Notes on the Modified Buildup Factor Generation in CAP88-PC V3, Release of 03/17/06

The CAP88-PC Release version of March 17, 2006 modified the method for implementing buildup factors in CAP88-PC. Earlier releases of version 3 used a calculationally optimized method of generating the buildup factors based upon a (default 100 year) decay and buildup using the standard bateman equations for radioactive decay and progeny ingrowth. This method replaced the buildup factor method from earlier version of CAP88, which used precalculated build-up factors for select decay chains to multiply the isotope concentrations. This method could not be adopted in version 3 because of the much larger number of elements and isotopes, with subsequently much more complex decay chains, in the FGR-13 dataset compared to older versions of CAP88.

Additional research into the buildup methodology used by the previous version of CAP88 determined that the method in place in earlier releases of version 3 was not accounting for the same isotopic release period, nor was it using the same method of accounting for the removal of isotopes that had been deposited on the ground over the (default 100 year) release period, as had been modeled in previous version of CAP88. The method used in previous releases of version 3 was producing very similar results to those from the earlier version of CAP88 for isotopes having long half lives, but was potentially understating the dose from ingestion and ground shine for isotopes with half lives under a year.

The CAP88-PC V3 release of 03/17/06 adopts the build-up factor calculation method from previous version of CAP88, and also retains the capability to allow for variable buildup times that was part of the optimized method used in earlier releases of version 3. The code now calculates the full buildup factor set for all decay chains contained in the FGR-13 isotope database using the calculation method employed to pre-calculate the buildup factor multipliers that were present in earlier versions of CAP88-PC. This buildup calculation is (and in version 3 always has been) done when the dataset input is completed, for example when the “Save and Close” button is pressed on the isotope input screen. The advantage to this change is that the buildup factor calculation is now fully compatible with the approach used in earlier version of CAP88. The drawback to the change is that this calculation is now much more computationally rigorous. For cases where the isotopes on the input nuclide list have short progeny chains, such as I-131, the buildup factor calculation completes within a few seconds. However, for cases where the isotopes on the input nuclide list have long progeny chains, such as U-238, the calculation can be extensive and time consuming. Long lists of those nuclides over multiple stacks can result in buildup factor calculation times in excess of 1 hour.

Execution time for the actual CAP88-PC run after the buildup factor calculation completes has not been significantly affected.