



# Lead > Secondary Lead Smelter eTool

## Refining and Casting

Crude lead produced during smelting operations is remelted in cast iron kettles and refined by the addition of reagents, such as sulfur and caustic soda. The purified lead is then cast into molds or ingots.

Significant lead emissions can occur from poorly controlled refining, casting, and drossing operations.

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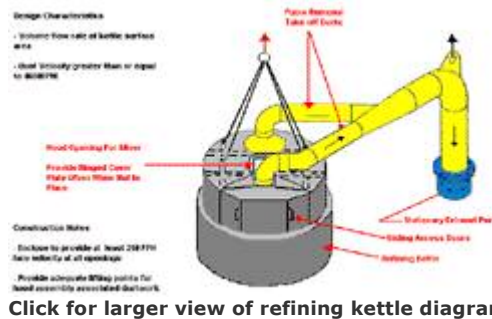
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## Lead > Secondary Lead Smelter eTool

### Refining and Casting > Refining

Typically, metal from the smelting furnace is melted in an indirect-fired kettle or pot and the trace elements are combined to produce the desired alloy. Employees may be exposed to lead fume and particulate during the refining process.



Click for larger view of refining kettle diagram

#### Refining

##### Potential Sources of Exposure:

- Lead particulate may become airborne due to updrafts created by thermal rise from the surface of the refining kettle during preheating and cleaning.
- Lead fumes or particulate may be emitted from the surface of the molten lead during the transfer of lead to the kettle and from the kettle during melting, adding refining agents, and stirring of molten alloy.
- Lead emissions may occur while drossing lead kettles.
- Settled dust may be reentrained due to vibrating equipment and vehicular traffic in the area.

##### Engineering and Work Practice Controls:

- Provide exhaust ventilated enclosure for refining kettles (**Fig. 1**).  
▶ [Refining Kettle Diagram](#)
- Enclose and exhaust ventilate all launders (**Fig. 2**).  
▶ [Controls for Lead Tapping and Pouring](#)
- Pump rather than pour molten lead when possible.
- Keep molten lead temperatures to a minimum to reduce lead fume generation.
- Provide local exhaust ventilation hoods and ductwork that does not



Fig. 1. Removing pump from enclosed refining kettle

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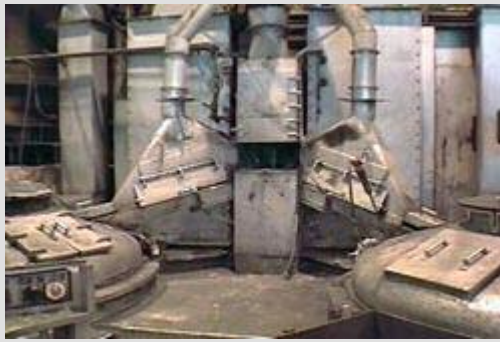
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interfere with the use of overhead cranes.

- Provide roll back access doors to allow the addition of refining agents.
- Provide a supplied air island near the refining kettle.

▶ [Supplied Air Island Diagram](#)



**Fig. 2. Ventilated lead launders to refining kettles**

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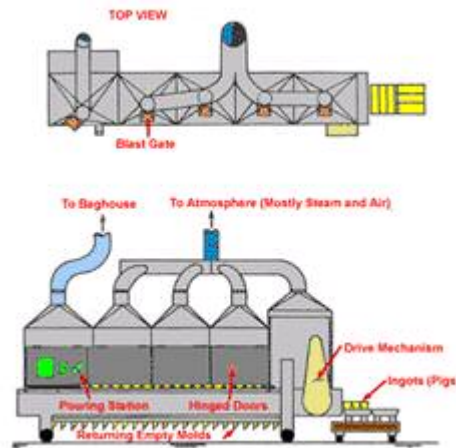


## Lead > Secondary Lead Smelter eTool

### Refining and Casting > Casting

Molten, refined, or alloyed lead is pumped via heated pipes from kettles to a casting reservoir, or casting wheel, which directs a measured amount of lead into steel or cast iron molds. Hand operations include drossing and stacking cooled castings. Castings typically consist of "pigs" (up to 80 pounds) and blocks (up to 2000 pounds) (**Fig. 1**). Employees may be exposed to lead fumes emitted from the molten lead during the casting and drossing operations.

- [Block Casting](#)
- [Pig Casting](#)



Click for larger view of pig/ingot casting diagram

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### Block Casting

#### Potential Sources of Exposure:

- Lead fumes may be emitted during heating and cleaning of lead transfer pipes and pumps.
- Lead fumes may be emitted during the heating of lead reservoir and casting equipment.
- Lead fumes may be emitted during the pouring and cooling of lead castings.
- Lead fumes may be emitted during the drossing of lead oxides from the reservoir and casting surfaces.
- Spillage and emissions of lead fumes and dust may occur during the handling, transport, and storage of drosses.
- Lead fumes and dust may be emitted during mold casting line cleaning, heating, and maintenance.
- Lead dust may be generated during the application of mold release agents.
- Lead dust may be reentrained by mobile traffic moving through the area.



Fig 1. Block casts

#### Possible Engineering and Work Practice Controls:



- Provide local exhaust ventilation for the castings and molds while pouring molten lead.

▶ [Controls for Lead Tapping and Pouring](#)

- Provide a supplied air island at the operator work station.

▶ [Supplied Air Island Diagram](#)

- Use automatic drossing machines when feasible.

▶ [Mechanical Drossing Diagram](#)

- Dross into an exhaust ventilated container.

▶ [Dross Hood Diagram](#)

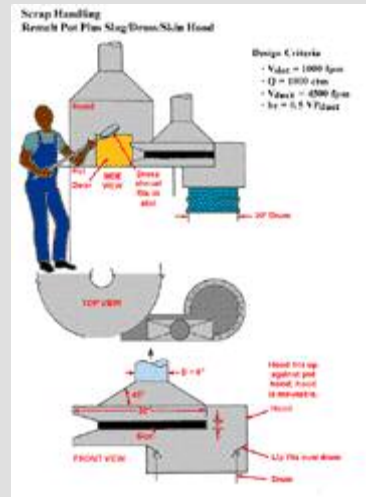
- Enclose and exhaust ventilate all launders.

- Keep molten lead temperature below 1000° F to minimize lead fumes and particulate emissions during lead transfer and drossing of castings and molds.

- Eliminate or minimize the use of a torch for equipment cleanup and spilled lead or dross.

- If a torch must be used, provide portable local exhaust ventilation or a ventilated torch.

▶ [Portable Tool Exhaust Diagram](#)



Click for larger view of lead pot and dross hood

## Pig Casting

### Potential Sources of Exposure:

- Lead fumes may be emitted during heating and cleaning of lead transfer pipes and pumps.
- Lead fumes may be emitted while heating the lead reservoir and casting equipment.
- Emissions may occur during the pouring and cooling of lead castings.
- Lead fumes and dust may be emitted during the drossing of lead oxides from the reservoir and casting surfaces (**Fig. 2**).
- Spillage and emissions of lead fumes and dust may occur during the handling, transportation, and storage of drosses.
- Lead fumes and dust may be emitted during mold and casting line cleaning, heating, and maintenance.
- Lead dust may be generated during the application of mold-release agents.



Fig. 2. Manual drossing of pigs

- Lead dust may be reentrained by mobile traffic moving through the area.

### Possible Engineering Controls

- Provide local exhaust ventilation for the castings and molds while pouring molten lead (Figs. 3 & 4).

▶ [Ingot/Pig Casting Diagram](#)

- Provide a supplied air island at the operator work station.

▶ [Supplied Air Island Diagram](#)

- Use automatic drossing machines when feasible.

▶ [Mechanical Drossing Diagram](#)

- Dross into an exhaust ventilated container.

▶ [Dross Hood Diagram](#)

- Enclose and exhaust ventilate all launders.

▶ [Controls for Lead Tapping and Molding](#)

- Keep molten lead temperature below 1000°F to decrease lead fumes and particulate emissions during lead transfer and drossing of lead oxides from the reservoir and casting surfaces.

- Eliminate or minimize the use of a torch for cleanup of spilled lead metal or dross.

- If a torch must be used, provide portable local exhaust ventilation or a ventilated torch.

▶ [Portable Tool Exhaust Diagram](#)



Fig. 3. Automatic casting machine with local exhaust ventilation



Fig. 4. Enclosed and exhaust ventilated star caster

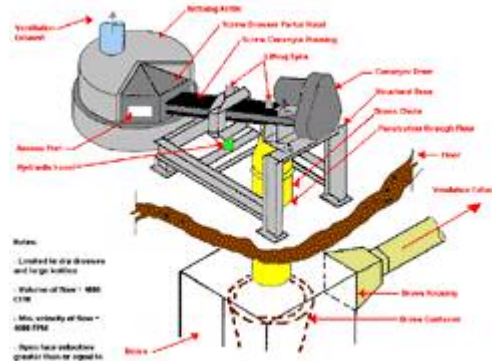


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## Refining and Casting > Drossing

During drossing operations, dross is skimmed to the rim of the kettle and manually shoveled or "spooned" into a container. Mechanical drossing methods, such as vacuum drossing, are used by some secondary lead smelters. Significant levels of lead fume and dust may be released during drossing.

- o [Drossing](#)
- o [Video Exposure Monitoring: Manual Drossing](#)



Click for larger view of mechanical drossing diagram

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### Drossing

#### Potential Sources of Exposure:

- o Lead dust and fume may be emitted during manual or vacuum dross removal (**Fig. 1**).
- o Lead dust may be emitted when depositing dross into a waste container.
- o Emissions may be released while charging dross to the storage bin via pneumatic conveyance system.
- o Lead dust may be spilled and emitted while handling, transporting, and storing dross.



Fig. 1. Manual removal of dross may expose workers to lead dust and fume

#### Possible Engineering and Work Practice Controls:

- o Eliminate or minimize the use of manual drossing. Use automated dross machines where ever possible (**Fig. 2**).
  - ▶ [Mechanical Drossing Diagram](#)
- o Provide an exhaust ventilated barrel or bin in which dross can be deposited before transfer to the storage area.
  - ▶ [Dross Hood Diagram](#)

- Provide portable local exhaust ventilation or enclosure to control emissions from dross which is manually deposited in ladles (**Fig. 3**).

▶ Moveable Exhaust Hood Diagram

- Provide enclosure and exhaust ventilation for dross storage.

▶ Dross Storage Diagram

- Use a drossing shovel, which allows molten lead to drain prior to removal of dross.

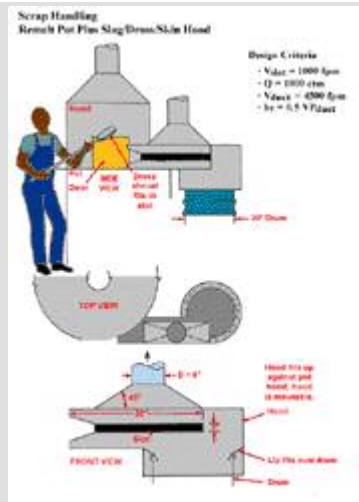
- Use local exhaust ventilation at drossing access locations.

- Do not overfill dross containers.

- Eliminate or minimize the use of a torch for dross cleanup.

- If a torch must be used provide portable local exhaust ventilation or a ventilated torch.

▶ Portable Tool Exhaust Diagram



Click for larger view of dross pot hood diagram



Fig. 2. Portable dross hood with flexible duct attachment port



Fig. 3. Mechanical dross vacuum

### Video Exposure Monitoring: Manual Dross Removal

With video exposure monitoring (VEM), worker exposures to lead are monitored and recorded with a direct reading instrument. At the



same time, work place activities are recorded on a video tape. The right hand bar indicates changes in total dust concentrations over time.

As the employee skims dross (oxide and other impurities) from the kettle, the increasing red bar indicates that the local exhaust ventilation is inadequate to effectively capture lead dust generated during the transfer of dross from the kettle to the ventilated dross receiving vessel.



Low Bandwidth Video

Dial up Modem, ISDN

High Bandwidth Video

LAN, DSL, T1, T3

Note: This example illustrates the level and duration of exposure to total dust and is used to show how VEM can be used for determining sources of employee exposure.

Other sources of employee lead exposure can be determined by using VEM sampling for a full work shift.

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