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SUBJECT: Provides suppl info on Westinghouse Alloy 600 SG mechanical tube plugs,per NRC Bulletin 89-001.

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Florida Power & Light Company, P.O. Box 128, Fort Pierce, FL 34954-0128

FPL

December 11, 1995

L-95-322
10 CFR 50.4

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

RE: St. Lucie Unit 1
Docket No. 50-335
NRC Bulletin 89-01, Supplemental Information on
Westinghouse Alloy 600 Steam Generator Mechanical Tube Plugs

In a meeting on December 22, 1994 between Westinghouse and the NRC, recent operating experience affecting the predicted service life of Westinghouse steam generator mechanical tube plugs fabricated from Thermally Treated (TT) Alloy 600 was reviewed. The NRC concluded the issue does not represent an immediate safety concern and informally requested the industry to take a proactive approach to resolve this issue. In response to this request, several items were identified by Westinghouse to be addressed by each utility with Westinghouse TT Alloy 600 mechanical plugs.

The St Lucie Plant addressed the items identified by Westinghouse in a letter to the NRC, FPL letter L-95-27, dated January 30, 1995. As stated in that letter , a tube plug repair plan will be provided no later than 30 days prior to the next scheduled refueling outage at St. Lucie Unit 1. The next Unit 1 refueling outage is currently scheduled for April 1996. The purpose of this letter is to provide the tube plug repair plan as committed.

FPL is currently planning to replace the St. Lucie Unit 1 steam generators in the first quarter of 1998. Therefore, all plugs will be visually inspected in the April 1996 refueling outage and repaired or replaced if leaking. With the steam generator replacement, all the remaining plugs will be removed from service. FPL will provide additional notification in the event that changes are made to the attached plug repair plan for St. Lucie Unit 1.

Please contact us if there are any questions about this submittal.

Very truly yours,

D. A. Sager
Vice President
St. Lucie Plant

DAS/GRM

cc: Stewart D. Ebneter, Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, St. Lucie Plant

JE31

St. Lucie Unit 1
Docket No. 50-335
NRC Bulletin 89-01, Supplemental
Information - Westinghouse Alloy 600
Steam Generator Mechanical Tube Plugs

FPL INSPECTION PLAN FOR SPRING 1996 REFUELING OUTAGE

The FPL response in letter L-95-27 dated January 30, 1995 is updated based on information provided in Addendum 4 to WCAP-12245, Rev 3, issued May 1995. Florida Power and Light has performed remote tube sheet visual inspections of all installed tube plugs, regardless of manufacture, at each refueling outage subsequent to the issuance of NRC Bulletin 89-01. At St. Lucie Unit 1, the most recent inspection identified 15 leaking hot leg Westinghouse mechanical tube plugs which were subsequently replaced with welded Alloy 690 plugs. In addition, all subject hot leg plugs in tube rows 1-4, which are subject to tube perforation in the event of plug top release, were also replaced. The impact of Addendum 4 has been assessed for applicability at St. Lucie Unit 1. Addendum 4 lists all remaining subject hot leg plugs at St. Lucie Unit 1 as Repair Category 1 and all remaining subject cold leg plugs as Repair Category 3.

The FPL plug repair plan consists of the following actions:

1. All subject plugs which are determined by visual inspection to be leaking during the next refueling outage currently scheduled for Spring 1996 will be repaired or replaced.

2. As stated in Addendum 4, plant specific circumstances may exist which support a one time deferral of remedial action for Category 1 plugs which are not repaired or replaced at the next scheduled outage. Specific circumstances include:

   a. FPL is planning to replace the St. Lucie Unit 1 steam generators during the Spring 1998 refueling outage. All remaining Category 1, 2 and 3 plugs which are not replaced during the refueling outage currently scheduled for Spring 1996 will be removed from service when the steam generators are replaced. Continued operation is justified in that (1) there is a low probability of plug top release for remaining plugs; (2) All remaining plugs are located in tubes that are not expected to experience perforation if a plug top release occurs; (3) The population of tubes which may perforate as a result of plug top release is limited; (4) Should perforation occur following plug top release, the primary to secondary leakage consequences are limited; (5) there is only a very low likelihood that multiple plugs could be in a

condition that would be capable of resulting in plug top release; and (6) Plant Emergency Response Guidelines are adequate to bring the plant to safe shutdown following plug top release.

In addition, approximately 3/4 of the remaining 489 hot leg plugs are located in tubes which were removed from service as a preventative measure and, therefore, should provide an adequate pressure boundary. Only about 1/4 of the remaining plugs are located in tubes plugged for localized tube wall degradation, however none of these tubes contained a perforation at the time they were plugged. If a tube contained a through wall perforation it would be less likely to experience a plug top release because the secondary pressure would reduce the axial stress on the plug. Should a plug top release result in a tube perforation, the maximum leakage is not expected to exceed 80 gpm through a plug, which is bounded by the Updated Final Safety Analysis Report (UFSAR) steam generator tube rupture (SGTR) event. A maximum of seven plug top releases and tube ruptures would have to occur to exceed the analyzed SGTR event. It is not credible to postulate multiple tube and plug failures concurrently. Therefore all remaining plugs are bounded by the basis for the industry justification for continued operation.

b. Repair or replacement of Category 1 plugs which are not leaking, as determined by visual inspection during the Spring 1996 refueling outage, would pose significant additional Man-Rem burdens and schedule impact with insignificant impact on safe operation of the unit. A summary of our assessment of available repair options and the impact of these options on ALARA follows:

St. Lucie Unit 1
Docket No. 50-335
NRC Bulletin 89-01, Supplemental
Information - Westinghouse Alloy 600
Steam Generator Mechanical Tube Plugs

ASSESSMENT OF PLUG REPAIR METHODS AND ALARA

Methods available for removal and replacement or repair of 3/4" diameter Westinghouse Alloy 600 mechanical plugs are (1) removal by drilling, (2) removal by electric discharge machining (EDM), (3) removal by pulling and, (4) repair by installing a plug insert. These methods are available commercially from each of the NSSS vendors and are evaluated and discussed below.

Removal by Drilling - Various methods of drilling are offered. Each method has been successfully demonstrated in the field and is available to FPL. The ABB/CE and Westinghouse drilling methods completely remove the plug. The tube is then replugged using a replacement mechanical or welded tube plug. The BWNT process removes only the bottom ½" of the Westinghouse plug. It also removes the tube-to-tubesheet weld, and spot faces the tubesheet clad for installing a welded tubesheet plug. Removal by drilling is typically preferred for use in the field. The approximate time and dose required for drilling methods are provided in the table summary below.

Removal by Electric Discharge Machining (EDM) - Each NSSS Vendor offers removal of Westinghouse Alloy 600 mechanical plugs using EDM. EDM is typically used as a backup for drilling in the event that a drill bit becomes stuck or breaks off inside a plug and cannot be removed by other means. In this case, EDM is capable of removing the stuck or broken drill bit and the Westinghouse plug. EDM equipment installation and machining time can exceed one shift to remove a broken drill bit and plug. EDM is not offered as a primary method due to the additional time required to remove tube plugs and, therefore, time and dose estimates are not provided in the table summary below.

Removal by Pulling - Removal by pulling is offered by Westinghouse and ABB/CE. The process involves pushing up the expander mandrel to relieve the contact strain at the tube-to-plug interface. The ABB/CE process further attempts to "stretch" the plug and provide additional contact strain relief. This process has been successfully demonstrated in the field for 7/8" diameter plugs. Unfortunately, neither the ABB/CE or Westinghouse pulling methods work predictably for 3/4" diameter Westinghouse mechanical plugs, particularly when cracking is present. Demonstrated field success rate for the 3/4" plug is only about 10%. Additionally, an unsuccessful pulling attempt typically leads to EDM for removal of the remnants. In summary, removal by pulling is not offered for

3/4" Westinghouse Alloy 600 mechanical plugs and, therefore, time and dose estimates are not provided in the table summary below.

Repair by Installing a Plug Insert - The Westinghouse plug is not removed with this option. Instead, a plug insert is screwed into the plug expander and is captured by crimping or tack welding the insert head to the bottom of the Westinghouse Alloy 600 mechanical plug. The primary function of the insert is to limit the amount of primary system energy available to propel the plug top up the tube in the event of a plug top release. Since the insert is screwed into the center hole of the plug expander, it effectively blocks the flow path through the plug and into the tube. This precludes the possibility of a plug top release and subsequent tube perforation. In the event that leakage occurs through the plug and into the tube, and a tube perforation also exists, the potential primary to secondary leakage is limited by the insert to less than 0.1 gpm. Installation time for the insert is comparatively low. However, since the potentially cracked plug remains in service, plug inserts are not as desirable as removal methods. Approximate time and dose required for plug insert installation is provided in the table summary below.

ASSESSMENT SUMMARY & IMPACT ON ALARA - The following table summarizes schedule and dose impact for viable removal and repair methods discussed above. This information was provided verbally by the NSSS vendors based on recent field experience. Average dose estimates quoted by each NSSS vendor ranged from 50mr to 100mr to drill out and replace each Westinghouse Alloy 600 mechanical plug. The average dose estimate used for installation of plug inserts was 20mr. The table shows that EDM and pull or stretch & pull methods are not offered for 3/4" diameter plugs. Installation of plug inserts is less desirable for reasons mentioned above. Plug inserts should be considered in the event that remedial action becomes necessary for all Category 1 Westinghouse plugs during the Spring 1996 refueling outage. Assuming that remedial action is necessary for only those plugs determined to be leaking in the Spring 1996 refueling outage, the plugs should be removed by drilling and replaced with mechanical or welded Alloy 690 plugs.

The number of Westinghouse Alloy 600 mechanical plugs that will be identified as leaking in the Spring 1996 refueling outage is uncertain. A number of 50 is used as an estimate. As shown at the top right portion of the table, the difference in ManRem for replacing an estimated 50 leaking plugs versus replacing all 489 Category 1 plugs is 32 ManRem. Installation of plug inserts in all remaining plugs (not determined to be leaking) is estimated to require an additional 9 ManRem.

Therefore, the preferred course of action is to replace only those plugs determined to be leaking at the Spring 1996 refueling outage. The remainder of the Westinghouse Alloy 600 mechanical plugs would then be removed from service with the steam generator replacement in the Spring of 1998.

REMOVAL & REPAIR METHODS FOR WESTINGHOUSE ALLOY 600 MECHANICAL TUBE PLUGS					
METHOD or PROCESS	RATE INFO[5]	SCHEDULE IMPACT ESTIMATES		DOSE IMPACT ESTIMATES	
		50 PLUGS	489 PLUGS	50 PLUGS	489 PLUGS
DRILLING	2 Hrs /plug	3 Days	21 days	5 ManRem[1]	37 ManRem[2]
Pulling or Stretch & Pull	not offered	n/a	n/a	n/a	n/a
EDM	3 Hrs /plug	not offered	n/a	n/a	n/a
Plug Insert	.5 Hrs /Insert	1-2 Days	6-8 days	1.2 ManRem[3]	10 ManRem[4]

Table Notes:

1. - Average 100mr used for smaller campaign.
2. - Average 75mr used for larger campaign.
3. - Average 25mr used for smaller campaign.
4. - Average 20mr used for larger campaign.
5. - Rate includes replacement plugging.