



# Lead > Secondary Lead Smelter eTool

## Smelting

The smelting process is a major source of lead fume emissions. Smelting involves the reduction of lead-bearing scrap into metallic lead in a furnace. Each furnace is designed and operated to produce a certain lead product. The following furnaces are the most common types of smelting furnaces used in the industry:

- [Blast Furnace](#)
- [Reverberatory Furnace](#)



Lead tap at reverberatory furnace

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- Do not overfill bucket elevators, conveyors, or skip hoists.
- Maintain positive-pressure, HEPA filtered air systems on mobile equipment to ensure effective operation. Check and change air filters regularly as part of an effective scheduled preventative maintenance program.
- Vacuum any spills immediately with a HEPA filtered vacuum system. Water should not be used in the smelting area for dust suppression due to the possibility of oxide fires and the mixing of water and molten lead.

## Tapping

Blast furnace tapping operations involve removing the slag and then tapping molten lead from the furnace into molds or ladles. Some smelters tap metal directly into a holding kettle which keeps the metal molten for refining. The other smelters cast the furnace metal into blocks and allow the blocks to solidify.

### Potential Sources of Exposure:

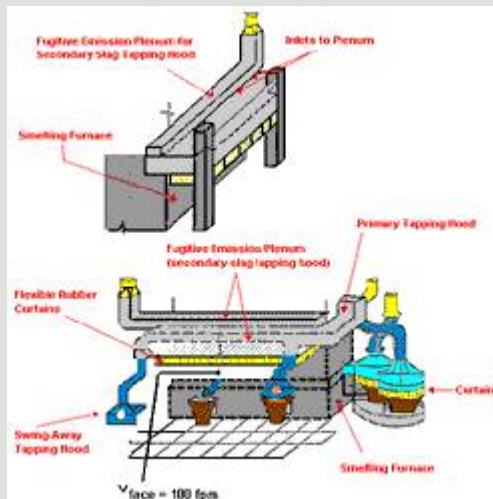
- Lead fumes may be emitted at the lead or slag tapping plugs during removal of the tapping plug or while lancing the tapping plug.
- Emissions may occur while pouring lead or slag at the tapping launder, mold, ladle, or refining kettle.
- Lead dust may become airborne due to disturbance of settled dust in the smelting area.
- Emissions may occur from ladles containing slag or molten lead.
- Spilled slag or molten lead may emit lead fumes.



Slag tap with enclosure hooding and local exhaust ventilation

### Possible Engineering and Work Practice Controls:

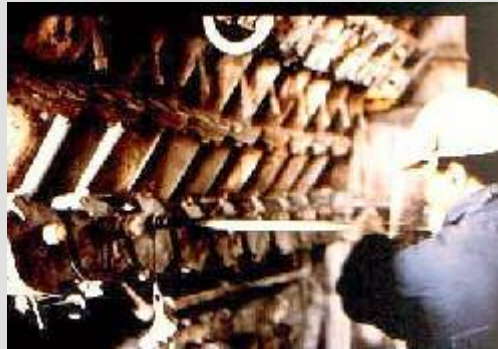
- Provide local exhaust ventilation at the lead and slag tap, launders, molds, ladles, and refining kettles.
  - ▶ [Blast Furnace Lead Tap Controls Diagram](#)
  - ▶ [Blast Furnace Slag Tap Controls Diagram](#)
- Allow lead and slag pots to remain under the exhaust hood until crusted to minimize fume emissions.
  - ▶ [Secondary Exhaust Hood Diagram](#)
- Provide a supplied air island at lead and slag tapping stations.
  - ▶ [Supplied Air Island Diagram](#)
- Provide local exhaust ventilation for staged slag pots if necessary.



Click for larger view of secondary exhaust hood diagram

### Tuyere Punching

Blast air for the combustion process enters the blast furnace through "tuyeres." The tuyeres occasionally begin to fill with accretions and must be physically punched, usually with a steel rod, to keep them unobstructed. The conventional method used for this task is to remove the cover of the tuyeres and insert the steel rod. After the accretions have been "punched," the cover is replaced.



Manual tuyere punching

Recently smelters have been able to adapt an "off-the-shelf" automatic tuyere puncher that has greatly reduced employee lead exposure. However, even with the automatic system there are occasions when the tuyere pipe has to be cleared by using a jackhammer or rod.

#### Potential Sources of Exposure:

- Significant lead fume emissions may come from the furnace during manual punching.

#### Possible Engineering and Work Practice Controls:

- Provide automatic tuyere punching.
  - [Hydraulic Tuyere Punch Diagram](#)
- Use notched, rotating tuyere covers to minimize tuyere opening during punching.
- Stand to the side of the tuyere when opening the cover during the tuyere punching operation.
- Provide a rod of sufficient length to minimize operator exposure.
- Provide a viewing port on the tuyere cover so that plugging can be observed without removing the cover.



Automatic tuyere puncher

### Additional Images



Lifting recently cast lead blocks from mold



Slag side of blast furnace



Local exhaust ventilation at lead tap



Automatic tuyere punch



Liquid lead cooling in molds



Lead flowing into mold

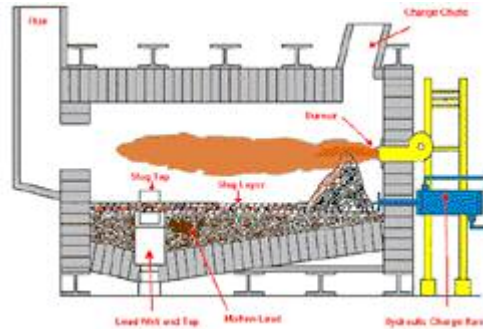


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## Smelting > Reverberatory Furnace

Reverberatory furnaces are designed and operated to produce a soft, nearly pure lead product. Reverberatory furnaces emit high levels of lead fume during the following processes:

- [Charging](#)
- [Tapping Lead and Slag](#)



Click for larger view of reverberatory furnace

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### Charging

#### Potential Sources of Exposure:

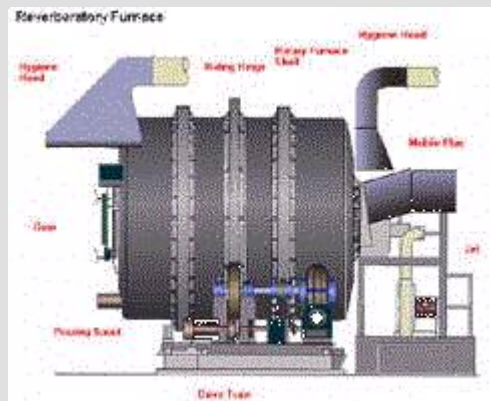
- Spillage or emissions may occur at feed conveyor transfer and charging points of the reverberatory furnace.
- Emissions may occur through leaks in refractory material, which allow lead dust and fumes to escape.
- Lead fume and dust may be emitted from the reverberatory furnace if the furnace is run at positive pressure or if bridging occurs during charging wet materials.



Reverberatory furnace tap hole hood

#### Possible Engineering and Work Practice Controls:

- Enclose and provide exhaust ventilation for the reverberatory furnace.
- Provide hooding with sufficient exhaust ventilation to capture dust that may be generated by filling or emptying charge material conveyors.
  - ▶ [Conveyor Belt Ventilation Diagram](#)
- Maintain positive-pressure, HEPA filtered air system on mobile equipment to ensure effective operation. Check and change air filters regularly as part of an effective scheduled preventative maintenance program.
  - ▶ [Tempered Air Cab Diagram](#)



Click for larger view of reverberatory furnace diagram

- Maintain raw material storage and handling areas under negative pressure to prevent contamination of adjacent furnace areas.
- Provide process controls to maintain sufficient negative air pressure on the furnace during charging to prevent puffing.
- Do not overfill conveyors and ram feeders.
- Vacuum any spills immediately with a HEPA filtered vacuum system. Water should not be used for dust suppression in the smelting area due to the possibility of oxide fires and the mixing of water and molten lead.

## Tapping

Reverberatory furnace tapping operations involve pouring the molten lead and slag from the furnace into molds or ladles. Some smelters tap metal directly into a holding kettle, which keeps the metal molten for refining. Other smelters cast the furnace metal into blocks and allow the blocks to solidify.



Reverberatory furnace lead tap with local exhaust ventilation

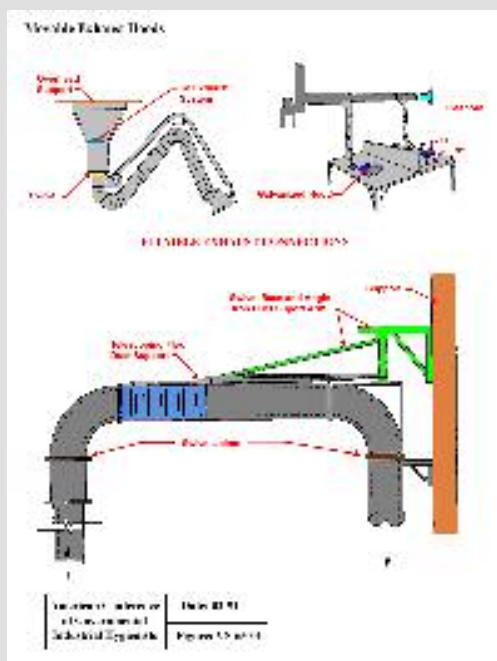
### Potential Sources of Exposure:

- Lead fumes may be emitted at the lead or slag tapping plugs during removal of the tapping plug or while lancing the tapping plug.
- Pouring lead or slag into the tapping launder, mold, ladle or refining kettle may emit fumes.
- Lead dust may become airborne due to the disturbance of settled dust in the smelting area.
- Ladles containing slag or molten lead may emit fumes.
- Spilled slag or molten lead may emit lead fumes.

### Possible Engineering and Work Practice Controls:

- Provide local exhaust ventilation at the lead and slag tap, launders, molds, ladles, and refining kettles.
- Allow lead and slag pots to remain under the exhaust hood until crusted to minimize the emission of fume.
  - ▶ [Secondary Exhaust Hood Diagram](#)
- Provide supplied air island at lead and slag tapping stations.
  - ▶ [Supplied Air Island Diagram](#)
- Provide local exhaust ventilation for staged slag pots if necessary.
  - ▶ [Moveable Exhaust Hood Diagram](#)
- Reline or repair refractory as necessary

to minimize lead fume leakage from furnace.



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