

Group Standard

D2 – Molten Materials

Group standard	Title: Molten Materials			
	Function: Health, Safety, Environment and Communities (HSEC)			
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Owner: Global head of Health, Safety, Environment and Communities		Approver: Executive Committee		Target Audience: All Rio Tinto staff and each Rio Tinto Group business and function
Direct Linkages to other relevant Policies, Standards, Procedures or Guidance notes: Rio Tinto HSEC Management System Standard				
Document purpose: To support implementation of the Group Safety policy. It defines the minimum requirements for preventing injuries and fatalities from activities and equipment involving molten materials.				

D2 - Molten Materials

Intent and scope

This standard is applicable to all Rio Tinto business units and managed operations, including new acquisitions, administration/corporate offices and research facilities located off site; during exploration, through all development phases and construction, operation to closure and, where applicable, for post closure management.

This standard applies to all activities and equipment involving molten materials.

Control requirements

Requirements in this standard apply in addition to any defined in the Rio Tinto Management System. At all times, the elimination of risk is the priority.

Planning

- 1.1 Personnel involved in the handling of molten material or those working in the vicinity of molten material must be deemed competent and authorised in relation to the controls required to safely manage the hazards.
- 1.2 A risk assessment must be carried out to establish access control, vehicle cab protections and Personal Protective Equipment (PPE) requirements in areas and for tasks where there is the potential for spillage, emissions of flame or gases, explosion, projected particles or potential exposure to extreme radiant heat.

Implementation and operation

Process management

- 1.3 Hazard analysis must be used to define access, standard operating conditions and control measures for all molten material processes and take into account risks due to run-outs, hot work, explosions, hazardous fumes, foaming and spillage.
- 1.4 Operating procedures must exist for inspection, cleaning, blasting and other process maintenance activity.
- 1.5 The operating temperature of molten materials shall be maintained within the defined limits required by the process. Temperature ranges must be established and a system for identifying, recording and managing any deviations must be in place.
- 1.6 Fuel combustion systems must be fitted with appropriate flame safety systems to prevent conditions that could lead to an explosion or fire.
- 1.7 Technologies and practices must be employed to capture hazardous fumes and gaseous products to keep the risk as low as reasonably practicable.
- 1.8 Work procedures should avoid the necessity of working over an opening into an equipment containing molten material by applying engineering controls, i.e. protective covers, barricades or other suitable mitigation.

Work in the vicinity of an open vessel containing molten material must be performed at a safe distance with appropriate tools and safety equipment. When this is not possible, a risk assessment must be used to define appropriate operating conditions, practices and control

measures to be implemented in order to prevent an accidental fall and contact with the molten material.

Charge materials

- 1.9 There must be a system to ensure that the level of moisture and the reactivity of charged materials does not lead to an explosion or violent reaction. This system must include the specification, purchase, inspection, storage and appropriate practices for materials, including scrap, used to charge furnaces and ladles.
- 1.10 There must be a system in place to ensure that bottles, cans and other closed liquid or gas containers are not charged to equipment containing molten material.
- 1.11 An assessment must be made to determine the potential for hazardous levels of radioactivity to be present in charge materials, including purchased scrap metal. Where the potential for hazardous levels of radioactivity in charge materials exists, then appropriate measures must be taken to manage the risk.

Equipment containing molten material and tools in contact with molten material

- 1.12 All equipment must be designed to prevent the likelihood and implications of a spill, “breakout”, “foaming” or splashing of molten material including exposure to excess heat.
- 1.13 Appropriate emergency exits must be provided to allow for safe exit from the furnace or vessel area in the event of an emergency.
- 1.14 Water sumps, drains, piping and potential water accumulation spots should, as far as reasonably practicable, be located in areas where contact with molten materials is not possible. To the extent that this cannot be achieved, they must be protected from contact by molten material by suitable heat resistant barriers and diversions.
- 1.15 Electrical systems, hydraulic, air and water systems (piping), control systems, fuel and oxygen systems and compressed gas cylinders should, as far as is reasonably practicable, be located in areas where contact with molten material is not possible. Where contact by molten materials is possible, suitable heat resistant barriers and diversions must be provided.
- 1.16 The integrity of equipment containing molten material must be inspected or monitored on a periodic basis e.g. for wear, cracking, mechanical or refractory damage. The inspection frequency must be determined by a risk assessment.
- 1.17 There must be a system to ensure that the level of moisture or other impurities on the surface of any equipment or tools does not lead to an explosion or violent reaction by coming into contact with molten material.
- 1.18 The structural elements of furnaces must be kept within their operating temperature design limits. A system must be in place to ensure that these are known and monitored. The system must also include means of managing factors that could impact control, such as the accumulation of dust or other insulating material.
- 1.19 Furnace binding tie rods must be fitted with retention devices.
- 1.20 All direct chill water cooled casting equipment, water cooled furnaces and water cooled access or transfer equipment that require a continuous water flow for safe operation, must have an assured water supply in the event of power failure, equipment breakdown or other emergency. Procedures for reestablishment of cooling water after an outage must be established.

- 1.21 Granulation water supply systems must be designed with automatically acting back up supply in the event of failure of the primary water supply.
- 1.22 For granulation processes, controls must be in place to ensure water and molten material flow is maintained within design specification and safe operating envelope.
- 1.23 Equipment involved in the safe operation and management of molten material must be designed to “fail safe” in the event of any power or energy source failure. Where a fail-safe design is not practicable, an assessment must be done to identify required mitigation controls.
- 1.24 Hazard analysis must be used to establish the requirement for explosion containment or vents to allow the controlled release of gases in a low risk direction and to mitigate the effects of explosions.
- 1.25 Standard operating procedures and adequate indicators and alarms are required for both normal and emergency operations and maintenance.

Molten material transfer

- 1.26 A risk assessment of on-site molten material transport roads and rail lines must be carried out to identify and control the hazards that could result in molten material spillage or loss of vehicle control or possible derailment. Radius of turns, camber and bends, road surface condition and maintenance, operational speeds and vehicle design requirements must be considered as part of this assessment.
- 1.27 The hazards associated with molten material transfer off and on public roads and rail lines must be subjected to a risk assessment and the practice must be authorised by the appropriate government authorities.
- 1.28 Traffic rules for molten material transport vehicles must be developed and enforced.
- 1.29 Controls must be implemented to safeguard against the consequences of a dropped load, spill or leak of molten material.
- 1.30 Transfer points and systems, e.g. launders, must be designed and built so that excessive flows will be readily diverted and contained within a pit, or a designated overflow vessel or receptacle of adequate size.
- 1.31 Exposure to extreme temperature must be taken into consideration when specifying design, inspection and operating requirements for lifting equipment used for molten material transfer e.g., ladles, hooks, bail beams, chains.
- 1.32 There must be a back-up system to control molten material pouring equipment to a safe position in the event of equipment or power (energy source) failure. Suspended loads must be securely held in the event of a power (energy source) failure and a specific emergency procedure must exist.

Protective Equipment

- 1.33 Personal Protective Equipment (PPE) identified in the risk assessment must be used in areas and for tasks where there is the potential for spillage, emissions of flame or gases, or explosion or potential exposure to extreme radiant heat.
- 1.34 Vehicle cabs and operating positions exposed to splashes, falling material, explosion or projected particles, identified in the risk assessment, must be protected or screened with

appropriate material, e.g. heat resistant glass or plastic where visibility is a requirement or by metal or fabric shields.

Monitoring

- 1.35 Emergency shutdown procedures must be reviewed at least once every three years, updated where necessary and operating personnel must conduct drills at least annually.
- 1.36 There must be a system for periodically assessing the effectiveness of critical controls relating to the safe operation and management of molten material.