

Savannah River Remediation Cost Savings Initiative – 12339

Neil R. Davis

Savannah River Remediation

ABSTRACT

Savannah River enjoyed two years of increased funding as a result of the American Reinvestment and Recovery Act and Department of Energy (DOE) directed scope additions. Moving into FY2012, a much lower funding level is anticipated. In the past, the first response to a reduced funding scenario was to defer scope and slow down the program. This time, Savannah River decided that a better process was needed to try to maximize value to the government. This approach was named the Cost Savings Initiative (CSI). The CSI process is similar to a zero-based budget concept. Every element of work scope was screened to eliminate everything that was not directly related to safety and regulatory compliance. Then the schedules for the regulatory-driven scope were deferred such that the regulatory milestones were achieved just in time with no acceleration. This resulted in a strategy that met regulatory requirements in FY2012-13 with some remaining funding but not in FY2014-15. The remaining funding was then invested in cost savings initiatives in FY2012-13 to reduce the future cost of doing business in the FY2014-15 timeframe and beyond. This resulted in a Strategy that:

- Meets all regulatory commitments;
- Meets some regulatory commitments early; and
- Preserves most of the life cycle savings that were built in to the baseline plan

The CSI process used at Savannah River may be considered for application elsewhere in the DOE Complex.

INTRODUCTION

The Savannah River Site is managed by six separate contracts, one of which is the Liquid Waste (LW) contract. The scope of the LW contract includes the receipt and storage of liquid High Level Waste (HLW), volume reducing HLW to conserve tank space, pretreating HLW in the Defense Waste Processing Facility and in the future Salt Waste Processing Facility, and disposing of the Low Level Waste fraction as saltstone grout. Each fiscal year, LW funding is allocated based on an Integrated Priority List that is developed by both the Department and the LW contractor.

The preliminary funding guidance for all Liquid Waste activities for Fiscal Year (FY) 2012 of \$582 million is significantly less than the \$854 million required to execute the baseline¹ mission. Small funding reductions are usually accommodated by dropping some of the lower priority activities off the bottom of the Integrated Funding List. Large changes, such as the change from an expected \$854 to \$582 million require a new overall strategy with a new Integrated Priority

List. The process used to develop the new strategy and priorities is discussed below as well as the results.

The initial iteration of the CSI process indicated that regulatory requirements could not be met in the FY2014-15 timeframe unless there was an upfront investment in cost savings initiatives to reduce the cost of doing business in the subsequent years. After several iterations, the CSI process led to a strategy that is expected to:

- Meet all regulatory commitments;
- Meet some regulatory commitments early; and
- Preserve most of the life cycle savings that were built in to the baseline plan

FY2012 Funding Guidance

Funding for FY2012 is assumed to be \$582 million (\$527 million new Budget Authority plus \$55 million of carryover). About 40% of the assumed carryover is obligated to ongoing procurements of equipment that will be delivered in FY2012. A flat funding profile of \$552 million of New Budget Authority was assumed for FY2013-2016. The effects of escalation were not considered thus there is a management challenge to continue to reduce costs to offset the effects of escalation.

Buying Power

More important than the actual funding level is the buying power that remains after including the effects of other factors that are beyond SRR's ability to control:

- Cost of goods and services obtained from the site Management and Operations contractor;
- Cost of pension/legacy programs; and
- Introduction of new projects that must be funded from the flat funding profile

These three factors combined to significantly reduce the buying power. As an example, costs for the same level of goods and services increased 45% vs. prior years, pension/legacy costs increased 100% vs. prior years, and a new \$104 million Glass Waste Storage Building was added to the list of projects that must be funded under the assumed flat funding profile.

METHOD

Incremental changes to the previous plan as described in Liquid Waste System Plan (LWSP) revision 16² were not possible given the significant reduction in buying power. An entirely new strategy was needed. In addition, the cost of doing business must be reduced to have any chance of preserving some of the acceleration in LWSP rev 16. Savannah River Remediation (SRR) implemented the following Cost Savings Initiative (CSI) process to make maximum use of the available funding:

- Add in known new scope and pricing that is needed to execute the mission;
- Delete all scope that is not needed to maintain a safe work environment and to meet regulatory requirements;

- Defer all scope to meet regulatory requirements until Just in Time (JIT);
- Price the JIT scope of work;
- Compare the JIT cost to forecasted funding;
- Use the funding available above the JIT cost to implement Cost Savings Initiatives to drive down the cost of doing business in the future; and
- Use the future savings to buy back mission acceleration or to reduce risk

The output of the CSI process is the Recommended Strategy (hereafter referred to as *Strategy*) for the assumed funding profile and associated buying power.

New Technologies

This *Strategy* is a departure from previous exercises of this nature. It is not based on deployment of new technologies or relief from regulations or requirements. Experience has shown that new technologies take several years to mature and deploy and quite often take longer than planned to achieve the expected benefits. In addition, relief from regulations and other requirements seldom materializes. Success in this *Strategy* is based on mature, proven technologies in the current regulatory environment with demonstrated schedule durations. Future costs are based on demonstrated results to ensure high confidence that this *Strategy* can be executed. As a result, every element in this *Strategy* should be reasonably achievable based on current technologies and conditions.

It is acknowledged that additional significant savings can occur if constraints can be relieved. The CSI process identified many cost saving initiatives that are beyond the control of Savannah River, either SRR or the Department of Energy-Savannah River (DOE-SR), that could reduce costs but none of the potential cost savings are included in this *Strategy*. Potential savings are treated as future opportunities.

Just in Time Plan

LWSP revision 16 is based on FY2012 funding in the amount of \$854 million with similar funding in the outyears. This funding profile enabled across the board acceleration of waste treatment, waste disposal and tank closures. A lean funding profile results in decelerating the mission, possibly to the point of regulatory non-compliance. The first step in the CSI process was to determine the minimum scope and schedule to meet two major regulatory requirements:

- Federal Facilities Agreement – requires closure of all 24 old-style waste tanks per a fixed schedule that ends in FY2022; and
- Site Treatment Plan – requires the treatment of all existing and future High Level Waste by the end of 2028.

A brief discussion of each regulatory driver follows.

Federal Facilities Agreement (FFA)

The FFA imposes requirements to remove the bulk waste from the 24 old-style tanks as well as to operationally close (fill with grout) the tanks. The schedule requirements for closing the remaining 22 old-style tanks (2 are already closed) are listed below.

- CY2012 2 tanks (specified as Tanks 18-19)
- FY2015 4 tanks
- FY2017 2 tanks
- FY2019 2 tanks
- FY2021 5 tanks
- FY2022 7 tanks

SRR is currently ahead of this schedule given the funding levels experienced in FY2010-2011.

Site Treatment Plan (STP)

The objective of the STP is to set a timetable for the processing of HLW at Savannah River:

“Upon the beginning of full operations, DWPF will maintain canister production sufficient to meet the commitment for the removal of backlogged and currently generated waste inventory by 2028.”

This means that all current and future HLW sludge and salt must be processed by the end of 2028. Given the current understanding of sludge mass in the Tank Farm, the canister production rate must average 275 cans/year to complete the mission by the end of 2028. The Defense Waste Processing Facility (DWPF) has met and sustained this production rate thus there is high confidence that this requirement can be met.

Just in Time Priorities

There are 5 primary elements of the Liquid Waste System Plan that SRR must cause to occur during the current contract period (July 2009 through June 2015) in order to meet regulatory requirements. Each element has several sub-elements that taken together describe the JIT scope. The JIT primary elements are shown below:

1. Surveillance and Maintenance of Existing Waste Inventory
2. Process sludge to support STP & FFA Just in Time
3. Process salt to support STP & FFA Just in Time
4. Support Tank Closures to meet FFA Just in Time
5. Support other critical site missions

The JIT scope represents the minimum scope and schedule that enables regulatory compliance with no acceleration.

New Scope and Revised Pricing

Before the cost of the JIT case can be estimated, the new scope and revised pricing that was not in the baseline was added:

- Operation of Interim Salt Processing from September 2012 through April 2014 (19 additional months) to support the delay in the SWPF startup;
- Interim Salt Processing modifications to support the extended mission of this interim facility;

- Surveillance and maintenance of old-style tanks not closed in 2010 and 2011 due to changes in the regulatory approval process for tank closure;
- Modifications to the Saltstone Production Facility to increase reliability as needed to support the planned 8,000,000 gallons per year Salt Waste Processing Facility (SWPF) average production rate; and
- Modifications to the SWPF Blend and Feed tanks and transfer system to accommodate the SWPF startup delay and to correct as found conditions.

Revised FY2012 pricing for the same scope as in FY2011 was added:

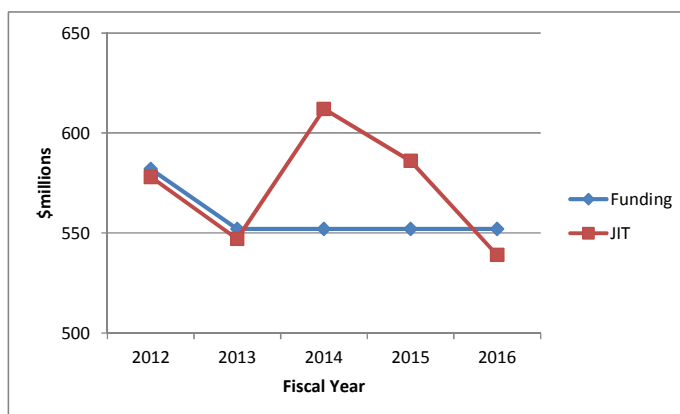
- Increases to the cost of SRR's share of site expenses;
- Increases to the cost of SRR's share of the contribution to the site's Pension/Legacy program; and
- Increases to the cost of Site Utilities – steam and electrical power

These costs were added to the JIT scope cost.

JIT Cost Estimate

The cost of the JIT scope was estimated using current audited and certified pricing in the baseline plus incremental new scope and pricing. Note that the latter cost is based on the best available information at the time and has not been certified. The estimate showed that the funding profile was not sufficient to meet regulatory requirements in the FY2014-15 timeframe (Figure 1). This is due in large measure to the emergent need to start constructing Glass Waste Storage Building #3 concurrently with finishing all of the modifications in the Tank Farm that are needed to support SWPF startup.

Figure 1 – Cost of JIT Scope compared to Funding.



The initial results indicated that cost savings initiatives must be implemented during FY2012-13 where there is some available funding to lower the cost in the subsequent years such that a compliant JIT case could be developed.

Cost Savings Initiatives

Previous cost savings initiatives have been developed over the last several years and many initiatives have already been implemented. A new and comprehensive approach was needed.

Identifying ways to drive down the cost of doing business, i.e., find ways to do the same scope for less cost, was accomplished via the following methods:

- Value Engineering;
- Brainstorming Sessions;
- Systems Engineering Evaluations;
- Program Reviews; and
- System Planning

As expected, hundreds of potential cost savings ideas were generated, and almost all of them required some initial investment to realize future cost savings. More discussion of each method follows.

Value Engineering - SRR was in the early stages of performing a Value Engineering study when CSI started. The study was focused on reducing the cost of disposing of Low Level Waste at Savannah River. Two concepts emerged that were incorporated into the Brainstorming list: (1) replacing small Saltstone Vaults with much larger vaults, and (2) reducing the volume of Low Level Waste prior to disposition. These will be discussed later.

Systems Engineering Evaluation (SEE) - The idea to reduce the volume of Low Level Waste prior to disposal was further developed using the SEE process. The high scoring alternative was to deploy a small evaporator at Tank 50 for volume reduction. This process was estimated to cost \$50-100 million thus it was not viewed as affordable in this lean funding environment. The idea, however, still had merit so lower cost versions were developed and considered.

Brainstorming - Two facilitated, structured sessions were held with extensive participation from SRR, Savannah River National Laboratory and DOE-SR. Brainstorming resulted in 432 individual ideas plus the 2 ideas carried over from Value Engineering for a total of 434 ideas.

Program Reviews - Each major program or project in the SRR program was reviewed. A senior experienced Program Lead was identified for each area. Lines of Inquiry were developed. Each Program Lead prepared information to address the Lines of Inquiry and then presented their program to the CSI Core Team. In most cases, the Program Lead was asked to develop additional information based on the information presented and the opportunities for savings that were identified.

System Planning - All promising ideas and combinations of ideas were modeled using an offline version of the LWSP to verify that each idea could be incorporated into the flowsheet without creating unintended or adverse consequences.

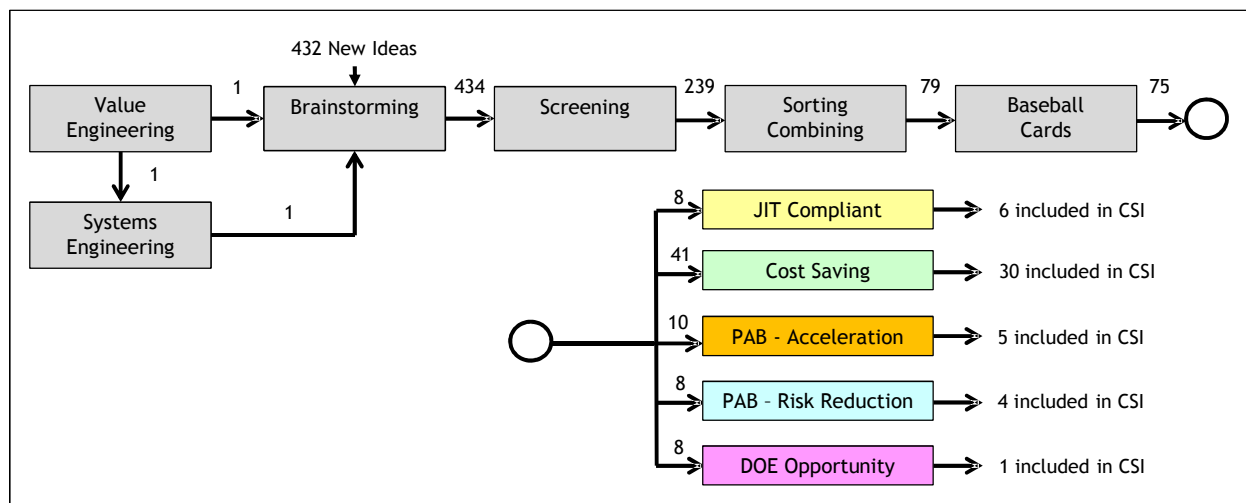
Baseball Cards

The 434 potential cost saving ideas were rendered down to a workable list. Screening Criteria were developed and applied to the ideas. If an idea received a “no” answer to any of the six screening criteria, then it was rejected. There were 239 ideas remaining after application of the screening criteria. Duplicate ideas were eliminated. Synergistic ideas were combined. This resulted in 75 ideas that were expected to reduce cost, accelerate the schedule, or reduce risk if

implemented. Each of these ideas was further developed and documented in “Baseball Cards”. The concept of the Baseball Cards was to capture the salient points of the idea on one page.

A total of 30 Cost Savings Ideas in the form of Baseball Cards were included in this *Strategy*. The upfront investment of \$15 million during FY2012-2013 saved \$203 million over the balance of the contract and was sufficient to enable a *Strategy* that met and in some cases exceeded regulatory requirements. The process used is shown in Figure 2 below.

Figure 2 – Process Used to Identify Cost Savings Initiatives



Priority Add Back (PAB) Process

Available funding identified as a result of implementing the Cost Saving Initiatives was used to fund regulatory-driven scope as needed to achieve regulatory compliance Just in Time during the FY2014-15 timeframe. Additional funding was then used to fund Priority Add Back scope for the purpose of accelerating the program or reducing programmatic risk.

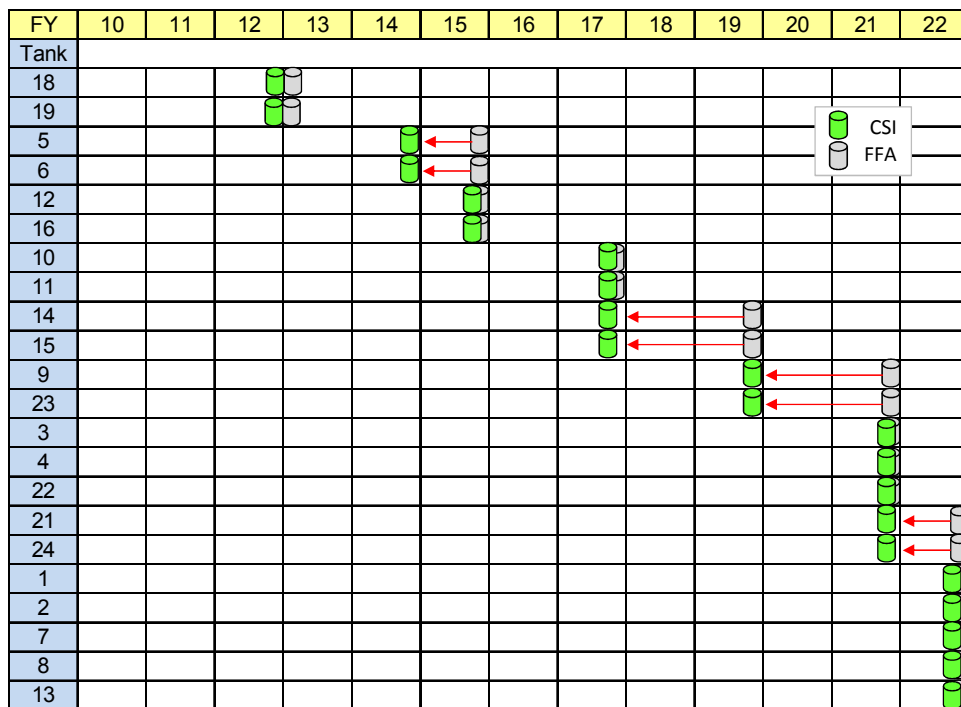
Allocation of funding generated by the CSI process was governed by the priority listing shown below. This list is an extension of the Just in Time priority listing shown previously thus it starts at priority 6.

6. Cost Saving Initiatives with a Return on Investment (ROI) < 3 Years
7. Tank 48 Waste Treatment Technology Maturation
8. Reduce SWPF Risk (late start, throughput less than planned, etc.)
9. Partial Acceleration of FFA Closures
10. Life Cycle Acceleration from 2028 to 2026
11. Salt Processing Risk Reduction
12. Full Acceleration of FFA Closures
13. Tank 48 Waste Treatment
14. Improvement Programs

RESULTS

The CSI process identified available funding sufficient to ensure that regulatory requirements will be met and exceeded down to priority 11 on the priority listing. A total of 8 tanks will be closed ahead of the FFA requirements as shown below and in Figure 3.

Figure 3 – Tank Closure Schedule



In addition, the CSI process identified available funding to reduce mission risk via buying back the following risk reduction initiatives during the current contract period:

- Tank 48 Alternative Technology Development
- Lean Enhanced Chemical Cleaning
- Small Column Ion Exchange
- Demonstrate One-Step Cleaning

These initiatives enable Savannah River to stay ahead of FFA requirements, maintain 4 years and \$2 billion of life cycle savings, and reduce the risk in the salt processing side of the Liquid Waste flowsheet. A brief discussion of each risk reduction initiative follows.

Tank 48 Waste Treatment

Tank 48 is a new-style 1.3 million gallon waste tank that contains 240,000 gallons of HLW combined with 22,000 kgs of organic material. Processing this waste and recovering Tank 48 for other uses has been a high priority at Savannah River for more than 20 years. This *Strategy* enabled enough funding to be applied to Tank 48 technology development to ensure that a treatment process can be developed and tested by the end of 2015.

Enhanced Chemical Cleaning (ECC)

The HLW tanks at Savannah River must be extensively cleaned prior to closure. This is because the tanks contain a high specific activity waste, are close to the water table and close to the Point of Compliance. Tank cleaning is complicated by over 4 miles of 2 inch diameter cooling coils in each tank. The preferred cleaning method therefore employs an acid cleaning step before declaring the tanks clean enough to close. Management of the spent acid is problematic in the Savannah River system flowsheet so a process has been developed to destroy the spent acid (ECC). This *Strategy* provides enough funding to bring ECC on line in early 2018 to support the tank closures that are required in the FY2021-2022 timeframe.

Small Column Ion Exchange (SCIX)

This *Strategy* is based on finishing sludge and salt processing in 2026. SCIX is not needed to support 2026 mission completion if the Salt Waste Processing Facility (SWPF) starts up and operates as planned. However, there is some risk that SWPF may not start up as planned in October 2014 or it may not achieve the planned production rates as quickly as planned. SWPF is a new facility with a new operating staff and some discovery should be expected. For these reasons, this *Strategy* provides funding for SCIX starting in FY2016 such that SCIX will be operating in late 2018 to provide risk mitigation for problems that may arise during SWPF startup.

One Step Cleaning

Savannah River has 4 HLW tanks that have no internal structures such as cooling coils or support columns. The baseline method to retrieve the waste in these tanks includes large mixer pumps and supporting infrastructure. These tanks are very similar to the Hanford tanks only larger. Hanford recently deployed an arm-based cleaning system that could be used for the 4 tanks at Savannah River. This *Strategy* includes funding to demonstrate this concept at Savannah River which should lead to a significant cost reduction.

DISCUSSION

Savings to fund the above activities were generated by investing in cost savings initiatives in the base operations area as described below.

Tank Farms and Effluent Treatment Facility

This base operations area accounts for about \$170 million/year of funding and is the largest single element in the Liquid Waste system. Over the contract period, the cost was driven down to less than \$150 million/year via several Cost Savings Initiatives.

This *Strategy* includes funding for the consolidation of the three different control rooms into one continuously manned control room. This reduces the future staff by 57 Full Time Equivalent (FTE) employees. This staff then becomes available to support the startup, commissioning and initial operation of the SWPF. Re-deploying this staff to the SWPF avoids the cost of severing

these employees as well as saves training costs for SWPF. Eight other Cost Saving Initiatives are also included.

Salt Processing

Salt Processing will be accomplished by the Interim Salt Processing facility in the near term and by SWPF starting in October 2014. Of the estimated 92 million gallons of salt feed to be processed between FY2012 and the end of the mission, Interim Salt Processing will process about 4.5 million gallons and SWPF about 88 million gallons. This *Strategy* assumes that the SWPF processing rate will be 8 million gallons per year starting in 2018 as shown in Table 1.

Table 1 – Recommended Salt Processing Production Plan

FY	Gallons x 1,000	Cumulative	Notes
Prior Years	5,135	5,135	Interim Salt Processing
2012	1,785	6,920	Interim Salt Processing
2013	1,785	8,705	Interim Salt Processing
2014	892	9,597	Interim Salt Processing for 6 months
2015	4,500	14,097	SWPF year 1 production rate
2016	7,000	21,097	SWPF year 2-3 production rate
2017	7,000	28,097	SWPF long term production rate
2018	8,000	36,097	
2019	8,000	44,097	
2020	5,333	49,430	4 month melter outage
2021	8,000	57,430	
2022	8,000	65,430	
2023	8,000	73,430	
2024	8,000	81,430	
2025	8,000	89,430	
2026	5,500	94,930	Heel processing
2027	1,140	96,070	Heel processing for 3 months

Sludge Processing

Sludge feed preparation and vitrification started in 1996. Over 3,300 canisters have been produced from 7 different sludge batches. At this point, there is little risk in the sludge side of the Liquid Waste flowsheet as compared to the salt side. DWPF has also demonstrated the ability to produce over 30 canisters per month so the ability to increase throughput is proven under current conditions.

The JIT production rate for DWPF averages 275 cans/year. This completes the vitrification mission September 2028 in compliance with the Site Treatment Plan. This includes two 4 month melter outages the first of which is assumed to occur in 2014 and the second in 2020. To finish in December 2026 in concert with SWPF, the DWPF production rate will be increased in FY2017 to 320 cans/year where it will remain until 2026 when the rate is necessarily decreased to enable processing of residual tank heels and flushing of the system. This is shown in Table 2 below.

Table 2 – Recommended DWPF Production Plan

FY	Canisters	Cumulative	Notes
Prior Years	3,246	3,246	Actual
2012	275	3,521	Forecast
2013	275	3,796	
2014	183	3,979	4 month melter outage
2015	275	4,254	
2016	275	4,529	
2017	320	4,849	
2018	320	5,169	
2019	320	5,489	
2020	320	5,809	4 month melter outage
2021	213	6,022	
2022	320	6,342	
2023	320	6,662	
2024	320	6,982	
2025	320	7,302	
2026	215	7,517	Rate reduced for heel processing
2027	40	7,557	

This production plan results in SWPF and DWPF both completing their mission at the end of 2026 which is 4 years ahead of the previous plan in a way that reduces the life cycle cost as compared to the previous plan by \$2 billion.

Glass Waste Storage Building #3 (GWSB#3)

GWSB#3 is required to be operational by December 2016 in this *Strategy*. The previous plan was to complete GWSB#3 by September 2015. This places the funding peak for this project (\$36 million in FY2014) at exactly the same time as the need to finish all of the project work that supports the October 2014 startup of SWPF. To levelize the funding demand, the schedule for GWSB#3 was moved out 6 months such that the peak is reduced while maintaining some schedule float relative to the GWSB need date.

Melter#5

DWPF is currently using Melter#2. Melter#3 is ready to install and Melter#4 was delivered to the site in September 2011. Based on the experience to date, Melter#5 may not be needed to complete the mission. This *Strategy* recommends that funding for Melter#5 and its associated storage box and storage vault be deferred to FY2018 or beyond.

DWPF Base Operations

Five Cost Saving Initiatives are planned for DWPF:

- Rerouting the Replacement Ventilation Stack;
- Transitioning to Next Generation Bubblers;
- Changing the material of construction for the Next Generation Bubbler thermocouples;
- Transitioning to Thin Wall Canisters; and

- Consolidating control rooms with Saltstone

These initiatives are part of the 26 Cost Saving Initiatives that enable regulatory compliance thus they are funded in FY2012-2013 in this *Strategy*.

Low Level Waste Disposition

Low Level Waste disposition was another major focus area for the CSI process. This area consumes about \$60-70 million/year of funding for the operating cost of the Saltstone Facility and the cost of new Saltstone Vaults with the vaults consuming most of the funding. The current vault design costs about \$60 million for 11,600,000 gallons of storage in the form of four separate cells (each cell looks like a flat vertical cylindrical tank). The “to go” life cycle cost of vaults is \$1.08 billion.

Given the high cost, SRR has been exploring cost effective alternatives. One alternative, referred to as the Mega-Vault (MV) is included in this *Strategy*. The next set of vaults to be built need to be in radioactive operations by March 2015. This will be the first MV. The MV will be a much larger unit at 32 million gallons each. The life cycle “to go” cost for seven MVs is \$623 million, a significant savings as compared to the previous design.

Low Level Waste Base Operations

Four Cost Saving Initiatives are planned in this area:

- Automated Curie Calculator software;
- Delay of 24 hour/day operations;
- Operators performing the dry feeds Quality Assurance (QA) receipt inspection; and
- Increasing the reliability of the dry feeds system

These initiatives are part of the 26 Cost Saving Initiatives that enable regulatory compliance thus they are funded in FY2012-2013 in this *Strategy*. The plan is to add operating staff in 2013 such that they can be trained, proficient and ready to support the increased plant throughput starting October 2014.

Program Support

This area experienced significant growth during FY2010-2011 to execute manpower-intensive tasks that were needed at the start of the SRR contract:

- Develop the Contract Performance Baseline;
- Install an Earned Value Management System (EVMS) and culture in the workforce;
- Install new timekeeping and work management systems; and
- Support the incremental scope associated with American Recovery and Reinvestment Act (ARRA) and SCIX

The long term maintenance of the first three will require less manpower than during the initiation phase. The completion/suspension of ARRA/SCIX will also drive down the support manpower demand.

Five Cost Saving Initiatives are planned for Program Support:

- EVMS automation;
- EVMS streamlining;
- Reduce/Eliminate Blackberries, Pagers and Landlines;
- Reducing the cost of operating 2 Material Access Centers; and
- Credit work for other sites

These initiatives are part of the 26 Cost Saving Initiatives that enable regulatory compliance thus they are funded in FY2012-2013 in this *Strategy*.

Staffing

The previous plan called for staffing ranging between a high of 2,835 in FY2011 to a low of 2,100 in the FY2016 timeframe. This Strategy enables manpower to reduce to the 2,100 level much earlier, in 2014 as shown in Table 3 below.

Table 3 – Staffing Comparison

FY	Previous Plan	This <i>Strategy</i>	Delta
2011	2,835	2,835	-
2012	2,707	2,343	(364)
2013	2,523	2,286	(237)
2014	2,671	2,107	(564)

REFERENCES

1. Contract DE-AC09-09SR22505 – Request for Approval - Contract Performance Baseline revision 1, June 30, 2010
2. Liquid Waste System Plan, revision 16, SRR-LWP-2009-00001, December 2010