Fauske & Associates, Inc.
16W070 West 83rd Street, Burr Ridge, Illinois 60521
Phone: (630) 323-8750 • email: info@fauske.com

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REVISED ACCIDENT SOURCE TERMS: NUREG-1465 vs MAAP 4.0.2

PART I: NUREG-1465 vs MAAP 4.0.2

Technical specifications for commercial nuclear power plants in the United States are currently based on accident source terms presented in regulatory Guides 1.3 (BWR) and 1.4 (PWR). These source terms, which were originally published by the U. S. Atomic Energy Commission [*TID-14844, 1962*], provide releases of fission products from Light Water Reactor (LWR) cores to the containment atmosphere for purposes of calculating 10 CFR part 100 doses. Since the fission products are assumed to be instantaneously available for release and neglect sequence and plant specific features, they provide a conservative estimate of plant source terms.

In recognition of the advances made over the past 30 years in the field of reactor safety and severe accident analysis, the NRC has prepared revised accident source terms for regulatory use [*NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants," (February, 1995).*]. The advantage of the revised source terms is that they reflect time dependent release characteristics associated with postulated core melt accidents, as opposed to using the Reg Guide assumption of instantaneous releases. The release magnitude and timing of the revised source terms were obtained using reference plant analyses for severe accidents contained in NUREG-1150 with supplementary calculations based on the NRC severe accident codes STCP and MELCOR.

As stated in NUREG-1465, an additional advantage of using the revised source terms is that, "The NRC staff also intends to allow credit for removal or reduction of fission products within containment." The time dependent releases presented in NUREG-1465 make it possible to realistically credit fission product retention. This includes retention due to use of engineered safety features such as sprays and filters, or through natural processes, such as aerosol deposition and impaction.

Due to the strong dependence of fission product retention of plant specific features and accident sequence progression, however, NUREG-1465 source terms do not already credit retention. This is left up to the individual licensees. One solution is for the licensees to develop separate hand calculations to estimate fission product retention. Perhaps a better option would be to use EPRI's integrated severe accident code, MAAP 4.0.2.

The advantage of using MAAP 4.0.2 is that, in a single integrated analysis, it will provide time dependent fission product release from the core, transport to the containment, leakage to the reactor or auxiliary buildings, credit for all major engineered safeguard features, and modeling of all active and passive fission product retention mechanisms. Also, most nuclear utilities have already used MAAP to support their Individual Plant Examination (IPE) studies in response to Generic Letter 88-20. Therefore, many utilities currently have both the in-house expertise and requisite input files and plant models for running MAAP. Finally, MAAP 4.0.2 can be easily coupled with the MAAP4-DOSE program to yield immediate estimates of dose to operators in the control room and offsite doses at the site boundary.

Over the past 10 years, MAAP has been used extensively for source term analyses and has been successfully benchmarked against most major experimental studies related to severe accidents as well as against the TMI core melt accident. MAAP has also been developed under a QA program which meets 10CFR50 Appendix B Quality Assurance requirements. Furthermore, numerous comparisons exist in the open literature between MAAP and MELCOR/STCP. Thus, there is a basis for the use of MAAP to generate revised, plant-specific source terms for regulatory applications.

Figure 1 compares directly the timing and magnitude of BWR releases into containment as prescribed in NUREG-1465 with those calculated with MAAP 4.0.2. As shown, while NUREG-1465 provides point estimates of fission product release for specific accident release phases, MAAP provides a continuous, time dependent release calculation. Results from this preliminary comparison indicate that the magnitude and timing of MAAP 4.0.2 releases to containment are similar to those presented in NUREG-1465.

MAAP 4.0.2 calculations of source term release can be used to bound the NUREG-1465 results by accounting for inherent uncertainties in reactor vessel fission product retention. Thus, it is possible to substitute the MAAP releases to containment for those presented in NUREG-1465, then take advantage of the already existing MAAP fission product retention calculations to credit the reduction of fission products within containment as allowed under NUREG-1465.

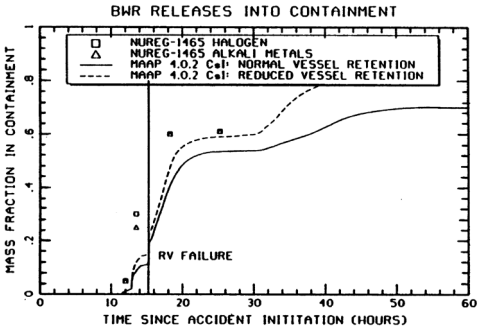

Figure 1 BWR Volatile Fission Product Release into Containment.

Please call to obtain additional information on the MAAP4/NUREG-1465 comparison, MAAP 4 benchmarking, and MAAP 4 analyses to support MSIV leakage or other Tech Spec applications.

Technical Contact:

Chris Henry (630) 887-5258
email: cehenry@fauske.com

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