U. S. Postal Service

Emergency Preparedness Plan

for

Protecting Postal Employees and Postal Customers

From Exposure to Biohazardous Material

and for

Ensuring Mail Security

Against

Bioterror Attacks

Emergency Preparedness Plan
Date of Report: March 6, 2002

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Postal Service Transmittal Letter

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Executive Summary

Introduction

On September 11, 2001, the terrorist attack on the World Trade Center in New York damaged two postal facilities. In October 2001, some individual or group of individuals used the U.S. Mail to send anthrax to organizations and individuals in the United States, harming both employees and customers 5 people died, and 18 became ill. Two postal facilities have been temporarily closed (Brentwood Facility in Washington, D.C., and Hamilton Township Facility in New Jersey). Numerous facilities had to be tested for the presence of anthrax, and many had to be cleaned. Hundreds of postal employees were tested for exposure to anthrax, and many more were put on a regimen of antibiotics for prophylactic purposes.

Unlike the large-scale biological attack predicted by experts that could kill thousands, if not hundreds of thousands, this attack was small and carefully targeted. Biological weapons of mass destruction were feared as part of an asymmetric strategy on the part of less powerful state or non-state actors.[1] This attack has demonstrated the asymmetric value of introducing a biological agent into a nationwide distribution network. Not only is the relative power of the attacker small, it also means that a small-scale, carefully targeted attack can cause reactions far beyond the actual threat.

It was correctly predicted that an NBC [Nuclear, Biological, or Chemical] attack against a civilian population would, in all likelihood, trigger a panic far in excess of the real effects of the weapons. [2] This panic was magnified by the use of the nation s most extensive logistics network the U.S. Mail. The U.S. Postal Service delivers 680 million pieces of mail per day to virtually every household and business in the United States. Compromising this system has the potential to adversely impact the entire nation with a simple terrorist act.

The Postal Inspection Service has provided the Postal Service a threat assessment, which serves as a basis for this plan. The Postal Inspection Service maintains a continuous liaison with all appropriate federal law enforcement agencies and monitors threats to the nation and its mail. (The threat assessment is not a public document, due to security concerns.) The threat assessment states, in part, the sheer size and presence of the Postal Service makes it vulnerable to be a target of terrorism or to be used as a vehicle to carryout terrorist activities. The Postal Service is not immune to the possibility of being a terrorism target again and we believe the threat level increased with the media publicity surrounding the delivery of the anthrax laden letters to the Senate. The threat assessment concludes, Accordingly, the Postal Service believes, and is acting on the assumption that the threat for the inappropriate use of the mails continues.

The greatest opportunities to limit the damage of covert NBC attacks, or prevent them entirely, exist during the first phases of the incident. [3] This report emphasizes just such an approach. It places a premium on threat identification combined with protection to both employees and customers of the Postal Service at the earliest feasible point in our distribution system.

There is an unavoidable tradeoff between maintaining the values and strengths of a free nation and taking certain steps that could significantly increase the odds of gaining advance detection of a terrorist or covert NBC attack. [4] We have considered several different process and technology changes to reduce the volume of high-risk mail from anonymous senders. However, a cornerstone of the service we provide our nation is an open and accessible system. While we can take steps to

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reduce the volume of high-risk mail from anonymous senders, we cannot eliminate it. A closed and restricted system for the acceptance of all mail is inconsistent with a viable U.S. Postal Service.

The safety of our employees and customers, the security of the mail, and the confidence of the American public in the Postal Service were challenged by the events of last fall. Day-to-day postal operations were disrupted, and the negative financial impact on the Postal Service and on our nation s economic activity was significant. We cannot assume these attacks were isolated and will never be repeated. Rather, we must assume our vulnerability is known and we must take the appropriate steps to reduce risk.

Overview

The Postal Service looked at a variety of process changes and technology initiatives that could be applied to the threat of biohazards in the mail. Careful review and consideration was given to all processes and technologies in this report. The paramount conclusion is that no single solution exists to solve the problem of using the mail as a tool of bioterrorism. Further, no solution or even series of solutions can totally eliminate the threat.

The conclusions, and the implementation plan in this report, reflect the need to put in place process changes and technology applications that can reasonably reduce risk. The objective is to reduce risk for both employees and customers of the Postal Service while at the same time maintaining current service levels.

The viability of the Postal Service, and its value to the American people, is dependent upon an open and accessible system. Extreme procedural changes could reduce threats, but would significantly damage the financial position of the Postal Service. The procedural changes included in this report reflect the balance between enhanced security and the continued ability of customers to do business with the Postal Service.

The technology assessment in this report considered several risk factors. First, at what state of development is the technology? In many cases, there are very interesting developments underway but remain several years from full production capability. Second, to what extent can the technology be integrated into the Postal Service operating system? Heavy emphasis was placed on the ability to maintain current service levels. Third, what is the cost of the technology? There are several approaches that simply do not provide a sufficient level of risk reduction to justify their cost. Finally, what are the levels of risk reduction? Proposals vary as to the level of protection provided and the point at which they should be deployed in our system.

We concluded that there was a need to focus our efforts on a combination of procedural changes and technologies that are at or near production. However, while we continue to evaluate these system-wide applications, our first priority will be the cleaning, decontamination and reopening of both the Brentwood and Trenton facilities. This work was begun as part of our initial response and will continue during the next phase.

System-wide detection technology is focused on the initial operation in processing facilities for mail picked up at collection boxes, residences, and small businesses -- mail with the greatest risk. This technology, combined with enhanced security procedures for our bulk quantity mailers, provides significant risk reduction as mail enters our distribution system.

In order to provide another layer of protection, we will install a vacuuming and filtration system on many of our automated sorting machines. In controlled laboratory tests we were able to replicate the anthrax dispersion events that took place in Trenton and Brentwood. We have a clear understanding of how a powderized biohazard escapes from the mail.

Based upon this knowledge we worked with the manufacturers of our processing equipment to design and build the vacuum/filtration systems. These systems are capable of capturing and trapping most of the biohazardous material as it escapes from the mail. The result is reduced risk to the postal employees operating this equipment and in turn reduction in cross-contamination that can affect our customers.

We will continue to work with the manufacturers of irradiation technology. This technology remains the only scientifically accepted means to decontaminate mail exposed to biohazards. The electronic beam (e-beam) systems we purchased will be deployed in a configuration optimized for mail. This limited deployment will allow us to accurately evaluate the operational impacts, costs and effects on mail and its contents. The results of this evaluation, combined with the effectiveness of the technologies described above, will dictate the appropriate next steps for irradiation technology. In addition, we will continue to work with manufacturers of alternative technologies to determine whether these technologies could be used to decontaminate mail.

Beyond these first steps, we will continue to work with the manufacturers of several different technologies. Additional testing and prototyping is necessary to fully determine their viability. Key areas of focus are (1) redesign of collection box for both risk reduction and detection, (2)˚technology and procedures to reduce the volume of anonymous mail, (3) further deployment of vacuum/filtration technology on automated sorting equipment, (4) use of mass spectrometry for detection, and (5) a variety of technology to aid investigators in finding whoever committed this act, and deterring further attempts at placing biohazards in the mail.

This plan is dynamic. We will work with the Inspection Service to periodically update the threat assessment. At the same time, we will continue to evaluate a variety of technologies as they reach maturity. We also are committed to exploring research and development efforts to identify new approaches to solve this problem.

Format of the Report

The report is presented in six parts. It begins with an introduction that provides background information and a summary of the initial responses to anthrax contamination.

The second section outlines the assumptions, methodologies and framework for analysis used throughout the report.

The third section provides a structure for grouping the various categories of both process change and technology. It includes a short-listing of the technologies and process changes that were proposed and initially evaluated.

The fourth section provides the detailed analysis of the most promising technologies or process changes that were considered. For each item there is a brief description, technical risk assessment, operational risk assessment, cost risk assessment and finally a bottom-line viability assessment.

The fifth section draws upon the analysis portion of the report and provides the conclusion as to the combination of technology and process change that should be adopted.

The sixth, and final, section provides a plan as to how these technologies and process changes should be implemented. It places these items in a near-term (current fiscal year), intermediate-term (2-3 years), and long-term (4-5 years) format. It also addresses issues for future consideration.

Goals

This Emergency Preparedness Plan addresses the requirements of P.L. 107-117 and its goals of protecting postal employees and postal customers from exposure to biohazardous material and safeguarding the mail system from future bioterror attacks while maintaining current service levels to the American public.

To achieve this goal, four strategic objectives are being pursued:

Detect biohazardous materials introduced into the mail stream as soon as possible

Contain biohazardous materials identified in the mail stream as soon as possible

Neutralize biohazardous materials found in the mail stream

Deter against the use of the mail as a tool for bioterrorist acts

This will be accomplished by taking action along six core technology-based and process-based initiatives:

Prevention — Reduce the risk that someone would use the mail as a tool of terror.

Protection and Health-Risk Reduction — Reduce risk of exposure to biohazards, and prevent cross-contamination of mail if biohazards should be introduced into the mail system.

Detection and Identification — Detect and identify potential hazardous materials as early as possible in the mail stream.

Intervention — As a precaution, neutralize potential contaminants in the mail.

Decontamination — Eliminate known contaminants, both in the mail and in equipment and facilities.

Investigation — Enhance criminal investigative infrastructure to enable more effective forensic analysis.

Conclusions

The conclusions that follow are drawn from the qualitative analysis of technologies and processes. The viability of the various technologies and processes has been categorized as immediate, near-term (current fiscal year), intermediate-term (2-3 years), and long-term (4-5 years). The overall availability and state of maturity of technologies in these areas, and their adequacy to accomplish the objectives of each core initiative are also considered. This section is organized by core initiatives, to facilitate reference to the analysis.

<u>Prevention</u>

The application of detection, containment, and decontamination technologies at the collection box cannot be immediately implemented. The fact that the Postal Service has approximately 350,000˚collection boxes, and the current state of detection technology make immediate introduction of these technologies impractical at this time. Several technologies are being conceptually evaluated and will be tested and prototyped in the intermediate term, where appropriate.

The use of intelligent mail (each piece of mail having a unique identity) is an effort that predates the current problem with biohazards. The Postal Service has already invested in the infrastructure to support this effort. The basis for this investment has been for business reasons -- both revenue generation and cost reduction -- and was not motivated by security reasons. The effort will continue and assist the Postal Service with its security needs.

The Postal Service currently has a program that video records retail transactions. The system is not fully implemented at all postal facilities. In addition there are available image recording systems that would need to be integrated with our information systems to allow us to fully benefit from this technology. Prototyping this system will be necessary to better understand system requirements and cost.

Security control for large mailers is viable in the near to intermediate term. This will help ensure that mail from identified sources is secure.

Access security control can be accomplished by borrowing heavily from technologies already in place in other areas of the government.

In summary, prevention involves a large spectrum of efforts to incorporate technologies at several different levels of maturity. Significant progress is expected in the intermediate term.

Protection and Health Risk Reduction

The objective of this initiative is to reduce the risk of exposure to biohazards, and prevent cross-contamination of mail, if biohazards should be introduced into the system. Mature and available technologies exist to support this initiative. The protection of employees from air-borne biohazards will be accomplished by the implementation of two mature technologies and by the conduct of a feasibility study in a third conceptual area.

The use of high-efficiency particulate air (HEPA)-filtered vacuum cleaners for equipment cleaning, as a replacement for compressed air blowing is a mature and available technology that can be implemented immediately with low risk.

The retrofitting of custom-designed filtration vacuum systems on each type of mail-processing equipment involves applying the mature technologies of vacuum systems and multi-stage HEPA filtering in a custom design that can be prototyped and implemented on a large scale in the near to intermediate term with low risk.

The installation of enhanced filtration or other means of trapping or killing of bacteria or other bioagents in the heating, ventilation, and air conditioning (HVAC) system is a concept that involves the potential application of a variety of technologies. A preliminary feasibility study is required to define the technical and operational risk of this approach in the context of the implementation of the above two mature technologies, and to identify the technologies that should be evaluated more rigorously for potential insertion into the HVAC.

Implementation of the two mature technologies will reduce the health risks to our employees and protect our customers. If the modification of HVAC appears feasible it will provide a further means to reduce health risk.

Detection and Identification

The objective of this initiative is to detect and identify potential hazardous materials as early as possible in the mail stream. Technologies for detection and identification of threats are not at a stage of development that allows immediate implementation. However, promising cutting-edge technologies exist to effectively accomplish this initiative in the intermediate term, after appropriate testing and pilot studies have been done.

Triggering technologies are not at the stage of maturity where commercial off-the-shelf equipment will provide continuous, unattended monitoring and reporting of the existence of a potential threat. These technologies require intermediate-term testing to determine further viability.

Confirmation technology requires specific and reliable identification of a biohazard with a validated technique. For this purpose, polymerase chain reaction (PCR) as a means of detecting the presence of specific biohazard signatures is a technology that merits near-term prototyping with potential near- to intermediate-term implementation.

Mass spectrometry as a confirmation technology is of moderate to high technical risk due to questions about the specificity of the method and its ability to function in the high-particulate environment of mail processing. If technical risk related to specificity of this technique could be overcome, this combination could also provide acceptable confirmation of a threat.

In summary, while detection cannot be accomplished by immediate implementation of an off-the-shelf technology, near-term prototyping of intermittent air sampling, and automated presentation of samples to analysis by PCR shows the best promise for effective detection.

Intervention

The objective of intervention is to neutralize potential contaminants in the mail. This is a precautionary measure. A mature technology e-beam has been identified and implemented for the irradiation of selected mail. The two facilities presently in use were not specifically designed for mail; therefore, the configuration is not optimal.

Plans are moving forward for the deployment of e-beam technology in at least one, and potentially two facilities specifically designed for mail processing. Only targeted mail would be irradiated at this facility. This optimal configuration will allow for a better evaluation of the costs, operational impacts, and effects on the mail and its contents. Results of this deployment will largely determine the viability of a large-scale use of irradiation technology.

Decontamination — Mail

The objective of decontamination is to eliminate known contaminants in the mail. Decontamination of mail involves the sterilization of selected items of mail, which have been identified as being contaminated. It is essentially the same process as intervention, except that it would be applied selectively to mail that is pre-identified as contaminated.

Irradiation remains as the only scientifically accepted method for decontaminating mail once it is exposed to a biohazard. No other technology has yet proven the ability to effectively penetrate and clean a non-homogenous product such as mail.

Decontamination — Facilities and Equipment

Gaseous treatment technologies were found to be the most viable for facility decontamination because of their uniform permeation throughout the facility and exposure to all surfaces accessible to contamination. Of the gaseous treatment technologies, chlorine dioxide is the most viable because of the precedent for its use as a building decontaminant. Spot decontamination can be effectively accomplished with the direct application of anti-microbial agents.

Investigation

The objective of investigation is to enhance the criminal investigative infrastructure to enable more effective forensic analysis. The technologies under evaluation and development for this initiative are image capture and analysis, wide field of view cameras, and mailpiece tracking.

Image capture and analysis is based on real-time analysis of images that are presently captured. This is an ongoing Postal Service project with three distinct phases. The first two phases that include the capability to perform automated, real-time analysis of scanned images have intermediate-term viability. Phase III, which includes handwriting comparison, is somewhat less mature.

The use of the full mailpiece image utilizing a Wide Field of View (WFOV) camera is a critical component to this effort. This camera upgrade was previously funded and approved by the Postal Service as part of its normal investment projects. Full deployment of the WFOV will be completed in the next two years. Full image capture is already available on Postal Service automated flats distribution equipment.

Plan

Initial Response

Ongoing activities resulting from this initial response include the purchase of approximately 16,000 HEPA-filtered vacuums for cleaning equipment and building surfaces within postal facilities of 5000 square feet or larger, the provision of gloves and masks to all employees, the use of e-beam technology for mail sanitization, and decontamination of equipment and facilities. (Reference Table 1)

Table 1 Usage of Initial Appropriations

	Appropriation	Activities to Date (as of 2/28/02)
Irradiation Equipment and Services	$ 100.0	$ 53.0
Other Activities and Services		
Employee Personal Protection		$ 29.0
On-Site First Response Environmental Testing		$ 24.0
Nationwide Mailing and Communications		$ 15.0
Site Clean-Up		$ 45.0
Medical Costs		$ 9.0
Sum of Other Activities and Services	$ 75.0	$ 122.0
Total	$ 175.0	$ 175.0

Near-Term Strategy

The Postal Service s near-term strategy is based on using available production (or near-production) technologies and processes to provide initial security capabilities. The Postal Service s implementation of these capabilities over the next year is intended to provide a level of protection and adequate time to allow subsequent investigation and validation of emerging technologies.

The first priority of our near-term activity is the continuation of equipment and facility decontamination at the Brentwood and Trenton facilities, and repair of the postal facilities damaged in New York City.

Our next priority is detection technologies, principally based on PCR technology, which will be used in conjunction with air sampling. Further operational testing of PCR equipment for use in postal environments will occur before full deployment in processing and distribution centers.

Protective and health-risk reduction technologies include the design and installation of filtration vacuum systems on processing equipment at 292 locations for initial induction operations. The first priority is the loose mail culling 010 systems, the Advanced Facer Canceler Systems (AFCS), followed by the outgoing Delivery Bar Code Sorters (DBCS) and the Automated Flats Sorting Machines (AFSM 100). This will provide for significant risk reduction to postal employees and greatly limit cross-contamination should a biohazard event occur in the future.

Intervention, in the form of e-beam irradiation, will continue for all mail being delivered to government offices within the 202 to 205 ZIP Codes. In addition, construction will begin on at least one, and potentially two facilities to house the eight e-beam accelerators purchased as one of the initial response actions. Once construction of these facilities is complete and the e-beam equipment is installed it will be available for continued intervention activities as well as decontamination of mail, should future bioterrorism attacks occur against the Postal Service.

Finally, research and development activities, pilot testing, and emergency response planning and training will continue.

The estimated cost for near-term activities is $587 million. (Reference Table 2)

Intermediate-Term Strategy

The Postal Service has identified an initial set of technologies that it will evaluate during the next 24 to 36 months. These technologies are intended to build on the baseline of technologies selected for near-term implementation. The Postal Service will both evaluate these intermediate-term technologies and pursue new technologies that have potential benefits. The Postal Service will establish an on-going team that will be specifically tasked with identifying, evaluating, and developing technologies during this time period.

Technology-based activities under prevention will be focused on minimizing the anonymous mailer threat at collection boxes and retail outlets. Manufactured mail security and vehicle access control will be strengthened.

Protection and health-risk reduction activities will continue efforts to install vacuum filtration systems on mail-processing equipment, including the remaining DBCS and Carrier Sequence Bar Code Sorters (CSBCS). It will also investigate the feasibility of adding high-efficiency filtration and sanitization technologies to postal facility HVAC systems.

Under Detection, the use of mass spectrometry as both a triggering and confirmation technology for biohazards will be explored with the expectation that it could complement PCR.

Investigation will deal with a series of process-based activities aimed at both deterring and identifying terrorists.

The estimated cost for intermediate-term activities is at $1.7˚billion ($800 million in FY-03, $897.5 million in FY-04), as shown in Table˚2.

Long-Term Strategy

The Postal Service s long-term strategy is focused on technology deployment and process changes based on the research and development activities and pilot tests conducted during both near-term and intermediate-term phases. This continued development activity could result in further maturing technologies that could be deployed in the 4 to 5 year time frame.

The long-term strategy must reflect the dynamic nature of this plan. Updates will include an ongoing evaluation of threats. Threat assessment must consider an ever-changing array of biohazards that may be placed in a form suitable to pose a threat in the mail. In addition, assessment must evaluate the threat of explosives, chemical agents and radioactive material.

Periodic updates will reflect the further maturation of a variety of technologies under consideration. It will also be necessary to continue to investigate new technologies that may offer viable solutions. Reference Table 2 for long-term cost estimates for planning purposes.

Table 2 Ongoing and Proposed Initiatives Costs

		Costs (in $M)			
		Near-Term	Intermediate-Term		Long-Term
		Current Year (Thru 9/02)	Year 2 (FY-03)	Year 3 (FY-04	Year 4-5 (FY-05 / 06)
Current On-Going Activities					
	Decontamination				
	Building Decontamination	$ 35.0			
	Intervention and Sanitization				
	Mail Irradiation Facilities #				1 - 2.25 B
	Current On-Going Activities Total	$ 35.0			1 - 2.25 B
Proposed Initiatives					
	Detection and Identification				
	Polymerase Chain Reaction (PCR) ##	$ 200.0			
	Protection and Health Risk Reduction				
	Filtration on 010	$ 60.0			
	Filtration on AFCS	$ 55.0			
	Filtration on AFSM 100	$ 50.0			
	Filtration on DBCS (Out-Going) ***	$ 80.0			
	R&D / Pilot	$ 9.0			
	Emergency Response Plan	$ 0.5			
	Facility Repair				
	Repair	$ 10.5			
Current On-Going & Proposed Initiatives Sub-Total		$ 500.0		**$ -**	
Supplemental Funding Requirements					
	Filtration on DBCS (Outgoing)***	$ 11.0			
	Prototype and Testing	$ 10.0			
	Detection and Identification				
	Triggers ##		$ 60.0	$ 40.0	
	Facility Air Monitoring ##		$ 120.0	$ 80.0	
	Protection and Health Risk Reduction				
	Filtration on DBCS	$ 50.0	$ 120.0		
	Filtration on CSBCS		$ 44.8	$ 30.0	
	HVAC *	$ 6.0	$ 120.0		
	Prevention				
	Collection Box & Drop Slots **	$ 10.0	$ 50.0	$ 292.0	
	Retail Outlet **		$ 150.0	$ 100.0	
	Manufactured Mail Security			**	
	Vehicle Access Control Security		$ 135.0		
	Investigation				
	Image Capture			$ 20	
	Image Profiling			$ 56	
	Handwriting Analysis			$ 56	
	Wide Field of View Image Camera			$ 4	
	Mail-Piece Tracking and Tracing			$ 210	
	Positive Product Tracking			$ 9.5	$ 111.0
	Proposed Initiatives Total	$ 587.0	$ 799.8	$ 897.5	1 - 2.4 B

* Funding for study, further funding is dependent on outcome of the study.
** Options and costs pending further analysis.
*** Limited quantity without Supplemental Funding
\# Potential costs if intervention systems deployed nationwide.
\## Either PCR and triggers, or Mass Spectrometer will be pursued. (Note, only one of the potential triggers will be used in fielded systems.)

Note: These estimates are for planning purposes only. Funding will be prioritized to account for any necessary changes.

Summary

We are proceeding on the basis of the Inspection Service assessment that the inappropriate use of the mails is a continuing threat. Potentially, the mail can be used to transmit a variety of threatening materials, including biohazards.

This plan provides for the process changes and technology applications necessary to ensure the enhanced safety of both postal employees and postal customers. The emphasis is placed upon prevention, detection, and risk reduction at the earliest point feasible in our distribution network.

The applications utilized in both prevention and detection rely upon mature or near-mature technology. In the case of PCR, piloting and testing is moving forward at a pace that will allow for its near-term deployment. The use of this type of proven technology provides for a systems approach with effective and reliable results.

This plan makes optimal use of the appropriated funds. The combination of process change and an array of technology applications across prevention, detection, and risk reduction provide maximum protection for employees and customers.

Preface

The Department of Defense Appropriations for the fiscal year ending September 30, 2002, HR 3338, authorized $500 million funding to protect postal employees and postal customers from exposure to biohazardous material, to sanitize and screen the mail, and to replace or repair Postal Service facilities destroyed or damaged in New York City as a result of the September 11, 2001, terrorist attacks. (Enacted as Public Law 107-117, signed January 10, 2002.)

In the Joint Explanatory Statement accompanying the bill, the conferees stated they are pleased with the current actions and progress made by the Postal Service to date. Additionally:

> The conferees further believe that additional actions taken by the Postal Service should be based on a comprehensive emergency preparedness plan.
>
> As part of its emergency preparedness plan, the conferees expect the Postal Service to include an assessment of threats to the health and safety of employees and customers of the Postal Service and the integrity of the mail; testing and evaluating the options for detecting and/or addressing those threats, including both technology-based and process-based options; a comparison of the costs and benefits of options under consideration; an evaluation of the strengths and weaknesses of the technologies under consideration for mail sanitization, including an analysis of risks to human health and safety and to mail products associated with each of those technologies; and a timetable for implementing the options selected.

This document contains the U. S. Postal Service (USPS) Emergency Preparedness Plan as defined by the bill focusing on the technology-based and process-based initiatives that together establish multiple layers of protection against the use of the mail as a tool of terrorism and that protect Postal employees and customers from exposure to biohazardous material while maintaining the current level of service to the American public.

Section One

Introduction

1.1 History

On September 11, 2001, the terrorist attack on the World Trade Center in New York damaged two postal facilities. In October 2001, an individual or a group of individuals used the U.S. Mail to send anthrax to organizations and individuals in the United States, harming both employees and customers 5 people died, and 18 became ill. Two postal facilities have been temporarily closed, the Brentwood Facility in Washington, D.C., and the Hamilton Township Facility in New Jersey. Numerous facilities had to be tested for the presence of anthrax, and many had to be cleaned. Hundreds of Postal Employees were tested for exposure to anthrax, and many more were put on a regimen of antibiotics for prophylactic purposes.

Unlike the large-scale biologic attack predicted by experts that could kill thousands, if not hundreds of thousands, this attack was small and carefully targeted. Biologic weapons of mass destruction were feared as part of an asymmetric strategy on the part of less powerful state or non-state actors.[5] This attack has demonstrated the asymmetric value of placing a biologic agent into a nationwide distribution network. Not only is the relative power of the attacker small, it also means that a small-scale, carefully targeted attack can cause reactions far beyond the actual threat.

It was correctly predicted that an NBC [Nuclear, Biological, or Chemical] attack against a civilian population would, in all likelihood, trigger a panic far in excess of the real effects of the weapons. [6] This panic was magnified by the use of the nations most extensive logistics network the U.S. Mail. The U.S. Postal Service delivers 680 million pieces of mail per day to virtually every household and business in the United States. Compromising this system has the potential to impact an entire nation in one simple terrorist act.

The Postal Inspection Service has provided the Postal Service with a threat assessment as a basis for this plan. The Postal Inspection Service maintains a continuous liaison with all appropriate federal law enforcement and monitors threats to the nation and its mail. (The threat assessment is not a public document, due to security concerns.) The threat assessment states, in part, the sheer size and presence of the Postal Service makes it vulnerable to be a target of terrorism or to be used as a vehicle to carryout terrorist activities. The Postal Service is not immune to the possibility of being a terrorism target again and we believe the threat level increased with the media publicity surrounding the delivery of the anthrax laden letters to the Senate. The threat assessment concludes, Accordingly, the Postal Service believes, and is acting on the assumption that the threat for the inappropriate use of the mails continues.

The greatest opportunities to limit the damage of covert NBC attacks, or prevent them entirely, exist during the first phases of the incident. [7] This report emphasizes just such an approach. It places a premium on threat identification combined with protection to both employees and customers of the Postal Service at the earliest feasible point in our distribution system.

There is an unavoidable tradeoff between maintaining the values and strengths of a free nation and taking certain steps that could significantly increase the odds of gaining advance detection of a terrorist or covert NBC attack. [8] We have considered several different process and technology

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changes to reduce the volume of high-risk mail from anonymous senders. However a cornerstone of the service we provide our nation is an open and accessible system. While we can take steps to reduce the volume, we cannot eliminate it. A closed and restricted system for the acceptance of all mail is inconsistent with a viable U.S. Postal Service.

The safety of our employees and customers, the security of the mail, and the confidence in the Postal Service by the American public were challenged by the events of last fall. The day-to-day operations of the postal system were disrupted, and the negative financial impact on the Postal Service and on United States economic activity was significant. We cannot assume that these attacks were isolated and will never be repeated. Rather, we must assume our vulnerability is known and take the appropriate steps to reduce risk.

1.2 Initial Response to Anthrax Contamination

The initial response of the Postal Service to these events included employee protection (testing, treatment, education, communications, and protective wear), building and equipment testing, building and equipment decontamination, and mail decontamination. These actions were taken after consultation with Postal employee union representatives, the Office of Homeland Security, the Centers for Disease Control and Prevention, the Federal Occupational Safety and Health Administration, the Environmental Protection Agency, the Office of Science and Technology Policy, the National Academy of Science, and other scientific, health, and safety organizations, both public and private.

1.2.1 Establish Employee Personal Protection Program

Gloves, masks, and other protective gear were purchased and provided to all employees as soon as the need was recognized. High-Efficiency Particulate Air (HEPA) filtering vacuums were obtained for custodial and maintenance cleaning.

1.2.2 Provide Medical Support and Cover Medical Costs

As the impact of the anthrax contamination became more apparent, a formal proactive employee-, building-, and equipment-testing program was instituted. When completed, 8,424 employees were offered antibiotics for prophylactic purposes.

1.2.3 Perform On-Site First Response/Environmental Testing

In order to determine the condition of sites of possible contamination, and to evaluate specific downstream sites and random sites throughout the country, test equipment, systems, and contract services were obtained. When testing was completed in late November 2001, 284˚facilities were tested, with 23 positive and 261 negative results.

1.2.4 Perform Site Cleanup

Where localized building or equipment contamination was found, protective safety and health measures were undertaken and decontamination activities were performed.

At two locations Washington, DC, and Trenton, NJ contamination was found throughout the Processing and Distribution Centers; consequently, the facilities have been shut down completely, and clean up has begun.

1.2.5 Obtain Irradiation Equipment and Decontaminate Mail

Mail from the Brentwood and the Trenton facility was immediately quarantined. Arrangements were made with two commercial organizations to assist in sanitization of this mail through the use of electron-beam (e-beam) irradiation.

1.2.6 Create Nationwide Mailing, Messaging, and Communication Program

Direct mailings, special internal messages, and stand-up talks were undertaken with postal employees. A national mailing to all customers took place. There were daily news briefings, and the Postal Service Web page was continuously updated to keep employees, customers, and the American public fully informed.

At the time of this writing, employee testing and treatment and building and equipment testing are largely complete. Except for Brentwood and Trenton, building and equipment decontamination has been completed. (Planning is in process for decontaminating these two facilities.) Most First Class Mail from Brentwood and Trenton has been decontaminated. (Larger items are still quarantined awaiting availability of X-ray—capable irradiation systems.) As a precautionary measure, mail sanitization for selected destinations is currently an ongoing activity.

1.3 Current Actions

Throughout this period, Postal Service senior management, union leaders, stakeholders, and representatives of the White House, Senate, House, and other governmental agencies met regularly. These discussions focused on the appropriate response to these incidents; the impact of these incidents on the Postal Service, its customers, and its stakeholders; and the economic effect on the Postal Service. The General Accounting Office (GAO) sponsored a conference on Options to Enhance Mail Security and Postal Operations, which was held December 10, 2001. Participants included representatives from Congress, the Postal Service, and many of the stakeholders (major mailers, mailer associations, postal equipment manufacturers, postal unions, management associations, and various federal agencies).

1.4 Background

A brief description of the USPS mail system follows to assist the reader s understanding of the Emergency Preparedness Plan. A more detailed view of the postal system is presented in Appendix A.

The mail system is primarily dedicated to the collection, distribution, and delivery of hard-copy mail items. These items are primarily letters, flats (larger than letters, yet shaped similarly, such as catalogs and periodicals), and parcels. These vary in sizes and shapes and include items as diverse as bills, payments, greeting cards, magazines, books, advertising materials, boxes, bags, and even mufflers and tailpipes. The Postal Service handled more than 210 billion pieces of mail in FY2001 — nearly 680 million pieces daily.

Mail enters the system in numerous ways. There are more than 350,000 collection boxes, and nearly 40,000 Post Office lobby drops located throughout the country. Postal employees gather mail from these collection boxes on a daily basis. There are over 38,000 post offices, stations, and branches that function as retail outlets. These outlets include small country post offices, suburban post offices, major metropolitan processing centers, and postal outlets in local stores, shopping centers, and malls. At these locations, mail entry may occur over-the-counter or through retail slots. Mail may also be entered into the system at the point of delivery in 136 million locations the mailbox on the street in front of an individual s house. This is considered anonymous mail because at this point the Postal Service cannot effectively associate the mail with the mailer.

Commercial mailers, as compared to the individual consumer, use the mail as a tool of commerce to buy, sell, and transact business. This mail consists primarily of bills and statements, advertising mail, and periodicals. This comprises over 60 percent of the total volume of mail processed by the Postal Service. Most of this mail enters the mail stream in bulk quantities at entry points called Business Mail Entry Units that are dedicated to this business.

Many private commercial organizations provide their own mail entry points for their customers, and subsequently enter it into the postal mail stream. These include private mail systems, and commercial mail retail establishments that cater to the general public.

The Postal Service has nearly 300 processing and distribution centers that handle outgoing mail. At these centers, mail is processed and distributed from its origin to its final destination using computer-controlled electro-mechanical sorting equipment and computer data processing systems. A vast transportation network, using trucks, planes and trains moves the mail between these centers.

Once mail reaches its final destination-processing center, it is sorted and distributed directly to large volume customers, Post Office Box sections for customer pickup, or to letter carriers for delivery to the final customer, ranging from large and small businesses, governmental agencies, small offices, and home offices to private homes throughout the nation.

It is in this context that we must consider the complexity of the initiatives that must be undertaken to protect the mail system from bioterror.

Section Two

Assumptions, Methodology, and Approach

2.1 Assumptions

This Emergency Preparedness Plan addresses the requirements of the House-Senate Conference bill, with the overriding goal of protecting postal employees and postal customers from exposure to biohazardous material and to safeguard the mail system from future bioterror attacks with no reduction in service to the American public.

To achieve this goal, four strategic objectives are being pursued.

Detect biohazardous materials introduced into the mail stream as soon as possible.

Contain biohazardous materials introduced into the mail stream as soon as possible.

Neutralize biohazardous agents found in the mail stream.

Deter against the use of the mail as a tool for bioterrorist acts.

This will be accomplished by taking action on six core technology-based and process-based initiatives:

Prevention—Reduce the risk that someone could use the mail as a tool of terror.

Protection and Health-Risk Reduction—Reduce risk of exposure to biohazards, and prevent cross-contamination of mail if biohazards should be introduced into the mail system.

Detection and Identification—Detect and identify potential hazardous materials as early as possible in the mail stream.

Intervention—As a precaution, neutralize potential contaminants in the mail.

Decontamination—Eliminate known contaminants, both in the mail and in equipment and facilities.

Investigation—Enhance criminal investigative infrastructure to enable more effective forensic analysis.

Consistent with the conclusions of the GAO-sponsored conference of December 10, 2001, the Postal Service has determined that no single initiative will eliminate risk completely. Instead, the Postal Service must create several layers of defense against using the mail as a tool of terrorism.

To ensure the greatest level of protection, the Postal Service is planning to use a multi-layered approach. It includes initiatives to prevent the introduction of biohazards into the mail system, actions to deter potential terrorists from using the mail, technologies to detect the presence of biological agents, tools and methods to reduce the health risk to employees and customers, processes to neutralize biohazardous contaminants, and investigative tools to enable a quick response to terrorist acts.

2.2 The Framework for the Analysis

According to the Postal Inspection Service, there are four classes of agents that could use the postal mail system as a carrier to threaten life and economic activity in the United States: biological, chemical, explosive, and radiological. In accordance with the requirements of P.L. 107-117, this plan addresses methods and technologies primarily directed at the class of biological agents. The initiatives discussed will provide an underlying infrastructure upon which the Postal Service will build initiatives capable of addressing chemical and radiological threats. The Postal Service already has an extensive prevention and response plan for explosives in the mail.

2.3 Methodology

Several teams of Postal executives, managers, and functional area experts have been investigating and evaluating strategies and exploring support technologies. Representatives from all relevant functional areas participated in these sessions. They have solicited input from government, military, industry, and mailer groups. Lab and field tests have been performed whenever possible. In many instances, ongoing reviews and evaluations are currently under way.

Additionally, a Mail Security Task Force was formed immediately by the Postmaster General, CEO, John E. Potter. The ongoing Task Force is headed by Kenneth Weaver, Chief, Inspection Service, USPS.

Dr. John Marburger of the Office of Science and Technology Policy hosted a number of meetings. Dr. Marburger was instrumental in bringing the scientific community together to resolve this new and complex set of challenges. At these interagency and vendor meetings and subgroups, a great many proposed technologies were reviewed and evaluated.

A one-day conference was held at the National Academy of Sciences on November 14, 2001 to evaluate and assess various technologies for decontaminating mail. At this conference, the scientific community concluded that e-beam irradiation is the only valid technology meeting USPS needs at this time.

A GAO-sponsored session, Options to Improve Mail Security and Postal Operations, held on December 10, 2001, provided a forum for an exchange of ideas among Postal, governmental, industry, and mailer groups.

The Postal Service continues with ongoing collaborative research and development (R&D) and evaluation efforts with the Department of Defense and the Armed Forces Radio-Biological Research Institute.

2.4 Approach

The Mail Security Task Force established a focal point for developing a comprehensive plan. This task force investigated both technology-based and process-based initiatives. The seven subgroups are Safety and Security in the Workplace, Mailroom Security, Contingency Planning System-Wide, Mail Screening, Mail Preparation, Communicating and Messaging, and Mail Transportation Security.

The Postal Service looked at a variety of process changes and technology initiatives that could be applied to the threat of biohazards in the mail. Careful review and consideration was given to all processes and technologies in this report. The paramount conclusion is that no single solution exists to solve the problem. It is important to note that no solution or even series of solutions can totally eliminate the threat.

The conclusions and the implementation plan in this report reflect the need to put in place process changes and technology applications that can reasonably reduce risk. The objective is to reduce risk for both employees and customers of the Postal Service, while at the same time maintaining current service levels.

The viability of the Postal Service and its value to the American people are dependent upon an open and accessible system. Extreme procedural changes could reduce threats, but they would also significantly damage the financial position of the Postal Service. The procedural changes included in this report reflect the balance between enhanced security and the ability of customers to do business with the Postal Service.

The technology assessment in this report considered several risk factors. First, what is the state of development of the technology? In many cases, there are very interesting developments under way that remain several years from full production capability. Second, to what extent can the technology be integrated into the Postal Service operating system? Heavy emphasis was placed on the ability to maintain current service levels. Third, what is the cost of the technology? There are several approaches that simply do not provide a sufficient level of risk reduction to justify their cost. Finally, it is necessary to determine what the levels of risk reduction are. Proposals vary as to the level of protection provided and the point at which they should be deployed in our system.

We concluded that there was a need to focus our efforts on a combination of procedural changes and technologies that are at or near production. However, while we continue to evaluate these system-wide applications, our first priority will be to clean, decontaminate, and reopen the Brentwood and Trenton facilities. This work was begun as part of our initial response and will continue during this next phase.

At the initial operation, system-wide detection technology in processing facilities for mail picked up at collection boxes, residences, and small businesses is focused on the mail with the greatest risk. This technology, combined with enhanced security procedures for our bulk quantity mailers, provides significant risk reduction as mail enters our distribution system.

In order to provide another layer of protection, we will install a vacuuming and filtration system on many of our automated sorting machines. In controlled laboratory tests, we were able to replicate the anthrax dispersion events that took place in Trenton and Brentwood. We now have a clear understanding of how a powderized biohazard escapes from the mail.

Based upon this knowledge, we worked with the manufacturers of our processing equipment to design and build the vacuum/filtration systems. These systems are capable of capturing and trapping most of a biohazard as it escapes from the mail. The result is reduced risk to the postal employees operating this equipment and in turn reduction in cross-contamination that can ultimately affect our customers.

We will continue to work with the manufacturers of irradiation technology. This technology remains the only scientifically accepted means of decontaminating mail exposed to biohazards. The electronic beam (e-beam) systems we purchased will be deployed in a configuration that is optimized for mail. This will allow us to accurately evaluate the operational impacts, costs, and effects on the mail and its contents. The results of this evaluation, combined with the effectiveness of the technologies described above, will dictate the appropriate next steps for irradiation technology. In addition, we continue to work with manufacturers of alternative technologies to determine whether they could be used to decontaminate mail.

Beyond these first steps, we will continue to work with the manufacturers of several different technologies. Additional testing and prototyping is necessary to fully determine their viability. Key areas of focus are (1) redesign of collection box for both risk reduction and detection, (2)˚technology and procedures to reduce the volume of anonymous mail, (3) further deployment of vacuum/filtration technology on automated sorting equipment, (4) use of mass spectrometry for detection, and (5) a variety of technologies to help investigators identify the individual(s) who committed this act, as well as to deter further attempts at placing biohazards in the mail.

This plan is dynamic. We will work with the Inspection Service to periodically update the threat assessment. At the same time, we will continue to evaluate a variety of technologies as they reach maturity. We also are committed to working with research and development efforts as new approaches are developed to address this problem.

2.5 Results

The Postal Service used the many ideas and possible approaches gathered through these forums and investigations to put together the optimum mix of methods and technologies to reduce the probability of using the mail as a tool for biologic attacks, to minimize the health risk of any future attack if there were to be one, and to be prepared with a quick response strategy to contain any negative side effects. The Postal Service used Mitretek Systems to finalize, review, and evaluate the plan for completeness and efficacy. Mitretek, a nonprofit research and development corporation supporting federal government agencies, has extensive experience with chemical and biological materials, as well as with Postal Service operations.

This plan provides for both the process changes and technology applications necessary to ensure the enhanced safety of both postal employees and postal customers. The emphasis is placed on prevention, detection, and risk reduction at the earliest point feasible in our distribution network. The combination of process change and an array of technology applications across prevention, detection, and risk reduction provides maximum protection for employees and customers.

Section Three

Survey of Available Strategies and Technologies to Meet Biologic Threats

There are six initiatives where specific actions may be taken to reduce the risk of introducing biohazards into the mail stream or to mitigate the potential effects of such an event: prevention, protection and health-risk reduction, detection and identification (of biohazards), intervention (and sanitization), decontamination (mail, equipment, and facilities), and investigation (support for criminal prosecutions).

This section presents a brief overview of the major process-based and technology-based projects that were proposed and initially evaluated for the six initiatives. (Detailed information regarding these projects is provided in the appendices.)

3.1 Prevention

At Entry Points

On the Streets Reduce risk of exposure through collection box redesign, detection, containment and decontamination; and enable mail tracking at the batch level to the collection box.

At the Retail Outlet Reduce anonymous mailing by associating individual retail transactions with uniquely identified postal products; reduce the risk of exposure through detection, containment, and decontamination.

At Business Entry Points Reduce risk by implementing security standards at commercial mailers facilities.

Via Access Control

Enhance security at truck entrances at postal facilities.

3.2 Protection and Health-Risk Reduction

Protect employees from exposure through improved housekeeping procedures, use of protective wear, use of filtered vacuum systems, integrated filtered vacuum systems on mail processing equipment, and upgraded air-handling and heating, ventilation, and air-conditioning (HVAC) filtering systems.

3.3 Detection and Identification

Triggering

Provide continuous, unattended monitoring, with rapid reporting of the existence of potential threats.

Confirmation

Positively verify the presence of biohazardous agents.

3.4 Intervention—Precautionary

Mail Sanitization

Eliminate risk of exposure by destroying microbial organisms that may be present in the mail.

3.5 Decontamination

Mail Decontamination

Eliminate risk of exposure by destroying microbial organisms known to have contaminated the mail.

Facility and Equipment Decontamination

Eliminate risk of exposure by destroying microbial organisms known to have contaminated facilities and equipment.

3.6 Investigation

Deter use of mail as a tool of terror by increasing effectiveness of forensic investigation through image capture and analysis, mailpiece tracking and tracing, and positive product tracking.

3.7 Technologies and Processes Under Considerations

The specific technologies and processes considered and investigated by the Postal Service are presented and briefly described below. Detailed information on these technologies and processes may be found in the appendices.

3.7.1 Prevention

At Entry Points

On the Streets

Name	Description
Collection Box Containment	Redesign collection box to contain mail in a separate box or containment bag.
Detection	Use biohazard detection strips in collection box.
Decontamination	As a precaution, use sealed polyethylene bags in collection boxes and a decontaminating agent.
Tracking	Modify existing system to track unit loads in collection boxes using Delivery Confirmation scanner.

At the Retail Outlet

Name	Description
Transaction Recording	Integrate retail and video systems by using unique identifying product codes to match customers with purchases and mailing.
Intelligent Mail	Use information currently on, or placed on, a mailpiece to identify sender, intended recipient, and process location.
Drop Box Pathogen Detection	Use detection devices inside USPS facilities to detect biological hazards in collection mail drop slots.

At Bulk Entry Points

Name	Description
Security Process for Commercial Mailers	Expand security procedures and standards to ensure safety of manufactured mail.

Via Access Control

Name	Description
Access Control of Vehicles and Individuals at Truck Entrances of Postal Facilities	Use access control devices at truck/business entrances.

3.7.2 Protection and Health-Risk Reduction

Name	Description
Permanent Vacuum Filtration Systems on Processing Equipment	Install permanent vacuum (ventilation) systems on mail-processing equipment to automatically and continuously vacuum, and to extract and capture particulate matter.
Filtration Systems in HVAC	Upgrade the efficiency of filter media used in ordinary HVAC systems. Consider ultraviolet light, ultrasonics, or anti-microbials.
High-Efficiency Particulate Air (HEPA) Cleaning Systems	Use filtered vacuums to clean mail-processing equipment or building surfaces.
Custodial Cleaning	Use rider and walk-behind power scrubbers, for use with chlorine bleach.
Protective Wear	Equip workers with protective gloves and masks and provide training on how to use these items.

3.7.3 Detection and Identification

Triggering

Name	Description
Particle Counter	Continuously collect air from a specified point in the mail stream where a biohazardous plume is most likely to occur. Compare the profile of the size and amount of particulate with known biohazards.
Particulate Shape Analyzer	Measure shape and size of every particle in the 2-20˚micron range from the air continuously collected from a specified point in the mail stream. Compare to profiles of known biohazardous agents.
Laser Discriminator	Collect particles amassed from a continuous air stream within a defined size range; fluoresce with laser to determine whether signature matches biohazardous material signatures.

Confirmation

Name	Description
Biological Indicator Strip	Use strip(s) with indicator agent(s) that react(s) to compounds found in the biothreat.
Immunoassay Test Strip	Introduce liquid sample of target substance onto a test strip. Strip indicates the positive presence of a biohazard.
Polymerase Chain Reaction (PCR)	Introduce liquid sample into a self-contained cartridge that determines presence of a biohazard.
Mass Spectrometer	Use electric and magnetic fields to precisely measure the mass of the charged particles. Match mass spectrum of a sample against a library of known substances.

3.7.4 Intervention

Mail Sanitization

Name	Description
Irradiation—Ionizing Radiation Electron Beam X Ray Gamma Ray	Irradiate mail with electrons, X-rays, or gamma rays to break chemical bonds and damage deoxyribonucleic acid (DNA) of bacteria. The bacteria s ability to reproduce and spread infection is destroyed.
Irradiation—Non-ionizing Radiation Ultraviolet (UV) Light	Use UV radiation to kill microorganisms by damaging DNA resulting in cell death.
Microwave	Use microwave radiation to heat and kill microorganisms.
Gas Plasmas	Use plasma generators to produce high-temperature, reactive material. Technology limited to facility/equipment decontamination; not a viable option for mail.
Ultra-High-Pressure (UHP) Sterilization	Use UHP to inactivate microorganisms by physically changing protein and nucleic acid structure.
Gaseous Treatment Chlorine Dioxide Ethylene Oxide Methyl Bromide Ozone	Use gases with anti-microbial properties to kill potential biohazardous materials.

3.7.5 Decontamination

Mail Decontamination

Name	Description
Irradiation—Ionizing Radiation Electron Beam X Ray Gamma Ray	Irradiate mail with electrons, X-rays, or gamma rays to break chemical bonds and damage DNA of bacteria. The bacteria s ability to reproduce and spread infection is destroyed.

Mail Decontamination (Continued)

Name	Description
Irradiation—Non-ionizing Radiation Ultraviolet (UV) Light	Use UV radiation to kill microorganisms by damaging DNA, resulting in cell death.
Microwave	Use microwave radiation to heat and kill microorganisms.
Gas Plasmas	Use plasma generators to produce high-temperature, reactive material. Technology limited to facility/equipment decontamination; not a viable option for mail.
Ultra-High-Pressure (UHP) Sterilization	Use UHP to inactivate microorganisms by physically changing protein and nucleic acid structure.
Gaseous Treatment Chlorine Dioxide Ethylene Oxide Methyl Bromide Ozone	Use gases with anti-microbial properties to kill potential biohazardous materials

Facility and Equipment Decontamination

Name	Description
Gaseous Treatment Chlorine Dioxide Ethylene Oxide Methyl Bromide Ozone	Use gases with anti-microbial properties to kill biohazardous materials.
Paraformaldehyde powder	Use fumigant to permeate space and kill viable microbial forms of life.

3.7.6 Investigation

Image Capture and Analysis

Name	Description
Image Capture and Analysis	Collect, save, and analyze images captured by existing mail recognition equipment.
Wide Field of View (WFOV) Image Capture	Install WFOV cameras to capture complete mail images for recognition processes.
Mailpiece Tracking and Tracing	Print additional tracking information on mail by using two-dimensional bar codes applied to mailpieces. Use WFOV cameras to read the additional information.
Positive Product Tracking	Uniquely identify and track all retail mail and mail products presented at USPS retail outlets.

Section Four

Analysis

4.1 Scope and Approach

The scope of this analysis encompasses the technologies and methods identified in Section 3, as applied in six core initiatives (see Section 2.1). The information supporting this analysis is found in Appendices B through G and reflects the efforts of the Postal Service teams and task forces identified in Section˚2.

The approach to this analysis is to first conduct a qualitative assessment of programmatic risk based upon technical, operational, and cost risk factors for individual technologies and processes. For applications where multiple candidate technologies have been proposed, the technologies are ranked against each other based on their relative risk. Technologies and methods found to have acceptable risk levels are then evaluated on their abilities to implement the overall Postal Service strategy articulated in Section Two and the plan described in Section Six.

4.2 Qualitative Risk Assessment

The purpose of the qualitative risk assessments is to assess the viability of the candidate technologies to determine if they should be included within a core initiative within the postal environment. These core initiatives are Prevention, Protection and Health-Risk Reduction, Detection and Identification, Intervention, Decontamination, and Investigation (see Section 2.1 for further details). The viability of a technology is assessed in terms of the technical, operational, and cost risk associated with a proposed application.

Technical risk includes consideration of the following factors:

Maturity in terms of current commercial availability or development status (e.g., concept development, prototype)

Effectiveness in comparable applications and environments

Dependence upon supporting technologies

Operational risk is closely allied to technical risk and includes consideration of the following factors:

Training and support requirements

Impact on postal workflows

Regulatory (e.g., environmental) considerations

Acceptance in the workplace

Cost risk factors include the following:

Confidence in the accuracy and precision of direct and life-cycle cost estimates (low risk implies high confidence in the quality of the cost estimate, *not* that the actual cost is low).

The magnitude of the application cost relative to the benefit of spending additional dollars in another area.

Table 4-1 maps these risk factors to specific topic areas discussed in the following analysis and detailed in the appendices. It also documents the relationship between the risk analysis and the determination of each application s viability.

This analysis is a qualitative risk assessment based on currently available information. The information for each technology or process change was evaluated to determine an ordinal scale risk value for each risk factor considered. These ordinal scale values are presented below:

Low Risk Few if any obstacles have been identified other than standard deployment issues, and none are considered to be serious.

Moderate Risk Some obstacles are present and known, but none are considered serious enough to jeopardize deployment. Further development and testing are required.

High Risk One or more obstacles exist that either require significant effort to address or have a high degree of uncertainty pertaining to cost or operational impacts.

Unacceptable Risk This technology is not considered a viable option due to one or more significant hazards.

The values for applicable risk factors are combined to form a risk-scale value (Low, Moderate, High) for each of the three risk areas (Technical, Operational, and Cost). Professional judgment is used to determine the overall risk-scale values. Where risk factors vary within a risk area, a risk-scale value range may be assigned (e.g., Low to Moderate Risk). Likewise, in the case where a risk-scale value of High is assigned to an important risk factor, an overall risk area value of High may be assigned.

As a final step, a determination of the viability of the technology is made based on the Technical Risk, Operational Risk, and Cost Risk values. Viability for a proposed Postal Service application will be assigned as follows:

Immediate already completed.

Near-Term Viability potentially deployable within 1 year, based on available information.

Intermediate-Term Viability potentially deployable within 2—3 years, based on available information.

Long-Term Viability potentially deployable within 4—5 years, based on available information.

Not Viable technology has one or more major drawbacks or insufficient information is available to make a valid judgment.

A summary of the resulting technology and process viability assessment is presented in Table˚4-1.

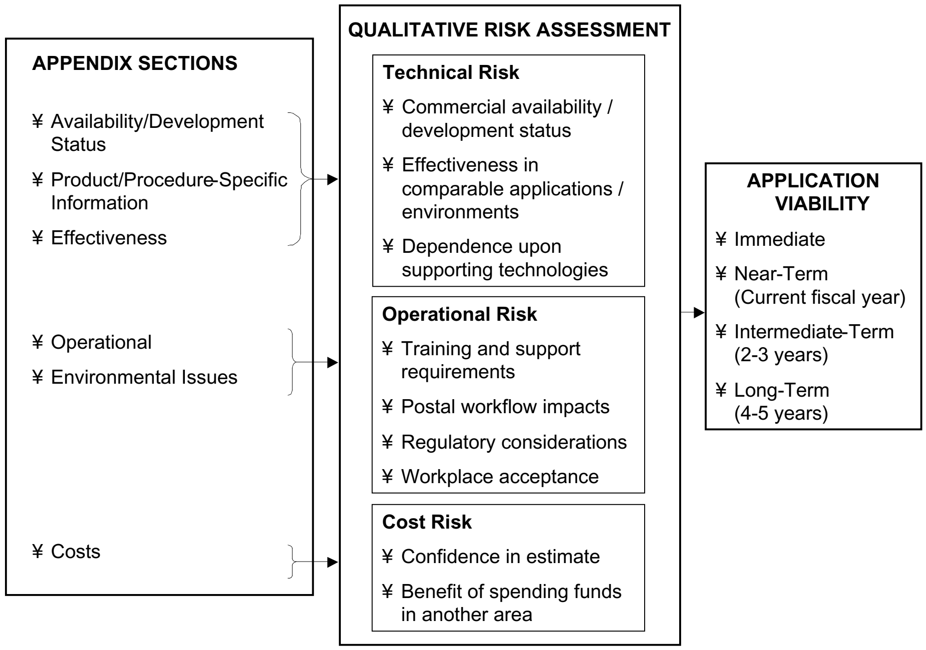

Figure 4-1. Risk Factor Map

Table 4-1. Summary of Technology and Process Viability

Initiative/Technology	Risk			Viability	Comments
	Technical	Operational	Cost		
Prevention					
• Collection Box: Redesign	Moderate-High	Low-Moderate	Moderate	Intermediate- to Long-Term	Requires development of an automated bag closing mechanism that will not interfere with customer mail deposit.
• Collection Box: Detection	Moderate	Moderate	Low	Intermediate-Term	Extensive testing required for the detection strips.
• Collection Box: Decontamination	Moderate	High	Moderate	Long-Term, possibly Not Viable	Possible leakage of decontaminate pose a threat to postal patrons and employees.
• Retail Security Initiative—Positive Product Tracking System	Low-Moderate	Moderate-High	Low	Intermediate-Term	Requires development of technology to provide near universal encoding of retail merchandise in an acceptable manner. Requires implementation in a large number of sites.
• Security Process for Commercial Mailers	Low	Moderate-High	Moderate	Near- to Intermediate-Term	Requires commercial mailers to implement and maintain security that is compliant with Postal Service standards.
• Access Control at Truck Entrances	Low	Low	Low	Near-Term	No issues.
Protection and Health-Risk Reduction					
• Filtration Vacuum Systems on Processing Equipment	Low	Low	Low	Intermediate-Term	Established technology, some design work required.
• HVAC System Filtration or Modification	Not Applicable	Not Applicable	Low	Immediate	Feasibility study only, prototyping may result based on study findings.
• HEPA Cleaning Systems	Low	Low	Not Applicable	Immediate	Vacuums have been purchased.
Detection					
• Biological Indicator Strip	Moderate	Low	Low	Near- to Intermediate-Term	This technology is just becoming available. These strips must be used in conjunction with a confirmation technology.
• Particle Counter	Moderate-High	Low-Moderate	Low-Moderate	Intermediate-Term	A high particulate background within the postal processing environment may affect this technology.
• Particulate Shape Analyzer	High	Low-Moderate	Low-Moderate	Intermediate-Term	A high particulate background within the postal processing environment may affect this technology.
• Laser Discriminator	High	High	High	Intermediate—Term	A high particulate background within the postal processing environment may affect this technology.
• Immunoassay Test Strip	High	Low	Low	Near- to Intermediate-Term	There may be insufficient sensitivity for some applications.
• Polymerase Chain Reaction (PCR)	Low-Moderate	Low	Low	Near- to Intermediate-Term	Established technology must be tested in an operational postal environment.
• Mass Spectrometer	Moderate-High	Low-Moderate	Moderate	Intermediate	A high particulate background within the postal processing environment may affect this technology.

Table 4-1. (Concluded)

Initiative/Technology	Risk			Viability	Comments
	Technical	Operational	Cost		
Intervention					
• Electron Beam	Low-Moderate	Low-Moderate	Low	Near- to Intermediate-Term	Currently in use for mail irradiation; continued studies on effects to mail and its contents
• X Ray	Moderate-High	Moderate	Not Applicable	Long-Term	Technology has not been demonstrated for high throughput.
• Gamma Ray	Moderate-High	Unacceptable	Not Applicable	Not Viable	Unacceptable due to introduction of radioactive materials into postal operations.
• Ultraviolet Light Irradiation	Unacceptable	Not Applicable	Not Applicable	Not Viable	Provides surface sterilization only.
• Microwave Irradiation	High	Low-Moderate	Insufficient Information	Not Viable	Provides non-uniform sterilization.
• Ultra-High-Pressure Sterilization	High	Insufficient information	Insufficient Information	Insufficient Information	This technology is not currently commercially available.
• Sterilization by Gaseous Treatment Methods	Unacceptable	Not Applicable	Not Applicable	Not Viable	Technologies have not demonstrated the ability to kill biohazards that may be present in an effectively sealed envelope.
Decontamination (Facility)					
• Chlorine Dioxide	Low	Low-Moderate	Low	Near-Term	Has been used in the Hart Senate Office Building.
• Ethylene Oxide	Moderate-High	Moderate-High	Insufficient Information	Intermediate- to Long-Term	Lack of previous use as a facility decontaminant.
• Methyl Bromide	Unacceptable	Not Applicable	Not Applicable	Not Viable	Lack of availability beyond 2006.
• Ozone	Moderate-High	Moderate-High	High	Not Viable	Not demonstrated to be effective, plus possible damage to postal equipment.
• Paraformaldehyde	Low-Moderate	High	Insufficient Information	Not Viable	Identified as a carcinogen.
Investigation					
• Image Capture and Analysis	Low — High	Low — Moderate	Low	Intermediate-Term	Risk varies by project phase.
• Wide Field of View Image Camera	Low	Low	Low	Near- to Intermediate-Term	Systems will need to read mail at a high rate of speed in order not to degrade workflow.
• Mailpiece Tracking and Tracing	Low	Low-Moderate	Low	Intermediate-Term	Depends upon successful implementation of the wide field of view camera.

4.2.1 Prevention

Four technologies/procedures that provide capabilities for preventing contaminated mail from entering the mail processing system have been identified for further evaluation:

Collection Box

Retail Security Initiative

Security Process for Larger Mailers

Access Control at Truck Entrances

Each technology/procedure provides a different facet in providing prevention protection in the Postal Service s mail processing environment. Each is a viable candidate that could prevent contamination of mail. Each candidate technology/procedure can be used independently of the other candidates and can also be used concurrently with other candidate technologies. Additional information on each of these technologies is included in Appendix B.

4.2.1.1 Collection Box

Description

The overall risk for this technology is moderate-high since the three enhancements listed below have not been developed, implemented, or tested in a Postal Service environment. This candidate technology comprises three potential enhancements to the collection box:

Redesign of the collection box to keep all of the mail dropped into the box in a single bag/tub or other container that can be closed before the mail is removed from the box.

Use of detection strips to detect contamination of mail while it is still isolated in a collection bag/tub or other container.

Decontaminating the mail while still in a sealed collection bag/tub or other container.

Some combination of these technologies could be implemented in collection boxes to prevent the introduction of contaminated mail into the mail-processing system. The risk for each sub-technology/procedure is evaluated below. The cumulative risk for collection box technologies has also been determined.

The impact of increased protection of the mail by reducing the number of collection boxes available to the public has been evaluated. The Postal Service has determined that reducing the number of collection boxes will have a minimal impact on preventing contaminated mail from entering the system. A terrorist intending to use the mail to spread biohazardous contaminants will find a collection box to use. However, the trade-off analysis indicates that reducing the number of collection boxes would have a negative impact on the level of service provided to Postal Service customers. Even a one-third reduction in the number of collection boxes on the street would result in a minimal reduction in the level of risk for biohazard contamination since two thirds of the boxes would still be available to a potential terrorist. However, that level of reduction in the number of street collection boxes would have a significant negative impact on customer convenience. Completely removing collection boxes from the street would totally undermine the economic viability of the Postal Service. Additional information about the impacts of reducing the number of collection boxes is included in Appendix H.

Technical Risk

No collection box is commercially available that meets the requirements of isolating hazardous materials yet allows the safe deposit of mail. The technical risk is in the development of an automated bag/tub closing mechanism that can be installed without interfering with the customer s ability to deposit mail in the collection box. It is dependent on mechanical technologies that could be modifications of existing mechanisms. Such a collection box would need to be designed and tested; the technical risk here is judged to be moderate to high.

The technical risk for collection-box detection is moderate at the time this evaluation was produced. The Postal Service has recently received samples of the detection strips that would be used for this solution and has not had the opportunity to complete testing and evaluation.

Decontamination bag technology has been developed and could be implemented within the Postal Service but only after extensive testing. The technical risk for this capability is judged to be moderate.

Operational Risk

Operational impacts deriving from the collection box re-design present low to moderate risk. A manual closing mechanism introduces an additional responsibility on the collector, and there will be an operational impact on the amount of time it takes the collector to collect the mail and install a new collection bag/tub.

An automated bag/tub closing capability would introduce additional operational risks, as the closing mechanism would require maintenance levels in excess of that required for current collection boxes, and is vulnerable to temperature extremes, moisture, and substances that may be introduced into the box. If the automated closing mechanism becomes inoperable when the collector attempts to collect the mail, the collector will be at increased risk.

The overall operational risk level of in-box detection is moderate but will require that adequate training initiatives for collection personnel be developed. The in-bag/tub (or other) technology would use a detection strip that is an integral part of the collection container. The operational risks are derived from (1)˚bag/tub handling by the mail collector and (2) storage and maintenance of the bags/tubs prior to installation in a collection box.

The operational risks for in-box decontamination are judged to be high. If the decontamination gases are included as part of the collection container, then there is a moderate to high possibility that the gases could escape from the collection box and threaten a customer. If the bags/tubs are returned to a delivery unit for decontamination, there is lower risk to the customer but potentially higher risk to employees. There are also regulatory risks and the risk of possible resistance from the employees working at the delivery unit.

Cost Risk

The cost risk for collection box redesign is moderate. The initial cost estimate for the redesign of collection boxes is $1,000 per box. Based on that initial estimate the projected cost for all collection boxes will be $352 million; however, since such boxes have not yet been developed, this projected cost is still just an estimate. Further, the large number of such boxes significantly magnifies the cost risk for this technology. Other technologies discussed in this report could provide equal or better protection for lower cost.

The overall cost risk for detection strips is low. The cost has been estimated at less than $1.00 for biological indicator strips. Bulk purchase of strips in the required quantities may lower the cost per strip.

The direct cost risk is moderate for collection box decontamination. Decontamination gases are available commercially although the Postal Service may need to have the gases generated at the decontamination site.

The cost for containment bags that include the decontamination gases is $0.50 per bag. The projected cost for collection boxes and drop slots using these bags is $61 million annually. This cost may not reflect the total cost of using this technology.

Viability

The viability of collection box redesign is Intermediate- to Long-Term. This effort must start at the conceptual stage and move through development.

The viability of collection box detection is Intermediate-Term. Available technologies require further testing and possible development.

The viability of collection box decontamination is Long-Term to Not Viable. The routine use of decontamination technology for all Postal Service collection boxes may not be feasible.

4.2.1.2 Retail Security Initiative

Description

The Retail Security Initiative is a combination of technologies that will enable the Postal Service to match retail merchandise with retail customers. The initiative will be accomplished with the development of a positive product system. This positive product tracking system would combine video images of customers with recorded time and date data, plus encoded data that identifies items purchased by the customer or delivered by the customer for mailing. All data will be collected and stored at the retail unit. If required, the data will be available to support subsequent investigations.

Technical Risk

The technical risk is low-moderate. The positive product system will be developed using existing POS ONE terminals and installed video technologies and equipment. An unknown risk factor, at this time, is the development of a technology to provide near-universal encoding of retail merchandise in a manner that is acceptable to the Postal Service s customers.

Operational Risk

The operational risk is moderate for the technology but high for actual implementation since there are a large number of facilities that do not have the required existing technologies. Therefore, the overall risk is moderate-high. For sites with existing technologies, the operational impacts will be minimal. Storage technologies required to support large quantities of video and identification data would be evaluated as part of the positive product tracking development effort. There will be minimal operational impacts on postal employees and on the workflow in the retail unit. Workplace acceptance is not expected to be an issue.

Cost Risk

The cost risk is low. The projected costs, $250 million, are significant because of the large number of retail units that must be upgraded. The average cost per site is under $17,000. The Postal Service can minimize the financial impacts with phased implementation of the initiative.

Viability

The retail security initiative is Intermediate-Term in viability because additional technology is necessary to complement existing low-risk technology.

4.2.1.3 Security Process for Commercial Mailers

Description

The Postal Service will work with commercial mailers to develop a set of security standards that the larger mailers can implement in their facilities. These security standards will provide the commercial mailers with security capabilities to reduce the risk that mail can be contaminated before it is delivered to the Postal Service. The Postal Service expects to receive mail from these commercial mailers that has been protected from possible tampering or contamination. When commercial mailers comply with Postal Service security standards, the Postal Service will consider that the mail is safe, e.g., it has not been exposed to possible contaminations. The Postal Service will accept and process this safe mail without submitting it for detection and possible decontamination processing.

Technical Risk

The technical risk is low. The security standards will be based on established procedures and the use of established security technologies. The security standards, when implemented, will effectively control access to mail before it is shipped to the Postal Service. Additionally, there are no technology dependencies. The primary issues that will have to be addressed are business impact and operational risks.

Operational Risk

There is a moderate-high level of operational risk since the commercial mailers may be reluctant to modify their in-house security operations. The Postal Service will be dependent on the commercial mailers to implement and maintain security that is compliant with jointly developed security standards. The commercial mailers will need to train their employees to comply with security standards. The security standards may impact the workflow at the commercial mailers facilities and may, therefore, become impediments that the commercial mailers must overcome. Operational problems at a commercial mailer s workplace puts the Postal Service at risk since the Postal Service must retain its customer base and still receive and process the customer s mail.

Cost Risk

The cost risk for the Postal Service is moderate. The cost to develop the security standards should be low since security standards would be based on existing standards (both USPS and other government agencies). The Postal Service will increase staff levels to monitor compliance by commercial mailers.

Viability

The viability of a security process for large mailers is Near- to Intermediate-Term. Although Technical and Cost risks are low, customer concerns elevate the operational risk to a moderate level.

4.2.1.4 Access Control at Truck Entrances

Description

The Postal Service will undertake an initiative to increase the security at its large mail-processing facilities. The objective of this effort is to increase controls on access to postal facilities through truck entrances. The Postal Service will accomplish this objective by upgrading and installing additional electronic and mechanical security features. The Postal Service will also install badge/card readers and will increase the number of personnel at the truck entrances.

Technical Risk

The technical risk is low. Security enhancements at facility entrances will use commercially available components that are widely used. The Postal Service plans to leverage efforts by government agencies and commercial organizations to achieve comprehensive security coverage with minimal costs.

Operational Risk

The operational risk is very low. There should be no impacts on workflow. The technologies are standard and should not produce regulatory concerns. Training and support requirements are minimal.

Cost Risk

The cost risk is low. The projected cost for equipment and systems development is $64 million. The average cost of $160,000 for each of the 400 sites is reasonable and consistent with the proposed technologies. The projected staff cost, $70 million, is reasonable when the intent is to fully staff facility entrances.

The benefits to the Postal Service are projected to be substantial. The Postal Service will protect its facilities and equipment and will provide employees with increased confidence that their workplace is safe.

Viability

The access control for vehicles at truck entrances is viable in the Near-Term through the use of readily available and mature technologies.

4.2.2 Protection and Health-Risk Reduction

Three technologies have been identified as potentially applicable for health-risk reduction in postal facility applications: (1) installation of filtration vacuuming systems on processing equipment, (2) installation of higher efficiency filtration systems or application of control technologies within HVAC systems, and (3) use of HEPA vacuuming systems for cleaning mail-processing equipment and building surfaces.

These are three distinct applications with one candidate technology for each application. A qualitative risk assessment follows for each technology application, based on information found in Appendix C. Since there are no identified competing technologies within an application area, no comparative analysis has been performed to supplement the individual risk assessments.

4.2.2.1 Filtration Vacuum Systems on Processing Equipment

Description

This candidate technology entails the design and installation of air-cleaning systems on existing mail-processing equipment to reduce the potential risk of employee exposure to airborne hazards. This technology would automatically and continuously vacuum letter-processing equipment to minimize the risk of airborne biohazards in processing facilities. The use of pre-filters and HEPA filters in these air-cleaning systems should minimize paper dust and possible airborne hazards by several orders of magnitude.

Technical Risk

Engineering and development teams are currently testing prototype systems for Culling 010 systems, for the Delivery Bar Code Sorter (DBCS) and the Automated Flats Sorting Machine (AFSM˚100) in an operational environment. The experience gained from these efforts will then be applied in the design of systems for other postal equipment. The collection systems must be designed for each equipment type, including fabrication of hoods and shrouds for previously open equipment, including conveyor systems; experience gained in early efforts will be applied to other equipment. The technology maturity/development risk is considered low.

Equipment such as the Advanced Facer Canceler System (AFCS), AFSM 100, and the DBCS, are generally a standard configuration. This standardization and commonality of equipment facilitates the deployment of vacuuming and filtration modifications. The application of a multi-stage vacuum filtration capability, including HEPA filtration, has been shown to be 99.7˚percent efficient at the 0.3-micron particle size and is thus considered to be a proven and effective technology. This technology has been widely applied in bio-safety facilities and other locations where maximum state-of-the-art sub-micron particulate material removal is required. The technical risk regarding application as proposed in the postal environment is considered to be low.

The overall technical risk, based on the factors discussed above, is considered low. There are no other overriding technical considerations.

Operational Risk

Engineering designs will include consideration of possible operational impacts that may include increased energy consumption, decreased machine availability, increased heat load on HVAC systems, loss of floor space, decreased accessibility for open systems due to installation of hoods and shrouds, and the need to maintain the filtration systems. Additional training and support requirements as well as the workflow impacts are considered acceptable risk issues, or they can be subject to risk mitigation. The operational risk associated with these factors is considered to be low.

No regulatory or environmental issues are believed to exist beyond the handling and disposal of potentially contaminated filters, for which standard procedures exist. Consequently, operational risk from environmental factors is considered low.

As a final concern, workplace acceptance is not considered to be an issue. The potential health benefits outweigh the training, support and workflow impacts identified above.

Based on the above, the overall operational risk is considered to be low.

Cost Risk

The rough-order-of-magnitude costs used in the analysis are representative of preliminary estimates provided by the equipment manufacturers. Testing efforts scheduled for January—May

2002 will provide a basis for validating or revising the unit production and support costs. The near-term availability of this cost data supports assignment of a low risk value for these factors.

Installation of continuous vacuum filtration systems on 1,100 AFCS and 1,800 outgoing DBCS machines is estimated to cost $145 million. The Postal Service s intent is to conduct a phased deployment based on funding, and deployment is aimed at the most vulnerable areas first.

Overall cost risk is considered to be low.

Viability

This technology has potential Intermediate-Term viability for the Postal Service. Based on the technical, operational, and cost risk factors, the efforts to develop and deploy filtration vacuum systems on postal facility processing equipment will be continued. Trade-off studies will be conducted to prioritize the equipment purchases so that the benefits for postal employees and customers are maximized.

4.2.2.2 HVAC System Filtration or Modification

Description

This project would investigate the potential use of high-efficiency air filtration and decontamination technologies in postal facility HVAC systems. The purpose of this study would be to determine the feasibility of such technologies, leading to possible prototyping.

Technical Risk

The analysis of technical risk is not directly applicable to this project as the study purpose is to determine the feasibility and thus identify the technical and operational risks of using these filtration and decontamination technologies in typical postal facilities. The candidate technologies are presumed to be commercially available. The only technical risk factors to consider are the study design itself and the validity of extending study results to other, non-study postal facilities.

Based on the above, a technical risk value is not assigned.

Operational Risk

Since the scope of this investigation is limited to a small-scale study and not to the full-scale deployment of specific technologies, no operational impacts have been identified.

Based on the absence of operational impacts, no operational risk is assigned.

Cost Risk

The Postal Service has received a firm proposal of $135,000 for this study. Cost risk is therefore assumed to be low.

The cost of this feasibility study is relatively small in comparison to other technology proposals considered here. The results of this study will be used to develop better cost estimates.

Based on the above, cost risk is considered to be low.

Viability

The relative low cost and limited scope of this feasibility study make it a viable first step as part of an effort to develop information to further assess these candidate technologies within the postal system. Effectively, viability is assigned an Immediate level.

4.2.2.3 HEPA Cleaning Systems

Description

Postal Service Headquarters is acquiring and deploying approximately 16,000 HEPA-filtered vacuums for facilities that have more than 5,000 square feet of space. These vacuums will be used for cleaning equipment and building surfaces within the postal facilities. This is an ongoing initiative that is scheduled for completion in March 2002. These vacuums will be used to implement new cleaning practices (vacuuming and wet methods).

Technical Risk

These vacuums are commercial off-the-shelf products and have been procured based on Postal Service specifications. As of the end of January, over 9,000 of these vacuums have been delivered to postal facilities. Final deployment of all vacuums is expected by the end of March 2002. Postal Service Engineering is continuing to review additional equipment.

Given that these are standard commercially available products and have been procured in accordance with a Postal Service specification, low technical risk is assumed.

Operational Risk

Potential operational impacts include a possible increase in the time and labor needed to clean postal equipment, compared to previous practices of dry sweeping and the use of compressed air. These impacts are considered acceptable and require little additional training or support.

There are some initial concerns that these new processes are not cleaning DBCS systems as thoroughly as the previous blow and go procedures and the machines could clog.

There are no known regulatory or environmental issues governing the use of these vacuums. Workplace acceptance is assumed to be high since lower noise levels will result from the use of these vacuums. Furthermore, vacuuming should result in a potentially cleaner work environment than existed when using the previous cleaning practices of dry sweeping and air blowing since these procedures reduce airborne particulates.

Based on the above, a low operational risk level has been assigned.

Cost Risk

The cost of this acquisition has been approximately $12.6 million and for practical purposes is completed. Therefore, no cost risk is assumed.

Viability

Since this technology is already used in postal environments for equipment and building surface cleaning, viability is assigned an Immediate level. Additional vacuums may be acquired if local funds are available.

4.2.3 Detection and Identification

Detection technologies presently under consideration fall into three somewhat overlapping categories: triggering technologies, confirmation technologies (biohazard signature testing), and combined triggering and confirmation technologies. The three air-monitoring technologies are candidates for triggering technologies, while the integrated polymerase chain reaction (PCR) assay system and immunoassay test strip are possible confirmation technologies. Note that PCR may be coupled to an automatic air sampler to provide periodic air monitoring and automated confirmation. An air particulate concentrator interfaced to a mass spectrometer is a possible triggering and confirmation technology in the same unit. The indicator strips could also be placed in an air concentrator, but would require further confirmation testing.

All of the triggering technologies within the first category must be used in conjunction with a confirmation technology within the second category. In addition, only the biological indicator strip is a possible candidate for use in environments other than processing and distribution centers. All other technologies would be deployed within postal facilities. Additional information on each technology is found in Appendix D. Technology R&D efforts continue to produce new viable technologies that the Postal Service will evaluate for future, expanded facility monitoring.

4.2.3.1 Biological Indicator Strip

Description

The Biological Indicator Strip is a piece of paper impregnated with indicator reagent(s) that react with compounds found in the bio-threat to produce a color change. The strip being considered has reagents that will react with a compound found in bacteria of the genus *Bacillus* and several others. The technology was initially conceived for bacterial testing in the food industry. Its potential application as part of the Postal Service approach to biohazard threats is for bacterial testing of surfaces or other samples at almost any point in the mail-processing system. Its simplicity and low cost make it potentially deployable at collection boxes (see Section 4.2.1.1).

Technical Risk

The indicator strip technology is becoming commercially available and was initially conceived to be used in the food production industry.

The indicator strip does not specifically identify anthrax or any other biohazard and would require use of a complementary confirmation technology.

One area of concern is the sensitivity level of the indicator strip. If a large quantity of biohazard is needed to obtain a positive test result, the potential applicability of the technology in the postal environment could be limited. Detection of airborne spores may require an aerosol collector front end.

Based on the above, a moderate technical risk level is assigned to this technology.

Operational Risk

The indicator strip should have little or no impact upon postal operations beyond establishing training and support in its use. There are no regulatory or environmental issues beyond the disposal of used test strips. Workplace acceptance should be high, assuming that the technology proves to be effective and neither results in too many false positives or false negatives, the latter caused by a lack of sensitivity.

Given the above, a low operational risk level is assigned to this technology.

Cost Risk

The indicator strips are estimated to cost less than $1 per strip. Support costs are also presumed to be low. Therefore, a low cost risk is assigned to this technology.

Viability

The indicator strip can potentially help the Postal Service rapidly identify contamination with certain biohazards wherever it may occur in the mail-processing system. In particular, the relatively low cost of the indicator strip may allow for monitoring at the earliest point in the process the mailbox and/or on personnel identification badges. Its value to USPS will ultimately depend on its sensitivity. A relatively low sensitivity test will only give a positive result when a large amount of contamination is present. In addition, the need for sampling by air filtration must be evaluated. Consequently, the indicator strip technology appears to have Near- to Intermediate-Term viability subject to further testing to determine its sensitivity.

Note that this technology must be used in conjunction with a confirmation technology in order to provide effective detection of biohazards.

4.2.3.2 Particle Counter

Description

The particle counter is considered a possible triggering technology. This technology continuously compares the size distribution of particulates present in the air stream at a given point in time with that observed over the preceding few seconds. If a biohazardous particulate is introduced in the mail stream, a reading of the profile of both size and amount of particulate will be recognized as outside of a normal profile. Typically used in laboratories and industrial settings, it could be inserted into the mail processing system at points where mechanical forces are likely to cause release of substantial amounts of spores from a piece of mail.

Technical Risk

Particle counters are widely available as commercial off-the-shelf items that are typically used in laboratories and industrial settings where airborne particles pose a risk to human health and/or product quality. This technology, or variants of it, is available from multiple vendors, can be installed or portable, can be set to specific particle size ranges, and can be calibrated using National Institute of Standards and Technology standards. Vendors can supply certification and performance measures data.

Of principal concern is this technology s effectiveness in the postal processing environment, where there may be a high background level of particulates. It remains to be determined whether a particulate counter/sizer can effectively identify bacterial spores or other kinds of bioterror threats against a high background. A second concern is that dry bacterial spores, even the type used in the anthrax letters, have a wide range of particle sizes, suggesting that particle size distribution is not a very good criterion for identifying the presence of biological contamination.

Based on the above, a moderate to high technical risk level is assigned to this technology.

Operational Risk

The use of particle counters on processing and distribution center equipment such as the AFCS would not require retrofitting that might impact equipment functioning or serviceability. Since the technology is currently in use in other industrial settings, this is not a major concern.

Operation of the particle counters would require specialized user training and support, but this is not seen as a determining factor. Maintenance requirements are not known at this time. No environmental or regulatory issues have been identified, and workplace acceptance should not be an issue.

Based on the above, a low to moderate operational risk level is assigned to this technology.

Cost Risk

Capital costs are estimated at $5,000 per unit. Assuming 2,000 units required at major processing and distribution centers, the total cost could be $10˚million. Other operational and maintenance costs are not known.

Cost risk is assessed to be low to moderate.

Viability

The viability of this technology hinges on its ability to identify bacterial spores or other kinds of bioterrorism threats (from a single contaminated letter) against a high background such as is found in the postal processing and distribution center environment. It has not been proven that particle size distribution is an effective criterion to identify the presence of biological contamination. Additional modification may be required to improve the capabilities of this technology. Consequently, this technology appears to have Intermediate-Term viability subject to successful testing.

As in the case of other triggering technologies, the particle counter must be used in conjunction with a confirmation technology in order to provide effective detection of biohazards.

4.2.3.3 Particulate Shape Analyzer

Description

The particulate shape analyzer is a device that counts and images airborne particles. It measures the shape and size of every particle in the 2—20 micron range from an air stream continuously collected at a specific location. The resulting profile is then compared to established profiles of shape/size combinations for a match with other biohazardous agents. If a biohazardous particulate is introduced in the air stream, a reading of the profile of both size and amount of particulate will be recognized as outside of a normal profile. Typically used in laboratories and industrial settings, it has primarily found applications in Europe. It could be inserted into the mail-processing system at points where mechanical forces are likely to cause release of substantial amounts of spores from a piece of mail.

Technical Risk

Particulate shape analyzers are commercial off-the-shelf items from a small number of vendors. This device is designed primarily for use in industrial applications for quality control of particulate products. Such devices may have been evaluated for military/industrial uses to monitor for the presence of, and tentatively identify, airborne pathogens.

This technology has been developed to the stage of commercial equipment with well-defined performance specifications. A major concern about the effectiveness of this technology is that the postal processing environment has a very high background level of particulates. The capability of a particle shape analyzer to effectively identify bacterial spores or other kinds of bioterrorism threats against this high background must still be proven.

Based on the above, a high technical risk level is assigned to this technology.

Operational Risk

The use of particulate shape analyzers on processing and distribution center equipment such as the AFCS would not require retrofitting that might impact equipment.

Operation of the particulate shape analyzers would require specialized user training and support, but this is not seen as a determining factor. Maintenance requirements are not known at this time. No environmental or regulatory issues have been identified, and workplace acceptance should not be an issue.

Based on the above, a low to moderate operational risk level is assigned to this technology.

Cost Risk

Capital costs are estimated at $50,000 per unit. Assuming 2,000 units required at major processing and distribution centers, the total cost could be $100˚million. Other operational and maintenance costs are not known.

Cost risk is assessed to be low to moderate.

Viability

As was the case with the particle counter, the viability of the particulate shape analyzer hinges on its ability to identify bacterial spores or other kinds of bioterrorism threats (from a single contaminated letter) against a high background level of particulates such as is found in the postal processing and distribution center environment. Additional modifications may be required to improve this capability. Consequently, this technology appears to have Intermediate-Term viability subject to successful testing.

As in the case of other triggering technologies, the particulate shape analyzer must be used in conjunction with a confirmation technology in order to provide effective detection of biohazards.

4.2.3.4 Laser Discriminator

Description

The laser discriminator is a device that counts and optically characterizes airborne particles. It measures the ratio of scattering to fluorescence of particles in an air stream continuously collected from a specific location. The resulting profile is then compared to established optical profiles for a match with other kinds of particles, including biohazardous agents. The resulting profile is then compared to established profiles for a match with other biohazardous agents. If a biohazardous particulate is introduced in the mail stream, a reading of the profile will be recognized as outside of a normal profile. Several variants of this device under pilot production are currently undergoing evaluation for possible military applications. This kind of device could be inserted into the mail-processing system at points where mechanical forces are likely to cause release of substantial amounts of spores from a piece of mail.

Technical Risk

Laser discriminator technology is a continuously emerging technology. Improvements in laser and optics technology could improve the device s performance significantly, but this may require some additional development before reaching a deployable device.

The device is designed for military/industrial use to monitor for the presence of and tentatively identify airborne pathogens. It is a precision instrument that is likely to require periodic maintenance and calibration, although the exact frequency is not known. There are reports of degradation of performance over time due to deposits of particulate matter on the optics.

A major concern about the effectiveness of this technology is that the postal processing environment has a very high background level of particulates. It remains to be seen whether a laser discriminator can effectively identify bacterial spores or other kinds of bioterrorism threats against this high background. It has been demonstrated to be effective in distinguishing bacterial spores from non-biological particles such as road dust. However, the technology has been assessed as having difficulty with the background.

Based on the above, a high technical risk level is assigned to this technology.

Operational Risk

The relative instability of this technology suggests a high operational risk at this time since none of the operational risk criteria can be evaluated.

Cost Risk

Capital costs are estimated at $50,000 per unit. Assuming 2,000 units required at major processing and distribution centers, the total cost could be $100˚million. Other operational and maintenance costs are not known.

Lack of production units and a long operational history suggest a high cost risk for this technology.

Viability

High technical, operational, and cost risk suggests that this technology is not ready for near-term deployment. Additional development and testing is required to determine whether it has potential for Intermediate-Term viability.

4.2.3.5 Immunoassay Test Strip

Description

The immunoassay test strip is a small, self-contained, one-time-use test for the presence of a specific pathogenic agent. A sample (a single drop of a liquid solution or suspension) is introduced into a port, the test is allowed to develop, and the result is read visually or optically using an automated strip reader. The test strips have been used in environmental testing for the presence of pathogenic agents. They have been used in testing anthrax-contaminated areas following the discovery of contaminated mail.

Immunoassay test strips were initially considered by the Postal Service as a possible confirmation test to follow a positive trigger with the air particle monitoring technology since they do not function unattended. They must be coupled with a liquid air concentrator.

Technical Risk

Immunoassay test strips are commercially available in variants from several vendors. Six to ten tests for different pathogenic organisms of terrorist concern are currently available from one vendor. The specificity of the tests is highly dependent on the antibodies selected, and the fact that some antibodies may not be species-specific. Any test strips selected would be evaluated against organisms present in the background. If additional assays are required, substantial lead-time may be required to produce antibodies and develop the tests.

An alternative and somewhat less mature variant of this technology uses up converting phosphors in place of silver particles and can combine several tests into a single strip, each with a specific color readout. In addition, there are commercially available, disposable, integrated sample preparation and analysis cartridges that employ deoxyribonucleic acid (DNA) amplification and lateral flow assays to identify organisms.

The device produces a test result within 15 minutes following application of a sample. However, there is concern that there may be an insufficient level of sensitivity for most applications. The specificity of the antibodies in the test is also an issue not all tests that are nominally for a given organism are equally specific, and vendors must be compared carefully on this issue.

The immunoassay test strips are not a certified technology and are specifically stated as not qualified for use in clinical testing. Hence this technology requires a more rigorous method of confirmation before action is taken. The extent of its use in various applications is unknown, but the devices are generally known as useful for environmental testing and have seen considerable use. Variants of this technology are under development and may be more viable.

The combination of an air sampler, sample applicator, test strip, and readout device has been advertised as an integrated solution for testing for airborne particles of biohazardous agents. The effectiveness and reliability of this combination of devices is a concern.

Based on the above, a high technical risk level is assigned to this technology.

<u>Operational Risk</u>

Used as a confirmation test for an air monitoring (triggering) system, immunoassay test strips can help establish the reliability of that system, as well as help determine the course of action following a trigger on the air-monitoring device.

Implementation in a postal processing environment should be straightforward. The sampler and reader devices require a square foot or so of space and a low level of line power.

There are no known environmental, regulatory, or occupational constraints on the use of these strips. Workplace acceptance should not be an issue.

Based on the above, a low operational risk level is assigned to this technology.

<u>Cost Risk</u>

As expendables, the strips currently cost about $20 per test, a value that could be considerably lower in high volume. The strips are one-time-use, disposable items. Bench-top sampling and readout devices are each available in the range of several thousand dollars as a capital outlay.

If the strips are used as confirmation tests in conjunction with an air particulate monitoring technology, and that technology is effective in alarming only when independent tests show that bacterial spores are present, then the usage rate will be relatively low.

Based on the above, a low cost risk level is assigned to this technology.

<u>Viability</u>

Low operational and cost risks but a high technical risk suggest that this technology probably is not viable. Issues yet to be resolved are the adequacy of current sensitivity and specificity levels. Given the information available this technology is deemed to be Near-Term, but viability is questionable.

4.2.3.6 Polymerase Chain Reaction/Integrated Air Sampling/Sample Preparation Assay System

Description

PCR is a technology for detecting small quantities of DNA with a particular genetic sequence. Typically, tests are designed to be specific for a given species or strain of an organism. Tests for a pathogen usually focus on the genes responsible for its pathogenicity. If the target DNA sequence is present in any of the DNA in the sample, the reaction produces multiple copies of the target sequence. These multiple copies can then be detected directly or indirectly to give a positive test result. If no target sequence is present, no copies are made and a negative test result is obtained.

PCR is broadly used in the biological sciences for organism identification. It has been used for clinical, forensic, and environmental testing for the presence of and specific identification of such things as pathogenic agents, human DNA, and interspecies relationships. In the context of Postal Service requirements, it is envisioned as a primary or confirmation test that would be used to monitor airborne particles released during automated mail processing and to detect biohazardous agents that may be present. It could be used for direct sampling and analysis of these particles, or as a follow-up to a positive trigger with the air monitoring technology. It could also be used as a confirmation test following a positive test with biological indicator strips.

Technical Risk

PCR is a mature technology that has a wide variety of experimental and commercial variants. Bench-top thermocyclers are available in some variety of designs, some of which employ an integrated microfluidic cartridge that automates the sample processing steps. Handheld thermocyclers are also becoming available. Variants also exist in which the PCR reaction is carried out at a constant temperature.

Thermocycling instruments some with optical readout and data management capabilities are available from multiple vendors. Reagents for many tests are commercially available or can be made to order by specialty companies from specifications for previously developed tests. Development of new tests can be challenging, but adequate tests exist for most pathogenic agents of concern for bioterrorism.

The specific technology under consideration is an integrated air sampling/sample preparation/PCR technology using disposable microfluidic cartridges. It is designed to automate the sample collection, preparation, analysis, and readout processes into a single seamless process. Two commercial variants of this system are available, but both are relatively new.

PCR generally is an extremely sensitive assay method, and PCR testing routinely can detect as few as 50 copies (organisms) per sample within 15 to 30 minutes, and its theoretical detection limit is one copy of DNA per sample. Consequently, it is viewed widely as the gold standard of detection methods.

Problems with this kind of assay may arise if certain contaminants are present that inhibit the DNA polymerase used in the reaction. Such contaminants are frequently found in environmental samples, but methods are being developed to filter and clean inhibitors to reduce risk.

Based on the above, a low to moderate technical risk level is assigned to this technology.

Operational Risk

Operational impacts may vary depending on how PCR testing is used. When used as a confirmation test for an air-monitoring system, their use can help establish the reliability of that system, as well as help determine the course of action following a trigger on the air-monitoring (triggering) device. Following a determination of contamination, PCR tests may be used as part of the process of verifying successful decontamination (e.g., via surface sampling).

Implementation in a postal processing environment should be straightforward. The sampler and thermocycler devices require several square feet of space and a low level of line power. The sampler device may have to be interfaced with air monitoring systems if used, or directly to mail-processing equipment.

There are no known environmental, regulatory, or occupational constraints on the use of PCR. Workplace acceptance should not be an issue.

Based on the above, a low operational risk level is assigned to this technology.

Cost Risk

The cost per assay labor and materials will run in the $10s to $100s range, depending on assay format, use of cartridges, and so forth; costs are expected to be lower in high volume. Research-grade bench-top thermocycling devices are in the range of $50,000-$100,000 in capital outlay; portable and handheld versions are less costly. To meet Postal Service testing requirements, approximately 2,000 thermocyclers would be required. For situations involving possible contamination at other facilities, samples could be transported to the nearest major processing and distribution center for analysis.

If not used in association with triggering devices, each of the PCR instruments will need an integrated air-sampling device at a cost of about $3,000 each.

The maturity of this technology results in the assignment of a low cost risk.

Viability

The technology is fairly well understood, and will be pilot tested in a mail-processing environment, where low levels of analyte, the possible presence of inhibitors and other interferents with the assay, and integration with the process are all factors that will be thoroughly evaluated. This technology is much more sensitive than the immunoassay test strips and is more flexible than the test strips (new assays can be added relatively easily) but more costly per test.

Low operational and cost risks plus low to moderate technical risk suggests that this technology is deemed to have Near- to Intermediate-Term viability.

4.2.3.7 Mass Spectrometer/Air Particle Concentrator

Description

Mass spectrometry is an analytical method that identifies chemical species by their mass-to-charge ratio. Under some circumstances, it can be an accurate means of identifying specific bacteria. A mass spectrometer works by producing charged particles (ions) from the substances to be analyzed and then uses electric and magnetic fields to separate and quantify the ions by their mass-to-charge ratio. The instrument can interpret the masses and relative abundances of the ions generated from a complex (e.g., biological) sample to obtain information on the composition of the sample.

Mass spectroscopy is a mature technology that has been used widely throughout the scientific community for decades as a means of identifying chemical unknowns and verifying proposed chemical composition and structure for new substances. It has been used widely by the military for chemical warfare agent detection in battlefield settings and by law enforcement in forensic applications such as detection of explosives residues. It could be deployed at the USPS as an integrated alternative to the combination of an air-monitoring technology and a confirmation-testing technology. Two unique solutions were presented to the Postal Service that attempts to automate the whole process and allow for continuous monitoring of the air. These systems use an air concentrator to collect a sample of the aerosolized particles and then present the sample for ionization and mass spectrometry.

Technical Risk

Research mass spectrometers are widely available commercially. The integrated air sampler-biological mass spectrometers being considered for Postal Service deployment are in pilot production and have limited availability.

Mass spectrometers of various types are used in research environments for chemical identification. The technology has found limited but increasing use in microbiology for bacterial identification and cytology, largely due to new technologies for producing ions from high molecular weight solid materials. However, most biological applications of mass spectroscopy do not allow for real-time, continuous monitoring. These devices still require biochemists to perform manual sample preparation and analysis.

Mass spectroscopy is a highly sensitive technique requiring very small amounts of analyte for bacteria, hundreds of cells are sufficient for analysis. The promise of this technology rests on the observation that each species has its own set of chemical constituents (biomarkers) that allows it to be distinguished from others. The relative proportion of these biomarkers can be viewed as a fingerprint for the organism. A limitation of this approach is that the relative proportion of these substances may vary depending on the conditions under which the bacteria are grown or to which they are subsequently exposed. Overall, it is a much bigger challenge to identify bacterial species from their mass spectra than to identify pure chemical substances by mass spectroscopy. It will require the development of an extensive reference library of mass spectra of both pathogenic and non-pathogenic bacteria, including those considered likely agents of bioterrorism (possibly under a variety of growing conditions. This is a potentially costly and data-intensive undertaking. Furthermore, it is a big leap to go from analyzing a homogeneous sample of bacterial cells of a single type, to the complex mixture of particles that one would encounter in a mail-processing environment.

Based on the above, a moderate to high technical risk level is assigned to this technology.

Operational Risk

The operational considerations for implementing this technology in the Postal Service environment are nominal. The devices will require space and power but on a scale much smaller than the machines to which they will be interfaced/retrofitted. Operation, and to a greater extent maintenance, will require substantial training. Maintenance requirements are not known but may be significant.

There are no known environmental, regulatory, or occupational constraints on the use of PCR. Workplace acceptance should not be an issue.

Based on the above, a low to moderate operational risk level is assigned to this technology.

Cost Risk

The devices under consideration are expected to have initial capital costs of about $150,000 each for 1,128 units or $169.2 million. There will be nominal ongoing costs for consumables used during the operation of the device and for materials used for periodic maintenance. There will be potentially significant labor costs for maintaining the devices in working order. No other kinds of costs are expected to be significant.

The current stage of development of the technology being considered by the Postal Service suggests assignment of a moderate cost risk.

Viability

The critical issues relative to this technology s viability in the postal environment are (1) whether it can function effectively given the high level of particulates expected to be present in processing and distribution centers and (2) its effectiveness in identifying specific pathogenic bioagents. The technology is in prototype/pilot stage and may be available in a timeframe acceptable to USPS, but if so, it will only be in limited quantities. In the near term, it may have to be supplemented with a combination of airborne particulate monitoring and confirmation testing.

Additional testing of the technology is needed. Critical to the usefulness of the technology is that it be demonstrated to be able to positively identify and distinguish closely related bacterial species independently of their growth conditions and environmental history. In addition, it is critical that it be shown to work in a postal facility in the presence of the typical load of particulates found there.

Given the above, this technology is deemed to have potential Intermediate-Term viability.

4.2.4 Intervention

Intervention technologies under evaluation are those potentially applicable for the bulk sterilization (killing of all live organisms present) of mail prior to its entry into processing. These technologies primarily fall into two basic categories, irradiation and gaseous treatment. One additional physical method, ultra-high-pressure sterilization, was also evaluated. Irradiation technologies included for consideration are: electron beam (e-beam), X rays, gamma rays, ultraviolet light, and microwave. The first three of these technologies are evaluated together under ionizing radiation because of their similarity. Gaseous treatment technologies include chlorine dioxide, ethylene oxide, methyl bromide, and ozone. Additional information on intervention technologies can be found in Appendix E.

4.2.4.1 Ionizing Radiation—Electron Beam, X Ray, Gamma (Y) Ray

Description

Ionizing radiation relies on the deposition and absorption of energy at the molecular level. The absorbed energy breaks chemical bonds, destroying essential chemical structures and resulting in reactive ions and free radicals, which cause additional damage. Damage to DNA and cellular proteins required for a cell to survive and reproduce results in the death of cells, including infectious organisms.

An e-beam is a beam of electrons driven by a high accelerating voltage, similar to the beam of electrons generated in a television picture tube. The accelerating voltage determines the energy content of the driven electrons. At sufficiently high energies, these electrons sterilize biological materials by reacting with the DNA and proteins of cells. The result is a biological particle that has lost the ability to reproduce and is thus non-infectious.

X rays are high-energy electromagnetic radiation. Bombarding electron-dense materials with high-energy electrons generates X-ray photons. In sufficient quantity, X rays can disrupt nucleic acids of cells, leading to cell death. X rays can also damage proteins by generating reactive free radicals. Because of their higher energy content, X rays can penetrate materials more easily than e-beam electrons.

Gamma-ray systems are functionally similar to X rays and e-beams, but they are the most energetic portion (shortest wavelength) of the electromagnetic spectrum. They are generated by the decay of radioactive sources such as cobalt 60 or cesium 137. Gamma rays are even more powerful and have an even higher penetration capability than X rays.

Irradiation technology is of potential use to the Postal Service because it provides the capability to penetrate sealed envelopes in a relatively non-destructive manner, allowing for the sterilization of both the contents and the wrapper or envelope of an item of mail.

Technical Risk

All three irradiation technologies are currently used to sterilize medical equipment and for food pasteurization. Each technology has demonstrated the capability to effectively destroy *B. anthracis.*

The e-beam process has been in use for high throughput uses, such as the sterilization of foods on a factory-scale. It has been adapted (in coordination with the Office of Science and Technology Policy and various federal agencies; with the concurrence of the National Academy of Sciences, resulting from a one day conference) to process mail from the Brentwood and Trenton postal facilities and continues to be used to irradiate incoming government mail for Zip Codes 202-205. Neither X-ray nor gamma-ray technologies have been demonstrated for high throughput applications. E-beam has been shown to be effective in eradication of biohazards.

Due to the amount of energy transferred to the mail by any of the irradiation processes described, all three technologies may damage certain types of mail, including film, electronic equipment, and live samples, such as seeds.

Another issue in the effectiveness of irradiation technologies is the possibility of materials within the mail that are opaque to radiation. Such materials could shield portions of the mail from the radiation and allow biohazards to survive the treatment. This issue is being resolved by irradiating from multiple directions or by turning the mail as it passed through the irradiation chamber.

Based on the above, a low to moderate technical risk level is assigned to e-beam irradiation and a moderate to high technical risk level is assigned to X-ray and gamma-ray irradiation.

Operational Risk

Irradiation technology as used for intervention will likely impact workflow operations. It will require a new step in the mail-processing system, which may result in an increase in mail delivery times. A large and heavy footprint for irradiation technologies requires that the equipment be located outside of existing postal processing and distribution buildings. Locating the intervention equipment outside of existing postal facilities is consistent with the intent of eliminating biohazards before they enter the processing facility.

E-beam and X-ray technologies may present worker safety issues, which are readily resolved by appropriate shielding and safety interlocks. The equipment is self-contained and requires little or no operator intervention during normal operation. Gamma-ray technology may present additional safety hazards to workers due to the presence of highly radioactive sources. While the sources will be shielded during use, workers could be exposed during maintenance activities.

Training and support requirements for irradiation technologies remain to be established. However, these processes are likely to be significantly automated, and it is unlikely that much training will be required. Vendors will be requested to provide additional information, as needed.

Based on the above, a low to moderate operational risk level is assigned to e-beam technology given its current use to irradiate mail. A moderate operational risk level is assigned to X-ray technology. An unacceptable risk level is assigned to gamma-ray technology due to the dangers involved in introducing radioactive materials into Postal Service operations.

Cost Risk

The Postal Service has purchased 8 e-beam systems for installation in the Washington, DC, area and in the New York/New Jersey area. The Postal Service paid $40.2 million for these systems and will also pay $2.5 million per month for contracts to operate and maintain the systems.

Based on the above, a low cost risk level is assigned to the e-beam technology. Comparable estimates for X-ray and gamma-ray technologies are not available.

Viability

Each technology has demonstrated the capability to effectively destroy *B. anthracis;* however, only the e-beam technology is currently developed to the point where it is immediately available. Two contracts have been awarded for off-site e-beam sterilization of mail from the Brentwood and Trenton facilities.

The e-beam technology requires further study in terms of integrating it into the postal mail flow process and to increase its efficiency. It is considered to have Near-Term to Intermediate-Term viability. The other irradiation technologies pose higher technical, operational, and cost risks. X-ray technologies are considered as potential Long-Term alternative, but gamma-ray technologies are considered as not viable due to their required use of radioactive materials.

4.2.4.2 Ultraviolet Light (UV) Irradiation

Description

Ultraviolet (UV) radiation is non-ionizing radiation that kills microorganisms by disrupting the organism s ability to reproduce. The primary target site for UV radiation is DNA. Several types of damage result from UV exposure, but the most important of these are DNA strand breaks and the formation of photoproducts such as thymine dimers. Damage to DNA results in cell death.

Technical Risk

UV radiation is currently used for surface disinfection and sterilization and to treat air in specific environments. Susceptibility to UV radiation varies widely some microbes are easily killed by UV radiation, while others (including some viruses) are very resistant to its effects. Further, because it does not penetrate, microbes protected in shadowed areas are unaffected by it.

UV light does not penetrate light opaque materials. It would only be effective on directly exposed surfaces and thus is not considered effective in killing biohazards that may be inside a letter, flat, or parcel.

The lack of effectiveness in destroying biohazards enclosed within a letter, flat, or parcel is considered to be a showstopper regarding this technology s use in intervention. Technical risk is considered to be unacceptable.

Operational Risk

Operational risk has not been assessed given that the technical risk is unacceptable.

Cost Risk

Cost risk has not been assessed has not been assessed given that the technical risk is unacceptable.

Viability

UV light is not considered to be a viable intervention technology given the previous discussion of unacceptable technical risk.

4.2.4.3 Microwave Irradiation

Description

Microwave radiation is non-ionizing due to its relatively low energy. The energy from microwaves is transferred to water molecules in biological materials. As microwave energy is absorbed by water, it increases the temperature of the water phase and can transfer heat to the surrounding materials. Thus, the primary effect of microwave radiation on biological materials results from thermal changes.

Technical Risk

Microwave generators are an established commercial off-the-shelf technology and are used in large-scale industrial processes. Existing microwave chambers could be adapted to process mail with minimal difficulty, although there is no equipment certified for this use.

Because it is very difficult to control the thermal effects induced in biological materials when they are microwaved, hot spots and cold spots are common. This dramatically reduces the effectiveness of microwave irradiation as a disinfection or sterilization tool. Further, because many of the biological agents of interest to the Postal Service will not have high moisture content, the effectiveness of microwave exposure could not be relied upon for uniform intervention.

Based on the above, a high technical risk level is assigned to this technology.

Operational Risk

The use of microwave radiation for intervention applications would require a new step in the mail-processing system, thus affecting workflow and increasing mail delivery times. The extent of this increase is not known.

As with other intervention technologies, there would be training and support impacts; however, these are not considered to be determining factors. Workplace acceptance is also not considered to be a determining factor relative to this technology since any health and environmental implications would be subject to regulation.

Based on the above, a low to moderate operational risk level is assigned to this technology.

Cost Risk

Because this technology has been assigned a high technical risk, cost estimates have not been developed specifically for a Postal Service application.

Viability

Because of the lack or precision in the heating process hot spots, cold spots, edge overheating and so forth microwave radiation technology is considered to have high technical risk with regard to its ability to sterilize the mail. This problem would be exacerbated by the heterogeneous nature of the mail and its low water content. Finally, the water content of anthrax spores may be so low that microwave radiation would not inactivate them without very long exposure times to high microwave energy levels.

Based on the above, microwave irradiation is not considered to be a viable technology for intervention.

4.2.4.4 Ultra-High-Pressure Sterilization (UHP)

Description

Application of pressure approaching 100,000 psi in specially constructed vessels inactivates biological particles directly, apparently by physical changes in protein and nucleic acid structure induced by the pressurization/depressurization cycles. It may be less effective against spores than against vegetative cells unless the vessel is also heated during the processing. Relatively short cycle times (less than 30 minutes) are possible with relatively large volumes (>200 liters).

Technical Risk

The technology is not currently commercially available for application, but it is under development for use in the food industry. It has been demonstrated to be effective on both liquid and solid foods. A commercial company has been reported to be developing high-volume, low-cost vessels that can be used with this technology. The lead-time for application in a Postal Service environment is likely to be several years.

Currently used in development processing, UHP sterilization is reported to be non-destructive of the products upon which it is used. Depending on the mail item, this technology could be applicable to inactivate most biological agents. Its affect on toxins is not known at this time.

Based on its current development status, a high risk level is assigned to this technology.

Operational Risk

Insufficient information is available to assess operational risk.

Cost Risk

Insufficient information is available to assess cost risk.

Viability

Insufficient information is available to assess viability as an intervention technology.

4.2.4.5 Sterilization

Description

The Postal Service has identified chlorine dioxide, ethylene oxide, methyl bromide, ozone, and vapor phase hydrogen peroxide as candidate technologies for intervention by chemical sterilization.

Chlorine dioxide is an oxidizer and reacts with a wide range of materials. Chlorine dioxide has been used as a surface sterilant in several industries and was recently used as a spatial disinfectant in the Hart Senate House Office Building, which had been contaminated with *Bacillus anthracis* spores. The physiological mode of action of chlorine dioxide in bacteria is disruption of proteins and interference with protein synthesis. It inactivates the outer protein structures of viruses.

Ethylene oxide is a sterilant gas that can be used in bulk delivery sterilizers (similar to autoclaves) or in specialized packages using premeasured volumes of the gas. The physiological mode of action of ethylene oxide in bacteria and viruses is by alkylation of proteins, disrupting protein function and inactivating cells and viruses.

Methyl bromide is a colorless, gaseous, toxic pesticide primarily used for soil fumigation, post-harvest protection, and quarantine treatments. It is also used to control insects, nematodes, weeds, and pathogens in more than 100 crops, in forest and ornamental nurseries, and in wood products.

Ozone is a strong, naturally occurring oxidizing agent with a long history of safe use in disinfection of municipal water, process water, bottled drinking water, and swimming pools. Studies on the sporicidal action of ozone indicate that spores of *Bacillus* spp. are more susceptible to ozone than to hydrogen peroxide and at 10,000-fold lower concentration. The outer spore coat layers were found by electron microscopy to be the probable site of action of ozone.

Technical Risk

Chlorine dioxide as a decontaminating agent is a mature technology and is currently available in small- to large-scale applications. Industrial uses of chlorine dioxide include microbial control of food processing, food-equipment sanitization, and wastewater and drinking water treatment. It has also been used in air duct sanitization and food processing, as well as to sanitize and disinfect hospitals. The need for Postal Service mail sterilization by chlorine dioxide or other gas will be a specialty requirement best handled by approved vendors familiar with the hazards of the gas. Sterilization of mail using chlorine dioxide will require large quantities of the gas, so long-term utilization will be an issue. An additional issue is the fact that chlorine dioxide is reactive and can break down to more reactive chlorine gas.

Ethylene oxide as a sterilant is a mature technology that is currently available through a variety of vendors from small to large scale. Industrial uses of ethylene oxide include sterilization of hospital equipment and supplies, especially items that cannot be subjected to heat or pressure, such as fiber-optic scopes. Because it does not react with equipment or many other materials, there may be specialized applications for this type of sterilization technology. It is not clear whether the sterilization would be conducted at Postal Service facilities or at the vendor s location. A major drawback to using this technology is the quantity of gas that would be used to process mail in the amounts necessary to minimize the treatment s effect on moving the mail.

Methyl bromide is an Environmental Protection Agency (EPA)-registered pesticide that has been proven effective in fumigating large buildings, including those in urban settings such as flourmills infested by insects. However, it has been identified as an ozone-depleting chemical and as such will be phased out of use in the United States by 2006. This severely limits its applicability as a potential sterilant for use by the Postal Service even if it is proven effective against bacteria and viruses. There are no documented cases of methyl bromide s efficacy in eradicating anthrax.

The use of gaseous ozone as a fumigant to sterilize mail is a possibility. Ozone could also be used in aqueous form for topical application to surfaces. The specific application constraints would have to be developed independently because they are not now available.

According to EPA, ozone has been extensively used for water purification, but ozone chemistry in water is not the same as ozone chemistry in air. High concentrations of ozone in air, when people are not present, are sometimes used to help decontaminate an unoccupied space from certain chemical or biological contaminants or odors (e.g., fire restoration). However, little is known about the chemical by-products left behind by these processes. Vendors claim ozone kills mold spores; however, there does not appear to be definitive information about its efficacy against anthrax.

Ozone is an effective disinfectant of water and may be an effective gaseous sterilant. Ozone has 1.5 times the oxidizing potential of chlorine and 3,000 times the potential of hypochlorous acid. Anti-microbial action times are about 4 to 5 times less than chlorine. There are a number of scientific reports that indicate sporicidal activity of ozone. However, the effect of ozone on *Bacillus* spores varies depending upon the strain.

While each of the above is considered to be an effective sterilant for the applications noted, none of these are comparable to the intervention application required by the Postal Service. It is not evident that any of these gaseous treatment methods have the ability to kill biohazards that may be present within an effectively sealed letter, flat, or parcel. For this reason, technical risk is considered to be unacceptable.

Operational Risk

Operational risk has not been assessed given that the technical risk is unacceptable.

Cost Risk

Cost risk has not been assessed has not been assessed given that the technical risk is unacceptable.

Viability

Sterilization by gaseous treatment methods is not considered to be a viable intervention technology given the previous discussion of unacceptable technical risk.

4.2.5 Decontamination

Decontamination technologies under consideration are those potentially applicable to either (1)˚mail sterilization or (2) postal equipment and facility sanitization. Technologies applicable to mail sterilization have previously been evaluated in Section 4.2.4.5 and Appendix E, Intervention, and thus will not be discussed here. Although intervention is a precautionary approach (large volumes of mail will be treated) and decontamination is a response when contaminants are known to be present (controlled amounts of mail are treated), they both use the same technology to accomplish Postal Service objectives.

Gaseous treatment technologies are deemed most appropriate for equipment and facility decontamination where biohazard contamination has occurred through migration from a source to accessible surfaces. Specific decontaminating agents being evaluated include chlorine dioxide, ethylene oxide, methyl bromide, ozone, and paraformaldehyde. Because the risk factors for these agents vary significantly for the purposes of decontamination, they are considered separately in the following subsections. Additional information about these decontamination technologies is available in Appendix F.

4.2.5.1 Chlorine Dioxide

Description

Chlorine dioxide is an oxidizer and reacts with a wide range of materials. It has been used as a surface sterilant in several industries and was recently used as a spatial disinfectant of a large office building that had been contaminated with *Bacillus anthracis* spores. The physiological mode of action of chlorine dioxide in bacteria is disruption of proteins and interference with protein synthesis. It inactivates the outer protein structures of viruses.

Technical Risk

Chlorine dioxide as a decontaminating agent is a mature technology and is currently available in small- to large-scale applications. Industrial uses of chlorine dioxide include microbial control of food processing, food-equipment sanitization, and wastewater and drinking water treatment. It has also been used in air duct sanitization and food processing, as well as to sanitize and disinfect hospitals.

Decontamination of the Hart Senate Office Building with chlorine dioxide was successful after several preliminary attempts. Further evaluation of the lessons learned from these attempts is an important part of the future use of chlorine dioxide in facility decontamination.

Based on its previous use in decontaminating postal facilities, a low technical risk level is assigned to this technology.

Operational Risk

A major operational impact of the decontamination of facilities by gaseous treatment sterilants is the requisite shutdown of the facility. The facility cannot be reopened until the decontamination of the bioagent and the successful degassing of the chlorine dioxide has been shown to be complete. Additional operational issues may become obvious from the experience with this decontamination technology at the Trenton and Brentwood facilities and at the Hart Senate Office Building. Careful documentation and evaluation of the experience in decontaminating these facilities will provide valuable insight into the operational impact of this technology.

OSHA sets maximum allowable levels of chlorine dioxide exposure by workers, while the EPA and state regulatory agencies would regulate air release of the gas. Potential short-term environmental effects are likely if gas escapes containment when used in a facility. The gas is an irritant to eyes, lungs, and skin, and concentrations in excess of 5 ppm are considered immediately dangerous to life and health. Adequate degassing of facilities must be assured before they can be re-entered.

Based on the above, a low to moderate operational risk level is assigned to this technology.

Cost Risk

A breakout of the aggregate costs of the decontamination of the Brentwood and Trenton postal facilities is as follows: the aggregate cost for decontaminating both facilities is estimated to be $80 million. This cost is expected to decrease for subsequent necessary decontamination because of the knowledge gained in developing the technology at Brentwood. The future cost for decontaminating a facility of this size is estimated to be $10-15 million. These are total costs, including building and other infrastructure preparation, gassing and testing, and also preparing contaminated mail for shipment to irradiation facilities.

Based on the past experience with this technology, a low cost risk is assigned.

Viability

Recent experience with this technology at the Hart Senate Office Building and the lessons to be learned in its use at the Brentwood and Trenton postal facilities leads to the conclusion that it has Near-Term viability.

4.2.5.2 Ethylene Oxide

Description

Ethylene oxide is a sterilant gas that can be used in bulk delivery sterilizers (similar to autoclaves) or in specialized packages using premeasured volumes of the gas. The physiological mode of action of ethylene oxide in bacteria and viruses is by alkylation of proteins, disrupting protein function and inactivating cells and viruses.

Technical Risk

Ethylene oxide as a sterilant is a mature technology that is currently available through a variety of vendors from small to large scale. Industrial uses of ethylene oxide include sterilization of hospital equipment and supplies, especially items that cannot be subjected to heat or pressure, such as fiber-optic scopes. While certified for use in medical device sterilization applications by the Food and Drug Administration, use as a facility decontaminant would be a new application subject to evaluation for the specific requirements.

Lack of previous use in facility decontamination suggests a moderate to high technical risk.

Operational Risk

As previously noted, a major operational impact of the decontamination of facilities by gaseous treatment sterilants is the requisite shutdown of the facility. The facility cannot be reopened until the decontamination of the bioagent has been shown to be complete, and the successful degassing of the ethylene oxide has been shown to be complete as well.

Bulk use of ethylene oxide will trigger air quality permit requirements, including Clean Air Act requirements. Further, because of the flammability and potential carcinogenicity of the compound, there may be even more severe regulatory constraints on its use. It is an irritant to the eyes, lungs, and skin. There may be reproductive issues with women exposed to very low levels of the compound.

Based on the above and lack of previous use in facility decontamination, a moderate to high operational risk level is assigned.

Cost Risk

Cost data is not available regarding use of this technology in facility decontamination.

Viability

Lack of previous use in facility decontamination suggests that this technology requires further study. Pending further study, this technology is considered to have potential for Intermediate- to Long-Term viability.

4.2.5.3 Methyl Bromide

Description

Methyl bromide is a colorless, gaseous, toxic pesticide primarily used for soil fumigation, post-harvest protection, and quarantine treatments. It is also used to control insects, nematodes, weeds, and pathogens in more than 100 crops, in forest and ornamental nurseries, and in wood products.

Technical Risk

Methyl bromide is an EPA-registered pesticide that has been proven effective in fumigating large buildings, including those in urban settings such as flourmills infested by insects. However, it has been identified as an ozone-depleting chemical and as such will be phased out of use in the United States by 2006. This severely limits its applicability as a potential sterilant for use by the Postal Service even if it is proven effective against bacteria and viruses. There are no documented cases of methyl bromide s efficacy in eradicating anthrax.

Based on it potential lack of availability by 2006, this technology is considered to have an unacceptable technical risk level.

Operational Risk

Operational risk has not been assessed given this technology s unacceptable technical risk.

Cost Risk

Cost risk has not been assessed given this technology s unacceptable technical risk.

Viability

This technology is not considered to be viable given its future lack of availability.

4.2.5.4 Ozone

Description

Ozone is a strong, naturally occurring oxidizing agent with a long history of safe use in disinfection of municipal water, process water, bottled drinking water, and swimming pools. Studies on the sporicidal action of ozone indicate that spores of *Bacillus* spp. are more susceptible to ozone than to hydrogen peroxide and at 10,000-fold lower concentration. The outer spore coat layers were found by electron microscopy to be the probable site of action of ozone.

Technical Risk

Ozone is an effective disinfectant of water and may be an effective gaseous sterilant. Ozone has 1.5 times the oxidizing potential of chlorine and 3,000 times the potential of hypochlorous acid. Anti-microbial action times are about 4 to 5 times less than chlorine. There are a number of scientific reports that indicate sporicidal activity of ozone. However, the effect of ozone on *Bacillus* spores varies depending upon the strain. Ozone could harm or destroy components of mail-processing equipment due to its properties as a strong oxidant. In addition, unstable in water, ozone decomposes to oxygen with a half-life of about 20 minutes. Thus, maintaining effective concentrations may be difficult.

Based on the above and lack of experience with ozone in facility decontamination, this technology is assigned moderate to high technical risk.

Operational Risk

The operational risks associated with the use of ozone in facility decontamination are similar to those for the other gaseous treatment sterilants. In addition, ozone is a benchmark of air pollution in urban areas. Exposure standards are set at about 0.1 ppm. EPA approval would presumably be required for use.

Based on the above and lack of previous use in facility decontamination, a moderate to high operational risk level is assigned.

Cost Risk

Application costs are estimated to be around $1,000 per pound of ozone, but it is not clear what the usage rates would be, thus no firm estimate can be provided at this time.

Based on the above, a high cost risk is assigned to this technology.

Viability

Facility decontamination with ozone does not appear viable at this point because of the lack of demonstration of effectiveness against anthrax spores and possible damage to mail and mail facility equipment by its strong oxidizing properties.

4.2.5.5 Paraformaldehyde

Description

As a fumigant, paraformaldehyde is depolymerized by heating to produce formaldehyde gas that permeates space and kills all viable microbial forms of life. Past uses of paraformaldehyde include sterilizing surfaces and detoxification. It is known to eliminate *Bacillus anthracis* and other infectious agents and toxins. Paraformaldehyde is used internationally in hospitals, in biomedical, veterinary, pharmaceutical, and research organizations, and in universities. Formaldehyde gas is widely used in the poultry industry.

Technical Risk

Paraformaldehyde is widely used as a disinfectant. For sterilization, formaldehyde gas exposure for 16 hours at a concentration of 1.0 mg/liter at 40 percent to 60 percent relative humidity, ambient temperature, is recommended.

Paraformaldehyde has been proven effective in eliminating infectious pathogens and poses no significant health risks when properly used. In an experiment performed by Taylor, Barbetto, and Gremillon, formaldehyde gas treatment was completely successful in sterilizing facilities, materials, and equipment of several organisms, including *C. botulinum*, in a lab environment. There seemed to be no problems of repolymerization or other residual when the concentration and humidity were controlled. Mechanical, electronic, and optical equipment showed no visible operational effects as a result of treatment.

Based on its limited use in facility decontamination, a low-to-moderate technical risk is assigned.

Operational Risk

In addition to the operational impact of shutting down the facility for decontamination by paraformaldehyde, the carcinogenic and toxic nature of paraformaldehyde requires that facilities using this method of disinfection must have specially designed ventilation systems and are subject to air monitoring requirements.

Based on the above, a high operational risk is assigned to this technology.

Cost Risk

Cost information has not yet been developed for this technology.

Viability

Paraformaldehyde fumigation as a means of facility decontamination is Not Viable for Postal Service use because of its status as a carcinogen.

4.2.6 Investigation

Three technologies are currently being evaluated to enhance the criminal investigative infrastructure. These technologies include enhanced image capture and analysis, development of wide field of view cameras, and enhanced capabilities to track and trace mailpieces. The Postal Service is also investigating the use of positive product , which has previously been described in Section 4.2.1.2. Additional information regarding Investigation technologies is found in Appendix˚G.

4.2.6.1 Image Capture and Analysis

Description

The Postal Service is developing enhancements for current image scanning technology that will provide the capability to scan, capture, save, analyze, and retrieve mailpiece images. These enhanced capabilities will be implemented in three phases.

> Phase I will provide the capability to scan images and store them in on-line databases for subsequent retrieval and analysis.
>
> Phase II will provide the capability to perform automated, real-time analysis of the content of the images scanned from the mailpieces.
>
> Phase III will provide the capability to apply handwriting analysis technologies to images of mailpieces to search for and isolate mailpieces satisfying selected criteria.

Technical Risk

Each of the phases has a different level of technical risk.

Phase I is a low-risk technology. It will use existing capabilities. There is a minor performance risk that can easily be addressed with existing hardware technology.

Phase II is a low-moderate—risk technology. The hardware is low risk. There will need to be specialized software to analyze the stored images and to correctly apply decision criteria.

Phase III is high risk. Software to perform handwriting analysis is commercially available, however the reliability of existing software is not well understood. In addition it is unknown if the current packages have been used to perform the level of analysis the Postal Service will require.

Given the above, this initiative has a low-to-high level of technical risk.

Operational Risk

There will be significant performance issues that will need resolution as the image-scanning process becomes sophisticated and increases the volume of image data that needs to be collected and saved. The server and channel capacity requirements will be low risk. Throughput could easily become a moderate risk. The operational risk from using this technology is low-to-moderate.

Cost Risk

The projected cost for developing and deploying this technology is low risk. Technical and operational risk items can be addressed prior to the commitment of funds for widespread deployment. (Cost estimates for the three phases are provided in Appendix G.)

Viability

Phase I, II, and III viability is set at Near-Term, Intermediate-Term and Long-Term, respectively. Overall project viability is Intermediate-Term.

4.2.6.2 Wide Field of View (WFOV) Camera

Description

The Postal Service is developing enhanced cameras to increases the amount of data that can be scanned from a mailpiece. The Wide Field of View (WFOV) camera systems are being designed to accomplish the following Postal Service objectives:

Scan 100 percent of the mailpiece image (currently less than 100 percent)

Capture increased detail from a mailpiece by increasing the amount of information read from a mailpiece

This initiative consists of acquiring the WFOV camera systems, a task already under way, and developing and deploying the software capabilities required to support the new camera technology.

Technical Risk

The technical risk is low. While the WFOV camera is a new technology, it is an upgrade and the issues were addressed prior to the production contract. As such, the WFOV camera systems introduce a low level of risk.

Operational Risk

Operational risk is low as the operational impacts were reviewed and addressed prior to the production contract award.

Cost Risk

The cost risk for this technology is low since the Postal Service has already funded this program.

Viability

Based on the above, this technology is deemed to have Near- to Intermediate-Term viability.

4.2.6.3 Mailpiece Tracking

Description

The Postal Service is developing enhanced capabilities to track and trace mailpieces based on information in the two-dimensional bar codes applied to the mail when it enters the mail-processing system. This initiative is dependent on the implementation of the WFOV camera systems addressed in Section 4.2.6.2. This enhanced tracking capability will increase the level of confidence that mailpieces that originated with business customers are safe for both Postal Service employees and Postal Service customers.

Technical Risk

Since the Technical Risk for the WFOV camera systems is low, the technical risk for this initiative is also low.

Operational Risk

The operational risk for mailpiece tracking is low to moderate. This is an established capability, and it will continue to operate without the WFOV camera systems. The enhanced tracking capability initiative requires WFOV cameras.

Cost Risk

The contract for the WFOV camera upgrades has already been awarded. The cost risk to develop required network and data storage capabilities is very low. The costs for network enhancements, servers, storage, and miscellaneous processing equipment is projected to be $210 million.

Viability

Based on this initiative s partial dependence on the WFOV camera, this technology is viewed as having potential Intermediate-Term viability.

Section Five

Conclusions

This section presents conclusions regarding technology selection and process change decisions that follow from the qualitative risk and viability analysis presented in Section 4. This section is organized by core initiatives to facilitate reference to the analysis.

5.1 Prevention

The objective of the prevention initiative is to reduce the risk that someone would use the mail as a tool of terror. A variety of technologies are under evaluation to address this initiative. They include application of detection, containment and decontamination technologies at the collection box, video recording of retail transactions, security process for large mailers, and access security control for vehicles and individuals at truck entrances to facilities.

The application of detection, containment, and decontamination technologies at collection points has been assessed as having potential intermediate- to long-term viability. Near-term implementation of these technologies, even if they were mature, would be problematic due to the sheer number of collection boxes (approximately 350,000). Several technologies are being conceptually evaluated and will be tested and prototyped in the intermediate term, if appropriate. More immediate benefit can be realized with prevention methods applied at the retail and postal facility levels.

The Postal Service is continuing its efforts to create an intelligent mail stream, whereby each mail item can be uniquely identified. This system would allow identification of both sender and receiver and would provide the necessary infrastructure for forensic investigations, as required.

Video recording of retail transactions is a work in progress, integrating existing technologies with those yet to be prototyped.

Security control for commercial mailers appears to be viable in the near to intermediate term, contingent upon acceptance by these mailers.

Access security control can be accomplished by borrowing heavily from technologies already in place in other areas of the government.

In summary, prevention involves a large spectrum of efforts to incorporate technologies at several different levels of maturity. Significant progress is expected in the intermediate term.

5.2 Protection and Health-Risk Reduction

The objective of the protection and health-risk reduction initiative is to reduce risk of exposure to biohazards and to prevent cross-contamination of mail if biohazards should be introduced into the system. Mature and available technologies exist to support this initiative. The protection of employees from airborne biohazards could be accomplished by the implementation of two mature technologies and by the conduct of a feasibility study in a third conceptual area.

The use of HEPA-filtered vacuum cleaners for equipment cleaning, as a replacement for compressed air blowing, is a mature and available technology that can be implemented immediately with low risk. The application of custom-designed filtration vacuum systems on several types of mail-processing equipment can be accomplished with mature technologies that include vacuum systems and multi-stage HEPA filtering. Prototyping can begin immediately, with large-scale implementation being viable in the intermediate term.

The installation of enhanced filtration or other means of trapping or killing of bacteria or other bioagents in the HVAC system involves the potential application of a variety of technologies. A preliminary feasibility study is required to define the technical and operational risks involved and to further identify the technologies to be evaluated. This study should be undertaken to further establish the viability of candidate technologies and designs.

Implementation of the two mature technologies will accomplish the objectives of the core initiative of protection and health-risk reduction. If the modification of HVAC appears feasible, it will provide a further means of reducing health risk.

5.3 Detection and Identification

The objective of this initiative is to detect and identify potential hazardous materials as early as possible in the mail stream. Technologies for detection and identification of threats are not at a stage of development that allows immediate implementation; however, cutting-edge technologies exist with promise to effectively accomplish this objective in the intermediate term, after appropriate testing and pilot studies have been undertaken.

The desired approach is one that uses a combination of triggering and confirmation technologies. Triggering technologies would provide continuous, unattended monitoring, with rapid reporting of the existence of a potential threat. Appropriate triggering technologies tend to be high in sensitivity with potential tradeoffs in reliability and perhaps specificity. Thus, they require confirmation of the presence of a real threat by more reliable confirmation technologies. Confirmation technologies would be applied as a follow-up to a triggering report and provide a higher level of confidence that the threat is real, and perhaps a greater level of detailed information about the threat.

Triggering technologies are not at the stage of maturity where commercially available off-the-shelf equipment will provide continuous, unattended monitoring and reporting of the existence of a potential threat. Several technologies, however, are in final stages of development and production such that an effective triggering technology should be available in the intermediate term. The technologies evaluated for triggering include the biological indicator strip and various types of particle analyzers. PCR detection of DNA signatures and mass spectrometry are under evaluation as confirmation technologies.

Of the triggering technologies evaluated, the biological indicator strip seems to be the most conceptually promising technology for continuous, unattended monitoring. Technical risk is presently high due to a need for testing of the sensitivity, specificity, and unattended functioning of this technology. Further information and testing of the sensitivity, specificity, and unattended functioning of the biological indicator strip are required to reduce the technical risk to the point where this technology can be prototyped with a reasonable degree of confidence.

The immunoassay test strip is widely used as a rapid field test for the presence of selected bioagents. It cannot function as a trigger in its present state of development because it requires attending by an operator for sample application and reading of the results. It is not ideal as a confirmation technology because of somewhat limited reliability. Coupling of this technology to an automated air sampling technology that would present the immunoassay strip with periodic samples is under development. Mechanical readers are also available. Automation of both the sample application and the readout would allow this technology to function as a stand-alone device. This combination of technologies requires intermediate-term testing to determine further viability.

Several technologies that count and characterize airborne particles possess potential as triggering technologies because of their ability to continuously monitor the air. They have a high technical risk, however, because of the high concentration of particulates that result from mail-processing functions. It appears likely that the high background concentrations of airborne dust would interfere with the ability of these instruments to selectively detect a relatively small quantity of airborne particulate biohazard. A further contributor to technical risk is the lack of data on the ability of these methods to identify biological organisms. Thus, these technologies require intermediate-term testing to determine further viability.

Confirmation technology requires specific and reliable identification of a biohazard with a validated technique. For this purpose, PCR as a means to detect the presence of specific biohazard signatures is a technology that presents low risk and merits near-term prototyping and potential near- to intermediate-term implementation. Coupling of the PCR analysis to intermittent air sampling and automated sample preparation will also provide the continuous monitoring needed for a triggering function. This technology combination has the potential to provide both triggering and confirmation with one equipment item.

Mass spectrometry as a confirmation technology is of moderate to high technical risk due to questions about the specificity of the method and its ability to function in the high airborne particulate environment of mail processing. The coupling of mass spectrometry to continuous air sampling could satisfy the triggering need. If technical risk related to the specificity of this technique could be overcome, this combination could also provide acceptable confirmation of a threat.

In summary, while the core initiative for detection cannot be accomplished by immediate implementation of an off-the-shelf technology, near-term prototyping of intermittent air sampling and automated presentation of samples to analysis by PCR show the best promise for effective detection. Mass spectrometry, coupled to continuous air sampling, may provide an alternative triggering-confirmation technology if the specificity of this technology can be demonstrated. Biological indicator strips could emerge in the intermediate term as viable triggering technology if technical risks could be overcome.

5.4 Intervention

The objective of intervention is to neutralize potential contaminants in the mail, as a precautionary measure. A mature technology, e-beam, has been identified and implemented for the irradiation of selected mail.

Irradiation technologies using ionizing radiation (e-beam, X rays, and gamma rays) were evaluated together and found to be viable for the effective killing of bioagents. E-beam emerged as the lowest risk candidate of the three technologies because of its immediate availability and a lack of other operational issues that were present for the X-ray and gamma-ray technologies.

Other irradiation technologies ultraviolet light and microwave were unacceptable for intervention because of high technical risk due to lack of uniform penetration of mail.

At the present time, gaseous treatment technologies are deemed to be technically unacceptable for intervention because of lack of evidence that gases would dependably penetrate all types of sealed mail to effectively and uniformly sterilize the contents.

The intervention initiative is being presently accomplished for selected locations by the use of off-site e-beam technology. This technology will be deployed at USPS facilities in the near to intermediate term on a pilot basis to determine its impact on postal operations. The results of monitoring of performance, operational impact, and cost in the context of real-time mail processing and the continuing monitoring of emerging threat will be the basis of deciding how widely to deploy this technology throughout the country.

5.5 Decontamination

The objective of decontamination is to eliminate known contaminants, both in the mail and in equipment and facilities. Decontamination of mail involves the sterilization of selected items of mail, which have been identified as being contaminated. It is essentially the same process as intervention, except that it would be applied selectively to mail that is pre-identified as contaminated. Thus, the conclusions about intervention technologies in Section 5.4 also apply to the decontamination of mail.

For the decontamination of facilities and equipment, gaseous treatment technologies were found to be the most viable because of their uniform permeation throughout the facility and exposure to all surfaces accessible to contamination. Of these technologies, chlorine dioxide is the most viable because of the precedent for its use as a building decontaminant.

The decontamination core initiative can be accomplished by available technology. Mail decontamination can be accomplished by e-beam technology and facility decontamination can be accomplished by the use of chlorine dioxide.

5.6 Investigation

The objective of investigation is to enhance criminal investigative infrastructure to enable more effective forensic analysis, and to enable the Postal Service to better track cross-contaminated mail and equipment. The technologies under evaluation and development for this initiative are image capture and analysis, WFOV image camera, and mailpiece tracking and tracing.

Image capture and analysis is based on real time analysis of images that are presently captured for each piece of mail. Accomplishing this objective is a matter of hardware and software development and the development of suitably exclusive criteria for the identification of suspect mailpieces. To develop these capabilities the Postal Service is putting together a three-phase plan for implementing the capabilities to scan, capture, and analyze mailpieces that have been read as part of the Postal Service s mail processing system. Phase I and II capabilities to include the ability to perform automated, real-time analyses of scanned images have potential intermediate-term viability, while Phase III handwriting analysis is somewhat less mature. In summary, useful image capture and analysis tools for investigative purposes could be available within two to three years.

The WFOV camera system is a program the Postal Service has already funded and the additional information captured is required for the mailpiece tracking initiative. The initial production, testing, and evaluation are planned for May 2002. Technical and operational risks for this technology have been assessed as low since these impacts were reviewed and addressed prior to contract award. The overall viability determined to be near- to intermediate-term, contingent upon camera system manufacture.

Mailpiece tracking and tracing extends the existing capabilities by applying a data collection system to the tracking of mail and associated images. Its implementation is dependent upon the availability of the WFOV cameras; consequently, it also has potential intermediate-term viability.

In summary, enhancement of investigation capability by the implementation and coordination of the three technologies described here is an extension of projects being considered or under way, with potentially deployable capabilities within two to three years.

Section Six

Plan

6.1 Overview

The Postal Service seeks to implement a multi-layered, multi-year Emergency Preparedness Plan to achieve its overriding goals of (1) protecting postal employees and postal customers from exposure to biohazardous material and (2) safeguarding the mail system from future bioterror attacks with no reduction in service to the American public. These goals will be achieved when the Postal Service has the following capabilities:

Detect biohazard materials introduced into the mail stream as soon as possible

Contain biohazard materials identified in the mail stream as soon as possible

Neutralize biohazard materials found in the mail stream

Deter against the use of the mail as a tool for bioterrorist acts

Developing such capabilities will require undertaking a series of technology-based and process-based initiatives, including the following:

Prevention — to deter the use of the mail as a tool of terror and to enable quick response (including police action) in the event of an attack. This includes minimizing the anonymous mailer, establishing mail-collection and entry-point controls, improving manufactured mail security, and implementing methods and technologies to identify and track all retail mail presented at USPS retail outlets.

Protection and Health-Risk Reduction — to reduce risk of exposure to biohazards if introduced into the mail system. This includes improved custodial methods, standard operating procedures using of gloves and masks, air vacuum and filtration, and vacuum filtration systems integrated with mail-processing equipment.

Detection and Identification — to identify the presence of biohazardous materials in near—real-time to enable containment, minimize cross-contamination, and reduce the risk to employees and customers. This includes introducing detection systems, establishing emergency response plans to ensure the safety and health of employees, and defining strict protocols to ensure containment of hazards and ensure the health and safety of employees.

Intervention — to neutralize potential hazards in the mail stream. This includes ongoing sanitization of the mail for targeted groups as indicated through guidance provided by law enforcement threat analysis.

Decontamination — to eliminate known contaminants both in the mail and in equipment and facilities. This includes e-beam and X-ray irradiation of contaminated mail and use of gaseous treatment sterilants in postal facilities.

Investigation — to deter individuals from using the mail for criminal activities. This includes developing an intelligent mail system and capturing and retaining data to enable tracking and tracing of mail items, data mining to allow forensic investigation, and positive product tracking to eliminate anonymous mail and enable quick response.

This plan provides a phased approach to capability development, one that emphasizes near-term (current fiscal year) deployment of mature or nearly mature technologies, followed by continued, intermediate-term (2-3 years) development and deployment of promising technologies and implementation of process changes. Long-term (4-5 year) actions build upon this technology development or serve as responses to changing threat conditions. This plan also accounts for the Postal Service s initial response following the September 11, 2001, terrorist attack on the World Trade Center in which several New York City postal facilities were damaged, as well as the subsequent use of the U.S. mail to send anthrax-contaminated letters. Both initial response and proposed activities are listed in Table 6-1. The costs associated with initial response activities are shown in Table 6-2, while those associated with ongoing and proposed activities are shown in Table 6-3.

The actions described in this plan are designed to lower the risk to postal workers and patrons of bioterrorism through the mails. These actions are also intended to help ensure that the Postal Service will continue to serve its customers as it has in the past. However, no set of technologies or process changes can completely eliminate the threat of bioterrorism.

6.2 Initial Response

Section 1 discussed the initial response activities following the detection of anthrax-contaminated mail at the Brentwood and Trenton postal facilities. The experience gained from employee testing and treatment, building and equipment testing and decontamination, and mail decontamination has provided essential information in terms of what technologies and processes are available and effective. It has also provided a critical look at where additional work needs to be done in areas such as prevention, detection, and health-risk reduction. The lessons learned from initial response activities and the ongoing study by the Postal Service are reflected in the following near-term, intermediate-term, and long-term strategies.

As part of its initial response, the Postal Services has purchased approximately 16,000 HEPA-filtered vacuums for cleaning equipment and building surfaces within postal facilities; it is now using e-beam technology for mail sanitization as well. The HEPA-filtered vacuums are being used to implement new cleaning procedures designed to minimize the health risk associated with the spread of airborne particulates from postal operations. It has and continues to provide gloves and masks to all employees.

Current costs and obligations for mail sanitization ($51.8 million) include the e-beam irradiation of the mail contaminated at Brentwood and Trenton, irradiation of mail being delivered to government offices within the 202 to 205 ZIP codes, and the purchase of eight e-beam accelerators for future use as both an intervention and a decontamination measure. An additional $45 to $50 million will be required for mail irradiation through the end of the current fiscal year and to cover construction and installation costs for the eight e-beam units at two facilities.

The cost of other activities and services, including employee personal protection, on-site environmental testing, nationwide mailings and communications, site clean-ups, and medical costs is approximately $120.5 million. This exceeds the $75 million funded for these activities by $45.5 million. (Reference Table 6.2. $175 million funded, $ 100 million irradiation equipment/services and $ 75 million for other activities/services)

6.3 Near-Term Strategy

The Postal Service s near-term strategy is based on using available production (or near-production) technologies and processes to provide initial security capabilities. The Postal Service s implementation of these capabilities over the next year is intended to provide a level of protection and adequate time for subsequent investigation and validation of emerging technologies.

The first priority under this strategy is to complete the cleaning, decontamination, and reopening of the Brentwood and Trenton facilities, which was begun as an initial response activity (see Section˚6.2). The next priority under the near-term strategy is to put in place health-risk reduction and detection measures within the postal processing and distribution centers, the earliest point in the postal system where it is currently feasible to do so.

Table 6-1. Implementation Plan

Initiative/Project	Viability	Implementation			
		Initial Response	Near-Term Strategy	Intermediate-Term Strategy	Long-Term Strategy
Prevention					
• Collection Box	Intermediate- to Long-Term			X	
• Retail Security	Intermediate-Term			X	
• Manufactured Mail Security	Near- to Intermediate-Term			X	
• Vehicle Access Control Security	Near-Term			X	
Protection and Health-Risk Reduction					
• Employee Personal Protection	NA	X			
• On-Site First Response Environmental Testing	NA	X			
• HEPA Cleaning Systems	Immediate		X		
• Filtration Vacuum Systems on Processing Equipment	Intermediate-Term		X	X	
• HVAC System Filtration or Modification Study	Immediate			X	
• Emergency Response Plan	NA		X		
• R&D / Pilots	NA		X		
Detection					
• Triggers	NA			x	
• Polymerase Chain Reaction (PCR)	Near- to Intermediate-Term		X		
• Facility Air Monitoring Mass Spectrometer	Intermediate-Term			X	
Intervention					
• Mail Irradiation (e-beam, contract)	Immediate		X		
• Mail Irradiation (e-beam, facilities)	Near- to Intermediate-Term		X	X	X
Decontamination (Facility)					
• Chlorine Dioxide	Near-Term		X		
Decontamination (Mail)					
• E-beam (contract)	Near- to Intermediate-Term		X	X	

Table 6-1. (Concluded)

Initiative/Project	Viability	Implementation			
		Initial Response	Near-Term Strategy	Intermediate-Term Strategy	Long-Term Strategy
Investigation					
• Image Capture	Near-Term			X	
• Image Profiling	Intermediate-Term			X	
• Handwriting Analysis	Long-Term			X	
• Wide Field of View Camera	Near- to Intermediate-Term			X	
• Mail-Piece Tracking and Tracing	Intermediate-Term			X	
• Positive Product Tracking	Intermediate-Term			X	X
Other					
• Nationwide Mailing, Messaging, and Communications	NA	X			
• Site Cleanup	NA	X			
• Medical Costs	NA	X			
• Facility Repair	NA		X		

NA: Not Applicable or Not Assessed

Table 6-2. Initial Response Activity Costs

	Appropriation	Activities to Date (as of 2/28/02)
Irradiation Equipment and Services	$ 100.0	$ 53.0
Other Activities and Services		
Employee Personal Protection		$ 29.0
On-Site First Response Environmental Testing		$ 24.0
Nationwide Mailing and Communications		$ 15.0
Site Clean-Up		$ 45.0
Medical Costs		$ 9.0
Sum of Other Activities and Services	$ 75.0	$ 122.0
Total	$ 175.0	$ 175.0

Table 6-3. Ongoing and Proposed Initiatives Costs

		Costs (in $M)			
		Near-Term	Intermediate-Term		Long-Term
		Current Year (Thru 9/02)	Year 2 (FY-03)	Year 3 (FY-04	Year 4-5 (FY-05 / 06)
Current On-Going Activities					
	Decontamination				
	Building Decontamination	$ 35.0			
	Intervention and Sanitization				
	Mail Irradiation Facilities #				1 - 2.25 B
	Current On-Going Activities Total	$ 35.0			1 - 2.25 B
Proposed Initiatives					
	Detection and Identification				
	Polymerase Chain Reaction (PCR) ##	$ 200.0			
	Protection and Health Risk Reduction				
	Filtration on 010	$ 60.0			
	Filtration on AFCS	$ 55.0			
	Filtration on AFSM 100	$ 50.0			
	Filtration on DBCS (Out-Going) ***	$ 80.0			
	R&D / Pilot	$ 9.0			
	Emergency Response Plan	$ 0.5			
	Facility Repair				
	Repair	$ 10.5			
Current On-Going & Proposed Initiatives Sub-Total		$ 500.0		**$ -**	
Supplemental Funding Requirements					
	Filtration on DBCS (Outgoing)***	$ 11.0			
	Prototype and Testing	$ 10.0			
	Detection and Identification				
	Triggers ##		$ 60.0	$ 40.0	
	Facility Air Monitoring ##		$ 120.0	$ 80.0	
	Protection and Health Risk Reduction				
	Filtration on DBCS	$ 50.0	$ 120.0		
	Filtration on CSBCS		$ 44.8	$ 30.0	
	HVAC *	$ 6.0	$ 120.0		
	Prevention				
	Collection Box & Drop Slots **	$ 10.0	$ 50.0	$ 292.0	
	Retail Outlet **		$ 150.0	$ 100.0	
	Manufactured Mail Security			**	
	Vehicle Access Control Security		$ 135.0		
	Investigation				
	Image Capture			$ 20	
	Image Profiling			$ 56	
	Handwriting Analysis			$ 56	
	Wide Field of View Image Camera			$ 4	
	Mail-Piece Tracking and Tracing			$ 210	
	Positive Product Tracking			$ 9.5	$ 111.0
	Proposed Initiatives Total	$ 587.0	$ 799.8	$ 897.5	1 - 2.4 B

* Funding for study, further funding is dependent on outcome of the study.
** Options and costs pending further analysis.
*** Limited quantity without Supplemental Funding
\# Potential costs if intervention systems deployed nationwide.
\## Either PCR and triggers, or Mass Spectrometer will be pursued. (Note, only one of the potential triggers will be used in fielded systems.)

Note: These estimates are for planning purposes only. Funding will be prioritized to account for any necessary changes.

Protective and health-risk reduction technologies include the design and installation of filtration vacuum systems on processing equipment, which includes the Culling 010 operation, AFCS, outgoing DBCS, and AFSM 100. These filtration systems are intended to (1) capture particulate matter at the earliest stages of processing and (2) ensure that biohazardous materials are not released into the facility and are not available for cross-contamination of other mailpieces. Detection technologies, principally based on PCR technology will be used in conjunction with the filtration systems. Further operational testing of PCR equipment for use in postal environments will occur before deployment.

Other proposed activities include research and development leading to the pilot testing of promising detection and health-risk reduction technologies, including mass spectrometry. The level of this effort will depend upon funding availability.

The repair of New York postal facilities and equipment damaged in the terrorist attacks on September 11, 2001 will also be completed.

Intervention, in the form of e-beam irradiation, will continue for mail being delivered to government offices within the 202 to 205 ZIP codes as noted in Section 6-2. Once installation of Postal e-beam systems is complete, and subject to its successful operation in a live postal environment, the e-beam equipment could be available for continued intervention activities, as well as for decontamination of mail, should future bioterrorism attacks occur against the Postal Service.

In addition, the Postal Service will continue its effort to refine its emergency preparedness planning, including enhanced training to response personnel, if funding is available.

The estimated cost for near-term activities is approximately $587 million, as shown in Table 6-3. Approximately $87 million of the $587 million near-term strategy total represents an unfunded need.

6.4 Intermediate-Term Strategy

The Postal Service has identified an initial set of technologies that it will evaluate during the next 24 to 36 months if additional funding is available. These technologies are intended to build on the technologies selected for near-term implementation. The Postal Service will evaluate these candidate intermediate-term technologies and will pursue new technologies that have potential benefits. The Postal Service will establish an ongoing team that will be specifically tasked with identifying, evaluating, and developing technologies during this time period.

Intermediate-term research and development activities are planned within all of the core initiative areas except for intervention and mail decontamination -- these two areas will continue to be dealt with through e-beam irradiation. Under detection, the use of mass spectrometers as both a triggering and confirmation technology for biohazards will be explored with the expectation that it could complement the detection capability provided by PCR. Protection and health-risk reduction activities will continue the near-term strategy efforts to install vacuum filtration on postal facility processing equipment (i.e., remaining DBCS and CSBCS equipment). It will also investigate the feasibility of adding high-efficiency filtration and sanitization technologies to postal facility HVAC systems. Technology-based activities under prevention will focus on minimizing the anonymous mailer threat at collection boxes and retail outlets. Example projects are described in Appendix B. Process-based activities under prevention will focus on changing mail security procedures for known mailers (i.e., manufactured mail) and for tightening security for vehicle access at postal facilities. Investigation will involve a series of process-based activities. Candidate projects include image capture, image profiling, handwriting analysis, and wide field of view camera mailpiece tracking, among others.

The estimated cost for intermediate-term activities is still being developed but will exceed $1.7 billion ($ 800 million in FY-03, $897.5 million in FY-04), as shown in Table 6-3.

6.5 Long-Term Strategy

The long-term strategy consists of continued intervention through mail sanitization and technology development resulting from research and development activities and pilot tests that started during the previous near-term and intermediate-term phases. Actions occurring during this period will also reflect the outcome of continued threat assessment. Continued threat assessment will include an ever-changing array of biohazards and the evaluation of the threat posed by explosives, chemical agents, and radioactive materials. Reference Table 2 for long-term cost estimates.

6.6 Outlook and Next Steps

The writing of this Emergency Preparedness Plan is only a first step in the much longer process that the Postal Service must undertake to ensure the safety of the mail, its employees, and its customers. This plan itself will be revisited and updated on a regular basis as the threats evolve, as better methods to counter those threats are discovered or existing methods are improved, and as costs of available methods change. Some of the techniques discussed in this report for example, biological indicator strips are themselves new technologies that only months ago could not have been considered for inclusion.

In addition to the continual updating of this plan, the Postal Service will do the following:

> Complete the full assessment of threats that may impinge on the mail, to include the full spectrum of biological, chemical, explosive, and radiological threats. This report addresses primarily the biological threat, but future terrorists are most likely to devise new attacks, for which the Postal Service must be prepared.
>
> Establish a team of professionals, as stated in Section 6.4, that will be specifically tasked with identifying, evaluating, and developing new technologies for the countering of threats.
>
> Continue to update its infrastructure and equipment, taking into account the need for countering threats in designs for new infrastructure and equipment. By building in countermeasures from the start and avoiding retrofitting, the Postal Service will more effectively counter threats at a lower overall cost.
>
> Develop detailed plans for the testing, acquisition, deployment, and operation of the systems selected to be used as threat countermeasures.
>
> Determine, and budget for, the recurring costs of operating and maintaining the equipment needed for countermeasures, as well as for the new procedures that will be required. Some of this analysis has been performed in the process of developing this report, but additional, more detailed effort will be needed once the operational plans have been fully developed.
>
> Continue its collaboration with other government agencies, including the Department of Defense and Centers for Disease Control and Prevention, in understanding threats and ways to counter them.

In summary, this Emergency Preparedness Plan makes optimal use of the appropriated funds. The combination of process change and an array of technology applications across prevention, detection and risk reduction provides maximum protection for employees and customers. This plan is dynamic. As such, the Inspection Service will be called upon to periodically update the threat assessment. At the same time, the Postal Service will continue to evaluate a variety of technologies as they reach maturity. The Postal Service is committed to work with research and development efforts to introduce new approaches to solve the bioterrorism problem.

Glossary

ACRONYM	MEANING
AFCS	Advanced Facer Canceler System
AFSM 100	Automated Flats Sorting Machine 100
CBDS	Collection Box Decontamination System
CH_2O	Paraformaldehyde
ClO2	Chlorine dioxide
CSBCS	Carrier Sequence Bar Code Sorter
CT	Computed Tomography
DBCS	Delivery Bar Code Sorter
DNA	Deoxyribonucleic acid
DPRC	Dual Pass Rough Cull Systems Barney
EPA	Environmental Protection Agency
EtO	Ethylene oxide
GAO	General Accounting Office
HEPA	High-Efficiency Particulate Air
HVAC	Heating, ventilation, and air conditioning
LMLM	Letter Mail Labeling Machine
MLOCR	Multi-line Optical Character Reader
MOS	Metal on silicone
MPBCS	Mail Processor Bar Code Sorter
NaOCl	Sodium hypochlorite
NAS	National Academy of Sciences
NBC	Nuclear, Biological, or Chemical
NQR	Nuclear Quadrupole Resonance
O_3	Ozone
OSHA	Occupational Safety and Health Administration
OSTP	Office of Science Technology Planning
P&DC	Processing and distribution center
PCR	Polymerase Chain Reaction
R&D	Research and development
RAM	Reliability, availability, and maintainability
SPBS	Small Parcel and Bundle Sorter
TMS	Tray Management System
UHP	Ultra-high-pressure sterilization
USPS	United States Postal Service
UV	Ultraviolet radiation
WFOV	Wide Field of View