

UNITED STATES OF AMERICA
BEFORE THE NUCLEAR REGULATORY COMMISSION

In the Matter of:)

Florida Power & Light Co.)

St. Lucie Plant, Unit 2)
_____)

Docket No. 50-389

November 6, 2014

**SOUTHERN ALLIANCE FOR CLEAN ENERGY’S
MOTION FOR LEAVE TO AMEND HEARING REQUEST
WITH SECOND SUPPLEMENTAL DECLARATION OF ARNOLD GUNDERSEN**

Pursuant to 10 C.F.R. § 2.309(c)(1)(i)-(iii), Southern Alliance for Clean Energy (“SACE”) hereby seeks leave to amend its Hearing Request of March 10, 2014, by submitting the attached Second Supplemental Declaration of Arnold Gundersen (Nov. 6, 2014). The purpose of Mr. Gundersen’s Second Supplemental Declaration is to explain why the results of a March 2014 inspection by Florida Power & Light Co. (“FPL”) of the St. Lucie Unit 2 replacement steam generators (“RSGs”) have not altered the opinions Mr. Gundersen expressed in his original declaration and supplemental declaration in support of SACE’s Hearing Request. *See* Declaration of Arnold Gundersen (March 9, 2014) (“Gundersen Declaration”); Supplemental Declaration of Arnold Gundersen (April 25, 2014). FPL’s report regarding the March 2014 inspection, hereinafter referred to as “2014 S.G. Inspection Report,” is attached to a letter from FPL to the NRC dated September 18, 2014 (ML14279A237).

In his previous declarations, Mr. Gundersen stated his opinion that design changes to the RSGs that were made by FPL and approved by the NRC Staff without conducting a formal license amendment proceeding have major safety significance and exceed the reactor’s design basis. Mr. Gundersen also explained why these design changes not only increase the damage to the steam generator tubes but also increase the risk of steam generator failure and therefore have an adverse effect on public health and safety.

At the time SACE filed its Hearing Request, an unusual degree of damage to the RSGs already had been revealed during inservice inspections conducted between 2009 and 2012. The March 2014 inspection took place while SACE's Hearing Request was pending.

As discussed in Mr. Gundersen's Second Supplemental Declaration, the March 2014 inspection revealed that both the A and B steam generators at St. Lucie Unit 2 continue to experience a significant degree of deterioration, and that the cumulative amount of steam generator degradation in both steam generators is extremely high. Although the rate of steam generator degradation at St. Lucie Unit 2 between 2012 and 2014 has decreased from the rate observed in previous inspections, it nevertheless is greater than at any other nuclear power plant in the U.S. Therefore, the opinions Mr. Gundersen expressed in his March 9, 2014 declarations have not changed.

To the extent that 10 C.F.R. § 2.309(c)(1)(i)-(iii) may be applicable to this proceeding, SACE respectfully submits that this filing meets the requirements of 10 C.F.R. § 2.309(c)(1)(i)-(iii). First, the 2014 Steam Generator Inspection Report was not publicly available until October 7, 2014, when it was posted by NRC on ADAMS. The information is also different from all other publicly available information, because it constitutes the only report that documents the results of the March 2014 St. Lucie Unit 2 steam generator inspection in any detail. Finally, SACE is submitting Mr. Gundersen's analysis of the information within 30 days of its becoming available on ADAMS, a presumptively reasonable period. *Shaw AREVA MOX Services* (Mixed Oxide Fuel Fabrication Facility), LBP-08-11, 67 NRC 460, 493 (2008).

Accordingly, the Commission should accept Mr. Gundersen's Second Supplemental Declaration for filing and consider it in ruling on SACE's Hearing Request.

Respectfully submitted,

(Electronically signed by)

Diane Curran

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November 6, 2014

CERTIFICATION REGARDING CONSULTATION

Pursuant to 10 C.F.R. § 2.323, I certify that on November 5, 2014, I consulted counsel for FPL and the NRC Staff in a sincere effort to resolve the concerns raised by this motion. Counsel for FPL stated that FPL would oppose this motion. Counsel for the NRC Staff stated that the Staff would wait to take a position until it had an opportunity to review the motion.

[Electronically signed by]

Diane Curran

**BEFORE THE UNITED STATES
NUCLEAR REGULATORY COMMISSION**

_____)
In the Matter of: _____)

Florida Power & Light Co. _____)

St. Lucie Plant, Unit 2 _____)
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November 6, 2014

SECOND SUPPLEMENTAL DECLARATION OF ARNOLD GUNDERSEN

Under penalty of perjury, I, Arnold Gundersen, hereby declare as follows:

INTRODUCTION

1. My name is Arnold Gundersen. I am Chief Engineer for Fairewinds Associates, a paralegal services and expert witness firm. I have been retained by Southern Alliance for Clean Energy (SACE) to evaluate safety and licensing issues related to the replacement steam generators (RSGs) that Florida Power & Light Co. (FPL) installed in the Unit 2 St. Lucie nuclear reactor in 2007.
2. I previously submitted two declarations in this proceeding: Declaration of Arnold Gundersen (March 9, 2014) (Gundersen Declaration), attached to Southern Alliance for Clean Energy's Hearing Request Regarding De Facto Amendment of St. Lucie Unit 2 Operating License (March 10, 2014); and Supplemental Declaration of Arnold Gundersen (April 25, 2014) (Supplemental Gundersen Declaration), attached to Southern Alliance for Clean Energy's Amended Hearing Request Regarding *De Facto* Amendment of St. Lucie Unit 2 Operating License (April 25, 2014).
3. The purpose of my Declaration and Supplemental Declaration was to support two contentions by SACE challenging the lawfulness of the U.S. Nuclear Regulatory Commission's (NRC's) *de facto* amendment of the operating license for St. Lucie Unit 2 to allow operation of Unit 2 with substantially re-designed replacement steam generators (RSGs). In my declarations, I identified at least five major design changes that FPL made to its original steam generators (OSGs). I also showed that these design changes were approved by the NRC Staff without

offering the public an opportunity for a public hearing. Finally, I explained the basis for my conclusion that the design changes made by FPL to its OSGs exceed the design basis for Unit 2 and pose an unacceptable risk to public health and safety. The statements of fact I made in those declarations continue to be true to the best of my knowledge, and the statements of my professional opinion in those declarations continue to be accurate expressions of my best professional judgment.

4. The purpose of this Second Supplemental Declaration is to explain how and why the conclusions I reported in my Declaration and Supplemental Declaration regarding the safety risks posed by the St. Lucie Unit 2 RSGs are supported by FPL's recently released report of the results of the steam generator inspection conducted during the spring 2014 refueling outage. FPL's report, which I will refer to as "2014 S.G. Inspection Report," is attached to a letter from FPL to the NRC dated September 18, 2014 (ML14279A237).
5. To summarize, in my professional opinion, the 2014 S.G. Inspection Report shows that degradation of the St. Lucie Unit 2 steam generators continues at an unacceptable rate and poses an unreasonable health and safety risk to the public. Although the rate of steam generator degradation at St. Lucie Unit 2 between 20120 and 2014 has decreased from the rate observed in previous inspections, it nevertheless is greater than at any other nuclear power plant in the U.S. And the cumulative rate of degradation is far greater than at any other U.S. nuclear power plant. As demonstrated by Figure 1, most nuclear reactor generators show minimal if any degradation at all during their operating lives. It is reasonable to anticipate that deterioration of the Unit 2 RSGs will continue in the future, and that they will need to be replaced before the end of the operating license term for St. Lucie Unit 2. Furthermore, the degraded condition of the steam generators increases the likelihood of a severe accident damaging the nuclear reactor core.

II. BACKGROUND

6. As summarized in my Supplemental Declaration, my review of correspondence and documents related to St. Lucie Unit 2 steam generators shows that FPL made at least five major design changes to the steam generators for St. Lucie Unit 2 when it replaced them in 2007.
 - 6.1. First, the RSGs no longer contained the stay cylinders that were part of the original steam generator (“OSG”) design discussed in the Final Safety Analysis Report (“FSAR”) as structural support for the reactor coolant system and included in the Aging Management Program (AMP).
 - 6.2. Second, documents related to subsequent inspections of the St. Lucie Unit 2 steam generators show that AREVA added 588 new tubes to the original 8,411 tubes, now totaling 8,999 tubes. The addition of 588 new tubes changes the pattern of water and steam circulation in the steam generator and therefore has significant safety implications.
 - 6.3. Third, FPL replaced the pre-existing eggcrate tube supports with trefoil broached plates, despite the fact that such plates were specifically excluded from the original steam generator design for safety reasons.
 - 6.4. Fourth, in order to accommodate the 588 new tubes, it is reasonable to infer that the region of the tubesheet that had been directly above the stay cylinder was now perforated with 588 new holes.
 - 6.5. Finally, the RSG design includes, for the first time, “steam nozzle venturis.” The purpose of steam nozzle venturis is to limit the rate at which steam (mass and energy) leaves the RSG in the event of a steam line break accident. The fact that FPL included this new component in the RSG design demonstrates that the mass and energy flow rate from the RSGs is greater than the mass and energy flow rate from the OSGs. As discussed in my Supplemental Declaration, this design change alone

constitutes a change to an important safety parameter that should have been analyzed and treated as a license amendment.

7. As discussed in my previous declarations, all of these changes have major safety significance and exceed the reactor's design basis.
8. As also discussed in my previous declarations, it is my professional opinion that these design changes not only increase the damage to the steam generator tubes but also increase the risk of steam generator failure and therefore have an adverse effect on public health and safety.
9. Even before the latest refueling outage inspection in 2014, the two St. Lucie Unit 2 RSGs showed the most tube degradation of any steam generators in the nation. The rate of tube degradation in the St. Lucie Unit 2 steam generators between 2009 and 2012, measured in 2012, was very high. The total number of tubes exhibiting wear increased 81%, from 2,046 in 2009 to 3,714 in 2012. As reported in a September 2012 NRC inspection report, completed before the 2012 refueling outage, an astonishing 25% of steam generator tubes (2,211 out of 8,999 tubes) in steam generator A (SG A) showed 7,646 wear indications. In steam generator B (SG B), 17% of steam generator tubes (1,503 out of 8,999 tubes) showed 3,988 wear indications. Gundersen Declaration, par. 37.
 - 9.1. St. Lucie Unit 2 also has a high proportion of severely degraded tubes. FPL has plugged more tubes at St. Lucie Unit 2 during the past 7 years than have been plugged at any other operating plant in the United States.

III. 2014 STEAM GENERATOR TUBE INSPECTION

10. In March 2014, FPL conducted a 100% steam generator tube inspection in SG A and SG B. The results of the inspection show that during the 18-month period between the 2012 and the 2014 outages and inspections, tube denting indications in SG A increased by 4% of the total tubes (from 31% to 35%). In SG B, tube

denting increased from 18% to 22% of the total tubes for a net increase of 4%. The rate of increased denting indications between 2012 and 2014 was 14% for SG A and 17% for SG B. A detailed breakdown of the number of tubes that were found dented in 2012 compared to the number of tubes that were found dented in 2014 is attached to this report and labeled as Tables 1 and 2.

11. According to the 2014 S.G. Inspection Report, the St. Lucie Unit 2 steam generator tubes that are dented exceed 20% of the wall thickness and therefore are given a special inspection category that should be considered seriously damaged. In SG A, the number of tubes with denting that exceed 20% has increased at a rate of 17% from 599 to 700, just since the last steam generator inspection only 18-months ago. The 2012 steam generator inspection showed that 7% of the tubes were damaged. Now this new report details that the March 2014 inspection showed serious damage to 8% of the tubes in SG A. Similarly, tubes with denting that exceed 20% of the total dented tubes in SG B have increased from 126 in 2012 to 157 in 2014. This increase in dented tubes equals a 23% rate of increase during the 18-month interval between inspections. A detailed breakdown of the number of tubes seriously dented in 2012 compared to the number of tubes found to be seriously dented in 2014 is assembled in Table 3 and attached to this report.
12. Unfortunately, the 2014 S.G. Inspection Report does not analyze the significant differences in serious damage between SG A and SG B, nor to my knowledge has the NRC Staff made such an analysis.

IV. ANALYSIS

13. Steam generator tubes are expected to be smooth and are not designed with dents in them. Quite simply, any tube denting is a real indication of damage to the integrity of the tube. Tube denting damage can be caused when the tubes violently vibrate and hit surrounding structures, called anti-vibration bars. As the

tubes continue to vibrate against the anti-vibration bars, the gap between the tube and the bars will increase due to the damage that is already occurring. As this gap widens, both in-plane and out-of-plane vibration can occur. Eventually, these in-plane and out-of-plane vibrations will lead to tube-to-tube damage. Thus, once the process of tube vibration begins, it often becomes exacerbated.

14. I am concerned that the rate of steam generator tube deterioration in St. Lucie Unit 2, although decreased from previous outages, continues to be extraordinarily high compared to other steam generators nationwide. Figure 1 shows that most reactors experience little or no steam generator degradation throughout time periods of operation spanning decades. During the normal operating lifetime of a steam generator, the rate of degradation during its operating life is not likely to exceed 4% of the total tubes in the entire steam generator. In comparison, the percent of increased damage experienced by the St. Lucie Unit 2 SG A during just the last 18 months between inspections is 4% and the total damage in only 6-years is 35%.
15. I continue to believe the unprecedented and extraordinarily high level of steam generator tube degradation that has occurred in the St. Lucie Unit 2 RSGs since they were installed is directly attributable to the design changes that FPL made in 2007 and NRC Staff approved without a license amendment.
16. The cumulative steam generator degradation in Unit 2 is also a matter of serious safety concern. In March 2014, the cumulative degradation in SG A was 35% of all tubes, and the cumulative degradation in SG B was 22% of all tubes. These are astronomical figures, considering that most steam generators experience almost no degradation. The high level of cumulative degradation, combined with the fact that some degradation continues, raises the concern that a fundamental design problem is causing the degradation. Unless and until FPL and the NRC Staff conduct a thorough analysis of the RSG designs and how the rate of degradation could be stopped or significantly slowed, it is reasonable to assume that it will continue. As a result, it is also reasonable to assume that the safety

performance of the steam generators will continue to decline, putting public safety at risk.

17. An additional safety concern is raised by the fact that a significant portion of SG A tubes are seriously damaged.
 - 17.1. While the damage in SG B is less than the damage in SG A, the damage in SG B is still greater than that in any other steam generator in the country other than St. Lucie Unit 2 SG A. The data in the 2014 S.G. Inspection Report show that St. Lucie Unit 2 is operating with SG A and B as the most damaged steam generators at any operating nuclear power plant in the nation.
 - 17.2. The high rate of steam generator tube deterioration at St. Lucie Unit 2 raises safety concerns because of the important safety role played by steam generators. For instance, the more compromised the condition of the steam generators becomes, the greater is the chance for a steam generator tube rupture accident. According to FPL's own Individual Plant Examination (IPE) for St. Lucie 2, Steam Generator Tube Rupture is one of the ten most likely precursors to damage of the nuclear reactor core. IPE Figure 1.4-1 on Page 1.0-7 (December 31, 1993) (Fiche No. 77517:02-77519:084).
18. I disagree with some statements that FPL has made in the press about the St. Lucie Unit 2 steam generators. According to the April 4, 2014 Tampa Bay Times, Florida Power and Light spokesperson Michael Waldron said, *"As we've said all along, steam generators usually see wear early in their life and that wear attenuates with time. There is no need to replace the steam generators at the St. Lucie plant anytime in the near future."* Mr. Waldron does not have a basis for favorably comparing the St. Lucie Unit 2 steam generators to other steam generators in the U.S. As discussed above, the St. Lucie Unit 2 steam generators are deteriorating at a far higher rate than any other steam generators in the

country. Moreover, as discussed above in Section II, once a pattern of vibration has been established, it often becomes exacerbated.

19. Mr. Waldron also lacks a factual basis for saying that there is no need to replace the St. Lucie Unit 2 steam generators at any time in the near future. The high cumulative rate of degradation, combined with the significant degradation that has occurred between 2012 and 2014, are far more indicative of a shortened steam generator life than a fully useful one. In any event, Mr. Waldron does not identify any technical analysis conducted by FPL or the NRC Staff regarding the likelihood that the Unit 2 steam generators will need to be replaced. To my knowledge, no such analysis has been conducted.

End

I declare that under penalty of perjury that the testimony submitted in this proceeding is true and correct to the best of my knowledge. The facts presented in this declaration are true and correct to the best of my knowledge, and the opinions expressed are based on my best professional judgment.

Executed in Accord with 10 CFR 2.304 (d),

(Electronically signed)

Arnold Gundersen, MSNE, RO
Fairewinds Associates, Inc
Burlington, Vermont 05401
Date: November 6, 2014

ATTACHMENTS:

Table 1: *St. Lucie Unit 2: A Steam Generator Tube Denting Indications*

Table 2: *St. Lucie Unit 2: B Steam Generator Tube Denting Indications*

Table 3: *St. Lucie Unit 2: A Steam Generator Serious Tube Damage*

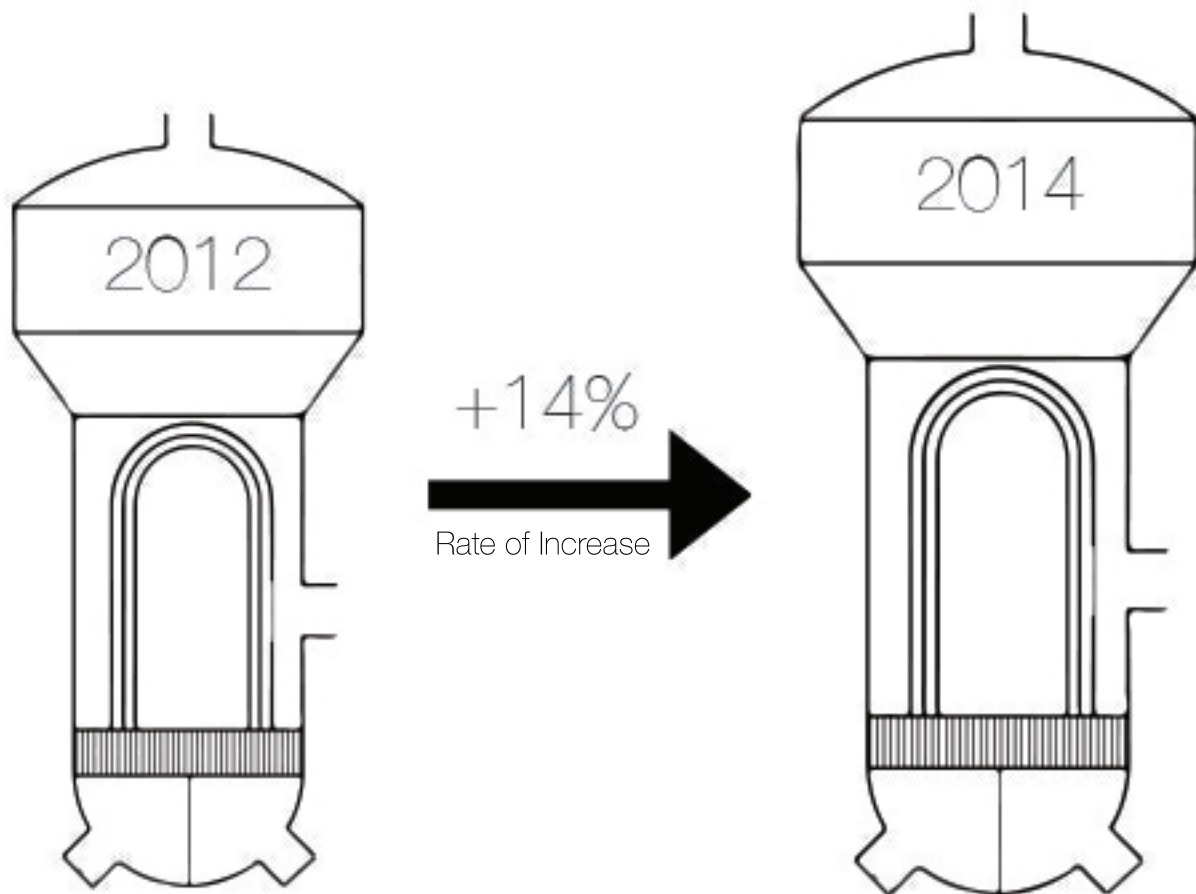
Table 4: *St. Lucie Unit 2: B Steam Generator Serious Tube Damage*

Figure 1: Number of Damaged Steam Generator Tubes, *FAR OUTSIDE THE NORM: The San Onofre Nuclear Plant's Steam Generator Problems in the Context of the National Experience with Replacement Steam Generators*, by Daniel Hirsch and Dorah Shuey with a Foreword by Dale Bridenbaugh, September 12, 2012, Figure 4, Page 14, <http://www.committeetobridgethegap.org>

Table 1

St. Lucie Unit 2 : **A** Steam Generator

Tube Denting Indications



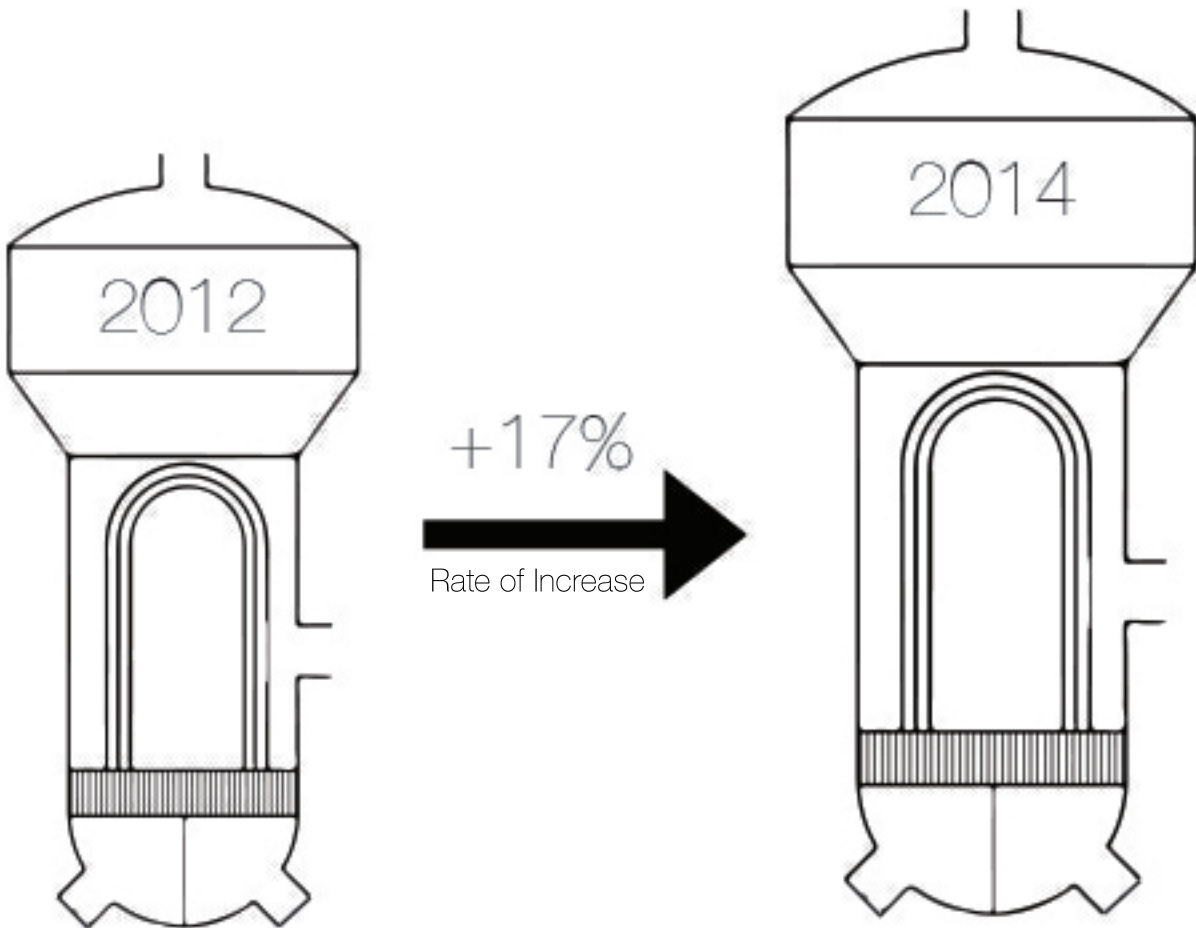
Total Steam Generator Tubes with Tube Denting Indications at Anti-Vibration Bar

Year	Steam Generator	# of tubes	% of tubes (8,999 total)	Change since previous year	% Increase over previous inspection
2012	A	2,809	31%		
2014	A	3,207	35%	+398	14%

Table 2

St. Lucie Unit 2 : **B** Steam Generator

Tube Denting Indications



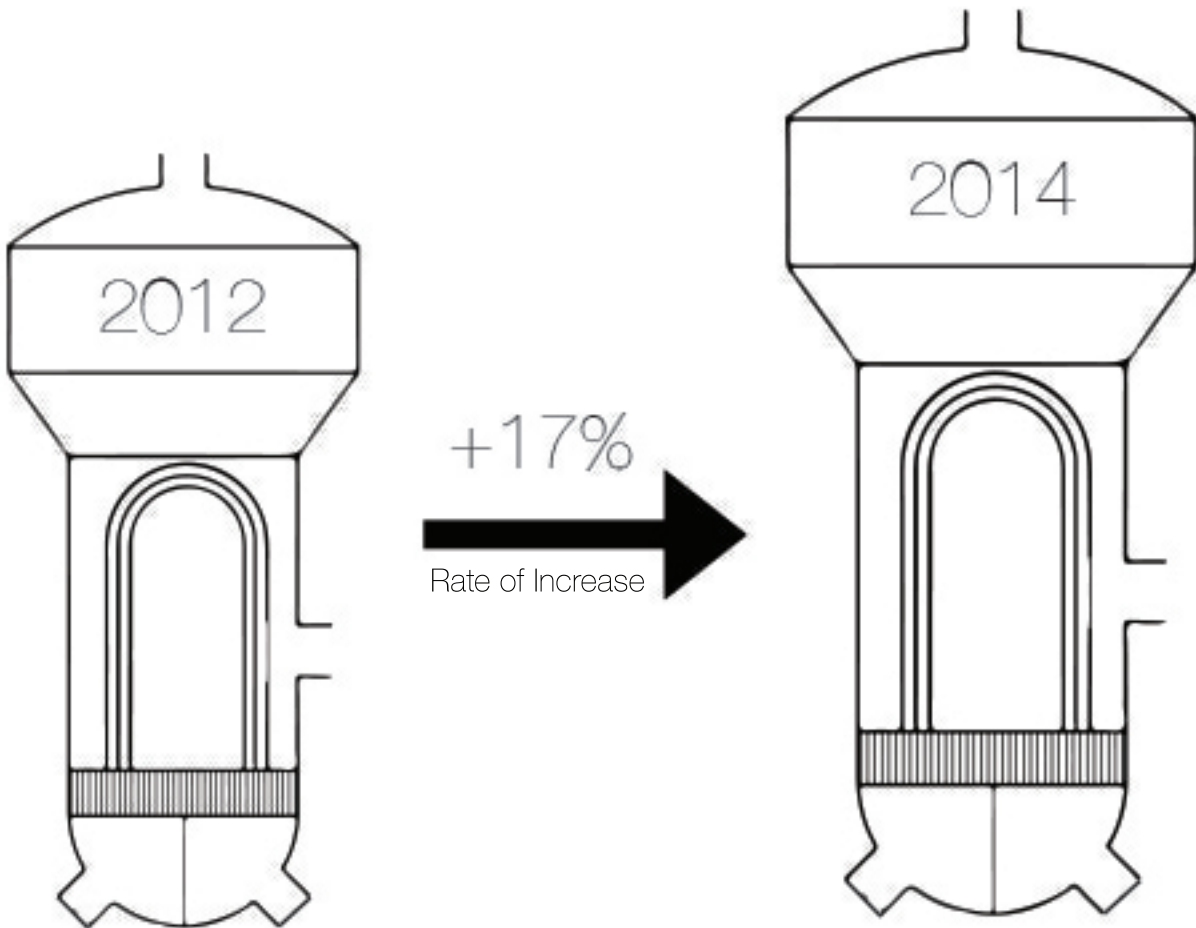
Total Steam Generator Tubes with Tube Denting Indications at Anti-Vibration Bar

Year	Steam Generator	# of tubes	% of tubes (8,999 total)	Change since previous year	% Increase over previous inspection
2012	B	1,656	18%		
2014	B	1,938	22%	+282	17%

Table 3

St. Lucie Unit 2 : **A** Steam Generator

Serious Tube Damage



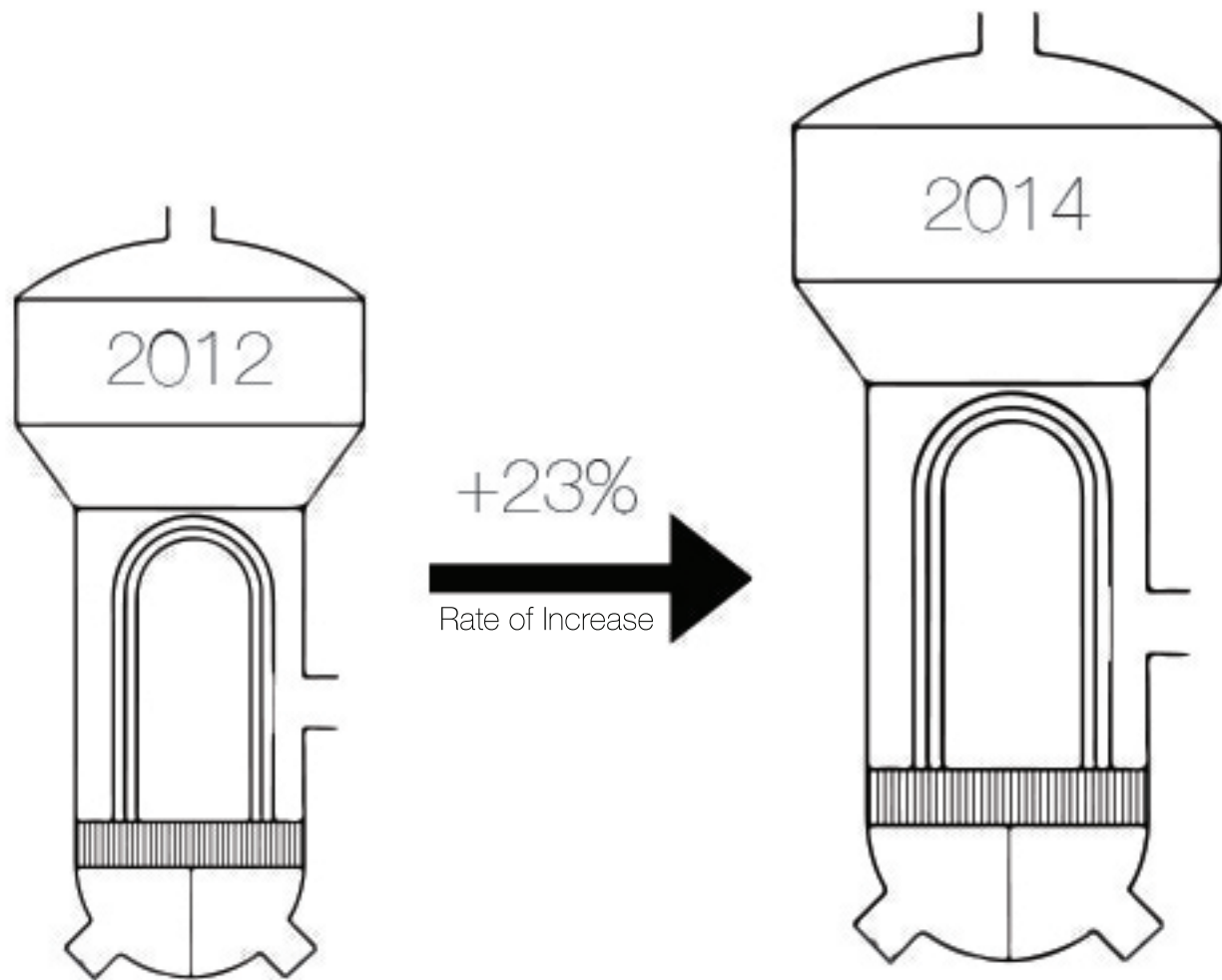
Steam Generator Tubes with Serious Anti-Vibration Bar Damage (> 20%)

Year	Steam Generator	# of tubes (8,999 Total)	% of tubes	Change since previous year	% Increase over previous inspection
2012	A	599	7%		
2014	A	700	8%	+101	17%

Table 4

St. Lucie Unit 2 : **B** Steam Generator

Serious Tube Damage

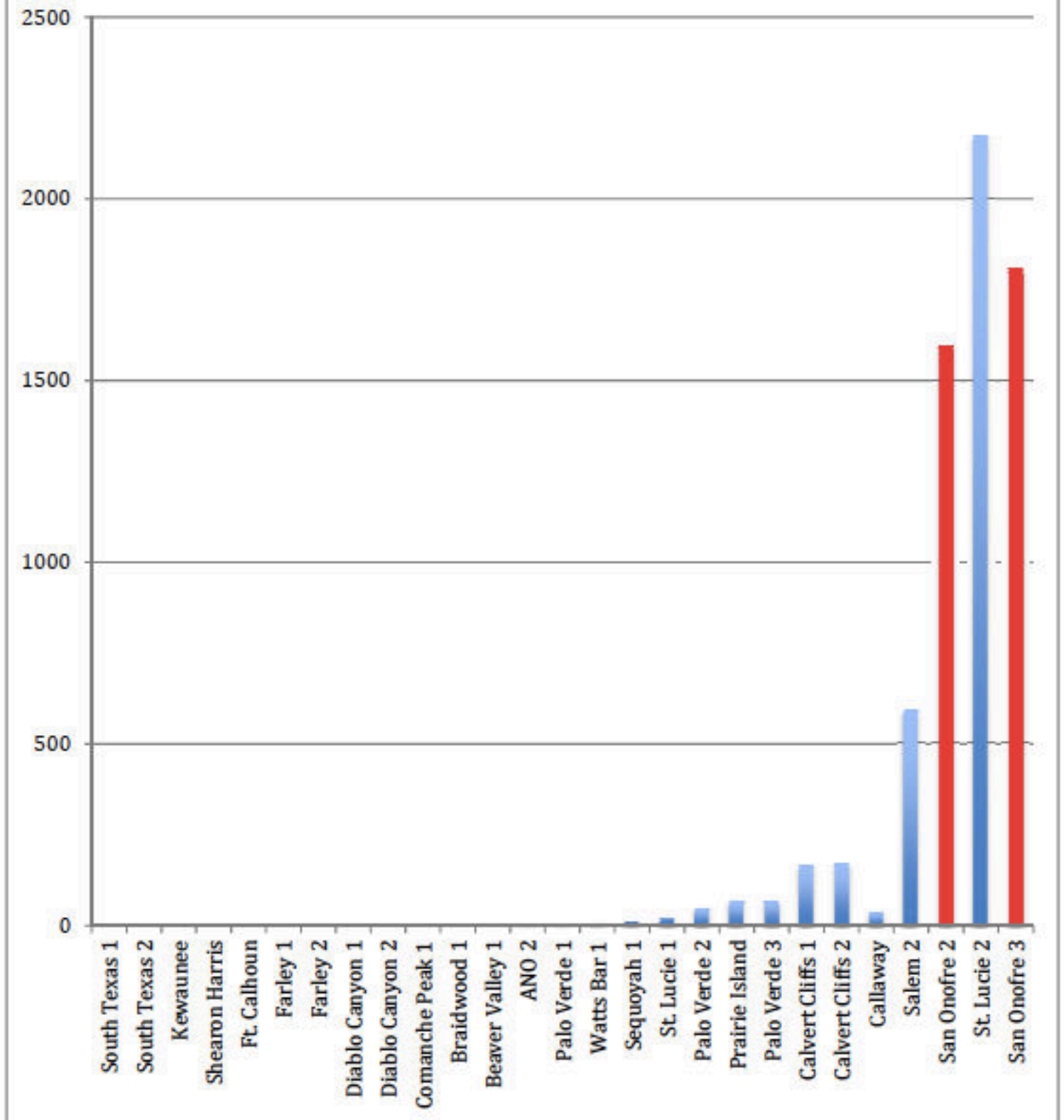


Steam Generator Tubes with Serious Anti-Vibration Bar Damage (> 20%)

Year	Steam Generator	# of tubes (8,999 Total)	% of tubes	Change since previous year	% Increase over previous inspection
2012	B	126	1.4%		
2014	B	157	1.7%	+31	23%

Figure 1

Number of Damaged Steam Generator Tubes



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CERTIFICATE OF SERVICE

I certify that on November 6, 2014, I served copies of the foregoing SOUTHERN ALLIANCE FOR CLEAN ENERGY'S MOTION FOR LEAVE TO AMEND HEARING REQUEST WITH SECOND SUPPLEMENTAL DECLARATION OF ARNOLD GUNDERSEN on the parties to this proceeding by posting it on the NRC's Electronic Information Exchange.

(Electronically signed by)

Diane Curran