

## Basic Environment, Health & Safety Guidelines for Foundries

- Design collection system and location of coal storage facilities to prevent impacts to soil and water resources. Coal stockpile areas should be paved to segregate potentially contaminated stormwater for pretreatment and treatment in the wastewater treatment unit.

### Noise

The foundry process generates noise from various sources, including scrap handling, furnace charging and EAF melting, fuel burners, shakeout and mould / core shooting, and transportation and ventilation systems. Recommended noise management techniques include the following:

- Enclose the process buildings and / or insulate them;
- Cover and enclose scrap storage and handling areas, as well as shake out and fettling processes;
- Enclose fans, insulate ventilation pipes and use dampers;
- Implement management controls, including limitation of scrap handling and transport during nighttime. Noise abatement measures should achieve the ambient noise levels

### Occupational Health and Safety

The following occupational health and safety issues may be encountered during foundry activities:

- Physical hazards
- Radiation
- Respiratory hazards
- Electrical hazards
- Noise
- Burial hazards
- Fire and explosions

### Physical Hazards

Recommendations for the prevention and control of physical hazards Industry specific physical hazards are discussed below. Physical hazards in foundry operations may be related to handling of large, heavy, and hot raw materials and product (e.g. charging of furnaces); accidents related to heavy mechanical transport (e.g. trains, trucks and forklifts); injuries from grinding and cutting activities (e.g. contact with scrap material ejected by machine-tools); and injuries due to falls from elevation (e.g. high platforms, ladders, and stairs).

## **Lifting / Movement of Heavy Loads**

Lifting and moving heavy loads at elevated heights using hydraulic platforms and cranes presents a significant occupational safety hazard in foundries. Recommended measures to prevent and control potential worker injury include the following;

- Clear signage in all transport corridors and working areas;
- Appropriate design and layout of facilities to avoid crossover of different activities and flow of processes;
- Implementation of specific load handling and lifting procedures, including:
  - Description of load to be lifted (dimensions, weight, position of center of gravity);
  - Sling scheme and strength parameters;
  - Train staff in the handling of lifting equipment and driving mechanical transport devices.
- The area of operation of fixed handling equipment (e.g. cranes, elevated platforms) should not cross above worker and pre-assembly areas;
- Proper handling and shielding of moving hot liquids, as well as solid metal parts;
- Material and product handling should remain within restricted zones under supervision, with particular attention paid to proximity of electrical cables / equipment;
- Regular maintenance and repair of lifting, electrical, and transport equipment should be conducted.

## **Product Handling**

Prevention and control of injuries related to handling, grinding and cutting activities, and use of scrap, include the following:

- Locate machine-tools at a safe distance from other work areas and from walkways. Individual, enclosed workplaces should be provided to prevent accidents resulting from fettling or the use of grinders;
- Conduct regular inspection and repair of machine-tools, in particular protective shields and safety devices / equipments;
- Provide rails along the transfer plate with interlocked gates that open only when machine is not in use;
- Train staff to properly use machines-tools, and to use appropriate personal protection equipment (PPE).

## **Heat and Hot Liquid Splashes**

High temperatures and direct infrared (IR) radiation are common hazards in foundries. High temperatures can cause fatigue and dehydration. Direct IR radiation also poses a risk to sight. Contact with hot metal or hot water may result in severe burns. Recommended measures for prevention and control of exposure to heat and hot liquids / materials include the following:

- Shield surfaces where close contact with hot equipment or splashing from hot materials is expected (e.g. in cupola furnaces, EAF, induction melting ladles, and casting);

- Implement safety buffer zones to separate areas where hot materials and items are handled or temporarily stored. Rail guards around those areas should be provided, with interlocked gates to control access to areas during operations;
- Use appropriate PPE (e.g. insulated gloves and shoes, goggles to protect against IR and ultraviolet radiation, and clothing to protect against heat radiation);
- Implement shorter shift durations for work in high air temperature environments. Provide regular work breaks and access to drinking water for workers in hot areas;
- Install cooling ventilation to control extreme temperatures.

## **Exposure to Radiation**

Workers may be exposed to gamma rays and related ionizing radiation exposure risks. The following techniques may be used to limit the worker exposure risk:

- Gamma ray testing should be carried out in a controlled, restricted area using a shielded collimator. No other activities should be undertaken in the testing area;
- All incoming scrap should be tested for radioactivity prior to use as feedstock material;
- If the testing area is near the plant boundary, ultrasonic testing (UT) should be considered as an alternative to gamma ray techniques;
- Regular maintenance and repair should be conducted on testing equipment, including protective shields.

## **Exposure to Respiratory Hazards**

### **Insulation Materials**

The use of insulation material is widespread in foundries and handling of this material during construction and maintenance may release fibers and present an occupational health hazard. Asbestos and other mineral fibers widely used in older plants may expose people to inhalation risks of cancer-causing substances. In order to limit releases, appropriate and material specific work practices should be applied.

### **Dust and Gases**

Dust generated in foundries includes iron and metallic dusts, which are present in melting, casting and finishing shops; and wooden and sand dusts, which are present in the molding shop. In the former, workers are exposed to iron oxide, and silica dust that may be contaminated with heavy metals such as chromium (Cr), nickel (Ni), lead (Pb), and manganese (Mn). The dust present in the melting and casting shops is generated by high temperature operations, and the fine particle size, and potential metallurgical fumes, creates a serious occupational inhalation risk. In the molding shop, workers are exposed to sand dust, which may contain heavy metals, and wood dust, which may have carcinogenic properties, particularly if hard wood is used. Recommendations to prevent exposure to gas and dust include the following:

- Sources of dust and gases should be separated and enclosed;

- Design facility ventilation to maximize air circulation. Outlet air should be filtered before discharge to the atmosphere;
- Exhaust ventilation should be installed at the significant point sources of dust and gas emissions, particularly the melting shop;
- Use automated equipment, especially in the fettling process;
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- Provide separated eating facilities that allow for washing before eating;
- Provide facilities that allow work clothes to be separated from personal clothes and for showering / washing after work and before eating;
- Implement a policy for periodic personnel health checks.
- Respiratory hazard control technologies should be used when exposure cannot be avoided with other means, such as operations for creating sand moulds; manual operations such as grinding or use of non-enclosed machine-tools; and during specific maintenance and repair operations.
- Recommendations for respiratory protection include the following:
  - Use of filter respirators when exposed to heavy dust (e.g. fettling works);
  - For light, metallic dust and gases, fresh-air supplied respirators should be used. Alternatively, a complete facial gas mask (or an “overpressure” helmet) can be used, equipped with electrical ventilation;
  - For carbon monoxide (CO) exposure, detection equipment should be installed to alert control rooms and local personnel. In case of emergency intervention in areas with high levels of CO, workers should be provided with portable CO detectors, and fresh-air supplied respirators.

## **Explosion and Fire Hazards**

Handling of liquid metal may generate a risk of explosion, melt run out, and burns, especially if humidity is trapped in enclosed spaces and exposed to molten metal. Other hazards include fires caused by melted metal, and the presence of liquid fuel and other flammable chemicals. In addition, iron foundry slag may be highly reactive if calcium carbide is used to desulfurize the iron. Recommended techniques to prevent and control explosion and fire hazards include the following:

- Design facility layout to ensure adequate separation of flammable gas and oxygen pipelines, and storage tanks, away from heat sources;
- Separate combustible materials and liquids from hot areas and sources of ignition (e.g. electrical panels);
- Protect flammable gas and oxygen pipelines and tanks during “hot work” maintenance activities;
- emergency preparedness and response.

## **Emissions and Effluent Guidelines**

Guideline values for process emissions and effluents in this sector are indicative of good international industry practice as reflected in relevant standards of countries with

recognized regulatory frameworks. These guidelines are achievable under normal operating conditions in appropriately designed and operated facilities through the application of pollution prevention and control techniques.

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