Caring for Those Who Care
Protecting the Health and Safety of Health Workers (including Waste Handlers)

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Health Care Without Harm
Rate of Injury & Illness Cases Per 100 F-T Workers

- Private Ind.
- Hospitals
- Nursing & Personal Care Homes
Environment of Work

Environment as a whole:
Persistent Organic Pollutants
Hazardous Drugs
Mercury and other neurotoxics

Environment of Care

Environment of Work
Categories of Workplace Hazards

- Chemical
- Physical
- Psychosocial
- Biological
- Biomechanical
- Inadequate staffing?

Source: National Institute for Occupational Safety and Health
Elimination

- Complete removal of a hazard from the work area

- Preferred method to control hazards and should be selected whenever possible

- EXAMPLE:
  - Needleless IV Systems
  - "Latex Free" Environment
Substitution

- Replacing a conventional material or process with a less harmful alternative.

- **EXAMPLE:**
  
  - Glutaraldehyde – typically used as a cold sterilant to disinfect heat-sensitive equipment such as endoscopes, can cause asthma, conjunctivitis, & dermatitis. Less toxic disinfectants are equally effective and reduce the potential for adverse effects.
Removing or isolating a hazard through technology.

This measure focuses on the source of the hazard or the pathway of transmission.

**EXAMPLE:** Ceiling-Mounted Lift
Policies aimed at limiting worker exposure to a hazard, typically accomplished through work assignments

**EXAMPLE:**

– Workplace Violence: To prevent a patient from assaulting a nurse, staff members may work in pairs when providing care to or transporting a patient on a psychiatric unit. The presence of multiple staff members may discourage patients from attacking.
• Reduce exposure to occupational hazards through the behavior of workers.

• Example:

Prohibiting Re-capping Used/Contaminated Needles
Clothing & equipment designed to be a barrier between worker and hazard

- Least effective measure of control

- Should be last option when trying to reduce worker exposure, since it doesn’t control the hazard itself

- EXAMPLE:

  Gowns, gloves, masks, and eye shields when caring for a patient with SARS
Resources

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• [www.nursingworld.org](http://www.nursingworld.org) search health and safety or by hazard

• [www.cdc.gov/niosh](http://www.cdc.gov/niosh)

• [www.osha.gov](http://www.osha.gov) (search by healthcare industry or hazard)
Transforming Medical Waste Disposal Practices to Protect Public Health:

WORKER HEALTH AND SAFETY AND THE IMPLEMENTATION OF LARGE SCALE, OFF-SITE STEAM AUTOCLAVES

California Department of Health Services Occupational Health Branch

Hospitals for a Healthy Environment Teleconference

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INTRODUCTION

• Incinerators: major sources of dioxins and other hazardous emissions

• Medical waste disposal practices have changed in response to regulatory and public recognition of the hazards

1997 - 2,400 hospital/medical waste incinerators in US

2004 - 110 hospital/medical waste incinerators in US
INTRODUCTION

• Large scale, off-site steam autoclaves implemented to treat waste in lieu of incinerators shut down due to improved environmental regulations

• What are the potential occupational health impacts of these autoclaves?

~ 90% of CA hospitals manage essentially all regulated medical waste off-site

9 of 12 off-site medical waste treatment facilities in CA utilize steam sterilization technology

Few data on worker health and safety impacts
METHODS

• Observed medical waste treatment process at 1 steam autoclave

• Interviewed employer representatives, workers, key informants

• Reviewed employer written records

• Assessed the presence of:
  - Worker exposures and control measures
  - Worker training and hazard communication about their exposures
RESULTS
Steam Autoclave Workforce

- 70 male workers
- 23-61 years (mean 39 years)
- Jobs
  - Drivers (N=38; 54.3%)
  - Plant Workers (N=22; 31.4%)
  - Managers/Supervisors (N=10; 14.3%)
- English and/or Spanish speaking
- Workday
  - Plant Workers: 8 to 10 hour shifts
  - Drivers: up to 15 hours/day, 12 hours of driving
- Non-unionized
RESULTS

Steam Autoclave Work Process

1. Segregate and collect the medical waste stream
Radiation detector at hospital exit

Environmental Services worker transports waste to central storage area
2. Drivers transport medical waste to the off-site steam autoclave
Loading docks at steam autoclave facility
3. Plant Workers unload waste-filled tubs from truck
4. Scan, weigh, and monitor tubs for radiation

Plant Workers lift tubs of waste onto conveyor
Plant Workers scan waste tubs

Radiation scanner
Discrepant waste identified and removed from conveyor
Radioactive waste storage area
5. Dump waste from tubs into autoclave bin
Waste tipped into autoclave bin
Tipper and autoclave tracks

Autoclave bins on tracks
6. Autoclave Waste
7. Compact treated waste

Compactor box
8. Wash tubs

Tub washer conveyor

Enclosed system for tub washing
9. Maintain autoclave, boiler, and conveyor system

Daily and weekly checklists

We did not observe this part of the work process
10. Bury treated medical waste at landfill

Worker unloads treated waste at landfill
Dumping treated medical waste at landfill
Bulldozing and compacting treated medical waste at landfill
RESULTS

Worker Injury Rate

62 injuries per 100 full-time workers (April – Dec. 2002)

46 injuries per 100 full-time workers (2003)
RESULTS

Ergonomic Hazards (1)

- Many hazards reduced by work process design
  - handcarts, conveyor, tipper reduced lifting and carrying
  - autoclave bins mechanically moved in and out of autoclave
  - treated waste mechanically transferred from autoclave to compactor and landfill
RESULTS
Ergonomic Hazards (2)

- Many risk factors for injury still present
  - Extensive, repetitive manual handling of heavy waste containers
  - Picking up tubs of waste stored at generators in inaccessible areas
  - Transporting very heavy tubs
  - Stacking 2-3 tubs on top of each other

Over one year, workers lifted, pushed, pulled, or otherwise handled:

- More than 500,000 containers
- 20 million pounds of waste containers, each weighing 6 to 379 pounds
- Tubs handled multiple times
- 58.7% of tubs had an average weight of 40 or more pounds
- 17% of tubs had an average weight of 87 pounds
RESULTS
Biological Agents

- Work process involved manual handling of open tubs of infectious waste
- Workers had the potential for direct contact with untreated waste during routine and maintenance activities
RESULTS

Waste Packaging Protection Was Part of Work Process Design

• Waste generally contained by packaging prior to autoclaving

• Efficacy of steam autoclave did not rely on “unpackaging” of infectious waste
RESULTS

Post-Treatment Compaction of Sharps Containers is a Hazard for Workers

- Compacting treated sharps containers discharged needles and syringes from packaging

- Treated sharps waste is a safety hazard and biological hazard - sterility is not maintained in the ambient environment

- Caused worker injury at landfill
RESULTS

Generally Good Housekeeping, Some Weaknesses

• Clean work clothes, gloves, safety glasses, face shields, lockers, showers, hand washing stations

• Weaknesses
  • Short sleeved shirts
  • Eye protection not required and/or consistently used by all workers
  • No written policies about glove use at autoclave control panel
  • Timing and frequency of cleaning not specified and documented
  • Contaminated poles and shovels placed haphazardly at dumping station
RESULTS
Hazardous Chemicals Used for Cleaning and Maintenance

TABLE 4: KEY HAZARDS OF WORKER EXPOSURE TO CHEMICALS IN PRODUCTS USED AT A STEAM AUTOCLAVE

<table>
<thead>
<tr>
<th>Task</th>
<th>Chemicals in Products Routinely Used in Large Volumes</th>
<th>Primary Hazards of Worker Exposure to Chemicals in Products Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor Cleaning</td>
<td>Butoxyethanol, sodium hydroxide, bacterial concentrate</td>
<td>Eye and respiratory irritation</td>
</tr>
<tr>
<td>Cleaning Spills</td>
<td>Bleach</td>
<td>Eye, respiratory irritation</td>
</tr>
<tr>
<td>Handwashing</td>
<td>Alcohol, ethanolamine</td>
<td>Eye, respiratory irritation; asthma</td>
</tr>
<tr>
<td>Tub Washing</td>
<td>Quaternary ammonium compounds</td>
<td>Eye, respiratory irritation; asthma</td>
</tr>
<tr>
<td>Autoclave</td>
<td>Solvent-based aerosol cleaners</td>
<td>Central nervous system effects, i.e., headache, nausea, dizziness, clumsiness, drowsiness, cancer</td>
</tr>
<tr>
<td>Boiler</td>
<td>Sodium metabisulfite and sodium sulfite</td>
<td>Severe eye and respiratory irritation; asthma</td>
</tr>
</tbody>
</table>
RESULTS
Carbon Monoxide Exposure from Operating Forklifts

- Colorless, odorless gas
- Short term levels of concern measured at this facility
- Forklift trucks are a major source of work related carbon monoxide poisoning
- Acute illness, permanent neurological damage, death
RESULTS

Noise Exposure at or Above Cal/OSHA Action Level

Figure 39: Range of Worker Exposure to Noise by Job Task

N = 17  8-hour time-weighted average samples from 12 Plant Workers

Job Task
- Dumping Containers (N=4)
- Scanning/Weighing Tubs (N=4)
- Unloading/Loading Trucks (N=5)
- Washing Tubs (N=3)
- Maintenance (N=1)

Range of Noise Exposure dB(A) TWA

Source: EnvirOSH Services, Inc. Industrial Hygiene Survey
RESULTS

Traffic Hazards

Considerable hazard while transporting waste

No vehicular accidents reported
RESULTS
Radioactive, Chemical, and Other Unsuitable Waste Was Sent to Steam Autoclave

• ~ 0.24% of waste stream sent to steam autoclave

• Steam autoclave facility required to notify CDHS when radioactivity above specified levels

• No other established mechanism, and no requirement to systematically compile, evaluate, and report discrepant waste stream
RESULTS
Chemicals in Waste Can Be Volatilized Into Workplace Air

- Results of employer air sampling demonstrated that on the days that sampling was conducted, all chemicals below detectable levels

- Air sampling may have been limited in ability to fully characterize worker exposures
RESULTS

Mercury Released Into Environment

- Mercury detected in 12 of 13 wastewater samples
- Four of 13 samples at levels three to seven times limits
- Mercury in accumulated solids at concentrations greater than hazardous waste levels
RESULTS

Other Chemicals Released Into Environment

- Twelve of 14 wastewater samples in 2003 out of compliance with local Total Toxic Organic discharge limits
- ~90% isopropyl alcohol and acetone
- Other chemicals released included: Trichloroethylene, Xylene, 1,4 dichlorobenzene, DEHP
- Virtually impossible to trace back to the source of hazardous chemicals due to the concentration and commingling of large volumes of waste
RESULTS
Drivers Transported Radioactive Waste

• Drivers relied on generators to screen the waste

• Some hospitals not screening, did not have a detector, or did not have a detector that was working properly

• Workers maximum measured exposures to ionizing radiation ~300 mrem/year

• There should be no work-related exposures to ionizing radiation for workers transporting and treating medical waste
RESULTS

Waste Not Properly Packaged for Transport

Drivers often encountered waste not properly packaged for transport

Drivers authorized and trained to refuse to pick up waste unsuitable for transport

Drivers also obliged to provide excellent service by taking away waste without complaint before it piles up
RESULTS
Worker Training and Medical Monitoring

• Strengths
  - Initial and ongoing health and safety training
  - Training in primary language
  - MSDSs readily available
  - Pre-placement and periodic physical exams
  - Offered Hepatitis B vaccinations

• Weaknesses
  - No Health and Safety Committee
  - Medical Monitoring Program did not fully incorporate the expectation that workers would encounter considerable ergonomic hazards
CONCLUSIONS

Workers Had a Very High Rate of Injury

- 3.4 and 5.8 times higher than the rate of injury among California waste treatment and disposal workers, and health care workers, respectively

- Injuries resulted from ergonomic stressors, sharps, and safety hazards
CONCLUSIONS
Workers Encountered a Variety of Hazardous Exposures
Measures Were Taken to Prevent Worker Exposures
Hazards Not Eliminated

Measures taken to reduce ergonomic hazards were an inadequate match for the heavy physical demands of the job.

Measures to detect, evaluate, and correct waste segregation errors at the facility inadequate.
CONCLUSIONS
Generators Sent Waste Unsuitable for a Steam Autoclave to the Facility for Treatment

- Waste segregation errors identified in ~ 0.24% medical waste containers
- Underestimate of true error rate
- A “small” error rate can have large downstream impact

~ 100 million pounds of medical waste generated/year in California
CONCLUSIONS
Waste Segregation Errors Can Lead to Hazardous Worker and Environmental Exposures

- **Mercury** found in wastewater, accumulated solids, and potentially in workplace air

- **Radioactive materials** in waste led to intermittent, unrecognized, and largely unmeasured worker exposure to ionizing radiation
CONCLUSIONS

Hazards Related to the Design of the Work Process, Not to Steam Autoclave Technology

- Predictable consequence of a work process design that involved extensive manual handling of untreated waste

- Design features that may be advantageous to the environment such as compaction of treated sharps may introduce worker hazards
CONCLUSIONS
Feedback Mechanisms to Identify, Evaluate, and Prevent Occupational Hazards Were Inadequate, Fragmented, or Absent

- No industrial hygiene assessment required as part of permitting
- No Health and Safety Committee
- Detection of radioactive materials only after materials had been transported
- Worker injury rates not calculated, evaluated, or reported to workers
- No comprehensive electronic tracking and reporting system for waste segregation errors or environmental emissions
LIMITATIONS

• Observed 1 steam autoclave at one point in time
  
  - This “snapshot” may not be fully representative. Systematically compiled and reported data related to the occupational and environmental impacts of medical waste disposal are lacking
  
  - However, findings were:
    
    • Consistent with limited available research
    • Reflect consistency among multiple reporting sources
    • Reviewed by regulatory and technical experts with breadth and depth of knowledge of the waste stream
  
  - Waste segregation and packaging errors identified not unique to the facility in this investigation - among the most frequently found violations of the Medical Waste Management Act

• Did not take independent measurements

• Did not thoroughly assess safety hazards and maintenance activities - maintenance activities may involve the most hazardous exposures

• Worker participation was low
RECOMMENDATIONS
Generate Less Medical Waste

• Eliminate the use of needles and sharps wherever feasible

• Decontaminate infectious laboratory waste within the laboratory where it is generated

• Participate in, monitor, and evaluate pollution prevention activities
RECOMMENDATIONS

Incorporate Prevention of Work-Related Hazards into Design of All Medical Waste Treatment Technologies and Work Processes

• Anticipate and prevent hazardous technology and work process design features

• Segregate and package waste properly

• Build interdisciplinary partnerships
RECOMMENDATIONS

Adopt Education, Feedback, and Incentive Mechanisms to Support Primary Prevention

• Educate decision-makers and end-users as to the worker health and safety consequences

• Scrutinize medical waste disposal technologies and work processes – do not transfer hazards across populations and time

• Adopt industry-wide regulatory, economic, and other incentives
What Can Off-Site Medical Waste Treatment Service Providers Do?

• Identify and prevent hazardous exposures

• Implement monitoring and feedback mechanisms

• Provide pollution prevention education and incentives to waste generators
What Can Facilities that Generate Medical Waste Do?

- Reduce the danger and quantity of medical waste
- Segregate and package waste properly
- Integrate measurable occupational health criteria into decision-making about waste treatment service providers
- Train employees about the occupational and environmental impacts of practices
- Serve as a model for best practices
What Can Agencies That Regulate Aspects of the Medical Waste Stream Do?

• Build partnerships between labor and public health programs

• Encourage the development of public health protective waste treatment technologies and work processes

Primary Prevention
Promote Alternatives that Do Not Transfer Risks to Workers
TO GET A COPY OF THE FULL (104 PAGE) REPORT

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