

March 30, 2004

MEMORANDUM TO: John Flack, ARREB, RES
THROUGH: Jose Ibarra, ARREB, DSARE, RES */RA/*
FROM: Ronald C. Emrit, ARREB, DSARE, RES */RA/*
SUBJECT: STAFF TRIAL OF CRIC-ET CONSEQUENCE FILES

In accordance with RES Operating Plan Item 1DAC, the trial of the Computational Risk Integration and Conditional Evaluation Tool (CRIC-ET) consequence files has been completed by ARREB and found to be acceptable. These files were generated by Sandia National Laboratory (SNL) under contract FIN Y6532.

Background

The CRIC-ET code is a computer code developed for sensitivity studies of various accident consequence measures to changes in containment response parameters, specifically the Level II and Level III portions of a complete probabilistic risk analysis. CRIC-ET is capable of some limited Latin hypercube sampling error analysis, but its calculational modules are primarily table-lookup calculations, based on the Level II and Level III portions of the NUREG-1150 series of PRAs.

CRIC-ET has not seen much use as a PRA analyst's tool. However, its ability to translate changes in overall core damage frequency or changes in plant damage state frequencies into public risk estimates (person-rem per reactor-year) make it a very useful tool for generic issue screening analysis.

Approach

There are six PRA models loaded into the CRIC-ET code: five NUREG-1150 PRAs, and the LaSalle RMIEP PRA. Thus, the CRIC-ET models include three PWR containment models (large dry, subatmospheric, and ice condenser) and three BWR containment models (Mark I, II, and III). The tabulated consequence calculations are, of course, based on the specific sites for these six plants. However, generic issue screening calculations, as described in the introduction to NUREG-0933, are normally based on a simplified generic site. Specifically, this generic site has a uniform population density of 340 persons per square mile out to 50 miles, and a standard site meteorology based on Joliet, Illinois, which is typical of a location in a central midwest plain.

Thus, the purpose of this project is to load new consequence files into CRIC-ET to match the generic plant site, but keep the existing containment response calculations unchanged. SNL was able to provide such files for five of the six. (The necessary information for the Zion PRA was not readily available.)

For purposes of checkout, all five files were loaded into the CRIC-ET package. All five loaded successfully. Then, a set of calculations were run, using the NUREG-1150 plant damage state frequencies. Two runs were made for each plant model, once with the existing, site-specific parameters, and once with the new, generic site parameters. All ten calculations executed successfully. Thus, it is safe to conclude that these new consequence files will work with the CRIC-ET models. A remaining question is: Are the calculated numbers correct? Since this is primarily a table-lookup calculation, there is no reason to disbelieve them. The credibility of the results depend on the MACCS2 calculations which generated the consequence tables.

However, one "sanity check" was made. In the screening analysis of GI-189, some CRIC-ET calculations were made, and the results were re-normalized by hand to correct for the difference in population density between the generic site and the specific sites used for GI-189 (Sequoyah and Grand Gulf). It was thought that the difference in population density would be the dominant parameter differentiating the generic site analysis from the site-specific analysis, and a hand calculation indicated that the generic site population density was a factor of 1.79 greater than that of the Sequoyah site, and a factor of 8.65 greater than the Grand Gulf site. (The number of significant figures is given for calculational convenience; it is not intended to imply that the ratios are known to this accuracy.) These ratios were then compared to the ratios of generic site person-rem to site-specific person-rem, as calculated in the CRIC-ET tryouts.

Results

Site	Ratio Calculated by CRIC-ET	Ratio from GI-189 Hand Calculation	% Difference
Sequoyah	1.79	2.14	18%
Grand Gulf	9.30	8.65	7%

Conclusion

Compared to most PRA uncertainties, the above results are in reasonable agreement. (It should be noted that the new CRIC-ET calculations are actually more credible than the hand calculation, since the new CRIC-ET files account for non-uniform populations, meteorology, etc., as well as overall population density.) Therefore, it is recommended that the new SNL-generated generic issue screening CRIC-ET consequence files be accepted.

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