Enclosure 14 to
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Summary of Differences Between ARCON96 and ARCON96-NAI and Between PAVAN and PAVAN-NAI Codes

(3 pages)

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The differences between the ARCON96 and ARCON96-NAI atmospheric dispersion codes may be summarized as follows:

- As described in NUREG/CR-6331 (PNNL-10521) Rev. 1 "Atmospheric Relative Concentrations in Building Wakes," the ARCON96 code was designed to run "from a Visual Basic shell under the DOS operating system." The Visual Basic runtime library that was used was needed for operation of ARCON96 was compatible with Windows 95, Windows 98, and Windows XP. However, it is not compatible with Windows 7 or subsequent versions of the Windows operating system. The ARCON96-NAI code was recompiled by Numerical Applications, Incorporated (NAI, now Zachry Nuclear) to remove dependence on the unsupported Visual Basic runtime.
- A minor output processing error (in which part of the input echo could be overwritten) in ARCON96 was corrected in ARCON96-NAI.

The differences between the PAVAN and PAVAN-NAI atmospheric dispersion codes may be summarized as follows:

- As described in NUREG/CR-2858 (PNL-4413) "PAVAN: An Atmospheric-Dispersion Program for Evaluating Design-Basis Accidental Releases of Radioactive Materials from Nuclear Power Stations," the PAVAN code was "compatible with a CDC 7600 computer system under the NOS 1.0 operating system." The PAVAN-NAI code was recompiled by NAI to allow operation under the Windows 7 operating system.
- Additional functionality was added to the PAVAN-NAI code to optionally allow the meteorological data input to be provided as hourly data in the ARCON96 input format in lieu of the joint frequency distribution (JFD) tables that PAVAN had originally been designed to use. This option was not used for the calculations of relative concentrations at the Exclusion Area Boundary (EAB) and Low Population Zone (LPZ) boundary that were performed in support of the subject license amendment request for implementation of alternative source terms in accordance with 10 CFR 50.67.
- PAVAN-NAI was also modified to process more than two receptor locations within a single run. Likewise, a bug related to using variable boundary distances for each wind direction was corrected.

The process used for verification and validation of the PAVAN-NAI and ARCON96-NAI codes may be summarized as follows:

- The original Oak Ridge National Laboratory Radiation Safety Information Computational Center (RSICC)-delivered versions of PAVAN and ARCON96 were installed according to the included directions. The codes were then dedicated under the Zachry Nuclear QA Program by running the RSICC supplied verification cases.

- PAVAN-NAI and ARCON96-NAI were developed from the original, verified RSICC-delivered versions to incorporate updated output details, cumulative minor fixes, expanded input capability, and recompilation to allow stand-alone implementation (no Visual Basic user interface) for Windows 7.
- A test suite containing the ORNL supplied test cases, as well as a sufficient number of NAI-developed example cases to demonstrate the new or significantly modified features of the NAI installation of the code were utilized for the new code verification and validation. For ORNL supplied and NAI test cases, the acceptance criteria were that the numerical results (the actual X/Q's generated) should not vary by more than a few digits in the last reported X/Q result decimal place. This reflects the nature of modern 64 bit PC processors, and newer compilers which may result in slight computational differences.
- For new edits, and revised edit formats, the acceptance criteria were that the headings should generally match the existing style of the current outputs of the code.
- For the implementation of the new ARCON96 formatted card image input capability for PAVAN-NAI, the acceptance criteria were that the originally formatted (JFD) input process would continue to work without changes, and the new ARCON96 input process should yield equivalent results (should not vary by more than a few digits in the last reported X/Q result decimal place) to a JFD input case for the same met data time period.
- All test cases passed the defined verification criteria and were documented in an NAI software dedication package in accordance with the NAI QA program.