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**SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 AND 2, LICENSE RENEWAL APPLICATION
EVALUATION OF ERRORS IN THE SEVERE ACCIDENT
MITIGATION ALTERNATIVES ANALYSIS
PLA-6280**

**Docket Nos. 50-387
and 50-388**

*References: 1) PLA-6110, Mr. B. T. McKinney (PPL) to Document Control Desk (USNRC),
"Application for Renewed Operating Licenses Numbers NPF-14 and NPF-22,"
dated September 13, 2006.*

In accordance with the requirements of 10 CFR 50, 51, and 54, PPL requested, in Reference 1, the renewal of the operating licenses for the Susquehanna Steam Electric Station (SSES) Units 1 and 2. Included within Reference 1, Appendix E, Attachment E, is an analysis of Severe Accident Mitigation Alternatives (SAMA).

Recently, three errors were discovered in Sandia National Laboratory's SECPOP2000 computer code used in the SSES SAMA analysis. These errors were identified via communications between PPL contractors performing the SSES Level 3 analysis and the SECPOP2000 code developers. The impacts of the errors on the SSES SAMA analysis were discussed in a teleconference between NRC and PPL on September 12, 2007 and are evaluated in the attached "Evaluation of SECPOP2000 Errors on the Severe Accident Mitigation Alternatives Analysis". This evaluation was performed at the request of PPL Susquehanna, LLC (PPL).

The SSES SAMA analysis was not impacted by the first and third SECPOP errors described in the attachment.

However the SAMA analysis is affected by the second error. When this error was corrected the dose-risk and economic cost-risk both decreased for each of the release categories considered in the SAMA analysis. These reductions are slight and do not yield

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any new cost effective SAMAs nor change the conclusions about any borderline SAMA such that cost benefit calculations would have to be re-performed. Therefore, no additional analysis or revision to previously submitted documents is required to resolve the impacts of the second error on SSES.

There are no new regulatory commitments or changes to existing commitments that are necessary as a result of the attached evaluation. If you have any questions, please contact Mr. Duane L Filchner at (610) 774-7819.

I declare, under penalty of perjury, that the foregoing is true and correct.

Executed on: 10-2-07



For B. T. McKinney

Attachment: Susquehanna Steam Electric Station – Evaluation of SECPOP2000 Errors on the Severe Accident Mitigation Alternatives Analysis

Copy: NRC Region I

Ms. E. H. Gettys, NRC Project Manager, License Renewal, Safety

Mr. R. V. Guzman, NRC Sr. Project Manager

Mr. R. Janati, DEP/BRP

Mr. F. W. Jaxheimer, NRC Sr. Resident Inspector

Mr. A. L. Stuyvenberg, NRC Project Manager, License Renewal, Environmental

Attachment to PLA-6280

**Susquehanna Steam Electric Station
Evaluation of SECPOP2000 Errors
on the
Severe Accident Mitigation Alternatives Analysis**

Susquehanna Steam Electric Station

Evaluation of SECPOP2000 Errors on the Severe Accident Mitigation Alternatives Analysis

ERIN Document
P0464040001-2827

REVISION 0

MACCS2 Analysis

Prepared by: Grant Teagarden Date: Sept 7, 2007
Grant Teagarden

Reviewed by: Mike Saunders Date: 9/7/07
Mike Saunders

MMACR Evaluation

Prepared by: Don MacLeod Date: 9/7/07
Don MacLeod

Reviewed by: Don Vanover Date: 9/7/07
Don Vanover

1.0 SENSITIVITY ANALYSIS: IMPACT OF SECPOP ERROR CORRECTIONS

The SECPOP2000 code is used to process population and economic data to serve as input data for the Level 3 PRA code MACCS2 that is used to support SAMA evaluations. The SECPOP2000 code is sponsored by the NRC and is maintained by Sandia National Laboratory.

After completion of the SSES SAMA analysis, three SECPOP errors were identified that if uncorrected, result in MACCS2 utilizing incorrect data thereby impacting the SAMA cost benefit calculations. The SSES SAMA evaluation was not impacted by the first and third SECPOP errors described in this discussion (i.e., Error #1 and Error #3, respectively), but the analysis is affected by the second error (Error #2). All three errors are discussed below for completeness.

1.1 ERROR #1

In May 2007, a formatting error associated with the SECPOP2000 output file option (which generates a text file for use as an input file to MACCS2) was publicized throughout the industry. The error involves the formatting of the columns in the text file resulting in MACCS2 mis-reading the data. ERIN was aware of this formatting error well before its publication throughout the industry. For the SSES SAMA analysis, PRA staff had manually corrected the alignment of the SECPOP2000 output for proper reading by MACCS2. As a result, the SSES SAMA evaluation is not impacted by this error.

1.2 ERROR #2

In mid-July 2007, an error associated with the formatting of the 1997 economic database file used by SECPOP2000 was discovered by an MACCS2 industry user. This error was discovered when the user attempted to update the database file with new data, and the SECPOP2000 output did not change. Investigation revealed that a formatting error in the database file resulted in SECPOP2000 processing incorrect economic and land use data (i.e., data is output for the wrong counties). The incorrect county selection results in incorrect data being used in MACCS2, ultimately influencing the SAMA cost benefit calculations.

The industry has developed a formatting fix to the SECPOP2000 database, which consists of entering a place holding character ("0") in the comments field of the database so that MACCS2 reads the data fields in the proper order. Verification of correct SECPOP2000 processing incorporating the fix is straightforward in that the SECPOP2000 output can be compared against the database file to confirm that proper county selection has occurred.

The magnitude of the error's impact on the results is different for each site as it depends on the relative difference between the correct county data and incorrect county data read by SECPOP2000, which varies for each county considered. As a result, a site-specific analysis is required to assess the impact on the cost benefit analysis.

1.3 ERROR #3

In early-August 2007, an additional SECPOP2000 error was identified related to the use of the 1997 economic database file. SECPOP2000 was written to process the county data based on a sequential county numbering system; however, there are gaps in the data file. The first gap appears at county number 955 and any county beyond 955 is handled incorrectly by SECPOP2000. This error can be corrected by manipulating the county numbering system in the 1997 economic database file and re-running SECPOP2000; however, SSES was not impacted by this error as all of the relevant county data is located before the data gap at county number 955. As the case for Error #2, verification of correct SECPOP2000 processing incorporating the fix is straightforward in that the SECPOP2000 output can be compared against the database file to confirm that proper county selection has occurred.

2.0 IMPACT ON SSES MMACR (SAMA SUBMITTAL)

Review of the SSES SAMA analysis indicates that correcting Error #2 results in a measurable change to both of the MACCS2 outputs that are used to quantify the SSES Modified Maximum Averted Cost-Risk (MMACR):

- 50 Mile Population Dose
- 50 Mile Economic Cost

After addressing the error, the MACCS2 model was re-quantified and the revised results were used to update the MMACR calculation. The following tables provide a summary of the corrected results for the Unit 1 Post-EPU case (considered to be a bounding evaluation of the changes) compared with the base case. The designator "PE" is used to identify the case in which Error #2 has been corrected.

SECPop2000 Error Correction - Internal Events Results Overview (SSES Unit 1, Post EPU)			
	CDF (/yr)	Dose-Risk (person-rem/yr)	OECR (\$/yr)
Internal Events Results - Base	1.97E-06	1.90	\$11,151
Internal Event Results - Post Error Correction (case PE)	1.97E-06	1.82	\$10,409
Percent Change	0.0%	-4.2%	-6.6%

The following tables provide the release category specific results:

Release Category	H/E	H/I	H/L	M/E	M/I	M/L	L/E	L/I	L/L	LL/I	LL/L	Total
Frequency _{BASE}	1.72E-07	1.59E-07	1.31E-10	0.0E+00	5.38E-07	1.51E-07	1.08E-07	4.87E-07	9.46E-09	1.56E-09	2.22E-08	1.65E-06
Frequency _{PE}	1.72E-07	1.59E-07	1.31E-10	0.0E+00	5.38E-07	1.51E-07	1.08E-07	4.87E-07	9.46E-09	1.56E-09	2.22E-08	1.65E-06
Dose-Risk _{BASE}	0.50	0.25	0.00	0.00	0.79	0.18	0.02	0.16	0.00	0.00	0.00	1.90
Dose-Risk _{PE}	0.49	0.24	0.00	0.00	0.75	0.17	0.02	0.15	0.00	0.00	0.00	1.82
OECR _{BASE}	\$2,632	\$2,099	\$4	\$0	\$5,057	\$995	\$18	\$337	\$9	\$0	\$0	\$11,151
OECR _{PE}	\$2,494	\$1,956	\$3	\$0	\$4,708	\$923	\$16	\$301	\$8	\$0	\$0	\$10,409

Based on these results, the revised internal events MACR can be calculated using the methodology from Section E.4, which yields \$260,700. Given that the base case internal events MACR was developed by rounding the results of this process to the next highest thousand, the same is done here to obtain \$261,000. The MMACR can then be determined by applying the 2.0 multiplier on the internal events results:

**SECPOP2000 Error Correction - MMACR
(Unit 1, Post EPU)**

PE Internal Events Cost-Risk	External Events Multiplier	MMACR
\$261,000	2.0	\$522,000

This result represents a decrease of 5.1% from the base case ($(\$522,000 - \$550,000) / \$550,000 * 100 = -5.1\%$).

For SSES, correction of the SECPOP2000 error resulted in a minor decrease in both the dose-risk and economic cost-risk for each of the release categories considered in the SAMA analysis. Therefore, the net values calculated for each of the SAMA candidates would be slightly reduced. Given that these slight reductions would not yield any new cost effective SAMAs and that they would not change the conclusions about any "borderline" SAMA candidates, the Phase II cost benefit calculations have not been re-performed. It is assumed that all SAMAs identified as cost beneficial would retain their classification as cost beneficial.