Savannah River Site Nuclear Materials Stabilization & Storage Year 2000 "At Risk" Systems White Paper

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I. Executive Summary

One Nuclear Material Stabilization and Storage (NMSS) roll-up system contains two F-Canyon control systems that are scheduled to attain Year 2000 compliance by 9/30/99, 6 months beyond the desired 3/31/99 date. These 1970s vintage systems, which are integral to the operation and safety of high-level radioactive material processing systems, require both hardware and software modifications. Based upon previous experience with upgrading similar systems, prudent engineering dictates a schedule with sufficient time to procure equipment, conduct rigorous off-line testing including pilot operation of all new hardware, and obtain high quality, accurate documentation. Schedule acceleration, which negatively impacts any of the critical phases in the modification process risks hardware and/or software failures/errors, could significantly extend outages, with cost penalties estimated at \$3 million per week. This is in addition to the increased costs associated with schedule acceleration (i.e., increased need for outside system experts, significant overtime, and additional development equipment). The proposed schedule directed at full Year 2000 compliance by 9/30/99 provides for implementation based upon best engineering and operations judgment, minimal cost and facility disruption, 3 months of normal systems operation prior to 1/1/2000, and a contingency plan, which provides that the facility is maintained in a safe configuration at all times, ensuring no adverse impacts on facility personnel, property, or the general public.

II. Process Overview

The primary mission of Nuclear Materials Stabilization and Storage (NMSS) is the stabilization of plutonium (Pu) and uranium (U) bearing legacy nuclear materials. The F-Canyon Distributed Control System (DCS) and the F-Area Outside Facilities (OF-F) Chemical Handling Programmable Logic Controller (PLC) are independent process control systems used to control a portion of the nuclear material stabilization process. (See the simplified block diagram of the F-Canyon and Outside Facilities processes.)

The purpose of the F-Canyon facility is to recover Pu and U from irradiated targets and Pu/U bearing scrap materials received from onsite and offsite facilities. The F-Canyon DCS is used to monitor and control the 2nd Pu and 2nd U solvent extraction processes used in the process of dissolving, purifying, and stabilizing plutonium and uranium. The F-Canyon DCS provides sequenced process control and an interactive operator graphics interface for evaporator and mixer/settler operations that further decontaminate and concentrate Pu and U solutions. Loss of the F-Canyon DCS system removes the capability of process monitoring/control and suspends process operations, creating problems such as delays in detecting changes in vessel levels from a leak (in or out) or evaporation of solution, potentially allowing an increased and potentially unsafe concentration of nuclear material. When the control system is not operating, other measures (usually manual vs. computer-controlled) are taken to safely monitor and control the process. These measures are typically labor-intensive and usually have a maximum duration by the end of which normal automated process control must be re-established.

The OF-F PLC controls the safe storage and transfer of chemicals such as nitric acid, sodium hydroxide, and hydrofluoric acid to the F-Canyon, FB-Line, and other F-Area nuclear processing facilities. It also provides interactive graphic displays for the chemical handling operators. Loss of the OF-F PLC removes the capability of process monitoring/control and suspends chemical storage and handling operations supporting F-Area facilities. Other measures (usually manual vs. computer-controlled) are

taken to safely monitor and control the process. Like the F-Canyon system, these measures are typically labor-intensive and usually have a maximum duration by the end of which normal automated process control must be re-established.

Both of these systems are essential to safe, effective, and efficient nuclear material stabilization.

III. Concerns Regarding the 3/31/99 Implementation Date

The F-Canyon and chemical handling control systems are 1970s vintage equipment. The vendor has determined that the systems are not Year 2000 compliant, and our tests have confirmed the vendor's findings. The Year 2000 solution requires that these systems be upgraded to a more recent version of hardware and software that is Year 2000 compliant. Over the past 3-4 years, NMSS has worked to upgrade the microprocessor-based control systems to ensure vendor technical, spare parts, and warranty support for hardware/software is available and that NMSS has taken advantage of advances in process control, trending, and reporting capabilities that newer equipment provides. Several NMSS systems onsite such as the 221-F FB-Line DCS and the 221-H DCS have been or are being upgraded. Through these efforts, NMSS has developed proven testing methods and installed/tested software modules for processes and equipment similar to the F-Canyon DCS and OF-F PLC. Experience has demonstrated that rigorous off-line and post-modification testing of hardware and software is the responsible engineering approach to minimizing the risk of process upsets from hardware failures and software errors. This testing includes simulating process signals to/from the control system while operator graphic displays and process sequencing programs are running in order to detect and correct errors. It also allows for hardware operation on a trial basis before the hardware is put into service, reducing the hardware failure rate once the system is installed. Quality software documentation is also critical to adequate maintenance after startup. This documentation is usually the last item completed and compressing the schedule unnecessarily could result in inadequate or poor quality documentation. Historically, this has been a problem in the computer industry.

Based on the NMSS experience noted above, the 3/31/99 milestone is too aggressive to deliver technically sound replacement systems without

increased potential for process upsets. For example, the control system may be asked or programmed to open a valve during a solution transfer; but, because of the shortened time allotted for post-modification testing, a different valve may actually be opened and the solution transferred to the wrong location. Accelerating the schedule would also require an increased number of already scarce technical experts, increase the amount of development equipment required to support these additional resources, and result in extensive overtime pay. The estimated incremental cost increase would be \$350,000. More importantly, an accelerated schedule would limit off-line and post-modification testing efforts and could result in on-line hardware and software failures/errors and an outage extension of many weeks. This could cost an estimated \$3 million per week in lost production and increased life-cycle costs. The accelerated time frame also does not support adequate training of operations, engineering, and maintenance personnel, increasing the probability of human error and subsequent system upsets in the facility. There is also high potential to delay the planned stabilization of 94-1 Nuclear Material (Rocky Flats material), and subsequent facility deactivation due to the high potential for multiple/extended outages.

IV. Proposed Solution

The proposed solution is system replacement and implementation, including all off-line testing, by 9/30/99. This allows for approximately 90 days of 24-hour-per-day, normal system operations prior to 1/1/2000. This solution optimizes the completion of Year 2000 work in as accelerated a schedule as is prudent, considering the previous experience in replacing these types of control systems. This solution balances facility production demands, utilization of critical facility and vendor personnel resources, personnel training needs, and completion of Year 2000 work. Facility outages are also optimized by taking full advantage of the scheduled outages. This solution minimizes the:

- Risk of system failures and process upsets to nuclear facilities
- Risk of multiple/extended facility outages
- Need for development equipment
- Overtime by facility and vendor personnel.

Thus, it represents the lowest cost, lowest risk option for the government and the taxpayer.

V. Recommended Schedule

The project has a start date of 8/1/96 and a completion date of 9/30/99. The identification, assessment, prioritization, and planning stages are complete, and progress continues on schedule. It will take approximately 16 months to complete design, development, and off-line testing prior to installation of the replacement systems. Installation is estimated to take 4 weeks to complete. Installation of this equipment is being integrated into the facility processing schedule and the FY99 Annual Operating Plan to ensure optimal outage efficiency and will include support of other outage needs such as installation of other new/modified equipment, system repairs, and process changes.

VI. Contingency Plans

The proposed solution provides a high confidence level that the required Year 2000 work will be completed by the 09/30/99 schedule dates. In the unlikely event the date is not met, the Year 2000 work will continue until it is complete. The facilities will be kept in a safe configuration until the work is completed.

Contingency planning in F-Canyon and OF-F is a continuous process, and there are a variety of contingency plans for system and component failures. These plans are contained in Alarm Response Procedures, Abnormal Operating Procedures, Emergency Operating Procedures, and Limiting Conditions of Operation. Any failure of any component or system, whether Year 2000-related or not, would invoke one or more of these plans, which would result in actions placing the affected facility in a safe and stable configuration. Contingency plans for the NMSS "At Risk" systems will be completed by 12/18/98.

Activity ID	Early Start	Early Finish	FY97	FY98	FY99
YEAR 2000 IMPLEMENTATION					
NMSS PROGRAM OPERATIONS (NMSSPOPS)					
* INVENTORY					
	01AUG96A	20MAY97A			
* ASSESSMENT					
	21MAY97A	27JUN97A			
* PLANNING					
	01MAY97A	30APR98			
* RENOVATION					
	05FEB98A	31JAN99			
* VALIDATION					
	01JAN99	30SEP99			
* IMPLEMENTATION					
	01SEP98	30SEP99			
NMSS PROGRAM TRNG & DEV (NMSPT&D)					
* INVENTORY					
	01AUG96A	20MAY97A			
* ASSESSMENT					
	21MAY97A	27JUN97A			
* PLANNING					
	01MAY97A	30APR98			
* RENOVATION					
	01FEB98A	01SEP98			
* VALIDATION					
	15JAN99	15FEB99			
* IMPLEMENTATION					
	01SEP98	31MAR99			

Project Start

01JAN97

Project Finish

30SEP99

Date Date

27APR98

Run Date

27APR98

Early Bar

Progress Bar

BASIC SYC

WESTINGHOUSE SAVANNAH RIVER COMPANY

NMSS DIVISION

YEAR 2000 IMPLEMENTATION SCHEDULE

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Revision

Checked

Approved

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Appendix 1 - NMSS Schedule (Page 2 of 3)

Activity ID	Early Start	Early Finish	FY87	FY88	FY89	FY90
SYSSSEP4005	15JAN99*	15FEB99				
SYSSSEP0107	01FEB99*	30SEP99				
SYSSSEP0105	01JUL99*	15SEP99				
SYSSSEP1005	15AUG99*	15SEP99				
IMPLEMENTATION						
SYSSSEP5207	01SEP98*	15MAR99				
SYSSSEP2407	01OCT98*	15MAR99				
SYSSSEP1107	01OCT98*	31MAR99				
SYSSSEP4007	01OCT98*	31MAR99				
SYSSSEP1007	01JAN99*	30SEP99				
NMSS PROGRAM TRNG & DEV (NMSPT&D)			NMSS PROGRAM TRAINING & DEVELOPMENT (NMSPT&D)			
INVENTORY						
SYSSSEP100A	01AUG96A	20MAY97A	2K INVENTOR			
ASSESSMENT						
SYSSSEP102A	21MAY97A	27JUN97A	Y2K ASSESSMEN			
PLANNING						
SYSSSEP0601	01MAY97A	02FEB98A	OFF/F FISHER DCS SIMULATOR - PLANNIN			
SYSSSEP4101	01MAY97A	30APR98	211-H GSE DCS TRAIN/DEVELOPMENT - PLANNIN			
RENOVATION						
SYSSSEP0603	01FEB98A	31AUG98	OFF/F FISHER DCS SIMULATOR - RENOVATIO			
SYSSSEP4103	01MAY98*	01SEP98	211-H GSE DCS TRAIN/DEVELOPMENT - RENOVATIO			
VALIDATION						
SYSSSEP0605	15JAN99*	15FEB99				
SYSSSEP4105	15JAN99*	15FEB99				
IMPLEMENTATION						
SYSSSEP0607	01SEP98*	31MAR99				
SYSSSEP4107	15SEP98*	31MAR99				