

PTP-000813, Rev.: 02 – 20/12/2019

**Department Issuer:** Health, Safety and Operational Risks

**Technical Responsible:** Occupational Safety and Geographic Support Management

**Target Audience:** All professionals who act in Health, Safety and Operational Risk in Vale

**Training Needed:** (x) YES ( ) NO

## Expected Results:

- ✓ To develop and improve existing requirements focusing on the pillar “Zero Lives Lost and Zero Lives Changed”;
- ✓ To consolidate the Critical Activities Requirements as a high-level document and global standard for application throughout Vale in all its business and processes;
- ✓ To reinforce the link with HS legislation, Integrated Management System and associated documents.

## Purpose

To establish minimum requirements for performing critical activities in order to preserve people's lives.

## Application

This document applies to Vale at a global level and must be adopted by its subsidiaries or entities where, by shareholders' agreement, Vale is responsible for health and safety management.

## Important Definitions

- **Short term occasional access:** Uncertain and/or casual event, related to an urgent/emergency, where there is no prediction of recurrence.
- **Critical Activity:** Activity that presents risks with potential to generate fatality or life changed.
- **Mining Area:** Mineral exploration and waste disposal area including machinery, equipment, accessories, installations and civil works used in surface or underground areas in which the industrial exploitation of the mineral deposit is carried out until processing. Administrative areas, cafeterias, accommodations, for example, are not considered mining areas.
- **Medical Contraindication:** Medical term used to characterize the prohibition of exposure to a hazard due to an individual health condition.
- **Transitional Activity Limitation:** Individual health condition that temporarily restricts the performance of a critical activity by an individual. This condition shall be reassessed after the restriction period determined by a certified doctor.
- **Qualified Professional:** Professional who has adequate experience and training to be considered competent to perform their duties in critical activities, considering relevant laws and internal guidelines.

## Premises

This document establishes mandatory requirements that must be complied with in all areas and organizational processes, whether performed by Vale employees or by contractors, on the following subjects:

- RAC 01 - Working at heights
- RAC 02 - Light motor vehicles
- RAC 03 - Mobile equipment operation
- RAC 04 - Lockout, tagout and zero energy
- RAC 05 - Lifting of loads
- RAC 06 - Confined spaces
- RAC 07 - Machine guarding

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- RAC 08 - Ground stability
- RAC 09 - Explosives
- RAC 10 - Work with electricity
- RAC 11 - Molten metal

The requirements in this document must be included in the control measures established within the area's risk management. Therefore, the prevention of incidents related to critical activities is not limited to complying with this document.

All requirements described in this document are mandatory, must be implemented by leadership in their respective areas and are auditable. Failure to comply with the requirements described in this document must be classified and treated as major nonconformities.

It is essential to meet the requirements of the Integrated Management System (IMS), with attention to: Hazards and Risks, Aspects and Impacts and Management of Change; Operational Control; and Emergency Preparedness and Response.

Questions and questions related to this document should be forwarded to the Health, Safety and Operational Risk department by email [saude.seguranca.corporativa@vale.com](mailto:saude.seguranca.corporativa@vale.com).

## Compliance with legislation

Complying with the requirements in this document does not cover all requirements in local health and safety legislations. Therefore, full compliance with local health and safety legislation must be adopted as a basic premise.

In case of conflict between a requirement in this document and that of the local legislation, the one that is most restrictive in health and safety must be applied.

## Exception criteria

In the event of the absolute impossibility to comply with any requirement in this document or the need to replace this requirement with another practice, equipment or facility that is equivalent in risk reduction, the following must be adopted, under the sole responsibility of the requesting department:

- a) Preparation of technical study including, as a minimum, the description of the activity, justifications for non-compliance or replacement, proposed control measures and documented risk analysis;
- b) Formal approval from the business unit Executive Manager;
- c) Communication and submission of the study to Vale's Health, Safety and Operational Risks Department.

The HSOR Department must review the Technical Study and approve or decline the exception for non-compliance or requirement substitution. Any cancellation of the non-compliance or replacement request must also be formally reported to the Health, Safety and Operational Risks Department.

## Criteria for short-term occasional access

Short-term Occasional access where employees are expected to perform critical activities may be permitted without the need for applicable RAC training as per the procedure below:

- a) Orientation with the site's general safety rules, including emergency procedures.
- b) Preparation of a documented risk analysis, with the participation of those involved to discuss risk situations and control measures.

Where applicable, employees must have training records that demonstrate compliance with local legislation. This permission is not applicable for Vale employees.

## General requirements

- a) This document must be referenced and incorporated into procedures regarding local practices and safety equipment and devices must be designed, installed, manufactured and/or purchased as prescribed by legislation, technical standards and/or manufacturers specifications;
- b) Modifications to equipment must be made upon approval by the manufacturer. When the manufacturer is not commercially or technically available, modifications must be made according to a formal project by a qualified professional. Modifications must follow the local management of change process;

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- c) The training required in the RACs must follow the Valer Training Guidelines for the country concerned. In the absence of these guidelines, training must follow local legislation;
- d) Training conducted in one site must be accepted in other sites;
- e) It must be implemented a health assessment program in accordance with local legislation, for employees mapped to perform critical activities: “working at heights”, “light motor vehicles”, “mobile equipment operation”, “lockout, tagout and zero energy”, “lifting of loads”, “confined spaces”, “working with electricity and molten metal”, in order to identify individual conditions that could prevent or temporarily limit the execution of these activities. The program must comply with local legislation and follow the standards of the "PGS-003523 Corporate Guideline for Occupational Health Management" and the "PTP-000779 Specification of examinations for monitoring Occupational Health, RAC, ACT and Traveler's Health".

## Roles and Responsibilities

- a) Business units must:
  - I. Keep a list of requirements that the unit failed to comply with or replaced out of necessity, as per item “Exception criteria” of this document;
  - II. Keep a list and quantity of employees who perform critical activities under this document;
  - III. Maintain an action plan for the implementation of new requirements under this document, considering the implementation deadline of these new requirements.
- b) Local Health and Safety areas must:
  - I. Plan, coordinate and monitor the implementation, maintenance and compliance with Critical Activities Requirements;
  - II. Support contract managers and leaders in the procurement and contracting processes of goods and services related to the Critical Activities Requirements;
  - III. Unfold the requirements of this Instruction to management and supervisory level employees.
- c) Management and Supervisory Level Employees:
  - I. Ensure implementation and compliance with Critical Activities Requirements;
  - II. Ensure that all employees involved in performing critical activities are competent professionals;
  - III. Ensure the training of employees to perform critical activities.
- d) Health, Safety and Operational Risks Department:
  - I. Provide technical assistance to Business Units in the implementation, compliance and monitoring of Critical Activities Requirements;
  - II. Review the document and establish maximum deadlines for complying with the new critical activities requirements;

## Note about the revision

RAC's 01, 02, 03, 04 and 05 were reviewed in both content and form. RAC's 06, 07, 08, 09, 10 and 11 will be revised posteriorly and therefore continue with the same content and format as the previous version of the document.

This document is valid from the date of its publication. The deadline for implementing new requirements (identified in bold) is:

- Equipment and installations: 1 (one) year;
- Procedures: 6 (six) months.

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## 1. RAC 1 – WORKING AT HEIGHT

### 1.1 Foreword

A significant portion of fatalities and high-potential incidents at Vale had occurred during work at height. The main contributing factors associated with these incidents were:

- a) Failure to perceive the risk situation;
- b) Work space for inadequate or congested work;
- c) Defective / inadequate guards or barriers;
- d) Undertaking the activity in an unsafe manner;
- e) Defective / inappropriate tool or equipment;
- f) Absence of barrier that prevents falling of person or object.

### 1.2 Purpose

Establish Health and Safety requirements to eliminate, control and minimize the risk of fatalities, injuries or incidents involving work at heights.

### 1.3 Application

Working at height where there is a risk of a person or objects falling a vertical distance equal to or higher than 1.80 meters.

### 1.4 Exceptions

The requirements of this RAC do not apply to:

- a) Elevated work areas and walkways.<sup>1</sup>

### 1.5 Important definitions

- **Man Basket:** Vehicle equipment intended for lifting people to perform work at height, with movable, articulated, telescopic or mixed arm, with bucket or platform, with or without electrical isolation, and it also can, as long as it is designed for this purpose, lift material by winch and complementary boom (JIB), complying with the manufacturer's specifications.
- **Elevated work area and walkways:** Access and work areas composed by floor and railing (toe board, intermediate and upper handrail) and that follow engineering standards.
- **Coupled man basket:** Bucket or platform attached to a vehicle crane for lifting people and performing work at height, with or without electrical isolation, and it can also lift support material indispensable for the performance of the service.
- **Suspended man basket:** Set formed by the suspension system and the bucket or platform suspended by crane equipment.
- **Fall protection system:** Measures and equipment, collective and individual, adopted to suppress or contain the risks of occupational accidents in activities performed above 1.80 m.
- **Anchor Point:** Certified point of attachment for lifelines, lanyards or travel restraint (deceleration) devices.
- **Connector:** A self-closing device used to connect various parts of personal fall arrest or travel restraint systems.
- **Fall protection:** A method of minimizing the possibility of falling.
- **Fall arrest protection:** An assembly of components that when the assembly is connected to an anchor point, it is capable of arresting a worker's fall.

<sup>1</sup> The PRO-022565 shall be followed in situations and conditions are found to have damaged elements in guardrails that pose a risk of falling.

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- **Fall Motion Limiter:** A type of fall displacement system that is designed to limit a worker 's movement and the potential for a finite distance fall.
- **Body belt:** A device worn on the body (from the hip area to the upper torso) that can prevent a worker from falling vertically or nearly vertically.
- **Lanyard:** A certified line / strap having a connector at each end for connecting the body belt or body harness to an anchorage point.
- **Fall arrest system:** System used to arrest a person in a fall from an elevation. It consists of an anchorage, connectors and full-body harness, and may include a lanyard, deceleration device and/or lifeline.
- **Self-retracting lifeline:** A certified spring wound line that automatically adjusts its length under mild tension and, under high tension, locks to arrest further movement or a fall.
- **Travel restraint system:** A system capable of restricting a person's movement on a work surface and preventing the person from reaching a location from which he or she could fall. (This will include the use of a
- **Work positioning systems:** Aerial or elevating work platforms, ladders, boatswain's chairs, suspended baskets and scaffolding.

## 1.6 Requirements for installations and equipment

### 1.6.1 General requirements to prevent fall of objects, materials and tools:

- a) Area isolation and warning: Isolation and warning must be done **with physical barriers, such as barrier mesh and pedestal**. For short-term activities, after risk analysis performed by the area, other types of isolation and signaling such as nylon tape, ropes or chains may be used. **The use of plain plastic zebra tape is prohibited;**
- b) Tool securing system;
- c) Toe board with minimum height according to local regulations<sup>2</sup>, at the bottom of lifting equipment, scaffolding, platform ladders and places where there is a risk of falling objects.
- d) **Safety nets, where, due to the nature of the activity, isolation of the area is impossible, and the presence of persons involved in the work at a lower level is required.**

### 1.6.2 General requirements to prevent fall of people:

To prevent the risk of fall during work at heights, the following should be adopted:

- a) Handrail, in lifting equipment, scaffolding, platform ladders, excavations and places where there is a risk of falling people, designed in accordance with local regulations, containing:
  - I. Upper railing;
  - II. Mid section railing.
- a) Full Body Safety Harness including double safety strap with double lock rigging gear;
- b) Life line must be affixed to independent structure at:
  - I. Activities using ropes;
  - II. Using suspended scaffolds;
  - III. Using Suspended chairs;
  - IV. Exposed to the risk of falling due to a structural collapse;
  - V. Truss-out scaffold.

### 1.6.3 General requirements for the scaffold:

- a) Consist of metal framing structural members: **Exception: Framing structures for work in electrical substations must consist of non-conductive materials;**
- b) Be tubular, glove type, wedge or platform, **with protection in the clamp safety fasteners;**

<sup>2</sup> In the absence of local standards that establish a minimum height for toe boards, another rule shall be adopted with the consent of Vale's Health, Safety and Operational Risks Board.

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- c) Have by qualified professional;
- d) **Trapdoors in scaffolding are only allowed in atypical situations where external access is impossible and should be considered in the project with physical barrier to avoid falling people.**

## 1.6.4 Variable requirements according to scaffold:

Specific Requirements	Fixed supported scaffold	Mobile supported scaffold	Suspended scaffold
(a) Access ladder incorporated to the structure.	X	X	
(b) Shoes in solid / resistant bases.	X		
(c) Locking of casters.		X	
(d) Automatic mechanical locking device, meeting the maximum cargo capacity of the equipment.			X
(e) Independent life line.			X
(f) Visible plate with maximum allowable workload.	X	X	X

## 1.6.5 General requirements for the ladders:

- a) Stairs<sup>3</sup> must contain dimensions, including intermediate levels, as per local regulations. In the absence of these, another standard shall be adopted with the consent of Vale's corporate occupational safety.
- b) **To access industrial fixed ladders<sup>4</sup> and fixed above 1.8 meters, the alternative use is mandatory:**
  - I. **Fixed life line;**
  - II. **Retractable life line;**
  - III. **Anchoring rod with retractable life line provided that the height of the rod corresponds to the height of the ladder;**

## 1.6.6 Variable requirements according to ladder type (mobile):

Specific Requirements	Simple ladder	Double dadder (Opened)	Extendable ladder	Fixed cage ladder
(a) Steps and platforms whit material non-slip surface.	X	X	X	X
(b) Non-slips shoes.	X	X	X	X
(c) Specific maximum length	X	X	X	
(d) Stabilization devices / Locking of casters				X

## 1.6.7 General requirements for people hoisting equipment:

Aerial work platforms and hoisting equipment to hoist people must contain:

- a) Anchoring point for safety belts;
- b) Movement control of the platform or basket at the bottom;
- c) Emergency stop device on the lower control panel;

<sup>3</sup> In the absence of local standards that establish a minimum height for toe boards, another rule shall be adopted with the consent of Vale's Health, Safety and Operational Risks Board.

<sup>4</sup> **The safety cage for cage ladders is not considered as a fall protection device and the following should be adopted.**

## 1.6.8 Variable requirements according to equipment:

Specific Requirements	Aerial Work Platform	Lifting Equipment to hoist people		
		Man Basket	Coupled Man Basket	Suspended Man Basket
(a) Stabilizer system with inclination indicator.	X	X	X	X
(b) Improper inclination locking system.	X	X	X	
(c) Wheel lock / braking system.	X	X <sup>(a)</sup>		
(d) Emergency system allowing arm movement and tower rotation in case of failure.	X	X	X	
(e) System that allows basket leveling and prevents inclination.	X	X	X	
(f) Visual sound signaling during the vertical movement of the equipment.	X			
(g) System that prevents stabilizer shoes from operating without the previous retraction of the mobile arm.		X	X	
(h) Anemometer with visual and audible alarm.	X			X
(i) Boom radius and angle indicators with visual and audible alert.				X
(j) Block lift height indicator that stops lifting when reaching set height.				X
<b>(k) Proximity device that prevents impact of the upper part of the equipment against another structure.</b>	X			

(a) When no using outriggers

## 1.7 Procedural requirements

### 1.7.1 General requirements for procedures:

- Before any activity involving work at height, in the planning stage, it should be considered which system of individual and collective protection will be adopted;**
- Equipment for Working at Heights shall be subject to pre-use inspection;
- Full body safety harnesses shall be secured throughout the activity;
- The abdominal safety belts are not considered fall protection PPE and therefore can only be used for travel restraint, although the full body harness remains the preferred choice for all work at height.

### 1.7.2 Requirements for scaffolds:

- Be supported by a resistant structure; when equipment and/or installations used to support scaffolds shall be resistant enough to avoid any collapse;**
- Be constructed on a flat surface free of damage or deformation;
- The trapdoor and the barrier around it must always be closed;**
- Be formally released for use by:
  - The verification of compliance with the project;**
  - Completing the inspection checklist;**
  - The signature of the person responsible for the release;**
  - Indication of approval to be used/not approved to be used through plate;
- The movement of mobile scaffold with equipment, tools or objects on or supported is prohibited;

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- f) Units shall designate representatives (or prefect) - called scaffolding inspectors - duly empowered to verify and ensure the execution of scaffolding in accordance with the assumptions of their designs, including verification of assembly modifications, duly documented by assembly service providers based on technical criteria established by the specialized assembly company.
- g) Units, through their engineering departments, shall provide information so that scaffolding structure designs that may be mounted on (supported) process equipment meet the mechanical strength limits of such equipment in order to avoid collapses thereof, their structures and devices.

### 1.7.3 Equipments to hoisting people:

- a) Suspended man basket activities may only be performed in rescue and emergency situations;
- b) Stabilization of hoisting equipment on level ground shall be achievable with maximum extension of stabilizer arms;
- c) It is prohibited to move outside the aerial work platform basket.

### 1.7.4 Requirements to anchor point:

- a) The anchor point must be resistant to the stresses imposed;
- b) The anchor system shall be designed by a certified professional;
- c) The integral structure of an anchorage system shall withstand the maximum applicable force;
- d) The anchoring point system shall be selected such that the impact force transmitted to the worker is not more than 6kN upon any fall;
- e) The anchor system must follow the applicable technical standards;
- f) The anchor system must be installed by a qualified professional (under the responsibility of a qualified professional);
- g) Periodic inspection of the anchor system shall occur with a frequency no greater than annual;
- h) Vale's fixed anchor system inspections and service providers shall be recorded in a central system (preferably computer based) where such this information may be tracked.

### 1.7.5 Requirements to rescue at height:

- a) The Emergency Response Plan shall contain existing work at heights scenarios and staff shall be qualified and prepared, and appropriate equipment for rescuing at heights;
- b) Rescue conditions involving inert suspension shall be simulated and actions taken to reduce the suspension trauma scenario.

### 1.7.6 Requirements for rope access:

- a) Rope access shall be performed according to local regulatory requirements<sup>5</sup>.
- b) The use of rope access should be used whenever the slope of the ground surface does not allow the worker to perform his activities without risk of falls and without the aid of ropes and at least one of the following items is observed
  - I. The worker needs the rope during the activity in order to keep himself standing on the work structure/surface.
  - II. It is necessary to use 2 ropes to perform the activity, one for task and one for rescue.
  - III. The worker needs to use rope to reach a certain point of the structure / terrain without risk of falling.
  - IV. The worker requires the rope to move vertically and horizontally over the structure / work ground.
  - V. The height to the next lower plane is greater than 1.8 meters

<sup>5</sup> In the absence of these, another standard shall be adopted with the consent of Vale's corporate occupational safety



## 1.8 Training requirements

- a) Employees who perform activities at height, considering the applicability criteria of this RAC, should be trained in:
  - I. Risk Prevention at Working at Heights, including recycling;
  - II. First aids training;
  - III. **Training (s) for working at height required by local law;**
- b) **The legally qualified professional responsible for the elaboration of a fall protection system should be specifically trained in this subject, following the premises of the local legislation;**
- c) Employees operating aerial work platforms and personnel lifting equipment shall be certified in the safe operation of such equipment.

## 1.9 Roles and responsibilities

### 1.9.1 Contract Manager:

- a) Ensure all CAR requirements are implemented in his/her areas; follows the services suppliers 'safety performance and requirements accomplishment; participate on any incident related event investigation involving work at height activities performed by contractors.

### 1.9.2 Maintenance Planning and Scheduling:

- a) Need to know the CAR requirements applicable to his/her areas and ensure that risk analysis for work at height are initiated on his/her work process steps.

### 1.9.3 Tool Shop Supervisor and/or Resources (Materials) Responsible (professionals in charge to manage the work at height equipment and devices):

- a) Ensure that all devices for work at height are inspected on receiving step, as well as, periodically; set the inspection plan including frequency according to related regulatory requirements. Segregate and send for disposal all equipment and device in nonconformance condition.

### 1.9.4 Work at Height Supervisor:

- a) Provide support for risk analysis of activities involving work at height; support the engineering area to identify and define points to apply fixed or mobile anchorage systems (pre-engineered devices) ; support the Vale (or prefect) scaffolding inspector. Set all working at height scenarios and activities mapped and update. Perform risk analysis to define (if applicable) the rope access.

### 1.9.5 Scaffolding Inspector:

- a) Verify and ensure that scaffolding assembling according to the related Project assumptions, including the changes on scaffolding, and following the service providers documents, based on technical criteria set by specialized scaffolding assembling.

### 1.9.6 Anchorage and Fall Protection System Specialist:

- a) Assigned, skilled and legally authorized to elaborate anchorage systems and its fixing elements projects.

## 2. RAC 02 – LIGHT MOTOR VEHICLES

### 2.1 Foreword

Several incidents with critical or catastrophic potential have occurred with the involvement of light motor vehicles. The main causes of these events are:

- a) Speed incompatible with the road conditions;
- b) Vehicle instability;
- c) Poor conditions of the vehicle;
- d) Lack of visibility;
- e) Driver fatigue;
- f) Driver distraction;
- g) Other risky driver behaviors.

### 2.2 Purpose

Establish requirements for the safe operation of motor vehicles at service of Vale.

### 2.3 Application

This RAC applies to the operation of Vale owned, leased and short-term rental light motor vehicles, while at service of Vale. The RAC also applies to service provider vehicles operated as part of a Vale contract in public or Vale roads (including underground and surface mining areas).

Types of light motor vehicles covered in this document include: automobiles, sport utility vehicles, pick-up trucks, minivans, full size vans, and buses (both compact and full size).

### 2.4 Exceptions

This document does not apply to:

- a) Vehicles which are not at service of Vale, driven by people who have permission to access the Sites of Vale. However, the specifications of these vehicles must comply with local legislation and drivers must obey the Site Traffic Plan;
- b) Vehicles for emergency response.

### 2.5 Important definitions

- **Mining Area:** areas used for mining activity, such as open pits, underground mines, waste disposal squares, maneuvering areas, loading and unloading squares, where the access of motor vehicles, mobile equipment and people is controlled.
- **Operational Area:** all internal areas of Vale's Sites (Terminals, Power Plants, Railways, Mining Areas, Parking Areas, among others), whether operational or administrative, where the access of motor vehicles, mobile equipment and people is controlled.
- **Operational road:** the roads, access roads and traffic lines in the exploitation areas
- **Owned / Leased Vehicle:** vehicles that are owned, or long term leased, which make up the fleet of Vale light motor vehicles.
- **Primary Speed Retarding System (Engine Braking):** mechanical braking property which reduces or keeps the speed of the vehicle, when the driver takes the foot off the accelerator pedal while the vehicle's engine is in low gear on a descent
- **Rental vehicle:** vehicles that are rented directly from approved car rental companies, at airports or agencies. These contracts shall not extend over 3 consecutive months, regardless of whether it is a single contract or different contracts.
- **Dedicated Vehicles:** vehicles operating in administrative and / or operational areas other than mining areas.

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- **Secondary Speed Retarding System (electric or hydraulic):** an auxiliary braking system that works independently of, and in conjunction with, the service brakes and engine braking.
- **Speed monitoring system (telemetry):** wireless data transmission and reception technology designed to remotely monitor vehicles
- **Vehicle that accesses mining areas:** any vehicle that access operating roads in mining areas, with or without interaction with mobile equipment

## 2.6 Requirements for installations and equipment

### 2.6.1 Requirements for the operating roads and circulation of light motor vehicles:

- All the operating roads shall be identified in the Traffic Plan;
- Physical barriers or protective devices (such as walkways, bumps or lights activated by pedestrians on safe walking paths, among others). Shall be installed, to segregate the interfaces between people and motor vehicles as much as possible, where there is a significant risk of contact between vehicles and people;**
- Speed road signs shall be installed at regular intervals indicating maximum allowable speed on the internal roads;**
- Parking areas shall be designated for parking light motor vehicles the areas shall allow a safe separation from mobile equipment);**
- Traffic routes for the circulation of mobile equipment, vehicles and pedestrians shall be clearly identified;**
- The internal roads of permanent facilities shall be preferentially paved. The mining areas shall be leveled;**
- In underground mining, cutouts shall be designed for the parking of motor vehicles in a way that does not interfere with the traffic in the main roads.**

### 2.6.2 Requirements for all light motor vehicles:

- The use of motorcycles, bicycles, tricycles, quadricycles and other vehicles not mentioned in this document, at service of Vale and/or inside Vale property, is prohibited;**
- All vehicles must receive the required preventive maintenance as recommended by the manufacturer;
- Modifications in motor vehicles shall only be done with the formal approval of the manufacturer.

### 2.6.3 Specific Requirements according to light motor vehicle:

Specific Requirements	Dedicated Vehicles	Rental Vehicles	Vehicles that access mining areas	Vans	Micro buses	Buses
a) Three-point seat belts for all passengers	X	X	X			
b) Three-point seat belts for first row of seats and two point for other seats				X	X	X
c) Headrest or high backed (bucket) seat with fixed head restraint for all passengers	X	X	X	X	X	X
d) Front airbag for the driver and the front seat passenger	X	X	X	X		
e) Anti-lock braking system (ABS)	X	X	X	X		
f) Vehicle warning signaling devices such as reflective triangles and / or cones	X	X	X	X	X	X
g) Reverse Audible Alert	X		X	X	X	X
h) <b>Reverse Sensor</b>	X		X	X	X	X
i) <b>Location and speed monitoring system (telemetry)</b>	X		X	X	X	X
j) <b>Driver drowsiness detection system (*)</b>	(*)		(*)	X	X	X

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k)	Electronic Braking Control (EBD)			X			
l)	Stability control			X			
m)	Four wheel or permanently engaged all-wheel drive systems			X			
n)	Traction control system			X			
o)	Reflective striping			X			
p)	communication system between vehicles and mobile equipment			X			
q)	Visible pennant with LED light at the tip, installed according to the height of the highest equipment circulating in the mine			X			
r)	Roof Mounted flashing, rotating or strobe light			X			
s)	Proximity Alert Sensor for Heavy Equipment, with audible alert sound			X			
t)	Primary speed retarding system (engine brake)					X	X
u)	Secondary speed retarding system (electric or hydraulic)						X
v)	Emergency exits with single handle opening mechanism					X	X

**NOTE:** Where vehicles are manufactured with Anti-Rollover Devices (ROPs), it is recommended that this option be adopted as a further protective barrier for the vehicle occupants.

(\*): Consult requirement 2.7,c,V below

## 2.7 Procedural requirements

- a) All persons who drive vehicles at the service of Vale, inside or outside Vale property, shall comply with the following rules:
- I. Comply with the Site traffic plan;
  - II. **Do not drive under the influence of alcohol and drugs;**
  - III. Ensure that the number of passengers fits with the number of 3-point seat belts and head restraints available in the vehicle;
  - IV. The driver of buses, micro-buses, vans and minivans shall obey the maximum capacity of the vehicle;
  - V. Ensure that all vehicle occupants use the seat belt at all times while the vehicle is in movement;
  - VI. The drivers must not exceed the maximum vehicle capacity of buses, minibuses, vans and minivans;
  - VII. Certify that the luggage and items loaded into the vehicle are packed and restrained in a manner that ensures the safety of the occupants;
  - VIII. Respect the speed limits established by the road signs or the legislation;
  - IX. Always have the headlights turned on while the vehicle is in movement;
  - X. Do not use the following devices, except when the vehicle is parked in a safe place: TV / DVD, headset sound and mobile phone (including headphones and handsfree features);
  - XI. Have the vehicle parking brake applied and the vehicle engine turned off before leaving the vehicle's direction, except when a different practice is documented in a safety operating procedure approved by the manager;
  - XII. Chock the wheels of vans, minibuses or buses after parking the vehicles;

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- XIII. Always keep the two-way communication radio turned on for interaction with other vehicles and equipment, as well as the gyroscopic light always on, in the vehicles which transport personnel in underground mining areas;
  - XIV. Have a high visibility flag installed on top of the vehicle antenna, always keep bidirectional communication radio turned on for interaction with other vehicles and equipment, and gyro light always on, in the vehicles which transport personnel carriers in surface mining areas;
  - XV. Only transport cargo in vehicles suitable for this, considering the type and size of cargo to be transported, in compliance with local legislation. Always use a mooring system compatible with local legislation to carry loads;
  - XVI. Communicate any damages, breakdowns, collisions and accidents to Vale's leadership and report them in the official system.
- b) All Vale Sites must have a Traffic Plan that includes the basic elements described in Annex.
- c) Local procedures shall be implemented in all operational areas that have mobile equipment circulation and these shall include, in synergy with the operational area Traffic Plan:
- I. Formal initial mobilization inspection of the vehicle;
  - II. Formal inspection of lights, tires...at each change of the vehicle driver;**
  - III. Fatigue Plan, as per PTP 000829 – Guidelines for Fatigue Prevention Programs;
  - IV. Telemetry management system, including:**
    - **System for periodic and routine verification of the information available;**
    - **Consequence Policy in case of violations.**
  - V. Management of drowsiness detection systems, including:**
    - **Which vehicles will have drowsiness detection systems;**
    - **System for periodic and routine verification of the information available;**
    - **Reporting of anomalies;**
    - **Actions to be taken in case of deviation.**

## 2.8 Training requirement

All persons who drive vehicles at the service of Vale shall:

- a) Be trained according to the Vale guidelines;
- b) Have a valid driving license specific for the type of motor vehicle, according to local legislation;
- c) Have all the required training within the expiration date.

## 2.9 Roles and responsibilities

### 2.9.1 Leader of each location / site (supervisor, manager or director):

- a) Implement the Traffic plan;
- b) Implement the requirements for light motor vehicles;
- c) Implement the specific procedures previewed in this RAC;
- d) Approve modifications or inclusion of safety accessories in the light motor vehicles.

### 2.9.2 Leader of each operation / project (supervisor, manager or director):

- a) Document the inventory of light motor vehicles at service of Vale in the location, for Vale and contractor companies' vehicles;
- b) Document the list of people authorized to drive the vehicles validated by their immediate superiors and trained in Defensive Driving, containing the following information:
  - I. Training dates;
  - II. Date of next refresher training;

III. Number and date of expiration of driving licenses, including people who drive rental cars.

## 3. RAC 03 – MOBILE EQUIPMENT OPERATION

### 3.1 Foreword

Over the past 10 years, a number of potentially critical and catastrophic incidents involving mobile equipment have occurred in Vale's operating areas. The main contributing factors of these events were:

- a) Equipment operating conditions;
- b) Equipment instability;
- c) Equipment fires;
- d) Speed incompatible with road conditions;
- e) Lack of visibility;
- f) Defective or inadequate protection barriers;
- g) Operator fatigue;
- h) Other risky operator behaviors.

The requirements contained in this document were consolidated and defined from the analysis of the contributing factors of these events and constitute the main barriers and mitigation elements that must be implemented in Vale's operating areas that have mobile equipment in order to prevent high potential incidents from occurring.

### 3.2 Purpose

Establish requirements for the safe operation of mobile equipment at Vale.

### 3.3 Application

Operation of Vale's own, leased or rented surface and underground mining mobile equipment, as well as equipment of service providers that are subject to the scope of Vale's contract and that circulate on public roads, operating areas, mining areas and operational routes.

### 3.4 Exceptions

The requirements of this RAC do not apply to:

- a) Motor vehicles covered by RAC 02;
- b) Equipment moving exclusively on railway tracks;
- c) Ship loaders;
- d) Overhead cranes;
- e) Monorails;
- f) Aerial work platforms;
- g) Stacker reclaimers and yard forklifts;
- h) Prerequisites for the transport of dangerous goods;
- i) Emergency response equipment.

Mobile equipment for lifting personnel and/or load must also comply with the requirements of RACs 01 and 05, respectively.

### 3.5 Important definitions

- **Mobile Equipment:** motor-driven equipment used to move, transport, excavate, displace or push materials.
- **Large mobile equipment:** equipment with a tare of 45 tons or more.
- **Surface mobile equipment:** motor grader, scraper, backhoe, excavator, tractor, forklift, tire handler, off-highway truck, other trucks, drilling rig, skid steer loader - non exhaustive list.

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- **Mobile underground mining equipment:** loader, lorry, transporter, roof hoisting and throwing equipment, motor grader, backhoe, drilling rig, scalers, rig - non exhaustive list.
- **Operational Area:** all internal areas of Vale's Sites (Terminals, Power Plants, Railways, Mining Areas, Parking Areas, among others), whether operational or administrative, where the access of motor vehicles, mobile equipment and people is controlled.
- **Mining Area:** areas used for mining activity, such as open pits, underground mines, waste disposal squares, maneuvering areas, loading and unloading squares, where the access of motor vehicles, mobile equipment and people is controlled.
- **Operating routes:** roads, accesses and traffic roads within the mining areas.
- **Other trucks:** road truck, tipper truck, track truck, articulated truck, bucket truck, tank truck, road train truck, stump truck, flatbed trailer truck and articulated truck mounted crane. The latter must also meet the requirements of RAC-05 - Load Lifting.
- **Synchronized gearbox:** mechanical device installed in the gearbox, which allows matching of the toothed element speeds before gear engagement, allowing smooth shifts without jumps and without the need to stop equipment.
- **Safety distance:** minimum distance from the equipment or vehicle in front, which allows the driver or operator to stop the vehicle or equipment without causing a collision in the event of braking or sudden stopping of the vehicle in front.
- **Restricted Areas (Exclusion Zones):** operational areas where the access of people, vehicles and equipment shall be restricted and controlled, primarily to reduce the number of people exposed and the potential of accidents.
- **Telemetry:** wireless data transmission and reception technology designed to remotely monitor mobile equipment and motor vehicles.
- **Proximity alert system between equipment:** system installed on mobile equipment, motor vehicles and/or people that allows georeferencing and triggers an alert if they are within a defined proximity limit.
- **Anti-collision system with automatic braking of equipment:** system installed on mobile equipment, motor vehicles and/or people, for their georeferencing, and that acts automatically on the braking system of equipment and vehicles when there is the risk of an imminent collision.

## 3.6 Requirements for installations and equipment

### 3.6.1 Requirements for mobile equipment operating routes:

- a) Protective berms shall be constructed with a minimum height equal to half the diameter of the largest tire among equipment that travel on the surface mining areas:
  - I. On all operating routes;
  - II. Along excavations;
  - III. In areas where there is a risk of equipment falling or rollover;
  - IV. **Around the equipment, during parking in mining areas (except workshops) for maintenance or interference;**
  - V. **Around electrical equipment such as panels, transformers and electric poles;**
  - VI. **On the exposed sides of pipelines located at ground level or suspended (pipe racks), near the operating routes;**
  - VII. **In the vicinity of the explosive storehouses.**
- b) **In underground mining areas, where it is not possible to construct berms, other types of physical barriers shall be adopted to isolate the area;**
- c) **All electrical lines, pipelines and structures in mining areas must be properly signaled;**
- d) Safety barriers (such as beams, limiters, height sensors) must be installed for the operation of mobile equipment in the vicinity of air and underground obstacles;



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- e) In operational areas and mining areas, where there is a significant risk of contact among equipment and people, the following shall be done:
  - I. Install physical barriers or protective devices (such as air walkways, bumps, gates or lights activated by pedestrians on safe paths, roads, accesses, etc.) that separate as much as possible the interfaces among people and mobile equipment;
  - II. **Provide two-way communication radios, if there are road observers or spotters, so that they can communicate with the operators of the mobile equipment;**

### 3.6.2 Requirements for all mobile equipment:

- a) Trucks must have synchronized gearboxes;
- b) Mobile equipment with pivot points where there is a risk of crushing or pinching shall have that hazard clearly and visibly signaled;
- c) Mobile equipment with outrigger floats (stabilizer systems) shall be hydraulically actuated;
- d) **The access ramps of the board trailers must have an electro-hydraulic system to move the access ramps;**
- e) **Mobile equipment must have maximum load and tare signaling;**
- f) **Mobile equipment must have external identification signs that allow remote visualization;**
- g) **Any changes to equipment access stairs must be previously approved by the equipment manufacturer;**
- h) **The use of manned mobile equipment without cabin is not permitted;**
- i) **All mobile equipment must have laminated glass;**
- j) For night operations and/or in low visibility conditions, and whenever the standard lighting of the equipment is not efficient, auxiliary lighting approved by the manufacturer or the Engineering area shall be used;
- k) Mobile equipment must have audible reverse alarm;
- l) Loads carried on trucks, which may move, displace or tip over, must be tied, secured or contained, except for bulk ore loads, which must be evenly distributed;
- m) **All mobile equipment must receive the preventive maintenance recommended by the manufacturer;**
- n) **Modifications to mobile equipment shall only be performed after formal approval by the manufacturer;**

### 3.6.3 Specific requirements according to mobile equipment:

Specific Requirements	Graders	Scrapers	Wheel Loaders	Backhoes	Excavators	Tractors	Forklifts	Tire Handlers	Drills	Off-road Trucks	Other Trucks
a) Safety belt 03 points.							X			X <sup>(a)</sup>	X
b) Safety belt 02 points.	X	X	X	X	X	X		X	X		
c) Rollover Protection Structure (ROPS).	X	X	X	X	X <sup>(b)</sup>	X				X	
d) Falling Object Protection Structure (FOPS).	X	X	X	X	X <sup>(b)</sup>	X				X	
e) Windshield Protection Grid (FOG).			X <sup>(c)</sup>	X <sup>(c)</sup>		X <sup>(c)</sup>					
f) Escape and landing alternatives in emergency situations.	X	X	X	X	X	X				X	
g) Proximity alert system between equipment.	X <sup>(e)</sup>	X <sup>(e)</sup>	X <sup>(e)</sup>	X <sup>(e)</sup>						X	X <sup>(e)</sup>
h) <b>Anti-collision system with automatic equipment braking.</b>										X	
i) Front video cameras.										X	
j) Rear video cameras.			X <sup>(d)</sup>		X <sup>(d)</sup>	X <sup>(d)</sup>			X <sup>(d)</sup>	X <sup>(d)</sup>	
k) Sides video câmeras.					X <sup>(d)</sup>	X <sup>(d)</sup>			X <sup>(d)</sup>	X <sup>(d)</sup>	
l) <b>Air-conditioned cabin.</b>	X	X	X	X	X	X	X <sup>(g)</sup>	X	X	X	X
m) Two-way communication radio.	X	X	X	X	X	X	X	X	X	X	X <sup>(e)</sup>
n) <b>Location and speed (telemetry) monitoring systems.</b>										X	X
o) Load monitoring systems.										X	
p) Tire pressure and temperature monitoring systems.			X <sup>(d)</sup>							X	
q) Traction on at least two axes when there are 3 or more axes.											X <sup>(e)</sup>
r) Reflective stickers on sides and rear.							X	X			X
s) Reverse warning light.	X		X			X <sup>(f)</sup>	X	X		X	X
t) Speed limiting device.							X	X		X	
u) Operator presence detection system.							X	X			
v) Fixed load table next to the commands.			X	X	X		X	X			
w) Primary (motor brake) and secondary (electric or hydraulic) speed retarding system.											X
x) Head rest.											X
y) Tilt position indicator (visual and audible on panel).										X	*
z) Low tilt physical indicator.										X	
aa) Signaling devices (reflective triangles, cones, plastic drums or stanchions).											X
bb) <b>Operator drowsiness detection system.</b>										X	X <sup>(e)</sup>
cc) <b>Hydraulic actuation of fork opening and closing.</b>							X <sup>(g)</sup>				

(a) Mandatory for the operator

(b) Mandatory for 6 to 50 tons excavators

(c) Mandatory for mobile equipment used in vegetable clearance and demolition

(d) Required for large equipment

(e) Required for mining areas only

(f) Required for tire tractors

(g) Not required for electric pallet trucks and forklifts

(\*) See item 3.6.3.– dd

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- dd) All road-type dump trucks that have internal mechanisms to drive and lift the implements (bucket, board, vacuum, among others) located inside the cab must have:
- I. Elevated/high tilt position indicator (visual and audible in the panel);
  - II. **Travel speed limiter of the equipment in the raised tilt condition;**
  - III. Inclinometer.

### 3.6.4 General requirements for underground mining equipment:

- a) Safety belt;
- b) Falling Object Protection Structure (FOPS);
- c) **Roll Over Protection Structure (ROPS);**
- d) **Auxiliary lighting, approved by the manufacturer or engineering area, in addition to standard equipment lighting;**
- e) Audible reverse alarm;
- f) **Reverse warning light;**
- g) **Escape and landing alternatives from the equipment in case of emergencies;**
- h) Two-way communication radio;
- i) **Traction in at least 02 (two) axes;**
- j) Safe braking system (service, parking and emergency brakes) independent of equipment engine operation.

### 3.6.5 Specific requirements according to mobile underground mining equipment:

Specific Requirements	Graders	Wheel Loaders	Low Profile Loaders	Excavators	Underground Drills	Scalers	Telescopic Handlers	Rigs	Articulated Trucks (Off-Road)	Scissors lift trucks	Other trucks
a) Windshield Protection Grid (FOG).				X							
b) Front video cameras.			X								
c) Rear video cameras.		X	X						X		
d) Air-conditioned cabin.	X	X	X	X		X	X		X	X	X
e) Location and speed monitoring systems (telemetry).									X	X	X
f) Reflective stickers on sides and rear.	X			X	X	X	X	X	X	X	X
g) Speed limiting device.									X		
h) Fixed load table next to commands.		X	X	X							
i) Primary (motor brake) and secondary (electric or hydraulic) speed retarding system.									X <sup>(a)</sup>		X <sup>(a)</sup>
j) Head rest.	X					X			X	X	X
k) Signaling devices (reflective triangles, cones, plastic drums or stanchions).											X
l) Operator drowsiness detection system.									X	X	X

(a) Secondary type speed retarding system is more efficient and more suitable for large equipment and its use on steep slopes.

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## 3.6.6 Requirements for fire detection, mitigation and prevention on mobile equipment

- a) Mobile equipment with a cabin floor with height of 1.80 meters or above shall have:
  - I. Automatic fire detection and suppression systems sized according to the size of the equipment and recommended by manufacturer of the system or approved by the Engineering Department;
  - II. Thermal blankets in the exhaust ducts (turbine and silencer);
  - III. **Diffuser valves for relieving internal tire pressure;**
  - IV. **Evacuation system the enables the operator to safely evacuate the equipment in the event of equipment fire;**
  - V. Automatic and emergency engine shutdown logic in case of activation of the fire detection and suppression system (shutdown);
- b) **Mobile underground mine equipment shall have manual and cabin level fire suppression systems, except for rigs and trucks with a payload of up to 4 tons.**
- c) **Automatic fire detection and suppression systems on mobile equipment must be maintained, inspected and available for use.**
- d) In addition to automatic fire detection and suppression systems, portable fire extinguishers recommended by the manufacturer shall be available on mobile equipment.
- e) **Large water trucks must have automated water monitors to support firefighting on mobile equipment.**

## 3.7 Procedural requirements

Local procedures shall be implemented in all operational areas that have mobile equipment circulation and these shall include, in synergy with the operational area Traffic Plan:

- a) **Access control of mobile equipment, motor vehicles and people to the mining areas;**
- b) **Definition of restricted areas (exclusion zones);**
- c) External circulation;
- d) **Operation outside the Vale site/area;**
- e) **Telemetry management including:**
  - I. **System for periodic and routine verification of the information available;**
  - II. **Consequence Policy in cases of violations.**
- f) **Management of drowsiness detection systems including:**
  - I. **System for periodic and routine verification of the information;**
  - II. **Reporting of abnormal cases;**
  - III. **Actions to be taken in case of deviations.**
- g) **Tire pressure and temperature monitoring management, including:**
  - I. **System for periodic and routine verification of the information;**
  - II. **Actions to be taken in case of deviations.**
- h) Pre-use and periodic inspections;
- i) Equipment checks and tests for release before first use and after maintenance, including brake testing according to the manufacturer specifications;
- j) Gas emission test in underground mining equipment;
- k) **Mandatory use of Tire Handlers to handle tires with an outside diameter of 1350 mm or greater;**
- l) **Operational conditions of automatic fire detection and suppression systems in mobile equipment;**
- m) **Mobile equipment trailer, complying with the following hierarchy:**
  - I. **Use of towing devices;**
  - II. **Use of boards;**

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- III. Use of drawbar, approved by the Engineering Department, only when the equipment has steering and brake systems in perfect working order.
- n) Utilization of chocks<sup>6</sup> compatible with the tire dimensions of the mobile equipment and its implements and in sufficient numbers to block its movement in the following situations:
  - I. **In maintenance performed in workshops or maintenance stalls;**
  - II. **In activities where the equipment must remain switched on and the operator must stay outside the cab, except in shift changes, which must take place at appropriate and safe locations for this activity;**
  - III. **In parking lots;**
  - IV. **In case of mobile equipment that is damaged or needs to be temporarily parked on roads, access roads or sloped roads, with the operator outside the cab.**
- o) **Manual positioning of excavator power cables, including the following:**
  - I. **They must be supervised by an Electrician (instructed professional) carrying a two-way communication radio;**
  - II. **They shall only be performed if the Operator of the excavator maintains eye contact with all persons performing the activity;**
  - III. **They shall only be performed in daylight, in good visibility conditions;**
  - IV. **They must be interrupted during thunderstorms or risk of lightning;**
  - V. **They must be performed under the condition of zero energy in case the cable is submerged by water and/or mud.**
- p) **Mobile equipment in traffic under energized and non-insulated power lines at a distance of less than 6.0 meters, complying with the following requirements:**
  - I. **Under the supervision of an Instructed Electrical Person and a Mine Operation Technician, who must have two-way radio communication with the Operator of the equipment.**
- q) Equipment headlamps shall be turned on during operation of the equipment, except on external roads when not permitted by local law;
- r) As long as the equipment is not parked in a safe place, the use of TV/DVD devices, headphones/earphones, and mobile phones, including headset or speakerphone features, is prohibited;
- s) People circulating in operating areas shall wear reflective clothing or waistcoats;
- t) People in underground mining areas shall wear reflective adhesive hardhats;
- u) All Vale Sites must have a Traffic Plan that includes the basic elements described in Annex I;
- v) All operating routes must be considered in the operational area Traffic Plan.

### 3.8 Training requirements

Mobile equipment operators must have:

- a) Valid driver's license for the type of mobile equipment they will operate, when required by local law;
- b) Certification for the operation of the specific equipment type;
- c) Mobile equipment risk prevention training;
- d) **Training in the operation of the automatic fire detection and suppression systems, evacuation techniques and activation of the site emergency plan, if operating mobile equipment with such systems.**

<sup>6</sup> The use of chocks is not mandatory when the equipment is on the outrigger floats or when the implement is lowered at ground level, which prevents its involuntary movement.

## 3.9 Roles and responsibilities

### 3.9.1 Leader of each location/site (Supervisor, Manager, or Director):

- a) Implement the local Traffic Plan;
- b) Implement the equipment requirements of this RAC;
- c) Implement the specific procedures described in this RAC;
- d) Approve modifications or the inclusion of safety accessories in the mobile equipment.

### 3.9.2 Leader of each operation/project (Supervisor, Manager or Director):

- a) Document the inventory of mobile equipment in use at Vale's service in the location, whether by his own employees or contractors;
- b) Document the inventory of operators authorized to operate mobile equipment, with the following information:
  - I. Type of mobile equipment;
  - II. Category and expiration date of the license;
  - III. Date of issue of certification for operation on the specific equipment type and date of next refresher course;
  - IV. Date of training in the traffic plan of the current operational area, risk prevention of mobile equipment and notions in first aid, including refresher courses.

## 4. RAC-04 – LOCKOUT, TAGOUT AND ZERO ENERGY

### 4.1 Foreword

A significant proportion of harm to people and reporting of high-potential incidents occurring within Vale included cases when the energy sources were not properly locked out. The main contributing factors were associated with:

- a) Failure to lockout and tagout;
- b) Failure to test for zero energy;
- c) Absence of a lockout procedure or a procedure that did not identify the requirement to lockout;
- d) Failure in the lockout method/procedure;
- e) Gaps in the qualification process;
- f) Failure to replace the protection devices
- g) Failure in assuring all safety conditions have been met prior to work starting;
- h) Failure in work planning/scheduling;
- i) Failure in communication between work groups.

### 4.2 Purpose

To define the Health and Safety requirements to be applied for effective control of the risk of harm to people or downgrading incidents involving the release of hazardous energies.

### 4.3 Application

Maintenance activities and services involving processes and equipment where procedures are required for isolation and lockout / tagout of energy sources that ensure the control of potential release of hazardous energy.

### 4.4 Exceptions

The requirements of this RAC do not apply to:

- a) Activities in machinery, equipment and installations where safeguards ensure effective protection of workers from exposure to hazardous energies created by an unexpected energy release and workers do not expose any part of the body to the danger zones associated with the operation of machinery, equipment or installations.
- b) Equipment which can be de-energized by unplugging from an electrical outlet, when the person doing service or maintenance has exclusive control of the plug (working alone) and the electricity is the only energy source present.

### 4.5 Important definitions

- **Chemical energy:** Energy contained at a molecular level within a chemical substance. It is a measure of the substance's capacity to transform into another substance via a chemical reaction subsequently releasing, or absorbing, energy.
- **Dangerous energy treatment:** It is the action by specific methods to prevent a dangerous energy from hurting people, when the isolation of the energy is not possible.
- **Electrical energy:** Energy from flow of electrical current as a result of a potential difference between two points in an electrical field.
- **Gravitational energy:** Energy of an object (at rest or in motion) exerted by the gravitational pull of the earth.
- **Hazardous energy isolation:** Is the act of removing, disconnecting and preventing inadvertent restoration of energy. It includes the removal and disconnection of energy sources, discharge of residual energy, blocking and / or locking, labeling and testing of the removal or disconnection of hazardous energy.
- **Hydraulic energy:** Is the energy stored within a pressurized liquid. When under pressure, the fluid can be used to move heavy objects, machinery, or equipment.

- **Mechanical energy:** Is the energy transferred by means of a force on an object through a distance, or an object in motion.
- **Pneumatic energy:** Energy produced from compressing air within an enclosed system.
- **Radioactive (or nuclear) energy:** Energy produced as a result of a fission or fusion reaction during the molecular transformation of unstable atomic nuclei.
- **Lockout of hazardous energies:** The application of specific isolation requirements to prevent harm as a result of being exposed to an uncontrolled release of energy. This may occur with the unexpected activation of machinery and equipment or release of hazardous energy during maintenance or service activities.
- **Exclusive lockout:** Management of work on equipment or a process is transferred solely to one service team for exclusive control of the isolation, lockouts and work without any other party being allowed to access the process / equipment until it is released by the workgroup. (This is performed where there is increased risk caused by simultaneous activities.)
- **Lockout devices:** A mechanical means of locking equipment or system energy source isolation devices that prevents machinery or equipment from becoming energized.
- **Isolation devices:** A device capable of being locked out for isolation of an energy source, such as sectioning keys, valves, dampers, switches, circuit breakers, etc.
- **Hazardous energy:** Potential energy that if released can result in significant harm.
- **Residual energy:** Accumulated energy remaining when energy sources to a system are turned off. Left undissipated residual energy can result in significant harm and therefore must be tested, and where present, eliminated so that a zero energy state is obtained.
- **Energized:** Connected to an energy source or containing residual or stored energy.
- **Tag:** Individual warning card fastens on the equipment requiring isolation, lock and tagging and includes name, date, time and reason for lockout.
- **Thermal energy:** Energy generated by the kinetic energy of the atoms of a substance.
- **Energy source:** Any electrical, hydraulic, pneumatic, chemical, mechanical, nuclear, gravitational, residual, thermal.
- **Lockout matrix:** A formal means of identification of energy sources and lockout points associated with machinery, equipment, system or facility isolation.
- **Local standards:** Formal regional / industrial/ legislated requirements applicable to the operational area that are to be reflected in local procedures.
- **Visitor:** A person that, although not being directly involved in activity related to the process lockout must also apply individual lockout device(s).
- **Zero energy state:** An energy level that is so low that it cannot result in harm.

## 4.6 Requirements for installations and equipment

- a) **Processes (including machinery) and equipment within an operating facility must be clearly identified, formally documented and the energy isolation devices must be capable of being locked out;**
- b) **Isolation devices must be clearly identified in area process and referenced in isolation procedures. Isolation devices must be, preferentially, designed as permanent physical installations;**
- c) **Process flow, instrumentation and electrical drawings must be up-to-date, so that isolation points can be referenced and clearly identified in process isolation procedures;**
- d) Lockout devices must:
  - I. Be durable to withstand the environment in which they are used;
  - II. Be designed to directly enable the use of locks;
  - III. Have mechanical integrity that does not enable tampering;
  - IV. Meet format requirements of local standards.
- e) Locks must:



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- I. **Be designed for energy isolation lockout purposes and have at least 6 pins;**
  - II. Be single keyed and combination locks are prohibited;
  - III. **Be designed to retain the key when the lock is open;**
  - IV. **Be constructed of nonconductive material where there is the possibility of contact with electrically energized surfaces.**
- f) Lockout tags must:
- I. Be durable to withstand the environment in which they are used;
  - II. **Be traceable;**
  - III. Indicate the name of person, date, time and reason of lockout;
  - IV. Follow the format requirements of local standards.
- g) **Any process (including machinery) and equipment supplied by electrical energy where isolation devices are located in sub stations, electrical rooms or motor control centers must have a formally implemented system to manage the isolation and lockout of electrical energy stages through the:**
- I. **Identification of all energy paths connected to equipment that must be isolated;**
  - II. **Compliance with all requirements of lockout/tagout and of removal of locks.**

## 4.7 Procedural requirements

- a) Each location must have defined and implemented lockout and tagout procedures that include, at a minimum:
- I. **Identification of hazards and required controls;**
  - II. **Responsibilities, accountabilities and approvals;**
  - III. **Method(s) which the person(s) that working under the isolation will use to install his/her (their) lockout and tagout devices, i.e., directly on the isolation devices themselves or in a box which contains the key of the locks installed by the authorized person(s) who performed the lockout/tagout in the isolation devices;**
  - IV. Lockout process stages and steps to be taken including:
    - **Identification of equipment to be locked out;**
    - **Process to check that all energy sources are properly identified;**
    - **Isolation of energy sources;**
    - **Release of residual energy, including steps to sustain a zero energy state;**
    - **Application of lockout and tagout in each energy source;**
    - **Verification process to evaluate that zero energy has been achieved.**
  - V. Steps to be followed for changes and shift handover, following the requirements established in this document.
- b) **A lockout matrix is to be defined for each process / equipment lockout to be performed which includes, at a minimum, identification of all energy sources and isolation devices;**
- c) Prior to initiating any activity, each person working under the isolation must install their own individually keyed lock and individual tag when locking out devices. No one is to attempt to remove any protection lock other than themselves;
- d) No one is to attempt to damage or violate any lockout device applied in machinery, equipment and facilities;
- e) Any person working under an isolation process must verify zero energy is made before starting their activities, as defined in local procedures;
- f) Where it is not possible to obtain zero energy state, a specific procedure must be developed using a hazard analysis approach to define effective controls that eliminate exposure to hazardous energies and must be approved by the area manager;
- g) **Additional control must be implemented for equipment that has the potential to reaccumulate energy during the performance of activity;**

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- h) Wherever a piece of equipment is positioned at an elevated height and it has the potential to fall, subjected to gravitational energy, this hazardous situation shall be identified and dealt with in such a way as to prevent the fall;
- i) Only one authorized professional should be designated to confirm that all necessary locks and tags have been correctly performed or installed if more than one team is engaged in activities on the same locked equipment or in the event of an exclusive lock;
- j) Criteria and guidelines for execution of exclusive lockouts must be defined in local procedure. Equipment whose any intervention may generate risks to other teams should be under exclusive lockout, prohibiting performance of simultaneous activities on this equipment while the exclusivity lasts.
- k) For tasks requiring a change of zero energy state, with the temporary introduction of power for testing on machines, equipment, or installations under isolation these steps shall be followed:
  - I. Exclusive lockout of the machine, equipment or installation;
  - II. Risk analysis associated with the temporary change;
  - III. Application of the required control measures according to the local procedure;
  - IV. Communicate the change to all people working under the lockout;
  - V. Interruption of the work of all people working under the lockout who are not directly acting on tests that require the temporary introduction of energy;
  - VI. Temporary change in lockout;
  - VII. Confirmation by the authorized professional that all required control measures have been correctly applied;
  - VIII. Conducting the tests;
  - IX. Return the machine, equipment or installation to its previous zero energy condition by removing the temporarily introduced energy and returning the disconnecting devices to their position as originally locked
  - X. Confirmation by the authorized professional that the lockout has been returned to its original zero energy condition;
  - XI. Communication of the return of the lockout to all people who are working at the machine, equipment or installation under the isolation;
  - XII. Resumption of jobs originally planned under the isolation.
- l) To address the removal of a lock where the key cannot be found or where the lock owner is absent from work and cannot be contacted, a special authorization must be granted by the area manager as established in local procedure, including the analysis of the risks involved.
- m) Procedures for the removal of locks and tags for re-energizing the isolated system must include, at a minimum:
  - I. Confirmation that all involved parties concluded their activities and are permanently out of the risk area;
  - II. Confirmation that all tools and parts were removed from the risk area;
  - III. Confirmation that all mechanical or electric protection mechanisms, individual or collective ones, were returned to their original condition.

## 4.8 Training requirements

- a) People involved in activities or tasks that require lockout/tagout must be trained in “Prevention of Risks in Lockout, Tagout and Zero Energy”, including refresher training.

## 4.9 Roles and responsibilities

### 4.9.1 Executive Officers or Managements:

- a) Formally designate one or more persons responsible for developing and maintaining the following processes / procedures / controls:

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- I. Lockout and tagout process;
- II. Lockout matrix;
- III. Formal implemented system to manage the isolation and lockout of hazardous energies stages for any process (including machinery) and equipment supplied by electrical energy where isolation devices are located in sub stations, electrical rooms or motor control centers;
- IV. Training and evaluation program for employees involved in the isolation of hazardous energy, lockout and tagout processes including testing for residual energy;
- V. Program for verifying the effectiveness of the implementation of the requirements described in this document.
- VI. Ensure the necessary resources for the implementation of hazardous energy control.

### 4.9.2 Managers:

- a) Approve safety operating procedures containing control measures that eliminate exposure to hazardous energy when a zero energy state cannot be achieved on a given equipment, installation or system;
- b) Formally approve employees authorized to perform hazardous energy lockout;
- c) Formally designate one or more persons responsible for confirming that all necessary locks have been correctly performed if there is more than one team involved in activities on the same locked equipment or in the event of an exclusive lock.

### 4.9.3 Employees involved in hazardous energy blocking processes:

- a) Exercise the right of refusal when irregularity in the lockout and tagout process is identified.
- b) Comply with the requirements established in this document and in local procedures.

### 4.9.4 Any employee (Vale, Contractor or Other):

- a) Exercise the right of refusal when irregularity in the lockout and tagout process is identified.
- b) Comply with the requirements established in this document and in local procedures.

## 5. RAC 05 – LIFTING OF LOADS

### 5.1 Foreword

A significant portion of fatalities and high potential incidents at Vale included lifting loads. The main contributing factors associated with these incidents were:

- a) Use of inappropriate tool / equipment;
- b) Inadequate position for the task;
- c) Failure to alert / warn / communicate;
- d) Improper loading / tethering;
- e) Failure to identify and assess risks;
- f) Unintentional deviation from working standards (error);
- g) Lack of risk perception / awareness;
- h) Defective / inappropriate tool / equipment;
- i) Inadequate lifting / lifting;
- j) Failure to perceive the risk situation.

### 5.2 Purpose

Establish requirements for lifting loads at Vale.

### 5.3 Application

Activities associated with the lifting of any load by equipment owned, leased or rented by Vale, including service provider lifting equipment that are part of a contract scope with Vale, from the following types of lifting equipment: cranes, overhead cranes, monorail lifting systems, lifting booms, mobile cranes, and electrical hoist and any other hoisting equipment or non-manual lifting system.

It is understood in the scope of the activity of lifting the preparation and modifications made to the equipment and the area the activity is carried out.

### 5.4 Exceptions

The requirements of this RAC do not apply to:

- a) Load lifting activities performed by hand, manual hoists;
- b) Atividades de transporte de carga por veículos ou equipamentos;
- c) During the maintenance<sup>7</sup> of load lifting equipment while not in use for lifting, except when, in the maintenance activity there is load lifting;
- d) Damage to load lifting equipment through collisions or other causes that occur when a lift is not being performed;
- e) When people are hoisted.

### 5.5 Important definitions

- **Accessories:** shackles, synthetic straps, chain slings, wire ropes, forged fittings and special devices.
- **Factor or utilization rate:** is the ratio between the gross load of the crane to be hoisted and its capacity according to its load chart and configuration.

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<sup>7</sup> The responsible for the lifting equipment handling during the maintenance activity must be properly qualified to operate the equipment, this qualification must enable the responsible for maintenance to ensure the minimum knowledge required for handling the equipment tests.

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- **Critical Lifting:** Any lifting that has at least one of the mandatory conditions for the elaboration of a Rigging plan (see item 5.5 - Requirements for procedures, letter 'g').

## 5.6 Requirements for installations and equipment

### 5.6.1 General requirements for installations and equipment:

- Visible indication of the maximum load handling capacity on lifting accessories and equipment;
- Hooks with safety locks on load lifting equipment;
- Load lifting accessories shall comply with national and / or international regulatory requirements**

### 5.6.2 Specific requirements according to equipment:

Specific Requirements	Tower Crane	Vehicle-mounted crane	Other Cranes	Overhead Crane	Mono-rails	Electric Hoist	Manual Gantry Crane
a) Load table fixed next to the control Levers.	X	X	X				
b) Movement sound alarm.	X			X	X		
c) Top lights.	X						
d) Grounded structures.	X			X	X	X	
e) Outriggers pressure monitoring.			X				
f) Outriggers leveling control system.		X	X				
g) Extensions and Outriggers with hydraulic drive.		X	X				
h) Limit stop switch (stop of equipment and alarm when the limit of course is exceeded).	X		X	X	X	X	
i) Loose cable in the limit switch.				X	X		
j) Anti-collision sensors				X			
k) Remote control (Joystic) for off-vehicle cargo handling.		X					
<b>l) Inclinometer that prevent load lifting with improper cable angulation or cargo dragging.</b>				X			
m) Boom with hydraulic drive.		X					
n) Wheel locknut.							X
o) Anemometer.	X						
p) Emergency button.	X	X	X	X	X	X	X
q) Overload sensor, stop of equipment and audible/visual alarm when rated capacity is exceeded.		X	X	X	X		
r) Safe brake system.	X	X		X	X	X	

## 5.7 Procedural requirements

- a) Isolation of the lifting area shall be implemented, considering:
  - I. The perimeter of the load travel;
  - II. The operating area of the lifting equipment, for boom for cranes;**
  - III. The outrigger.distance for boom cranes;**
- b) **The use of zebra tape for area isolation is prohibited;**
- c) **Where load lifting activities must take place over existing equipment and facilities, the isolation shall take into consideration the magnitude of an unplanned event based on the load dropping and the consequent collapse of the structure below;**
- d) Where radio communication is used (between an operator and signalman), **it must take place using an exclusive radio frequency;**
  - I. **Local procedure(s) shall be defined which include, at a minimum:**
  - II. Pre-use Inspection of Lifting Equipment and Accessories, (in accordance with the requirements of the respective applicable standards);**
  - III. Periodic inspection of lifting equipment and accessories in accordance with manufacturers specifications and local legislation;**
  - IV. Lifting equipment counterweight movement;**
  - V. Verifications, tests and approval of equipment acquisition / procurement before first use.**
- e) Um Plano de Içamento de Carga (Plano de *Rigging*<sup>8</sup>) deve ser desenvolvido e estar disponível para içamentos críticos com guindaste sobre rodas/esteira, guindaste veicular articulado e grua. Um plano de Rigging deverá ser elaborado se qualquer um dos itens abaixo sejam aplicáveis ao içamentos:
  - I. Applied to any lift exceeding 10 tons;
  - II. Total load equal to or greater than 75% of the maximum capacity of lifting equipment, based on the limits of the loading table to the corresponding distance in which it is lifted;
  - III. Where two or more cranes or forms of lifting equipment is involved;
  - IV. Proximity to power lines or buss bars;
  - V. Loads with large and irregular shape;
    - I. With onboard cranes.
- f) **The minimum content of the rigging plan shall follow Annex II to this document;**
- g) The maximum capacity of any lifting equipment or device must be not be exceeded;
- h) **In disassembly activities, when a crane is used to support a high load during the removal of its support points in the structure where it is mounted, the limit of 70% of the operation utilization factor shall be adopted;**
- i) Defective and/or worn lifting accessories must be discarded and disposed of permanently;
- j) Outriggers on mobile boom cranes shall be fully extended for all lifts, regardless of the weight of the load;
- k) **When not defined in the Rigging plane, the pads shall be shimmed with a slab area of at least twice as large as the pad area;**
- l) It is strictly forbidden to for people to directly stabilize (touch) a suspended load. Instead, guide cables should be used whenever stabilization is required;
- m) It is strictly forbidden to place people under a suspended load, considering the risk of falling and movement;
- n) **It is forbidden to access an isolated area for load lifting without proper authorization;**
- o) **Lifting loads using improvised or adapted equipment not manufactured or designed for this purpose is prohibited, except with the express permission of the manufacturer. Example: forklift adaptation.**

<sup>8</sup> ANNEX II

## 5.8 Training requirements

- a) Equipment operators shall have:
  - I. Valid qualification for driving equipment when required by local law;
  - II. Certification for operation of specific load lifting roles and lifting equipment operators, the latter including training for each major type of equipment.
- b) The employees or third parties responsible for preparing the Rigging plan must have:
  - III. Certification for elaboration of the Rigging plan;
- c) Operators of equipment, signalers and helpers shall have training in cargo lifting risk prevention, including recycling.

## 5.9 Roles and responsibilities

### 5.9.1 Contract Manager:

- a) Ensure all CAR requirements are implemented in his/her areas; follows the services suppliers 'safety performance and requirements accomplishment; participate on any incident related event investigation involving load lifting activities performed by contractors.

### 5.9.2 Maintenance Planning and Scheduling:

- a) Need to know the CAR requirements applicable to his/her areas and ensure that risk analysis for load lifting are initiated on his/her work process steps.

### 5.9.3 Rigging Supervisor:

- a) Coordinate, guide and follows all steps (mobilization, operation and demobilization) related to the load lifting activities that are covered by Rigging Plans. Follows all CAR's requirements RAC and in line with the calculations and requirements of the Rigging plan.

### 5.9.4 Load Lifting focal point:

- a) Skilled and formally assigned to act as technical representative to work with the load lifting service providers prefects.

### 5.9.5 Tool Shop Supervisor and/or Resources (Materials) Responsible (professionals in charge to manage the work at height equipment and devices:

- a) Ensure that all devices for work load lifting are inspected on receiving step, as well as, periodically; set the inspection plan including frequency according to related regulatory requirements. Segregate and send for disposal all equipment and device in nonconformance condition.

### 5.9.6 Maintenance Engineering:

- a) Assigned professional to perform load lifting activities in his/her area to identify and elaborate the procedures for the following situation: verticalization / horizontalization / tipping operations of common loads in workshops or in the field and activities where the entry and / or stay of persons within the isolation area is required when the load is still supported by the hoisting equipment (see item 5.7 - Requirements for procedures, letter 'p').

## 6. CAR-06 – CONFINED SPACES:

- **Scope**
  - Entering and working in confined spaces.
- **Plant and Equipment Requirements**
  - Confined spaces shall have a permanent and durable signage installed to inform personnel of the hazard.
  - In classified areas (potential for explosion), equipment and electrical devices shall be specified and certified for use in these areas.
  - Rescue equipment shall be available for emergency situations.
- **Procedural Requirements**
  - Shall have local procedures that includes:
    - Entering and working in confined spaces (general).
    - Each type of confined space. In the absence of a procedure, a Job Safety Analysis must be developed.
  - There shall be updated inventory/survey of confined spaces (including out of service) with their risks.
  - The confined space entrance shall be isolated and sign posted / signalized during the work.
  - Means of preventing atmospheric hazards (e.g. ventilation) shall be available during the work.
  - Maintain and monitor acceptable atmospheric conditions at the entrance and during the entire execution of the work.
  - Measuring equipment shall be calibrated and tested before each use.
  - An observer person shall remain outside the confined space at the entrance, in permanent contact with the employees inside. The observer cannot perform other tasks that may otherwise limit their ability to fulfill this role.
- **People Requirements**
  - For authorization in this CAR:
    - Employees responsible for confined spaces entry approval shall have “Confined Space Entry Supervisors” training, including refresher training.
    - Employees that entry and work in confined spaces shall have “Confined Space Observer and Authorized Employee” training, including refresher training on a regular basis.
    - Both training courses shall include topics related to “First Aids”.



## 7. CAR-07 – MACHINE GUARDING:

- **Scope**
  - Applies to machines and equipment where there is the potential for people to have contact with moving parts or falling or projected material and parts or components as a result of performing.
- **Plant and Equipment Requirements**
  - Guards, safeguarding devices and systems shall comply with local legislation or technical standard, taking into account aspects of maintenance and operation.
  - Movable type guards shall be equipped with interlocking devices.
- **Procedural Requirements**
  - Shall have local procedures that includes:
    - Periodic inspection of machines guards.
    - Maintenance, cleaning or inspection which requires the partial or total removal of the machine guards while the machine is in operation.
  - Machine Guards shall have project developed by a qualified professional.
  - Machine Guards that are removed shall be replaced before returning the machine or equipment operation.
- **People Requirements**
  - There is no specific training for authorization in this CAR.
  - Employees who work in areas with machinery and equipment shall receive guidance on the risks and control measures during introductory training (indoctrination), basic training for the function, toolbox talks, among others.

## 8. CAR-08 – GROUND STABILITY:

- **Scope**

- Activities where there are slopes excavations, waste rock pile, dams, tunnels and underground installations.
- Does not apply to piles.

- **Plant and Equipment Requirements**

- Underground mines and tunnels shall have:
  - Effective alarm system, including a backup system, to signify the occurrence of an emergency.
  - Clear and visible signs for evacuation routes.

- **Procedural Requirements**

- In operations in surface mining, underground and dams shall have local procedure(s) under the responsibility of a qualified professional for ground stability control, covering planning, implementation and monitoring of control measures, which include, as a minimum:
  - Preparation of geotechnical, hydrological and hydrogeological surveys, as needed.
  - Updating mine plans.
  - Communication of the changes of ground condition between shifts and between technical and operational teams.
  - Frequency and responsibility for the inspections of the ground conditions in different working areas.
  - Frequency and method for testing the ground support systems.
- It is the responsibility of a qualified professional:
  - Specify the controls necessary to permit the ground stability.
  - The release of unstable areas can only be authorized by a qualified professional.
- Operations in underground mining and tunnels shall have methods defined for removal and or stabilization (e.g. bolting) of unstable blocks with the application of specified ground equipment

- **People Requirements**

- There is no specific training for authorization in this CAR.
- Employees who work in mining areas shall receive guidance on the risks and control measures during their basic training for the function.

## 9. CAR-09 – EXPLOSIVES:

- **Scope**
  - Activities involving the transport, storage, handling, loading and detonation of explosives.
- **Plant and Equipment Requirements**
  - Explosive storage and preparation areas shall:
    - Be designed by a certified professional and shall comply with local legislation.
    - Have the required fire protection, lightning protection, and signage.
  - Vehicles transporting explosives shall be in accordance with local legislation and be provided with the required signage and or warning devices.
  - Underground storage areas shall be adequately locked and separated from vulnerable facilities (e.g. mechanical and electrical installations, refuge areas, fuel storage areas etc.).
  - An effective audible warning shall be given prior to detonation. For Underground central blasts, audible warnings are not required, and an effective process for access control to the blast area shall be in place (e.g. use of tag boards).
- **Procedural Requirements**
  - There shall be a local procedure for blast plan stating:
    - Layout and depth of the holes.
    - Types of explosives and accessories to be used and quantities required.
    - Detonation sequence.
    - Minimum time to allow contaminants to clear after detonation.
  - There shall be updated documentation proving compliance with quantity of safety distance criteria between surface explosive storage areas and populated areas, and vulnerable construction such as schools, hospitals, highways and railways.
    - The access of people to explosive storage and preparation areas shall be controlled.
    - Manufacturer safety guidelines for explosives and accessories shall be followed.
    - Explosive materials and accessories shall be stored and transported in its original packaging or in suitable containers.
      - It is prohibited to smoke, have open flames, carry lighters, tools or material that could produce sparks, or have any other device that has a radio frequency capable of setting off explosives and or accessories where explosives are being stored or handled.
      - Where static discharge can be a hazard for workers i.e. detonating explosives and or explosive accessories appropriate footwear shall be worn (e.g. static dissipative or conductive footwear).
      - The transportation from storage area to the place of use shall be done identified and signaled vehicles.
      - The responsible person for the activities shall check to ensure all persons have left the blasting site and any place in the vicinity that is endangered by the blast before releasing it for blasting, in order to ensure complete evacuation of people and equipment.
        - A process shall be in place to return the blasting area and shall occur only after the dissipation of gas and dust, misfire checking and authorization of the responsible person.
        - If misfires are observed or suspected in the detonated material, after the blast area has been released, the work shall be stopped immediately, the area shall be evacuated, and the concern shall be reported to the responsible person for the activities who in turn shall adopt of appropriate measures to control the risk.
        - Explosives with compromised conditions, including misfires, shall be destroyed in accordance with the local legislation and the manufacturer’s guidelines.
  - **People Requirements**
    - For authorization in this CAR, employees who perform explosives transportation, storage, handling, loading and detonation shall be trained in “Risks Prevention in Explosives”, including refresher training and “Basic First Aid”.

## 10. CAR-10 – WORKING WITH ELECTRICITY:

- **Scope**
  - Working with electricity above 50 volts in alternating current (AC) or 120 volts in direct current (DC).
- **Plant and Equipment Requirements**
  - Electrical panels, control centers, substations and energized equipment shall be adequately protected and inaccessible to unauthorized persons.
  - The equipment, devices and tools that have electrical insulation shall be appropriate to the voltage involved.
  - Garments and others personal protective equipment shall be appropriate to the work and voltage levels. being performed.
  - For classified areas (potential for explosion), equipment and devices shall be certified for these areas.
  - All facilities and working with electricity shall have adequate safety signs in accordance with the local legislation
  - An analysis should be conducted to determine the electrical circuits that require installation of residual-current circuit breaker (RCCB).
- **Procedural Requirements**
  - Shall have local procedures for:
    - Working with electricity.
    - Periodic inspection, electrical tests of tools, equipment and devices.
  - Formal ATPV - Arc Thermal Performance Value studies shall be completed for each operating area.
  - Electrical single line diagrams of installations shall be available.
  - No repairs or alterations shall be carried out on any energized equipment except where complete disconnection of the equipment is not feasible.
  - The steps for power down are the follows: a) sectioning, b) Lockout (prevention of re-energizing), c) verifying/ checking de-energization, d) where applicable, installation of temporary grounding conductors, e) signaling/tagging.
  - The preliminary assessment of existing overhead and ground lines shall be held in order to avoid contact with people or equipment during the work.
  - A radio communication between team members shall be available for all activities in high voltage electrical installations and electric power systems.
  - The use of conductive objects including personal adornments while engaged in electrical activities on or near exposed (i.e. not suitably guarded) energized electrical conductors or circuit parts shall be prohibited.
  - Work on or near exposed (i.e. not suitably guarded) high voltage energized electrical conductors or circuit parts shall not be performed alone.
- **People Requirements**
  - For authorization in this CAR, employees who work with electricity shall be trained in “Risks Prevention in Electricity”, and “Basic First Aid”.
  - Employees who work in Power Electrical Systems also shall be trained in “Power Electrical Systems Safety”, including refresher training.
  - Employees shall have refresher training in the topics of these trainings.
  - All employees who are authorized to carry out electrical work shall have a record of their authorization maintained in their employee records.

## 11. CAR-11 – MOLTEN METAL:

- **Scope**
  - Operational activities in processes with molten metal. Deadline for implementation: December 2016.
- **Plant and Equipment Requirements**
  - The facility shall be equipped with fire protection and have sufficient emergency exits (at least two from each section).
  - Handling and processing areas of molten metal shall:
    - Have restricted access by unauthorized persons.
    - Have means of spillage containment.
  - Where practicable, automatic shutdown systems shall be in place to eliminate the need for operator intervention.
  - Molten metal transfer equipment shall not be overfilled and transfer routes shall be planned to prevent the potential effects of a spillage or splashing molten metal or must have means of temporary containment.
  - Molten metal transfer launders and containment vessels shall be designed in a manner that provides a process for containment or diversion in the event of a potential spill.
  - Transfer equipment should have audible alarms to signify movement of molten material.
  - Water supplies to molten material areas shall be limited to dedicated systems (e.g. cooling jackets) and other sources of water (e.g. hoses for cleaning purposes) shall be restricted as far as practicable.
  - Activities with Molten Metal shall, wherever possible, be mechanized, automated and controlled from a remote location.
  - Molten metal transfer equipment must be designed to tolerances that can withstand exposure to high temperatures and potentially corrosive molten materials. Surfaces in contact with molten metal shall be coated to reduce the risk of molten metal cut-outs (e.g. slagging ladles).
  - Electrical systems, hydraulic, air and water systems (piping), control systems, fuel and oxygen systems shall, as far as is practicable, be located in areas where contact with molten metal is not possible. Where contact by molten metal is possible, resistant barriers must be provided.
  - Vehicle cabs and operating booths, exposed to splashes, explosion or projected molten metal shall be protected with appropriate material (safety barriers) wherever practicable.
  - Fuel combustion systems shall be fitted with appropriate flame safety systems to prevent conditions that could lead to an explosion or fire.
  - Supplemental requirements described in Annex 1 of this instruction shall be met.
- **Procedural Requirements**
  - Shall have procedures to:
    - Inspection of transport and handling of molten metal (trough, crucibles, dross pots) devices before being put into service.
    - Prevent feed, scrap and recycled materials containing moisture or other contaminants from being introduced to the molten metal process.
  - Operating procedures for equipment shall contain information and parameters for:
    - Evaluation of the structural integrity of the vessels and furnaces.
    - Control and monitoring of the variables of pressure, temperature and level of metal / dross.
    - Temperature and flow rate of the cooling water.
  - Operating parameters of process control shall be continuously monitored.
  - Flammables and combustibles shall be kept away of work areas with molten metal.
- **People Requirements**
  - For authorization in this CAR, employees who perform operational activities in process with Molten Metal shall be trained in:
    - “Risks Prevention in Molten Metal”, including refresher trainings.
    - “Basic First Aid”.

## ANEXX I - Internal Traffic Plan

The traffic plan must include at least the following basic elements:

- a) Purpose:
  - I. Purpose of the internal traffic plan.
- b) Responsibilities:
  - I. Describe the responsibilities under the internal traffic plan.
- c) Traffic Rules - Describe local rules from/to:
  - I. Traffic (general) and circulation, including overtaking;
  - II. Speed limits, considering adverse weather conditions;
  - III. Safety distances and restricted areas (exclusion zones);
  - IV. Parking lots (position, distance, etc.);
  - V. Approaching mobile equipment or mobile equipment areas;
  - VI. Access of Truck/cargo, use of spotters/observers Traffic of special cargo (chemicals, explosives, liquid metals);
  - VII. Emergency situations (e.g. collision, rollover, fire, explosion, projection of materials, crushing and running over) and towing;
  - VIII. Abnormal situations in motor vehicles and mobile equipment;
  - IX. Interaction between vehicles and equipment, including guidelines on the use of communication devices;
  - X. Communication between pedestrians, vehicles and equipment;
  - XI. Road block;
  - XII. Priority to the right between vehicle/equipment and pedestrian types;
  - XIII. Instructions on drilling, disassembly and disassembly siege areas, where applicable.
- d) Parking Areas:
  - I. Describe the parking areas by vehicle type and parking position;
- e) Roads - Describe the process for defining and reviewing roadways (design, layout, directions, slopes, surface, traffic control). The roads must be defined to:
  - I. Maximize the segregation of vehicles/equipment from other objects, including pedestrians, buildings, sidewalks, safe paths and other vehicles/equipment;
  - II. Consider paths and/or routes in case of emergencies;
  - III. For the transport of liquid metals, consider the possibility of exclusive internal roads and request the approval of traffic agencies for circulation on public roads.
- f) Pedestrian Safety and Internal Road Control Measures:
  - I. Describe the process for defining and maintaining pedestrian safety and internal road control measures (vehicle types, traffic, distances, guardrails, insulation barriers, sidewalks, among others);
- g) Lighting:
  - I. Describe the process for defining and maintaining the traffic lighting and operation roads;
- h) Signs:
  - I. Describe the process for defining and maintaining traffic signs (speed limits, directions, permissions and prohibitions, parking areas, crosswalks, intersections or roundabouts, level crossing, among others).

## ANNEX II – RAC 05

### Minimum Criteria for a Rigging Plan

The Rigging Plan must include the following technical information:

- a) General:
  - I. Company Name, place of work, work area, workpiece to be lifted / moved, workpiece weight;
  - II. Calculation memory, device designs, demonstrative drawings of all lifting phases, the most critical positions and expected clearances in relation to interference.
- b) Operational Detailing:
  - I. Crane Identification: Make, Model, Rated Capacity and Series, Slot Area;
  - II. Crane configuration: boom, crane capacity, workpiece net weight, attachment weight and block, operating radius, gross load weight, cable runs (number of cable legs), counterweights, shoe positioning, JIB length, JIB angle and etc;
  - III. Crane Utilization Percentage: Classification as a percentage of crane utilization in the operation in question;
  - IV. Crane gross capacity: according to load table values and crane lifting diagram, safety factor, load factor.
- c) Lifting:
  - I. Determine lifting accessories, wire rope loops (units), cable capacity, shackles, shackle capacity, type of lashing, other materials, capacity of other materials, lashing design.
- d) Rolling and positioning:
  - I. Shoe force / maximum load on the paddle, padding material (metal or wood), padding area, required minimum ground strength, padding detail and positioning (drawings);
- e) Additional safety information related to load lifting:
  - I. Maximum allowable wind speed for crane.
- f) Site / area visit data (where applicable):
  - I. Date of the technical visit, name of the person responsible for the technical visit, name of the person providing the information, date of preparation, name of the developer, date of revision, name of the controller.
- g) Drawings:
  - I. Complete layout of the operation with top, side, perspective, interference (electrical networks, equipment, installations, roads, access, gutters, culverts, ditches, pipelines, etc.) and their respective dimensions with technical drawing made by hand or through specific software.
- h) Approvals:
  - I. Signature of own or contracted rigger, area / customer signature, reviewer rigger signature, where applicable and date.

## ANEXO III – Supplemental Requirements – CAR 11 – Molten Metal

- **Plant and Equipment Requirements**

1. Furnaces, converters and calciners

System / Installation	Requirements
Gas Monitoring	Furnaces and converters heated by a combustible gas or electric current shall have off gas capture systems and harmful gases that may be generated during the process shall be monitored e.g. CO , CO2 , nitrous oxides , hydrogen or other.
Cooling	<ul style="list-style-type: none"> <li>- Shall be provided with supply dedicated and reliable booking system to allow safe procedure for emergency closing of the process.</li> <li>- Shall have routine monitoring of instrumented controls and visual inspection of water cooling system loops to ensure that leaks do not go undetected.</li> <li>- The temperature and flow rate of the cooling system fluid shall be monitored.</li> <li>- All water cooled equipment shall have a guaranteed supply in case of power failure, equipment failure or other emergency situation.</li> </ul>
Gas cleaning / treatment	<p>Shall be equipped with instrumentation to monitor :</p> <ul style="list-style-type: none"> <li>- Composition of the gas (to monitor the percentage of H2, CO and O2 and provide the appropriate alarms / interlocks).</li> <li>- Flow rate and temperature of the gas.</li> <li>- Interlock for extreme vibration of the fan.</li> <li>- Temperature of the sleeves of the filters.</li> <li>- Opacity of exit gases from chimneys.</li> </ul>
Temperature Monitoring	The furnaces shall include a temperature monitoring. A system must be established to monitor vessel (furnace) growth to detect unusual conditions that would signify an issue with the structural integrity.
Control rooms	<p>Shall meet at least the following requirements:</p> <ul style="list-style-type: none"> <li>- impact resistant concrete walls and high temperature resistant.</li> <li>- high temperature resistant double eye protection or polycarbonate.</li> </ul>