past inspection results you reference various support structures (e.g. AV7) and various tube locations (e.g. R25C26). In order to ascertain the locations of these indications, please provide a schematic of the Model Delta 75 steam generator identifying the nomenclature of the tube supports. In addition, provide a tubesheet map identifying the rows and columns of the tubes.**

Response RAI Question 2:

A schematic of the Steam Generator (SG) structure and a tube sheet map showing row and column designations is attached.

3. **During RF-12, as reported in V.C. Summer Special Report SPR-2000-005 dated November 8, 2000, five tubes with no tube expansion (NTE) were plugged. Presumably these tubes were never expanded prior to service. Have all tubes that have not been fully expanded in the tubesheet been removed from service? If not, discuss the potential for degradation to occur in this region until the next inspection is performed and provide the technical basis for removing some but not all of the NTE tubes from service during RF-12.**

Response to RAI Question 3:

As of the end of Refuel 12, a total of 8 tubes in all three steam generators were identified with no tube expansion. 3 tubes in SG "A", 1 tube in SG "B", and 4 tubes in SG "C". All tubes were removed from service by plugging. 100% inspection for non-expansion was performed in Refuel 12, so no further inspections for non-expansion will be required. Since all tubes have been removed from service, no further monitoring of these tubes for degradation, other than required inspection of tube plugs, is planned for future inspections.

4. **The licensee states the potential for loose parts entering the steam generator is minimized by the design of the feedwater ring spray nozzle assemblies, which consist of 0.25 inch diameter outlet holes. The LAR also mentions that if parts are small enough to pass through the feedwater spray nozzle outlet holes they will pass between the tubes and be transported to low velocity regions of the bundle. Please state whether any additional loose parts (other than the 0.5 inch long wire) were identified during 1R11. Provide a summary of loose parts identified in the replacement steam generators including the type, number, size, probable origin, and location (prior to removal). Are there any known or suspected loose parts in the steam generators at this time? Are you planning a foreign object search and retrieval inspection during the 1R14 outage in 2003?**

Response to RAI Question 4:

See combined response to questions 4 and 5 following question 5.

5. Recently another licensee reported several loose parts in their steam generators. Many of the loose parts were from the stainless steel face of FlexitallicTM gaskets used in various locations in the feedwater system. The licensee postulated that these gaskets extrude into the flow path and then break releasing pieces into the feedwater. Other licensees have also reported pieces of spiral wound gaskets in the steam generator. Indicate whether the V.C. Summer secondary side system contains gasket material that has created loose parts in the steam generator and how that would affect tube integrity during the requested extended operating interval between inspections.

Response to RAI Questions 4 and 5

Both questions relate to loose parts and debris. As discussed in our submittal, 1 loose part was identified on eddy current inspection in Refuel 11, and was confirmed visually and removed in Refuel 12. No other loose parts have been identified by eddy current inspection during the life of the current Steam Generators, installed in December 1994.

The feed ring nozzle design has been effective in preventing debris, introduced from secondary systems, from entering the tube bundle region since replacement in fall, 1994. In April, 1996, Refuel 9, during implementation of a moisture carry over modification requiring entry into the secondary sides of all Steam generators, 7 pieces of debris were found trapped by the feed nozzles of SG "A", and 2 pieces in SG "C". 1 piece was removed from "A" and both pieces from "C". In fall, 2000, during Refuel 12, 28 pieces were found in SG "A" nozzles, 4 pieces in SG "B", and 1 piece in SG "C". At that time, significant actions were performed to remove all debris from the 3 feed rings, and visually verify cleanliness within each feed ring. Note that all pieces found in the feed ring were very small, but had one dimension greater than 0.25 inch, which prevented them from passing into the tube bundle region. Also at that time, approximately 1 ounce of small material was filtered out of "A" SG sludge during tube sheet sludge lancing. The material was not seen visually during pre-sludge lance inspection, but was present in the sludge. No similar material was found in the sludge in "B" or "C" steam generators. The main component of all material found in Refuel 12 was pieces of a "flow straightener" in a valve, which controls the DA tank water level. The component is a tube bundle, which helps prevent cavitation at the discharge of the valve. The bundle was found damaged during maintenance in Refuel 12. The bundle material is 304 stainless steel. A minor amount of brass material was also present which was determined to be from

broken nuts on partition plates of 2 high pressure feed water heaters, and also some material from pop rivets used on extraction steam lines in the main condensers. The following corrective actions were taken to prevent future introduction of debris from the secondary systems to the Steam generators:

- Partition plate nuts were replaced with carbon steel self locking nuts
- The condensate valve bundle was replaced and set point changes performed
- All pop rivets located in the main condenser were tack welded
- Preventative maintenance tasks are in place to vacuum the Dearator (DA), DA Storage tank, and Main condenser hotwells each outage.

In regards to flexitallic gasket material, no significant amount has ever been found in the feed rings or sludge. Most material found in Refuel 12 was first thought to be flexitallic material, but upon closer inspection was determined to be pieces of the condensate valve flow straightener.

Overall, V.C. Summer steam generators have experienced no indications of wear from loose parts, very minor concerns with debris from the secondary side, and success with the feed nozzle design in preventing any loose material from entering the steam generators. Current plans are to perform all secondary side inspections, FOSAR, and sludge lancing in Refuel 15, when Eddy Current inspections are scheduled. It is the Steam Generator program policy to perform secondary side activities coincident with primary side inspections. This policy assures that any findings on the secondary side can be evaluated with eddy current inspection. No secondary inspections are scheduled for Refuel 14.

6. **One of the key steam generator improvements cited by the licensee as supporting extended operation between inspections is the resistance of the thermally treated Alloy 690 to corrosion, stress corrosion cracking (SCC), and other service related degradation mechanisms. Discuss the probability of corrosion, SCC and other service related degradation during the requested extended operating interval between inspections**

Response to RAI Question 6:

The current degradation assessment for V.C. Summer Steam Generators indicates no active degradation. Potential degradation mechanism is wear only. The station inspected tubes for wear in Refuel 12, and found no evidence. In fact, there has been no evidence of any tube wall degradation since steam generators were replaced in 1994. In preparation for the current refueling, since V.C. Summer plans to defer our inspection to the following refueling, the

degradation assessment is being reviewed to confirm that it supports the extended inspection interval. The EPRI Steam Generator Inspection Guideline, Revision 6, requires this. In regards to wear, AVB wear has not been detected to date. Additionally, loose part wear has not been detected, and is not a likely source based on V.C. Summer operating history and inspections performed to date.

The thermally treated alloy 690 tube material in V.C. Summer Delta 75 steam generators has superior corrosion resistance to previously utilized mill annealed and thermally treated alloy 600 material. To date, the Westinghouse Delta model RSG's have been operating corrosion-free for over 6 calendar years at hot leg temperatures of approximately 619 degrees F. Relative to mill annealed 600 tubing, the 690 material contains 13% higher chromium content, with a corresponding reduced nickel content. The higher chromium content and controlled heat treatment reduces the degree of sensitization (the amount of chromium depleted in the areas adjacent to the metal grain boundaries), thus increasing resistance to corrosion attack at the metal grain boundaries. Heat treatment and thermal treatments precipitate carbides on the metal grain boundaries into the tube metal microstructure. Resistance to SCC is greatest when the metal grain boundaries are fully populated with carbides. Extensive testing has been performed, which demonstrates that thermally treated alloy 690 tubing is superior to mill annealed Inconel 600 tubing in its resistance to both primary and secondary system SCC, pitting, and general corrosion. Examples can be provided if requested. Regarding steam generator chemistry, V.C. Summer maintains chemistry in accordance with EPRI Primary and Secondary Chemistry guidelines.

7. Describe what actions, if any, you have taken to verify that V.C. Summer steam generator tube processing was provided as specified. (Refer to IN-2002-21 dated April 1, 2003). If tubes with non-optimal tube processing have been identified, discuss the implications for the V. C. Summer operational assessment for the 58 month interval between inspections.

Response to RAI Question 7:

Back in June, 2002, when the Seabrook issue was first communicated, the steam generator organization at V.C. Summer looked at manufacturing records, procedures, and inspection reports for the tubing manufacturer, Sandvik steel. At that time, the steam generator organization concluded that there were adequate controls, inspections, and testing in place during manufacturing to assure that the thermal treatments were properly applied. Based on this review,

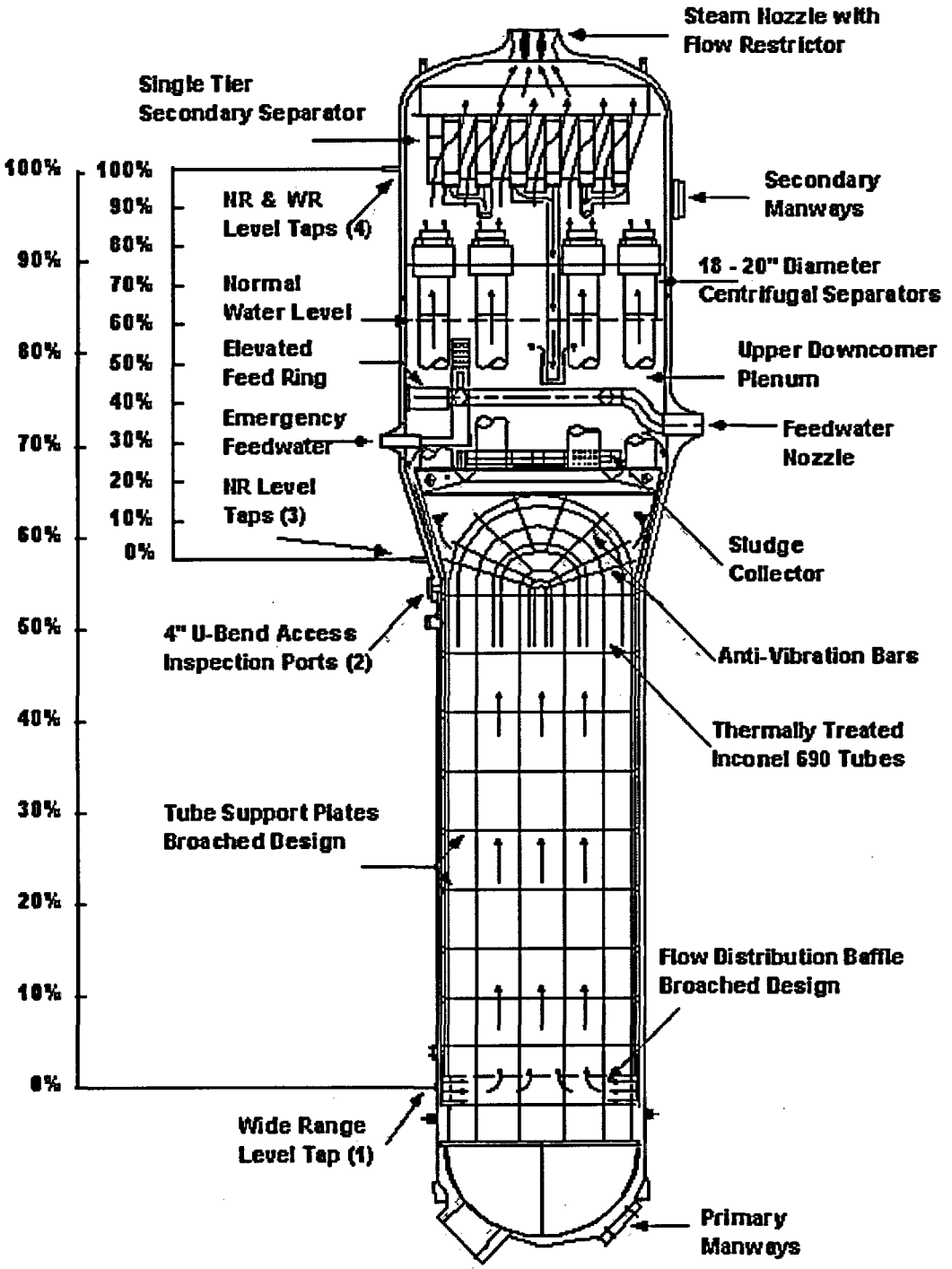
and on inspection results showing no tube degradation since replacement, no further actions are planned in this regard.

The April 1 revision to the NRC information notice has just been received by the steam generator organization for review. The organization does not anticipate any change to previous conclusions, and does not plan any additional actions.

8. Has there been any primary-to-secondary system leakage during the current operating cycle? Does V.C. Summer follow the EPRI PWR Primary-To-Secondary Leak Guidelines?

Response to RAI Question 8:

There has been no primary to secondary leakage during the current operating cycle, and no leakage has occurred since SG replacement. V.C. Summer complies with all EPRI guidelines specified by NEI 97-06, including the Primary-to-Secondary Leak guideline. V.C. Summer operating procedures require actions consistent with action levels described in the guideline.



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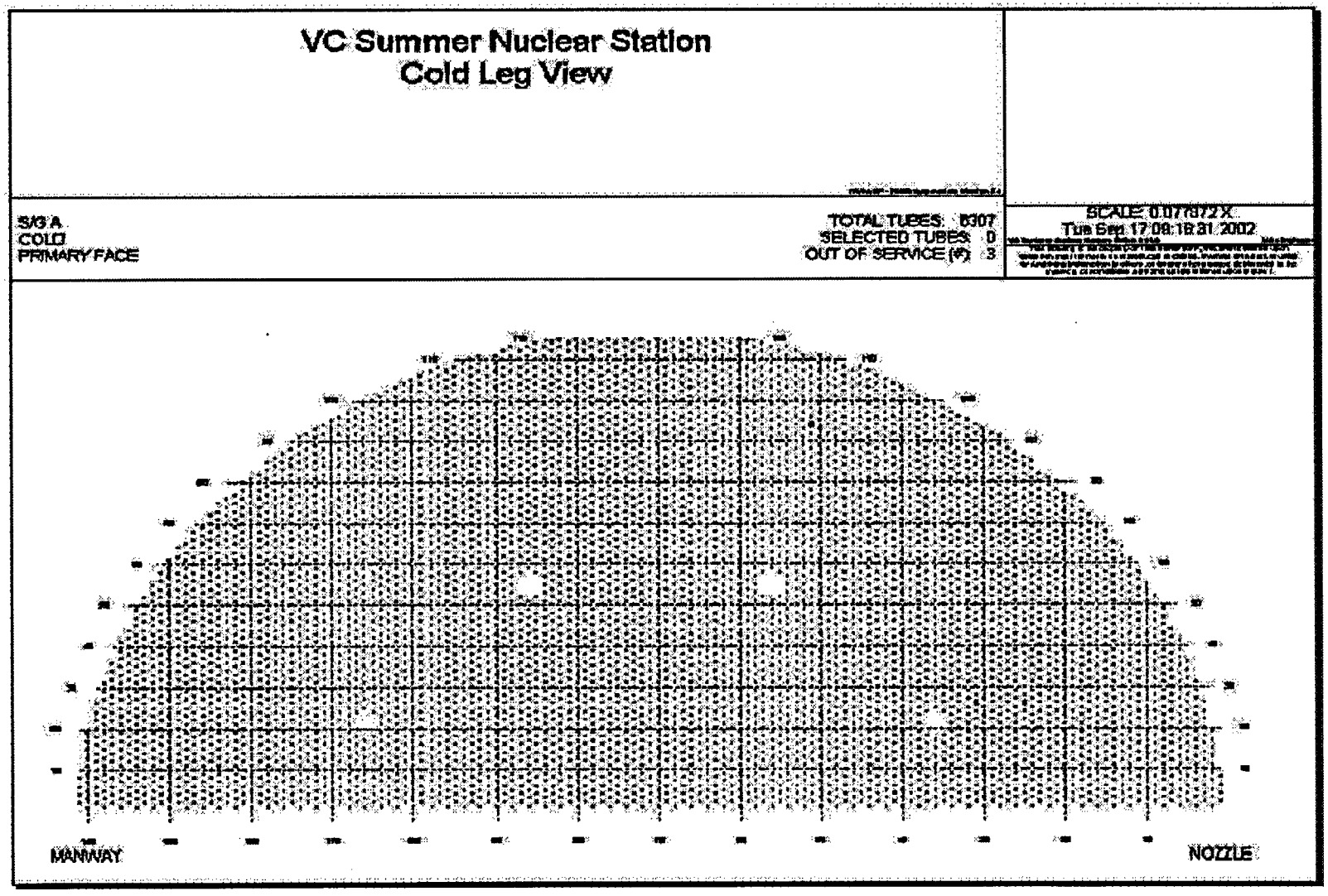
VC Summer Nuclear Station
Cold Leg View
S/G A
COLD
PRIMARY FACE
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SELECTED TUBES: 0
OUT OF SERVICE (#): 3
SCALE: 0.077872 X
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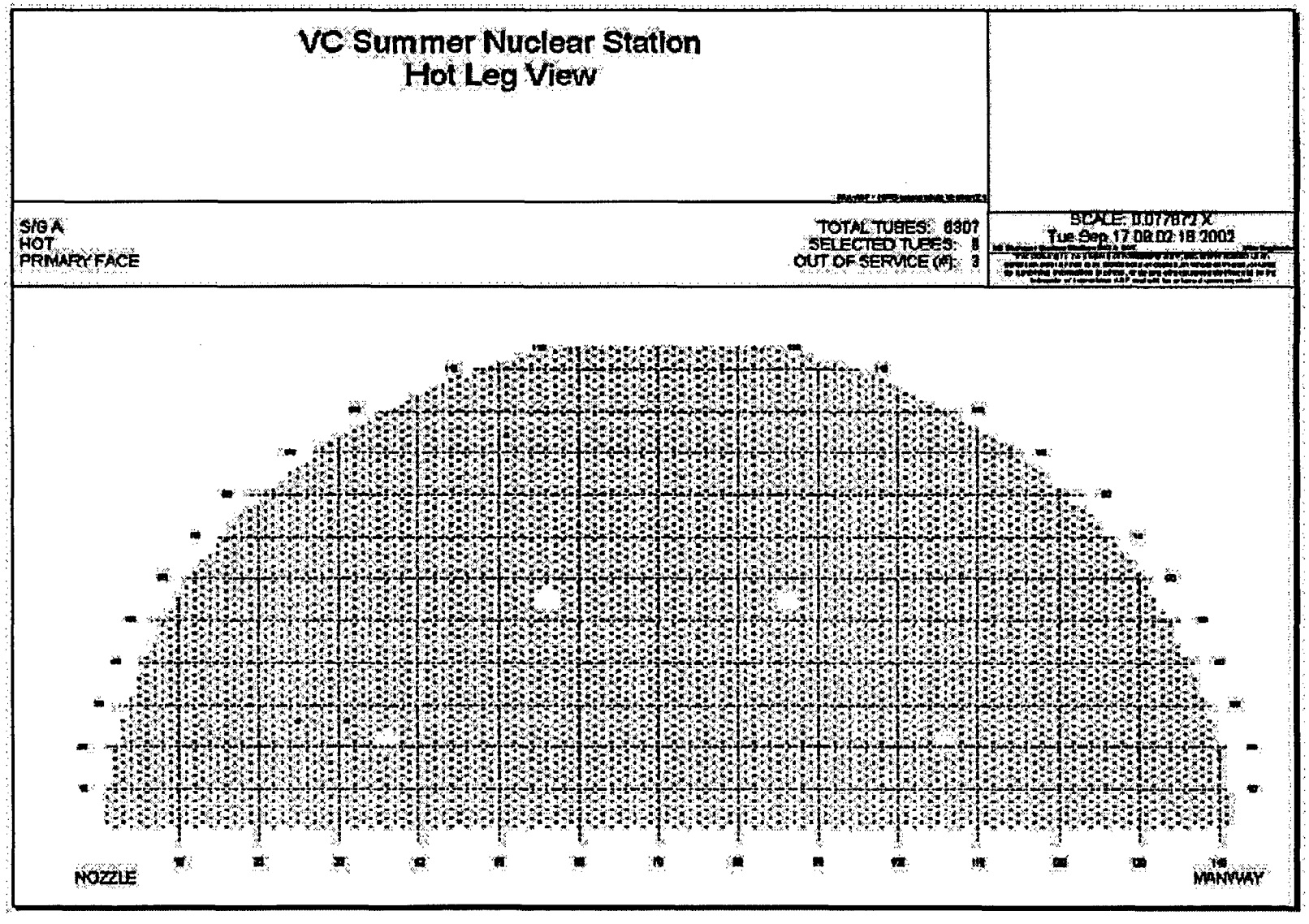
MANWAY
NOZZLE


VC Summer Nuclear Station
Hot Leg View
S/G A
HOT
PRIMARY FACE
TOTAL TUBES: 6307
SELECTED TUBES: 8
OUT OF SERVICE (#): 3
SCALE: 0.077872 X
Tue Sep 17 08:02:18 2002
NOZZLE
MANWAY