



OCT 05 2007

SERIAL: HNP-07-139
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U. S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

Subject: SHEARON HARRIS NUCLEAR POWER PLANT, UNIT NO. 1
DOCKET NO. 50-400 / LICENSE NO. NPF-63

IMPACT OF ERRORS IN THE SECPOP2000 COMPUTER CODE ON
THE SEVERE ACCIDENT MITIGATION ALTERNATIVES ANALYSIS
FOR SHEARON HARRIS NUCLEAR POWER PLANT LICENSE
RENEWAL

References: 1. Letter from Cornelius J. Gannon to the U. S. Nuclear Regulatory
Commission (Serial: HNP-06-136), "Application for Renewal of Operating
License," dated November 14, 2006

Ladies and Gentlemen:

On November 14, 2006, Carolina Power & Light Company, doing business as Progress Energy Carolinas, Inc., requested the renewal of the operating license for the Shearon Harris Nuclear Power Plant, Unit No. 1, also known as the Harris Nuclear Plant (HNP), to extend the term of its operating license an additional 20 years beyond the current expiration date. The application contained an analysis of Severe Accident Mitigation Alternatives (SAMAs) for the plant.

The SAMA analysis was performed using standard computer codes, including SECPOP2000, which was written for the NRC by Sandia National Laboratory. In mid-2007 three errors were discovered in the SECPOP2000 code. The errors resulted in changes to certain values reported in the SAMA analysis, but did not result in changes regarding cost-effectiveness of any SAMA. A discussion of the impacts of these errors is contained in the Enclosure to this letter.

Progress Energy Carolinas, Inc.
Harris Nuclear Plant
P. O. Box 165
New Hill, NC 27562

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NRR

Please refer any questions regarding this submittal to Mr. Roger Stewart, Supervisor - License Renewal, at (843) 857-5375.

I declare, under penalty of perjury, that the foregoing is true and correct
(Executed on **OCT 05 2007**).

Sincerely,



Christopher L. Burton
Director - Site Operations
Harris Nuclear Plant

CLB/jsk

Enclosure: Discussion of the Impact of Errors in the SECPOP2000 Computer Code on the Severe Accident Mitigation Alternatives Analysis for Shearon Harris Nuclear Power Plant License Renewal

cc:

Mr. P. B. O'Bryan (NRC Senior Resident Inspector, HNP)
Ms. B. O. Hall (Section Chief, N.C. DENR)
Mr. M. L. Heath (NRC License Renewal Project Manager, HNP)
Ms. M. G. Vaaler (NRC Project Manager, HNP)
Dr. W. D. Travers (NRC Regional Administrator, Region II)
Mr. Samuel Hernandez (NRC Environmental Project Manager, HNP)

**Discussion of the Impact of Errors in the SECPOP2000 Computer Code on
the Severe Accident Mitigation Alternatives Analysis for Shearon Harris
Nuclear Power Plant License Renewal**

In May 2007 Progress Energy was notified that an error had been discovered in the computer code SECPOP2000 (SECPOP), a program prepared for NRC by Sandia National Laboratories. That error resulted in the format of the SECPOP output file, which was designed to be directly used as the input site file for MACCS2, being incompatible with MACCS2 input format specification for regional economic data. The error resulted in incorrect county agriculture and economic data values being input into MACCS2. The error affected the numerical results (but not conclusions) of the Shearon Harris Nuclear Plant (HNP) License Renewal Environmental Report Severe Accident Mitigation Alternatives (SAMA) analysis.

Progress Energy contractors prepared an evaluation of the impact of the SECPOP error on the SAMA results entitled "SAMA Revision Regarding Incompatible SECPOP 2000 and MACCS2 File Formats." It concluded that "...corrections to the SECPOP input had a minimal impact on the averted cost-risk estimates and did not alter the conclusions for any of the Phase 2 SAMAs..." With regard to the effect on quantification (thus cost-effectiveness), the evaluation noted that although "net values" were affected by the correction, "...there were no changes to the conclusions for any of the SAMAs." In other words, none of the Phase 2 SAMAs became cost-effective as a result of the input correction.

In mid-July, Progress was notified of another SECPOP computer code problem. The second problem related to the way SECPOP county regional economic database entries were coded, specifically the absence of most county "note" entries. Although this entry is not used in the analysis, its absence resulted in SECPOP reading every other affected county entry (for most of the counties). This caused SECPOP to output county regional economic data for counties that shouldn't have been included in place of those that should have been.

After correcting the SECPOP data base by including "notes" for each county and revising the site file input into MACCS2 (which incorporated both the corrected data base and corrected output format), Progress Energy contractors reran MACCS2. The table below shows the baseline risks after this revision, along with the corresponding risks from the original analysis and the previous revision. With respect to both dose-risk and cost-risk, the revision 1 to revision 2 increases were both less than 1 percent. The revision 2 ("notes") error, therefore, had almost no effect on the averted cost and no effect on the conclusions for the evaluated SAMAs.

Baseline Risks for Harris LR ER SAMA as Affected by SECPOP Errors			
Revision	Dose Risk (person-rem/Ryr)	Cost Risk (\$/Ryr)	Notes
0	28.97	43,030	Original submittal
1	28.97	51,800	Corrects SECPOP format specification problem
2	29.18	52,060	Corrects SECPOP "notes" entry problem + revision 1
3	29.03	58,770	Corrects SECPOP county code numbering problem + revision 2

A third SECPOP problem was identified in August 2007. This error was the result of the way county census codes were numbered in the SECPOP data base. The SECPOP code assumed sequential numbering, but some code numbers were missing in the data base, as some counties were "erased" (merged with adjoining counties) between censuses. These deleted counties caused the wrong counties to be selected by SECPOP for many sites. Progress Energy contractors determined that the HNP results were again affected. A subsequently corrected data base, which added "null" counties corresponding to the missing codes, was used to evaluate the impact of this SECPOP error on the HNP SAMA results. As shown in the table above, after this correction (revision 3) the baseline dose-risk decreased from the previous revision (revision 2) by 0.5 percent and the cost-risk increased by 13 percent. More than 99.5 percent of the \$6,710 per reactor-year cost risk increase was from sequences RC-5 and RC-5C.

After rerunning MACCS2, incorporating corrections to all three known SECPOP2000 problems, Progress Energy contractors determined the revised conditional dose and economic costs associated with each of the accident scenarios considered in the HNP SAMA analysis. The Harris modified Maximum Averted Cost Risk (MACR) (accounts for external events) was then recalculated to ascertain the potential impact on the SAMA analysis. The modified MACR based on the mean Probabilistic Risk Assessment (PRA) results increased from \$3,510,000 to \$3,988,000 (13.6 percent increase). The 95th percentile PRA results sensitivity case was also recalculated and it was determined that the modified MACR increased from \$5,265,000 to \$5,982,000 (also a 13.6 percent increase). The changes to the modified MACR estimates did not impact the Phase I screening of the existing SAMAs.

In addition to its use as a Phase I screening tool, the MACR is also used to set the risk reduction worth (RRW) review threshold that is used to limit the depth of the importance list review. In this case, the increase in the MACR resulted in a reduction in the Core Damage frequency (CDF)

based RRW review threshold from 1.014 to about 1.013, which required the review of six events that were not addressed in the SAMA submittal. All six of the events are directly related to other events that were reviewed as part of the original analysis or imply the importance of a function that is already addressed by the existing SAMAs. No new SAMAs are required to address these events.

Finally, the SECPOP errors also impacted the averted cost-risks that were calculated for each of the SAMAs. The following table provides a summary of the impact of using the corrected results in conjunction with the mean PRA results in the detailed cost-benefit calculations that were performed.

Results Summary for Correction of SECPOP2000 Errors 1 Through 3 (Mean PRA Results)

SAMA ID	Cost of Implement- ation	Averted Cost- Risk (Base)	Net Value (Base)	Averted Cost- Risk (Post SECPop Corrections)	Net Value (Post SECPOP Corrections)	Change in Cost Effective- ness?
SAMA 1	\$1,000,000	\$389,627	-\$610,373	\$390,555	-\$609,445	No
SAMA 2	\$200,000	\$53,062	-\$146,938	\$58,896	-\$141,104	No
SAMA 3	\$565,000	\$34,204	-\$530,796	\$34,116	-\$530,884	No
SAMA 4	\$150,000	\$62,238	-\$87,762	\$61,906	-\$88,094	No
SAMA 6	\$150,000	\$111,240	-\$38,760	\$111,118	-\$38,882	No
SAMA 7	\$1,700,000	\$81,860	-\$1,618,140	\$81,890	-\$1,618,110	No
SAMA 8	\$300,000	\$298,979	-\$1,021	\$299,047	-\$953	No
SAMA 9	\$70,000	\$93,614	\$23,614	\$94,486	\$24,486	No
SAMA 10	\$50,000	\$11,222	-\$38,778	\$10,680	-\$39,320	No
SAMA 11	\$400,000	\$8,604	-\$391,396	\$8,030	-\$391,970	No
SAMA 12	\$275,000	\$60,584	-\$214,416	\$61,364	-\$213,636	No
SAMA 13	\$225,000	\$111,148	-\$113,852	\$111,570	-\$113,430	No
SAMA 15	\$250,000	\$93,974	-\$156,026	\$97,734	-\$152,266	No
SAMA 16	\$400,000	\$6,048	-\$393,952	\$5,446	-\$394,554	No
SAMA 17	\$500,000	\$52,820	-\$447,180	\$59,800	-\$440,200	No
SAMA 18	\$175,000	\$35,886	-\$139,114	\$40,488	-\$134,512	No
SAMA 19	\$50,000	\$9,384	-\$40,616	\$8,782	-\$41,218	No
SAMA 21	\$3,350,000	\$407,428	-\$2,942,572	\$408,120	-\$2,941,880	No
SAMA 22	\$350,000	\$65,813	-\$284,188	\$74,775	-\$275,225	No

As demonstrated in the table, the corrections to the SECPOP2000 input had a minimal impact on the averted cost-risk estimates and did not alter the conclusions for any of the Phase 2 SAMAs that are based on the mean PRA results.

In addition to the review of the mean PRA results estimates, it was necessary to examine how the 95th percentile PRA results quantifications were impacted given that they were also used to identify potentially cost beneficial SAMAs. The following table provides a summary of the cost benefit calculations using the corrected SECPOP2000 input in conjunction with the 95th percentile PRA results. As with the mean PRA results, there were no changes to the conclusions for any of the SAMAs.

Results Summary for Correction of SECPOP2000 Errors 1 Through 3 (95th Percentile PRA Results)

SAMA ID	Cost of Implement- ation	Averted Cost- Risk (Base)	Net Value (Base)	Averted Cost- Risk (Post SECPop Correction)	Net Value (Post SECPop Correction)	Change in Cost Effective- ness?
SAMA 1	\$1,000,000	\$584,441	-\$415,560	\$585,833	-\$414,168	No
SAMA 2	\$200,000	\$79,593	-\$120,407	\$88,344	-\$111,656	No
SAMA 3	\$565,000	\$51,306	-\$513,694	\$51,174	-\$513,826	No
SAMA 4	\$150,000	\$93,357	-\$56,643	\$92,859	-\$57,141	No
SAMA 6	\$150,000	\$166,860	\$16,860	\$166,677	\$16,677	No
SAMA 7	\$1,700,000	\$122,790	-\$1,577,210	\$122,835	-\$1,577,165	No
SAMA 8	\$300,000	\$448,469	\$148,469	\$448,571	\$148,571	No
SAMA 9	\$70,000	\$140,421	\$70,421	\$141,729	\$71,729	No
SAMA 10	\$50,000	\$16,833	-\$33,167	\$16,020	-\$33,980	No
SAMA 11	\$400,000	\$12,906	-\$387,094	\$12,045	-\$387,955	No
SAMA 12	\$275,000	\$90,876	-\$184,124	\$92,046	-\$182,954	No
SAMA 13	\$225,000	\$166,722	-\$58,278	\$167,355	-\$57,645	No
SAMA 15	\$250,000	\$140,961	-\$109,039	\$146,601	-\$103,399	No
SAMA 16	\$400,000	\$9,072	-\$390,928	\$8,169	-\$391,831	No
SAMA 17	\$500,000	\$79,230	-\$420,770	\$89,700	-\$410,300	No
SAMA 18	\$175,000	\$53,829	-\$121,171	\$60,732	-\$114,268	No
SAMA 19	\$50,000	\$14,076	-\$35,924	\$13,173	-\$36,827	No
SAMA 21	\$3,350,000	\$611,142	-\$2,738,858	\$612,180	-\$2,737,820	No
SAMA 22	\$350,000	\$98,719	-\$251,281	\$112,163	-\$237,838	No