

Hydrolysate Shipment Analysis for Pueblo and Blue Grass Pilot Plants – A Lean Six Sigma Assessment

November 2006

Objective of the Hydrolysate Shipment Analysis

The objective of the Assembled Chemical Weapons Alternatives (ACWA) Hydrolysate Shipment Analysis for Pueblo and Blue Grass Pilot Plants – A Lean Six Sigma (LSS) Assessment was to provide a data-driven recommendation for either onsite or offsite treatment of hydrolysate at Pueblo and Blue Grass. The team analyzed available existing data to determine the best options for hydrolysate produced at both sites.

Past studies have looked at the costs of onsite and offsite treatment of hydrolysate and assigned *qualitative* risks. For the LSS Hydrolysate Shipment Analysis, risk was *quantified* by identifying the most probable option for onsite and offsite processing of hydrolysate.

The team identified risks and specific shipment-related issues for onsite and offsite processing. The identified risks and issues were worked into the base case costs and schedules to determine the most probable outcome.

Why Lean Six Sigma?

On 28 April 2006, General Peter Schoomaker and Francis Harvey, Secretary of the Army issued a memo to implement LSS business methodologies army-wide. The intent of LSS is to improve effectiveness and implement efficiencies as well as deliver higher quality products and services more quickly and at a lower cost.

Lean views time as a strategic competitive weapon and focuses on removal of wasted efforts. Whereas, Six Sigma focuses on business profitability and growth and concentrates on driving out defects and process variation using a structured methodology, which is data driven.

When combined, *Lean* and *Six Sigma* create a structured methodology for reducing non-value added activities and variation. LSS empowers teams with the best tools to leverage talent and deliver accelerated business results. Using statistical analysis, LSS gains knowledge for making good decisions which are critical to success and combines the principles of waste elimination (*Lean*) and reduction in variation, coupled with consistent repeatable performance (*Six Sigma*)

The Team

The primary team for this project consisted of representatives from ACWA HQ and contractors and Chemical Materials Agency (CMA) HQ and contractors.

The Analysis

The Hydrolysate Shipment Analysis for Pueblo and Blue Grass Pilot Plants was conducted by defining the problem of hydrolysate shipment as it relates to the Pueblo and Blue Grass sites. Once the problem was defined, the team identified the specific areas which would impact cost and schedule (these specific areas are listed below in the Cost Impact Section). Please note that most of the cost information contained in the analysis is procurement sensitive and has been designated as *For Official Use Only* (FOUO). Therefore, the actual cost and schedule information and supporting documentation cannot be released. However, this report does provide approximate total cost and schedule information for both sites.

The basic data used for cost and schedule was taken from the ACWA PMs Life Cycle Cost Estimates (LCCE) for PCAPP Intermediate Redesign and BGCAPP Intermediate Design dated 30 June 2006. The ACWA PMs LCCEs for both sites have since been updated due to DOD funding guidance. The LSS Hydrolysate Shipment Analysis has not been updated with the most recent LCCEs information and there are no plans to do so, as of November 2006.

Data from the hydrolysate shipments from the Newport and Aberdeen sites were also considered and analyzed. This data included shipment issues, costs, schedule, treatment options, political issues, and community response. Additionally, the political response in Indiana and New Jersey (receiver site) was considered and factored into the analysis.

Additional information for the analysis was gathered from interviews with subject matter experts from ACWA HQ personnel, ACWA site personnel at Pueblo and Blue Grass, Mitretek, Battelle, the Bechtel Pueblo Team, the Bechtel Parsons Blue Grass Team, Newport Chemical Agent Disposal Facility (NECDF), and the Chemical Materials Agency (CMA).

Historical data on the chemical demilitarization program was reviewed but found to have little or no bearing on the hydrolysate shipment issues at Pueblo and Blue Grass. This was due to the different state regulatory requirements, community response, and technologies.

Assumptions

The team established some basic assumptions at the beginning of the analysis. These assumptions included:

1. Start Date for Schedule Impacts

- 1 October 2006 - Decision would be made regarding the treatment of hydrolysate at both sites.
 - This date was decided upon simply to create a begin date for the cost and schedule analysis, with the understanding that this date may be adjusted.

2. Permitting Requirements for Hydrolysate Offsite Treatment

- National Environmental Policy Act (NEPA) requirements would include an Environmental Assessment (EA) for both sites.
- Pueblo's current Research, Development and Demonstration (RD&D) permit would require modification beginning at Stage 3 Construction.
- Pueblo's Certification of Designation (CD) would require, at a minimum, a Formal Class B modification, which would include a detailed review process.
- Blue Grass' current RD&D permit would no longer be applicable, due to the removal of the Supercritical Water Oxidation (SCWO) unit and a RCRA Part B permit would be required.

3. Treatment Options for Hydrolysate Offsite Treatment

- Biotreatment would be the selected offsite treatment method at an approved Treatment, Storage, and Disposal Facility (TSDF) for the hydrolysate from both Pueblo and Blue Grass.
- The TSDF facility would be confirmed, agreed upon, and under contract before permitting at Pueblo and Blue Grass is complete. Without the treatment facility under contract, operating permits for the Pueblo Chemical Agent-Destruction Pilot Plant (PCAPP) and the Blue Grass Chemical Agent-Disposal Pilot Plant (BGCAPP) would not be issued.

4. Public Involvement

- PMACWA will execute public involvement at both Pueblo and Blue Grass, as well as the treatment facility community(s), so as to not impact the schedule.

Permitting Risks - Pueblo

For offsite treatment of hydrolysate at the Pueblo site, the team identified the necessary regulatory requirements and their impact to the schedule. It was determined

that NEPA requirements would require approximately 14 months and consist of an EA with the required public comment period and public meetings.

Impacting the schedule approximately 16 months, the State RCRA requirements would necessitate a modification to the current RD&D permit beginning at Stage 3 Construction. Design, Stage 1 Construction, Stage 2 Construction, and Stage 2 Systemization would not be impacted by the permitting requirements and would continue as scheduled. Therefore, the schedule impact for Pueblo would begin with Stage 3 Construction in December 2008.

In addition to the NEPA EA and State RCRA requirements, the Pueblo County Certificate of Designation (CD), which follows the schedule for RCRA, would also require modifications to reflect the changes made to the RCRA RD&D permit. This permitting requirement could take 23 months and would include public comment period, a possible appeal process, and a possible legal injunction.

Ramp Down/Up

The process of ramping down the construction efforts due to permitting schedule impacts and then ramping up again once the permits are issued would impact the schedule 6 months.

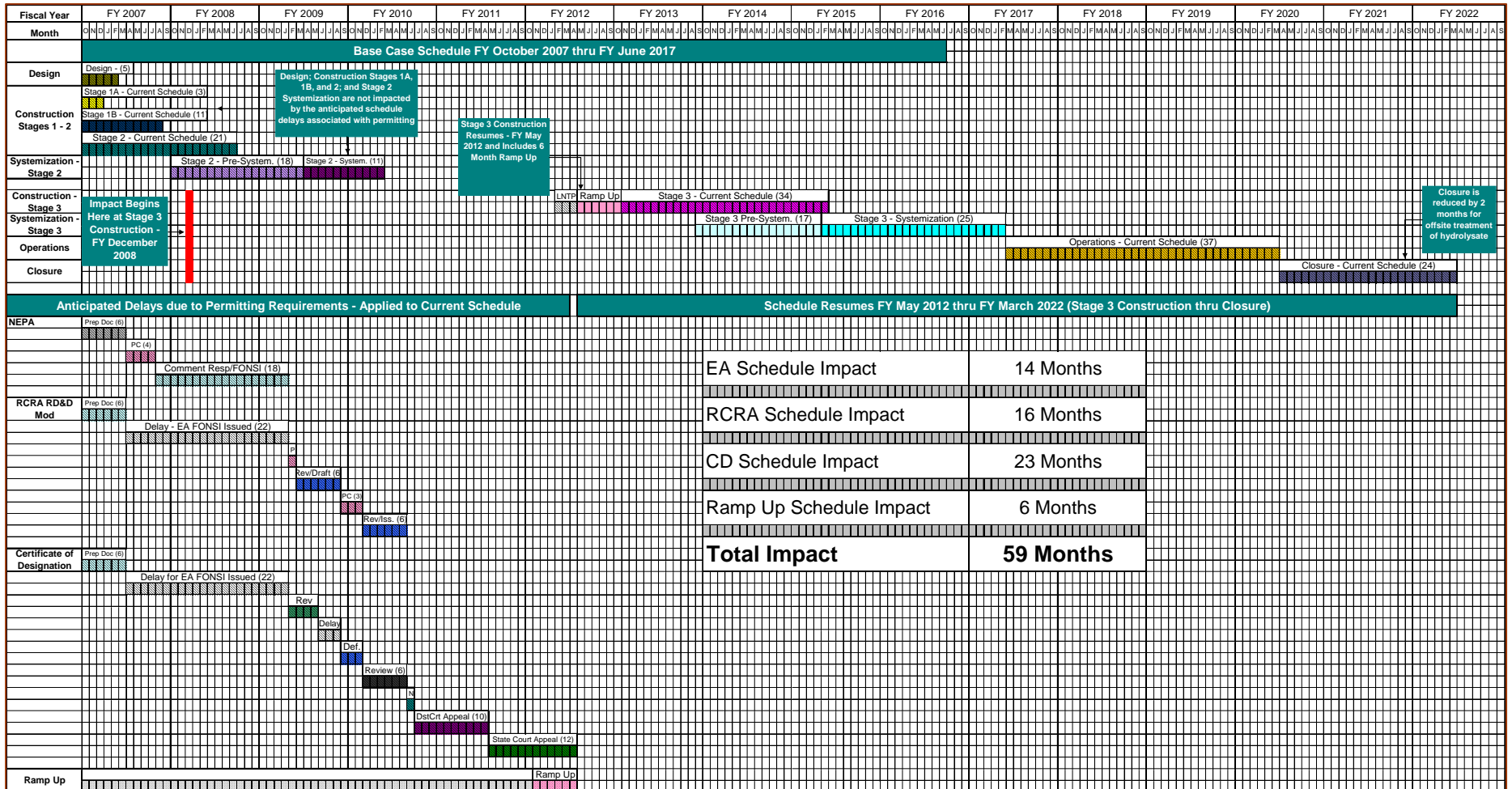
Pueblo Schedule Summary

Original PCAPP Schedule with Onsite Hydrolysate Treatment	PCAPP Schedule Adjustments for Offsite Hydrolysate Treatment
Onsite Schedule Start	Offsite Schedule Start
<i>Beginning at Stage 3 Construction</i>	<i>Impact Begins at Stage 3 Construction</i>
December 2008	November 2013
Onsite Schedule Completion	Offsite Schedule Completion
<i>Thru Closure</i>	<i>Thru Closure</i>
June 2017	March 2022

Offsite Shipment Regulatory Permitting Schedule Impacts	
EA Schedule Impact	14 Months
RCRA Schedule Impact	16 Months
CD Schedule Impact	23 Months
Ramp Up/Down Schedule Impact	6 Months
Total Schedule Impact	59 Months

Schedule – Pueblo (Continued)

This schedule outlines the impacts of permitting requirements for offsite treatment at Pueblo. Total impact to the Pueblo schedule would be 59 Months and the schedule delays would begin at Stage 3 Construction.



Permitting Risks – Blue Grass

For offsite treatment of hydrolysate at the Blue Grass site, the team determined the necessary regulatory requirements. It was determined that NEPA requirements would require approximately 28 months and consist of an EA with the required public comment period and public meetings. If the decision is made to ship the hydrolysate offsite for treatment, the State RCRA requirements would necessitate a full RCRA Part B permit as opposed to the current RD&D permit. The impact to the schedule would begin immediately and all construction work would halt and push the schedule out approximately an additional 32 months.

In addition to the NEPA EA and State RCRA requirements, the county emergency response certification was considered, but found to have no impact on the current schedule.

Ramp Down/Up

The process of ramping down the construction efforts due to permitting schedule impacts and then ramping up again once the permits are issued would impact the schedule 6 months.

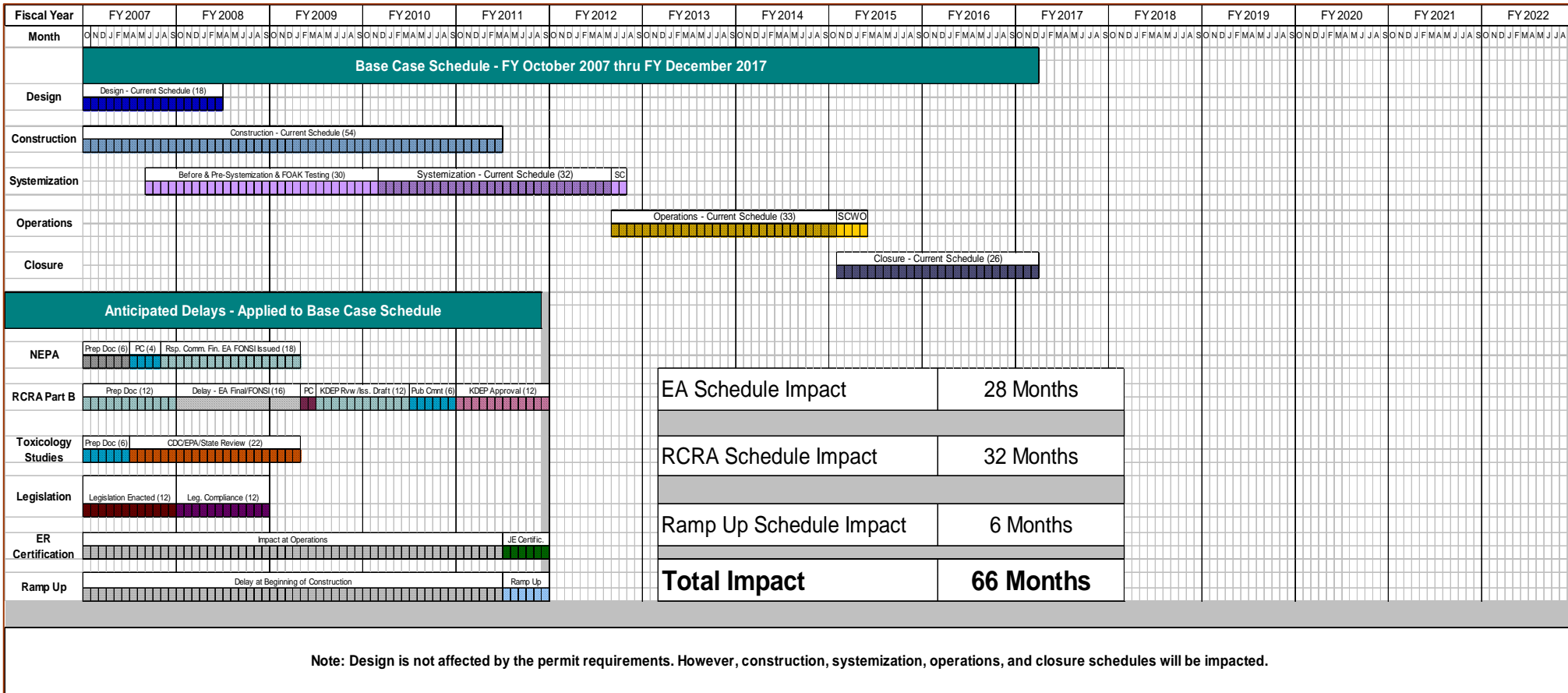
Blue Grass - Schedule Summary

Original BGCAPP Schedule with Onsite Hydrolysate Treatment	BGCAPP Schedule Adjustments for Offsite Hydrolysate Treatment
Onsite Schedule Start	Offsite Schedule Start
<i>Begins with Initial Construction</i>	<i>Impact Begins with Initial Construction</i>
October 2007	April 2012
Onsite Schedule Completion	Offsite Schedule Completion
<i>Thru Closure</i>	<i>Thru Closure</i>
December 2017	April 2022

Offsite Shipment Regulatory Permitting Schedule Impacts	
EA Schedule Impact	28 Months
RCRA Schedule Impact	32 Months
Ramp Up/Down Schedule Impact	6 Months
Total Schedule Impact	66 Months

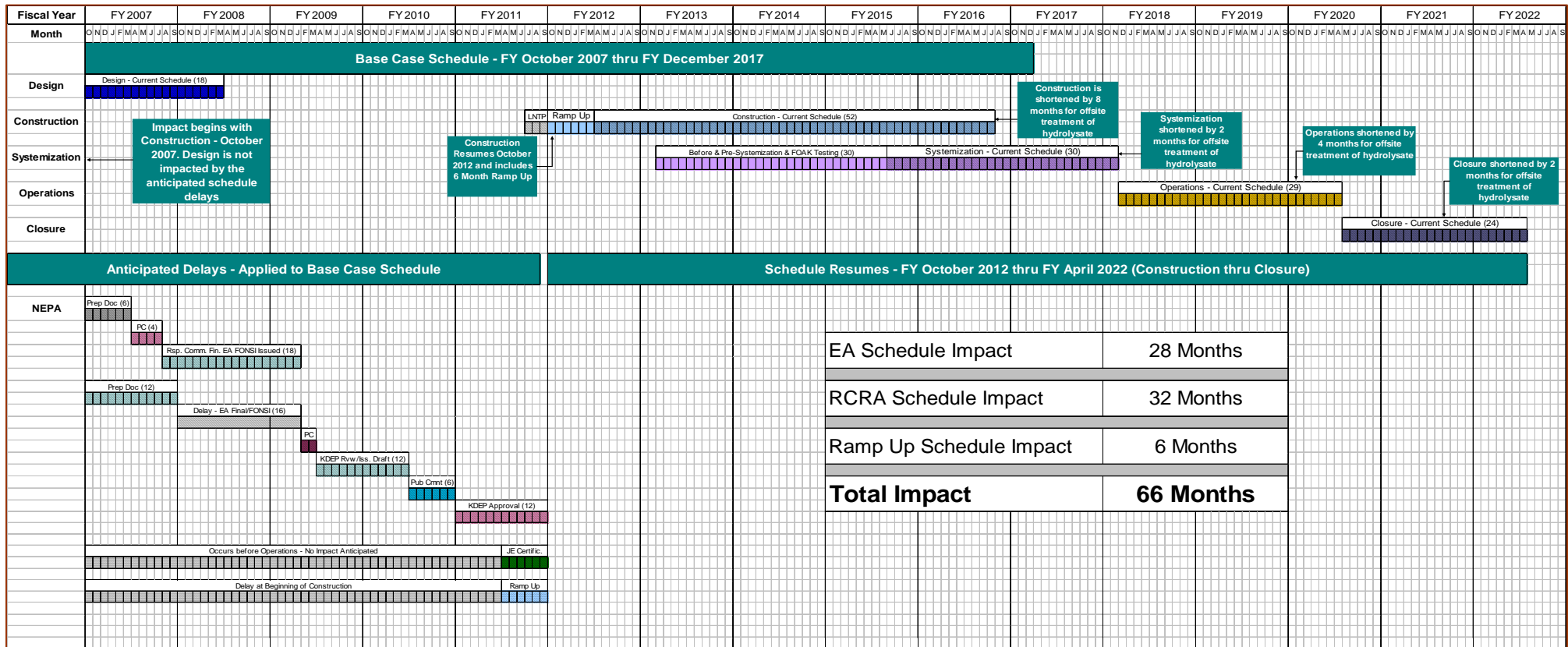
Schedule – Blue Grass

The top portion of this schedule shows the base case schedule for onsite treatment of hydrolysate as outlined in the ACWA PMs Life Cycle Cost Estimate for BGCAPP Intermediate Design dated 30 June 2006. The lower portion indicates the anticipated permitting requirements, which could impact the schedule if the hydrolysate is shipped offsite for treatment. The schedule on the following page indicates how the original schedule would be impacted with these permitting requirements.



Schedule - Blue Grass (Continued)

This schedule outlines the impacts of permitting requirements for offsite treatment for Blue Grass. Total impact to the Blue Grass schedule would be 66 Months. This impact would begin immediately and impact all construction.



Cost Summary - Offsite

When the permitting requirements outlined above were considered, the costs of the potential impacts were calculated. The specific costs and related documentation are procurement sensitive. Therefore, only the approximate costs, a list of related documentation (see Appendix A) and a list of cost area impacts are provided.

The following areas were considered to incur significant cost impacts due to the permitting requirements and/or schedule impacts.

- Total Pilot Plant Costs
 - As identified in the ACWA PMs Life Cycle Cost Estimates (LCCE) for PCAPP Intermediate Redesign and BGCAPP Intermediate Design dated 30 June 2006
- Depot Weapons Storage
 - Annual costs for weapons storage, security, and monitoring
- Additional Analytical Requirements
 - For extended processing for VX at Blue Grass only
- Programmatic Costs
 - ACWA HQ costs for staff and HQ contractors
- NEPA
 - Document preparation, review, and comment response
- RCRA
 - No significant additional direct costs would be associated with this requirement at either site. No additional site personnel would be required to prepare documentation and no significant additional funds for cooperative agreements with the states of Colorado and Kentucky would be required.
- Emergency Preparedness
 - No direct costs would be associated with this requirement at either site
- Certificate of Designation
 - For Pueblo only
 - Pueblo's CD would require at a minimum a Formal Class B modification, which would include a detailed review process.
 - There are no significant impacting fees associated with the Formal Class B modification and no additional site personnel would be required to prepare documentation; therefore, no significant costs with Pueblo County would be incurred for this action.
 - All related costs for any litigation would be incurred within other government agencies (Department of Justice, Department of Defense Legal) and was not feasible to track for this effort
- Assessment Studies
 - Related toxicology, treatability and transportation safety related to offsite shipment

- These studies would be conducted before shipment can be made to the TSDF
- Delay Costs
 - Costs associated with labor, maintenance, and construction for ramping up and down due to work stoppage related to permitting requirements
- Treatment at TSDF
 - Costs included in this analysis were calculated for biotreatment
 - Incineration and deep well injection costs were evaluated for comparison purposes only
- Public Involvement
 - Costs for public involvement efforts at the shipping and receiving site were considered

Cost Summary Onsite

- Total Pilot Plant Costs
 - As identified in the ACWA PMs Life Cycle Cost Estimates (LCCE) for PCAPP Intermediate Redesign and BGCAPP Intermediate Design dated 30 June 2006
- Depot Weapons Storage
 - Annual costs for weapons storage, security, and monitoring
- Programmatic Costs
 - ACWA HQ costs for staff and HQ contractors

Pueblo Cost Summary

All costs and schedules are approximate

	Pueblo – Onsite	Pueblo - Offsite				
Total Costs	\$2,680,454,000	\$2,845,866,000				
Total Schedule	174 Months	233 Months				
Operations End	April 2015	March 2020				
<table border="1" style="margin: auto;"> <tr> <td style="background-color: #008000; color: white;">Schedule Delta</td> <td style="text-align: center;">59 Months</td> </tr> <tr> <td style="background-color: #008000; color: white;">Cost Delta</td> <td style="text-align: center;">\$165,412,000</td> </tr> </table>			Schedule Delta	59 Months	Cost Delta	\$165,412,000
Schedule Delta	59 Months					
Cost Delta	\$165,412,000					

Blue Grass Cost Summary

All costs and schedules are approximate

	Blue Grass – Onsite	Blue Grass - Offsite
Total Costs	\$2,745,064,000	\$2,892,531,000
Total Schedule	166 Months	232 Months
Operations End	February 2015	April 2020
Schedule Delta		66 Months
Cost Delta		\$147,467,000

Recommendation

At the time of this analysis, due to the implications from the communities and the potential resultant permitting requirements, this analysis finds that to ship hydrolysate offsite will not save time or money. All schedule impacts are due to public opposition and regulatory permitting requirements resulting from this opposition. Which, if overcome, could make the offsite shipment of hydrolysate feasible.

Additionally, while onsite treatment of hydrolysate will have engineering and analytical risks, these can be controlled by DOD. Offsite shipment does not provide the ability to have direct control over managing these risks at an offsite facility.

Appendix A – Sample of Data Analyzed for the Hydrolysate Shipment Analysis for Pueblo and Blue Grass Pilot plants – A Lean Six Sigma Assessment

- ACWA PMs Life Cycle Cost Estimate (LCCE) for BGCAPP Intermediate Design (30 June 2006)
- ACWA PMs Life Cycle Cost Estimate (LCCE) for PCAPP Intermediate Redesign (30 June 2006)
- Analysis of Off-Site Treatment of Hydrolysates from Chemical Agent-Destruction Pilot Plants, July 2006
- Independent Economic Assessment Offsite Disposal of Agent and Energetic Hydrolysates: Interim Review
- Independent Economic Assessment Off-Site Disposal of Agent and Energetic Hydrolysates: Interim Review
- LCCE BGCAPP: Bechtel Parsons Blue Grass Team
- LCCE PCAPP: Bechtel Pueblo Team
- Monthly Agent Processing Reports – Newport (May 2005 – March 2006)
- ABCDF EA for Accelerated Options
- ABCDF EA for Hydrolysate Offsite
- NECDF EA for Accelerated Options and Hydrolysate Offsite
- PMACWA NEPA Implementation Plan
- Recommendations from CO CAC to PMACWA Concerning Acceleration Options for Pueblo
- CDC Meeting Summary: Newport VX Treatment
- BG VROM Cost Estimate – Ship All Hydrolysate Off-Site Including Processing
- Blue Grass Design Consideration #34 – Ship Hydrolysate Offsite
- Blue Grass DC #34 Executive Summary
- Applicability of SCWO at NECDF
- Independent Assessment Panel Evaluation for Secondary Treatment and Disposal of VX Hydrolysate at NECDF
- NECDF Post Treatment Alternatives Special Study
- Executive Summary Cost Benefit Analysis of Off Site vs Onsite Treatment and Disposal of Newport Caustic Hydrolysate
- Pueblo Technical Position Paper Offsite Shipment of Energetic & Secondary Waste Shipment Study
- Pueblo Technical Position Paper Offsite Shipment of Hydrolysate for PCAPP
- Appendix B: Anniston 03 Hazardous Waste Report – PCAPP Offsite Treatment of Hydrolysate Study
- Analysis of Impacts of Offsite Disposal Options for PCAPP
- Pueblo POTW/FOTW Options Study Final Report
- Pueblo Water Balance Sheets (Revision A)
- LCCE for PCAPP Intermediate Redesign (as prepared by FOCIS)
- LCCE for BGCAPP Intermediate Redesign (as prepared by FOCIS)
- CO and KY State Regulatory documents
- NECDF On-Site Hydrolysate Post Treatment Estimate, April 2006