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The U.S. Postal Service Response to the Threat of Bioterrorism Through the Mail

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Summary

The deliberate mailing of *Bacillus anthracis* spores through the U.S. Postal Service (USPS) has caused five deaths, twenty-two cases of anthrax, and massive disruptions to Congress and the USPS.

Both the public and private sector are examining an array of methods to limit the risk of future attacks. The array of potential solutions include improving mail handling procedures, changing the USPS anonymous mailing policy, installing bio/chem agent detectors, and sterilizing the mail.

For the USPS these decisions are complicated by its precarious financial state. Some proposed solutions may require an increase in postage rates and/or decreased levels of service. Each of these may further depress postal revenues and threaten the continued existence of the USPS as an independent, self-supporting entity.

Policymakers will need to decide if the USPS must ensure the safety of mail recipients. At this point it is not clear if this is practical or even possible with existing technology. It may be that it is practical to protect only the mail addressed to the most likely targets of future attacks.

Some of the measures that the USPS has taken or is planning to take to protect postal workers and mail recipients are common sense alterations to the mail processing procedures. These include measures to reduce cross contamination such as using vacuuming instead of pressurized air to dislodge dust, controlling air flow throughout sorting facilities to isolate potential exposure areas, and adding filters to air handling systems. The USPS is studying the feasibility of including biological weapon detectors during the sorting process. Additionally, the USPS is making gloves, masks, and educational materials available to all postal workers.

More controversial and potentially more costly are plans to sterilize the mail. Currently, all mail destined for federal offices in the Washington DC metropolitan area is shipped to sterilizing facilities for irradiation treatment before delivery. The USPS is studying whether this solution can be scaled up to sterilize all mail from anonymous senders. To implement irradiation procedures nationwide could cost between three and five billion dollars with up to another billion dollars each year in operating costs. This procedure may damage the contents of some mail.

Recent reports of skin rashes, headaches, breathing problems, vomiting and bleeding by people who handle irradiated mail have raised concerns about the safety of this treatment. The USPS is working with Congress and federal agencies to find out if the irradiated mail is causing these problems. Clearly this issue will need to be resolved before irradiating a larger portion of the mail.

Policymakers will need to balance concerns for safety, cost, and practicality while to deciding how to alter the practices of the USPS. This report will be updated as events warrant.

Contents

List of Tables

The U.S. Postal Service Response to the Threat of Bioterrorism Through the Mail

Introduction

The use of the U.S. Postal Service (USPS) to deliver agents of bioterror has caused twenty-two confirmed cases of anthrax including five deaths as well massive disruptions to Congress and the USPS.[1] The contamination caused by processing and opening of the letters shuttered the Hart Senate Office Building for more than three months and indefinitely closed mail processing centers in the District of Columbia, New Jersey and Maryland.

These attacks have radically changed the way the nation views mail delivery and mail safety. Both the public and private sectors are evaluating a variety of methods to reduce the risk of similar future attacks. These potential solutions include changing mail handling procedures, changing the USPS anonymous mailing policy, installing bio/chem agent detectors and sterilizing the mail.

For the USPS these decisions are complicated by its serious financial difficulties.[2] The USPS predicts that it will spend approximately $60 million dollars to provide medical treatment to affected workers and to test and clean up facilities. Additionally, the USPS projects costs of $1.2 billion in FY2002 for measures to protect postal workers and to begin evaluating systems to protect mail recipients. In the face of these increased costs, the USPS predicts the decrease in mail volume caused by the attacks will cost $2 billion dollars in lost revenues this fiscal year. USPS feels that its survival depends on being able to ensure the health of postal workers and to restore the faith of the American people in the safety of the mail.

Interest and Role of Congress

The efforts of the USPS to respond to the threat of bioterrorism has been the subject of hearings before the Senate Treasury and General Government Appropriations Subcommittee, Senate Committee on Governmental Affairs and the House Committee on Government Reform. At the request of Committee on

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[1]Centers for Disease Control and Prevention. Morbidity and Mortality Weekly Report. *Update: Investigation of Bioterrorism-Related Anthrax --- Connecticut, 2001*. December 7, 2001. Vol 48. No. 48. p. 1077.
[http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5048a1.htm].

[2] For a thorough review of the USPS financial situation, see CRS Report RL31069 *Postal Service Financial Problems and Stakeholder Proposals*, by Nye Stevens.
[http://www.congress.gov/erp/rl/pdf/RL31069.pdf].

Government Reform Chairman Dan Burton and Ranking Member Henry Waxman, the National Academy of Sciences and the General Accounting Office have convened meetings between USPS officials and outside experts to discuss appropriate technology and methodological changes to limit the threat of future attacks.

Postmaster General John Potter has stated that he views the plans to reduce the threat of terrorism through the mail as an integral part of homeland defense and thus plans to request Congress to appropriate billions of dollars.[3] In addition to the $175 million it received from the White House Emergency Response Fund, the USPS estimated that it would need an additional approximately $1.1 billion in FY2002 to respond effectively to the bioterror threat and to replace or repair facilities damaged in the September 11, 2001 terrorist attacks. The 2002 Department of Defense Appropriations Act (PL 107-117) appropriated $500 million to the USPS for these expenses. Because of ongoing concerns over plans to screen and sanitize mail, the Conferees required the USPS to submit an emergency preparedness plan to the Committees on Appropriations, the House Committee on Government Reform and the Senate Committee on Governmental Affairs before the money for these activities will be disbursed.

> ...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….[4]

In addition to these questions posed to the USPS, policymakers may want to ask themselves other questions to define the role the USPS should play. Clearly the USPS must protect postal workers, but should the USPS also guarantee the safety of mail recipients? Is that possible? If it is possible, how much are ratepayers or taxpayers willing to pay? Does safe mean safe from all potential biological attacks or only anthrax? What about chemical agents? What kind of reductions in USPS service are acceptable to ensure safety? Will changes to level of service add to the precarious financial position of the USPS? What portion of the costs should Congress appropriate and how much of the costs should rate payers bear?

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[3] Testimony of Postmaster John Potter before the Senate Treasury and General Government Appropriations Subcommittee November 8, 2001.

[4] U.S. Congress. House. Making appropriations for the Department of Defense for the fiscal year ending September 30, 2002 and for other purposes. 107th Congress, 1st session. H. Rept. 107-350. Washington, U.S. Govt. Print Off. 2001. p. 452.

Initial Response

Previous terrorist attacks via the mail, such as those of the Unabomber, generally targeted the recipient of the mail. However, because anthrax spores are smaller than the natural pores in envelopes, the spores can leak out during mail sorting, putting postal workers at risk. Additionally, spores can be transferred to other envelopes (a phenomenon called cross contamination), which puts at risk anyone whose mail was processed at the same facility as the anthrax tainted envelopes. Before these attacks, these risks were generally considered negligible by experts in biological warfare and the Centers for Disease Control and Prevention (CDC) because it was thought that the few spores could be transferred this way would not be sufficient to cause disease. Because this assumption proved wrong, the initial response of the USPS has focused on ways to protect postal workers from exposure and how to protect a subset of high risk addressees.

Shortly after the discovery of the contaminated letters, both mail processing facilities which handled the letters were closed indefinitely. The approximately 8,500 postal workers deemed at even remote risk for exposure to anthrax were offered a sixty day course of prophylactic antibiotics.[5] Following the initial 60-day course of antibiotics the CDC has recommended an additional 60-day course. The CDC also has made the controversial anthrax vaccine available for the workers.

The delay between the discovery of the tainted letters, facility closures and antibiotic treatments elicited comment both from postal worker unions and Congress.[6] The USPS attributed the difference between the immediate closing and testing of workers in the Hart Senate Office Building and the delay before postal facilities and workers were tested to a reliance on the evolving recommendations of the CDC.

After these attacks, the USPS examined its practices and found some changes could be made to reduce the risk to both postal workers and mail recipients. One of the most obvious changes concerned dust abatement procedures. Processing mail generates an enormous amount of dust. Compressed air had been the method of choice to clean the processing machines. The USPS recognized that this practice would widely distribute fine anthrax particles throughout the processing facility. It is switching to vacuum systems both to clean the sorting machines and to replace the general maintenance practice of broom sweeping. Similarly, following the suggestion by the CDC, the USPS will be installing high efficiency particulate air (HEPA) filters in all of their heating, ventilation and air conditioning (HVAC) systems to minimize the spread of bioterror agents. The USPS has also provided antimicrobial wipes, protective gloves and masks, and their related educational materials to ensure proper use to all postal workers. **Table 1** details the FY2002 projected costs associated with the changes discussed in this section.

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[5] Centers for Disease Control and Prevention. *Morbidity and Mortality Weekly Report*. Vol.50 No. 47, November 30, 2001, p. 1052.

[6] Washington Post. *U.S. Officials Defend D.C. Response*. October 24, 2001. p. A16.

Prior to the discovery of the tainted mail, no procedure was in place to sterilize potentially harmful biological agents in the mail. As an interim measure the USPS has decided to sanitize mail destined for all federal government offices in the Washington D.C. metropolitan area (zip codes 20200-20599). Initially this consists of sealing the mail into secure containers and shipping it to subcontractors in Lima, Ohio and Bridgeport, New Jersey to be sterilized by irradiation. The USPS claims to have sterilized and delivered nearly all of the mail that had been held undelivered since October. This sterilization procedure adds approximately five days to delivery times. The USPS forecasts that this procedure will be in place for only six months while a permanent solution is implemented which could reduce the delay to two days.

The USPS has purchased eight sterilization machines from the Titan Corporation for a total of $40 million. These will be used as part of an interim solution to sterilize the mail of what is considered high probability targets. These targets were determined by the USPS in cooperation with the Department of Justice. For national security reasons, the USPS will not disclose the exact make up of this list. However, they have publicly stated that some of these initial eight machines will be used to sterilize the mail destined for government offices in Washington D.C. If the decision to sterilize all mail is made, it may take several years before all of the required equipment can be installed. In this case, the target list will be used to prioritize which facilities to upgrade first.

Table 1. Select Projected FY2002 Costs for Bioterrorist Threat Reduction and Security
($ in millions)

Equipment and Building Cleaning Modifications – vacuums for machine maintenance and floor washing	67.0
Major Equipment Vacuum Modification – changes to processing machines to include vacuums to reduce risk of aerosolizing particles	145.1
Heating, Ventilation and Air Conditioning System Modification – HEPA filters for all processing plants and delivery units	97.9
Protective Equipment – masks, gloves and wipes	33.2
Communications and Education – including nationwide mailing to customers, employee training and education on threats and use of protective equipment	45.0
Off-Site Radiation Services – an interim solution to sterilize government agency mail while final plans are determined	9.5
Threat Detection Equipment – to detect the presence of potential biological weapon during the sorting process. This figure also include the installation of protective bags in the collection boxes.	306.5
Technology Deployment Costs – costs associated with testing and postal worker training for new equipment	53.0
Acquisition and Installation of Sterilization Equipment – Although the method to sterilize all mail has not yet been determined, this amount includes testing costs required for evaluating competing technologies and initial equipment purchases. Final costs could be in excess of $4 billion.	245.0

Source: USPS, November 2001

Long Term Response

The future viability of the USPS may depend on its long term response to this new challenge. The USPS is leaning towards a multilayered response that includes changes to mail handling and sorting procedures, threat detection and some level of mail sanitization.

Considerations

Efficacy. Obviously the most important aspect of any proposed solution is effectiveness; i.e. does the solution solve the problem? In this case, the simplest analysis of effectiveness is a measure of how well a proposed solution decreases the probability of a successful terrorist attack through the USPS. This raises further questions such as: Can we expect the solution to reduce the probability of a successful

attack to zero; i.e. how safe is safe? How does the proposal address biological, chemical and conventional attacks? How will the proposal restore the public's faith in the safety of the mail?

The USPS is working with the Office of Science and Technology Policy, the CDC, the National Research Council, the U.S. Army Medical Research Institute of Infectious Diseases at Fort Detrick, and other experts in the Department of Defense to determine which technologies are most promising. The USPS will then test these technologies for adaptability to real world mail sorting conditions.

Cost. Another important feature of any proposal is its cost. Because of the enormous scale of USPS operations, even many seemingly simple changes are likely to incur huge costs. For example, one proposal would place sterilizing equipment in each of the approximately three hundred distribution centers. This remedy has been estimated to require between three and five billion dollars in capital costs plus perhaps another one billion dollars annually in operating costs.

Cost will be evaluated with respect to who will pay. Postmaster General John Potter has testified before Congress that he believes that defending the mail is a function of homeland security and thus taxpayers rather than rate payers should bear the costs associated with implementation costs.[7] This funding plan has met with some skepticism in Congress. Given the precarious state of the USPS's financial situation, some Members have suggested that giving the USPS another five billion dollars may not be a judicious use of taxpayers money.[8]

Level of Service. A few aspects of the USPS's service are considered so important that it considers any changes to these policies to be extremely detrimental either its core mission or to its ability to continue operations. The USPS is reluctant to implement proposed anti-terrorist measures which significantly decrease the level of these services.

One relevant aspect of the mail system is anonymous mailings. Currently, two-thirds of the 680 million pieces of mail the USPS collects each day are from known commercial mailers. This includes mail such as utility bills, catalogues and other bulk mail from pre-identified mailing houses. This leaves more than 250 million pieces to be collected daily from anonymous sources including 300,000 blue collection boxes, mail slots in the 38,000 post offices, as well as more than 100 million addresses the USPS serves. It may be that to maintain the ubiquitous nature of mail pickup sites, some level of sender anonymity must be accepted.

The USPS also contends it is extremely important to not significantly add to delivery time. The USPS depends on the postage generated through bill payments. These revenues are already coming under pressure through the increasing volume of

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[7] Testimony of Postmaster John Potter before the Senate Treasury and General Government Appropriations Subcommittee November 8, 2001.

[8] For a summary of the financial problems facing the USPS see CRS Report RL31069 *Postal Service Financial Problems and Stakeholder Proposal* by Nye Stevens. [http://www.congress.gov/erp/rl/pdf/RL31069.pdf]

electronic bill paying.[9] Billions of dollars in bill payments and remittances flow through the USPS each year. The amount of interest that could be accruing on the money while it is in transit (known as the "float") is enormous. Increasing delivery time will increase the float and therefore decrease the profits of billing companies. This could cause the billing companies to increase pressure on consumers to use electronic bill payment options, greatly decreasing postal revenue.

Postal Worker Safety. Any changes to mail handling and sorting procedures designed to reduce the threat of terrorism should not increase risk to postal workers. For example, some of the sanitizing proposals could decrease workplace safety by requiring storage of radioactive material or very toxic gases. These risks might be manageable but the costs associated with ensuring workplace safety must be included in the proposal.

Potential Solutions

The procedures discussed below are not mutually exclusive. The USPS foresees a multifaceted response consisting of layers of semi-redundant procedures to at least ensure postal worker safety and reduce the risk of cross contamination.[10]

Procedural Changes. Some of the procedural changes discussed above will undoubtably play a part in the USPS long term solution and other changes are under consideration. Procedural changes are potentially attractive because they could be less expensive than plans to sterilize all mail. However because of the sprawling size of the USPS operations, even seemingly inexpensive, easy changes to procedures can quickly become expensive when multiplied by the more than 35,000 USPS facilities.

Changes in anonymity policy. Some have noted that USPS competitors (such as Federal Express and United Parcel Service) that have more stringent sender identification procedures have not been used to deliver biological weapons. There have been suggestions that decreasing the anonymity of senders through the use of "smart stamps" and/or better tracking methods such as sender identifying bar codes, could significantly decrease the probability of another attack.[11] The USPS maintains that sender anonymity is a very important aspect of its service. However, the USPS has also changed this policy in the past due to previous threats. In response to vulnerabilities highlighted by the Unabomber, the USPS began requiring packages weighing more than one pound enter the postal system via postal clerk; i.e. someone who wanted to mail such a package needed to go in person to a post office and hand it to a postal worker.

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[9]U.S. Federal Reserve System. *Retail Payments Research Project: A Snapshot of the U.S. Payment Landscape.* January, 2002.
[http://www.frbservices.org/Key-Initiatives/CheckElecPayResearch.cfm]

[10] Testimony of Postmaster John Potter before the Senate Treasury and General Government Appropriations Subcommittee November 8, 2001.

[11]House Committee on Government Reform Chairman Dan Burton and Ranking Member Henry Waxman, Letter to General Accounting Office Comptroller General David Walker. November 20, 2001.

These suggestions may require a shift in the general philosophy of the USPS. For example requiring the use of "smart stamps" encoded to identify the sender, may greatly decrease the wide availability of stamps. Instead of buying postage at a vending machine, or grocery checkout lane, a person might be required to go to a post office where their identity could be verified. Alternatively, some vending machines could be altered to accept credit cards which obviously could be linked to an individual sender. However this could also make it harder for people without credit cards to purchase stamps. These suggestions appear to be less expensive than comprehensive sterilization procedures, but they might not be. Even if smart stamps could be manufactured nearly as cheaply as paper stamps, the increase in work force for identity verification could prove cost prohibitive. These suggestions also raise questions of equal access to service such as: Do you need to have a permanent address to purchase stamps? Do you need a government issued identity card?

There are two likely assumptions needed for a change in the anonymity policy to decrease the threat of bioterrorism through the mail. The first assumption is that such a system could not be easily subverted by a terrorist, through an assumed identity while purchasing postage or even by the theft of already purchased stamps. The other assumption is that a terrorist would be dissuaded by the chance of being identified. In the September 11, 2001 attacks, terrorists were willing to die to accomplish their goals. Such individuals are unlikely to be dissuaded by the possibility of identification. The lag between the act of dropping off the tainted letter and the detection of the attack could give the determined terrorist ample opportunity for escape, even if positively identified. However policymakers may feel that these proposed solutions could reduce the number of likely terrorists and decrease the chances of a successful attack to an acceptable level of risk.

Changes in Mail Handling. The USPS contends that the mail carriers who collect the mail from the more than 300,000 blue mail drop boxes may be particularly vulnerable to exposure to envelopes leaking a biological weapon such as *Bacillus anthracis* spores. In addition to providing gloves and masks to these workers, the USPS plans to modify the boxes slightly. Currently, when mail is dropped through the opening it falls into a plastic mail tray that sits in the bottom of the box. The USPS is designing a bag system that catches the mail in an attempt to ensure that the postal carrier will not be exposed to leaking envelopes.

In mail sorting facilities, the USPS is no longer using pressurized air to remove dust from machines and is changing to vacuuming for all of its maintenance and general janitorial cleaning. The air handling processes are also being changed to minimize the risk of a tainted envelope contaminating the facility. This may include the use of negative pressure zones and the use of HEPA filters.

Detection. The same properties of the agents that made the recent attack so damaging may make it possible for the USPS to screen some or all of the mail for known bioterror weapons. During the initial phase of sorting, the mail is grabbed and propelled by pinch belts. The USPS found that much of the cross contamination is because these belts forcefully squeeze the air out of the envelopes, which in the case of the tainted envelopes produced a puff of spores. By enclosing this area, it may be possible to analyze the puff for the presence of dangerous materials as each piece of mail passes.

If it is possible to detect a tainted piece of mail within seconds of passing through the pinch belts, this could be used to trigger an immediate shut down of the sorting line. The mail could be quarantined and the workers would know to take the appropriate precautionary measures. This would greatly reduce the risk to postal workers, the chance for cross contamination of the mail and the risk of tainted mail being delivered.

According to a recent National Research Council report, the technology required for this type of detection has generally been plagued by false positives.[12] However the USPS is testing systems that may have much lower rates of false positives because of the specific design requirements of this application.[13] Based on the unique spectrographic signatures of agents, in theory, this method could be used to detect a wide range of threats. However questions remain about how well and how many types of threat these detectors could detect in practice.

Sterilization Methods. The USPS appears to be leaning towards including systematic sanitization of at least some of the mail stream as part of its comprehensive long term response. Because this part of the plan will probably be the most expensive component and since Congress will be asked to appropriate the necessary money, it is likely that policymakers will carefully scrutinize this decision.

Opponents of sterilization can argue that it may provide a false sense of security. While sterilization will reduce the risk of an attack using *Bacillus anthracis* or other bacteria, it will probably not reduce the risk of attack by other agents such as biotoxins (e.g. aflatoxin, botulinum toxin and ricin) or nerve agents. However policymakers may decide that these agents are less likely to be used in future attacks and the benefits of reducing the risk of only some biological weapons is worth the cost.

If policymakers decide that the USPS should sanitize the mail, the appropriate method of sterilization will need to be decided. The USPS is working with the White House Office of Science and Technology Policy (OSTP), National Academy of Sciences, and experts from the Department of Defense to evaluate sterilization technologies. This is a complicated question since nothing on this scale has been previously attempted and each method has its strengths and weaknesses. If policymakers decide that the costs of systematic sterilization (both financial and in terms of damage to the mail) outweigh the benefits, the USPS evaluations of these methods may prove useful to individual companies which may chose to adopt them on a small scale for their incoming mail.

The USPS is obligated to ensure the safety of postal workers. Sanitizing the mail as it enters the mail sorting stream should reduce the risk to many postal

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[12]National Research Council. *Chemical and Biological Terrorism: Research and Development to Improve Civilian Medical Response*. National Academy Press. Washington D.C. 1999. pp.78-95.

[13]USPS Vice President of Engineering Tom Day. Update on technology issues related to safeguarding the mail. Briefing for congressional staff. November 27, 2001.

workers. However, workers and work sites will still be at some risk. For instance, workers who handle mail before sterilization and even workers who work in areas where mail is handled before sterilization will still be at risk of exposure. Some policymakers may feel that workers would be better protected by an aggressive detection regime that could identify an exposure as one happens.

However the question remains whether it is the responsibility of the USPS to ensure the safety of mail recipients. In past the USPS has taken steps to reduce the risk of mail recipients but has refrained from ensuring their safety. For example, to reduce the risk of explosives being sent through the mail, the USPS altered its anonymous mailer policy as discussed above. This did not ensure the safety of mail recipients, it moderately increased the difficulty of mailing a letter bomb. If the USPS concludes that it is imperative to reduce the risk to mail recipients, then some sort of sanitization may be the most effective method. If Congress does not reach the same conclusion and does not appropriate funds for large scale sanitization, the USPS may be forced to re-evaluate its decision in the light of how much of the costs it feels it can pass on to the ratepayers while remaining in business.

On the other hand, policymakers may also conclude that the USPS is uniquely situated to serve as a centralized point for mail sterilization. This analysis grows from the assumption that if the USPS does not ensure the safety of the mail, then many companies will invest in expensive mail handling and sterilization equipment to reduce their vulnerability to massive financial losses that could be triggered by a bioterror attack through their incoming mail. It is possible that if enough businesses would otherwise resort to sanitizing their own mail, the economic savings by having the USPS sterilize all the mail could justify the expense of its implementation. This leaves open the question of who should bear the costs of the USPS sterilizing the mail. It can be argued that if the USPS sterilizes all the mail then companies would not have the costs associated with implementing their own procedures, so they should support a postage rate increase. On the other hand, it can be argued that in spite of support for higher rates, any postage increase will increase pressure to shift to electronic communications, which may irrevocably damage the USPS.

Irradiation. This controversial term describes the use of subatomic particles such as electrons and photons (electromagnetic radiation) as in ultraviolet light, X-Rays and gamma rays. However because there is a strong negative image associated with the term "irradiation," some companies, especially those treating food, prefer terms such as "cold pasteurization." All of these methods work on the same principle, high energy particles bombard the organism causing disruptions in its genetic material, either killing it or destroying its ability to propagate.

The Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA) have approved these forms of radiation to control or eliminate insects, *Trichinella spiralis* (the cause of trichinosis), *Salmonella*, and other food-borne pathogens.[14] For treating food for general consumption, the FDA and USDA

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[14] 21 CFR179.26. For a thorough review of the use of irradiation to treat food see GAO/RCED-00-217, *Food Irradiation: Available Research Indicates that Benefits Outweigh*
(continued...)

limit radiation dose to less than 30 kiloGrays (kGy), although an exception exists for U.S. astronaut food which receives more than 40 kGy. The World Health Organization recommends at least a 40 kGy dose to kill anthrax spores.[15] The USPS would probably plan to use more than 60 kGy to ensure a large margin of safety.[16]

Gamma Rays. Gamma rays are a form of electromagnetic radiation just like visible and ultraviolet light. Gamma rays, generated by the radioactive isotopes cobalt-60 or cesium-137, are currently used to treat food and some medical devices. Because gamma rays can penetrate through several feet, they could be used to sterilize large palettes of mail. However this benefit is outweighed by several other considerations such as relatively long processing times (probably several hours to achieve effective dose) and the large amount of shielding required to ensure worker safety. In addition, the USPS is wary of distributing to their processing facilities radioactive material that may act as a target for future terrorist attacks.

Electron Beam. An electron beam, also known as e-beam, is essentially a very powerful verison of the electron gun found in the cathode ray tubes of televisions and computer monitors. E-beams are currently used to sterilize many medical supplies, including baby bottle nipples and bandages. The eight machines and two sterilization facilities that were described above as part of the initial response of the USPS rely on e-beam technology.

E-beams have relatively shallow penetration through mail, greatly limiting the amount of mail that can be treated simultaneously and their ability to sterilize packages more than a few inches deep. However, the focused radiation of the e-beam means that a single letter could be sterilized in fractions of a second. The USPS contends that e-beam machines could be positioned early in the mail sorting process; just as the mail enters the sorting stream. The USPS also maintains that by placing one or two e-beam machines in each of its processing facilities, it could maintain current average delivery times. However this could boost the cost of system-wide implementation to three to four billion dollars. Another drawback of this approach is the limited production capacity of the e-beam manufacturers is likely to require at least two to three years to make the required number of machines.[17]

E-beam machines have the advantage over gamma rays in that they can be produced without radioactive isotopes. E-beams are generated by electricity and when the machine is switched off they do not produce radiation. They also require much less shielding to ensure postal worker safety than if gamma rays were used.

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[14](...continued)
Risks.

[15] World Health Organization. *Guidelines for the Surveillance and Control of Anthrax in Humans and Animals*. Geneva, Switzerland.1998. p. 38.

[16] USPS Vice President of Engineering Tom Day. Update on technology issues related to safeguarding the mail. Briefing for congressional staff. November 27, 2001.

[17]Postmaster General Potter. Testimony before the Senate Treasury and General Government Appropriations Subcommittee. Nov. 8, 2001.

X-rays. Although X-rays are similar to gamma rays in that they are also a form of electromagnetic radiation, X-rays can be generated using electricity the same way as e-beams. They penetrate mail better than e-beams but not as well as gamma rays. However X-ray machines would take longer to treat the mail and use much more electricity than e-beam machines.

One great advantage of X-rays is that they can be generated by the same machine as e-beams. Thus a combination of e-beam and X-rays could be used in the same sorting line, e-beam for the regular mail and X-rays for the packages more than a few inches deep.

Problems with using irradiation. Perhaps the largest barrier to choosing to irradiate all mail is the high cost associated with implementation and ongoing operation. According to the USPS, installing enough machines to ensure the irradiation of all anonymous mail could cost three to four billion dollars. The machines could also cost one billion dollars each year to operate and maintain.

Irradiating mail may also cause unwanted changes to items in the mail. Because nearly anything can be mailed, it is impossible to predict all the changes that the irradiation process could affect. However some things are known to be adversely affected by irradiation including:

- Paper can become discolored, dried, and embrittled. This may damage important papers and decrease the length of time paper or books can be archived.
- Plastics can be made brittle or discolored. It is also possible some plastics could give off minute quantities of undesirable compounds such as ozone, nitric oxide, cyanide, and chlorinated organic compounds including PCBs.[18] Credit cards can be damaged.
- Food could have its taste and smell changed.
- Unexposed film will be exposed.
- Pharmaceuticals could be weakened unpredictably.
- Explosives could be triggered.
- Medical samples could be destroyed. Currently many medical laboratories send samples to be analyzed through the mail.
- Some electronic equipment including semiconductors may be damaged.[19]
- Contact lenses may be damaged.
- Seeds would be destroyed.

Some of these issues could be addressed by a combination of solutions. For example, limiting irradiation to anonymous mailers could reduce problems for commercial mailings of credit cards and food. The USPS could create a known mailer program to include small businesses such as physicians who rely on mailing medical samples to laboratories for analysis. However as it becomes easier to become

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[18]Robert Woods and Alexi Pikaev. *Applied Radiation Chemistry: Radiation Processing.* John Wiley & Sons New York, NY, 1994. pp. 126-153.

[19] CompactFlash Association. Press release January 7,2002. [http://www.compactflash.org/pr/020107b.pdf].

part of a known mailer program, it may also become easier for this program to be subverted by a terrorist.

Other concerns such as the production of ozone and worker safety have been raised.[20] However the USPS considers these risks to be manageable through worker training and proper safety procedures. As pointed out by the GAO study, the few workplace injuries associated with these machines occurred because control systems or safety systems had been bypassed.[21]

Another concern is that the irradiation procedure may interact with the mail, creating irritants. There are reports of postal workers complaining of nausea after opening bags of irradiated mail.[22] The USPS attributed this to carbon monoxide being generated when the plastic wrapping the mail was irradiated and felt that this could easily be addressed by modifying the procedure slightly.

Perhaps even more alarming are the recent reports that staff from at least six Senate offices have complained of headaches, nausea, skin irritation and bleeding from their noses and ears after handling irradiated mail.[23] Although it is not clear yet that the irradiation process has caused these symptoms, there are prior reports of irradiation causing some materials to become irritating and perhaps allergenic.[24] The consumer advocacy group Public Citizen maintains that irradiating food and perhaps mail can produce toxic byproducts.[25] The USPS currently maintains that irradiated mail is safe.[26] The Senate Sergeant-at-Arms has formed a task force with the USPS, OSTP, the Office of Personnel Management and the Capitol Hill Police to determine if there is a link between the irradiated mail and the symptoms of the congressional

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[20]J.A. Savage. *An X-rayed X-mas: Should the USPS Irradiate Your Mail?* AlterNet Nov. 5, 2001. [http://www.alternet.org/story.html?StoryID=11852].

[21] U.S. General Accounting Office. GAO/RCED-00-217, *Food Irradiation: Available Research Indicates that Benefits Outweigh Risks.* August 2000. p. 14.

[22]The Oregonian. *Postal Service has Plans to Zap Mail for Anthrax*. December 17, 2001. p. A01.

[23]Roll Call Daily. *Health Scare Over Irradiated Mail Moves to the House*. January 28,2002. [http://www.rollcalldaily.com/rollcalldaily/1_80/news1/456-1.html], Roll Call Daily. *Officials Urge Staffers to Come Forward as Physician Logs 11 Cases of Reactions to Irradiated Mail*. January 29, 2002.
[http://www.rollcalldaily.com/rollcalldaily/1_81/news1/461-1.html].

[24]U.S. Food and Drug Administration Center for Devices and Radiological Health. *Medical Glove Report*. September 1997. [http://www.fda.gov/cdrh/glvpwd.html].

[25] Public Citizen. *Hidden Harm: How the FDA is Ignoring the Potential Dangers of Unique Chemicals in Irradiated Food.* December 2001. Washington D.C.
[http://www.publiccitizen.org/publications/release.cfm?ID=7113]
Roll Call Daily. *Consumer Advocate Questions Safety of Irradiated Mail*. January 31, 2002.
[http://www.rollcalldaily.com/rollcalldaily/1_84/news2/484-1.html]

[26] Roll Call Daily. *Postal Service Says Staffer Ailments Not Linked to Irradiated Mail.* January 30, 2002.
[http://www.rollcalldaily.com/rollcalldaily/1_83/news2/476-1.html]

staff.[27] Clearly this issue will need to be addressed before deciding to begin a larger scale program of mail irradiation.

Gaseous. Certain gases, including chlorine dioxide, ethylene dioxide and paraformaldehyde vapor have proven useful for decontaminating buildings and equipment. Chlorine dioxide may be the most promising of these since it has also been used extensively to treat drinking water for many years. However, it is not yet clear if these methods could be adapted for mail sterilization. In practice, the use of these gases is very complicated as demonstrated with the reoccurring problems in chlorine dioxide fumigation of the Senate Hart Building. The USPS is currently testing the efficacy of the most promising of these gases under likely operational conditions.

It has been suggested gaseous sterilization could be considerable less expensive than irradiation. This could be true, since this method would not require the purchase of the expensive irradiation machinery. However, it is not clear how much the postal sorting facilities would have to be modified to ensure the proper handling of these extremely toxic and potentially carcinogenic gases. Furthermore, the storage of these toxic gases on-site could pose a new target for terrorism.

Other methods. Several other methods that are used for sterilizing items in other circumstances have also been suggested to the USPS as a means of treating the mail. These include the use of ultraviolet light (UV) or heat. The USPS has generally found that these methods unsuitable for treating the mail for various reasons. For example, UV cannot penetrate envelopes. On the other hand, heat might be less expensive to implement than irradiation, but would likely have higher operating costs, be much slower and still have problems with causing changes to mailed items.

Conclusions

The series of decisions to be made in the wake of the *Bacillus anthracis* mailings will affect nearly everyone in the U.S. and may alter the fate of the USPS. Perhaps the most important decision to be made is what is an acceptable level of risk? Tightly wrapped up in this decision is how much are we willing to pay and who should bear the costs? Policymakers may also chose to carefully scrutinize the methods that the USPS chooses to implement to ensure that the best and most cost effective plans are executed.

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[27] Roll Call. *Mail Sparks Fears: Irradiated Mail Latest Cause for Concern*. January 28,2002 [http://www.rollcall.com/pages/news/00/2002/01/news0128a.html].

Useful Links

USPS Mail Security Page
[http://www.usps.gov/news/2001/press/serviceupdates.htm]

Centers for Disease Control and Prevention Bioterrorism Page
[http://www.bt.cdc.gov/]

Federal Bureau of Investigation: Anthrax Investigation Page
[http://www.fbi.gov/majcases/anthrax/amerithraxlinks.htm]

GAO Report Benefits and Risks of Food Irradiation (GAO/RCED-00-217)
[http://www.congress.gov/erp/rl/pdf/RL31069.pdf]