SAN ONOFRE:
FAR OUTSIDE THE NORM

February 7, 2013
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Note: The views presented here are those of the author and do not necessarily represent those of UCSC or CBG.

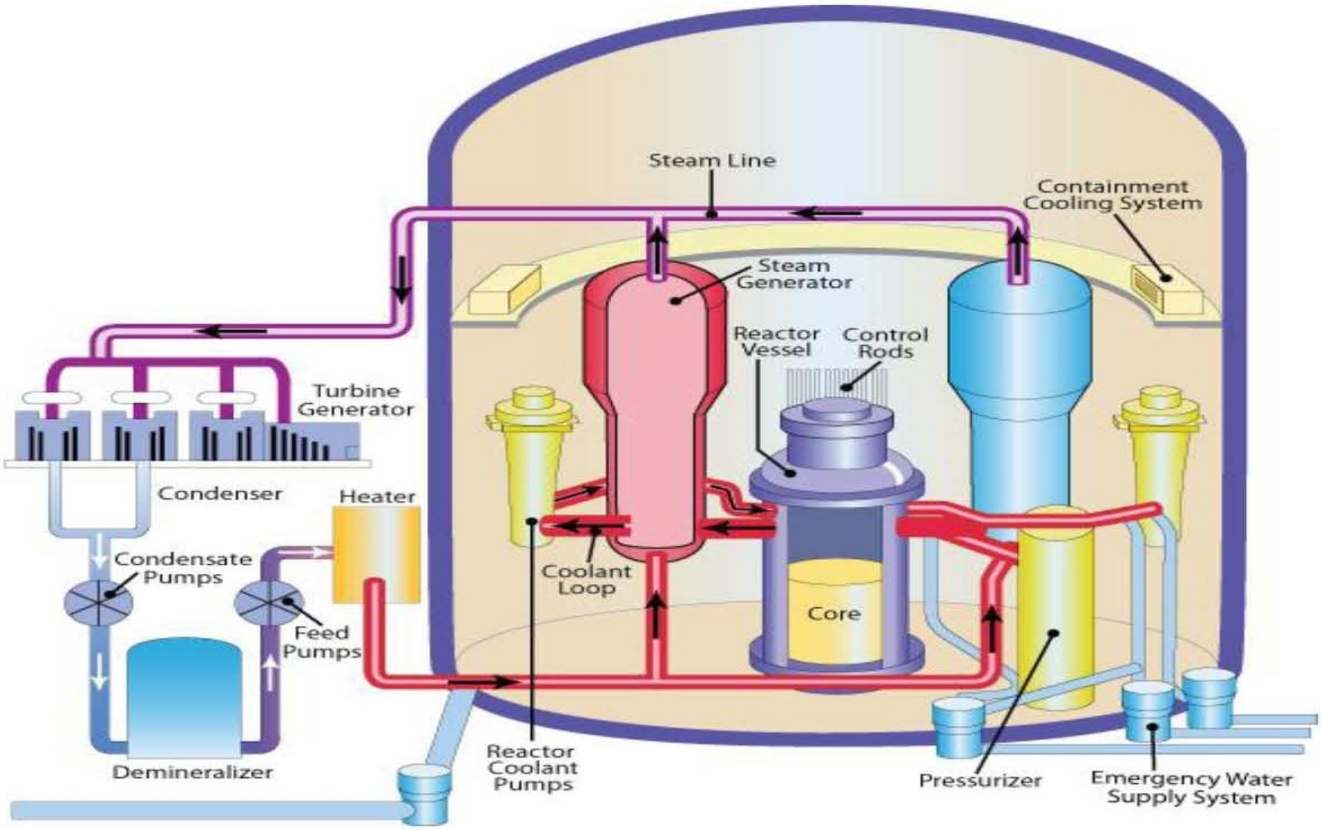
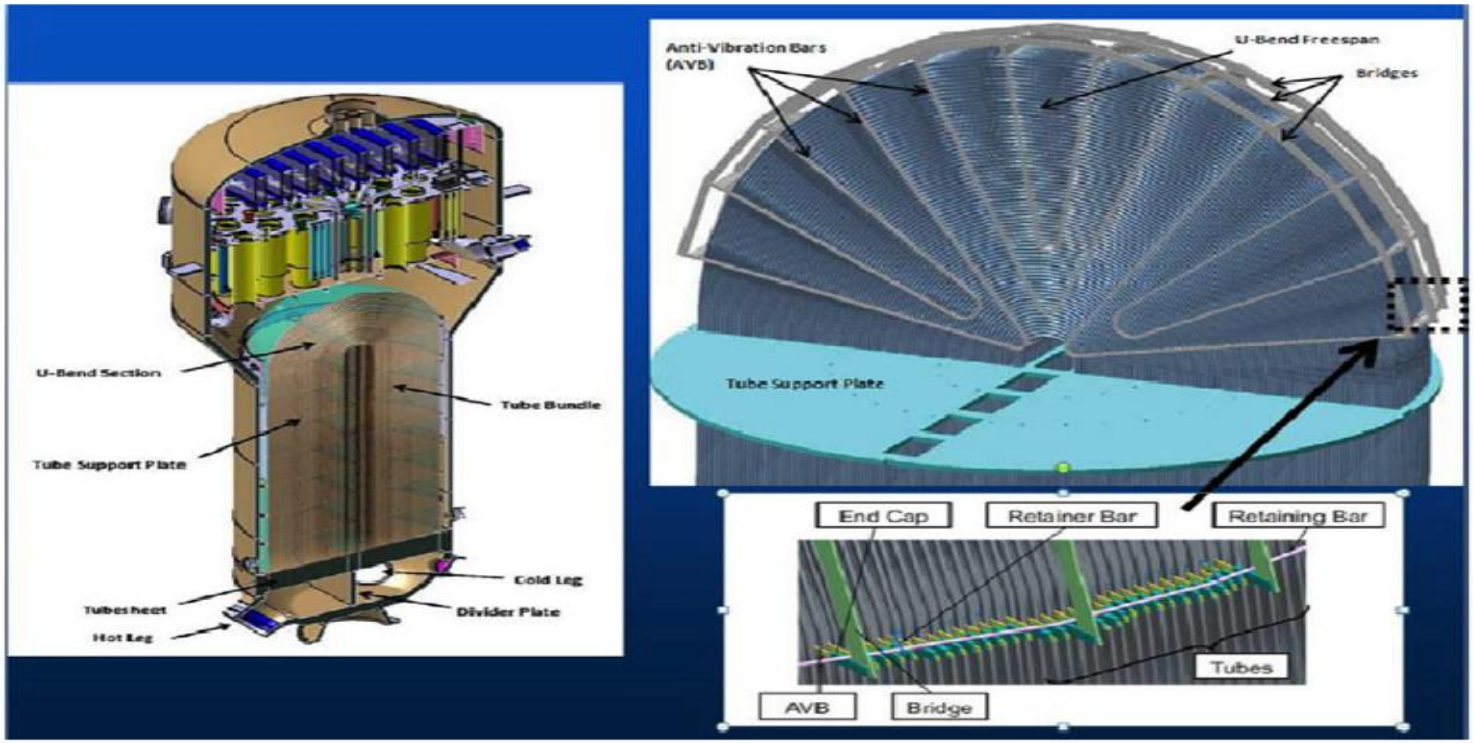

Steam Line
Containment Cooling System
Steam Generator
Reactor Vessel
Control Rods
Turbine Generator
Condenser
Heater
Condensate Pumps
Feed Pumps
Coolant Loop
Core
Demineralizer
Reactor Coolant Pumps
Pressurizer
Emergency Water Supply System

Figure 1 San Onofre Replacement Steam Generator Schematic



Source: NRC[iii]

EDISON MAKES TWO CLAIMS TO SUPPORT ITS REQUEST FOR RESTARTING UNIT 2.

FIRST: “The wear in Unit 2 is far less extensive than the wear in Unit 3” and “Unit 3 had more than 300 tubes with the unexpected tube-to-tube wear; Unit 2 only had two tubes exhibiting minor tube-to-tube wear.”

SONGS Unit 2 Steam Generators
Wear Depths Summary

Steam Generator SG2E88 (Through-Wall Wear)	Anti-Vibration Bar	Tube Support Plate	Tube-to-Tube Wear	Retainer Bar	Foreign Object	Total Indications	Tubes with Indications (out of 9727 total per SG)
≥ 50%	0	0	0	1	0	1	1
35 - 49%	2	0	0	1	0	3	3
20 - 34%	86	0	0	0	2	86	74
10 - 19%	705	108	0	0	0	813	406
< 10%	964	117	0	0	0	1081	600
TOTAL	1757	225	0	2	2	**1984**	**734***

Steam Generator SG2E89 (Through-Wall Wear)	Anti-Vibration Bar	Tube Support Plate	Tube-to-Tube Wear	Retainer Bar	Foreign Object	Total Indications	Tubes with Indications (out of 9727 total per SG)
≥ 50%	0	0	0	1	0	1	1
35 - 49%	0	0	0	1	0	1	1
20 - 34%	78	1	0	3	0	82	67
10 - 19%	1014	85	2	0	0	1101	496
< 10%	1499	53	0	0	0	1552	768
TOTAL	2591	139	2	5	0	**2737**	**861***

* This value is the number of tubes with wear indications of any depth and at any location. Since many tubes have indications in more than one depth and location, the total number of tubes is less than the total number of indiations.

Source: NRC[ix]

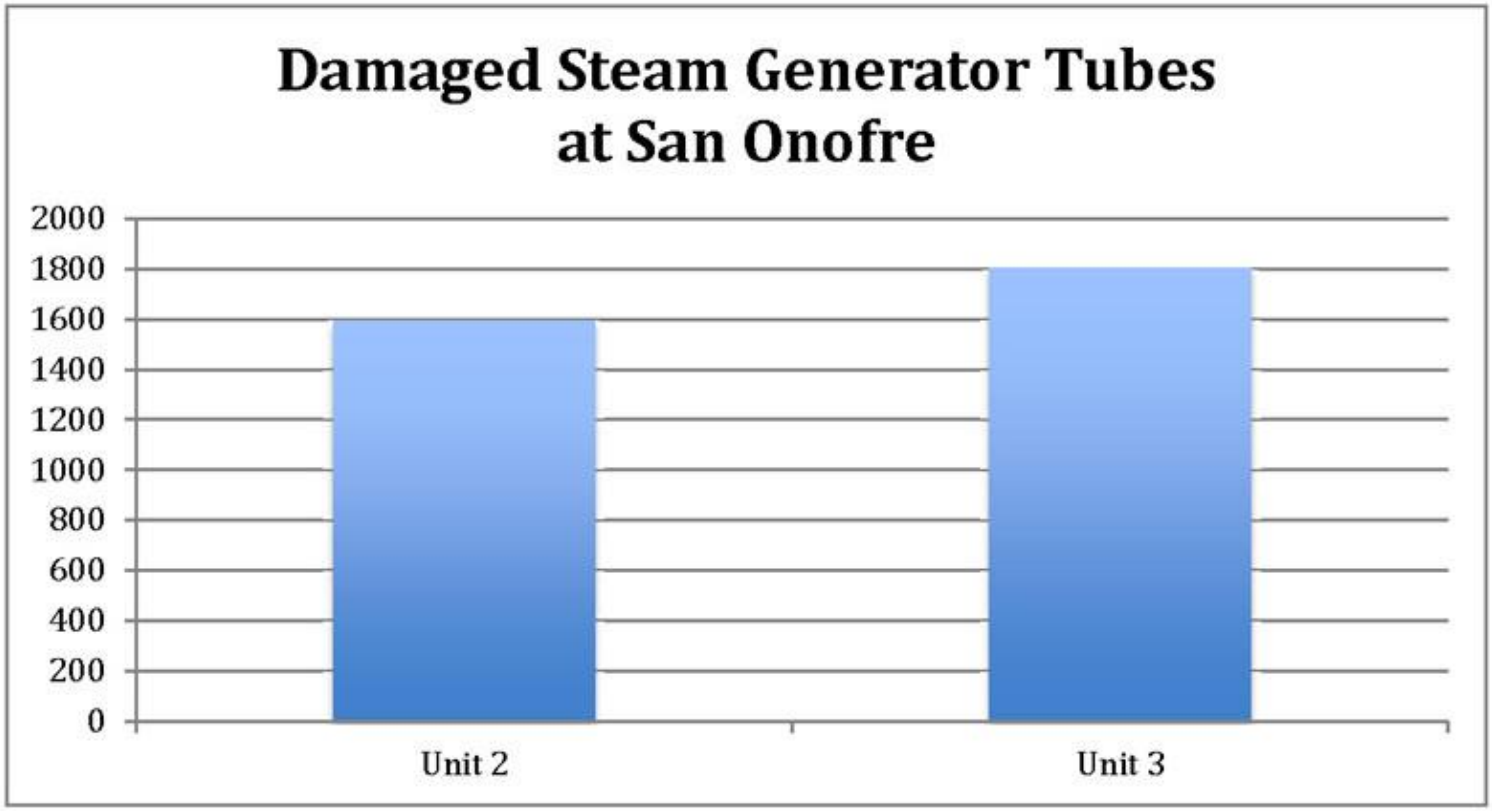
SONGS Unit 3 Steam Generators
Wear Depths Summary

Steam Generator SG3E88 (Through-Wall Wear)	Anti-Vibration Bar	Tube Support Plate	Tube-to-Tube Wear	Retainer Bar	Foreign Object	Total Indications	Tubes with Indications (out of 9727 total per SG)
≥ 50%	0	117	48	0	0	165	74
35 - 49%	3	217	116	2	0	338	119
20 - 34%	156	506	134	1	0	797	197
10 - 19%	1380	542	98	0	0	2020	554
< 10%	1818	55	11	0	0	1884	817
TOTAL	3357	1437	407	3	0	5204	919*

Steam Generator SG3E89 (Through-Wall Wear)	Anti-Vibration Bar	Tube Support Plate	Tube-to-Tube Wear	Retainer Bar	Foreign Object	Total Indications	Tubes with Indications (out of 9727 total per SG)
≥ 50%	0	91	26	0	0	117	60
35 - 49%	0	252	102	1	0	355	128
20 - 34%	45	487	215	0	0	747	175
10 - 19%	940	590	72	0	0	1602	450
< 10%	2164	94	1	0	0	2259	838
TOTAL	3149	1514	416	1	0	5080	887*

* This value is the number of tubes with wear indications at any depth and at any location. Since many tubes have indications in more than one depth and locations, the total number of tubes is less than the total number of indications.

Source: NRC[x]

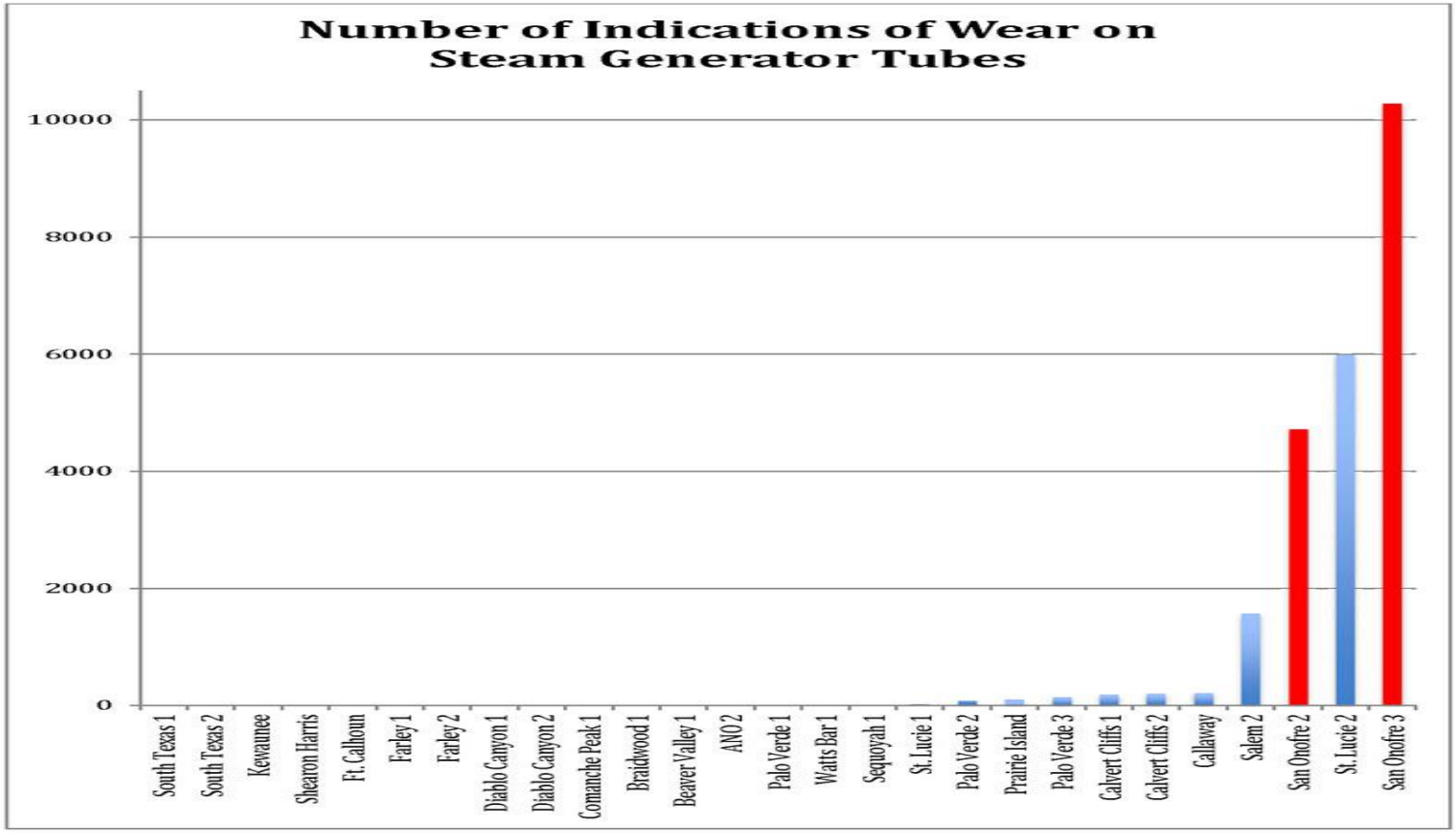

Damaged Steam Generator Tubes
at San Onofre
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Unit 2
Unit 3

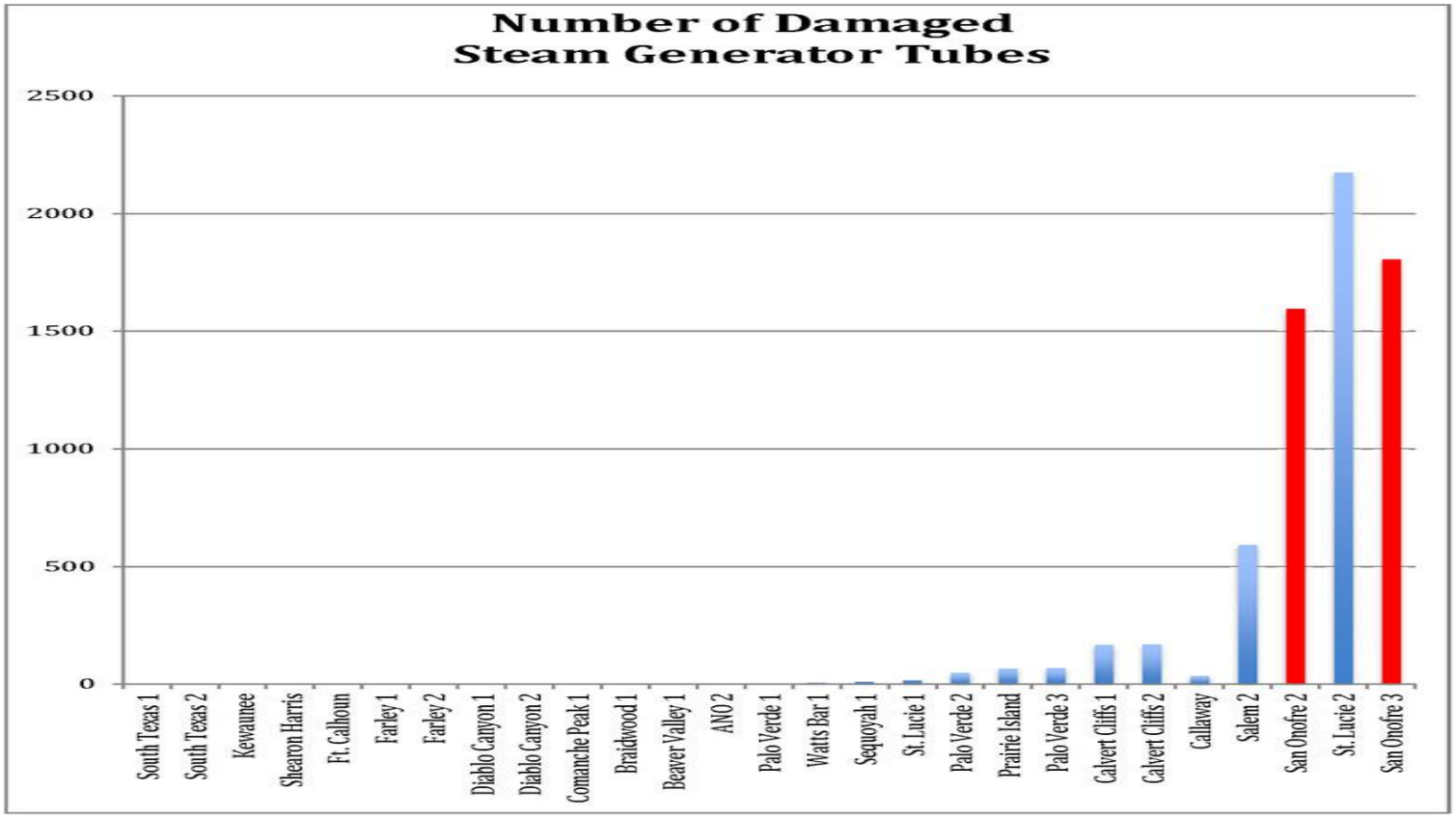
Second SCE Assertion:

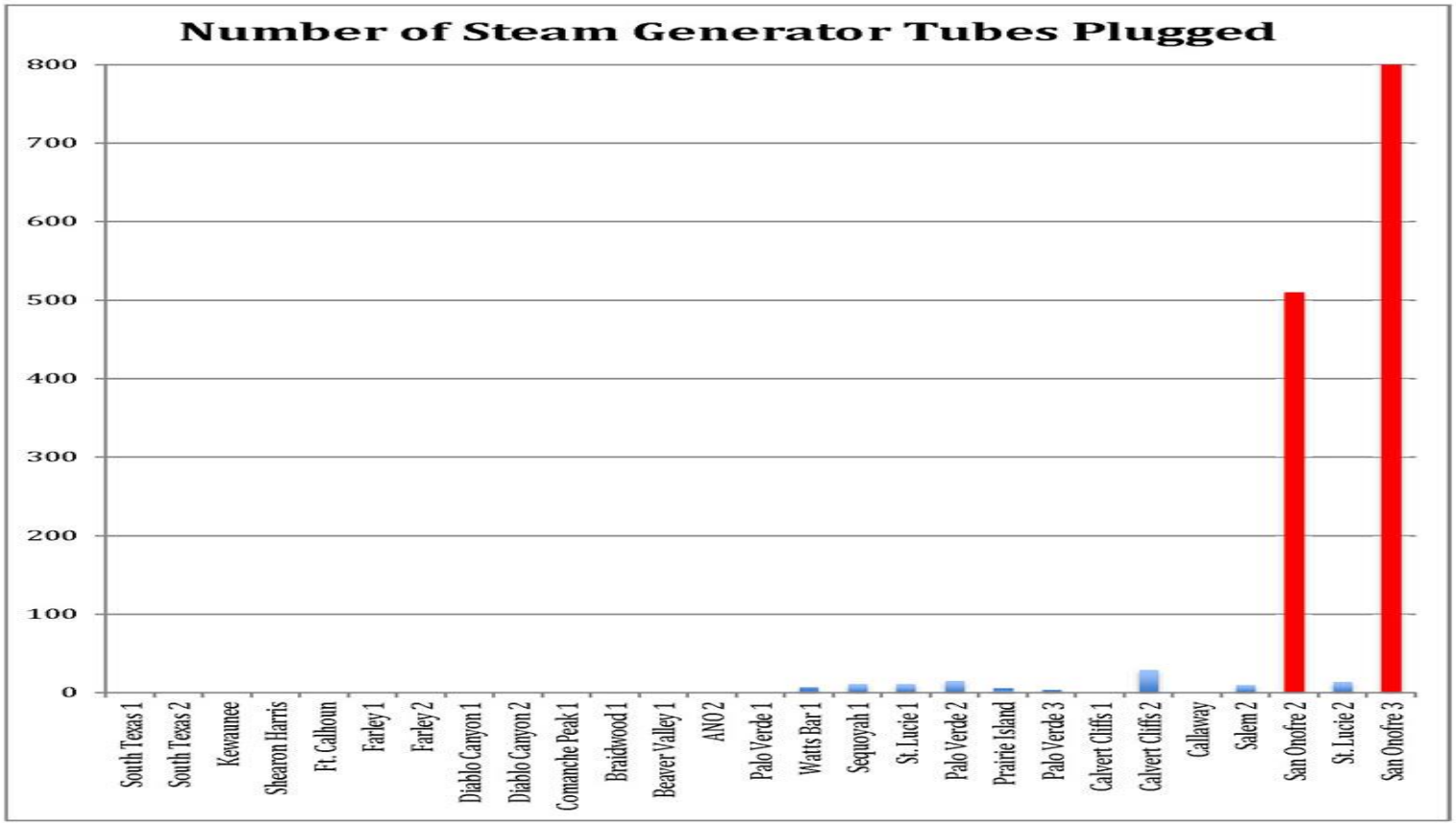
"The nature of the support structure wear is not unusual in new steam generators and is part of the equipment settling in."

Source: S. Cal. Edison Press Release, July 13, 2012

Nuclear Plant	# of Wear Indications	# of Damaged Tubes	# of Tubes Plugged	Total Tubes
South Texas 1	0	0	0	31,540
South Texas 2	0	0	0	30,340
Kewaunee	0	0	0	7,184
Shearon Harris	0	0	0	18,921
Ft. Calhoun	0	0	0	10,400
Farley 1	0	0	0	10,776
Farley 2	0	0	0	10,776
Diablo Canyon 1	1	1	0	17,776
Diablo Canyon 2	1	1	0	17,776
Comanche Peak 1	1	1	0	22,128
Braidwood 1	1	1	1	26,532
Beaver Valley 1	2	1	1	10,776
ANO 2	3	3	0	21,274
Palo Verde 1	4	4	0	25,160
Watts Bar 1	9	6	7	20,512
Sequoyah 1	11	11	11	19,932
St. Lucie 1	19	17	11	17,046
Palo Verde 2	81	48	15	25,160
Prairie Island	104	67	6	9,736
Palo Verde 3	140	68	4	25,160
Calvert Cliffs 1	189	166	0	16,942
Calvert Cliffs 2	200	170	29	16,942
Callaway	214	36	0	22,144
Salem 2	1,567	591	10	20,192
San Onofre 2	**4,721**	**1,595**	**510**	19,454
St. Lucie 2	5,994	2,174	14	17,998
San Onofre 3	**10,284**	**1806**	**807**	19,454


Number of Indications of Wear on Steam Generator Tubes
10000
8000
6000
4000
2000
0
South Texas 1
South Texas 2
Kewaunee
Shearon Harris
Ft. Calhoun
Farley 1
Farley 2
Diablo Canyon 1
Diablo Canyon 2
Comanche Peak 1
Braidwood 1
Beaver Valley 1
ANO 2
Palo Verde 1
Watts Bar 1
Sequoyah 1
St. Lucie 1
Palo Verde 2
Prairie Island
Palo Verde 3
Calvert Cliffs 1
Calvert Cliffs 2
Callaway
Salem 2
San Onofre 2
St. Lucie 2
San Onofre 3


Number of Damaged
Steam Generator Tubes
2500
2000
1500
1000
500
0
South Texas 1
South Texas 2
Kewaunee
Shearon Harris
Ft. Calhoun
Farley 1
Farley 2
Diablo Canyon 1
Diablo Canyon 2
Comanche Peak 1
Braidwood 1
Beaver Valley 1
ANO 2
Palo Verde 1
Watts Bar 1
Sequoyah 1
St. Lucie 1
Palo Verde 2
Prairie Island
Palo Verde 3
Calvert Cliffs 1
Calvert Cliffs 2
Callaway
Salem 2
San Onofre 2
St. Lucie 2
San Onofre 3


Number of Steam Generator Tubes Plugged
800
700
600
500
400
300
200
100
0
South Texas 1
South Texas 2
Kewaunee
Shearon Harris
Ft. Calhoun
Farley 1
Farley 2
Diablo Canyon 1
Diablo Canyon 2
Comanche Peak 1
Braidwood 1
Beaver Valley 1
ANO 2
Palo Verde 1
Watts Bar 1
Sequoyah 1
St. Lucie 1
Palo Verde 2
Prairie Island
Palo Verde 3
Calvert Cliffs 1
Calvert Cliffs 2
Callaway
Salem 2
San Onofre 2
St. Lucie 2
San Onofre 3

THE MEDIAN NUMBER OF STEAM GENERATOR TUBES SHOWING WEAR AFTER ONE CYCLE OF OPERATION NATIONALLY IS—

FOUR.

SAN ONOFRE UNIT 2 HAD 1595 DAMAGED TUBES, APPROXIMATELY 400 TIMES THE MEDIAN. SAN ONOFRE UNIT 3 HAD 1806.

THE MEDIAN NUMBER OF WEAR INDICATIONS ON STEAM GENERATOR TUBES AFTER ONE CYCLE OF OPERATION IS—

FOUR.

SAN ONOFRE UNIT 2 HAD 4721, GREATER THAN A THOUSAND TIMES MORE. SAN ONOFRE UNIT 3 HAD 10,284.

THE MEDIAN NUMBER OF STEAM GENERATOR TUBES THAT WERE PLUGGED AFTER ONE CYCLE OF OPERATION IS—ZERO.

SAN ONOFRE UNIT 2 HAD 510; UNIT 3 HAD 807.

SCE's CAL Response States:

"The actions to operate at reduced power and shut down for a mid-cycle inspection within 150 cumulative days of operation are *interim compensatory actions*.

“SCE will reevaluate these actions during the mid-cycle inspection based on the data obtained during the inspections.

"In addition, SCE has established a project team to develop and implement a *long term plan for repairing the SGs*."

(emphasis added)

Conclusion

It would be unwise to permit restart of San Onofre Unit 2 with its crippled steam generators that need repair or replacement without in fact repairing or replacing them.