

An hourglass-shaped graphic with a globe inside. The top bulb is dark blue, and the bottom bulb is light blue. The globe is a darker shade of blue. The hourglass is centered on the page.

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Irradiated Mail

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Abstract. In response to the mailings of the bioterror agent anthrax, the U.S. Postal Service has begun systematic sterilization of mail destined for federal government offices in the Washington, D.C., metropolitan area. The mail is sterilized using irradiation by electron beam, a method widely used to treat food and medical devices. The USPS is considering expanding sterilization procedures to include all non-commercial mail. This report examines some of the issues surrounding benefits and problems with mail sterilization in general and with irradiation in particular.

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CRS Report for Congress

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Irradiated Mail

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Summary

In response to the mailings of the bioterror agent *Bacillus anthracis*, the U.S. Postal Service has begun systematic sterilization of mail destined for federal government offices in the Washington D.C. metropolitan area. The mail is sterilized using irradiation by electron beam, a method widely used to treat food and medical devices. The USPS is considering expanding sterilization procedures to include all non-commercial mail. The USPS predicts that this may cost up to \$2.25 billion and could start as early as FY2005. This report examines some of the issues surrounding benefits and problems with mail sterilization in general and with irradiation in particular. In addition to large capital and operating costs, this procedure can damage some mail. There is also concern regarding people who have handled irradiated mail reporting skin rashes, headaches, breathing problems, vomiting and bleeding. The USPS is working with Congress and experts from the public and private sector to determine if the irradiated mail is the source of these problems. This group is also working to change mail processing procedures to minimize any potential problems caused by irradiation. Clearly, potential health effects will be addressed before irradiating a larger portion of the mail. This report will be updated as events warrant.

Introduction

The October 2001 mailings of *Bacillus anthracis* 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 and New Jersey.

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>].

The enormous potential cost of another attack has led the USPS to change many of its practices to minimize the threat and to ensure the safety of mail recipients and mail workers.² One of the solutions being pursued by the USPS is the sanitization of mail destined for high probability targets including federal government offices in the Washington D.C. metropolitan area. This is currently done using electron beam irradiation by contractors in Lima, Ohio and Bridgeport, New Jersey. The USPS has purchased eight electron beam sterilization machines and plans to take over this process once facilities are constructed.

To Sterilize or Not to Sterilize?

Although the USPS has decided to indefinitely continue mail sterilization for high probability targets, policymakers are still considering if systemic sterilization of all anonymous mail is advisable.

Opponents of sterilization argue that it may provide a false sense of security. While sterilization may 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 chemical agents. However some experts believe 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.

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 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.

The question remains, however, whether it is the responsibility of the USPS to ensure the safety of mail recipients. In past the USPS has taken steps to reduce risks to mail recipients but has refrained from ensuring their safety. Therefore, to reduce the risk of explosives being sent through the mail, the USPS began excluding packages greater than one pound from anonymous drop offs. This did not ensure the safety of mail recipients, but it moderately increased the difficulty of mailing a 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. However, 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 based on how much of the increased costs it can pass on to ratepayers.

On the other hand, policymakers may conclude that the USPS is uniquely situated to serve as a centralized point for mail sterilization. If the USPS does not ensure the safety of the mail, then many companies may invest in expensive mail handling and sterilization equipment to reduce their vulnerability to financial losses that a bioterror attack through

² For a comprehensive review of the USPS changes, see CRS Report RL31280 *The U.S. Postal Service response to the threat of bioterrorism through the mail.*

their incoming mail could trigger. It is possible that if enough businesses begin sanitizing their own mail, the savings to the overall economy by having the USPS sterilize all the mail could justify the expense of its implementation. Still unanswered is the question of who should bear the costs of the USPS sterilizing the mail. If the USPS sterilizes all the mail, then companies would not have the costs associated with implementing their own procedures. In turn, these businesses would likely support a postage rate increase. On the other hand, in spite of support for higher rates, any further postage increase may increase pressure to shift to electronic communications, which may irrevocably damage the USPS.

Which Is the Best Sterilization Method?

The USPS, with the help of experts from the National Academy of Sciences, the White House Office of Science and Technology Policy (OSTP), the General Accounting Office (GAO), and the Department of Defense (DOD), has evaluated many sterilization technologies. These include chemical technologies (chlorine dioxide, ethylene oxide, methyl bromide, and ozone) and irradiation technologies (microwave, ultraviolet light, gamma rays, X rays, and electron beam). Of these methods, only the irradiation technologies of X rays and electron beam (e-beam) were deemed adaptable for sterilizing mail.³

The term irradiation describes the use of subatomic particles such as electrons or 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. Irradiation is currently used to treat food and to sterilize medical devices.

The Food and Drug Administration (FDA) and the US 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.⁴ For treating food for general consumption, the FDA and USDA 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.⁵ The USPS is working with experts from the DOD to

³ Postmaster General John Potter. *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*. Postal Service Transmittal Letter to Congress. March 6, 2002. Appendix H pp. 44-59. [http://www.usps.com/news/2002/epp/emerpplan_ap.pdf]

⁴ 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 Risks*.

⁵ World Health Organization. *Guidelines for the Surveillance and Control of Anthrax in Humans and Animals*. Geneva, Switzerland.1998. p. 38.

determine which dosage is completely effective at killing spores while minimizing irradiation damage to the mail.⁶

E-beams. An electron beam is essentially a very powerful version of the electron gun found in the cathode ray tubes of televisions and computer monitors. E-beams are generated by electricity and when the machine is switched off they do not produce radiation. E-beams are currently used to sterilize many medical supplies, including baby bottle nipples and bandages. The eight USPS-purchased machines and two sterilization facilities that were described above 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, the experience so far with processing sterilized mail for Congress suggests that delivery times may be increased by a day or more. This delay might be decreased as the USPS learns from its experience with congressional mail.

X rays. X rays are a form of electromagnetic radiation similar to visible light and ultraviolet light. X rays can be generated using electricity the same way as e-beams. Although X rays penetrate mail better than e-beams, 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 Irradiation

Before mail irradiation could be expanded from the current limited program to include all anonymous mail, three issues would need to be addressed.

Cost. According to the USPS, installing enough machines to irradiate all anonymous mail could cost \$2.25 billion plus \$1 billion in annual operating costs.⁷ These large costs underscore the debate of whether postal ratepayers or taxpayers should bear the costs as discussed above.

Damage to Mail. Irradiating mail may cause unwanted changes to items in the mail. Already an issue with the limited irradiation program, this problem would be greatly exacerbated if irradiation were expanded. Because nearly anything can be mailed, it is

⁶ USPS Vice President of Engineering Tom Day. Update on technology issues related to safeguarding the mail. Briefing for congressional staff. November 27, 2001.

⁷ *USPS Emergency Preparedness Plan*. p. ES-9.
[<http://www.usps.com/news/2002/epp/emerpplan.pdf>]

impossible to predict all the changes that the irradiation process could cause. 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 embrittled or discolored. This could damage credit cards and contact lenses. 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.⁸
- 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.⁹
- 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, food and seeds. 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. Yet, as it becomes easier to become part of a known mailer program, it may also become easier for a terrorist to subvert this program.

Health Concerns. Issues regarding postal worker safety and the recipient of irradiated mail have been raised. These concerns, already evident in the limited irradiation program, have the potential to become much greater if a larger population participates in the program.

Postal Worker Safety. Some have raised concerns about the ozone produced by irradiation machines and other worker safety issues.¹⁰ However the USPS considers these risks to be manageable through worker training and proper safety procedures. In a 2000 report, GAO found the few workplace injuries associated with these machines in other industrial settings occurred because control systems or safety systems had been bypassed.¹¹

⁸ Robert Woods and Alexi Pikaev. *Applied Radiation Chemistry: Radiation Processing*. John Wiley & Sons New York, NY, 1994. pp. 126-153.

⁹ CompactFlash Association. Press release January 7, 2002. [<http://www.compactflash.org/pr/020107b.pdf>].

¹⁰ 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>].

¹¹ US General Accounting Office. GAO/RCED-00-217, *Food Irradiation: Available Research Indicates that Benefits Outweigh Risks*. August 2000. p. 14.

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.¹² The USPS attributed this to carbon monoxide being generated when the plastic wrapping the mail was irradiated and has modified the procedure slightly. The USPS claims that there have been no worker complaints since the modification.

Mail Recipient Safety. Also of concern 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.¹³ 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.¹⁴ The consumer advocacy group Public Citizen maintains that irradiating food and perhaps mail can produce toxic byproducts.¹⁵ The USPS currently maintains that irradiated mail is safe but may be unusually dry and dusty which may account for some skin irritation.¹⁶

The Senate Sergeant-at-Arms has formed the Legislative Mail Task Force to determine if these symptoms are caused by the irradiated mail. The task force includes experts from the USPS, Department of Defense, the National Institute for Occupational Safety and Health, the Office of the Attending Physician, and the General Services Administration (GSA).¹⁷ The first products of this task force were guidelines for handling irradiated mail published by both the Office of the Attending Physician and GSA.

¹² The Oregonian. *Postal Service Has Plans to Zap Mail for Anthrax*. December 17, 2001. p. A01.

¹³ 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].

¹⁴ US Food and Drug Administration Center for Devices and Radiological Health. *Medical Glove Report*. September 1997. [<http://www.fda.gov/cdrh/glvpwd.html>].

¹⁵ 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]

¹⁶ 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]

¹⁷ 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>].