Drum-Top Crushing of Mercury Lamps

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What is Drum-Top Crushing?

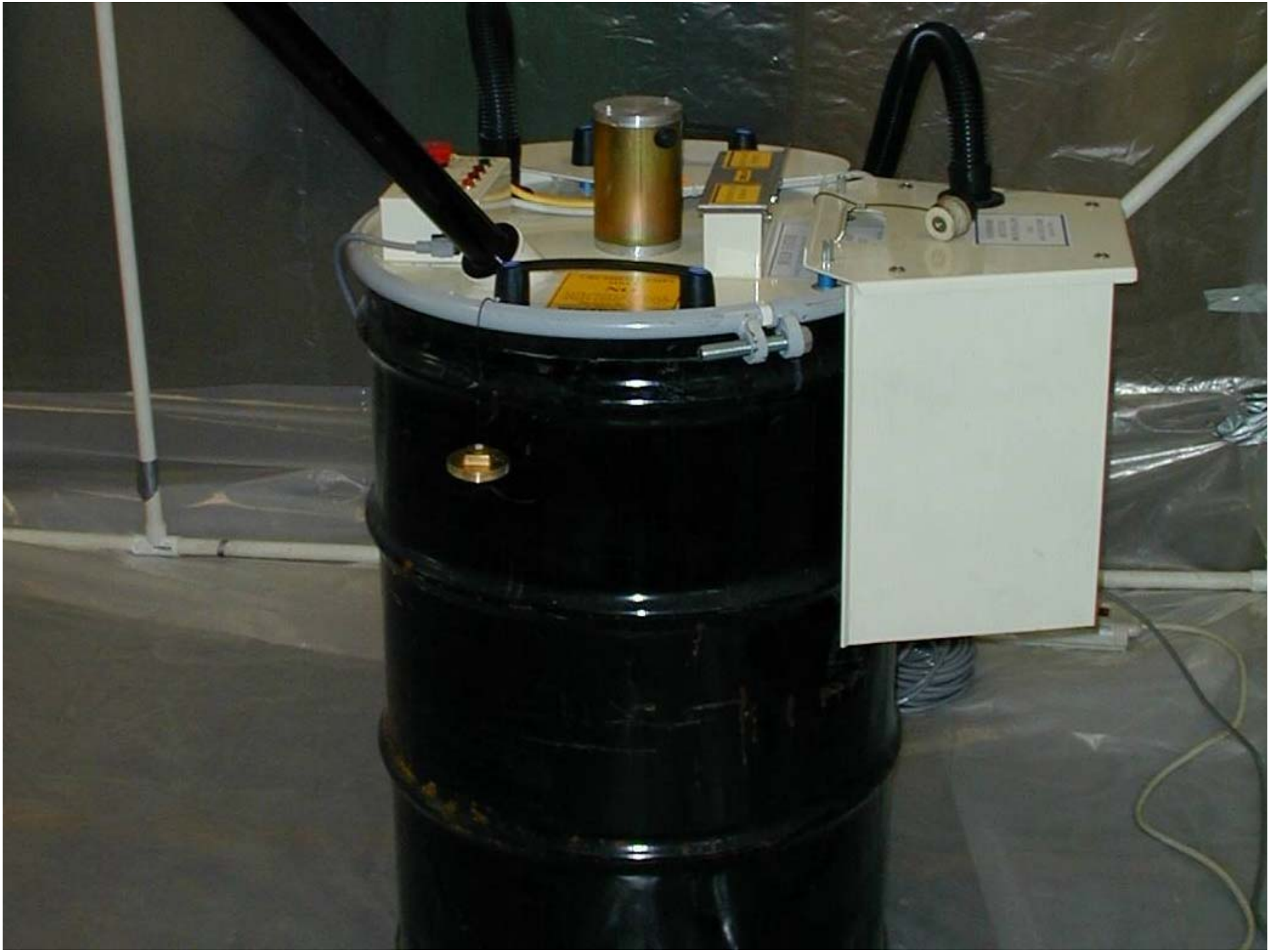
- Drum-Top Crushers are devices designed to volume-reduce waste fluorescent lamps by crushing them in a contained environment.
- Crushers fit on the top of a 55 gallon drum.
- When mercury lamps are broken or crushed, the mercury is released.

What is Drum Top Crushing?

- Crushers are designed to contain the mercury released from lamps when they are broken.
  - Crushers are sealed and operate at negative pressure (generated by a vacuum pump).
  - Air is exhausted through particle and GAC filters.
- Most mercury is contained by the Drum Top Crusher, but some is inevitably released.

What is Drum top Crushing?

- The key questions in operating Drum Top Crushers are:
  - How much mercury is released?
  - Who is exposed?
  - What are exposure levels?



BULB EATER
AIR CYCLE
HEPA


Tyvek
HEPA
1.2/100/02
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Why do Drum Top Crushing?

- Many waste mercury lamps are hazardous waste.
  - They are therefore required to be handled according to hazardous waste regulations for transport, storage, treatment and disposal.
  - Alternately, hazardous waste lamps may be handled as Universal Wastes (UW).
    - The UW rule reduces RCRA requirements to facilitate entry of lamps into the waste management system

Why Do Lamp Crushing

- Spent lamps are a high-volume, low-mass waste.
  - Available storage may be limited.
  - Lamps are fragile, and breakage may occur.
  - Shipping crushed lamps is much cheaper than shipping whole lamps (on a per-lamp basis).
- Approximately 600-800 lamps will fit in a 55 gallon drum when crushed.

Who Might Do Drum-Top Crushing?

- Lamp Generators: Any facility that generates a significant number of waste lamps.
  - Industrial/manufacturing plants
  - Office buildings
  - Other commercial buildings

How is Drum-Top Crushing Regulated?

- EPA considers lamp crushing to be waste treatment because it changes the physical form of the waste to reduce its volume and make storage and transport safer and easier.
  - 40 CFR 260.10 and 64 FR 36477-78, 7/6/99

How is Drum-Top Crushing Regulated?

- Hazardous Waste treatment usually requires a RCRA waste treatment permit.
  - Exception: Waste generators may treat wastes without a RCRA treatment permit, under 40 CFR 262.34 accumulation regulations (51 FR 10168, 3/24/86; 57 FR 37194, 8/18/92).
  - However, lamps crushed under this provision cannot subsequently be handled as UW.

How is Drum-Top Crushing Regulated?

- In the UW rule preamble, EPA recognized that some states have allowed lamp crushing without a RCRA treatment permit.
- The UW waste rule preamble said states could allow crushing by UW handlers if the state program includes a demonstration of equivalency to the federal ban on treatment without a RCRA permit, including:
  - Effective mercury emissions controls
  - Compliance assurance

How is Drum-Top Crushing Regulated?

- Lamps crushed under a state permit issued as part of an approved state UW program remain UW for subsequent management (as allowed by the state program).

What Are Environmental Concerns?

- All fluorescent lamps contain some mercury, which is necessary for their operation.
- When a lamp is broken, the mercury is released.
- When lamps are broken in a drum-top lamp crusher, most mercury is retained, but some is released:
  - seals are imperfect and subject to wear;
  - GAC removes most, but not all mercury from exhaust air.

What Are Environmental Concerns?

- Potentially exposed individuals include:
  - The crusher operator
  - Other people working in the same work area
  - Other people working in spaces sharing the HVAC system
- Release to the environment

EPA Drum-Top Crushing Study

- The lack of detailed guidance in the UW rule preamble led Region 3 to draft guidance to state programs interested in allowing crushing.
- Discussion of the draft guidance led to interest in a better understanding of Drum-Top Crusher performance.
- Region 3 took the lead in conducting a study of crushers.

EPA Drum-Top Crushing Study

- Four rounds of testing were done with three drum top crushers in three locations
  - Crushers from Dextrite, Air Cycle, and RTI
  - A fourth crusher dropped out due to poor performance
  - Tests conducted in Virginia (twice), Arizona and Florida

EPA Drum-Top Crushing Study

- To reduce the effects of variations in air circulation on mercury levels, testing was conducted within a 12’x12’x10’ polyethylene containment.
- Mercury levels were tested in:
  - operator breathing zones,
  - crusher exhaust ports and other locations near the crusher, during drum changes, and
  - in the ambient air within and outside the containment during operation.

EPA Drum-Top Crushing Study

- Mercury was tested using Hopcalite sample media (for the operator samples), and a Jerome Mercury Vapor Analyzer for the ambient air levels.
- Data were collected through July 2003, and a draft report is being developed.
- The draft will be peer reviewed before public release.

Guidance to State Programs on Drum-Top Crushing

- Once the study report is completed we will return to the development of guidance to states on drum-top crushing programs.

Minnesota Dept. Health/ATSDR

- A limited study of drum top lamp crusher emissions, conducted by the Minnesota Dept. of Health, was released December 1, 2003.
- Minnesota Health Dept. and Pollution Control Agency staff attended a demonstration of an Air Cycle “Bulb Eater”.
- The demonstration ran for about 8 minutes.
- A Lumex analyzer was used to measure mercury vapor in the crusher exhaust air and at estimated breathing height in the room.

Minnesota Dept. Health/ATSDR

- Mercury levels at the exhaust port;
  - Range: 0.022-0.052 mg/M^3 (N=5).
- Mercury at breathing height range:
  - 0.020-0.049 mg/M^3 (N=4; door closed), and
  - 0.0026-0.020 mg/M^3 (N=3; door open).
- The OSHA PEL is 0.1 mg/M^3 (ceiling)
- The ACGIH TLV is 0.025 mg/M^3
- The EPA RfC is 0.0003 mg/M^3 (chronic exp.)

Conclusions

- Strong interest in lamp crushing to reduce volume and save transportation cost.
- Lamp crushing can create new exposures:
  - Crusher operator
  - Co-worker exposures
  - Exposures to the general public
  - Release to the environment
- Goal of study and guidance: ensure public health and control environmental release