RAMI Modeling of F-Area Ground Water Facility @ SRS

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Reliability, availability, maintainability, and inspectability (RAMI) analysis tool has been used to help control life-cycle cost of several systems and facilities at Savannah River Site (SRS). Recently a RAMI assessment was performed to determine how well the installed F-area Water Treatment Unit (WTU) will meet the established goal for plant availability committed to the State Regulatory Agency, South Carolina Department of Health and Environmental Control (SCDHEC).

The mission of F-area ground water remediation facility at SRS is to reduce concentration of RCRA metals, radio-nuclides and other contaminants in ground water influents to a level where it can safely be returned to the aquifer. The process chosen for treatment of the ground water was determined by review of chemical data, published reports, bench testing as well as discharge requirements that meet commitments made to SCDHEC. Contaminated water is drawn from an underground aquifer located at the F-area seepage basin, pre-filtered through sand filters and then passed through the Reverse Osmosis (RO) system where the ground water is separated into permeate and concentrate. The permeate will have 99% of all suspended solids removed and suitable for discharge to the injection well system. The concentrate is further processed to reduce volume and then disposed of in standard containers.

Per agreement with SCDHEC the unit must operate with an availability of at least 85% including scheduled shutdowns. The unit experienced troubles in meeting this goal from the very beginning. A preliminary RAMI analysis performed after unit commissioning identified problem components and sub-systems and need for redundancy in design of certain systems. Some of these were resolved through procurement of better performing components and elimination of a poor-performing process sub-system that was found to be non-essential. Additionally some new equipment were added to provide for greater operational flexibility. Some regulatory concessions were also negotiated where short duration (<4 hr) maintenance/repair related shut-downs could be ignored for availability computation. A detailed RAMI analysis of the modified unit was then initiated to consider and evaluate all identified operational modes and maintenance policy as well as regulatory relief.

The availability of the unit is estimated using a mathematical model that incorporates the basic RAMI inputs, mean time between failures (mtbf), mean time to repair (mttr) for each system components. The unit was subdivided into total of seven systems where failure in any one will directly impact unit's availability. The model estimates availability at component level and then rolls up to system level. Finally the systems are rolled up to obtain the overall unit availability.

Results from the analysis indicate that some of the systems in their present configuration and under current maintenance policy (only on day shifts and no week-ends) are most likely to cause the WTU to fall significantly short of the 85% target goal. Sensitivity studies with various operation modes, maintenance policies as well as component redundancy were performed. Dominant contributors to unavailability were identified and recommendations were made to

ensure that the availability goal of 85% would be achieved with some margin for unexpected contingencies.