Analysis of Impacts of Off-Site Disposal Options for the Pueblo Chemical Agent Destruction Pilot Plant (PCAPP)

Final Report

Prepared for:
Program Manager for
Assembled Chemical Weapons Alternatives
(PMACWA)
Aberdeen Proving Ground, MD

25 July 2003

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FOCIS Reference 32041.7.1.5

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Dear Mr. Novad:

Please find enclosed **five** (5) **copies** of the **"Analysis of Impacts of Off-Site Disposal Options for the Pueblo Chemical Agent Destruction Pilot Plant (PCAPP)" Final Report,.** The Final Report incorporates comments to the Draft Final Report, Revision 01 dated 26 June 2003 from PMACWA, the Bechtel Pueblo Team, the Acceleration Options Working Group (AOWG), and the Pueblo Chemical Depot operations Security. Most of the revisions were minor, adding clarity or correcting typographical errors or inconsistencies. Changes occurred in the government net revenues as a result of corrections made to employment numbers. None of these changes however, resulted in a change in the ratings of the options.

I hope this Final Report meets your needs and if you have any questions regarding the information contained herein, please contact me at 617/618-4608.

Very truly yours,

Armand A. Balasco
President

AAB/pb

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List of Acronyms

ABCDF	Aberdeen Chemical Agent Disposal Facility
ACWA	Assembled Chemical Weapons Alternatives
AEL	Airborne exposure limits
ANL	Argonne National Laboratory
ANS	Agent Neutralization System
AOWG	Acceleration Options Working Group
APG	Aberdeen Proving Ground
BPT	Bechtel Pueblo Team
CAC	Citizens Advisory Commission
CAMDS	Chemical Agent Munitions Disposal System
CatOx	Catalytic Oxidizer
CEHNC	Corps of Engineers (U.S. Army Engineering Division, Huntsville)
CST	Continuous Steam Treater
CWC	Chemical Weapons Convention
DAE	Defense Acquisition Executive
DOD	Department of Defense
DOT	Department of Transportation
DPE	Demilitarization Protective Ensemble
EA	Environmental Assessment
ECBC	Edgewood Chemical and Biological Center
ECR	Energetics Containment Room
ECV	Explosive Containment Room Vestibule
EDS	Engineering Design Study
EIS	Environmental Impact Statement
ENR	Energetics Neutralization Reactor
EPA	Environmental Protection Agency
ERH	Energetics Rotary Hydrolyser
FEIS	Final Environmental Impact Statement
FTE	Fulltime equivalent
HD	Blister agent distilled mustard, bis(2-chloroethyl)sulfide or 2,2 dichlorodiethylsulfide
HDC	Heated Discharge Conveyor
HRA	Health Risk Assessment
HT	Blister agent (blend of 60% blister agent HD and 40% agent T)
HVAC	Heating, ventilation and air conditioning
I&C	Instrumentation and control
IAS	Instrument air system
ICB™	Immobilized Cell Bioreactors
IDA	Institute for Defense Analysis
IMS	Integrated Master Schedule
KVA	Kilo volt amps
LCCE	Life cycle cost estimate
MACOM	Major Command
MACT	Maximum Achievable Control Technology
MDM	Multipurpose Demilitarization Machines
MPT	Metal Parts Treater
MSB	Munitions Storage Building
NECDF	Newport Chemical Agent Disposal Facility
NEPA	National Environmental Policy Act
NM	Non-Manual
NPDES	National Pollutant Discharge Elimination system
O&M	Operation and Maintenance

List of Acronyms (continued)

OTS	Offgas Treatment System
OVT	Operational Verification Testing
PCAPP	Pueblo Chemical Agent Destruction Pilot Plant
PCD	Pueblo Chemical Depot
PCP	Pentachlorophenol
PL	Public Law
PLA	Plant air system
PMACWA	Program Manager for Assembled Chemical Weapons Alternatives
PMCD	Program Manager for Chemical Demilitarization
PMD	Projectile/Mortar Disassembly Machine
PT&O	Pilot Testing and operations
RA	Reconfiguration Area
RAM	Reliability, availability, maintainability
RCRA	Resource Conservation and Recovery Act
RDT&E	Research, Development, Testing and Evaluation
REMI	Regional Economic Models, Inc., Policy Insight® Model
ROD	Record of Decision
TRA	Technical Risk Assessment
TRRP	Technical Risk Reduction Program
TSDF	Treatment, storage, and disposal facility
UPA	Unpack Area
WRS	Water Recovery System

EXECUTIVE SUMMARY

Introduction

FOCIS Associates, Inc. (a GEO-CENTERS, Inc. Company) of Newton, Massachusetts was tasked by the Program Manager for Assembled Chemical Weapons Alternatives (PMACWA) to investigate the impacts of shipping various liquid and solid process wastes from the Pueblo Chemical Agent Destruction Pilot Plant (PCAPP) to permitted off-site Treatment, Storage, and Disposal Facilities (TSDFs). The Army's current plan, referred to hereafter as the Base Case, is to treat all process wastes on site at PCAPP and to ship the treated effluents to a permitted TSDF for disposal. The Base Case alternative produces only solid wastes because all water used in the plant is recovered and reused in the destruction process. The purpose of the Impacts Analysis is to assess the potential economic impacts and technical risks of off-site treatment and disposal alternatives for the various process wastes that will be generated by the PCAPP over the life cycle of the project. The study was performed by FOCIS working in close cooperation with the Bechtel Pueblo Team (BPT), the Pueblo Citizens Advisory Commission (CAC) Acceleration Options Working Group (AOWG), and PMACWA.

Study Scope and Objectives

The PCAPP Impacts Analysis evaluates the costs, benefits, and risks of six (6) off-site waste treatment and disposal options relative to the Base Case design. The Base Case and 6 options evaluated in the Impacts Analysis are as follows:

- Base Case
  - Process the following wastes on site as indicated:
    - Agent and energetics hydrolysates – biotreatment
    - All dunnage and metal parts – 5X treatment
  - Ship solid process wastes (dewatered salts and biomass, 5X dunnage, and 5X metal parts) off site
  - Recycle maximum recoverable water
- Option 1: Ship uncontaminated wood dunnage off site for treatment and disposal (all other wastes processed as per the Base Case)
- Option 2: Ship propellant off site for treatment and disposal (all other wastes processed as per the Base Case)
- Option 3: Ship propellant and bursters off site for treatment and disposal (all other wastes processed as per the Base Case)
- Option 4: Ship propellant and bursters and agent hydrolysate off site for treatment and disposal (all other wastes processed as per the Base Case)
- Option 5: Ship agent and energetic hydrolysates off site for treatment and disposal (all other wastes processed as per Base Case)
- Option 6: Ship 3X munitions off site for treatment and recycling (all other wastes processed as per Base Case)

Initially, two cases for Options 4 and 5 were considered – one with and one without water returned to PCAPP equivalent to the volume of hydrolysate shipped off site. Given the critical issue of water supply in Pueblo, water return was identified as the only case for Options 4 and 5.

Each option is compared to the Base Case according to the following 14 evaluation factors:

- Technical Issues
- Safety
- Environmental Permitting and Compliance
- Transportation
- Water Consumption
- Power Consumption
- Treatment, Storage And Disposal Facility (TSDFs)
- Treaty
- Life Cycle Cost
- Life Cycle Schedule
- Employment
- State and Local Commercial Revenues
- State and Local Government Net Revenues (revenues minus expenditures)
- Public Outreach

The list of criteria was developed with input from PMACWA, the BPT and the AOWG. Each option is assessed over the life of the PCAPP project in terms of its impact relative to the Base Case on each of the factors, except for the TSDF factor, which is based on TSDF availability. Some of the factors (i.e., life cycle cost and schedule, transportation, utilities, employment, and revenues) are assessed quantitatively while others (i.e., technical issues, safety, environmental permitting and compliance, Treaty, and public outreach) are evaluated qualitatively. Wherever possible, the cost impacts associated with the qualitative factors have been accounted for in the life cycle cost analysis.

The Impacts Analysis does not consider the economic impact of government funding constraints during a given fiscal year, abnormal events or litigation during the life of the project, or the future-use of equipment and facilities after the plant is closed.

The purpose of the Impacts Analysis is to provide a rational basis upon which to compare the proposed off-site options to the Base Case. The specific objectives of the study are as follows:

- Perform a cost analysis of selected off-site treatment and disposal options, taking into consideration all future direct and indirect costs over all phases of the project (design through closure).
- Develop a complete listing of significant impacts, both positive and negative, associated with each alternative, and quantify and/or monetize as many of those impacts as possible.
- Use the results of the Impacts Analysis to assess potential economic impacts to the Pueblo community.

- Provide a rational basis for a future decision concerning implementation of any or all of the off-site disposal options considered in this study.

Approach

Table ES-1 lists the evaluation factors along with a description of the general assessment approach and the metrics or ratings applied to each factor. In general, each off-site option was rated as having either a positive (+), negative (-), or neutral (O) effect on the relevant factor in comparison to the Base Case. The ratings are based on a thorough and objective analysis of each option relative to the individual evaluation factors. Although the study team tried to be as impartial as possible in their evaluation, the application of the individual metrics and the final ratings were subject to the interpretation and professional judgment of the study team.

In addition to the factors addressed in this report, the AOWG will assess the level of public support for each off-site disposal option. Public support will be determined through a series of public meetings and information sessions held in the Pueblo community. Results of the assessment will be documented in a separate report by the AOWG. The current schedule for providing the public with the results of the Impacts Analysis and obtaining their input is as follows:

- Late June 2003 – Submit Draft Final Report to AOWG
- 8-9 July 2003 – Conduct a working session with the AOWG to obtain their input
- 10 July 2003 – Present results of the Impacts Analysis and AOWG recommendations to the CAC
- 26 July 2003 – Conduct a day-long Public Forum in Pueblo to answer questions and obtain input
- 14 August 2003 – CAC makes recommendation to the Army

The AOWG intends to use the Impacts Analysis report to formulate the group's recommendation to the CAC.

Summary of Off-site Disposal Option Impacts

Three things must be kept in mind when considering the impacts of the off-site disposal options:

- First and foremost is that the ratings are relative so a negative mark in any factor does not necessarily mean that the option is disqualified or eliminated from further consideration. It simply means that the option faces additional obstacles above and beyond those of the Base Case, and that additional effort and/or investment in time or money are required to move the option forward. After reviewing all of the available information, it can be said unequivocally that all of the options are technically feasible and can be done in a way that affords maximum protection to both human health and the environment.
- Second, not all factors carry the same weight; some may be more important than others depending on one's point of view. For example, cost and schedule may be more important to the Army than local employment or local government revenues, whereas the opposite may be true for the local government. Environmental permitting and compliance and safety are of

paramount importance to all stakeholders. Ultimately, it is up to the stakeholders to decide which of the other factors are the most important in determining which options to pursue.

- Third, while the study team tried to be as thorough and objective as possible, there were times when the study team had to rely heavily on professional judgment in arriving at a rating for factors where the data were either incomplete or of unknown quality or accuracy. This was particularly true for the government net revenue factor where the model error is essentially unknown. Consequently, for this factor, as well as for commercial revenues, it was assumed that any change in revenue less than 10% of the estimated Base Case revenue was marginal and therefore given a neutral (O) rating.

In reviewing the results of the analysis, Option 2, shipping propellant off site, appears to be the only option to offer advantages to the Base Case while not having any significant negative impacts. Option 2 offers advantages over the Base Case under the technical issues, safety, and schedule factors. In addition, Option 2 received a positive rating under the TSDF factor indicating that there are at least three TSDFs with the technical capability and required permits to process all of the propellant from PCAPP. Option 2 has no significant impact on the remaining factors: environmental permitting and compliance, transportation, water and power consumption, Treaty compliance, life cycle cost, local economics, and public outreach.

The other options, while having advantages over the Base Case, have one or more negative attributes that may render them less desirable than the Base Case:

- Option 1 has only one negative rating, that being for technical issues where the primary concern is over developing and implementing a method for verifying that the wood dunnage is uncontaminated.
- For Options 3, 4, and 6, the major concern is safety. In the case of Options 3 and 4, it is the manual handling of bursters, some of which could be contaminated with agent, which raises the most concern. For Option 6, it is the increased risk (however small) of worker exposure to residual agent from the improper handling of 3X decontaminated metal parts that results in the negative rating.
- Another concern for Options 4 and 5 is the fact that there is only one commercial biotreatment facility confirmed to have the excess capacity necessary to handle all PCAPP daily hydrolysate production (note, a few other smaller facilities could process some fraction of the PCAPP's daily hydrolysate production). This increases the risk that a problem at that facility would have negative consequences for operations at PCAPP. A similar concern exists for Option 6 in that only one facility was identified for processing 3X metal parts.
- Options 3, 4, and 5 also have negative ratings for public outreach because they will likely require substantial outreach efforts to garner and maintain public support. These efforts will likely extend beyond the local Pueblo community to other affected communities, such as those located along the shipping routes and near the TSDFs.

As expected, Options 4 and 5 result in the largest reductions in total life cycle cost; $115 million and $80 million, respectively. No other options produce cost savings >$50 million, the benchmark for determining whether or not the impact is significant. The elimination of all process equipment associated with hydrolysate treatment and water recovery has a substantial negative impact on state and local commercial revenues, which are generated from the sale of

bulk materials for those systems. Because employment is not significantly impacted, state and local government net revenues remain relatively unaffected. Both options have a considerable impact on project schedule. In the case of Option 4, the project construction schedule is shortened by 10 months. With Option 5, the potential construction schedule savings is about 6 months. The cost and schedule savings, which appear to be significant, must be weighed against the other negative risk factors shown in the table.

Table ES-1: Impacts Analysis Evaluation Factors

Factors	Assessment Approach	Metric
Technical Issues	Assess qualitatively the major technical issues and challenges associated with each option relative to the Base Case. Quantitative assessments of the technical issues will be reflected in the life cycle costs and schedules.	+ Major technical challenges are reduced or eliminated 0 The change in level of technical challenges is minimal – Additional major technical challenges arise
Safety	Assess qualitatively the impact of each option on worker and public safety relative to the Base Case. Worker safety will address the inherent hazard characteristics of each option and the controls required to mitigate the hazards to acceptable levels. Public safety will address the potential impacts to the public from normal plant operations and during upset conditions, including the potential impact to the public as a result of the accidental release of materials from the plant.	+ The facility is safer based on a decrease in the number and/or severity of inherent hazards 0 The facility is as safe based on the number and/or severity of the inherent hazards remaining the same – The facility is less safe based on an increase in the number and/or severity of inherent hazards
Environment Permitting and Compliance	Assess qualitatively the impact on the NEPA process (EIS and ROD) and environmental permitting and compliance requirements (RCRA, NPDES, Air). Cost and schedule impacts related to permitting and compliance will be included in the respective cost and schedule factors.	+ Permitting and compliance efforts decrease significantly 0 Permitting and compliance efforts are the same – Permitting and compliance efforts increase significantly
Transportation	Assess quantitatively potential impacts on traffic volume, traffic accidents, and overall transportation risks of each option relative to the Base Case. The information used to assess transportation risk will be obtained from the Transportation Risk Analysis recently completed for PMACWA by Argonne National Laboratory.	+ Transportation risks are low and net number of shipments of process wastes and treatment chemicals decreases by ≥10% 0 Transportation risks are low and net number of shipments of process wastes and treatment chemicals changes by <10% – Transportation risks are high and/or net number of shipments of process wastes and treatment chemicals increases by ≥10%
Water Consumption	Assess quantitatively the impacts of each option relative to the Base Case on water consumption.	+ Water consumption decreases by ≥10% 0 Water consumption changes by <10% – Water consumption increases by ≥10%

Table ES-1: Impacts Analysis Evaluation Factors (continued)

Factors	Assessment Approach	Metric
Power Consumption	Assess quantitatively the impacts of each option relative to the Base Case on power consumption.	+ Power consumption decreases by ≥10% 0 Power consumption changes by <10% – Power consumption increases by ≥10%
TSDF	Assess TSDF availability and capacity to handle each of the additional wastes being shipped.	+ There are three or more appropriately permitted TSDFs for each of the additional wastes being shipped off site 0 There are at least two appropriately permitted TSDFs for each of the additional wastes being shipped off site – There is only one appropriately permitted TSDF available for each of the additional wastes being shipped off site.
Treaty	Assess qualitatively the Treaty inspection and oversight requirements of each option relative to the Base Case. Any increases or decreases in costs associated with Treaty compliance will be factored into the cost analysis.	+ Inspection and oversight requirements decrease significantly 0 Inspection and oversight requirements remain essentially the same – Inspection and oversight requirements increase significantly
Life Cycle Cost	Develop cost estimates for each option on a present worth basis and compare the results to the Base Case. Cost elements will include: RDT&E, design and engineering, site development and utilities, facilities and equipment, construction, systemization, pilot testing, operations and maintenance, management, environmental permitting and compliance, and closure.	+ Life cycle cost decreases by ≥$50 million 0 Life cycle cost increases or decreases by less than $50 million – Life cycle cost increases by ≥$50 million
Life Cycle Schedule	Perform a high level, semi-quantitative analysis of the potential impacts of each option relative to the schedule for the Base Case. Results will be expressed as having an increase, decrease, or minimal impact on the Base Case schedule. Estimates of the amount of time saved from or added to the Base Case schedule will be provided.	+ Life cycle schedule is reduced by 6 months or more 0 Life cycle schedule is extended or reduced by less than 6 months – Life cycle schedule is extended by 6 months or more

Table ES-1: Impacts Analysis Evaluation Factors (continued)

Factors	Assessment Approach	Metric
Employment	Compare the number of full-time jobs (expressed as full-time equivalents or FTEs) required for each option relative to the Base Case.	+ Number of FTEs increases by ≥10% 0 Number of FTEs changes by <10% — Number of FTEs decreases by ≥10%
State and Local Commercial Revenues	Assess quantitatively the impact of each option relative to the Base Case on State and local commercial revenue. This would include revenue from goods and services provided by local businesses and suppliers.	+ State and local commercial revenue increases by ≥10% 0 State and local commercial revenue changes by <10% — State and local commercial revenue decreases by ≥10%
State and Local Government Net Revenues	Assess quantitatively the impact of each option relative to the Base Case on state and local government net revenues (revenues minus expenditures). Typical revenue sources include intergovernmental, taxes, (sales, property, income, fuel, etc.), license fees, unemployment compensation, and others. Expenditures include health, welfare, public education, transportation, police, fire, water, housing, parks, etc. Both are based on population estimates, which are affected by employment.	+ State and local government net revenue increases by ≥10% 0 State and local government net revenue changes by <10% — State and local government net revenue decreases by ≥10%
Public Outreach	Assess qualitatively the additional public outreach efforts required to gain public acceptance for each alternative.	+ Public outreach efforts decrease significantly 0 Little or no change in public outreach efforts — Public outreach efforts increase significantly

Source: PMACWA, BPT, and FOCIS Associates

1.0 INTRODUCTION AND BACKGROUND

1.1 Introduction

This report has been prepared by FOCIS Associates, Inc. (a GEO-CENTERS, INC. Company) for the Program Manager for Assembled Chemical Weapons Alternatives (PMACWA) under Contract Number DAAD13-01-D-0006, Task 10 – Cost-Benefit Analysis (Impacts Analysis) of PCAPP Hydrolysate and Energetics Treatment and Disposal Alternatives. The work is part of an ongoing PMACWA effort to identify opportunities to reduce cost and schedule and increase public involvement in the Pueblo Chemical Agent Destruction Pilot Plant (PCAPP) project. The report assesses the potential economic impacts and technical issues of off-site treatment and disposal alternatives for various wastes that will be generated by the PCAPP over the life cycle of the project. The study was performed by FOCIS Associates, Inc. (FOCIS) working in close cooperation with the Bechtel Pueblo Team (BPT), the Pueblo Citizens Advisory Commission (CAC) Acceleration Options Working Group (AOWG), and PMACWA.

The proposed plan for PCAPP, referred to as the Base Case, includes on-site thermal treatment to a 5X[1] condition of all wood dunnage (contaminated and uncontaminated), non-wood dunnage, and metal parts, and on-site biotreatment of agent and energetic hydrolysates. Because water is recovered and reused in the Base Case design, there is essentially no liquid discharge. Metal parts thermally treated to a 5X condition may be sold as scrap metal, while other solid process wastes (ash from 5X treatment of dunnage and dewatered salts and biomass from biotreatment and water recovery) are shipped off site to appropriate facilities for disposal. The Impacts Analysis assesses the economic impacts of off-site treatment and disposal options for uncontaminated wood dunnage, decontaminated (3X[2]) metal parts, energetics (propellants and bursters), and hydrolysates. The off-site options are also compared to the proposed Base Case design using other criteria, such as technical issues, schedule, safety, environmental permitting and compliance, and public outreach. The results of the Impacts Analysis will serve as part of the basis for a decision on the final configuration of the PCAPP.

1.2 Background

In March 2002, the Department of Defense (DOD), through the Defense Acquisition Executive (DAE) Review, selected chemical neutralization followed by biodegradation for the destruction of the chemical stockpile stored at the Pueblo Chemical Depot (PCD) in Colorado. The DOD decision, as documented in the Record of Decision (ROD) signed on 18 July 2002 [DOD 2000], was based on a number of factors including mission needs, cost, schedule, environmental and safety considerations, public concerns, and compliance with the Chemical Weapons Convention (CWC) Treaty.

[1] 5X refers to the state of agent decontamination after heating an object to 538°C (1,000°F) for 15 minutes, signifying that the material is clean of chemical agent and may be released from government control.
[2] 3X decontamination indicates an item has been surface decontaminated, bagged, or contained and that appropriate tests have verified that vapor concentrations do not exist above 0.003 mg/m^3 for sulfur mustard (H, HD and HT).

In response to concerns arising from the 11 September 2001 terrorist attacks, the DAE, in their technology decision, also directed the U.S. Army to investigate ways to accelerate the destruction of the chemical stockpile stored at PCD [DOD 2002]. These efforts are to be carried out in full compliance with the National Environmental Policy Act (NEPA). Consistent with that directive, PMACWA, initiated investigations to identify and evaluate acceleration options. Some of the options identified involve shipment of PCAPP wastes (energetics, hydrolysates, uncontaminated wood dunnage, and 3X decontaminated metal parts) off site to appropriate treatment, storage, and disposal facilities (TSDFs). At a meeting held in Pueblo on 14 November 2002, the AOWG requested that the PMACWA assess potential economic impacts of the various off-site shipment options being considered for PCAPP. In response to the AOWG request, PMACWA assigned FOCIS Associates the task of conducting a Cost-Benefit Analysis (Impacts Analysis) of the options.

In September of 2003, the DOD awarded the systems contract for PCAPP to a team of contractors lead by Bechtel National Incorporated (BNI) of San Francisco, California. The Bechtel Pueblo Team (BPT) consists of BNI, Parsons, Battelle Memorial Institute, and The Washington Group. Consistent with the PCAPP Request for Proposal (RFP), the BPT proposed concept design calls for the treatment of process wastes on site and recovery and reuse of water to the maximum extent possible. As previously mentioned, this proposed Base Case design includes on-site thermal treatment to a 5X condition of all wood dunnage (contaminated and uncontaminated), non-wood dunnage, and metal parts, and on-site biotreatment of agent and energetic hydrolysates. Water is recovered from spent decon and biotreatment effluent in the water recovery system (WRS) and reused in the plant.

Between November 2002 and April 2003, FOCIS project staff met with representatives of PMACWA, the AOWG and the BPT to develop and reach consensus on the general approach to the Impacts Analysis, the off-site options to be assessed, and the evaluation factors and metrics to be used in the analysis. Consensus was reached on these items at the AOWG meetings held in Pueblo on 12 February and 12 March 2003.

2.0 SCOPE, OBJECTIVES, AND APPROACH

2.1 Scope

The PCAPP Impacts Analysis evaluates the costs, benefits, and risks of six (6) off-site waste treatment and disposal options relative to the Base Case design. The Base Case and 6 options evaluated in the Impacts Analysis are as follows:

- Base Case
  - Process the following wastes on site as indicated:
    - Agent and energetics hydrolysates – biotreatment
    - All dunnage and metal parts – 5X treatment
  - Ship solid process wastes (dewatered salts and biomass, 5X dunnage, and 5X metal parts) off site
  - Recycle maximum recoverable water
- Option 1: Ship uncontaminated wood dunnage off site for treatment and disposal (all other wastes processed as per the Base Case)
- Option 2: Ship propellant off site for treatment and disposal (all other wastes processed as per the Base Case)
- Option 3: Ship propellant and bursters off site for treatment and disposal (all other wastes processed as per the Base Case)
- Option 4: Ship propellant and bursters and agent hydrolysate off site for treatment and disposal (all other wastes processed as per the Base Case)
- Option 5: Ship agent and energetic hydrolysates off site for treatment and disposal (all other wastes processed as per Base Case)
- Option 6: Ship 3X munitions bodies off site for treatment and recycle (all other wastes processed as per Base Case)

Initially, two cases for Options 4 and 5 were considered – one with and one without water returned to PCAPP equivalent to the volume of hydrolysate shipped off site. Given the critical issue of water supply in Pueblo, water return was identified as the only case for Options 4 and 5.

Each option is compared to the Base Case according to the following 14 evaluation factors:

- Technical Issues
- Safety
- Environmental Permitting and Compliance
- Transportation
- Water Consumption
- Power Consumption
- Treatment, Storage And Disposal Facilities (TSDFs)
- Treaty
- Life Cycle Cost

- Life Cycle Schedule
- Employment
- State and Local Commercial Revenues
- State and Local Government Net Revenues (revenues minus expenditures)
- Public Outreach

Each option is assessed over the life of the PCAPP project in terms of its relative impact on each of the factors. As will be discussed in subsequent sections of this report, some of the factors are assessed quantitatively while others are evaluated qualitatively.

The Impacts Analysis does not consider the economic impact of government funding constraints during a given fiscal year, abnormal events or litigation during the life of the project, or the future-use of equipment and facilities after the plant is closed. Consequently, the Impacts Analysis did not assess the following:

- Economic impact of government programmatic funding limitations
- Economic effect of potential chemical incidents, accidents, hazardous waste spills, transportation related incidents, or litigation
- Need for additional roads or bridges for site access and evacuation
- Residual value of facility and equipment after closure
- Economic redevelopment of the site after closure

The economic impact of any potential incidents at the facility, such as leaks or explosions and accidents during transport of chemicals and waste to and from the plant, are difficult to assess. In such events, federal assistance would be authorized independently of the existing PCAPP budget. Similarly, the impacts of litigation arising from lawsuits or other legal actions were also not addressed in the study. While the Army's baseline incineration sites have experienced delays and incurred considerable costs as a result of legal actions brought on by environmental and local citizens groups opposed to incineration, such actions will hopefully be avoided at PCAPP as a result of greater transparency and public participation in the technology selection process. Fiscal constraints that may be imposed by Congress also have not been factored into the analysis. While such constraints have previously impacted activities at other demilitarization sites, Congressional action is uncertain and unpredictable. There are plans to upgrade site access roads, but these would be unaffected by any of the options considered in this study. The change in residual or recovery value of the facility and equipment after closure also were not included in the analysis because it could not be predicted whether they would be returned to the community or retained as federal property. Similarly, the analysis did not consider the potential impacts of economic redevelopment of the site after PCAPP closure because redevelopment plans are still in the initial stages of development and not yet well defined. Under the Base Realignment and Closure law of 1988, PCD will be returned to the community following the destruction of the weapons. There is also a redevelopment authority in place at the depot that is recognized as the receiving authority for the property by the Secretaries of the Army and Defense. However, current redevelopment plans are not detailed enough for input into the economic model used to predict impacts on state and local revenues.

2.2 Objectives

The purpose of the Impacts Analysis is to provide a basis upon which to compare the proposed off-site options to the Base Case. The specific objectives of the study are as follows:

- Perform a cost analysis of selected off-site treatment and disposal options, taking into consideration all future direct and indirect costs over all phases of the project (design through closure).
- Develop a complete listing of significant impacts, both positive and negative, associated with each option, and quantify and/or monetize as many of those impacts as possible.
- Use the results of the Impacts Analysis to assess potential economic impacts to the Pueblo community.
- Provide a rational basis for a future decision concerning implementation of any or all of the off-site disposal options considered in this study.

2.3 Approach

As previously mentioned, each off-site option is compared to the Base Case using 14 criteria or evaluation factors. Table 2-1 lists the evaluation factors along with a description of the general assessment approach and the metrics or ratings applied to each factor. Some factors (i.e., transportation, employment, water and power consumption, life cycle cost and schedule, state and local commercial revenues, and state and local government net revenues) are evaluated quantitatively relative to the Base Case. The other factors (i.e., safety, environmental permitting and compliance, TSDF, Treaty, and public outreach) are evaluated qualitatively. Wherever possible, the cost impacts associated with these more qualitative factors have been accounted for in the analysis. For example, the incremental costs associated with technical issue resolution, environmental permitting and compliance, and additional treaty oversight efforts have been included in the cost analysis for each option as appropriate.

Technical Issues
This factor assesses qualitatively the major technical issues and challenges eliminated, mitigated, or created by each option relative to the Base Case. Cost and schedule impacts (either positive or negative) associated with a particular technical issue are accounted for in the Life Cycle Cost and Life Cycle Schedule factors.

Safety
Under the safety factor, the inherent hazards of the option are compared to those of the Base Case within the affected areas or processes. By considering the inherent hazards of each option independent of controls, it is possible to identify which option is more inherently hazardous. This does not mean a technology that is more inherently hazardous cannot be made to operate as safely as a technology with fewer inherent hazards; that ultimately depends on how well the process is controlled and the engineering and/or administrative controls that may be employed. However, it is generally the case that a more inherently hazardous process will require more engineering and administrative controls to mitigate the hazards. From a safety standpoint, a process with fewer and less severe inherent hazards would be preferred over one with more inherent hazards even though the mitigated risk is the same for both processes.

Table 2-1: Impacts Analysis Evaluation Factors

Factors	Assessment Approach	Metric
Technical Issues	Assess qualitatively the major technical issues and challenges associated with each option relative to the Base Case. Quantitative assessments of the technical issues will be reflected in the life cycle costs and schedules.	+ Major technical challenges are reduced or eliminated 0 The change in level of technical challenges is minimal — Additional major technical challenges arise
Safety	Assess qualitatively the impact of each option on worker and public safety relative to the Base Case. Worker safety will address the inherent hazard characteristics of each option and the controls required to mitigate the hazards to acceptable levels. Public safety will address the potential impacts to the public from normal plant operations and during upset conditions, including the potential impact to the public as a result of the accidental release of materials from the plant.	+ The facility is safer based on a decrease in the number and/or severity of inherent hazards 0 The facility is as safe based on the number and/or severity of the inherent hazards remaining the same — The facility is less safe based on an increase in the number and/or severity of inherent hazards
Environment Permitting and Compliance	Assess qualitatively the impact on the NEPA process (EIS and ROD) and environmental permitting and compliance requirements (RCRA, NPDES, Air). Cost and schedule impacts related to permitting and compliance will be included in the respective cost and schedule factors.	+ Permitting and compliance efforts decrease significantly 0 Permitting and compliance efforts are the same — Permitting and compliance efforts increase significantly
Transportation	Assess quantitatively potential impacts on traffic volume, traffic accidents, and overall transportation risks of each option relative to the Base Case. The information used to assess transportation risk will be obtained from the Transportation Risk Analysis recently completed for PMACWA by Argonne National Laboratory.	+ Transportation risks are low and net number of shipments of process wastes and treatment chemicals decreases by ≥10% 0 Transportation risks are low and net number of shipments of process wastes and treatment chemicals changes by <10% — Transportation risks are high and/or net number of shipments of process wastes and treatment chemicals increases by ≥10%
Water Consumption	Assess quantitatively the impacts of each option relative to the Base Case on water consumption.	+ Water consumption decreases by ≥10% 0 Water consumption changes by <10% — Water consumption increases by ≥10%

Table 2-1: Impacts Analysis Evaluation Factors (continued)

Factors	Assessment Approach	Metric
Power Consumption	Assess quantitatively the impacts of each option relative to the Base Case on power consumption.	+ Power consumption decreases by ≥10% 0 Power consumption changes by <10% – Power consumption increases by ≥10%
TSDF	Assess TSDF availability and capacity to handle each of the additional wastes being shipped.	+ There are three or more appropriately permitted TSDFs for each of the additional wastes being shipped off site 0 There are at least two appropriately permitted TSDFs for each of the additional wastes being shipped off site – There is only one appropriately permitted TSDF available for each of the additional wastes being shipped off site.
Treaty	Assess qualitatively the Treaty inspection and oversight requirements of each option relative to the Base Case. Any increases or decreases in costs associated with Treaty compliance will be factored into the cost analysis.	+ Inspection and oversight requirements decrease significantly 0 Inspection and oversight requirements remain essentially the same – Inspection and oversight requirements increase significantly
Life Cycle Cost	Develop cost estimates for each option on a present worth basis and compare the results to the Base Case. Cost elements will include: RDT&E, design and engineering, site development and utilities, facilities and equipment, construction, systemization, pilot testing, operations and maintenance, management, environmental permitting and compliance, and closure.	+ Life cycle cost decreases by ≥$50 million 0 Life cycle cost increases or decreases by less than $50 million – Life cycle cost increases by ≥$50 million
Life Cycle Schedule	Perform a high level, semi-quantitative analysis of the potential impacts of each option relative to the schedule for the Base Case. Results will be expressed as having an increase, decrease, or minimal impact on the Base Case schedule. Estimates of the amount of time saved from or added to the Base Case schedule will be provided.	+ Life cycle schedule is reduced by 6 months or more 0 Life cycle schedule is extended or reduced by less than 6 months – Life cycle schedule is extended by 6 months or more

Table 2-1: Impacts Analysis Evaluation Factors (continued)

Factors	Assessment Approach	Metric
Employment	Compare the number of full-time jobs (expressed as full-time equivalents or FTEs) required for each option relative to the Base Case.	+ Number of FTEs increases by ≥10% 0 Number of FTEs changes by <10% — Number of FTEs decreases by ≥10%
State and Local Commercial Revenues	Assess quantitatively the impact of each option relative to the Base Case on State and local commercial revenue. This would include revenue from goods and services provided by local businesses and suppliers.	+ State and local commercial revenue increases by ≥10% 0 State and local commercial revenue changes by <10% — State and local commercial revenue decreases by ≥10%
State and Local Government Net Revenues	Assess quantitatively the impact of each option relative to the Base Case on state and local government net revenues (revenues minus expenditures). Typical revenue sources include intergovernmental, taxes, (sales, property, income, fuel, etc.), license fees, unemployment compensation, and others. Expenditures include health, welfare, public education, transportation, police, fire, water, housing, parks, etc. Both are based on population estimates, which are affected by employment.	+ State and local government net revenues increases by ≥10% 0 State and local government net revenues changes by <10% — State and local government net revenues decreases by ≥10%
Public Outreach	Assess qualitatively the additional public outreach efforts required to gain public acceptance for each option.	+ Public outreach efforts decrease significantly 0 Little or no change in public outreach efforts — Public outreach efforts increase significantly

Source: PMACWA, BPT, and FOCIS Associates

Environmental Permitting and Compliance
This criterion addresses National Environmental Policy Act (NEPA) impacts, permitting issues, and general compliance requirements associated with each option. Cost and schedule impacts related to permitting and compliance have been included in the respective Life Cycle Cost and Life Cycle Schedule factors. Not covered in this factor are the potential impacts of TSDF operations on the local environment and surrounding communities. An assessment of such impacts is beyond the scope of this study. The environmental performance record of any prospective TSDF, as well as its relations with the local community, would be assessed in an environmental audit, which is normally conducted as part of a pre-bidding process.

Transportation Risk
The assessment of impacts on transportation is based largely on the results of the Transportation Risk Study conducted by Argonne National Laboratory (ANL) for PMACWA (ANL, 2003), which looked at the risks of fatalities and injuries as a result of accidents during transport of PCAPP wastes. The risk of terrorism and/or sabotage was not explicitly addressed in the ANL study. It is, of course, an overriding concern for any of the options involving shipment of energetics. From a statistical standpoint, it can be argued that the risk of a terrorist incident is extremely low and that the off-site disposal options will have little impact on the risk level. Therefore, for the purposes of this analysis, the transportation factor is rated based on the results of the ANL study and the impacts on traffic volume. Risks of <1 injury or fatality over the life of the project as a result of a particular option are considered in the Impacts Analysis to be essentially the same as the Base Case. If an option has a risk of injury or fatality of ≥1 then it receives a negative rating compared to the Base Case. There are no instances where an option would result in a lower transportation risk when only considering waste shipments because all options produce an equal or greater number of waste shipments when compared to the Base Case. (As noted in the ANL study, the number of shipments has a much greater influence on the risk estimates than does the type of cargo.)

The other element considered in this factor is the net change in total shipments of process wastes (including dunnage) and treatment chemicals during operations. The Base Case is estimated to require an average of 65 truck trips per week for shipping all process wastes and treatment chemicals. Options resulting in a ≥10% increase in the average number of truck trips (or an increase of ≥6.5 trips per week) receive a negative rating, while options resulting in a ≥10% decrease in the average number of truck trips receive a positive rating. An increase or decrease of <10% is considered to be negligible and therefore the option is given a neutral rating.

Water Consumption
This factor compares the water consumption of each option against that of the Base Case. The analysis focuses on net changes in process water consumption as a result of shipping a particular waste off site. The Base Case recovers and reuses process water, but still requires makeup water to replace process water lost through evaporation or with the bioreactor solids. The amount of make-up water required by the Base Case process is approximately 15,000 gallons per day (gpd) on a normal operating day. Options resulting in a >10% increase in water consumption are rated as having a negative impact, while options resulting in a >10% decrease in water consumption are rated as having a positive effect. An increase or decrease of 10% or less is considered to be negligible and therefore the option is given a neutral rating.

As will be discussed in subsequent sections of this report, all of the options result in a net reduction in full-time personnel. Consequently, there would be a reduction in onsite potable water consumption. This reduction is estimated to range from an average of <100 gpd (for Option 1) to <3000 gpd (for Option 4) over the project life cycle. These changes in potable water consumption are small compared to potential changes in process make-up water and therefore are not considered further in this analysis.

Power Consumption
This factor compares the electrical power consumption of each option against that of the Base Case. The analysis focuses on net changes in power consumption as a result of process changes resulting from shipping a particular waste off site. Natural gas consumption is not considered in the analysis because it is used mostly for building heat and not process heating. Because building heating requirements are only marginally affected by any of the options, natural gas consumption will be essentially the same for the Base Case and all options.

Ratings for this factor are determined based on the change in power consumption between the Base Case and option. An increase of ≥10% results in a negative rating, while a decrease of ≥10% results in a positive rating. An increase or decrease of <10% is considered to be negligible and the option is assigned a neutral rating.

Treaty
The Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction, also known as the Chemical Weapons Convention (CWC) or CWC Treaty, was signed by the United States on 13 January 1993 and ratified on 25 April 1997. The State Department has been designated by the President as the National Authority responsible for implementing the provisions of the CWC Treaty. The Treaty includes requirements for sampling, record keeping, reporting, and inspections for facilities engaged in or formerly engaged in activities involving chemical agents, agent precursors and other Scheduled chemicals. These requirements are delineated in 22 CFR Part 103 and 15 CFR Parts 710 through 722.

This factor assesses qualitatively the Treaty inspection and oversight requirements of each option relative to the Base Case. Options that result in an increase in Treaty inspection and verification requirements are given a negative rating, while those that result in a decrease in Treaty inspection and verification efforts receive a positive rating. Options having no impact on Treaty compliance efforts receive a neutral rating. Any increase or decrease in costs associated with Treaty compliance is factored into the life cycle cost analysis.

TSDFs
This factor identifies Treatment Storage and Disposal Facilities (TSDFs) with the technical capability, capacity, and required permits to handle the additional wastes to be shipped off site with each option. The types of TSDFs considered in the study depended on the individual wastes to be shipped. For example, for hydrolysate, only RCRA permitted TSDFs with biological treatment capabilities were considered in the study. RCRA permitted incinerators and deep well injection facilities, although technically capable of processing the hydrolysate, were not

considered in the study. For propellant and explosives, RCRA permitted incinerators were the only technically viable alternatives identified for off-site disposal of these materials. Two types of RCRA permitted TSDFs were considered for wood dunnage; landfills and incinerators. The thermal treatment unit at Rock Island Army Arsenal in Illinois was the only facility confirmed to have the capability and capacity to treat 3X metal parts from PCAPP. Additional information on all these facilities is provided in Section 3 of the report.

Ratings for this factor are determined based on the number of TSDFs identified that have the permits, technical capability, and capacity for processing the full volumes of the respective wastes from PCAPP. If only one TSDF was identified for a particular waste, the respective off-site option was given a negative rating to reflect the increased risk. Having only one TSDF available to receive the waste represents a greater risk to the program than the Base Case. If that facility should close or become unavailable for an extended period for any reason, the cost and schedule consequences to the program could be enormous. Contracting with more than one facility would mitigate this risk. With at least two TSDFs available to receive the waste, an option is considered to be on par with the Base Case in terms of process capacity and redundancy. With three TSDFs always available, the option is considered to offer greater redundancy and capacity than the Base Case, and hence receives a positive rating.

In evaluating this factor, the study team did not consider the political ramifications of shipping a specific waste off site to a particular TSDF. It is well recognized and appreciated that certain technologies and facilities raise concern among some members of the public. After all, the ACWA program was established as a direct result of public opposition to the Army's Baseline incineration program. Public concerns over the origin of the waste, misconceptions about its characteristics and hazard level, and apprehensions about its transport over public roads and through local communities can also thwart any efforts to ship these wastes off site to a commercial facility. All of these are legitimate concerns that must be addressed through public outreach efforts within all of the potentially affected communities, including Pueblo, the communities along the transportation routes, and the communities where the TSDFs are located.

Life Cycle Cost and Schedule

The impacts on life cycle cost and schedule were developed from data provided by BPT for this study and from information contained in the technology assessment reports prepared for PMACWA by Arthur D. Little (ADL) in 2001.

It should be noted that complete life cycle costs and schedules were not developed for the Base Case and each individual option. Instead, cost and schedule impacts are assessed over each phase of the project on a relative basis rather than on an absolute basis; that is they are based on estimated differences (deltas) in cost and schedule between the Base Case and the option as determined from knowledge about the individual systems and processes impacted by the proposed option. Deltas are used for comparison because life cycle cost and schedule for the Base Case were not available in time for this study. All costs are reported in current (2003) dollars. A complete listing of assumptions used in estimating costs are provided in the cost summary tables for each option provided in Section 3 of the report.

Employment
This criterion compares the number of full-time jobs (expressed as full-time equivalents or FTEs) required for each option relative to the Base Case. Changes in the number of FTEs are determined for each phase of the project based on information provided by BPT. Option ratings are based on the increase or decrease in the average number of FTEs calculated as a percent of the average Base Case FTEs over the life cycle of the project. For the Base Case, the estimated average number of FTEs over all phases of the project is 718. The predicted change in FTEs as a result of each option is shown in Table 2-4. Options that increase the average number of FTEs by ≥10% over the Base Case are rated as having a positive impact on employment. Options that result in a net decrease in the Base Case FTEs by ≥10% are considered to have a negative impact on employment. An impact of <10% is considered neutral with respect to the Base Case.

State and Local Commercial Revenues
A rule-of-thumb approach was used to estimate the change in state and local commercial revenues from goods and services affected by the options. The change in commercial revenues was based on changes in major equipment, facility, and process chemicals. According to BPT, bulk materials typically make up about 25% of the capital cost of equipment and facilities. Based on past experience at other demilitarization sites, approximately 25% of the bulk materials can be obtained from local suppliers and another 25% can be purchased from suppliers elsewhere in the state. It is assumed that the remaining 50% would be purchased form supplier in other states. The cost of major equipment and imported chemicals either deleted or added to the plant as a result of a given option was multiplied by these percentages to estimate the potential loss or gain in local and state commercial revenues. The percent gain or loss in commercial revenue is determined by dividing the change in commercial revenue by the estimated total state or local commercial revenue of the Base Case, which for this study has been assumed to be approximately $100 million for the state and $50 million for the local Pueblo community over the life of the project. Options resulting in an increase in commercial revenues of ≥10% are considered as having a positive impact. Options that decrease commercial revenues by ≥10% are rated as having a negative impact on commercial revenues. A change in commercial revenue of 10% or less is considered to be marginal or neutral with respect to the Base Case.

State and Local Government Net Revenues
In order to assess the impacts of each option on state and local government net revenues (revenues minus expenditures), the study team sought the help of the Institute for Defense Analysis (IDA) in Alexandria, Virginia. IDA is a federally funded research and development center established to assist the Office of the Secretary of Defense, the Joint Staff, the Unified Commands, and Defense Agencies in addressing important national security issues, particularly those requiring scientific and technical expertise. IDA also conducts related research for other government agencies on national problems for which the Institute's skills and experience are especially suited.

As part of the National Defense Authorization Act for Fiscal Year 2001, Congress directed the Secretary of Defense to complete an assessment and report on the economic effect on the communities surrounding the eight chemical demilitarization facilities located in the continental United States, and to include a recommendation of whether federal compensation to those

communities is warranted. In January 2001, the DOD asked IDA to conduct the required economic assessment.

In evaluating the incremental effect of chemical demilitarization activities on the local community, the legislation directed DOD to consider the following six criteria:

1. The impact that any change in population as a result of chemical agent demilitarization activities would have on the community.
2. The possible temporary nature of such change in population and the long-range impact of such a change in population on the permanent residents of the community.
3. The initial capitalization required for the services, facilities, or infrastructure to support any increase in population.
4. The operating costs for sustaining or upgrading the services, facilities, or infrastructure to support an increase in population.
5. The costs incurred by local government entities for improvements to emergency evacuation routes required by the chemical demilitarization activities.
6. Such other factors, as the Secretary of Defense considers appropriate.

IDA studied these criteria by combining economic modeling techniques and case studies.

As discussed in the IDA report [IDA 2001], there are two basic approaches to estimating incremental costs and benefits for a project the size and scope PCAPP. One approach is to conduct a detailed case study of the site. The other approach is to use an economic model. In their study, IDA used a regional economic model called REMI (Regional Economic Models, Inc., Policy Insight Model) as the principal analytical tool to estimate the incremental costs and benefits of the demilitarization facility at each site. Case study methods were used to gather information of the legislative criteria that were not easily quantifiable. Because of time constraints, the study team decided to use the same modeling approach, making use of IDA expertise and prior experience with the REMI model. IDA was contacted and agreed to provide assistance on the current study. Updated employment and schedule data developed by the BPT and FOCIS were provided to IDA for input into the model. IDA then ran the REMI simulation and provided the model output to FOCIS for analysis.

REMI Model Description. REMI is a regional econometric model consisting of a large number of linked mathematical equations. Each equation describes a detailed economic relationship. These equations are created using conventional economic theory to describe the structural relationships between variables. The parameters of each equation are calibrated to or estimated from historical data and local conditions. The model has the ability to generate forecasts for any combination of future years, providing users flexibility in analyzing the timing of economic effects. The main drivers of the model are population and employment.

One feature of REMI that made it especially desirable for use in both the IDA study and this study is the insight it provides into local government revenues and expenditures. Table 2-2 lists the individual revenue and expenditure variables used in REMI model. Not all of these variables, which are set to statewide averages, apply to every location since some of the categories of

revenue and expenditures will not be applicable everywhere. An example is individual income tax, which is not levied in the City of Pueblo or Pueblo County.

Table 2-2: REMI Revenue and Expenditure Variables

Government Revenues	Government Expenditures
• Federal intergovernmental • Property tax • General sales tax • Motor fuel sales tax • Alcoholic beverage sales tax • Tobacco sales tax • Public utility sales tax • Other sales tax • Individual income tax • Corporate income tax • Motor vehicle license fees • Other taxes • Education charges • Other charges and revenues • Utility and liquor store revenues • Unemployment compensation • Employee retirement	• Intergovernmental • Higher Education • Elementary and secondary education; libraries • Welfare • Health • Transportation • Police, fire, correction • Natural resources, parks, housing • Sewage, solid waste • Administration and unallocatable • Interest on debt • Utilities, transit • Insurance trusts

Source: IDA 2001

The multi-regional version of the REMI model used by IDA in their 2001 study examines the effects of the chemical demilitarization activity in the context of regular commuting and trading relationships that exist between a relatively small area (the core county where the facility is located) and its larger, surrounding region (counties contiguous to the core). REMI also produces estimates of the state's expenditures and revenues associated with the economic activity conducted within the core and surrounding region. For more information about the REMI Model, the reader is referred to the IDA report and to the REMI User Manual, which can download from the worldwide web at www.remi.com.

Modeling Approach for the Impacts Analysis. For this study, economic impacts were assessed in Pueblo County and within the State of Colorado taking into account the interactions between the core county (Pueblo) and the surrounding regions that might be affected by the chemical demilitarization facility. IDA ran three forecasts to determine the incremental effects on local and state governments. The first, a control forecast, was a prediction of what the future economic behavior of the core county, region, and state would look like in the absence of a chemical demilitarization program. The second was a simulation in which relevant policy variables (principally, employment and government expenditure) are changed in the model in order to estimate the economic effect of the Base Case facility, with emphasis on local government revenues, expenditures and net income (i.e., revenues minus expenditures). The third forecast

was a simulation in which the employment numbers are changed according to each off-site option in order to determine the effect on net revenue. In each case, the measure of interest is the difference (delta) between forecasts. The effects of the option are determined by subtracting the results of the Base Case from the results of the option.

For the Base Case forecast, IDA used demographic and spending data gathered for their 2001 study along with updated employment and schedule data provided by BPT and FOCIS.

The major variable for this analysis is employment data. Peak employment data used for the Base Case simulation are shown in Table 2-3.

Table 2-3: Base Case Peak Employment

Phase	Number of Employees[1,2]
Construction	1,350
Systemization	750
Pilot testing and operations	550
Closure	194

(1) The peak employment for construction, pilot testing and operations are based on information provided by the BPT at the kick-off meeting held at PCD on 22 January 2003.
(2) Peak employment for systemization and closure were estimated by IDA based on information they had collected from PMACWA and PMCD for their 2001 study.

The labor impact and schedule data provided to IDA for input into the REMI model are shown in Table 2-4. The sources of the information are listed at the bottom of the table. Schedule changes associated with each option were not factored directly into the model. According to information provided by the BPT, the construction phase is the only part of the schedule impacted by any of the off-site options. The BPT estimates for non-manual labor (e.g., management, quality assurance, administration) impacts during construction were based directly on estimated construction schedule impacts. Consequently, the schedule impacts have been indirectly accounted for in the labor estimates used in the model.

The cumulative effects of the Base Case and each option on net revenue (revenues minus expenditures) are determined at two points in time; the end of closure in October 2011 and 2035. Only the results through 2011 are discussed in the Impacts Analysis. Consistent with the original IDA study and the time horizon of the REMI model, the simulation is carried out through the year 2035 to capture the full effects of the project that continue to ripple through the local economy long after the facility closes.

Prior Modeling Results. In the IDA study conducted in 2001, the REMI model calculated that over the long-term the net economic effects of the chemical demilitarization project for most, but not all, local communities and surrounding regions would be negative. This modeling trend was true for six of the eight demilitarization sites studied, including Pueblo. Interestingly, at the state

Table 2-4: Schedule and Changes in Local Labor Provided to IDA for Input into REMI Model

Project Phase	Schedule[1]			Option 1 Ship wood dunnage off site		Option 2 Ship propellant off site		Option 3 Ship propellant and bursters off site	
	Begin Date	End Date	Duration (months)	Man-months[3]	FTE[4]	Man-months[3]	FTE[4]	Man-months[3]	FTE[4]
Design	7-Jan-03	22-Jun-05	29.5						
Construction	29-Jul-04	27-Apr-07	32.9	-232	-7.0	-788	-23.9	-936	-28.4
Systemization[2]	20-May-06	19-Nov-07	18.0	-54	-3.0	0.0	0.0	-126	-7.0
Pilot Testing and operations[2]	20-Nov-07	19-Nov-09	24.0	216	9.0	216	9.0	-48	-2.0
Closure	20-Nov-09	5-Oct-11	22.5	-11	-0.5	0.0	0.0	-40	-1.8
Total Project Duration	7-Jan-03	5-Oct-11	105.0	-81	-0.8	-572	-5.4	-1150	-11.0

Project Phase	Schedule[1]			Option 4 Ship propellant, bursters, and agent hydrolysate off site		Option 5 Ship agent and energetic hydrolysates off site		Option 6 Ship 3X munition bodies to Rock Island	
	Begin Date	End Date	Duration (months)	Man-months[3]	FTE[4]	Man-months[3]	FTE[4]	Man-months[3]	FTE[4]
Design	7-Jan-03	22-Jun-05	29.5						
Construction	29-Jul-04	27-Apr-07	32.9	-1528	-46.4	-832	-25.3	-498	-15.1
Systemization[2]	20-May-06	19-Nov-07	18.0	-414	-23.0	-288	-16.0	-234	-13.0
Pilot Testing and operations[2]	20-Nov-07	19-Nov-09	24.0	-648	-27.0	-600	-25.0	-0	-0.0
Closure	20-Nov-09	5-Oct-11	22.5	-80	-3.6	-80	-3.6	-35	-1.6
Total Project Duration	7-Jan-03	5-Oct-11	105.0	-2670	-25.4	-1800	-17.1	-767	-7.3

(1) Milestones adapted from BPT Schedule dated 18 Feb 03
(2) Phase duration adjusted according to BPT matrix dated 24-May-03
(3) Provided in BPT matrix dated 24-May-03
(4) FTE = full-time equivalent jobs = man-months/phase or project duration in months

level, the model consistently predicted a positive economic effect for all sites. The authors of the study explained the somewhat surprising local results as follows:

> "…the negative effects are due to the unnaturally sharp business cycles induced by the chemical demilitarization projects in these localities. The rapid infusion of construction expenditures is followed by several years of chemical demilitarization jobs that pay higher than average wages for the region. In general, all regions and states enjoy net gains during this active period. However, these benefits end quickly when the facility is closed. The temporary higher paying chemical demilitarization jobs turn out to be detrimental to most areas in the long run because they have inflationary effects on labor rates and real estate prices that cannot be sustained once employment returns to prior levels. Further investments made to accommodate the additional population must now be

> amortized over declining population and wage base following closure. Compared with most economic investments of this magnitude, the life cycle of the demilitarization activity is unusually brief."

The study goes on to say that:

> "…it is not the demilitarization activity per se that causes a negative effect; it is the sudden vacuum following closure that is detrimental to a community."

This boom-bust cycle appears to have a greater impact in terms of net economic losses on sites where workers and their families tend to stay after the facility is closed and for period of time are either unemployed or must settle for lower paying jobs. For the two sites that experienced net gains at the local level, it is suggested by the authors that workers either leave quickly after the facility closes or stay in the area but are able to find comparable paying jobs right away. In these latter situations, workers and their families do not burden the community with requirements for education, unemployment compensation, and other services.

Model Limitations. The REMI model, like all models, is a rough approximation of reality and, as such, has some significant limitations. In their 2001 report, IDA provided the following caveats when interpreting the modeling results.

- The results are based on sets of input data that in some cases are very preliminary and subject to change over time.
- The model is somewhat rigid in that, unlike the affected communities, it cannot recognize the unique, short-term nature of the demilitarization project and adjust its response accordingly. When faced with such an aberrant business cycle, affected communities may chose to respond differently than the model predicts.
- There is an indeterminate degree of error embedded in the estimating factors and equations in the model since they have been determined from empirical data. Because the Impacts Analysis looks at changes or deltas in net revenues, which are determined by subtracting one set of simulation results from another, some errors may cancel each other, thus improving the accuracy of the results. Even so, without a large statistical data set to compare with the model output, it is impossible to determine the magnitude of the errors and how they may vary with changes in the input data.
- Predicting the future is an inherently uncertain and inexact endeavor and this modeling effort is no exception to that general rule.

In view of the above limitations, the modeling results should be viewed as order-of-magnitude type estimates.

Public Outreach

Obtaining public support is probably the greatest challenge faced with some of the off-site disposal options, especially those involving wastes that may be subject to mischaracterization by the media or general public. A case in point is the VX hydrolysate that will result from the destruction of the VX stockpile at the Newport Chemical Depot in Newport, Indiana. It has been reported that when the Army began investigating treatment of the VX hydrolysate at a TSDF in Dayton, Ohio, some misinformed local residents believed the Army was intending to ship VX

agent to the TSDF. Despite the Army's public outreach efforts, this misconception has been difficult to overcome and has caused the Army to begin looking at other facilities to treat the VX hydrolysate. The type of TSDF, its past history, and its relations with the local community can also impact public acceptance.

Support for off-site shipment is needed not just within the Pueblo community, but also in communities along transportation routes and where the TSDFs are located. While the Army has previously received public support at other sites for off-site shipment of similar wastes, it cannot rely on precedent to predict how other communities will react to such options. Each situation is different, requiring slightly different approaches and different levels of effort tailored to meet the specific needs and concerns of the affected community. This factor assesses the additional public outreach efforts that may be required to secure public support for each option.

Public Support

In addition to the factors addressed in this report, the AOWG will assess the level of public support for each off-site disposal option. Public support will be determined through a series of public meetings and information sessions held in the Pueblo community. Results of the assessment will be documented in a separate report by the AOWG. The current schedule for providing the public with the results of the Impacts Analysis and gaining their input is as follows:

- Late June 2003 – Submit Draft Final Report to AOWG
- 8-9 July 2003 – Conduct a working session with the AOWG to obtain their input
- 10 July 2003 – Present results of the Impacts Analysis and AOWG recommendations to the CAC
- 26 July 2003 – Conduct a day-long Public Forum in Pueblo to answer questions and obtain input
- 14 August 2003 – CAC makes recommendation to the Army

The AOWG intends to use the Impacts Analysis report to formulate the group's recommendation to the CAC.

3.0 OFF-SITE DISPOSAL OPTIONS

This section of the report presents the evaluation results for the six off-site treatment and disposal options. Each option is evaluated independently of the other options using the 14 assessment factors shown in Table 2-1. At the beginning of each sub-section is a brief description of the Base Case process(es) affected by the proposed option. This is followed by a brief description of the proposed option, its potential impacts on the Base Case plant configuration, and its impacts relative to each of the evaluation factors.

3.1 Option 1: Ship Uncontaminated Wood Dunnage Off Site

3.1.1 Wood Dunnage Processing – Base Case and Option 1

Block flow diagrams for the Base Case and proposed option are shown in Figure 3-1. The top diagram shows the major unit processes and process rates used in the Base Case design for on site treatment of wood dunnage. The bottom diagram shows the process configuration and processing rates for the proposed off-site option. The figure serves as a useful reference for the discussion that follows.

3.1.1.1 Base Case for processing wood dunnage on site.

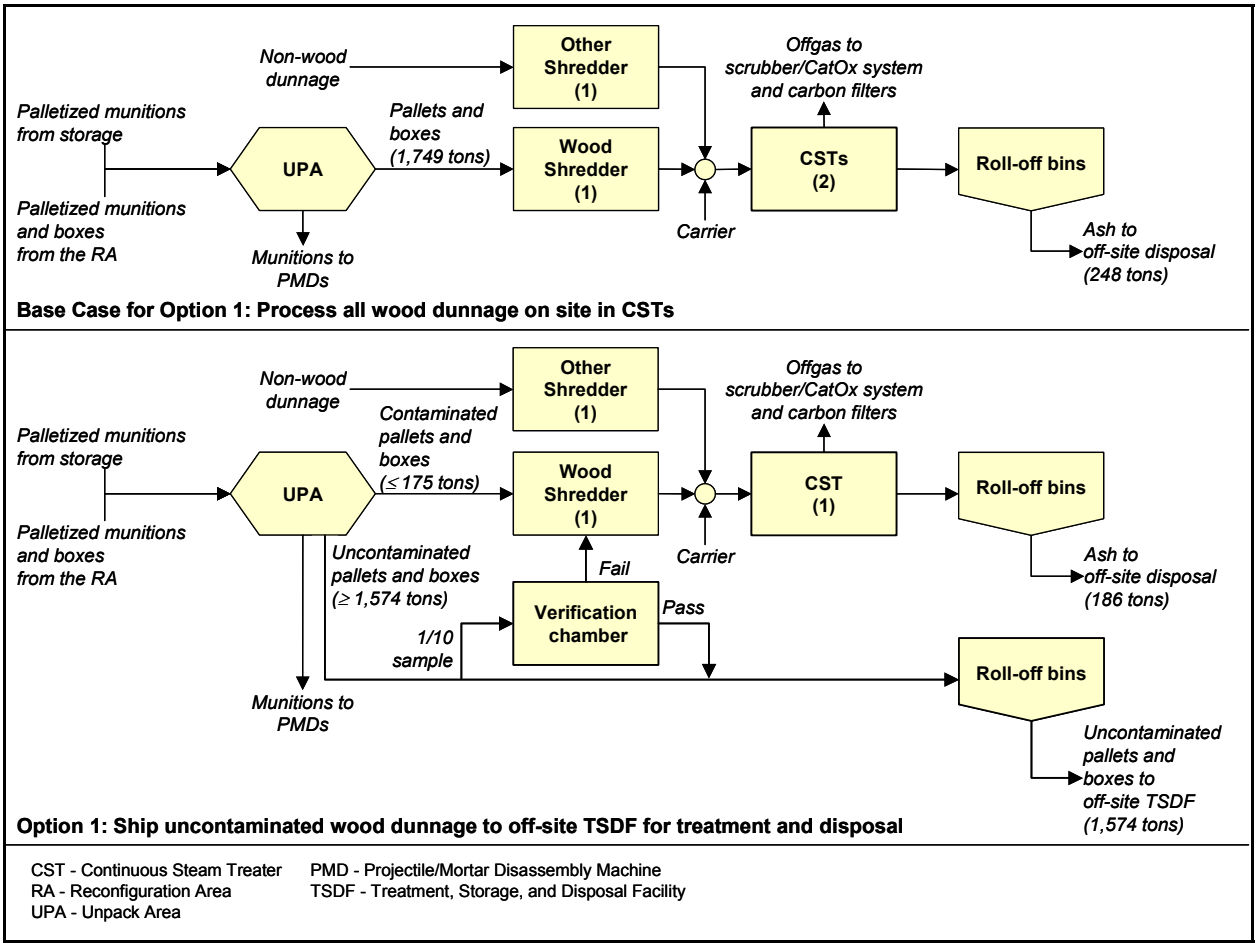
The munitions at the Pueblo Chemical Depot (PCD) are currently stored in igloos on wooden pallets, in wooden boxes, or a combination of both. Most of this wood has never been exposed to agent, the only exception being wood that once held a leaking munition, in which case the agent-contaminated wood has been over-packed along with the leaking munitions.

In the Base Case design, all wood dunnage, whether contaminated or uncontaminated, is treated on site at the Pueblo Chemical Agent Destruction Pilot Plant (PCAPP). The steps involved in on-site processing of wood dunnage include:

- Unpacking munitions from pallets and boxes
- Shredding boxes and pallets
- Treating shredded wood in the Continuous Steam Treaters (CSTs)
- Treating CST offgases
- Disposing of ash at an approved off-site facility

The wooden pallets and boxes are delivered to the Unpack Area (UPA) from the Munitions Storage Building (MSB) or the Reconfiguration Area (RA) of the Energetics Process Building (EPB). The boxes and pallets are loaded into a chute, which feeds a shredder. The shredder grinds the wooden materials into coarse sawdust. The sawdust is mixed with carbon, a carrier material, and fed (together with shredded non-wood dunnage) into one of two CSTs. The CST is an inductively-heated reactor that heats the materials to greater than 1000°F for more than 15 minutes to achieve 5X decontamination as defined by the Army. The sawdust is reduced under superheated steam conditions (no free oxygen) to gaseous byproducts and solid ash.

Figure 3-1: Base Case and Option 1 Flow Diagrams



Source: FOCIS Associates

The carbon carrier material, which is inert to the induction-heating process, transports the ash through the system to the outlet. The ash is separated from the carrier so the carrier can be recycled. The ash is disposed of off site at an approved RCRA permitted facility.

The gaseous byproducts are drawn out of the CST through a series of cyclones to a water scrubber/quench tower. The cyclones remove entrained solids that, like the ash, are disposed of at an off-site facility. The scrubber rapidly cools the gas to near-ambient conditions. Small quantities of sodium hydroxide are added to the scrubber water to neutralize any acid gas produced in the CST. Spent scrubber solution and CST condensate are mixed with spent decontamination solution and treated in the Immobilized Cell Bioreactors™ (ICBs™) along with the agent and energetic hydrolysates.

The cooled gas exiting the scrubber is mixed with air and reheated to approximately 800°F. The gas is passed through a catalytic oxidizer (CatOx), which acts similarly to an automobile catalytic converter. The CatOx breaks down the organic byproducts into simple molecules such as carbon dioxide and water. The gas from the CatOx is cooled to a near-ambient temperature,

passed through a carbon bed to remove any trace amounts of organic molecules, and discharged into the facility ventilation system.

3.1.1.2 Option 1 – Shipping uncontaminated wood dunnage off site for disposal.

In this option, uncontaminated wood pallets and boxes from the unpacking of munitions in the UPA will be shipped off site to an appropriate commercial facility for disposal. While this wood dunnage is not contaminated by agent, it contains wood preservatives and thus will be shipped as a hazardous waste to a Resource Conservation and Recovery Act (RCRA) treatment, storage, and disposal facility (TSDF). The uncontaminated pallets and boxes will not be processed through the shredder, but will instead be placed directly into roll-off containers and stored temporarily at PCAPP until shipped off site to a TSDF. A procedure for demonstrating that the wood dunnage is not contaminated with agent must be developed and validated.

For the purpose of this study, it is assumed that 90% of the total wood dunnage is uncontaminated by agent although the actual percentage of uncontaminated wood dunnage is expected to be much higher. The remaining 10% is assumed to be contaminated by agent and will be processed as described for the Base Case (i.e., shredded and treated in the CST).

The impact of this option on the plant configuration is as follows:

- Reduces the quantity of wood treated in the CST by 90% or more allowing for a reduction in the number of CSTs from two to one
- Adds a storage area for uncontaminated wood dunnage
- Adds truck bay for loading wood for off-site shipment

This option will require a method for determining that the wood dunnage is not agent-contaminated prior to release for off-site shipment. The cost of validating and certifying a method for use PCAPP has been included in the assessment of cost impacts.

3.1.2 Impacts of Option 1

3.1.2.1 Technical Issues.

The CST is a first-of-a-kind system and as such there are a number of technical challenges and developmental hurdles that must be overcome before full-scale operations begin. A prototype of the CST was tested during the ACWA Engineering Design Study (EDS) program. Although testing results were generally positive, there were a number of technical issues left unresolved, such as the system design capacity and throughput rate; system reliability, availability and maintainability (RAM) characteristics; and optimal carrier media. The BPT has proposed Technical Risk Reduction Projects (TRRPs) to address the most critical of these outstanding issues during the design phase. While there is a reasonable chance that the TRRPs will be successful, there is the possibility that they will be only marginally successful or inconclusive. Shipping uncontaminated wood dunnage off site will eliminate a significant portion of a major CST feed, thus reducing the size and/or number of units required for PCAPP. Reducing the dependence on the CST will limit the impact of unplanned CST shutdowns and interruptions on the plant throughput and availability.

The primary technical challenge for this option is developing a reliable and sufficiently sensitive method for verifying that the wood dunnage is not contaminated with agent prior to shipping it off site to a TSDF. The related non-technical challenge involves obtaining regulatory and stakeholder approval for the chosen sampling and analytical methods. While these challenges are not insurmountable, they do represent potential obstacles for implementation of this option.

The option does not eliminate any major technical issues associated with the Base Case. Consequently, it is given a negative (–) rating because it raises the additional major technical challenge of having to verify that the wood dunnage is agent contaminated.

3.1.2.2 Safety.

The most significant inherent hazard of the proposed option is the potential for worker exposure to agent-contaminated wood, especially at the TSDF where the wood would no longer be directly under government control. Instituting an effective monitoring or sampling program designed to detect agent contamination before the wood leaves the MSB or UPA mitigates the hazard and reduces the risk of worker exposure to a negligible level.

The other safety concern is the potential for worker exposure to pentachlorophenol (PCP), a hazardous chemical commonly used as a wood preservative because of its fungicidal properties. At high enough concentrations, PCP is toxic to humans and is a suspected human carcinogen. It is believed that the pallets at PCD have been pressure treated with PCP. Provided the pallets are not broken down or ground-up, the risk of worker exposure to PCP contaminated dust should be negligible.

Other occupational hazards, such as those associated with heavy lifting or with the use of heavy machinery (e.g., forklift) are essentially the same as those of the Base Case.

Implementing this option will neither enhance nor diminish the overall safety of the facility. Therefore the option is rated as neutral (O) with respect to the Base Case in terms of the impact on safety.

3.1.2.3 Environmental Permitting and Compliance.

The most significant environmental impact of implementing off-site shipment of wood dunnage concerns the Final Environmental Impact Statement (FEIS) for the destruction of chemical munitions at PCD, which was published in March 2002 [PMCD 2002]. Although off-site disposal of uncontaminated wood dunnage was addressed in the FEIS as part of the Army Baseline and modified Baseline incineration alternatives, it was not part of any of the neutralization-based alternatives considered in the FEIS. Consequently, the option represents a variance to the current plan and may require either a Record or Environmental Consideration (REC) or a supplemental Environmental Assessment (EA) before it can be implemented at PCAPP. Interestingly, the FEIS determined that baseline incineration and the proposed neutralization-based alternatives were all “environmentally acceptable for the destruction of the stockpile at PCD”. This implies that off-site disposal of uncontaminated wood dunnage is also environmentally acceptable.

Depending on the requirements, a REC could take 3 to 4 months to complete, where as a supplemental EA could take between 6 to 8 months to complete (with time for public comment included). Assuming an EA is required, there should be no impact on the project schedule if the EA process is started early enough in the design phase and if other factors, such as public acceptance, are favorable. Because final applications for RCRA, Air, and Water permits for the site will not be submitted until sometime during the construction phase, there is sufficient time to incorporate off-site disposal into the permitting process.

As in the Base Case, Option 1 will be carried out in full compliance with all applicable federal, state, local and Army rules and regulations. The uncontaminated wood dunnage will be disposed of at appropriate RCRA-permitted TSDFs in full compliance with all applicable hazardous waste regulations. Environmental audits of all candidate TSDFs will be carried out prior to shipping any waste from PCAPP to the facility.

In terms of the impact on other wastes generated by PCAPP, Option 1 reduces the amount of ash shipped off site to a RCRA TSDF by about 62 tons. This is the amount of ash that would have been produced from processing the uncontaminated wood dunnage in the CST. The option will also result in a slight decrease in air emissions at the PCAPP.

The supplemental EA and additional sampling efforts notwithstanding, the overall impact of Option 1 on permitting and compliance requirements is relatively minor, and therefore the option is rated as being neutral (O) compared to Base Case for environmental impacts.

3.1.2.4 Transportation.

This option will result in 225 additional truck trips for uncontaminated wood dunnage shipment, 8 fewer truck trips for ash shipment, and 12 fewer truck trips for imported materials shipment. This results in a net increase of 205 truck trips during systemization, pilot testing, and operations. Assuming the bulk of the trips will occur during the 12 months of operations, the net result is an increase of only about 4 truck trips per week over the 65 truck trips per week expected with the Base Case for process waste and treatment chemical shipping.

Transportation risks associated with off-site shipment and disposal of residual wastes from PCAPP were evaluated in the study conducted by Argonne National Laboratory (ANL) for PMACWA (ANL, 2003). The Argonne study found that the risk associated with trucking all solid waste (uncontaminated or 3X decontaminated wood dunnage, DPE, and metal parts and dewatered salts and biomass) off site to a RCRA permitted TSDF located in Last Chance, Colorado was very small. Total injuries and fatalities were estimated at 0.18 and 0.0065, respectively, over the life of the project. The risks of injuries and fatalities associated with shipping just the uncontaminated and 3X decontaminated wood dunnage would be even lower than those cited in the report because the number of shipments required for the wood dunnage alone would be much lower. Thus, the impact of Option 1 on transportation risk is deemed to be insignificant.

In view of the low transportation risk (exclusive of terrorism and sabotage) and low impact on traffic volume, Option 1 is rated as neutral (O) for this factor.

3.1.2.5 Utilities.

Water Consumption. Implementing Option 1 will have a negligible impact on the overall water balance of the plant. Water that may have been recovered from the moisture in the wood or in the air during processing of the wood dunnage in the CST is more than likely offset by water that would be lost in the CST ash and steam generating system. Therefore, the option is rated neutral (O) compared to the Base Case for this factor.

Power consumption. With the deletion of one of two CSTs in Option 1, the power consumption of the process will be reduced by approximately 18,000 kWhr per day of operation, which is about 5% of the total power consumption of the process. Therefore, the option is rated neutral (O) compared to the Base Case for this factor.

3.1.2.6 Treatment, Storage, and Disposal Facilities.

Because of the presence of PCP, the wood dunnage will have to be handled as a hazardous waste and shipped to a RCRA permitted TSDF. Two types of facilities are technically feasible for the wood dunnage: a TSDF with a RCRA Part C landfill and a TSDF with a RCRA permitted incinerator. The following three commercial TSDFs with RCRA permitted landfills were identified as potential candidates for accepting uncontaminated wood dunnage from PCAPP:

- Clean Harbors Deer Trail Landfill in Deer Trail, Colorado
- Waste Controls Specialists, LLC Landfill in Andrews County, Texas
- Heritage Environmental in Indianapolis, Indiana

All three TSDFs have sufficient capacity and resources to manage all of the wood dunnage from PCAPP. They also have extensive experience handling hazardous waste from DOD and other government agencies. The companies that own and operate the TSDFs appear to be financially stable and well managed.

In addition to the RCRA Part C landfills, several RCRA permitted incinerators were identified as potential sites for receiving wood dunnage from PCAPP. These include:

- Clean Harbor facilities in Aragonite, Utah; Kimball, Nebraska; and Deer Park, Texas
- Onyx Environmental in Sauget, Illinois.
- Heritage Environmental (Von Roll WTI Incinerator) in East Liverpool, Ohio.

The facilities have enough capacity to process all of the wood dunnage from PCAPP. The WTI Incinerator has been retrofitted recently to comply with the new Maximum Achievable Control Technology (MACT) standards for hazardous waste combustion facilities. The other facilities are either already in compliance or in the process of demonstrating compliance with the MACT standards.

Given the availability of TSDFs with sufficient capacity and technical capability of handling the wood dunnage from PCAPP, the option is assigned a positive (+) rating for this factor.

3.1.2.7 Treaty.

Wood dunnage is not subject to the verification requirements of the CWC Treaty. Because this option has no Treaty implications, it is rated neutral (O) compared to the Base Case.

3.1.2.8 Life Cycle Cost and Schedule.

The impact of Option 1 on the project life cycle cost (LCC) is shown in Table 3-1. Also provided in the table are the assumptions and cost bases used in deriving the estimated change in the LCC. All figures are in 2003 dollars.

The results of the LCC analysis indicate that Option 1 results in a potential savings of about $7 million. The cost savings is due in large part to the reduction in non-manual labor hours (e.g., management, project controls, quality assurance, administration) during construction and systemization. Since the impact on the LCC is less than $50 million, Option 1 is rated as neutral (O) for this factor.

The BPT has estimated that Option 1 could save up to 3 months on construction. This estimate is based on BPT experience at other chemical demilitarization sites and their best professional judgment. As a cautionary note, the project Integrated Master Schedule (IMS) was not available for this study. It is due to be released within the next few months. Because the estimate is not based on an analysis of the IMS, it must be viewed as being very preliminary and subject to change once the IMS is published. Without an IMS it is impossible to determine what systems and activities are on the critical path. This information is prerequisite for determining schedule impacts with any known degree of certainty and accuracy.

3.1.2.9 Local Economics.

Employment. Over the life cycle of the PCAPP project and relative to the Base Case, Option 1 will result in an average of one less full-time equivalent (FTE). See Table 3-2. The highest reductions will be during construction and systemization, when there will be about seven and three fewer FTEs, respectively. Option 1 will result in nine additional employees during pilot testing and operations. This option has minimal impact on employment during closure with less than one fewer FTE. Because it has minimal impact on the net change in employment at PCAPP over the life of the project (about 0.1%), Option 1 is viewed as neutral (O) compared to the Base Case for this factor.

State and Local Commercial Revenues. Based on the assumptions provided in Table 3-3, the total commercial revenue for the state is estimated to decrease by $810,000 over the life of the project. Local commercial revenue is estimated to decrease by approximately $405,000 over the life of the project. These losses in potential commercial revenues are a result of lower equipment construction costs and the use of smaller quantities of treatment chemicals. The potential loss in commercial revenues is probably very small when compared to the potential total commercial revenues that might be realized over the project life cycle. Although precise estimates of total state and local commercial revenues have not been compiled, it is believed that they would be on the order of $100 million (about $50 million each for local and elsewhere within the state). In that context, the impact is less than 1% of potential total commercial revenues of the Base Case and thus Option 1 is rated as having a neutral (O) effect on this factor**.**

Table 3-1: Option 1 Impacts on Life Cycle Cost

Item and Assumption	Cost basis	Change in LCC
Technical issues resolution		
Develop and certify a procedure for demonstrating that wood dunnage is not agent contaminated.	2,000 hrs, $150/hr	$ 300,000
Major equipment and building changes		
Delete one CST. Includes addition of approximately 10,000 craft hours, or 58 man months.	Lump sum	$ (6,500,000)
Add a 5000-ft^2 building or bay for storage of roll-off containers. Includes reduction of approximately 1000 craft hours, or about 6 craft months.	$75/$ft^2$ plus design and project management	$ 400,000
Off-site shipping and treatment		
Rental of roll-off containers.	Allowance	$ 250,000
Treatment of 1,574 tons of wood dunnage at TSDF.	$600/ton	$ 690,000
Shipping wood dunnage to TSDF at 7 tons/load.	7 tons/load, 1500 miles/load, $3/mile	$ 1,000,000
TSDF oversight		
Two half-time staff at TSDF on temporary duty (TDY) for 24-month pilot testing and operations	173 hrs/month/FTE, $80/hr $2,000/month for TDY	$ 380,000
Changes in wastes, imported materials, and utilities		
Reduce quantity of ash shipped to TSDF by 62 tons.	$600/ton	$ (37,000)
Reduce quantity of carrier used in CSTs by 36.3 tons and 50% NaOH by 7.2 tons.	$1/lb carrier, $380/ton	$ (80,000)
Reduction in power consumption with the deletion of one CST by approximately 20,000,000 kWhr.	$0.0384/kWhr	$ (770,000)
Environmental permitting		
Added requirement for Supplemental EA.	Allowance	$ 250,000
Labor changes		
Construction manpower changes: Reduce non-manual (NM) staffing by 60 for 3 months. This is in addition to craft savings of 10,000 hours included in major equipment changes costs.	173 hrs/month/FTE, $80/hr	$ (2,500,000)
Systemization manpower changes: Reduce NM staff by 3 for 18 months with deletion of one CST.	173 hrs/month/FTE, $80/hr	$ (690,000)
PT&Ops manpower changes: 8 additional lab staff.	173 hrs/month/FTE, $80/hr	$ 2,700,000
Closure manpower changes. Reduce staff with the deletion of one CST.	Allowance	$ (150,000)
Government program management: Reduce staffing one-to-one with Systems Contractor (60 FTEs) as a result of 3-month reduction in construction schedule .	173 hrs/month/FTE, $80/hr	$ (2,500,000)
Total		**$ (7,300,000)**

Source: FOCIS Associates and BPT

Table 3-2: Option 1 Impacts on Number of PCAPP Employees

Project phase	Phase duration[1], months	Net change in number of local employees, FTE[3]
Design	30	0
Construction	33	-7.0
Systemization[2]	18	-3.0
Pilot Testing and operations[2]	24	9.0
Closure	23	-0.5
Net over project life	105	-0.8[5]

(1) Milestones adapted from BPT Schedule dated 18 Feb 03.
(2) Phase duration adjusted according to BPT matrix dated 24-May-03.
(3) FTE = full-time equivalent jobs
(4) Design, construction, and systemization have some overlap, so the total project duration is less than the sum of the phase durations.
Source: FOCIS Associates and BPT

Table 3-3: Option 1 Impacts on State and Local Commercial Revenues

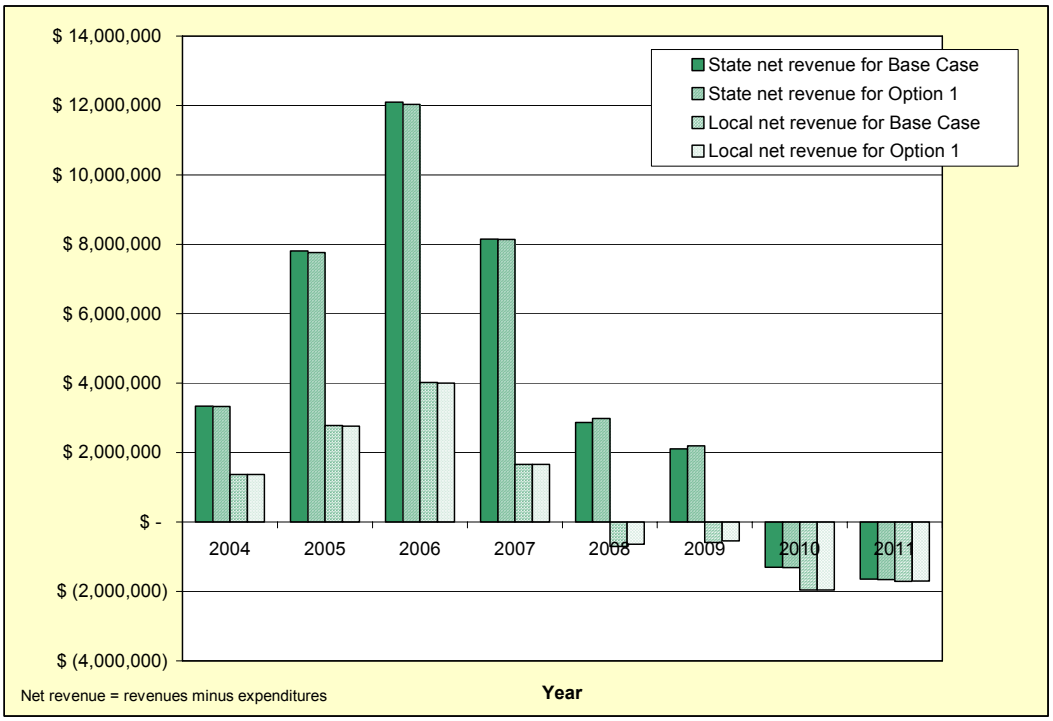
Source	Changes in local and state commercial revenues		
	Local	Elsewhere in Colorado	Total
Major equipment changes[1]	$ (410,000)	$ (410,000)	$ (820,000)
Additional space and/or transfer stations[1]	$ 25,000	$ 25,000	$ 50,000
Imported chemicals[2]	$ (20,000)	$ (20,000)	$ (40,000)
Net change	**$ (405,000)**	**$ (405,000)**	**$ (810,000)**

(1) Assume that 25% of capital cost is for bulk materials, 25% of bulk materials can be obtained from local suppliers, and 25% of bulk materials can be obtained from suppliers elsewhere in the state. [Assumption provided by Bechtel Pueblo Team at 13 May 2003 meeting.]
(2) Assume that 25% of imported chemicals can be obtained from local suppliers and 25% of imported chemicals can be obtained from suppliers elsewhere in the state. [Assumption by FOCIS Associates.]
Source: FOCIS Associates and BPT

State and Local Government Net Revenues. Figure 3-2 shows the government (state and local) net revenues for the Base Case and Option 1 from the start of construction in July 2004 through the end of site closure in October 2011. The net revenues are based on project related economic activity within the core county (Pueblo) and surrounding counties that contribute either to local (Pueblo) net revenues or to state (Colorado) net revenues. Figure 3-3 shows the percent change in government net revenues over the same period as a result of the off-site option.

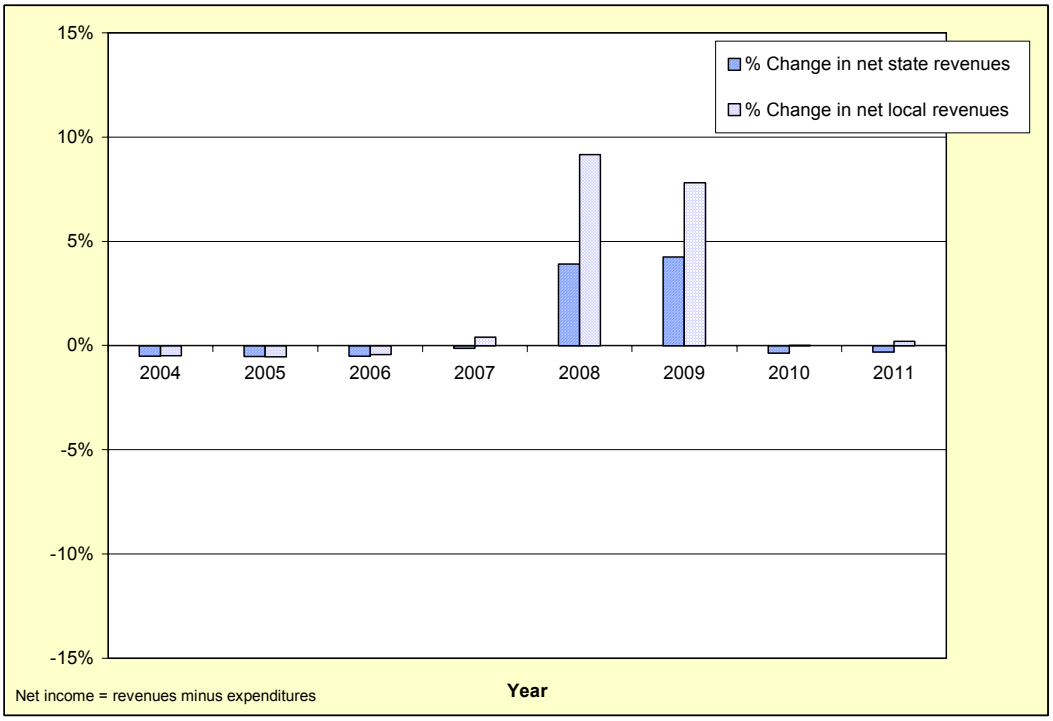
The data in Figure 3-2 show that both state and local net revenues peak during construction and then decline during operations and closure as the number of jobs begins to diminish. The model predicts that Pueblo County will experience negative local net revenues starting in the last two of years of operations and continuing through closure. State net revenues remain positive until closure, when they too become negative. IDA explains this phenomenon as a boom-bust cycle that is attributable to the distorted and extraordinarily sharp business cycle induced by the chemical demilitarization project. Revenues tend to decline in direct relation to the loss of jobs

Figure 3-2: Base Case and Option 1 Government Net Revenues during PCAPP Project



Source: FOCIS Associates and IDA

Figure 3-3: Option 1 Impacts on Government Net Revenues during PCAPP Project



Source: FOCIS Associates and IDA

while the reduction in expenditures tends to lag behind due to the recurring costs of maintaining investments made in infrastructure and public institutions during the project. Unless new high paying jobs are created to replace the ones lost by completion of the project, the local government may continue to run deficits. The impact of lost demil jobs on state net revenues tends to lag behind and be less severe than the impact on local government because the State is buffeted by higher revenues collected from state income taxes.

For the impacts analysis, the emphasis is on the differences (deltas) in net revenues, not necessarily on the values of the net revenues themselves. It is evident from the graphs that the impact of Option 1 on both local and state net revenues is almost imperceptible. That was expected given the small number of jobs affected by the proposed option. The model predicts that Option 1 will have the biggest effect on net revenues during pilot testing and operations (2007 to 2009), where net revenues are calculated to increase an average of 3% at the state level and by approximately 6% at the local level. This coincides with the addition of 9 FTEs during that period. While the magnitude of the increase appears to be somewhat higher than expected based on the percent change in employment, it is still nonetheless consistent with the employment trend.

The negligible effect of the option becomes even more apparent by looking at cumulative effects. Table 3-4 shows the cumulative local and net revenues for the Base Case and Option 1. As indicated in the table, the calculated percent change in total local net revenue over the project life cycle is only 1.7%. The percent change in cumulative net revenues for the state is even lower at 0.2%. The results are likely within the error of the model and therefore insignificant. The modeling results suggest that Option 1 has no significant effect on net revenues either at the state or local level and therefore the option is given a neutral (O) rating for this factor.

Table 3-4: Base Case and Option 1 Government Net Revenues during PCAPP Project

Government	Cumulative Net Revenues 2004-2011			
	Base Case	Option 1	Change	
State	$ 33,407,000	$ 33,467,000	$ 60,000	0.2%
Local	$ 4,861,000	$ 4,943,000	$ 82,000	1.7%
Total	$ 38,268,000	$ 38,410,000	$ 142,000	0.4%

Source: FOCIS Associates and IDA

3.1.2.10 Public Outreach.

Assuming that the regulators approve a method for verifying the wood dunnage is uncontaminated with agent, public opposition to this option is expected to be minimal provided the wood dunnage is shipped to a RCRA permitted landfill. Shipment to a hazardous waste incinerator is expected to meet with opposition from some environmental groups and individuals who are generally opposed to incineration of any wastes. Even then, given the relatively benign nature of the waste, this opposition is not expected to be great. Thus, the overall impact of this option on public outreach efforts is expected to be minimal and the option is therefore rated as having no (O) impact for this factor.

3.1.3 Summary of Impacts

Table 3-5 summarizes the likely impacts of Option 1 on the various evaluation factors.

- Compared to the Base Case, Option 1 is rated positive for the TSDF factor. TSDF capacity is not an issue as there were more than three facilities identified that could handle all of the PCAPP wood dunnage.
- Option 1 is rated negative for the technical issues factor due primarily to the need to develop and implement a method to verify that the wood dunnage is uncontaminated with agent.
- Option 1 is rated neutral for the remaining factors. These include safety, environmental permitting and compliance, transportation, water and power consumption, Treaty, life cycle cost and schedule, employment, state and local commercial revenues, state and local government net revenues, and public outreach.

Table 3-5: Summary of Evaluation Factor Ratings for Option 1

Factor	Comparative Rating	Rationale for Rating
Technical Issues	–	Eliminates one CST, leaving one CST for processing contaminated wood, DPE and other dunnage but does not eliminate any major technical issues related to the Base Case. Instead, the option adds the technical challenge of having to develop and implement a method to verify that the wood dunnage is not agent contaminated and consequently is viewed as increasing technical issues.
Safety	O	The major inherent hazard of shipping wood dunnage off site is the risk of worker exposure to agent contamination. The hazard is mitigated if not eliminated by an effective verification method to clear the wood. In general, the overall safety of the plant is unaffected by the option.
Environmental Permitting and Compliance	O	Requires a supplemental Environmental Assessment (EA) and additional sampling efforts to verify wood is not agent contaminated, which should not impact the permitting schedule. Additional sampling only marginally effects compliance requirements. The net impact on plant air emissions and effluents is negligible.
Transportation	O	Requires about 225 shipments of wood dunnage during pilot testing and operations. This is partially offset by a reduction in the number of truck trips for process chemicals and ash. Assuming the bulk of the shipments are made during the 12-month operations phase, Option 1 results in an increase of only 4 truck trips per week as compared to the Base Case, which has an average of 65 truck trips per week for shipping all process solid wastes and treatment chemicals. Risks of total injuries and fatalities from shipping all dunnage, metal parts, and dewatered salts and biomass off site are estimated to be 0.18 and 0.0065, respectively, over the life of the PCAPP project. Risks of just shipping wood dunnage would be even lower.
Water Consumption	O	Negligible impact on water consumption.
Power Consumption	O	The power consumption of the process will be reduced by approximately 18,000 kWhr per day of operation. This represents only about 5% of the expected total power consumption of the Base Case process.
TSDFs	+	The study identified three commercial landfills and three commercial incinerators with the required permits, technical capability and capacity for receiving uncontaminated wood dunnage.
Treaty	O	Inspection and oversight requirements are essentially the same as the Base Case because wood dunnage is not subject to Treaty monitoring and verification.
Life Cycle Cost	O	Total life cycle cost is reduced by about $7 million.
Life Cycle Schedule	O	Construction and total life cycle schedules are reduced by approximately 3 months.
Employment	O	The number of full time equivalents (FTEs) decreases by less than 1 over the life of the project, which is less than 0.2% of the average total FTEs for the Base Case.
State and Local Commercial Revenues	O	Total commercial revenue for the state decreases by about $810,000 over the life of the PCAPP project, which is about 0.8% of the estimated state commercial revenue for the Base Case. About half of that reduction is estimated to occur locally (in Pueblo County).
State and Local Government Net Revenue	O	State government net revenue (revenues minus expenditures) increases by about $60,000 over the life of the PCAPP project, which is less than 0.2% of the state government revenue for the Base Case. Local government net revenue increases by about $82,000 or 1.7% over the life of the project.
Public Outreach	O	The benign nature of wood dunnage should not raise significant public concerns. Outreach efforts expected to remain essentially unchanged from the Base Case.

Source: FOCIS Associates

3.2 Option 2: Ship Propellant Off Site

3.2.1 Propellant Treatment – Base Case and Option 2

Block flow diagrams for the Base Case and proposed option are shown in Figure 3-4. The top diagram shows the major unit processes and process rates used in the Base Case for on-site treatment of propellant. The bottom diagram shows the process configuration and processing rates for the proposed off-site option. The figure serves as a useful reference for the discussion that follows.

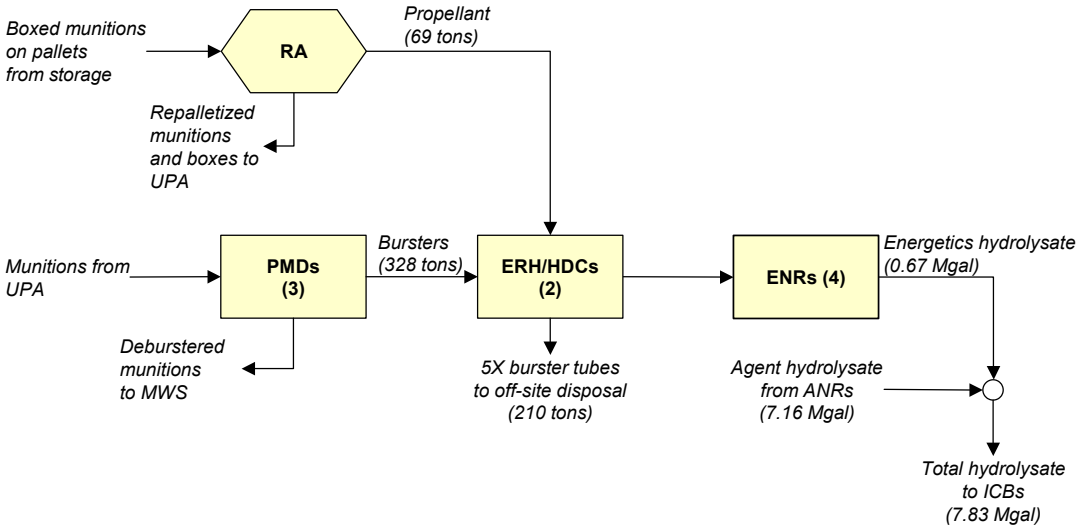
3.2.1.1 Base Case for on-site processing of propellant.

In the Base Case, munitions are transferred from the storage igloos to a storage building and then, depending on the presence or absence of propellant, to either the UPA or the Reconfiguration Area (RA) of the Energetics Process Building (EPB). Boxed munitions containing propellant are moved to the Reconfiguration Area in the EPB, where the munitions and propellants are removed from the boxes. The munitions are re-palletized and transferred to the UPA while the propellants are transferred by conveyor to one of two ERHs. In the UPA, palletized and re-palletized munitions are unpacked and transferred to one of three Projectile/Mortar Disassembly Machines (PMDs), where the fuzes and bursters are removed. The PMDs are essentially the same as those used at baseline incineration plants. The Base Case calls for three (3) PMD lines for removing energetics. The fuzes and bursters are transferred by conveyor from the PMDs to one of the two (2) ERHs. The propellants and the energetics contained in the bursters are hydrolyzed in the ERHs. Deburstered munitions are placed on trays and moved to the Agent Processing Building (APB) where they are accessed, drained of agent, and washed out in the Munitions Washout System (MWS) before being sent to one of three Metal Parts Treaters (MPTs) for 5X decontamination. The MWS is a modular, automated version of the manual prototype unit tested at CAMDS for ACWA during the Engineering Design Studies (EDS).

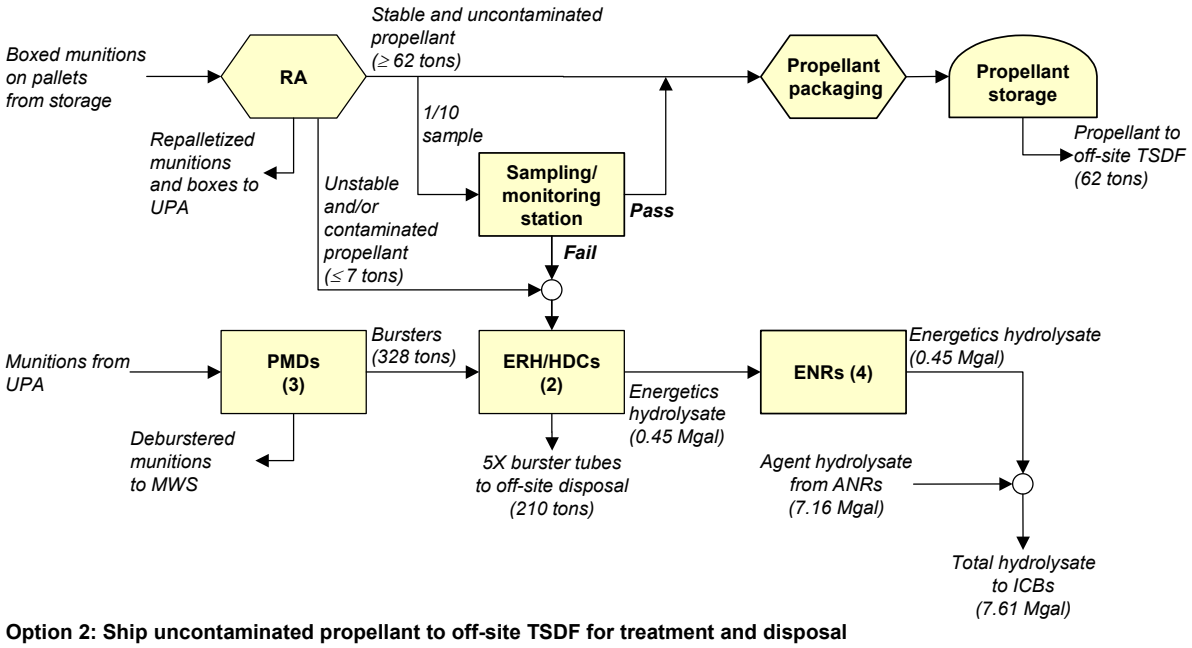
Each ERH is a full-scale version of the prototype unit tested by ACWA during EDS testing. It consists of a heated rotating drum with internal spiral flights for moving solid material through the process. The drum contains hot sodium hydroxide solution for solubilizing and hydrolyzing the energetics. The liquid effluent from the ERHs is pumped to one (1) of four (4) Energetics Neutralization Reactors (ENRs) where hydrolysis is completed and verified. The effluent hydrolysate from the ENRs is mixed with agent hydrolysate before being treated in the ICBs. Solids from each ERH are discharged onto an electrically heated, nitrogen-blanketed discharge conveyor (HDC) for 5X decontamination. Offgases from the ERHs and HDCs are vented to a CatOx treatment unit and then to activated carbon filters before being discharged to the atmosphere.

During ACWA testing of base hydrolysis of propellant, two processing concerns were identified: the handling of the rayon bags containing the M1 propellant charge and the handling of the cotton threads used to bundle the M8 sheet propellant. Rayon bags containing the M1 propellant could not be completely digested by the caustic solution and tended to form gum-like deposits on

Figure 3-4: Base Case and Option 2 Flow Diagrams



Base Case for Option 2: Process all propellant on site



Option 2: Ship uncontaminated propellant to off-site TSDF for treatment and disposal

RA - Reconfiguration Area
UPA - Unpack Area
PMD - Projectile/Mortar Disassembly Machine
ERH - Energetics Rotary Hydrolyzer
HDC - Heated Discharge Conveyor
ENR - Energetics Neutralization Reactor
WS - Munitions Washout Station
MPT - Metal Parts Treater
ANR - Agent Neutralization Reactor
ICB - Immobilized Cell Bioreactor
TSDF - Treatment, Storage, and Disposal Facility

Source: FOCIS Associates

piping and agitators presenting a potential clogging problem for the ERHs. Problems were also encountered in batch reactor tests with M8 sheet propellant. As the sheet propellant was hydrolyzed, the freed cotton threads clogged recirculation lines and became entangled on mixer impellers and shafts. It was concluded that further study was required to develop a means to

effectively handle the rayon bags from the M1 propellant and cotton threads from the M8 sheet propellant. Both items present potential operational and maintenance problems for the ERH. While this issue will be addressed in Technical Risk Reduction Projects (TRRPs), it is not known if they will be successful in finding a cost-effective solution to the problem.

3.2.1.2 Option 2 – Ship propellant off site for treatment and disposal.

In this option, propellant removed from boxed munitions will be packaged in bulk containers (in accordance with approved packaging instructions) and shipped off site to a commercial or government facility for incineration. For the purposes of this study, it is assumed that 90% of the total propellant load (about 62 tons) is suitable (i.e., uncontaminated and stable) for off-site shipment. The remaining 10% (or 7 tons) is assumed to be contaminated and/or unstable and will be treated in the ERH.

This option impacts the plant configuration in the following ways:

- Reduces materials handling requirements for ERH feeds
- Reduces risk of problems posed by propellant bags and strings in the ERH, thus enhancing ERH performance and reliability
- Adds propellant packaging and storage area
- Adds truck bay for loading of propellant for off-site shipment
- Adds requirements for determining that propellants are not agent contaminated and stable prior to release for off-site shipment

This option will require that procedures be developed for ensuring that the propellant is not agent contaminated. In addition, it will be necessary to sample and test the propellant to determine the stability of the various propellant lots. This is also a requirement for the Base Case. Sampling and testing for stability can be performed in advance of full-scale reconfiguration operations since the propellant can be accessed relatively easily. Stability testing may be performed using on-site instrumentation or by an off-site Army laboratory as required [FOCIS 2003].

While some of the impacts of this option potentially reduce cost and technical issue, others, such as the addition of a propellant storage area and need to verify that the propellant is stable and uncontaminated with agent before shipment, may add cost or raise new technical issues that could have significant cost and schedule impacts. In addition, the PCAPP must retain the capability of hydrolyzing any contaminated and/or unstable propellant on site. Since the quantity of contaminated or unstable propellant is expected to be relatively small ($\leq$ 7 tons), the BPT proposes to process this material in the ERH in a manner that will not impact plant availability and throughput.

3.2.2 Impacts of Option 2

3.2.2.1 Technical Issues.

Like the CST, the ERH is a first-of-a-kind system that faces several technical challenges before full-scale implementation at PCAPP. As discussed in the previous section, the Base Case presents a potential maintenance issue arising from processing a large number of propellant bags and sheets in the ERH. The primary technical issues associated with shipping propellants off site include:

- Need for verification that the propellant is stable and uncontaminated before shipping off site
- Processing contaminated or unstable propellant in the ERH

Methods for detecting low levels of agent in solid propellant will need to be developed and validated and certified for use at PCAPP. While methods for determining propellant stability are well developed [FOCIS 2003], they need to be certified for use at PCAPP. The second issue is basically the same one posed by the Base Case, but the problem will be more manageable and much less of a concern because of the very small quantity of propellant to be processed by the ERH. Although the exact quantity of unstable and/or agent-contaminated propellant is not known, it is believed to be much less than 10% of the total propellant in the PCD stockpile.

Once removed from the munitions, the propellant will have to be stored in appropriate bulk containers in a storage building rated for the appropriate quantity of explosive.

No other major technical challenges were identified for this option. Procedures for safely handling, storing, and shipping propellant, as well as methods for determining propellant stability, are well established and used routinely by the Army. Propellants downloaded from PCD munitions will be subject to Army propellant surveillance procedures in which levels of stabilizer in samples of the propellant are routinely monitored. If stabilizer contents are of a sufficient level, propellant is considered safe for continued storage or off-site shipment. If the stabilizer has been depleted past a certain point, the guidance states that the propellant will have to be destroyed immediately and locally. The propellant associated with the PCD munitions is easily accessed without any disassembly of the munition and testing could be performed at any time prior to, or during, reconfiguration. The most recent data available on PCD propellant indicate that the PCD propellant lots have tolerable stabilizer loss and unlimited storage life [FOCIS 2003].

Option 2 has the potential to reduce or eliminate the technical challenge associated with processing all of the PCD propellant in the ERH, but creates the additional requirement of having to verify that the propellant is agent free in order to ship it off site to a TSDF. On balance, the option is believed to reduce the overall technical issue associated with propellant destruction, and therefore it is given a positive (+) rating for this factor (i.e., major technical challenges are reduced or eliminated).

3.2.2.2 Safety.

The Base Case and Option 2 have similar inherent hazards. Both have the potential for fire and/or explosion of the propellant during reconfiguration operations or during propellant hydrolysis in the ERH. Both the option and the Base Case also have the potential for worker exposure to agent-contaminated propellant and other hazardous materials, such as hot caustic solutions of partially hydrolyzed energetics during maintenance operations. However, the exposure hazard is of particular concern for the Base Case where ERH maintenance requirements could be much higher than in Option 2. This is attributed to the greater potential for clogging and/or fouling problems caused by the propellant bags and threads. A high maintenance requirement also increases physical stress on workers as a result of a potentially higher number of entries into the ERH area. While the BPT intends to modify the design of the ERH to better handle the propellant bags and threads, the proposed modification is as yet undefined and

untested. Shipping the uncontaminated propellant to an off-site TSDF for destruction eliminates the need for potentially costly modifications to the ERH and reduces system maintenance demands.

An inherent hazard associated with shipping propellant off-site to a TSDF is the potential for explosion and/or fire resulting from the auto-ignition of bulk quantities of propellants. The PCAPP will follow standard Army procedures that ensure the safe handling, storing, and shipping of bulk propellant. Once removed from the munitions, the propellant at PCD will be subject to Army propellant surveillance procedures, which include analyzing propellant lots for stabilizer content. This will ensure that only propellant with sufficient levels of stabilizer is shipped off site to the TSDF. Propellant with insufficient levels of stabilizer will be destroyed within 60 days (or less) on site in the ERH. Because the procedures for the safe handling of propellant are well established and time-tested, the inherent risk of accidental ignition are believed to be very small. Specialized training for select personnel involved in handling and packaging the propellant must be carried out in accordance with DOT and Army regulations.

As mentioned above, with both the Base Case and option there is the potential, however remote, for worker exposure to agent-contaminated propellant. While the occurrence of agent-contaminated propellant is expected to be very low, a procedure will be required for verifying that the propellant is uncontaminated prior to shipping off site to a TSDF. Implementation of a reliable and accurate verification method should not be overly challenging. With a reliable verification method in place and with other administrative controls, the risk of worker exposure is believed to be negligible.

Like the Base Case, Option 2 also has the potential for worker exposure to hot caustic solutions containing partially hydrolyzed propellant. However, the inherent hazard should be lower in Option 2 than in the Base Case as result of the lower propellant quantity requiring hydrolysis, lower maintenance demands and fewer required entries into the ERH area.

The major concern with respect to public safety is the risk of an accident or terrorist incident during transport of the energetics from PCAPP to the TSDF. This concern is inherent in all of the off-site options involving shipment of energetics. As discussed below in the Transportation section, the risk of accidents resulting in injury or death is relatively low. The threat of terrorism is always present, but the risks and potential consequences are difficult to assess. For activities that are conducted on site at PCAPP, the option poses no additional safety risks to the general public. Any accident that would occur on site at PCAPP would be contained within the boundaries of the site.

The inherent safety hazards associated with this option can be effectively mitigated through existing standard engineering and administrative controls. Compared to the Base Case, Option 2 is believed to be a potentially safer alternative for propellant destruction due primarily to lower expected maintenance requirements of the ERH. Therefore, the option is given a positive (+) rating for this factor.

3.2.2.3 Environmental Permitting and Compliance.

Off-site disposal of propellant involves shipping the propellant from PCAPP to a RCRA permitted facility where the propellant will be incinerated and the resulting ash placed in a hazardous waste landfill. The Government's Final Environmental Impact Statement (FEIS) for the destruction of chemical munitions at PCD, which was published in March 2002 [PMCD 2002], did consider off-site disposal of propellant as part of the Army's Baseline incineration alternative. However, because it was not part of the neutralization alternatives considered in the FEIS and therefore represents a variance from the current plan, off-site disposal of propellant will likely require a supplemental Environmental Assessment (EA) before it can be implemented at PCAPP.

Interestingly, the FEIS determined that Baseline incineration with off-site disposal of propellant and the alternatives were all "environmentally acceptable for the destruction of the stockpile at PCD".

The supplemental EA, which could require 6 to 8 months to complete (including time for public comment), should not impact the project schedule provided it is started during the initial design phase. Because final applications for RCRA, Air, and Water permits for the site will not be submitted until sometime during the construction phase, there is more than enough time to incorporate off-site disposal into the permitting process.

As in the Base Case, Option 2 will be carried out in full compliance with all applicable federal, state, local and Army rules and regulations. The propellant will be disposed of at appropriate RCRA permitted TSDFs in compliance with all applicable hazardous waste regulations. Environmental audits of all candidate TSDFs will be carried out prior to shipping any waste from PCAPP to the facility.

The greatest threat to the environment would occur as a result of a fire or explosion during transport of the propellant. As will be discussed in the next section dealing with transportation, the risk of such occurrences has been shown to be very small. The propellant will be packaged and shipped to the TSDF in accordance with all relevant and appropriate RCRA, DOD and Department of Transportation (DOT) regulations, thus minimizing the risk of explosion hazards. Even if such an event were to occur, the extent of the impact would be limited and localized. Most communities have Hazmat and Emergency Response Teams that are well equipped to handle such emergency situations and limit potential damages.

In terms of environmental impacts, this option has neither significant advantages nor disadvantages compared to the Base Case. Although a supplemental EA may be required, permitting and compliance efforts for this option are similar to the Base Case, and therefore the option is rated as neutral (O) for this factor.

3.2.2.4 Transportation.

Shipment of propellant and bursters from PCAPP to an off-site TSDF was one of the options evaluated in the Transportation Risk Assessment conducted by Argonne National Laboratory (ANL) for PMACWA [ANL, 2002]. The study analyzed vehicle-related accident risks and cargo-related risks. Vehicle-related risks are based on statistics compiled by state agencies and

DOT. Cargo-related risks are based on the characteristics of the cargo. In the case of energetics, the probability of an explosion event is based on historical frequencies from shipments of explosive materials. The vehicle and cargo risks are combined to determine the total risk of injury or fatality as a result of an accident and/or cargo-related event (e.g., spill or detonation).

The Argonne study found that transportation risks are a function of the type of transport (rail or truck), characteristics of the waste streams being shipped, number of shipments, and transport distances. Even so, all of the transportation options (rail or truck) related to shipping energetics (both propellant and bursters) from PCAPP to any of the four TSDFs identified in the study are estimated to result in less than 0.002 fatalities and less than 0.03 injuries over the entire campaign. This means that there is a low probability of fatalities or injuries. Furthermore, the analysis showed that most of the risk of injuries and fatalities is attributable to vehicle crashes or train wrecks and not to explosion or fire of the energetic cargo. The study concluded that the transportation risks are "very small" and "well within the range of risks associated with national averages for commercial shipment of dangerous goods" over U.S. Highways and railways (ANL, 2002). Although not analyzed in the study, the risks associated with shipping just propellant off site are presumably lower due to the smaller quantity and lower hazard level of the material when compared to burster energetics.

The increase in traffic volume as a result of this option is insignificant. Assuming 6.2 tons of propellant per truckload, a total of only 10 truckloads will be required to ship all of the uncontaminated and stable propellant (estimated at 62 tons, or 90% of the total 69 tons of propellant in the PCD stockpile). This represents a relatively insignificant number of truck trips over the life cycle of the project. In fact, Option 2 actually results in a slight decrease (-0.2) in weekly truck shipments to and from the site due primarily to the reduction in sodium hydroxide shipments for energetics hydrolysis.

In view of the low transportation risk (exclusive of terrorism and sabotage) and negligible impact on traffic volume, Option 2 is rated as neutral (O) for this factor.

3.2.2.5 Utilities.

Water Consumption. This option has no impact on net water consumption. Therefore, the option is rated neutral (O) compared to the Base Case for this factor.

Power consumption. With the processing of 90% of the propellant off site, the power consumption of the process will be reduced by approximately 3,400 kWhr per day of operation (or a total of 3.7 million kWhr over the project life cycle), which is only 1% of the total power consumption of the process. Therefore, the option is rated neutral (O) compared to the Base Case for this factor.

3.2.2.6 Treatment, Storage, and Disposal Facilities.

The study identified the following four (4) TSDFs (one government owned facility and three commercial facilities) with the capability, capacity, and permits necessary for handling PCAPP propellants:

- Clean Harbors in Colfax, Louisiana
- Hawthorne Army Depot in Hawthorne, Nevada

- EBV Explosives Environmental Company (formerly known as ICI Explosives Environmental Company) in Joplin, Missouri
- Onyx Environmental in Sauget, Illinois.

All four facilities have RCRA permitted incinerators and storage magazines for Class 1.1 explosives. The incinerators at the three commercial TSDFs (Clean Harbors, EBV and Onyx) either already comply with or are in the process of complying with the latest emission standards based on current Maximum Achievable Control Technology (MACT) for hazardous waste combustion facilities. The incinerator at Hawthorne is currently being retrofitted to meet MACT standards. It should be ready for operation within the next 18 months, long before operations begin at PCAPP. The commercial facilities appear to be financially stable and well managed. All of the TSDFs have many years of experience handling explosives and propellants from the military.

Option 2 is rated as positive (+) with respect to the TSDFs for handling the propellant from PCAPP.

3.2.2.7 Treaty.

The option should have no impact (O) on Treaty inspection and oversight requirements. Once the propellant is confirmed to be uncontaminated by agent, it should not be subject to the verification provisions of the CWC Treaty. Therefore, the TSDF that receives the propellant should not be subject to the Treaty verification.

3.2.2.8 Life Cycle Cost and Schedule.

The impact of Option 2 on the project life cycle cost (LCC) is shown in Table 3-6. Also provided in the table are the assumptions and cost bases used in deriving the estimated change in LCC. All figures are in 2003 dollars.

The results of the LCC analysis indicate that Option 2 results in a potential savings of about $12 million. The cost savings is due in large part to the reduction in non-manual labor hours (e.g., management, project controls, quality assurance, administration) during construction and systemization. Since the impact on the LCC is less than $50 million, Option 2 is rated as neutral (O) for this factor.

The BPT has estimated that Option 2 could save up to 6 months on construction. This estimate is based on BPT experience at other chemical demilitarization sites and their best professional judgment. As a cautionary note, the project Integrated Master Schedule (IMS) was not available for this study. It is due to be released within the next few months. Because the estimate is not based on an analysis of the IMS, it must be viewed as being very preliminary and subject to change once the IMS is published. Without an IMS it is impossible to determine what systems and activities are on the critical path. This information is prerequisite for determining schedule impacts with any known degree of certainty and accuracy.

3.2.2.9 Local Economics.

Local Employment. Over the life cycle of the PCAPP project and relative to the Base Case, Option 2 will result in an average of 2.5 less full-time equivalents (FTE). See Table 3-7. The

highest reductions will be during construction, when there will be about 24 fewer local employees. Option 2 will result in nine additional employees (mostly laboratory personnel to support propellant and burster analysis) during pilot testing and operations. This option has no impact on local employment during systemization and closure. The net reduction in total employment over the life cycle of the project is about 0.8% of the total assumed Base Case average peak employment. Given its minimal impact on the net change in local employment, Option 2 is viewed as neutral (O) compared to the Base Case for this factor.

Table 3-6: Option 2 Impacts on Life Cycle Costs

Item and Assumption	Cost basis	Change in LCC
Technical issues resolution		
A viable procedure to demonstrate that propellant is uncontaminated needs to be developed and certified for use at PCAPP.	200 hrs, $150/hr	$ 30,000
Develop and certify a procedure to demonstrate propellant stability.	500 hrs, $150/hr	$ 75,000
Two TRRPs are eliminated.	Lump sum	$ (400,000)
Eliminate modifications to ERH/HDCs to allow treatment of propellant.	Lump sum	$ (500,000)
Major equipment and building changes		
The explosion containment rating of the ECRs is reduced with the reduction in quantity of propellant being treated in the ERH/HDCs. This includes reduction of approximately 75,000 craft hours, or 434 craft months.	Lump sum	$ (5,000,000)
Add a 2000-ft^2 building for storage of packaged propellant. Includes addition of approximately 1000 craft hours, or about 6 craft months.	$120/$ft^2$ plus design and project management	$ 300,000
Off-site shipping and treatment		
Packaging containers for 62 tons of propellant (Cat 1.1 DOT shipping container).	250 lb propellant/container, $500/container	$ 250,000
Treatment of 62 tons of propellant at TSDF.	$5/lb	$ 620,000
Shipping 10 loads of propellant to TSDF.	1500 miles/load, $3/mile	$ 45,000
TSDF oversight		
Two half-time staff at TSDF on temporary duty (TDY) for 24-month pilot testing and operations	173 hrs/month/FTE, $80/hr $2,000/month for TDY	$ 380,000
Changes in wastes, imported materials, and utilities		
Reduce quantity of dewatered salts and biomass shipped to TSDF by 154 tons.	$600/ton	$ (92,000)
Reduce quantity of 50% NaOH used in ERH/HDC/ENRs by 59 tons, quantity of inorganic nutrients used in ICBs by 3.2 tons, and the quantity of oxalic acid by 1.7 tons.	$380/ton 50% NaOH, $1,300/ton inorganic nutrients, $800/ton oxalic acid	$ (28,000)
Reduction in power consumption with slight reduction in ERH/HDC feed quantity by approximately 3,740,000 kWhr.	$0.0384/kWhr	$ (140,000)
Environmental permitting		
Added requirement for Supplemental EA.	Allowance	$ 250,000

Table 3-6: Option 2 Impacts on Life Cycle Costs (continued)

Item and Assumption	Cost basis	Change in LCC
Labor changes		
Construction manpower changes: Reduce non-manual (NM) staffing by 60 for 6 months. This is in addition to craft savings of 10,000 hours included in major equipment changes costs.	173 hrs/month/FTE, $80/hr	$ (5,000,000)
Systemization manpower changes: no impact.	Not applicable	$ -
PT&Ops manpower changes: 8 additional lab staff.	173 hrs/month/FTE, $80/hr	$ 2,700,000
Closure manpower changes. No impact.	Not applicable	$ -
Government program management: Reduce staffing one-to-one with Systems Contractor (60 FTEs) as a result of 6-month reduction in construction schedule .a	173 hrs/month/FTE, $80/hr	$ (5,000,000)
Total		**$ (11,500,000)**

Source: FOCIS Associates and BPT

Table 3-7: Option 2 Impacts on Number of PCAPP Employees

Project phase	Phase duration[1]	Net change in number of local employees, FTE[3]
Design	30	0
Construction	33	-23.9
Systemization[2]	18	0.0
Pilot Testing and operations[2]	24	9.0
Closure	23	0.0
Net over project life	105	-5.4[4]

(1) Milestones adapted from BPT Schedule dated 18 Feb 03.
(2) Phase duration adjusted according to BPT matrix dated 24-May-03.
(3) FTE = full-time equivalent jobs
(4) Design, construction, and systemization have some overlap, so the total project duration is less than the sum of the phase durations.

Source: FOCIS Associates and BPT

State and Local Commercial Revenues. Based on the assumptions provided in Table 3-8, the total commercial revenue for the state is estimated to decrease by $596,000 over the life of the project. Local commercial revenue is estimated to decrease by approximately $298,000 over the life of the project. These losses in commercial revenues are a result of the construction of less equipment and the use of smaller quantities of treatment chemicals. The potential loss in commercial revenues is probably very small when compared to the potential total commercial revenues that might be realized over the project life cycle. Although precise estimates of total state and local commercial revenues have not been compiled, it is assumed that they would be on the order of $100 million (about $50 million each for local and elsewhere within the state) statewide. In that context, the impact is relatively small and therefore Option 2 is rated as having a neutral (O) effect when compared to the Base Case.

Table 3-8: Option 2 Impacts on State and Local Commercial Revenues

Source	Changes in local and state commercial revenues		
	Local	Elsewhere in Colorado	Total
Major equipment changes[1]	$ (310,000)	$ (310,000)	$ (620,000)
Additional space and/or transfer stations[1]	$ 19,000	$ 19,000	$ 38,000
Imported chemicals[2]	$ (7,000)	$ (7,000)	$ (14,000)
Net change	**$ (298,000)**	**$ (298,000)**	**$ (596,000)**

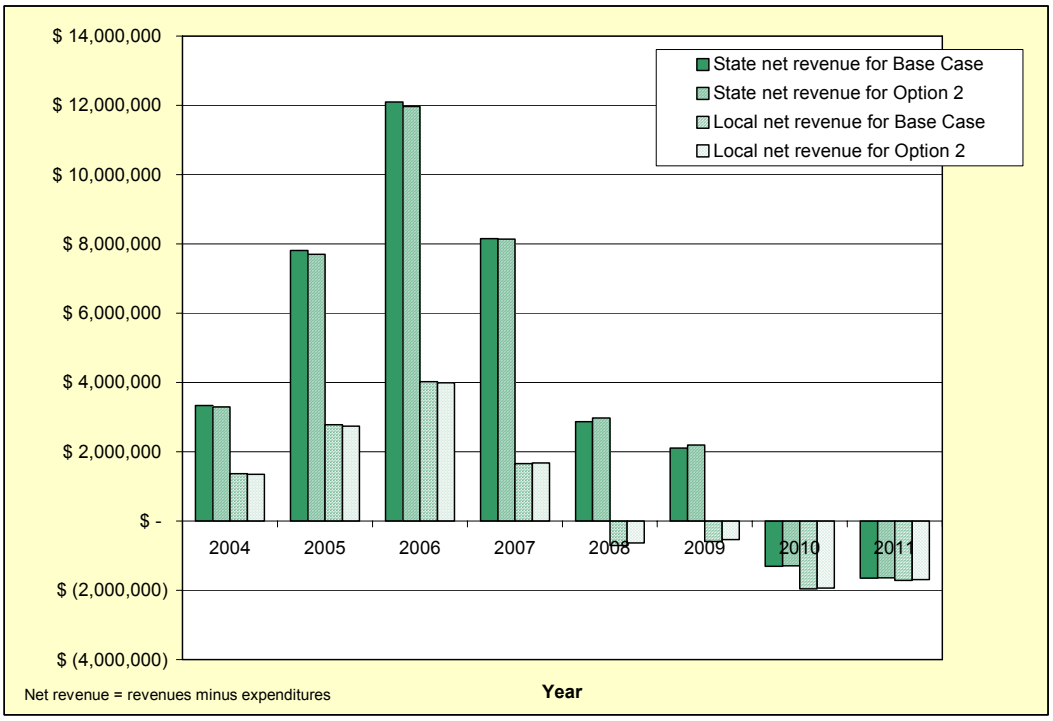
(1) Assume that 25% of capital cost is for bulk materials, 25% of bulk materials can be obtained from local suppliers, and 25% of bulk materials can be obtained from suppliers elsewhere in the state. [Assumption provided by Bechtel Pueblo Team at 13 May 2003 meeting.]
(2) Assume that 25% of imported chemicals can be obtained from local suppliers and 25% of imported chemicals can be obtained from suppliers elsewhere in the state. [Assumption by FOCIS Associates.]
Source: FOCIS Associates and BPT

State and Local Government Net Revenues. Figure 3-5 shows the government (state and local) net revenues for the Base Case and Option 2 from the start of construction in July 2004 through the end of closure in October 2011. The net revenues are based on project related economic activity within the core county (Pueblo) and surrounding counties that contribute either to local (Pueblo) net revenues or to state (Colorado) net revenues. Figure 3-6 shows the percent change in government net revenues over the same period as a result of the off-site option.

The trends in local and state government net revenues shown in Figure 3-5 for Option 2 are similar to those discussed previously for Option 1 (see Section 3.1.2.9). As expected, the impact of Option 2 on net revenues both at the state and local level is very small consistent with the relatively small number of jobs affected by the proposed option. The increase in state and local net revenues in 2008 and 2009 (Figure 3-6) is due largely to the higher employment levels of Option 2 during pilot testing and operations.

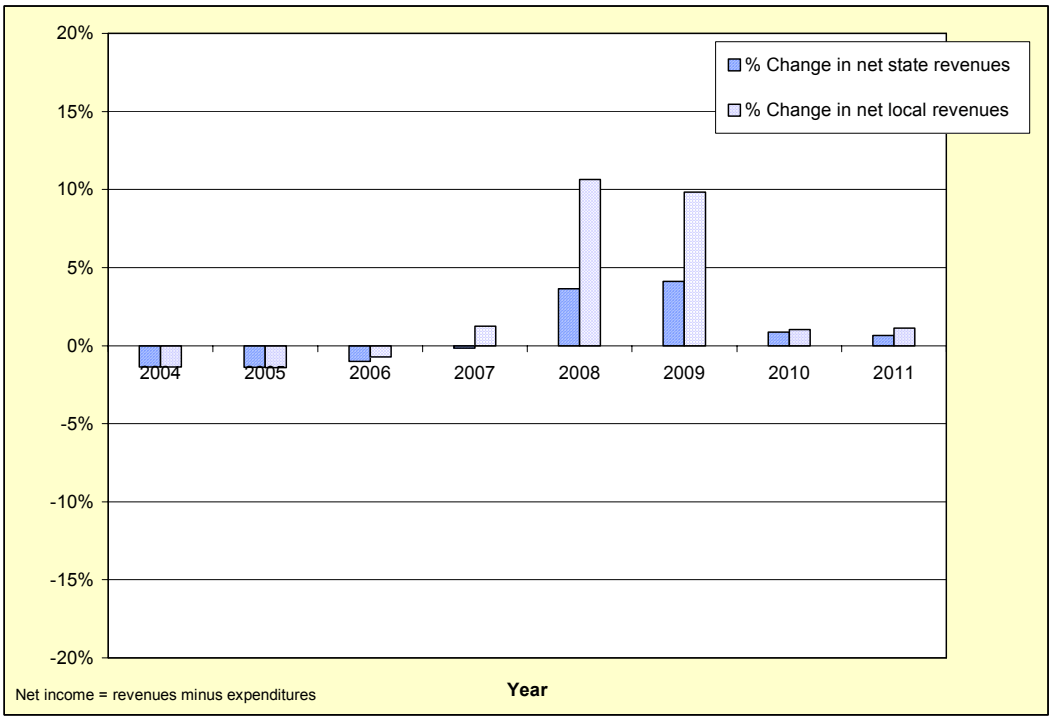
Table 3-9 shows the cumulative local and net revenues for the Base Case and Option 2. As indicated in the table, the calculated percent change in total local net revenue over the project's life cycle is only 2.2%. The percent change in cumulative net revenues for the state is even lower at 0.1%. In view of these small percent changes, Option 2 has negligible impact on government revenues and expenditures and therefore receives a neutral (O) rating for this factor.

Figure 3-5: Base Case and Option 2 Government Net Revenues during PCAPP Project



Source: FOCIS Associates and IDA

Figure 3-6: Option 2 Impacts on Government Net Revenues during PCAPP Project



Source: FOCIS Associates and IDA

Table 3-9: Base Case and Option 2 Government Net Revenues during PCAPP Project

Government	Cumulative Net Revenues 2004-2011			
	Base Case	Option 2	Change	
State	$ 33,407,000	$ 33,332,000	$ (75,000)	-0.2%
Local	$ 4,861,000	$ 4,967,000	$ 106,000	2.2%
Total	$ 38,268,000	$ 38,299,000	$ 31,000	0.1%

Source: FOCIS Associates and IDA

3.2.2.10 Public Outreach.

While this option may meet with some public disapproval because of its reliance on incineration to destroy the propellant, the quantity of material is relatively small such that incineration opponents may be willing to go along with the option if they are convinced that it offers far greater benefits to the program. The fact that the propellant will be sampled prior to shipment to verify that it is uncontaminated with agent and stable enough to transport should help to alleviate some concerns over shipping the material to a TSDF. The additional public outreach efforts required for this option are not considered to be markedly greater than those of the Base Case, and therefore the option is rated as having no (O) impact.

3.2.3 Summary of Impacts

Table 3-10 summarizes the likely impacts of Option 2 on the various evaluation factors.

- Compared to the Base Case, Option 2 is rated as having a positive impact on technical issues, safety, TSDFs, and life cycle schedule. The option reduces technical issues, enhances plant safety, and reduces schedule.
- No factor received a negative rating.
- Option 2 was rated neutral for environmental permitting and compliance, transportation, water and power consumption, treaty, life cycle cost, employment, state and local commercial revenues, and state and local government net revenues.

Table 3-10: Summary of Evaluation Factor Ratings for Option 2

Factor	Comparative Rating	Rationale for Rating
Technical Issues	+	Has potential to reduce or eliminate the major technical challenge associated with processing all of the PCD propellant in the ERH, but creates the additional requirement of having to develop and implement a method to verify that the propellant is not agent contaminated and implementing a method to verify propellant stability. Processing all of the propellant in the ERH is viewed as a greater challenge than verifying that the propellant is uncontaminated and stable. On balance, the option is believed to reduce the overall technical issues associated with propellant processing.
Safety	+	Reduces maintenance demands for the ERH, which has a positive impact on worker safety.
Environmental Permitting and Compliance	O	Propellant will be handled as a RCRA hazardous waste. Requires a supplemental Environmental Assessment (EA) and additional sampling efforts to verify propellant is uncontaminated. The EA will not impact permitting schedule. Additional sampling only marginally affects compliance requirements. Negligible impact on plant effluents and emissions.
Transportation	O	Requires about 10 shipments of propellant during pilot testing and operations. This is offset by a reduction in the number of truck trips for process chemicals and dewatered salts and biomass. Assuming the bulk of the shipments are made during the 12-month operations phase, Option 2 results in a decrease of less than 1 truck trip per week as compared to the Base Case, which has an average of 65 truck trips per week for shipping all process solid wastes and treatment chemicals. Risks of total injuries and fatalities from shipping all energetics (propellant and bursters) are estimated to be 0.03 and 0.002, respectively, over the life of the PCAPP project. Risks of just shipping propellant would be even lower. Propellant will be packaged and shipped to TSDF is accordance with RCRA, DOT, and DOD regulations.
Water Consumption	O	Negligible impact.
Power Consumption	O	The power consumption of the process will be reduced by 3,400 kWhr per day of operation, which is about 1% of the total power consumption for the Base Case process.
TSDFs	+	Four RCRA permitted TSDFs (three commercial incinerators and one Army incinerator facility) with required capability and permits to process propellant were identified as potentially suitable.
Treaty	O	Four RCRA permitted TSDFs (three commercial incinerators and one Army incinerator facility) were identified that have the required technical capability, capacity and permits to process all of the propellant from PCAPP.
Life Cycle Cost	O	Total life cycle cost is reduced by about $12 million.
Life Cycle Schedule	+	Construction and total life cycle schedules are reduced by approximately 6 months.
Employment	O	Results in a loss of 24 FTEs during construction and gain of 9 FTEs during pilot testing and operations for a net loss of 5 FTEs over the life of the PCAPP project, which is less than 1% of the total average number of FTEs for the Base Case.
State and Local Commercial Revenues	O	Total commercial revenue for the state decreases by about $596,000 over the life of the PCAPP project, which is 0.6% of estimated total state commercial revenue for the Base Case. About half of that reduction is estimated to occur locally (in Pueblo County).
State and Local Government Net Revenue	O	State government net revenue (revenues minus expenditures) decreases by about $75,000 over the life of the project, which is 0.2% of the state government revenue for the Base Case. Local government net revenue increases by $106,000 or 2.2% over the life of the project.
Public Outreach	O	Some resistance to incinerating propellant should be expected, but small quantity of propellant and benefits of off-site disposal may mute serious opposition. Public outreach effort not expected to increase significantly with this option.

Source: FOCIS Associates

3.3 Option 3: Ship Energetics (Propellant and Bursters) Off Site

3.3.1 Energetics Treatment – Base Case and Option 3

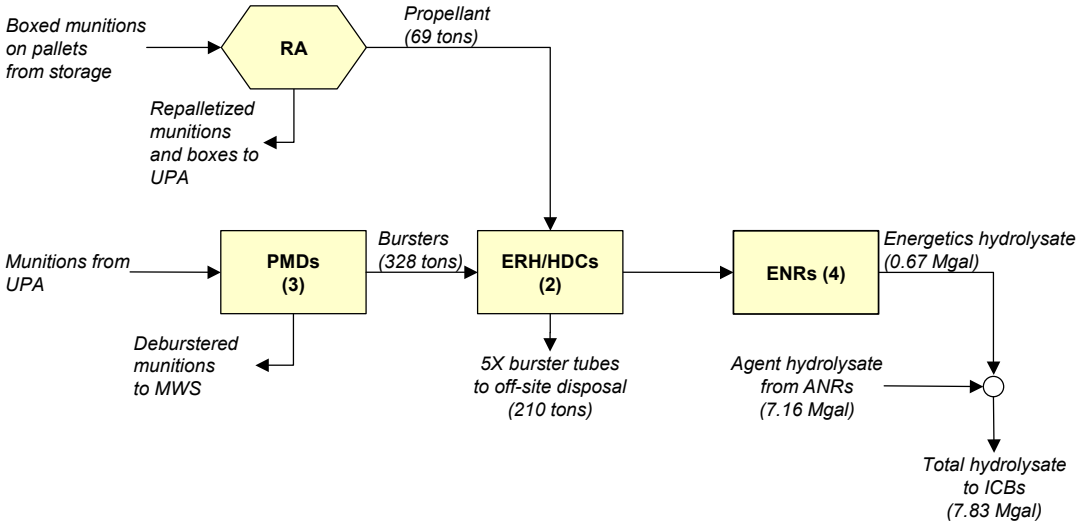
Block flow diagrams for the Base Case and proposed option are shown in Figure 3-7. The top diagram shows the major unit processes and process rates used in the Base Case design for on site treatment of propellant and bursters. The bottom diagram shows the process configuration and processing rates for the proposed off site option. The figure serves as a useful reference for the discussion that follows.

3.3.1.1 Base Case for on-site processing of energetics (propellant and bursters).

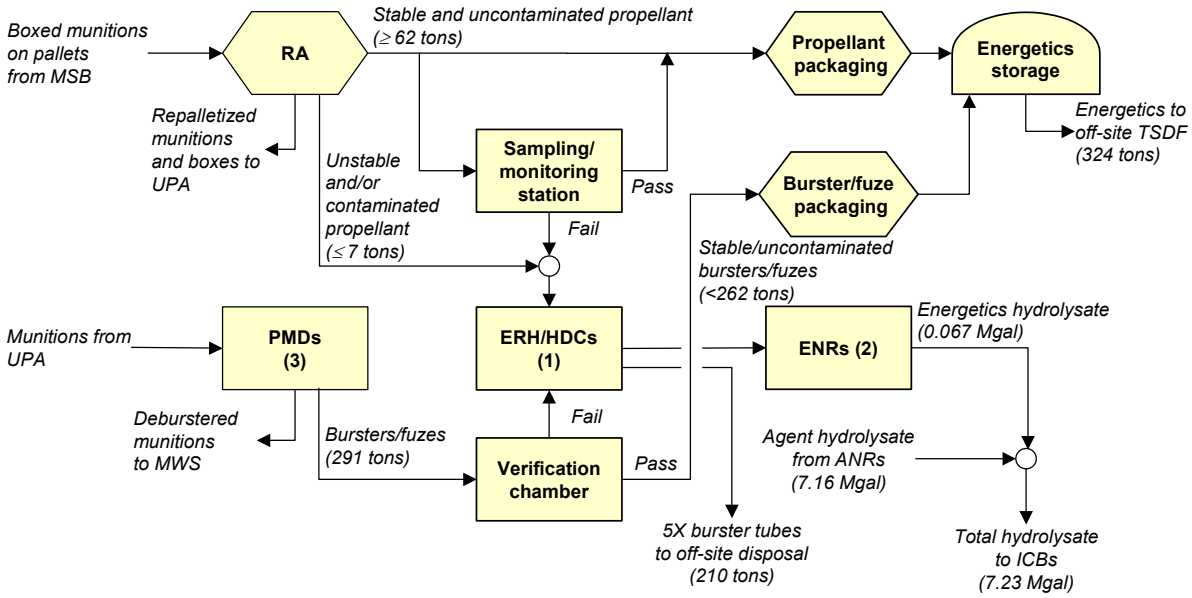
In the Base Case, all energetic materials including propellants, bursters, and fuzes are destroyed on site at PCAPP. As described under Option 2, munitions are transferred from the storage igloos to the MSB and then to the UPA or the EPB. Boxed munitions containing propellant are moved to the RA in the EPB, where the munitions and propellants are removed from the boxes. The munitions are re-palletized and transferred to the UPA, while the propellants are transferred by conveyor to one of two ERHs. In the UPA, palletized and re-palletized munitions are unpacked and transferred to one of three PMDs, where the fuzes and bursters are removed. The fuzes and bursters are transferred by conveyor from the PMDs to one of two (2) ERHs. The M1 and M8 propellants and the tetrytol and tetryl from the bursters are hydrolyzed in the ERHs. Deburstered munitions are placed on trays and moved to the APB where they are accessed, drained of agent, and washed out in the MWS before being sent to one of three MPTs for 5X decontamination. The MWS is a modular, automated version of the manual prototype unit tested at CAMDS for ACWA during the EDS.

Each ERH is a full-scale version of the prototype unit tested by ACWA during EDS testing. It consists of a heated rotating drum with internal spiral flights for moving solid material through the process. The drum contains hot sodium hydroxide solution for solubilizing and hydrolyzing the energetics. The liquid effluent from the ERHs is pumped to the energetic neutralization reactors where hydrolysis is completed and verified. The proposed design calls for four (4) energetic neutralization reactors to be operated in parallel. The effluent hydrolysate from the energetic neutralization reactors is mixed with agent hydrolysate before being treated in the ICBs. Solids from each ERH are discharged onto an electrically heated, nitrogen-blanketed discharge conveyor (HDC) for 5X decontamination. Offgases from the ERHs and HDCs are vented to a CatOx treatment unit and then to activated carbon filters before being discharged to the atmosphere.

Figure 3-7: Base Case and Option 3 Flow Diagrams



Base Case for Option 3: Process all energetics on site



Option 3: Ship uncontaminated energetics to off-site TSDF for treatment and disposal

RA - Reconfiguration Area
UPA - Unpack Area
PMD - Projectile/Mortar Disassembly Machine
ERH - Energetics Rotary Hydrolyzer
HDC - Heated Discharge Conveyor
ENR - Energetics Neutralization Reactor
MWS - Munitions Washout Station
MPT - Metal Parts Treater
ANR - Agent Neutralization Reactor
ICB - Immobilized Cell Bioreactor
TSDF - Treatment, Storage, and Disposal Facility

Source: FOCIS Associates

3.3.1.2 Option 3 – Ship propellant and bursters off site for destruction and disposal.

This option involves shipping all energetic materials, including propellants, bursters, and fuzes, off site to a commercial or government facility for incineration. This option affects the plant configuration and related costs in the following ways:

- Reduces the number of ERH/HDC systems from two (2) to one (1)
- Reduces the number of energetics neutralization reactors from four (4) to two (2)
- Adds burster and propellant storage areas
- Adds requirement for verifying propellant and bursters are stable and not agent contaminated
- Adds conveyors for transporting propellants and bursters to storage areas
- Adds truck bay for loading of energetics for off-site shipment

As discussed in Option 2, uncontaminated propellant removed from boxed munitions will be packaged in bulk containers for off-site shipment rather than treated on site in the ERHs. Similarly, uncontaminated bursters and fuzes removed from the munitions in the PMDs will be packaged for off-site shipment rather than treated on site in the ERHs. Procedures will be required for verifying that the propellant and bursters are stable and not contaminated with agent. Unstable and/or contaminated energetics material will be treated in the remaining ERH and agent neutralization reactors. For the purposes of this study, it is assumed that 90% of the energetics and related materials shown previously in Table 3-14 are suitable for off-site shipment. The remaining 10% is assumed to be contaminated and/or unstable and would be treated in the ERH.

While this option potentially relieves some technical issues associated with the ERH and its interface with the HDC, it also raises several new ones, such as issues related to the safe handling, storage and transport of propellant and bursters and the issue of verifying that the propellant and bursters are stable and uncontaminated. In addition, the PCAPP must retain the capability to treat contaminated and/or unstable energetics on site.

3.3.2 Impacts of Option 3

3.3.2.1 Technical Issues.

Option 3 has the potential of alleviating the aforementioned concerns associated with processing large numbers of propellant bags and sheets through the ERH. It also results in a substantial downsizing of the explosion containment room (ECR) where the ERHs are located. Because the quantity of unstable or uncontaminated energetics is believed to be small (<10% of the total energetics in the PCD stockpile), processing this material in the remaining ERH and energetic neutralization reactors will not be a potential bottleneck for the plant.

The technical challenges of this option are similar to those of Option 2, except the quantity of energetic material requiring off site disposal is larger due to the addition of the bursters. Consequently, the area needed for temporary storage of energetics may need to be larger and have a higher explosive rating than in Option 2. As before, propellant and burster explosives will need to be verified stable and uncontaminated prior to shipment. Methods for doing this will have to be validated and certified before pilot testing can begin. Unstable or contaminated propellant will be processed in the ERH. Fortunately, the amount of this material is expected to be relatively small and therefore processing it in the ERH should not be a major problem. The challenge of demonstrating that propellant and bursters are uncontaminated and stable offsets reduction in ERH risks, and thus the option has a net neutral (O) effect on technical issue.

3.3.2.2 Safety.

Option 3 has essentially the same safety concerns as Option 2 (i.e., detonation and/or conflagration of energetics during handling or storage, potential for worker exposure to highly caustic solutions, potential for worker exposure to agent contaminated energetics) but the hazards are magnified due to the addition of the burster energetics. As discussed previously, these same hazards exist with the Base Case to higher or lesser degree. Of particular concern in the Base Case is the potentially high maintenance demand of the ERH when processing propellant bags and the ramifications that may have on process reliability and worker safety. Higher maintenance requirements provide a greater opportunity for worker exposure to hazardous or stressful conditions. Shipping most of the propellant and bursters off site eliminates one of the ERH/HDC systems and would significantly reduce the maintenance requirements of the remaining ERH/HDC.

Option 3 requires workers to manually handle a relatively large quantity of energetics (at least 69 tons of propellant and 398 tons of bursters), some of which may be contaminated with agent. For propellant, the safety risk associated with handling propellant is the same for Option 3 and the Base Case. The major difference is with the handling of bursters. In the Base Case, these are handled remotely in an ECR. The only opportunity for workers to manually handle a burster in the Base Case would be if there were problems with the equipment (either with the PMD, transfer conveyors, or ERH) that necessitated unscheduled maintenance. With Option 3, operations personnel would perform burster packaging, storage, and truck loading operations manually. The manual aspect of these operations introduces additional hazards that are not present in the Base Case. Specialized training for select personnel involved in handling and packaging the energetics must be conducted in accordance with DOT and Army regulations.

The major concern with respect to public safety is the risk of an accident or terrorist incident during transport of the energetics from PCAPP to the TSDF. This concern is addressed under the transportation factor. For activities that are conducted on site at PCAPP, the option poses no additional safety risks to the general public. Any accident that would occur on-site at PCAPP would be contained within the boundaries of the site.

Based on the analysis of inherent hazards, Option 3 is rated as having a negative (–) impact on safety when compared to the Base Case. The rating is based primarily on the inherent hazards associated with the manual handling of bursters. That is not to say Option 3 could not be done safely. The rating is simply a reflection of the additional efforts or controls (either administrative or engineering) that would be required to achieve the same level of safety as the Base Case where bursters are handled remotely. The threat of sabotage or terrorist attack has not been factored into the rating.

3.3.2.3 Environmental Permitting and Compliance.

The environmental impacts of this option are essentially the same as Option 2. The propellant and bursters would have to be handled as a hazardous waste and shipped to a RCRA permitted incinerator. As previously discussed, off-site shipment of propellant was addressed in the Pueblo FEIS in association with the Baseline and modified Baseline incineration alternatives, but not in conjunction with neutralization. A supplemental EA will be required to comply fully with NEPA. Including time for public comment, a supplemental EA typically takes 6 to 8 months to

complete. This should not impact the project schedule provided the EA is started during the initial design phase of the project. Because final applications for RCRA, Air, and Water permits for the site will not be submitted until sometime during the construction phase, there is more than enough time to incorporate off-site disposal into the permitting process.

The propellant and bursters will be packaged and shipped from PCAPP to a RCRA permitted TSDF in accordance with applicable Army, local, state, and federal regulations. Environmental audits of all candidate TSDFs will be carried out prior to shipping any waste from PCAPP to the facility.

As in Option 2, the greatest threat to the environment would occur as a result of a fire or explosion during transport. As will be discussed in the next section dealing with transportation, the risk of such occurrences has been shown to be very small. The propellant and bursters will be packaged and shipped to the TSDF in accordance with all relevant and appropriate RCRA, DOD and DOT regulations, thus minimizing the risk of explosion hazards. Even if such an event were to occur, the extent of the impact would be limited and localized. Most communities have Hazmat and Emergency Response Teams that are well equipped to handle such emergency situations and limit potential damages.

The compliance requirements of this option are substantially increased over the Base Case because of the need to verify that the both the propellant and bursters are stable and uncontaminated with agent. Bursters are more of concern than propellant because there is a greater potential to be contaminated with agent given their location within the munition body. Unlike propellant, which is stored external to the munition, the bursters are inside the munition, separated from the agent cavity by only the burster well. The quantity of busters is also significantly larger than the quantity of propellant, thus the sampling burden to meet compliance requirements may be much higher for bursters than propellant. For these reasons, Option 3 is viewed as having a negative (–) impact on Environmental compliance.

3.3.2.4 Transportation.

As discussed previously under Option 2, shipment of propellant and bursters from PCAPP to a TSDF was evaluated in the ANL Transportation Risk Assessment study. The study concluded that the transportation risks were low and well within national averages for commercial shipment of “dangerous goods”. The risks associated with shipping energetics from PCAPP by truck to any of the four TSDFs identified in the study were estimated to result in <0.03 injuries and <0.002 fatalities over the life of the project.

The ANL Risk Assessment assumed a total of 38 truck shipments, while the Impacts Analysis assumes a total of 36 truck shipments. The lower number of shipments used in the Impacts Analysis is based on the assumption that 10% of the energetics may be unstable and/or contaminated with agent and will therefore be treated on site at PCAPP. The ANL study assumed that all of the energetics would be shipped off site. Regardless of which number is used, the number of shipments is low. Option 3 actually results in a slight reduction in the number of total truck shipments (<1 truck trips per week) to and from PCAPP. This is because the option reduces the quantity of treatment chemicals (primarily sodium hydroxide) shipped to the site and the amount of solid waste shipped off site.

In view of the low transportation risk (exclusive of terrorism and sabotage) and negligible impact on traffic volume, Option 3 is rated as neutral (O) for this factor.

3.3.2.5 Utilities.

Water Consumption. This option will have negligible impact on net water consumption. Therefore, the option is rated neutral (O) compared to the Base Case for this factor.

Power Consumption. With the deletion of one of two ERH/HDCs in Option 3, the power consumption of the process will be reduced by approximately 14,500 kWhr per day (or a total of 16 million kWhr over the project life cycle), which is only about 4% of the total power consumption of the Base Case process. Therefore, the option is rated neutral (O) compared to the Base Case for this factor.

3.3.2.6 Treatment, Storage, and Disposal Facilities.

In addition to being able to handle the propellant, each of the four TSDFs discussed previously in Section 3.2.2.6 for Option 2, has the capability and capacity to process all of the bursters, and fuzes from PCAPP. Therefore, in terms of TSDF availability, Option 3 is rated as positive (+).

3.3.2.7 Treaty.

Similar to Option 2, Option 3 should also have no impact on Treaty inspection and oversight requirements. The PCAPP would still be subject to essentially the same Treaty verification requirements as the Base Case even though the propellant, bursters, and fuzes, once removed from the munition and confirmed to be uncontaminated by agent, may not be subject to the verification provisions of the Treaty. If the energetics are not considered Treaty material, the TSDF that receives them will not be subject to Treaty inspection and oversight. Because there is no effect on Treaty requirements, Option 3 is given a neutral (O) rating for this factor.

3.3.2.8 Life Cycle Cost and Schedule.

The impact of Option 3 on the project life cycle cost (LCC) is shown in Table 3-11. Also provided in the table are the assumptions and cost bases used in deriving the estimated change in LCC. All figures are in 2003 dollars.

Table 3-11: Option 3 Impacts on Life Cycle Costs

Item and Assumption	Cost basis	Change in LCC
Technical issues resolution		
Develop and certify procedure to demonstrate that bursters and propellant are uncontaminated and certify procedure for propellant.	2000 hrs, $150/hr	$ 300,000
Develop and certify a procedure to demonstrate propellant and burster stability.	2300 hrs, $150/hr	$ 350,000
Two TRRPs are eliminated.	Lump sum	$ (400,000)
Eliminate modifications to ERH/HDCs to allow treatment of propellant.	Lump sum	$ (500,000)

Table 3-11: Option 3 Impacts on Life Cycle Costs (continued)

Item and Assumption	Cost basis	Change in LCC
Major equipment and building changes		
Eliminate one of two ERH/HDCs and two of four ENRs. Includes reduction of approximately 80,000 craft hours, or 462 craft months.	Lump sum	$ (25,000,000)
Add a 2000-ft^2 building for storage of packaged propellant. Includes addition of approximately 1000 craft hours, or about 6 craft months.	$120/$ft^2$ plus design and project management	$ 300,000
Off-site shipping and treatment		
Packaging containers for 62 tons of propellant and 262 tons of bursters (Cat 1.1 DOT shipping container).	250 lb propellant or burster/container, $500/ propellant container, $750/ burster container	$ 1,800,000
Treatment of 324 tons of propellant and bursters at TSDF.	$5/lb	$ 3,200,000
Shipping propellant and bursters to TSDF.	10 tons/load, 1500 miles/load, $3/mile	$ 150,000
TSDF oversight		
Two half-time staff at TSDF on temporary duty (TDY) for 24-month pilot testing and operations	173 hrs/month/FTE, $80/hr $2,000/month for TDY	$ 380,000
Changes in wastes, imported materials, and utilities		
Reduce quantity of dewatered salts and biomass shipped to TSDF by 386 tons.	$600/ton	$ (230,000)
Reduce quantity of 50% NaOH used in ERH/HDC/ENRs by 160 tons, reduce quantity of inorganic nutrients used in ICBs by 8.1 tons, and reduce quantity of oxalic acid used in WRS by 4.3 tons.	$380/ton 50% NaOH, $1,300/ton inorganic nutrients, $800/ton oxalic acid	$ (75,000)
Reduction in power consumption with the deletion of one ERH/HDC by approximately 15,9000,000 kWhr.	$0.0384/kWhr	$ (610,000)
Environmental permitting		
Added requirement for Supplemental EA.	Allowance	$ 250,000
Labor changes		
Construction manpower changes: Reduce non-manual (NM) staffing by 60 FTEs for 8 months. This is in addition to craft savings of 80,000 hours included in major equipment changes costs.	173 hrs/month/FTE, $80/hr	$ (6,600,000)
Systemization manpower changes: Reduce staff by approximately 7 FTEs for 18-month phase.	173 hrs/month/FTE, $80/hr	$ (1,700,000)
PT&Ops manpower changes: Net 3 fewer FTEs for 24-month phase.	173 hrs/month/FTE, $80/hr	$ (1,000,000)
Closure manpower changes. Reduce staff by 20 FTEs for 9 weeks.	40 hrs/week, $80/hr	$ (580,000)
Government program management: Reduce staffing one-to-one with Systems Contractor (60 FTEs) as a result of 8-month reduction in construction schedule .	173 hrs/month/FTE, $80/hr	$ (6,600,000)
Total		**$ (37,000,000)**

Source: FOCIS Associates and BPT

The results of the LCC analysis indicate that Option 3 results in a potential savings of about $37 million. The cost savings is due in large part to the reduction in non-manual labor hours (e.g., management, project controls, quality assurance, administration) during construction and systemization. Since the impact on the LCC is less than $50 million, Option 3 is rated as neutral (O) for this factor.

The BPT has estimated that Option 3 could save up to 8 months on construction. This estimate is based on BPT experience at other chemical demilitarization sites and their best professional judgment. As a cautionary note, the project Integrated Master Schedule (IMS) was not available for this study. It is due to be released within the next few months. Because the estimate is not based on an analysis of the IMS, it must be viewed as being very preliminary and subject to change once the IMS is published. Without an IMS it is impossible to determine what systems and activities are on the critical path. This information is prerequisite for determining schedule impacts with any known degree of certainty and accuracy.

3.3.2.9 Local Economics.

Local Employment. Option 3 will result in an average of 11 fewer full-time equivalents (FTE). See Table 3-12. The highest reductions will be during construction, when there will be about 28 fewer local employees. The option also impacts systemization, pilot testing and operations, and closure with about seven, two, and two fewer FTEs, respectively. Option 3 has an overall average employment that is approximately 1.5% less than the average employment numbers associated with the Base Case. The change in average employment over the life of the project is judged to be low and therefore Option 3 is viewed as neutral (O) compared to the Base Case for this factor.

Table 3-12: Option 3 Impacts on Number of PCAPP Employees

Project phase	Phase duration[1]	Net change in number of local employees, FTE[3]
Design	30	0
Construction	33	-28.4
Systemization[2]	18	-7.0
Pilot Testing and operations[2]	24	-2.0
Closure	23	-1.8
Net over project life	105	-11.0[4]

(1) Milestones adapted from BPT Schedule dated 18 Feb 03.
(2) Phase duration adjusted according to BPT matrix dated 24-May-03.
(3) FTE = full-time equivalent jobs
(4) Design, construction, and systemization have some overlap, so the total project duration is less than the sum of the phase durations.
Source: FOCIS Associates and BPT

State and Local Commercial Revenues. Based on the assumptions provided in Table 3-13, the total commercial revenue for the state is estimated to decrease by $3.2 million over the life of the project. Local commercial revenue is estimated to decrease by approximately $1.6 million over the life of the project. These losses in commercial revenues are a result of the construction of less

equipment and the use of smaller quantities of treatment chemicals. The potential loss in commercial revenues is probably very small when compared to the potential total commercial revenues that might be realized over the project life cycle. Although precise estimates of total state and local commercial revenues have not been compiled, it is assumed that they would be on the order of $100 million statewide. In that context, the impact is relatively small (about 3%) and therefore Option 3 is rated as having a neutral (O) effect when compared to the Base Case.

Table 3-13: Option 3 Impacts on State and Local Commercial Revenues

Source	Changes in local and state commercial revenues		
	Local	Elsewhere in Colorado	Total
Major equipment changes[1]	$ (1,600,000)	$ (1,600,000)	$ (3,200,000)
Additional space and/or transfer stations[1]	$ 19,000	$ 19,000	$ 38,000
Imported chemicals[2]	$ (19,000)	$ (19,000)	$ (38,000)
Total change	**$ (1,600,000)**	**$ (1,600,000)**	**$ (3,200,000)**

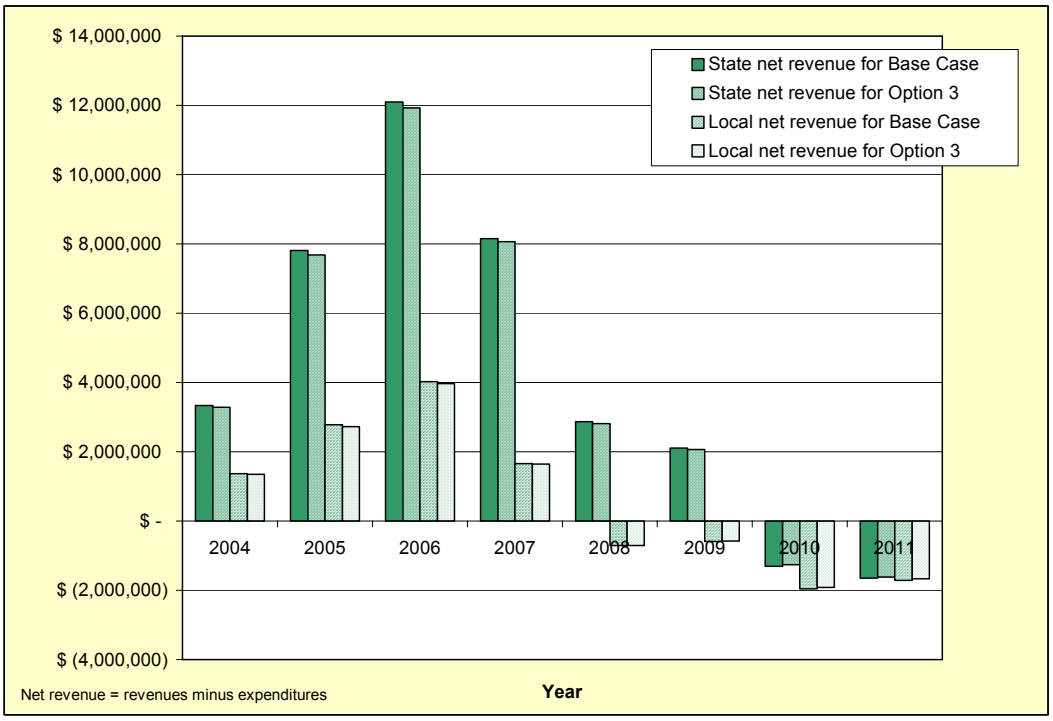
(1) Assume that 25% of capital cost is for bulk materials, 25% of bulk materials can be obtained from local suppliers, and 25% of bulk materials can be obtained from suppliers elsewhere in the state. [Assumption provided by Bechtel Pueblo Team at 13 May 2003 meeting.]
(2) Assume that 25% of imported chemicals can be obtained from local suppliers and 25% of imported chemicals can be obtained from suppliers elsewhere in the state. [Assumption by FOCIS Associates.]
Source: FOCIS Associates and BPT

State and Local Government Net Revenues. Figure 3-8 shows the government (state and local) net revenues for the Base Case and Option 3 from the start of construction in July 2004 through the end of site closure in October 2011. The net revenues are based on demilitarization project related economic activity within the core county (Pueblo) and surrounding counties that contribute either to local (Pueblo) net revenues or to state (Colorado) net revenues. Figure 3-9 shows the percent change in government net revenues over the same period as a result of the off-site option.

The difference in net revenues (both local and state) between the Base Case and option are barely discernible in Figure 3-8. As shown in Figure 3-9, the change in net revenues as a result of Option 3 ranges from about –2% to +3% for local government and –2% to +2%, for state government. Because of the lower job count during construction, systemization and pilot testing and operations, Option 2 produces slightly lower state and local net revenues during those periods.

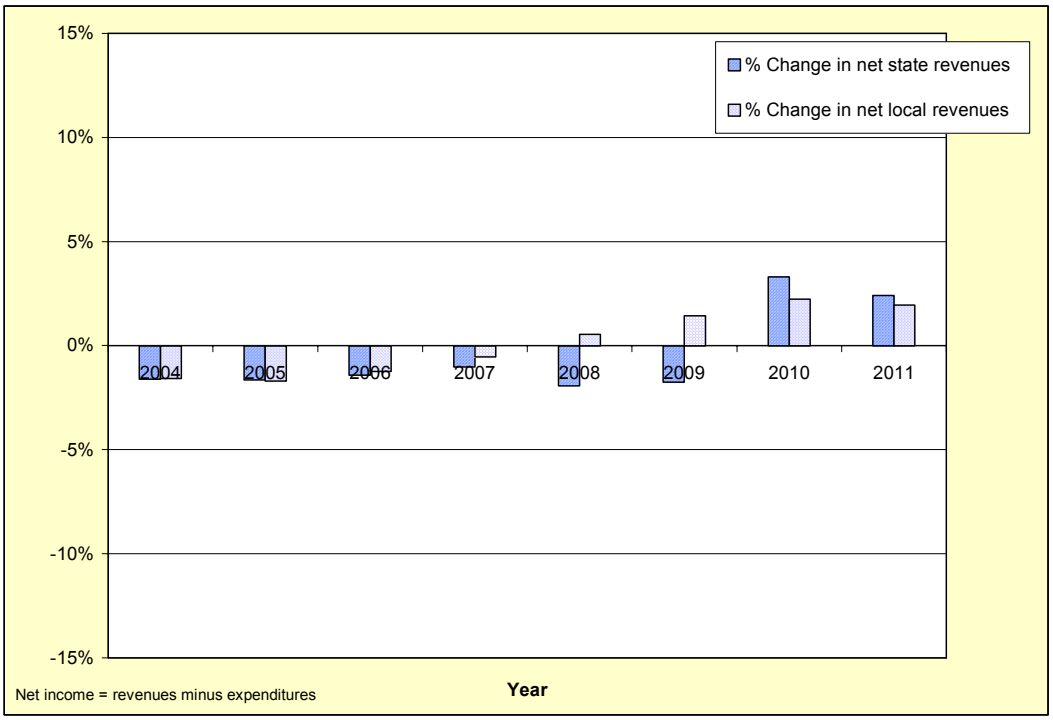
Table 3-14 shows the cumulative local and net revenues for the Base Case and Option 3. As indicated in the table, the calculated percent change in total local net revenue over the project's life cycle is only –0.8%. The percent change in cumulative net revenues for the state is -1.3%. The magnitude of the change is generally consistent with the number of jobs lost with this option. As with the previous two options, Option 3 has little impact (on a percent basis) on local and state net revenues and receives a neutral (O) rating for this factor.

Figure 3-8: Base Case and Option 3 Government Net Revenues during PCAPP Project



Source: FOCIS Associates and IDA

Figure 3-9: Option 3 Impacts on Government Net Revenues during PCAPP Project



Source: FOCIS Associates and IDA

Table 3-14: Base Case and Option 3 Government Net Revenues during PCAPP Project

Government	Cumulative Net Revenues 2004-2011			
	Base Case	Option 3	Change	
State	$ 33,407,000	$ 32,961,000	$ (446,000)	-1.3%
Local	$ 4,861,000	$ 4,823,000	$ (38,000)	-0.8%
Total	$ 38,268,000	$ 37,784,000	$ (484,000)	-1.3%

Source: FOCIS Associates and IDA

3.3.2.10 Public Outreach.

In terms of public outreach, this option has two main issues. The first is the same issue noted for Option 2, that is the reliance on incineration to destroy the propellant and bursters. Because of the larger quantity of material being shipped to an off-site incinerator, Option 3 may generate more opposition that shipping just the propellant. The second issue has to do with the fact that bursters are integral (i.e., inside) to the munition and therefore there could the perception that they are likely to be contaminated with agent. Even with an approved method to verify that bursters are uncontaminated, there may be some who will contend that the Army still runs an unacceptable risk of inadvertently shipping agent contaminated bursters to an off site facility. Add to this the safety concerns associated with handling and shipping high explosives, and it becomes apparent that this option is likely to require significantly greater public outreach efforts than the Base Case to secure public support. Therefore, Option 3 is rated as having a negative (–) impact on public outreach efforts.

3.3.3 Summary of Impacts

Table 3-15 summarizes the likely impacts of Option 3 on the various evaluation factors.

- Compared to the Base Case, Option 3 is rated as having a positive impact on TSDF and life cycle schedule.
- Option 3 is rated negative for safety, environmental permitting and compliance, and public outreach. The negative marks are due largely to the manual handling of bursters and the added requirement to verify that the propellant and bursters are uncontaminated with agent prior to shipment off site.
- Option 3 is rated neutral for the remaining factors. These include technical issues, transportation, Treaty, water consumption, power consumption, life cycle cost, employment, state and local government net revenues, and state and local commercial revenues.

Table 3-15: Summary of Evaluation Factor Ratings for Option 3

Factor	Comparative Rating	Rationale for Rating
Technical Issues	O	Reduces or eliminates the major technical challenge associated with processing all PCD propellant in the ERH. Creates additional requirements: developing and implementing methods to verify that the propellant and bursters are not agent contaminated, developing and implementing methods to verify burster stability, and implementing method to verify propellant stability. The challenge of demonstrating that propellant and bursters are uncontaminated and stable offsets the reduction or elimination of challenges associated with treating propellant in the ERHs.
Safety	–	Requires manual handling of bursters, some of which may be contaminated with agent.
Environmental Permitting and Compliance	–	Propellant and bursters will be handled as a RCRA hazardous waste. Requires a supplemental Environmental Assessment (EA), but should not impact schedule. Requires substantial additional sampling efforts to verify propellant and bursters are uncontaminated. Additional sampling is also required to verify that bursters are stable. Negligible impact on plant effluents and emissions. Required compliance efforts could increase significantly.
Transportation	O	Requires about 36 shipments of propellant and bursters during pilot testing and operations. This is offset by a reduction in the number of truck trips for process chemicals and dewatered salts and biomass. Assuming the bulk of the shipments are made during the 12-month operations phase, Option 3 results in a net decrease of less than 1 truck trip per week as compared to the Base Case, which has an average of 65 truck trips per week for shipping all process solid wastes and treatment chemicals. Risks of total injuries and fatalities from shipping all energetics (propellant and bursters) are estimated to be 0.03 and 0.002, respectively, over the life of the project. Propellant and bursters will be packaged and shipped to TSDF is accordance with RCRA, DOT, and DOD regulations.
Water Consumption	O	Negligible impact on net water consumption.
Power Consumption	O	With the deletion of one of two ERH/HDCs, the power consumption of the process will be reduced by approximately 14,500 kWhr per day (or a total of 15.85 million kWhr over the PCAPP project), which is only 4.2% of the total power consumption of the Base Case process.
TSDFs	+	Four RCRA permitted TSDFs (three commercial incinerators and one Army incinerator facility) were identified that have the required capability, capacity and permits to process all of the propellant and bursters from PCAPP.
Treaty	O	Inspection and oversight requirements are essentially the same as the Base Case because uncontaminated propellant and bursters shipped off site should not subject to Treaty monitoring and verification.
Life Cycle Cost	O	Total life cycle cost is reduced by about $37 million.
Life Cycle Schedule	+	Construction and total life cycle schedules are reduced by approximately 8 months.
Employment	O	Results in the following job losses: 28 FTEs during construction, 7 FTEs during systemization, 2 FTEs during pilot testing and operations, and 2 FTEs during closure for a net loss of 11 FTEs over the life of the project, or less than 2% of the average FTEs over all project phases for the Base Case.
State and Local Commercial Revenues	O	Total commercial revenue for the state decreases by about $3.2 million over the life of the PCAPP project, which is about 3% of the estimated total state commercial revenue for the Base Case. About half of that reduction is estimated to occur locally (in Pueblo County).

Table 3-15: Summary of Evaluation Factor Ratings for Option 3 (continued)

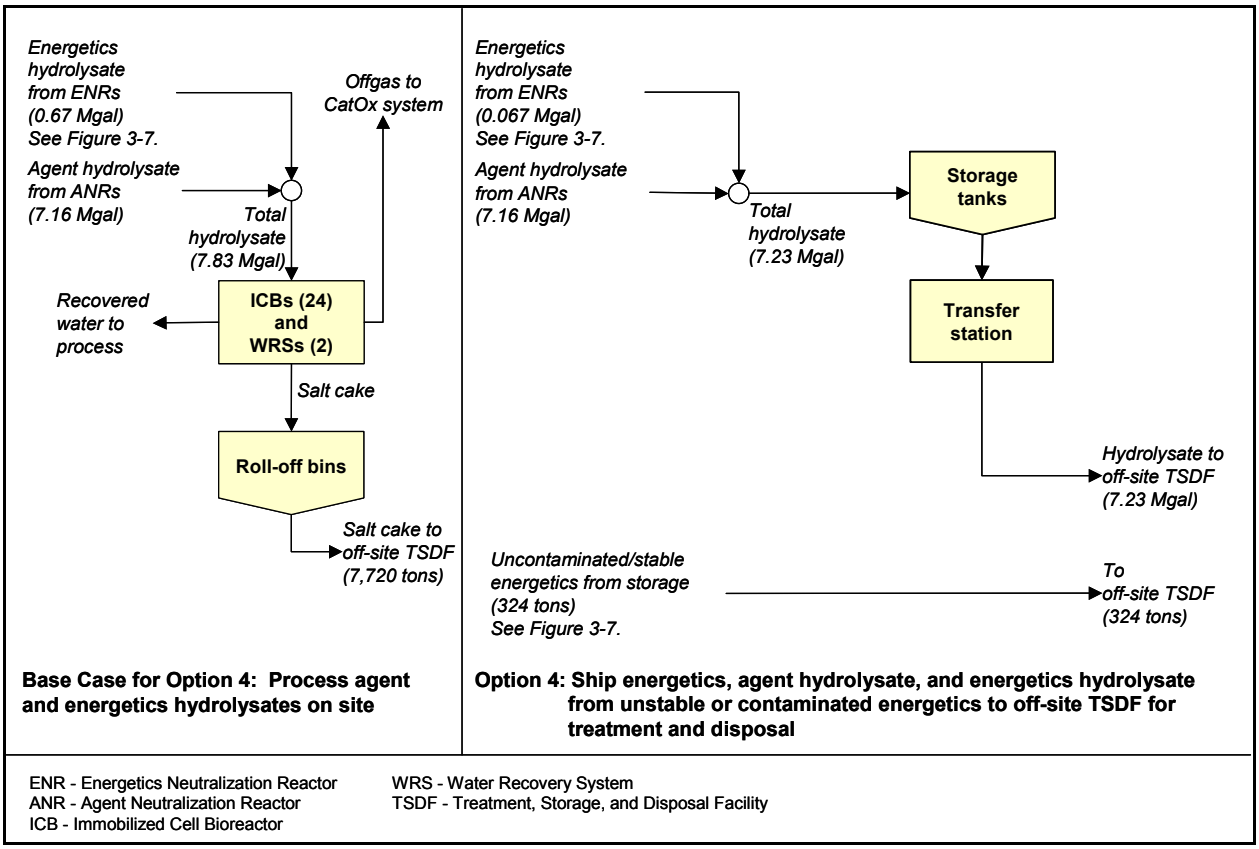
Factor	Comparative Rating	Rationale for Rating
State and Local Government Net Revenues	O	State government net revenue (revenues minus expenditures) decreases by $446,000 over the life of the PCAPP project, which is 1.3% of the state commercial revenue for the Base Case. Local government net revenue decreases by about $38,000 or 0.8% over the life of the PCAPP project.
Public Outreach	–	Increased public outreach efforts are likely to be required to overcome potential public opposition to incinerating relatively large quantities of high explosives and public concerns over transport and agent contamination.

Source: FOCIS Associates

3.4 Option 4: Ship Energetics and Agent Hydrolysate Off Site

Block flow diagrams for the Base Case and proposed option are shown in Figure 3-10. The diagram on the left side of the page shows the major unit processes and process rates used in the Base Case design for on-site treatment of agent and energetic hydrolysates. The diagram on the right side of the page depicts the process configuration and processing rates for the proposed off site option.

Figure 3-10: Base Case and Option 4 Flow Diagrams



Source: FOCIS Associates

3.4.1 Energetics and Agent Hydrolysate – Base Case and Option 4

3.4.1.1 Base Case for on-site processing of energetics and agent hydrolysate.

The individual systems used in the Base Case design for processing propellants and bursters on site were described previously in Options 2 and 3. After removal of propellant, bursters, and fuzes, the munitions are moved to the APB where they are accessed, drained of agent, and washed out in the MWS. The current design uses eleven (11) MWSs serviced by three (3) robots to feed and remove munitions. The drained agent and washout water from the MWS are pumped to separate storage tanks before being processed together in one of four (4) agent neutralization reactors. The hydrolysate from the agent neutralization reactors is first transferred to the agent hydrolysate holding tanks and then to the Immobilized Cell Bioreactor (ICB) feed tanks where it is combined with hydrolysate from the energetics neutralization reactors. The combined

hydrolysates are diluted with process water and supplemented with nutrients before being fed into one of twenty-four (24) ICBs (organized in six modules with four ICB units per module). The ICB is a fixed-film, aerobic bioreactor that degrades the organic compounds in the hydrolysate. Offgases from the ICBs are passed through CatOx units to remove trace organics and odors. Liquid effluent from the ICBs is pumped to one of two (2) identical water recovery systems (WRS) in the process auxiliary building (AUB) to recover water. Each WRS consists of a feed tank, brine concentrator, evaporator crystallizer, and filter press. Solids from the WRS (dewatered salts and biomass) are shipped off site to a hazardous waste facility for disposal.

3.4.1.2 Option 4 – Ship energetics and agent hydrolysate off site for treatment and disposal.

In this option, energetics (propellant, bursters and fuzes) and agent hydrolysate are shipped off site to appropriate facilities for treatment and disposal. As discussed previously in Option 2, uncontaminated propellant removed from boxed munitions will be packaged in bulk containers for shipment to an off-site commercial or government-owned facility for incineration. Similarly, uncontaminated bursters and fuzes removed from the munitions in the PMDs will be packaged for off-site shipment to an incinerator. Procedures will be required for verifying that the propellant and bursters are both stable and not contaminated with agent. For the purposes of this study, it is assumed that 90% of the total quantity of energetics (and associated metal items) is suitable (i.e., stable and uncontaminated) for shipment off site. The remaining 10% of the energetic material is assumed to be unstable and/or contaminated and will be treated in the ERHs. The resulting energetic hydrolysate will be combined with the agent hydrolysate and shipped to a commercial biotreatment facility either by tanker truck or rail car.

The potential facility and process impacts for Option 4 include all of those impacts identified in Option 3 plus additional impacts associated with the elimination of the ICBs and WRS. Potential facility and process impacts of Option 4 can be summarized as follows:

- Reduces the number of ERH/HDC systems from two (2) to one (1)
- Reduces the number of energetics neutralization reactors from four (4) to two (2)
- Adds burster and propellant storage areas
- Adds requirement for verifying propellant and bursters are stable and not agent contaminated
- Adds conveyors
- Adds truck bay for loading of energetics for off-site shipment
- Eliminates ICBs, WRS, and associated infrastructure
- Adds agent hydrolysate storage tank and tanker truck or tanker car loading facility

Issues associated with Option 3 are also of concern in this option. Shipping hydrolysate to an off-site facility adds an additional logistics concern. Primary concerns include:

- Safe handling, storage, and transport of energetic materials
- Need for verification that the energetics are stable and uncontaminated
- Must retain capability to treat contaminated and/or unstable energetics on site
- Logistics of shipping a large volume of hydrolysate (7.16 million gallons) and spent decontamination water (decon) off site (est. 0.5 million gallons)

To make-up the water lost with the hydrolysate, the BPT intends to return water to PCAPP in the tanker trucks and/or rail tanker cars used to ship hydrolysate to the TSDF. After discharging their load at the TSDF, the tanker trucks or tanker cars would be filled with tap water.

3.4.2 Impacts of Option 4

3.4.2.1 Technical Issues.

The technical issues associated with shipping energetics off site were discussed previously in Sections 3.2.2.1 and 3.3.2.1 and will not be repeated here. This section will focus on technical issues associated with shipping agent hydrolysate to a TSDF for treatment.

The characteristics of the mustard hydrolysate do not present significant technical issues for a TSDF. There is the concern over odor, but some facilities are equipped to deal effectively with this potential nuisance. The TSDF that will treat the mustard hydrolysate from the Aberdeen Chemical Agent Disposal Facility (ABCDF) in Maryland will pre-treat the agent hydrolysate with an oxidizer, such as hydrogen peroxide, to reduce or eliminate the hydrolysate odor before it is sent to the biological treatment process. The system also uses activated carbon in the activated sludge unit to adsorb recalcitrant and odor causing organic compounds. Because the hydrolysate will be transported to the TSDF in sealed tanker trucks or rail cars, fugitive odors will not be an issue during transport unless there is spill or accidental release.

As discussed in previous sections of the report, this option eliminates several major unit processes from the plant, including all of the ICBs and the WRS, one of two ERH/HDC systems, and two of four energetic neutralization reactors. In addition, this option effectively decouples agent destruction from downstream hydrolysate treatment. On the other hand, it makes the PCAPP facility dependent on a third party, i.e. the TSDF, to maintain operations. The risks of ICB and WRS equipment failures and shutdowns must be weighed against the risks of TSDF interruptions. The TSDF risk can be mitigated somewhat by contracting with multiple facilities. Equipment risks are often dealt with by providing excess capacity to accommodate more downtime. At this early stage in the project, it is impossible to determine with any degree of confidence which alternative poses the highest technical issue to the program.

It can be said, however, that the technical challenges and maintenance requirements associated with the ERH/HDC and the other equipment would be either be significantly reduced or eliminated by Option 4. The overall plant operation would less complex and there is the likelihood that overall plant availability would be improved with fewer systems to control and maintain.

The main technical disadvantage of this option is that it requires verifying that the energetics are stable and have not been contaminated with agent. It also adds the logistical challenge of managing waste shipments to several different TSDFs located in different states. This option results in 26 shipments of energetics at 10 tons per shipment. If shipped by 6,000 gallon tanker truck, the hydrolysate and spent decon will require about 1,288 shipments. (It should be noted that because of weight restrictions on interstate highways in some states the actual volume of liquid carried by the tanker might be less than the 6,000 gallon capacity.) The shipment of dewatered salts and biomass will be eliminated resulting in 772 fewer trips and the treatment chemical needs will be lower resulting in 300 fewer truck trips. Assuming the bulk of the shipments are made during the 12-month operation phase, the net result is an additional 5 truck

trips per week. While the number of shipments is manageable and would not pose an undue burden on either PCAPP or the TSDFs, it does require careful coordination between several different entities and facilities.

Coordination issues notwithstanding, this option is judged to present fewer overall technical challenges than the Base Case and is therefore viewed as having a positive (+) impact on technical issues.

3.4.2.2 Safety.

Option 4 has the same safety attributes as Option 3 with regard to shipping propellant and bursters off site, plus additional safety characteristics associated with shipping agent hydrolysate. Safety issues related to shipping energetics off site to a TSDF were addressed previously in Section 3.3.2.2. Compared to the Base Case, shipping propellant and bursters off site was deemed to be less safe than the Base Case due the inherent hazards associated with manually handling a large number of bursters, some of which could be contaminated with agent.

In terms of positive impacts, Option 4 eliminates hazards inherent in the water recovery system, specifically the brine concentrator and evaporator crystallizer (EC). These units operate at relatively high temperatures and may require frequent maintenance. Inherent hazards of these units include the potential for burns from contact with hot surfaces and steam lines, inhalation of hazardous dust, and exposure to fugitive emissions and hazardous dewatered salts and biomass.

Off-site treatment of hydrolysate eliminates the hazards associated with the biotreatment facility, which are similar to those found in most wastewater treatment plants. Hazards unique to PCAPP biotreatment operations involve possible worker exposure to hydrolysate from spills. This hazard is also present for the off-site option. The hydrolysate has relatively low toxicity and volatility. It is neither explosive nor flammable and some analyses have shown it to be non-hazardous. Nonetheless, it will be classified as a RCRA hazardous waste because of the possible presence of trace metals at levels above RCRA limits. The hydrolysate will be tested before it leaves the facility to ensure that no mustard agent can be detected. Because of the relatively benign nature of the hydrolysate, it does not pose a significant health threat to plant workers.

As in Options 2 and 3, the major concern for this option with regard to public safety has to do with the risk of accidents and the threat of a terrorist incident during transport of the energetics from PCAPP to the TSDF. Due to the absence of agent and the relatively low hazard level of the hydrolysate, this material is an unlikely target for acts of terrorism or sabotage. However, vehicular accidents during transport of the hydrolysate are of concern due to the relatively large volume of material that must be shipped to the TSDF. Transportation risks associated with energetics and hydrolysate shipments off site are addressed under the transportation factor (Section 3.4.2.4). For activities that are conducted on site at PCAPP, the option poses no additional safety risks to the general public. Any accident that would occur on site at PCAPP would be contained within the boundaries of the site.

Based on the analysis of inherent hazards, Option 4 is rated as having a negative (–) impact on safety when compared to the Base Case. The rating is based primarily on the inherent hazards associated with the manual handling of bursters. As discussed in Option 3, the rating does not

mean that manual handling of the bursters cannot be made safe; it can with the proper training and administrative and/or engineering controls. The rating reflects the fact that additional controls (e.g., burster sampling and/or monitoring) are required to ensure worker safety.

3.4.2.3 Environmental Permitting and Compliance.

The potential environmental impacts of shipping energetics off site to a TSDF were discussed previously in Sections 3.2.2.3 and 3.3.2.3. Both Options 2 and 3 require an Environmental Assessment because they represent a variance from the Base Case. Option 4 also requires an Environmental Assessment to determine the impacts of off site shipment of energetics and mustard hydrolysate because it is a departure from the alternatives evaluated in the FEIS.

As discussed previously, the FEIS for PCAPP addressed off-site disposal of propellant in conjunction with Baseline and modified Baseline incineration and concluded that these alternatives were environmentally acceptable. A precedent for shipping mustard hydrolysate off site to a commercial TSDF has already been established by the Aberdeen Chemical Agent Disposal Facility (ABCDF), which will ship over 4.5 million gallons of HD hydrolysate to the DuPont Chambers Works Plant in Deepwater, New Jersey, where it will be treated both chemically and biologically before being discharged to the Delaware River. The Maryland Department of Environment and the Environmental Protection Agency (EPA) approved the Army's plan in 2002.

The EA prepared by the Army to support off-site shipment of mustard hydrolysate from ABCDF [PMCD 2001] found that there were no significant environmental impacts as a result of this action. A similar finding is likely for this option because the mustard hydrolysate is readily biodegradable, has low volatility and toxicity, is neither reactive nor highly corrosive, and poses no real threat to either the environment or human health. Because it may contain some metals above regulatory limits, the mustard hydrolysate is likely to be classified as a hazardous waste and therefore will need to be shipped to a RCRA facility for treatment. The handling, shipping, treatment and disposal of the hydrolysate will be done in accordance with all applicable local, state, Army and federal regulations. The hydrolysate will be shipped in sealed containers to prevent fugitive emissions and odors during transport. Impacts from spills or other accidental releases are expected to be negligible due to the low hazard level of the hydrolysate.

It must be emphasized that Option 4 will be carried out in full compliance with all applicable local, state, Army, and federal regulations. The energetics will be packaged and shipped according to DOT, Army, and RCRA regulations to minimize the risks of a detonation during transport. The energetics will be incinerated at a RCRA permitted TSDF that has the capability and permits to process Class 1.1 explosives. The mustard hydrolysate will be handled as a RCRA hazardous waste. It will be transported (either by tanker truck, rail, or a combination of both) from PCAPP to a RCRA permitted TSDF in sealed, airtight containers to prevent fugitive emissions and odors. Carriers will be fully licensed and permitted to transport hazardous wastes. Even if a spill were to occur, the risk to the environment and general public would be negligible because the mustard hydrolysate is non-reactive and has low toxicity and volatility.

Option 4 will have some impacts on the types and quantities of effluent. The ICBs and WRS are both relatively minor sources of regulated air pollutants. Eliminating these processes will have

negligible effect on air quality at the site. Option 4 reduces the amount of dewatered salts and biomass that is produced by the WRS in the Base Case design. The reduction in those wastes is offset by an increase of more than 7 million gallons of liquid waste in the form of the mustard hydrolysate.

Based on conversations with the Colorado Department of Public Health and Environment, Option 4 could potentially reduce the complexity of the RCRA and Air permitting process by reducing the number processes requiring permitting and possibly eliminating the need for a Health Risk Assessment.

The increased environmental compliance requirements associated with sampling the propellant and bursters are offset by the reduction in environmental permitting effort and therefore this option receives a neutral (O) rating for this factor.

3.4.2.4 Transportation.

The transportation impacts of shipping energetics off site were discussed previously in Sections 3.3.2.4 and 3.2.2.4. It was concluded that off-site shipment of energetics did not result in a significant increase in either transportation risks or traffic volume. The conclusion was based on the results of the ANL Transportation Risk Assessment (TRA), which also assessed the risks of shipping hydrolysate. According to the TRA, shipping agent hydrolysate by truck to any of the TSDFs locations identified in the study results in fewer than 0.8 total injuries and less than 0.03 total fatalities over the life of the project. Shipping by rail results in even lower risks of injuries and fatalities. The ANL study concluded that transportation risks for all options, shipping methods and TSDF locations were “very small”.

There is the concern that off-site shipment could result in greater incidence of spills during transfer of the hydrolysate to and from truck and rail cars. Spill prevention and cleanup measures used in conjunction with proper containment equipment should minimize environmental impacts. Even if a spill were to occur, the risk to the environment and general public would be negligible because the mustard hydrolysate is non-reactive and has low toxicity and volatility.

This option results in 36 shipments of energetics at 10 tons per shipment. If shipped by 6,000 gallon tanker truck, the hydrolysate and spent decon will require about 1,288 shipments. The shipment of dewatered salts and biomass will be eliminated resulting in 772 fewer trips and the treatment chemical needs will be lower resulting in 300 fewer truck trips. Assuming the bulk of the shipments are made during the 12-month Operation phase, the net result is an additional 5 truck trips per week. This net increase is relatively low and inconsequential in terms of the impacts on traffic volume and roadway maintenance.

In view of the low transportation risk (exclusive of terrorism and sabotage) and low impact on traffic volume, Option 4 is rated as neutral (O) for this factor.

3.4.2.5 Utilities.

Water Consumption. Option 4 has the potential to eliminate nearly all of the 15,000 gallons per day of water consumed by the process during normal operations. In the Base Case, most of the water that is lost from the process and not recovered is contained in the ICB offgas stream and in

the dewatered salts and biomass. These streams are eliminated in Option 4. Instead that water will remain in the hydrolysate and be replaced when water is returned to PCAPP. Given this reduction in water consumption, Option 4 received a positive (+) rating for this factor.

Power Consumption. With the deletion of two ERH/HDCs, the ICBs and the WRS, Option 4 results in a reduction in power consumption of approximately 133,000 kWhr per day (or a total of 146 million kWhr over the project life cycle), which is about 39% of the total power consumption of the Base Case process. Given the significance of this reduction, Option 4 is rated as having a positive (+) impact on overall power consumption.

3.4.2.6 Treatment, Storage, and Disposal Facilities.

The availability of TSDFs to process energetics was discussed previously in Section 3.2.2.6. Four TSDFs were identified as technically viable candidates for receiving energetics from PCAPP. Therefore, Option 4 was rated as positive (+) for this factor for energetics.

The study identified the following five RCRA permitted TSDFs as technically viable for treating the agent hydrolysate:

- DuPont Chambers Works in Deepwater, New Jersey
- Perma-Fix Services in Dayton, Ohio
- Vopak Industrial Services in Deer Park, Texas
- Chemical Waste Management (CWM) in Model City, New York and Calumet, Illinois (2 sites)

All five facilities operate biological treatment plants. Only one of the facilities, namely the DuPont Chambers Works, has been confirmed to have sufficient excess capacity to treat all of the mustard hydrolysate from PCAPP. The other four facilities are significantly smaller than the Chambers Works and it is not clear at this time if they have enough excess capacity to process all of the hydrolysate. The DuPont Chambers Works and Perma Fix are contracted with the Army to treat agent hydrolysate. As previously discussed, the DuPont Chambers Works is contracted to treat all of the mustard hydrolysate from ABCDF and has, in fact, already successfully treated thousands of gallons of the material. Perma-Fix is currently conducting biotreatability and process engineering studies on nerve agent hydrolysate for the Newport Chemical Agent Disposal Facility (NECDF) located in Indiana.

Environmental and due diligence audits need to be conducted to assess each facility's compliance record, financial standing, and management and public Outreach capabilities. Presumably, audits of the Chambers Works and Perma-Fix have already been conducted either by the government or by the respective systems contractors at the ABCDF and NECDF sites. If Option 4 is pursued, the BPT should review this information prior to conducting its own audits of these facilities.

Since only one TSDF was identified as having sufficient excess capacity to treat all of the PCAPP hydrolysate, Option 4 is rated as negative (–) for this factor for hydrolysate.

3.4.2.7 Treaty.

As discussed previously, TSDFs receiving energetics from PCAPP are unlikely to be subject to inspection and monitoring under the CWC Treaty. However, because the mustard hydrolysate contains thiodiglycol, which is regulated as a Schedule 2 or agent precursor compound under the Treaty, the TSDF that receives the hydrolysate from PCAPP is likely to be subject to the declaration and verification provisions of the Treaty. While Treaty inspection and monitoring activities at PCAPP would be similar to the Base Case, there would be an additional effort and cost for ensuring that the TSDF complies with Treaty requirements. Therefore, the option is given a negative (–) rating because overall Treaty inspection and oversight requirements would increase.

3.4.2.8 Life Cycle Cost and Schedule.

The impact of Option 4 on the project life cycle cost (LCC) is shown in Table 3-16. Also provided in the table are the assumptions and cost bases used in deriving the estimated change in LCC. All figures are in 2003 dollars.

The results of the LCC analysis indicate that Option 4 results in a potential savings of over $115 million. The cost savings is due in large part to the reduction in non-manual labor hours (e.g., management, project controls, quality assurance, administration) during construction and systemization. Since the impact on the LCC is greater than $50 million, Option 4 is rated as positive (+) for this factor.

The BPT has estimated that Option 4 could save up to 10 months on construction. This estimate is based on BPT experience at other chemical demilitarization sites and their best professional judgment. As a cautionary note, the project Integrated Master Schedule (IMS) was not available for this study. It is due to be released within the next few months. Because the estimate is not based on an analysis of the IMS, it must be viewed as being very preliminary and subject to change once the IMS is published. Without an IMS it is impossible to determine what systems and activities are on the critical path. This information is prerequisite for determining schedule impacts with any known degree of certainty and accuracy.

3.4.2.9 Local Economics.

Local Employment. Option 4 will result in an average of 25 fewer FTEs. See Table 3-17. The highest reductions will be during construction, when there will be 46 fewer FTEs. The option also impacts systemization, pilot testing and operations, and closure with job losses of 23, 27, and 3.6 FTEs, respectively. On average, Option 4 results in a 3.6% reduction in employment over the life cycle of the project. This change, while significant, is still relatively low and therefore Option 4 is viewed as neutral (O) impact on this factor.

Table 3-16: Option 4 Impacts on Life Cycle Costs

Item and Assumption	Cost basis	Change in LCC
Technical issues resolution		
Develop and certify procedure to demonstrate that bursters and propellant are uncontaminated.	2000 hrs, $150/hr	$ 300,000
Develop and certify a procedure to demonstrate propellant and burster stability.	2300 hrs, $150/hr	$ 350,000
Two TRRPs are eliminated.	Lump sum	$ (400,000)
Eliminate modifications to ERH/HDCs to allow treatment of propellant.	Lump sum	$ (500,000)
Major equipment, building, transfer station changes		
Eliminate one of two ERH/HDCs and two of four ENRs. Includes reduction of approx 80,000 craft hours, or 462 craft months.	Lump sum	$ (25,000,000)
Add a 2000-ft^2 building for storage of packaged propellant. Includes reduction of approximately 1000 craft hours, or about 6 craft months.	$120/$ft^2$ plus design and project management	$ 300,000
Eliminate all ICBs and the WRS. Includes reduction of approximately 87,000 craft labor hours, or 501 craft man-months.	Lump sum	$ (99,000,000)
Add hydrolysate and process water transfer station including concrete pad, hydrolysate storage tank(s), returned process water tank(s), an all associating pumps and piping. Includes addition of approximately 5000 craft hours, or about 29 craft months.	Lump sum	$ 1,800,000
Off-site shipping and treatment		
Packaging containers for 62 tons of propellant and 262 tons of bursters (Cat 1.1 DOT shipping container).	250 lb propellant or burster/container, $500/ propellant container, $750/ burster container	$ 1,800,000
Treatment of 324 tons of propellant and bursters at TSDF.	$5/lb	$ 3,200,000
Shipping propellant and bursters to TSDF.	10 tons/load, 1500 miles/load, $3/mile	$ 150,000
Shipping 7.23 Mgal of hydrolysate and treatment at TSDF.	$6/gal	$ 43,000,000
Shipping 0.5 Mgal of spent decon and treatment at TSDF.	$6/gal	$ 3,000,000
TSDF oversight		
Two half-time staff at each of 2 TSDFs on temporary duty (TDY) for 24-month pilot testing and operations	173 hrs/month/FTE, $80/hr $2,000/month for TDY	$ 760,000
Addition of Treaty compliance services and equipment at the TSDF receiving hydrolysate.	Lump sum	$ 260,000
Changes in wastes, imported materials, and utilities		
Reduce quantity of dewatered salts and biomass shipped to TSDF by 7,720 tons.	$600/ton	$ (4,600,000)
Reduce quantity of 50% NaOH used in ERH/HDC/ENRs and ICBs by 2,824 tons and eliminate use of 162 tons of inorganic nutrients in ICBs and 85 tons of oxalic acid used in WRS.	$380/ton 50% NaOH, $1,300/ton inorganic nutrients, $800/ton oxalic acid	$ (1,400,000)
Reduction in power consumption with the deletion of one ERH/HDC, all ICBs, and the WRS by approximately 146,000,000 kWhr.	$0.0384/kWhr	$ (5,600,000)

Table 3-16: Option 4 Impacts on Life Cycle Costs (continued)

Item and Assumption	Cost basis	Change in LCC
Environmental permitting		
Added requirement for Supplemental EA.	Allowance	$ 250,000
Reduced effort in RCRA and Air permitting and elimination of HRA requirement.	Allowance	$ (1,000,000)
Labor changes		
Construction manpower changes: Reduce non-manual (NM) staffing by 60 FTEs for 10 months. This is in addition to craft savings of 167,000 hours included in major equipment changes costs.	173 hrs/month/FTE, $80/hr	$ (8,300,000)
Systemization manpower changes: Reduce staff by approximately 23 FTEs for 18-month phase.	173 hrs/month/FTE, $80/hr	$ (5,700,000)
PT&Ops manpower changes: Net 29 fewer FTEs for 24-month phase.	173 hrs/month/FTE, $80/hr	$ (9,600,000)
Closure manpower changes. Reduce staff by 20 FTEs for 4 months.	173 hrs/month/FTE, $80/hr	$ (1,100,000)
Government program management: Reduce staffing one-to-one with Systems Contractor (60 FTEs) as a result of 10-month reduction in construction schedule .	173 hrs/month/FTE, $80/hr	$ (8,300,000)
Total		**$ (115,000,000)**

Source: FOCIS Associates and BPT

Table 3-17: Option 4 Impacts on Number of PCAPP Employees

Project phase	Phase duration[1]	Net change in number of local employees, FTE[3]
Design	30	0
Construction	33	-46
Systemization[2]	18	-23
Pilot Testing and operations[2]	24	-27
Closure	23	-3.6
Net over project life	105	-25 [4]

(1) Milestones adapted from BPT Schedule dated 18 Feb 03.
(2) Phase duration adjusted according to BPT matrix dated 24-May-03.
(3) FTE = full-time equivalent jobs
(4) Design, construction, and systemization have some overlap, so the total project duration is less than the sum of the phase durations.

Source: FOCIS Associates and BPT

State and Local Commercial Revenues. Based on the assumptions provided in Table 3-18, the total commercial revenue for the state is estimated to decrease by $16 million over the life of the project. Local commercial revenue is estimated to decrease by approximately $8 million over the life of the project. These losses in commercial revenues are a result of the construction of less equipment and the use of smaller quantities of treatment chemicals. Although precise estimates of total state and local commercial revenues have not been compiled, it is assumed that they would be on the order of $100 million statewide. In that context, the impact is Option 4 is greater than 10% and therefore Option 4 is rated as having a negative (-) effect when compared to the Base Case.

Table 3-18: Option 4 Impacts on State and Local Commercial Revenues

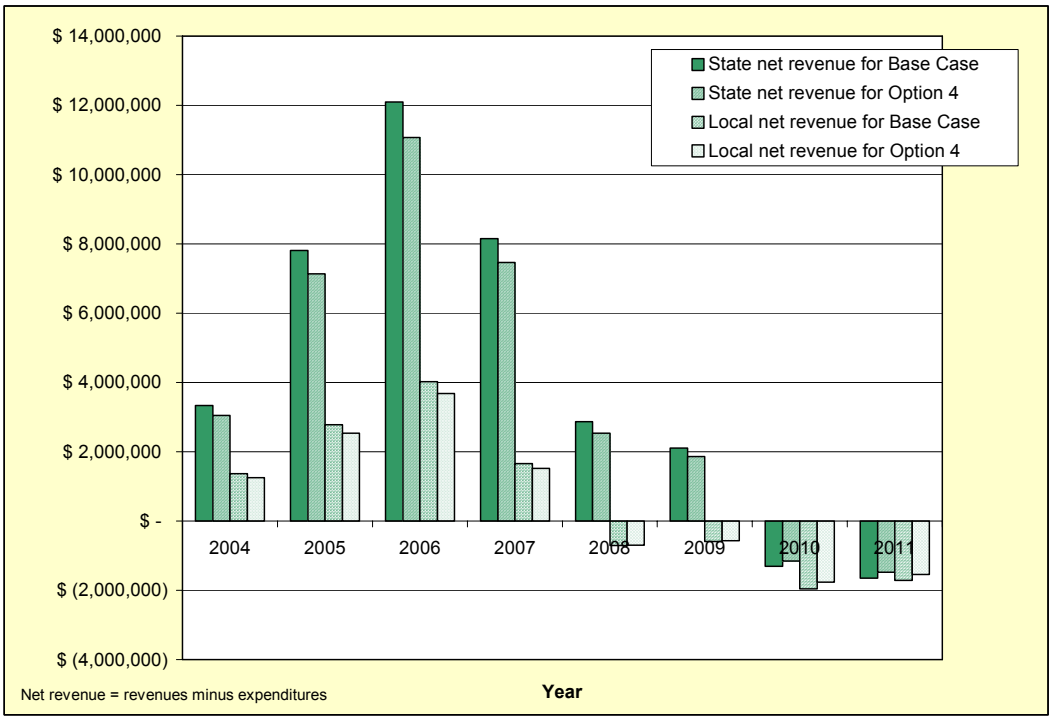
Source	Changes in local and state commercial revenues		
	Local	Elsewhere in Colorado	Total
Major equipment changes[1]	$ (7,800,000)	$ (7,800,000)	$ (15,600,000)
Additional space and/or transfer stations[1]	$ 130,000	$ 130,000	$ 260,000
Imported chemicals[2]	$ (350,000)	$ (350,000)	$ (700,000)
Total	**$ (8,020,000)**	**$ (8,020,000)**	**$ (16,040,000)**

(1) Assume that 25% of capital cost is for bulk materials, 25% of bulk materials can be obtained from local suppliers, and 25% of bulk materials can be obtained from suppliers elsewhere in the state. [Assumption provided by Bechtel Pueblo Team at 13 May 2003 meeting.]
(2) Assume that 25% of imported chemicals can be obtained from local suppliers and 25% of imported chemicals can be obtained from suppliers elsewhere in the state. [Assumption by FOCIS Associates.]
Source: FOCIS Associates and BPT

State and Local Government Net Revenues. Figure 3-11 shows the government (state and local) net revenues for the Base Case and Option 4 from the start of construction in July 2004 through the end of closure in October 2011. The net revenues are based on demilitarization project related economic activity within the core county (Pueblo) and surrounding counties that contribute either to local (Pueblo) net revenues or to state (Colorado) net revenues. Figure 3-12 shows the percent change in government net revenues over the same period as a result of the off-site option.

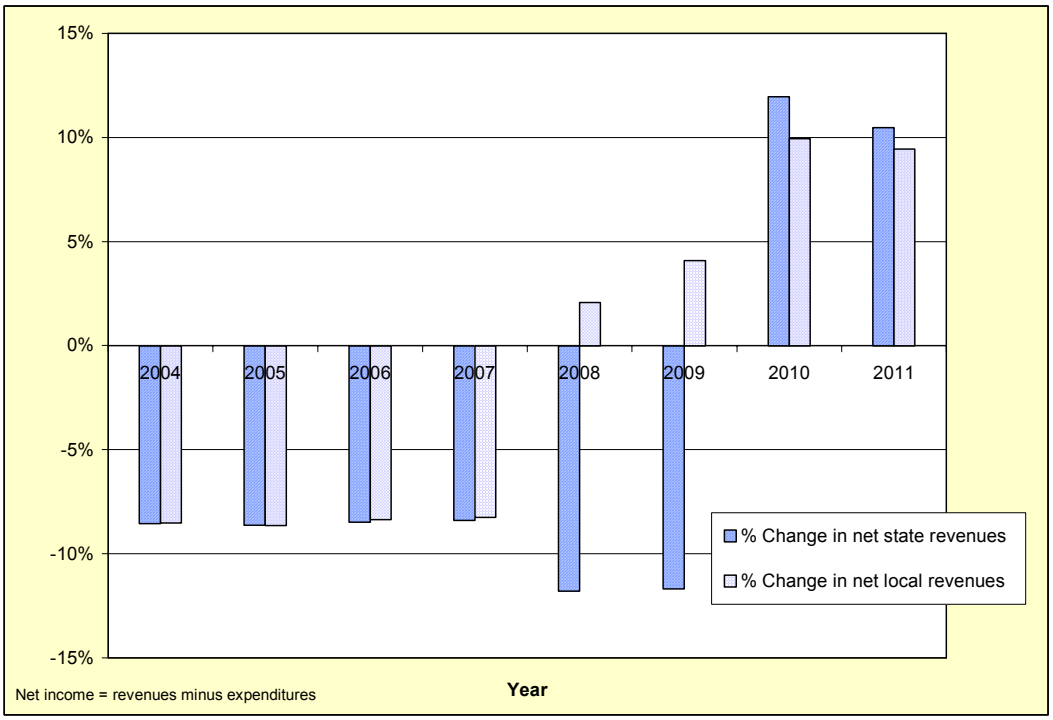
The trends in local and state government net revenues for this Option 4 are similar to those observed for the previous options, but the difference in net revenues between the Base Case and option are more pronounced due to the larger employment impacts brought about by Option 4. As shown in Figure 3-12, Option 4 has a greater impact on state revenues than local revenues, especially during operations (2008 –2009). Why there is such a significant difference in behavior between state and local net revenues in those two years is unclear. Answering that question requires a closer examination of the model structure and additional simulations that are beyond the scope of this study. Except for those two data points, the general trend of the data and magnitude of the results appear to be consistent with expectations and prior simulations.

Figure 3-11: Base Case and Option 4 Government Net Revenues during PCAPP Project



Source: FOCIS Associates and IDA

Figure 3-12: Option 4 Impacts on Government Net Revenues during PCAPP Project



Source: FOCIS Associates and IDA

Table 3-19 shows the cumulative local and net revenues for the Base Case and Option 4. As indicated in the table, the calculated percent change in total local net revenue over the project's life cycle is –8.9%. The percent change in cumulative net revenues for the state is –8.7%. The magnitude of the change appears to be consistent with the average number of jobs lost with this option. The decrease in cumulative net revenues (state and local) is <10% of the estimated Base Case net revenues, and thus the option is considered as having only a marginal or neutral (O) impact on state and local net revenues.

Table 3-19: Base Case and Option 4 Government Net Revenues during PCAPP Project

Government	Cumulative Net Revenues 2004-2011			
	Base Case	Option 4	Change	
State	$ 33,407,000	$ 30,484,000	$ (2,923,000)	-8.7%
Local	$ 4,861,000	$ 4,426,000	$ (435,000)	-8.9%
Total	$ 38,268,000	$ 34,910,000	$ (3,358,000)	-8.8%

Source: FOCIS Associates and IDA

3.4.2.10 Public Outreach.

Option 4 has the same outreach issues as Option 3 with respect to off-site shipment of propellant and bursters (see Section 3.3.2.10.) plus the additional issues associated with shipping agent hydrolysate. Public concerns of transporting energetics over public roads and through communities also apply to agent hydrolysate. The public outreach experience in Dayton, Ohio with shipment of VX hydrolysate underscores another problem with shipping agent hydrolysate to a community that has had little or no prior knowledge of chemical demilitarization issues. In the absence of a well-planned and well-coordinated outreach effort, misinterpretations of the facts are inevitable. Such misconceptions, which are often propagated by an equally ill-informed media, can eliminate any chance of securing public support for an off-site option.

Even the Army's prior success at obtaining the public approval to ship mustard hydrolysate from the ABCDF to the DuPont Chambers Works is no guarantee for success on PCAPP project. It is not uncommon for TSDFs to stop accepting certain types of wastes in response to public pressure. This happened with DuPont during the mid 1990s when the company stopped accepting agent hydrolysate from the Army Alternative Technologies Program because of concern over public perception. DuPont eventually reversed its decision in 2002 when it entered into a contract with the Army to accept mustard hydrolysate from the ABCDF.

The successful implementation of this option will require sustained and coordinated outreach efforts not just within the Pueblo community, but potentially in all affected communities, including those along the transportation routes and at the receiving site. Thus, the option is rated as having an overall negative (-) impact on public outreach because of the increased effort required to secure public approval.

3.4.3 Summary of Impacts

Table 3-20 summarizes the likely impacts of Option 4 on the various evaluation factors.

- Compared to the Base Case, Option 4 is rated as having a positive impact on technical issues, water consumption, power consumption, TSDFs for energetics, and life cycle cost and schedule. Option 4 reduces technical issue by eliminating several major systems, thus simplifying plant operation.
- Option 4 is rated negative for safety, Treaty, TSDFs for hydrolysate, state and local commercial revenues, and public outreach. The negative rating for safety is attributable to the manual handling of bursters and the need to verify that both the propellant and bursters are not agent contaminated. Treaty was given a negative mark because of the additional efforts required to monitor and verify CWC Treaty compliance at the TSDF. The TSDF received a negative rating for hydrolysate due to the inability to identify more than one TSDF with a biological treatment system having enough excess capacity to handle all of the agent hydrolysate from PCAPP. Public outreach efforts will increase to secure and maintain public support for burster and hydrolysate shipment within affected communities.
- Option 4 is rated neutral for the remaining factors. These include environmental permitting and compliance, transportation, employment, and state and local commercial and government net revenue.

Table 3-20: Summary of Evaluation Factor Ratings for Option 4

Factor	Comparative Rating	Rationale for Rating
Technical Issues	+	Reduces or eliminates the major technical challenge associated with processing all PCD propellant in the ERH and eliminates several major systems including one of the ERH/HDC systems, two of four energetic neutralization reactors, the ICBs and the WRS. Creates additional requirements: developing and implementing methods to verify that the propellant and bursters are not agent contaminated, developing and implementing methods to verify burster stability, and implementing method to verify propellant stability. Added requirements are more than offset by elimination of major systems and the resulting simplification of plant operation. Elimination of major systems potentially enhances plant reliability, availability and maintainability.
Safety	–	Requires manual handling of bursters, some of which may be contaminated with agent. Inherent hazards for workers increases.
Environmental Permitting and Compliance	O	Propellant, bursters and agent hydrolysate will be handled as RCRA hazardous wastes. Requires a supplemental Environmental Assessment (EA), but should not impact schedule. Requires substantial additional sampling efforts to verify propellant and bursters are uncontaminated. Additional sampling is also required to verify that bursters are stable. Reduces solid waste generation by 8000 tons, but increases liquid effluent by over 7.2 million gallons (about 33,000 tons). The elimination of the ICBs and WRS reduces the Environmental permitting effort, thus offsetting the increased compliance efforts associated with burster sampling.
Transportation	O	Requires about 1,334 shipments of propellant, bursters, and hydrolysate during pilot testing and operations. This is partially offset by a reduction in the number of truck trips for process chemicals and dewatered salts and biomass. Assuming the bulk of the shipments are made during the 12-month operations phase, Option 4 results in a net increase about 5 truck trips per week as compared to the Base Case, which has an average of 65 truck trips per week for shipping all process solid wastes and treatment chemicals. Risks of total injuries and fatalities from shipping all energetics (propellant and bursters) are estimated to be 0.03 and 0.002, respectively, over the life of the project. Propellant and bursters will be packaged and shipped to TSDF is accordance with RCRA, DOT, and DOD regulations. Risks of total injuries and fatalities from shipping all agent hydrolysate by truck results in fewer than 0.8 total injuries and less than 0.03 total fatalities over the life of the project.
Water Consumption	+	Option 4 reduces water consumption by the process by nearly 15,000 gallons per day during normal operations.
Power Consumption	+	The power consumption of the process will be reduced by approximately 133,000 kWhr per day (or a total of 146 million kWhr over the project life cycle), which is about 39% of the total power consumption of the Base Case process.
TSDFs	+ (Energetics) – **(Hydrolysate)**	Four RCRA permitted TSDFs (incinerators) with the required capability and permits to process propellant and bursters were identified. Five commercial RCRA TSDFs with biological treatment capability were identified as potential candidates for agent hydrolysate, but only one was confirmed to have sufficient excess capacity to handle all of the agent hydrolysate.
Treaty	–	TSDF receiving agent hydrolysate would be subject to CWC Treaty inspection and monitoring. Therefore, Treaty inspection and oversight requirements increase.
Life Cycle Cost	+	Total life cycle cost is reduced by about $115 million.
Life Cycle Schedule	+	Construction and total life cycle schedules are reduced by approximately 10 months.

Table 3-20: Summary of Evaluation Factor Ratings for Option 4 (continued)

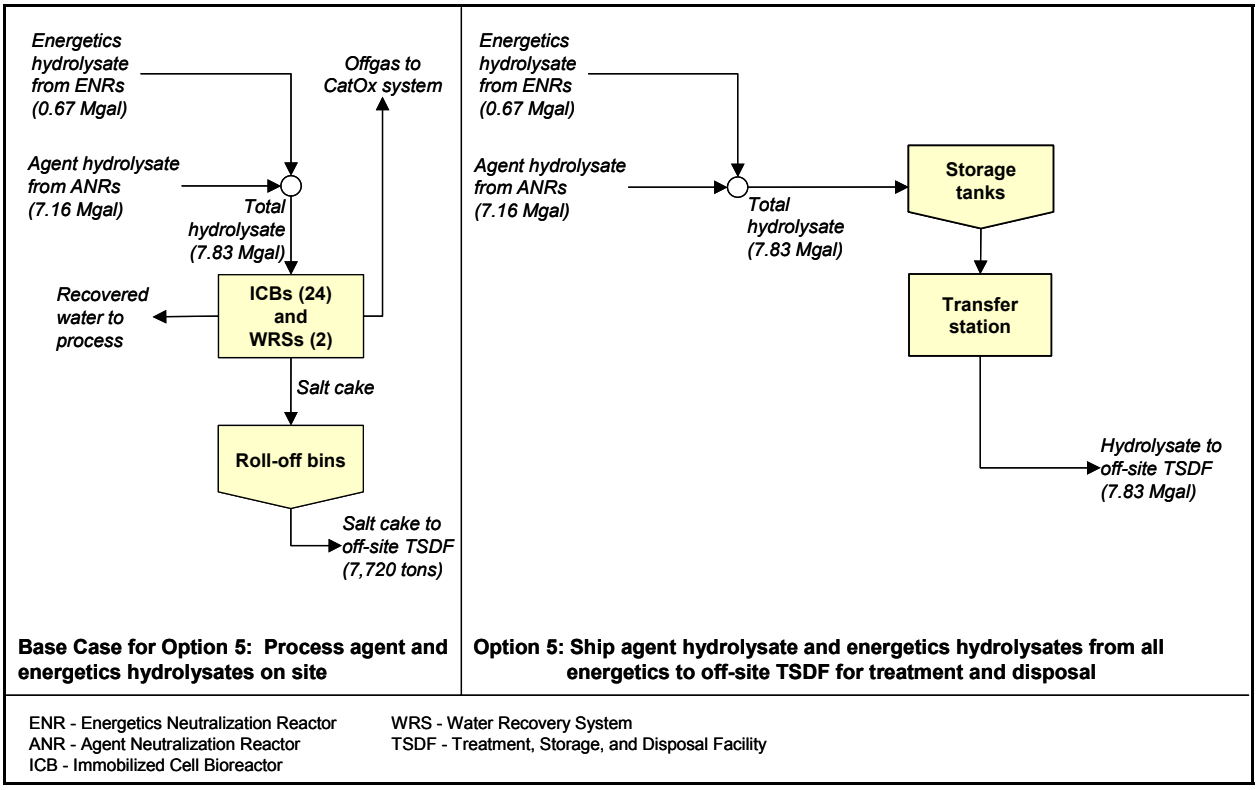
Factor	Comparative Rating	Rationale for Rating
Employment	O	Results in the following job losses: 46 FTEs during construction, 23 FTEs during systemization, 27 FTEs during pilot testing and operations, and 4 FTEs during closure for a net loss 25 FTEs (or 3% of the total average FTEs of the Base Case) over the life of the PCAPP project.
State and Local Commercial Revenues	–	Total commercial revenue for the state decreases by about $16 million over the life of the PCAPP project, which is 16% of the estimated total state commercial revenue for the Base Case. About half of that reduction is estimated to occur locally (in Pueblo County).
State and Local Government Net Revenue	O	State government net revenue (revenues minus expenditures) decreases by about $2.9 million over the life of the PCAPP project, which is about 8.7% of the estimated state government net revenue for the Base Case. Local government net revenue decreases by $ 435,000 or 8.9% over the life of the project.
Public Outreach	–	Although the Army has established a precedent for shipping large quantities of agent hydrolysate to a TSDF for treatment, each site is different and requires a sustained and well-coordinated outreach effort to garner public support within the affected communities.

Source: FOCIS Associates

3.5 Option 5: Ship Agent and Energetic Hydrolysates Off Site

Block flow diagrams for the Base Case and proposed option are shown in Figure 3-13. The diagram on the left side of the page shows the major unit processes and process rates used in the Base Case design for on site treatment of agent and energetic hydrolysates. The diagram on the right side of the page depicts the process configuration and processing rates for the proposed off site option.

Figure 3-13: Base Case and Option 5 Flow Diagrams



Source: FOCIS Associates

3.5.1 Agent and Energetic Hydrolysates – Base Case and Option 5

3.5.1.1 Base Case for on-site processing of agent and energetic hydrolysates.

The individual systems used in the Base Case design for processing propellants and bursters on-site were described previously in Options 2 and 3. A description of the base-case design for on-site treatment of agent and energetic hydrolysates was provided previously in the discussion of Option 4.

3.5.1.2 Option 5 – Ship agent and energetic hydrolysates off site for treatment and disposal.

This option involves shipping agent and energetic hydrolysates from PCAPP to a commercial biotreatment facility. Like Option 4, this option eliminates the ICBs and the WRS. But unlike Option 4, it retains the ERHs and all of the energetic neutralization reactors to destroy the energetics and produce the energetic hydrolysate. Option 5 also requires the HDCs for 5X treatment of solids from the ERHs, additional hydrolysate storage tank capacity, and a station for

loading tanker trucks and/or tanker cars. All other processes and facilities remain unchanged from the Base Case design.

The major facility and process impacts associated with Option 5 are summarized as follows:

- Eliminates ICBs, WRS, and associated infrastructure
- Adds agent and energetic hydrolysate storage tank capacity and tanker truck or tank car loading station

The primary issues associated with this option are the logistics of shipping large quantities of hydrolysate off site. Based on current hydrolysis procedures, approximately 7.16 million gallons of agent hydrolysate and 0.67 million gallons of energetic hydrolysate would have to be shipped.

3.5.2 Impacts of Option 5

3.5.2.1 Technical Issues.

By eliminating the ICBs and WRS this option effectively decouples agent destruction from downstream processes. This allows agent destruction to proceed independently of downstream processes provided a TSDF is always available to accept the hydrolysate. Eliminating major systems, such as the ICBs and WRS should improve plant availability and reliability while reducing maintenance demands. Because of the dependence on the TSDFs to treat the hydrolysates, Option 5, like Option 4, results in the government and the systems contractor relinquishing some control of the project.

Shipping energetic hydrolysate off site to a TSDF does not raise any additional technical concerns not already addressed under Option 4 for agent hydrolysate. The quantity of energetic hydrolysate is comparatively small, only 0.67 million gallons compared to 7.16 million gallons of mustard hydrolysate. As in the Base Case process, the energetic hydrolysate would be mixed with the agent hydrolysate before shipping to the TSDF. The physical/chemical properties, toxicity, and biodegradability characteristics of the resulting agent/energetic hydrolysate mixture are basically the same as those of agent hydrolysate.

In general, the technical issues associated with shipping agent and energetic hydrolysates off site to a TSDF are minor compared to the challenges of operating and maintaining 24 ICB systems and two large evaporator-crystallizers with ancillary equipment for recovering some 30,000 gallons per day of water from bioreactor effluent. The operational advantages of eliminating these major systems outweigh concerns over giving up control of part of the process to the TSDFs. Therefore, Option 5 is viewed as having a positive (+) impact on technical issue.

3.5.2.2 Safety.

The safety issues related to shipping mustard hydrolysate off site to a TSDF were addressed in Section 3.4.2.2. Safety issues for the combined mustard and energetic hydrolysates are the same as those discussed previously for mustard hydrolysate. The most significant concern with this option has to do with the potential for worker exposure to the hydrolysate due to spills or accidental releases. The risk of worker injury is however considered to be very low due to the low toxicity, low volatility and low hazard level of the material. The hydrolysate is neither explosive nor flammable, and not particularly corrosive. It will be tested before it leaves the

facility to ensure that no mustard agent can be detected. Odors are a potential nuisance that can be controlled through the use of proper equipment and sealed storage containers.

This option eliminates the hazards associated with the biotreatment facility, which are similar to those found in most wastewater treatment plants. Option 5 also eliminates the hazards inherent in the WRS, which include the potential for worker exposure to hot surfaces, hazardous dust, and fugitive emissions from the evaporator/crystallizer operations. While these hazards are effectively mitigated through standard engineering and administrative controls, they represent an added level of complexity not found in the option.

The advantages of eliminating the ICBs and WRS are offset by the hazards associated with shipping hydrolysate off site. On balance, Option 5 has a negligible impact on worker and public safety when compared to the Base Case and is therefore rated as neutral (O) for this factor.

3.5.2.3 Environmental Permitting and Compliance.

Option 5 has the same environmental impacts as Option 4 less the effects of shipping energetics (see Section 3.4.2.3). As with the other options, an EA is required to supplement the FEIS, which did not address shipping agent and energetic hydrolysates off site to a TSDF. As previously noted, the EA that was prepared by the Army to support off-site shipment of mustard hydrolysate from ABCDF [PMCD 2001] found that there were no significant environmental impacts as a result of this action. A similar finding is likely for this option because the combined energetics/mustard hydrolysate is readily biodegradable, has low volatility and toxicity, is neither reactive nor highly corrosive, and poses no real threat to either the environment or human health. Because it may contain some metals above regulatory limits, the agent/energetic hydrolysate is likely to be classified as a hazardous waste and therefore will need to be shipped to a RCRA facility for treatment. The handling, shipping, treatment and disposal of the hydrolysate will be done in accordance with all applicable local, state, Army and federal regulations. The hydrolysate will be shipped in sealed containers to prevent fugitive emissions and odors during transport. Impacts from spills or other accidental releases are expected to be negligible due to the low hazard level of the hydrolysate.

It must be emphasized that Option 5 will be carried out in full compliance with all applicable local, state, Army, and federal regulations. The energetics/mustard hydrolysate will be handled as a RCRA hazardous waste. It will be transported (either by tanker truck, rail, or a combination of both) from PCAPP to a RCRA permitted TSDF in sealed, airtight containers to prevent fugitive emissions and odors. Carriers will be fully licensed and permitted to transport hazardous wastes. Even if a spill were to occur, the risk to the environment and general public would be negligible because the mustard hydrolysate is non-reactive and has low toxicity and volatility.

Option 5 will have some impacts on the types and quantities of effluent. The ICBs and WRS are both relatively minor sources of regulated air pollutants. Eliminating these processes will have negligible effect on air quality at the site. Option 5 reduces the amount of dewatered salts and biomass that is produced by the WRS in the Base Case design. The reduction in those wastes is offset by an increase of more than 7.8 million gallons of liquid waste in the form of the mustard hydrolysate.

Based on conversations with the Colorado Department of Public Health and Environment, Option 5 could potentially reduce the complexity of the RCRA and Air permitting process by reducing the number processes requiring permitting and possibly eliminating the need for a Health Risk Assessment.

Environmental permitting and compliance efforts could potentially be reduced with Option 5 and therefore it receives a positive (+) rating for this factor.

3.5.2.4 Transportation.

The ANL TRA addressed shipping agent hydrolysate from PCAPP to various TSDFs. Although not explicitly addressed in the study, the risks of shipping combined agent and energetics hydrolysate should be very nearly identical to the agent hydrolysate case because the quantities and characteristics of the hydrolysates are very similar. According to the TRA, shipping hydrolysate by truck to any of the TSDFs locations identified in the study results in fewer than 0.8 total injuries and less than 0.03 total fatalities over the life of the project. Shipping by rail results in even lower risks of injuries and fatalities. The ANL study concluded that transportation risks for all options, shipping methods and TSDF locations were "very small".

There is the concern that off-site shipment could result in greater incidence of spills during transfer of the hydrolysate to and from truck and rail cars. Spill prevention and cleanup measures used in conjunction with proper containment equipment should minimize environmental impacts. Even if a spill were to occur, the risk to the environment and general public would be negligible because the mustard hydrolysate is non-reactive and has low toxicity and volatility.

If shipped by 6,000 gallon tanker truck, the hydrolysate and spent decon will require about 1,389 shipments. The shipment of dewatered salts and biomass will be eliminated resulting in 772 fewer trips and the treatment chemical needs will be lower resulting in 284 fewer truck trips. Assuming the bulk of the shipments are made during the 12-month Operation phase, the net result is an additional 6 truck trips per week. This net increase is relatively low and inconsequential in terms of the impacts on traffic volume and roadway maintenance.

In view of the low transportation risk (exclusive of terrorism and sabotage) and low impact on traffic volume, Option 5 is rated as neutral (O) for this factor.

3.5.2.5 Utilities.

Water Consumption. Option 5 has the potential to reduce water consumption by about 15,000 gallons per day during normal operations. In the Base Case, water leaves the plant in the ICB offgas stream and in the dewatered salts and biomass. These streams are eliminated in Option 5. Instead that water will remain in the hydrolysate and be replaced when water is returned to PCAPP. Given this reduction in water consumption, Option 5 received a positive (+) rating for this factor.

Power consumption. With the deletion of the ICBs and the WRS, Option 5 results in a reduction in power consumption of approximately 125,000 kWhr per day (or a total of 137 million kWhr over the project life cycle), which is about 37% of the total power consumption of the Base Case

process. Given the significance of this reduction, Option 5 is rated as having a positive (+) impact on overall power consumption.

3.5.2.6 Treatment, Storage, and Disposal Facilities.

Based on a preliminary survey, five (5) RCRA permitted TSDFs with biological treatment processes were identified as potential candidates for receiving hydrolysate from PCAPP. These were discussed previously in Section 3.4.2.6. Of the five, one is known to have sufficient excess capacity to treat all of the hydrolysate from PCAPP. This is the same facility that is contracted to treat the mustard hydrolysate from ABCDF. The other four facilities may have sufficient capacity, but this needs to be confirmed in follow-on investigations. All candidate facilities would be subject to detailed due diligence and environmental audits before and during operations.

Option 5 is rated as negative (–) because only one commercial RCRA permitted biotreatment facility was confirmed to have sufficient excess capacity to handle all of the hydrolysate.

3.5.2.7 Treaty.

Option 5 extends Treaty verification and monitoring requirements to the TSDFs. The mustard hydrolysate contains thiodiglycol, which is regulated as a Schedule 2 or agent precursor compound under the Treaty. Because of the quantity of material, the TSDF would be designated as a Schedule 2 compound processing facility and is therefore subject to the declaration and verification provisions of the Treaty. While Treaty inspection and monitoring activities at PCAPP would be similar to the Base Case, there would be an additional effort and cost for ensuring that the TSDF complies with Treaty requirements. Therefore, the option is given a negative (–) rating because overall Treaty inspection and oversight requirements would increase.

3.5.2.8 Life Cycle Cost and Schedule.

The impact of Option 5 on the project life cycle cost (LCC) is shown in Table 3-21. Also provided in the table are the assumptions and cost bases used in deriving the estimated change in LCC. All figures are in 2003 dollars.

The results of the LCC analysis indicate that Option 5 results in a potential savings of over $80 million. The cost savings is due in large part to the reduction in non-manual labor hours (e.g., management, project controls, quality assurance, administration) during construction and systemization. Since the impact on the LCC is greater than $50 million, Option 5 is rated as positive (+) for this factor.

The BPT has estimated that Option 5 could save up to 6 months on construction, which results in a positive (+) rating for this factor. This estimate is based on BPT experience at other chemical demilitarization sites and their best professional judgment. As a cautionary note, the project Integrated Master Schedule (IMS) was not available for this study. It is due to be released within the next few months. Because the estimate is not based on an analysis of the IMS, it must be viewed as being very preliminary and subject to change once the IMS is published. Without an IMS it is impossible to determine what systems and activities are on the critical path. This information is prerequisite for determining schedule impacts with any known degree of certainty and accuracy.

Table 3-21: Option 5 Impacts on Life Cycle Costs

Item and Assumption	Cost basis	Change in LCC
Technical issues resolution		
No impacts.	Not applicable	$ -
Major equipment, building, transfer station changes		
Eliminate all ICBs and the WRS. Includes reduction of approximately 87,000 craft labor hours, or 501 craft man-months.	Lump sum	$ (99,000,000)
Add hydrolysate and process water transfer station including concrete pad, hydrolysate storage tank(s), returned process water tank(s), an all associating pumps and piping. Includes addition of approximately 5000 craft hours, or about 29 craft months.	Lump sum	$ 1,800,000
Off-site shipping and treatment		
Shipping 7.83 Mgal of hydrolysate and treatment at TSDF.	$6/gal	$ 47,000,000
Shipping 0.5 Mgal of spent decon and treatment at TSDF.	$6/gal	$ 3,000,000
TSDF oversight		
Two half-time staff at TSDF on temporary duty (TDY) for 24-month pilot testing and operations.	173 hrs/month/FTE, $80/hr $2,000/month for TDY	$ 380,000
Addition of Treaty compliance services and equipment at TSDF receiving hydrolysate.	Lump sum	$ 260,000
Changes in wastes, imported materials, and utilities		
Reduce quantity of dewatered salts and biomass shipped to TSDF by 7,720 tons.	$600/ton	$ (4,600,000)
Eliminate use of 3,045 tons of 50% NaOH and 162 tons of inorganic nutrients used in ICBs.	$380/ton 50% NaOH, $1,300/ton inorganic nutrients, $800/ton oxalic acid	$ (1,400,000)
Reduction in power consumption with the deletion of all ICBs and the WRS by approximately 137,000,000 kWhr.	$0.0384/kWhr	$ (5,300,000)
Environmental permitting		
Added requirement for Supplemental EA.	Allowance	$ 250,000
Reduced effort in RCRA and Air permitting and elimination of HRA requirement.	Allowance	$ (1,000,000)
Labor changes		
Construction manpower changes: Reduce non-manual (NM) staffing by 60 FTEs for 6 months. This is in addition to craft savings of 167,000 hours included in major equipment changes costs.	173 hrs/month/FTE, $80/hr	$ (5,000,000)
Systemization manpower changes: Reduce staff by approximately 8 FTEs for 18-month phase.	173 hrs/month/FTE, $80/hr	$ (2,000,000)
PT&Ops manpower changes: Net 26 fewer FTEs for 24-month phase.	173 hrs/month/FTE, $80/hr	$ (8,600,000)
Closure manpower changes. Reduce staff by 20 FTEs for 4 months.	173 hrs/month/FTE, $80/hr	$ (1,100,000)
Government program management: Reduce staffing one-to-one with Systems Contractor (60 FTEs) as a result of 6-month reduction in construction schedule .	173 hrs/month/FTE, $80/hr	$ (5,000,000)
Total		**$ (80,000,000)**

Source: FOCIS Associates and BPT

3.5.2.9 Local Economics.

Local Employment. Option 5 will result in an average of 16 fewer FTEs. See Table 3-22. The highest reductions will be during construction and pilot testing and operations, when there will be about 25 fewer FTEs. The option also impacts systemization and closure with job losses of about 16 and 4 FTEs, respectively. On average, Option 5 results in a 2.4% reduction in employment over the life cycle of the project. This change, while significant, is still relatively low and therefore Option 5 is viewed as neutral (O) impact on this factor.

Table 3-22: Option 5 Impacts on Number of PCAPP Employees

Project phase	Phase duration[1]	Net change in number of local employees, FTE[3]
Design	30	0
Construction	33	-25
Systemization[2]	18	-16
Pilot Testing and operations[2]	24	-25
Closure	23	-3.6
Net over project life	105	-17 [4]

(1) Milestones adapted from BPT Schedule dated 18 Feb 03.
(2) Phase duration adjusted according to BPT matrix dated 24-May-03.
(3) FTE = full-time equivalent jobs
(4) Design, construction, and systemization have some overlap, so the total project duration is less than the sum of the phase durations.
Source: FOCIS Associates and BPT

State and Local Commercial Revenues. Based on the assumptions provided in Table 3-23, the total commercial revenue for the state is estimated to decrease by about $13 million over the life of the project. Local commercial revenue is estimated to decrease by approximately $6.4 million over the life of the project. These losses in commercial revenues are a result of the construction of less equipment and the use of smaller quantities of treatment chemicals. Although precise estimates of total state and local commercial revenues have not been compiled, it is assumed that they would be on the order of $100 million statewide. In that context, the impact is greater than 10% and therefore Option 5 is rated as having a negative (-) effect when compared to the Base Case.

State and Local Government New Revenues. Figure 3-14 shows the government (state and local) net revenues for the Base Case and Option 5 from the start of construction in July 2004 through the end of closure in October 2011. The net revenues are based on project related economic activity within the core county (Pueblo) and surrounding counties that contribute either to local (Pueblo) net revenues or to state (Colorado) net revenues. Figure 3-15 shows the percent change in government net revenues over the same period as a result of the off-site option.

Table 3-23: Option 5 Impacts on State and Local Commercial Revenues

Source	Changes in local and state commercial revenues		
	Local	Elsewhere in Colorado	Total
Major equipment changes[1]	$ (6,200,000)	$ (6,200,000)	$ (12,400,000)
Additional space and/or transfer stations[1]	$ 110,000	$ 110,000	$ 220,000
Imported chemicals[2]	$ (350,000)	$ (350,000)	$ (700,000)
Total	**$ (6,440,000)**	**$ (6,440,000)**	**$ (12,900,000)**

(1) Assume that 25% of capital cost is for bulk materials, 25% of bulk materials can be obtained from local suppliers, and 25% of bulk materials can be obtained from suppliers elsewhere in the state. [Assumption provided by Bechtel Pueblo Team at 13 May 2003 meeting.]
(2) Assume that 25% of imported chemicals can be obtained from local suppliers and 25% of imported chemicals can be obtained from suppliers elsewhere in the state. [Assumption by FOCIS Associates.]
Source: FOCIS Associates and BPT

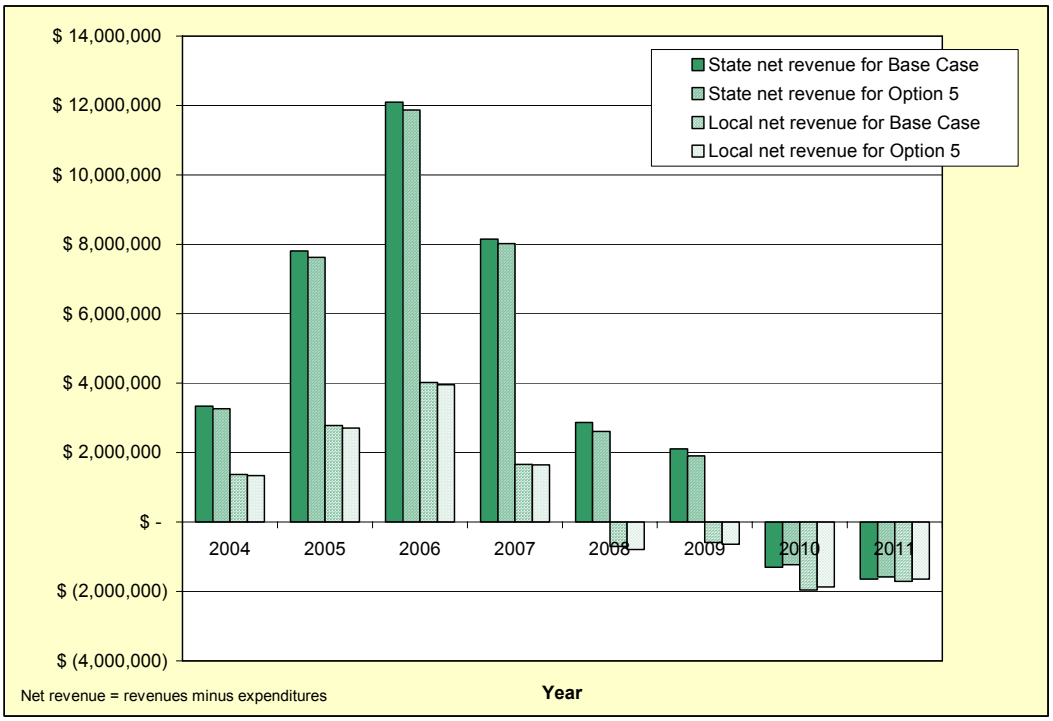
As illustrated in Figure 3-14 the differences in net revenues (both local and state) between the Base Case and option are small over the entire range of years. As shown in Figure 3-15 the biggest percent changes (about -8% to -12%) in both state and local net revenues occurs in 2008 and 2009, during pilot testing and operations. This is expected since this phase of the project experiences the highest percent decrease employment as a result of Option 5; -25 FTEs or -4.6% of the operations labor force. The slightly negative percent change in net revenues from 2004 to 2007 reflects the reduced labor during construction and systemization.

Table 3-24 shows the cumulative local and net revenues for the Base Case and Option 5. As indicated in the table, the calculated percent change in total local net revenue over the project's life cycle is –2.8%. The percent change in cumulative net revenues for the state is –2.8%. The magnitude of the change is generally consistent with the number of jobs lost with this option. The overall impact of Option 5 on local and state net revenues is considered to be negligible and thus the option receives a neutral (O) rating for this factor.

3.5.2.10 Public Outreach.

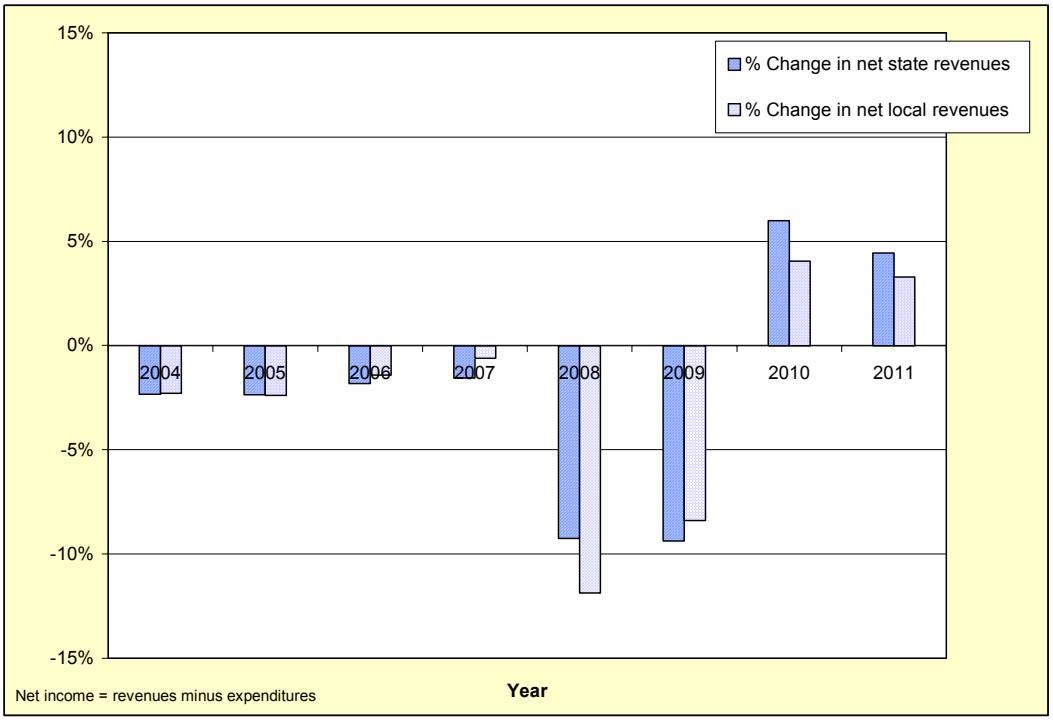
Public outreach issues for Option 5 are the same as those discussed previously in Option 4 (see Section 3.4.2.10). To foster local participation and increase the chances of broad public acceptance of the proposed off-site option, significant and sustained outreach efforts will likely be required in several locales, including Pueblo, communities along the shipping route, and the communities where the TSDFs are located. Option 5 is rated as having an overall negative (-) impact on public outreach because of the increased effort required to secure public acceptance.

Figure 3-14: Base Case and Option 5 Government Net Revenues during PCAPP Project



Source: FOCIS Associates and IDA

Figure 3-15: Option 5 Impacts on Government Net Revenues during PCAPP Project



Source: FOCIS Associates and IDA

Table 3-24: Base Case and Option 5 Government Net Revenues during PCAPP Project

Government	Cumulative Net Revenues 2004-2011			
	Base Case	Option 5	Change	
State	$ 33,407,000	$ 32,486,000	$ (921,000)	-2.8%
Local	$ 4,861,000	$ 4,698,000	$ (163,000)	-3.4%
Total	$ 38,268,000	$ 37,184,000	$ (1,084,000)	-2.8%

Source: FOCIS Associates and IDA

3.5.3 Summary of Impacts

Table 3-25 summarizes the likely impacts of Option 5 on the various evaluation factors.

- Compared to the Base Case, Option 5 is rated as having a positive impact on technical issues, environmental permitting and compliance, water consumption, power consumption, and life cycle cost and schedule. Option 5 reduces technical issues by eliminating several major systems, thus simplifying the overall plant operation.
- Option 5 is rated negative for Treaty, TSDF, state and local commercial revenues, and public outreach. Treaty was given a negative mark because of the additional efforts required to monitor and verify CWC Treaty compliance at the TSDF. The negative rating for the TSDF factor was due to the inability to identify more than one TSDF with a biological treatment system having enough excess capacity to handle all of the agent hydrolysate from PCAPP. Public outreach efforts will increase to secure and maintain public support for hydrolysate shipment within affected communities.
- Option 5 is rated neutral for the remaining factors. These include safety, transportation, employment, and state and local government net revenues.

Table 3-25: Summary of Evaluation Factor Ratings for Option 5

Factor	Comparative Rating	Rationale for Rating
Technical Issues	+	Eliminates the ICBs and the WRS. Simplifies plant operation and potentially enhances plant reliability, availability and maintainability.
Safety	O	Hazards of ICBs, WRS and shipping hydrolysate are moderate to low and offset each other. Hydrolysate is un-reactive and has relatively low volatility, low toxicity, and low hazard level. Impact on safety is negligible.
Environmental Permitting and Compliance	+	Energetic and agent hydrolysates will be handled as RCRA hazardous wastes. Requires a supplemental Environmental Assessment (EA), but should not impact schedule. Reduces solid waste generation by about 8000 tons, but increase liquid effluent by over 8.3 million gallons (about 36,000 tons). Negligible impact on emissions of regulated air pollutants. Negligible impact on overall compliance efforts. Reduces environmental permitting effort.
Transportation	O	Requires about 1,389 shipments of hydrolysate during pilot testing and operations. This is partially offset by a reduction in the number of truck trips for process chemicals and dewatered salts and biomass. Assuming the bulk of the shipments are made during the 12-month operations phase, Option 5 results in a net increase about 6 truck trips per week as compared to the Base Case, which has an average of 65 truck trips per week for shipping all process solid wastes and treatment chemicals. Risks of total injuries and fatalities from shipping all agent hydrolysate by truck results in fewer than 0.8 total injuries and less than 0.03 total fatalities over the life of the project. Risks are essentially the same for combined agent and energetics hydrolysate.
Water Consumption	+	Option 5 will to reduce water consumption on the order of 15,000 gallons per day during normal operations.
Power Consumption	+	Power consumption decreases by approximately 125,000 kWhr per day (or a total of 137 million kWhr over the project life cycle), which is about 37% of the total power consumption of the Base Case process.
TSDFs	–	Five commercial RCRA TSDFs with biological treatment capability were identified, but only one was confirmed to have sufficient excess capacity to handle all of the PCAPP hydrolysate.
Treaty	–	TSDF receiving hydrolysate would be subject to CWC Treaty inspection and monitoring. Therefore, Treaty inspection and oversight requirements increase.
Life Cycle Cost	+	Total life cycle cost is reduced by about $80 million.
Life Cycle Schedule	+	Construction and total life cycle schedules are reduced by approximately 6 months.
Employment	O	Results in the following job losses: 25 FTEs during construction, 16 FTEs during systemization, 25 FTEs during pilot testing and operations, and 4 FTEs during closure for a net loss 17 FTEs (or 2% of the average Base Case FTEs) over the life of the project
State and Local Commercial Revenues	–	Total commercial revenue for the state decreases by about $13 million over the life of the PCAPP project, which is 13% of the estimated total state commercial revenue for the Base Case. About half of that reduction is estimated to occur locally (in Pueblo County).
State and Local Government Net Revenue	O	State government net revenue (revenues minus expenditures) decreases by about $921,000 over the life of the PCAPP project, which is 2.8% of the state government net revenue for the Base Case. Local government net revenue decreases by about $163,000 or 3.4% over the life of the project.
Public Outreach	–	Although the Army has established a precedent for shipping large quantities of agent hydrolysate to a TSDF for treatment, each site is different and requires a sustained and well-coordinated outreach effort to garner public support within the affected communities.

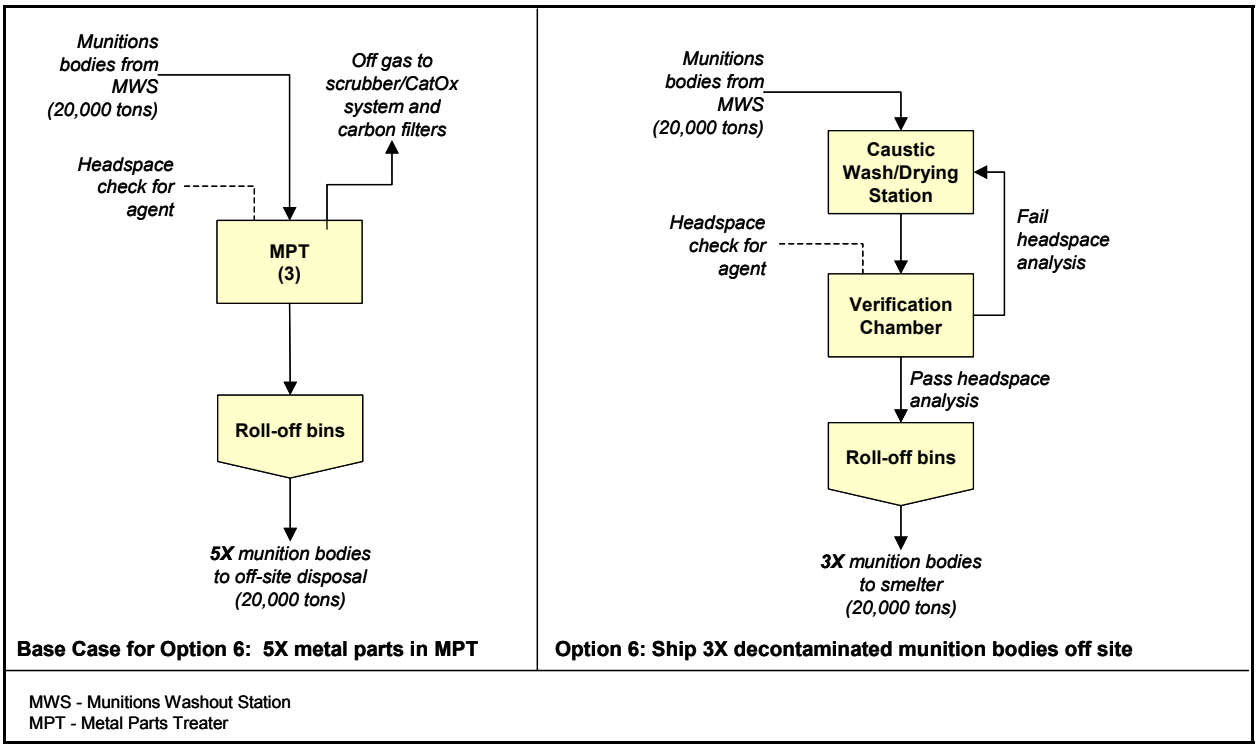
Source: FOCIS Associates

3.6 Option 6: Ship Metal Parts Off Site

3.6.1 Metal Parts – Base Case and Option 6

Block flow diagrams for the Base Case and proposed option are shown in Figure 3-16. The diagram on the left-hand side of the page shows the major unit processes and process rates used in the Base Case design for on site 5X treatment of metal parts. The diagram on the right-hand side of the page shows the process configuration and processing rates for the proposed off-site option. The figure serves as a useful reference for the discussion that follows.

Figure 3-16: Base Case and Option 6 Flow Diagrams



Source: FOCIS Associates

3.6.1.1 Base Case for on-site processing of metal parts.

In the Base Case design, munition bodies undergo 5X decontamination in the MPTs. Each MPT consists of the following major components: a nitrogen-purged, single-tray feed airlock; an external, inductively heated metal chamber holding two 4-ft x 10-ft munition trays; a nitrogen-purged, single-tray discharge airlock; and an off-gas treatment unit using CatOx units. The MPT uses external inductive heating coils and a superheated steam reagent/carrier gas to reach the 5X criteria for each tray of munition bodies.

Munition bodies are conveyed (on trays) from the MWS and transferred to one of three (3) MPTs. The trays are transferred into the airlock and the airlock is purged with nitrogen to remove oxygen from the headspace. The tray is moved forward into the inductively heated zone and superheated steam flows through the MPT, sweeping the gaseous byproducts from the

system. When the munition bodies are greater than 1000°F and have achieved the specified residence time, they are moved forward to the discharge airlock. The headspace is checked for agent. If no agent is detected, the munition bodies exit the MPT and are stored until shipped off site. If agent is detected, the munitions are returned to the heating chamber for additional treatment.

The gaseous byproducts are drawn out of the MPT to a water scrubber. The scrubber rapidly cools the gas to near-ambient conditions. Small quantities of sodium hydroxide may be added to the scrubber water to neutralize any acid gas produced in the MPT. Spent scrubber solution is treated in the ICBs along with the agent and energetic hydrolysates.

The cooled gas is mixed with air and reheated to approximately 800°F. The gas is passed through a CatOx. The CatOx breaks down the organic byproducts into simple molecules such as carbon dioxide and water. The gas is cooled to a near-ambient temperature and is discharged into the facility ventilation system where it is passed through a carbon bed to remove any trace amounts of organic molecules.

Besides munition bodies, the MPTs treat other miscellaneous metal parts, such as nails from the pallets. The MPTs are also used to decontaminate equipment during closure.

3.6.1.2 Option 6 – Ship 3X decontaminated metal parts off site.

In this option, the munition bodies are conveyed (on trays) from the MWS and transferred to a bath containing 18% sodium hydroxide. When the munition bodies have achieved the specified residence time, they are moved forward to the discharge verification chamber. The headspace is checked for agent. If no agent is detected, the munition bodies exit the verification chamber and are stored for 3X disposal. If agent is detected, the munitions are reversed back into the sodium hydroxide bath for additional treatment.

The major facility and process impacts associated with Option 5 are summarized as follows:

- Reduces the number of MPTs and their associated off gas treatment systems from three (3) to one (1). The remaining MPT will be used to treat other miscellaneous metal parts during pilot testing and operations and to decontaminate equipment during closure.
- Adds caustic wash, drying station, and verification chamber to each line of the MWS

The primary issue associated with this option is the development of a reliable procedure for confirming 3X condition prior to off-site shipment. In addition, items decontaminated to 3X level may not be released from Government control unless all Federal, State, and local provisions have been met and the MACOM commander grants approval. The shipper must maintain an audit trail of the documents.

3.6.2 Impacts of Option 6

3.6.2.1 Technical Issues.

The major technical challenge for this option is developing an effective method for decontaminating the metal parts to a 3X level and verifying that the metal parts are 3X decontaminated before shipping off site. The BPT will need to develop a washout system to scour the drained munition bodies to remove all traces of residual agent on exposed surfaces.

A recent incident at ABCDF points to the potential difficulty of 3X decontaminating metal parts. A monitor immediately adjacent to an empty mustard container that had been cleared for removal from a drain station detected low levels of agent vapor (CMA, 2003). The vapor was coming from the container, which had to be sealed and returned to the drain station for further processing and monitoring. Apparently, decontaminating the ends of the containers in the drain station has proven to require more time and effort than originally anticipated. Because they have irregularly shaped surfaces, the munition bodies at PCAPP are likely to be even more difficult to decontaminate to 3X than the ton containers at ABCDF. As noted in the previous section, the option results in the deletion of two of the three MPTs from the plant. With only one MPT to treat miscellaneous metal parts during operations and other material during closure, there is the risk that system failures or unexpected maintenance demands could result in extended downtime and schedule delays. The other problem with Option 6 is that it generates more spent decontamination solution that must be treated at PCAPP.

In effect, the option shifts the burden of decontaminating the metal parts from one first-of-a-kind system (i.e., the MPTs) to another first-of-a-kind system (i.e., a caustic washout and verification system). Both have their own unique technical challenges. Option 6 does not appear to offer any significant technical advantages over the Base Case when it comes to decontaminating metal parts. On the contrary, it appears to raise new technical challenges. Therefore, Option 6 is viewed as having a negative (–) impact on technical issue.

3.6.2.2 Safety.

While Option 6 reduces dependence on the MPTs for decontaminating munition bodies, it does not eliminate the need for the MPT for treating miscellaneous metal parts during operations and contaminated equipment and debris during closure. Thus, the inherent safety hazards of the MPT (e.g., high temperatures, super-heated steam, high voltage, exposure to fugitive emissions) are still present and must be dealt with through engineering or administrative controls. Option 6 may increase the risk of worker exposure to residual agent if the metal parts are not effectively 3X decontaminated or if PCAPP or TSDF personnel handle them improperly. If proper handling procedures are followed, 3X decontaminated material poses negligible exposure risks to workers and no increased risks to the general public.

Because of the additional procedures required for verifying and handling 3X material, Option 6 is viewed as having a negative impact on safety (–) when compared to the Base Case.

3.6.2.3 Environmental Permitting and Compliance.

All of the alternatives evaluated in the FEIS decontaminated the metal parts to a 5X level. Because Option 6 represents a significant departure from those alternatives, it will require a supplemental EA. Other permitting efforts for this option are the same as the Base Case.

By eliminating two of the MPTs, Option 6 eliminates two sources of air emissions from the site. However, the overall impact on air quality at the site will likely be minimal because the MPTs are not major sources of regulated air pollutants. No other significant environmental impacts are anticipated with this option.

With respect to compliance, Option 6 adds the requirement for verifying that the metal parts are 3X decontaminated, while reducing compliance efforts associated with the MPTs by virtue of eliminating two of these systems. Other environmental compliance and monitoring requirements of the PCAPP remain unaffected.

In terms of environmental impacts, Option 6 has no clear advantages or disadvantages when compared to the Base Case and therefore it is viewed as having a neutral (O) rating.

3.6.2.4 Transportation.

Assuming the metal parts can be verified to be 3X decontaminated, the transportation risks and traffic volumes associated with Option 6 will be essentially the same as the Base Case, and therefore it has a neutral (O) rating for this factor.

3.6.2.5 Utilities.

Water Consumption. This option has no impact on the quantity of water consumed by the process and is rated neutral (O) compared to the Base Case for this factor.

Power consumption. With the deletion of two ERH/HDCs, the ICBs and the WRS, Option 6 results in a reduction in power consumption of approximately 58,000 kWhr per day (or a total of 63 million kWhr over the project life cycle), which is about 17% of the total power consumption of the Base Case process. Given the significance of this reduction, Option 6 is rated as having a positive (+) impact on overall power consumption.

3.6.2.6 Treatment, Storage, and Disposal Facilities.

Army regulation imposes certain restrictions on the handling of 3X material. Items decontaminated to a 3X level may not be released from Government control unless all Federal, State, and local provisions have been met and the MACOM commander grants approval. If approval is granted, the material could be released to an appropriate TSDF for treatment and/or disposal. If approval is denied, the material must remain in government control.

The Army's Rock Island Arsenal in Illinois was the only facility identified in the study that has the capability of handling all of the 3X decontaminated munition bodies from PCAPP. One commercial TSDF indicated that it had experience treating 3X material, but this could not be confirmed. Rock Island uses a thermal treatment unit to treat 3X metal parts to a 5X level. The 5X metal parts are then transferred to the facility's smelter for recovery. In the past, the facility has treated 3X decontaminated ton containers from Aberdeen. It is currently accepting 3X decontaminated ton containers from ABCDF and expects to receive similar containers from NECDF within the next year.

Because the study was unable to identify more than one facility for receiving 3X decontaminated metal parts from PCAPP, the Option receives a negative (-) rating for this factor.

3.6.2.7 Treaty.

The 3X decontaminated munition bodies, which are deformed in the disassembly process, are not likely to be subject to Treaty verification and monitoring. Therefore Option 6 is rated as having no (O) impact on Treaty compliance requirements.

3.6.2.8 Life Cycle Cost and Schedule.

The impact of Option 6 on the project life cycle cost (LCC) is shown in Table 3-26. Also provided in the table are the assumptions and cost bases used in deriving the estimated change in LCC. All figures are in 2003 dollars.

The results of the LCC analysis indicate that Option 6 results in potential additional costs of about $10 million. The additional cost is due mostly to the cost of treating the 3X munition bodies to 5X at Rock Island. Since the impact on the LCC is less than $50 million, Option 6 is rated as neutral (O) for this factor.

The BPT has estimated that Option 6 could save up to 6 months on construction. This estimate is based on BPT experience at other chemical demilitarization sites and their best professional judgment. As a cautionary note, the project Integrated Master Schedule (IMS) was not available for this study. It is due to be released within the next few months. Because the estimate is not based on an analysis of the IMS, it must be viewed as being very preliminary and subject to change once the IMS is published. Without an IMS it is impossible to determine what systems and activities are on the critical path. This information is prerequisite for determining schedule impacts with any known degree of certainty and accuracy.

Table 3-26: Option 6 Impacts on Life Cycle Costs

Item and Assumption	Cost basis	Change in LCC
Technical issues resolution		
Certify a procedure for demonstrating that wood dunnage is not agent contaminated.	200 hrs, $150/hr	$ 30,000
Major equipment and building changes		
Delete two of three MPTs. Includes reduction of approx 55,000 craft hours, or 321 man months.	Lump sum	$ (26,000,000)
Add caustic wash system and monitoring station for 3X decontamination.	Lump sum	$ 15,000,000
No changes in storage facilities.	Not applicable	$ -
Off-site shipping and treatment		
Eliminate treatment/use of 20,000 tons of 5X metal parts.	$206/ton	$ (4,100,000)
Add treatment of 20,000 tons of 3X metal parts.	$2000/ton	$ 40,000,000
TSDF oversight		
Two half-time staff at TSDF on temporary duty (TDY) for 24-month pilot testing and operations	173 hrs/month/FTE, $80/hr $2,000/month for TDY	$ 380,000
Changes in wastes, imported materials, and utilities		
Reduce quantity of 59% NaOH in MPTs by 37 tons and 100 tons of 50% NaOH in the caustic wash system.	$380/ton	$ (11,000)
Reduction in power consumption with the deletion of two MPTs by approximately 63,000,000 kWhr.	$0.0384/kWhr	$ (2,400,000)
Environmental permitting		
No impact affecting cost.	Not applicable	$ -

Table 3-26: Option 6 Impacts on Life Cycle Costs (continued)

Item and Assumption	Cost basis	Change in LCC
Labor changes		
Construction manpower changes: Reduce non-manual (NM) staffing by 60 for 6 months. This is in addition to craft savings of 57,600 hours included in major equipment changes costs.	173 hrs/month/FTE, $80/hr	$ (5,000,000)
Systemization manpower changes: Reduce NM staff by 13 for 18 months with deletion of one CST.	173 hrs/month/FTE, $80/hr	$ (3,000,000)
PT&Ops manpower changes: Net 1 fewer FTEs for 24-month phase.	173 hrs/month/FTE, $80/hr	$ 330,000
Closure manpower changes. Reduce staff by 25 FTEs for 6 weeks.	40 hrs/week, $80/hr	$ (480,000)
Government program management: Reduce staffing one-to-one with Systems Contractor (60 FTEs) as a result of 6-month reduction in construction schedule .	173 hrs/month/FTE, $80/hr	$ (5,000,000)
Total		**$ 9,700,000**

Source: FOCIS Associates and BPT

3.6.2.9 Local Economics.

Local Employment. Option 6 will result in an average of about 7 fewer FTEs. See Table 3-27. The highest reductions will be during construction and systemization, when there will be 15 and 13 fewer FTEs. The option also impacts closure with about 2 fewer FTEs. The number of FTEs during pilot testing and operations is not impacted. On average, Option 6 results in a 1% reduction in employment over the life cycle of the project. This change, while significant, is still relatively low and therefore Option 6 is viewed as neutral (O) impact on this factor.

Table 3-27: Option 6 Impacts on Number of PCAPP Employees

Project phase	Phase duration[1]	Net change in number of local employees, FTE[3]
Design	30	0
Construction	33	-15
Systemization[2]	18	-13
Pilot Testing and operations[2]	24	0.0
Closure	23	-1.6
Net over project life	105	-7.3 [4]

(1) Milestones adapted from BPT Schedule dated 18 Feb 03.
(2) Phase duration adjusted according to BPT matrix dated 24-May-03.
(3) FTE = full-time equivalent jobs
(4) Design, construction, and systemization have some overlap, so the total project duration is less than the sum of the phase durations.

Source: FOCIS Associates and BPT

State and Local Commercial Revenues. Based on the assumptions provided in Table 3-28, the total commercial revenue for the state is estimated to decrease by about $1.3 million over the life of the project. Local commercial revenue is estimated to decrease by about $660,000 over the

life of the project. These losses in commercial revenues are a result of the construction of less equipment and the use of smaller quantities of treatment chemicals. The potential loss in commercial revenues is probably very small when compared to the potential total commercial revenues that might be realized over the project life cycle. Although precise estimates of total state and local commercial revenues have not been compiled, it is assumed that they would be on the order of $100 million statewide. In that context, the impact is relatively small (less than 2%) and therefore Option 6 is rated as having a neutral (O) effect when compared to the Base Case.

Table 3-28: Option 6 Impacts on State and Local Commercial Revenues

Source	Changes in local and state commercial revenues		
	Local	Elsewhere in Colorado	Total
Major equipment changes[1]	$ (1,600,000)	$ (1,600,000)	$ (3,200,000)
Additional space and/or transfer stations[1]	$ 940,000	$ 940,000	$ 1,880,000
Imported chemicals[2]	$ (2,800)	$ (2,800)	$ (5,600)
Total change	**$ (663,000)**	**$ (663,000)**	**$ (1,330,000)**

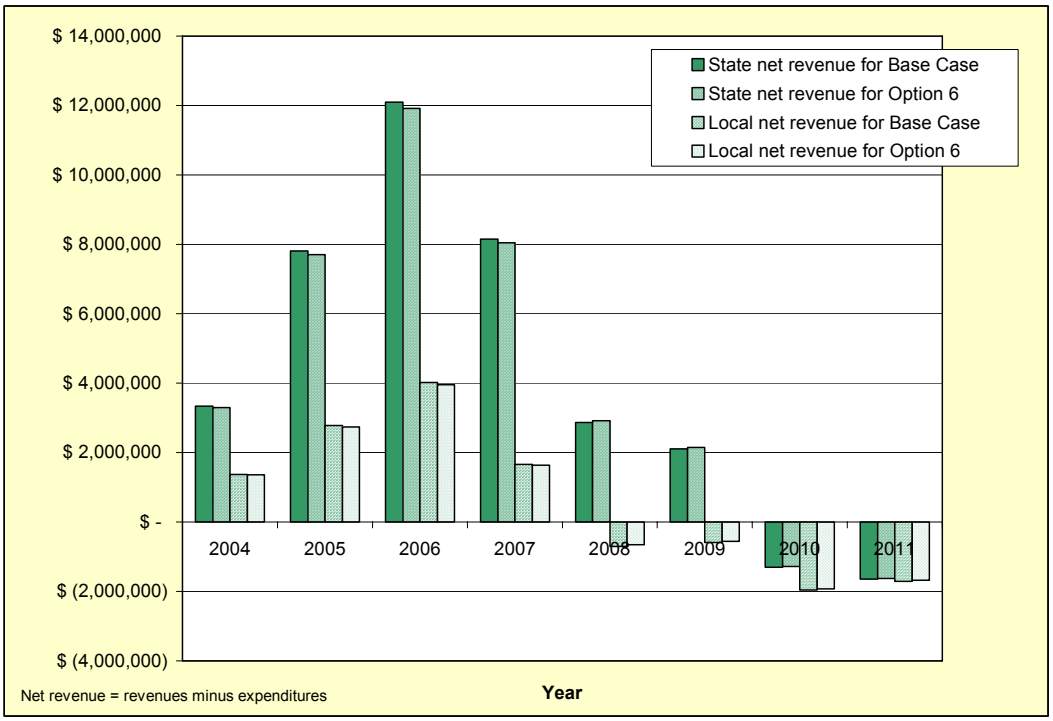
(1) Assume that 25% of capital cost is for bulk materials, 25% of bulk materials can be obtained from local suppliers, and 25% of bulk materials can be obtained from suppliers elsewhere in the state. [Assumption provided by Bechtel Pueblo Team at 13 May 2003 meeting.]
(2) Assume that 25% of imported chemicals can be obtained from local suppliers and 25% of imported chemicals can be obtained from suppliers elsewhere in the state. [Assumption by FOCIS Associates.]
Source: FOCIS Associates and BPT

State and Local Government Net Revenues. Figure 3-17 shows the government (state and local) net revenues for the Base Case and Option 6 from the start of construction in July 2004 through the end of closure in October 2011. The net revenues are based on project related economic activity within the core county (Pueblo) and surrounding counties that contribute either to local (Pueblo) net revenues or to state (Colorado) net revenues. Figure 3-18 shows the percent change in government net revenues over the same period as a result of the off-site option.

As shown in Figure 3-17, the differences in net revenues (both local and state) between the Base Case and option are very small over the entire range of years. As shown in Figure 3-18, Option 6 results in a 1% to 2% reduction in both state and local net revenues from 2004 to 2007 as a result of lower employment during construction and systemization. It is not known why Option 6 results in an increase in state and local net revenues after 2007 when the number FTEs is actually reduced by 0.5 to 1.5. This could be due to declining expenditures or the result of an anomaly or error in the model. In any case, the percent change is relatively small and probably insignificant.

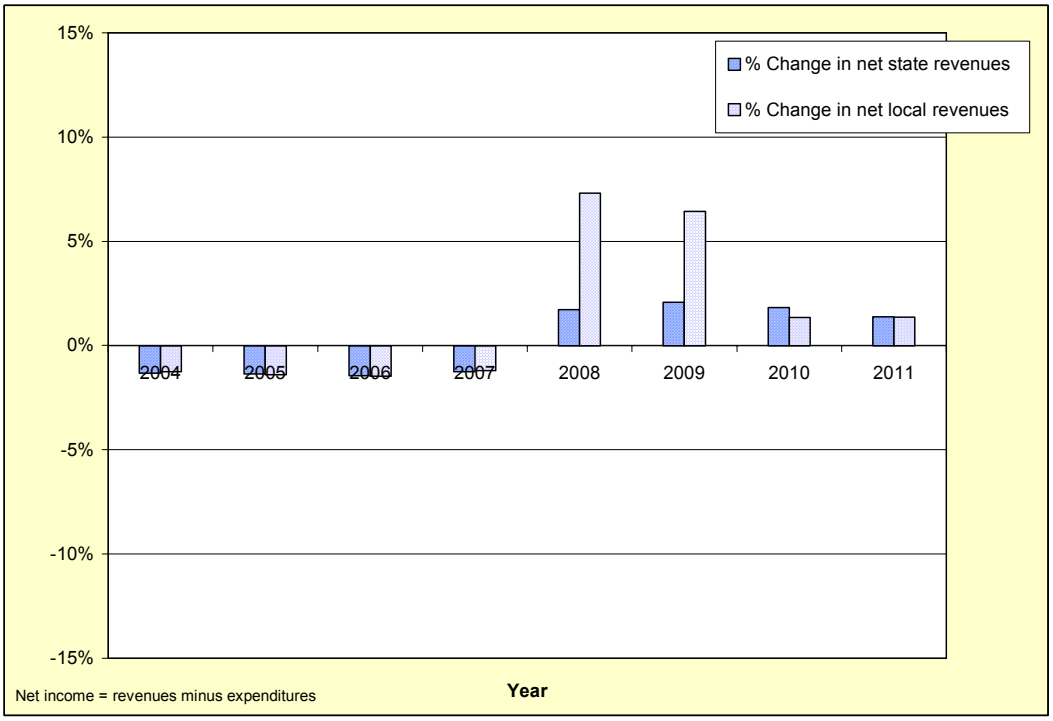
Table 3-29 shows the cumulative local and net revenues for the Base Case and Option 6. As indicated in the table, the calculated percent change in total local net revenue over the project's life cycle is +0.1%. The percent change in cumulative net revenues for the state is –0.9%. The magnitude of the change is generally consistent with the number of jobs lost with this option. The overall impact of Option 6 on local and state net revenues is considered to be negligible and therefore the option receives a neutral (O) rating for this factor.

Figure 3-17: Base Case and Option 6 Government Net Revenues during PCAPP Project



Source: FOCIS Associates and IDA

Figure 3-18: Option 6 Impacts on Government Net Revenues during PCAPP Project



Source: FOCIS Associates and IDA

Table 3-29: Base Case and Option 6 Government Net Revenues during PCAPP Project

Government	Cumulative Net Revenues 2004-2011			
	Base Case	Option 6	Change	
State	$ 33,407,000	$ 33,119,000	$ (288,000)	-0.9%
Local	$ 4,861,000	$ 4,865,000	$ 4,000	0.1%
Total	$ 38,268,000	$ 37,984,000	$ (284,000)	-0.7%

Source: FOCIS Associates and IDA

3.6.2.10 Public Outreach.

Shipping 3X decontaminated munition bodies is not expected to raise significant public concern or require a significant increase in public outreach efforts. The Army has already shipped 3X decontaminated ton containers from other chemical demilitarization facilities to Rock Island without incident and with little public opposition. Given this past history and the relatively benign nature of the waste, Option 6 is rated as having no (O) impact on public outreach.

3.6.3 Summary of Impacts

Table 3-30 summarizes the likely impacts of Option 6 on the various evaluation factors relative to the Base Case.

- Compared to the Base Case, Option 6 is rated as having a positive (+) impact on power consumption and life cycle schedule. Option 6 reduces the construction schedule by approximately 6 months. Process power consumption is reduced by 17% with the elimination of two of three MPTs.
- Option 6 is rated negative (-) for technical issues, safety, and TSDFs. Technical issues are increased because of the need to develop an effective washout machine to decontaminate the metal parts to a 3X level. Manually handling 3X material is a major safety concern for workers. The negative rating for the TSDF factor was due to the fact that Rock Island Arsenal was the only facility confirmed to have the ability to accept and process 3X-decontaminated metal parts.
- Option 6 is rated neutral (O) for the remaining factors. These include environmental permitting and compliance, transportation, water consumption, Treaty, life cycle cost, state and local commercial revenues, state and local government net revenues, and public outreach.

Table 3-30: Summary of Evaluation Factor Ratings for Option 6

Factor	Comparative Rating	Rationale for Rating
Technical Issues	–	Raises new technical challenges while offering few benefits. New challenges include developing an effective washout system to decontaminate munition bodies to a 3X level and verifying that washed munitions are 3X decontaminated before shipment off site. Leaves only one MPT for decontaminating material during closure, thus increasing risk that extended downtime could cause delays in closure schedule.
Safety	–	Increases the risk of worker exposure to residual agent on the metal parts if they are not effectively 3X decontaminated or if PCAPP or TSDF personnel handle them improperly.
Environmental Permitting and Compliance	O	Requires a supplemental Environmental Assessment (EA), but should not impact schedule. Adds requirement for verifying that the metal parts are 3X decontaminated, while reducing compliance efforts associated with the MPTs by virtue of eliminating two of these systems. Marginal reduction in regulated air emissions. Positive impacts are offset by 3X verification requirement.
Transportation	O	Transportation risks and truck shipments associated with Option 6 are essentially the same as the Base Case,
Water Consumption	O	Negligible impact on water consumption.
Power Consumption	+	With the deletion of the ICBs and the WRS the power consumption of the process will be reduced by approximately 125,114 kWhr per day (or a total of 137 million kWhr over the project life cycle), which is about 17% of the total power consumption of the Base Case process.
TSDFs	–	The Army's Rock Island Arsenal in Illinois was the only facility identified in the study that has the capability of handling all of the 3X decontaminated munition bodies from PCAPP. One commercial TSDF indicated that it had experience treating 3X material, but this could not be confirmed.
Treaty	O	3X decontaminate munition bodies are not subject to CWC Treaty verification and monitoring.
Life Cycle Cost	O	Total life cycle cost increases by about $10 million.
Life Cycle Schedule	+	Construction and total life cycle schedules are reduced by approximately 6 months.
Employment	O	Results in the following job losses: 15 FTEs during construction, 13 FTEs during systemization, 0 during pilot testing and operations, and 2 FTEs during closure for a net loss of 7 FTEs (or 1% of the average number of Base Case FTEs) over the life of the PCAPP project
State and Local Commercial Revenues	O	Total commercial revenue for the state decreases by $1.3 million or 1.3% over the life of the PCAPP project. Half of that reduction is estimated to occur locally.
State and Local Government Net Revenues	O	State government net revenue (revenues minus expenditures) decreases by about $288,000 over the life of the PCAPP project, which is 0.9% of the estimated state government net revenue for the Base Case. Local government net revenue increases by about $4,000 or 0.1% over the life of the project.
Public Outreach	O	Precedent already established for shipping 3X decontaminated ton containers to Rock Island for treatment. Practice has met with little public opposition and concern. Not expected to require a significant increase in outreach efforts.

Source: FOCIS Associates

4.0 SUMMARY OF OFF-SITE DISPOSAL OPTION IMPACTS

The results of the Impacts Analysis showing all of the factor ratings for each of the off-site options are summarized in Table 4-1. Three things must be kept in mind when viewing the table:

- First and foremost is that the ratings are relative so a red or negative mark in any factor does not necessarily mean that the option is disqualified or eliminated from further consideration. It simply means that the option faces additional obstacles above and beyond those of the Base Case, and that additional effort and/or investment in time or money are required to move the option forward. After reviewing all of the available information, it can be said unequivocally that all of the options are technically feasible and can be done in a way that affords maximum protection to both human health and the environment.
- Second, not all factors carry the same weight; some may be more important than others depending on one's point of view. For example, cost and schedule may be more important to the Army than local employment or local government revenues, whereas the opposite may be true for the local government. Environmental permitting and compliance and safety are of paramount importance to all stakeholders. Ultimately, it is up to the stakeholders to decide which of the other factors are the most important in determining which options to pursue.
- Third, while the study team tried to be as thorough and objective as possible, there were times when the study team had to rely heavily on professional judgment in arriving at a rating for factors where the data were either incomplete or of unknown quality or accuracy. This was particularly true for the government net revenue factor where the model error is essentially unknown. Consequently, for this factor, as well as for commercial revenues, it was assumed that any change in revenue less than 10% of the estimated Base Case revenue was marginal and therefore given a neutral (O) rating.

In reviewing the results of the analysis, Option 2 appears to be the only option to offer advantages to the Base Case while not having any significant negative impacts. Option 2, shipping propellant off site, offers advantages over the Base Case under the technical issues, safety, and schedule factors. In addition, Option 2 received a positive rating under the TSDF factor indicating that there are at least three TSDFs with the technical capability and required permits to process all of the propellant from PCAPP. Option 2 has no significant impact on the remaining factors: environmental permitting and compliance, transportation, water and power consumption, Treaty compliance, life cycle cost, local economics, and public outreach.

The other options, while having advantages over the Base Case, have one or more negative attributes that may render them less desirable than the Base Case:

- Option 1 has only one negative rating, that being for technical issues where the primary concern is over developing and implementing a method for verifying that the wood dunnage is uncontaminated.
- For Options 3, 4, and 6, the major concern is safety. In the case of Options 3 and 4, it is the manual handling of bursters, some of which could be contaminated with agent, which raises the most concern. For Option 6, it is the increased risk (however small) of worker exposure

to residual agent from the improper handling of 3X decontaminated metal parts that results in the negative rating.

- Another concern for Options 4 and 5 is the fact that there is only one commercial biotreatment facility confirmed to have the excess capacity necessary to handle all PCAPP daily hydrolysate production (note, a few other smaller facilities could process some fraction of the PCAPP's daily hydrolysate production). This increases the risk that a problem at that facility would have negative consequences for operations at PCAPP. A similar concern exists for Option 6 in that only one facility was identified for processing 3X metal parts.
- Options 3, 4, and 5 also have negative ratings for public outreach because they will likely require substantial outreach efforts to garner and maintain public support. These efforts will likely extend beyond the local Pueblo community to other affected communities, such as those located along the shipping routes and near the TSDFs.

As expected, Options 4 and 5 result in the largest reductions in total life cycle cost; $115 million and $80 million, respectively. No other options produce cost savings >$50 million, the benchmark for determining whether or not the impact is significant. The elimination of all process equipment associated with hydrolysate treatment and water recovery has a substantial negative impact on state and local commercial revenues, which are generated from the sale of bulk materials for those systems. Because employment is not significantly impacted, state and local government net revenues remain relatively unaffected. Both options have a considerable impact on project schedule. In the case of Option 4, the project construction schedule is shortened by 10 months. With Option 5, the potential construction schedule savings is about 6 months. The cost and schedule savings, which appear to be significant, must be weighed against the other negative risk factors shown in the table.

Table 4-1: Summary of Off-site Disposal Option Impacts

Factor	Impact of off-site disposal options relative to the Base Case					
	Option 1: Wood dunnage	**Option 2: Propellant**	**Option 3: Propellant and bursters**	**Option 4: Propellant, bursters, and hydrolysate**	**Option 5: Hydrolysates**	**Option 6: 3X metal parts**
Technical Issues	**–** Verification of wood noncontamination req'd	**+** Much less propellant in ERHs (+) more than offsets verifying stability and noncontamination (-)	**O** Verification of stability and noncontamination req'd (-) but much less propellant in ERHs (+)	**+** Verification of stability and noncontamination req'd (-) but much less propellant in ERHs (+) and major systems eliminated (+)	**+** Major systems eliminated	**–** Development of washout and 3X decontamination verification system req'd
Safety	**O** Similar level/number of inherent hazards	**+** ERH maintenance requirements reduced	**–** Manual handling of bursters req'd	**–** Manual handling of bursters req'd	**O** Similar level/number of inherent hazards	**–** Reliance on 3X verification
Environmental Permitting and Compliance	**O** Similar effort req'd	**O** Similar effort req'd	**–** Increased effort req'd	**O** Similar effort req'd	**+** Less effort req'd	**O** Similar effort req'd
Transportation	**O** Δ = 4 TT/wk more	**O** Δ = 1 TT/wk less	**O** Δ = 1 TT/wk less	**O** Δ = 5 TT/wk more	**O** Δ = 6 TT/wk more	**O** Δ = 0 TT/wk more
Water Consumption	**O** Δ = 200 gpd less	**O** Δ is negligible	**O** Δ is negligible	**+** Δ = 15K gpd less	**+** Δ = 15K gpd less	**O** Δ = 200 gpd less
Power Consumption	**O** Δ = 5% less	**O** Δ = 1% less	**O** Δ = 4% less	**+** Δ = 39% less	**+** Δ = 37% less	**+** Δ = 17% less

Table 4-1: Summary of Off-site Disposal Option Impacts (continued)

Factor	Impact of off-site disposal option relative to the Base Case					
	Option 1: Wood dunnage	**Option 2: Propellant**	**Option 3: Propellant and bursters**	**Option 4: Propellant, bursters, and hydrolysate**	**Option 5: Hydrolysates**	**Option 6: 3X metal parts**
TSDFs	+ >2 candidate TSDFs identified	+ >2 candidate TSDFs identified	+ >2 candidate TSDFs identified	+ >2 candidate TSDFs identified for energetics – Only 1 candidate TSDF identified for hydrolysate	– Only 1 candidate TSDF identified	– Only 1 candidate TSDF identified
Treaty	O Similar effort req'd	O Similar effort req'd	O Similar effort req'd	– Increased effort req'd	– Increased effort req'd	O Similar effort req'd
Life Cycle Cost	O Δ = $7M less	O Δ = $12M less	O Δ = $37M less	+ Δ = $115M less	+ Δ = $80M less	O Δ = $10M more
Life Cycle Schedule	O Δ = 3 months less	+ Δ = 6 months less	+ Δ = 8 months less	+ Δ = 10 months less	+ Δ = 6 months less	+ Δ = 6 months less
Employment	O Δ = 1 FTE less	O Δ = 3 FTEs less	O Δ = 10 FTEs less	O Δ = 10 FTEs less	O Δ = 16 FTEs less	O Δ = 9 FTEs less
State and Local Commercial Revenues	O Δ = $800K less	O Δ = $600K less	O Δ = $3.2M less	– Δ = $16M less	– Δ = $13M less	O Δ = $1.3M less
State and Local Government Net Revenues	O Δ = $142K more	O Δ = $31K more	O Δ = $484K less	O Δ = $3.4M less	O Δ = $1.1M less	O Δ = $284K less
Public Outreach	O Similar effort req'd	O Similar effort req'd	– Increased effort req'd	– Increased effort req'd	– Increased effort req'd	O Similar effort req'd

Δ = change from Base Case
TT/wk = truck trips per week for process waste and treatment chemical shipment
Source: FOCIS Associates

gpd = gallons per day during normal operations
M = million
K = thousand

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