

PNR-000069, Rev.02: 12/02/2021

Department Issuer: Health, Safety and Operational Risks

Technical Responsible: Occupational Safety and Geographic Support Management

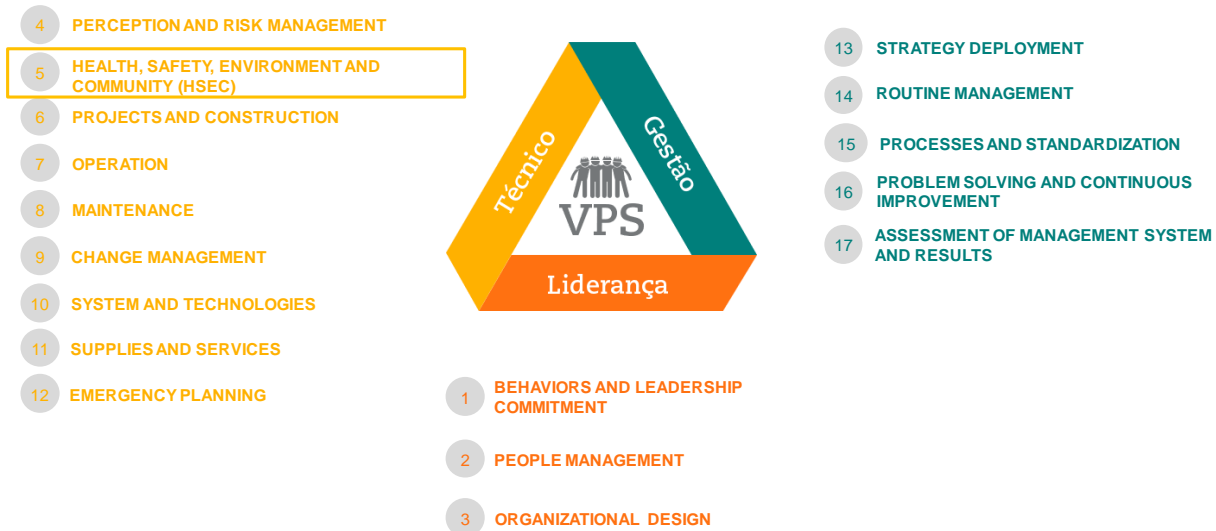
Target Audience: All professionals who act in Health, Safety and Operational Risk in Vale

Training Needed: () YES (x) 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;

Association with VPS:



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 lives 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.

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- **Transitional Activity Limitation:** Individual health condition that temporarily restricts the performance of a critical activity by an individual. This condition must 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:

- CAR 01 - Working at heights
- CAR 02 - Light motor vehicles
- CAR 03 - Mobile equipment operation
- CAR 04 - Lockout, tagout and zero energy
- CAR 05 - Lifting of loads
- CAR 06 - Confined spaces
- CAR 07 - Machine guarding
- CAR 08 - Ground stability
- CAR 09 - Explosives
- CAR 10 - Work with electricity
- CAR 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 comply with the elements of Vale Production System (VPS), with attention to: Perception and Risk Management (4); Change Management (9); Health, Safety, Environmental and Community; (5) and Emergency planning (12).

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.

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;

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- 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;
- c) The training required in the RACs must follow the Valer/HR Training Guidelines for the country concerned.
- 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:

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- 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.

Training

- a) First aid training must be required in accordance with local legislation.

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: 20/12/2020
- Procedures: 20/06/2020

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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 elevated work areas and walkways.¹

1.5 Important definitions

- **Anchorage Point:** Certified point for installing an anchoring system such as pre-engineering devices and connection elements for working at height.
- **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.
- **Connector:** Device that opens and closes, developed to unite different components of a fall protection system. Has versions with automatic closing, with manual lock and automatic lock.
- **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.
- **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.
- **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.
- **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.
- **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.

¹ The PRO-022565 must 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 Protection System - FPS:** System designed to eliminate the risk of falling workers or to minimize the consequences of falls in activities performed above 1.80 m.
- **Fall protection:** A method of minimizing the possibility of falling.
- **Lanyard:** A certified line / strap having a connector at each end for connecting the body belt or body harness to an anchorage point.
- **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.
- **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.
- **Suspended man basket:** Set formed by the suspension system and the bucket or platform suspended by crane equipment.
- **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.
- **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 regulations², 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:

- a) Handrail, in lifting equipment, scaffolding, platform ladders, excavations and places where there is a risk of falling people, designed in accordance with local regulations², containing:
 - I. Upper railing;
 - II. Mid section railing.
- b) Full Body Safety Harness including double safety strap with double lock rigging gear;
- c) 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.

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

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;**
- 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) Stairs³ must contain dimensions, including intermediate levels, as per local regulations. In the absence of these, another standard must be adopted with the consent of Vale's corporate occupational safety;
- b) **To access industrial fixed ladders⁴ 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

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

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

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1.6.7 General requirements for people hoisting equipment:

- 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.

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) Wheel lock /braking system	X	X ⁵		
(c) Emergency system allowing arm movement and tower rotation in case of failure.	X	X	X	
(d) System that allows basket leveling and prevents inclination.	X	X	X	
(e) Visual sound signaling during the vertical movement of the equipment.	X			
(f) System that prevents stabilizer shoes from operating without the previous retraction of the mobile arm		X	X	
(g) Anemometer ⁶ with visual and audible alarm.	X			X
(h) Boom radius and angle indicators with visual and audible alert				X
(i) Block lift height indicator that stops lifting when reaching set height.				X
(j) Physical or electronic device or proximity sensor that prevents the impact of the upper part of the equipment against another structure.	X			

1.7 Procedural requirements

1.7.1 General requirements for procedures:

- a) **Before any activity that involves working at heights, in the planning stage, one must analyze and define which protection system against individual and/or collective falls will be adopted;**
- b) **Equipment at work at height must undergo initial, pre-use and periodic inspection;**
- c) **Full body safety harnesses must be secured throughout the activity;**
- d) **The use of an abdominal belt is prohibited. The abdominal component of the harness should be used only for work positioning and movement restriction.**

1.7.2 Requirements for scaffolds:

- a) **Be supported by a resistant structure; when equipment and/or installations used to support scaffolds must be resistant enough to avoid any collapse;**
- b) **Be constructed on a flat surface free of damage or deformation;**
- c) **The trapdoor and the barrier around it must always be closed;**

⁵ When no using outriggers

⁶ Manual anemometer can be adopted . Must be installed on the equipment.

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- d) Be formally released for use by:
 - I. The verification of compliance with the project;
 - II. Completing the inspection checklist;
 - III. The signature of the person responsible for the release;
 - IV. Indication of approval to be used/not approved to be used through plate.
- e) The movement of mobile scaffold with equipment, tools or objects on or supported is prohibited;
- f) **Units must 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, must 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 must be achievable with maximum extension of stabilizer arms;
- c) It is prohibited to leave or enter the aerial work platform basket when elevated.

1.7.4 Requirements to anchor point:

- a) The anchor point must be resistant to the stresses imposed;
- b) The anchor system must be designed by a certified professional;
- c) The integral structure of an anchorage system must withstand the maximum applicable force;
- d) The anchoring point system must 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 must occur with a frequency no longer than annual;
- h) Vale's fixed anchor system inspections and service providers must 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 must contain existing work at heights scenarios and staff must be qualified and prepared, and appropriate equipment for rescuing at heights;
- b) Rescue conditions involving inert suspension must be simulated and actions taken to reduce the suspension trauma scenario.

1.7.6 Requirements for rope access:

- a) Rope access must be performed if the following conditions are verified:
 - I. The slope of the ground surface in the workplace does not enable the worker to perform his activities without risk of falling and without rope support;
 - II. The worker needs rope during the activity in order to keep himself standing on the work structure/surface;

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- III. It is necessary to use 2 ropes to perform the activity, one for task and one for rescue;
- IV. Rope is needed for the worker to reach a certain point of the structure without risk of falling;
- V. Rope is needed for the worker to move vertically and horizontally over the work structure;
- VI. The height to the next lower plane is greater than 1.8 meters.

1.8 Training requirements

- a) Employees who perform activities at height, considering the applicability criteria of this RAC, should be trained in:
 - I. RAC 01, including retraining, according to Vale guideline;
 - II. 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 must 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;
- b) Follows the services suppliers safety performance and requirements accomplishment;
- c) 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;
- b) 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;
- b) Support the engineering area to identify and define points to apply fixed or mobile anchorage systems (pre-engineered devices);
- c) Support the Vale (or prefect) scaffolding inspector;
- d) Set all working at height scenarios and activities mapped and update;
- e) Provide performance feedback of service for supply;
- f) Perform risk analysis to define (if applicable) the rope access;
- g) Keep all risk scenarios identified at working at height.

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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 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 Vale⁷;
- b) Vehicles for emergency response.

2.5 Important definitions

- **Dedicated Vehicles:** vehicles of permanent use operating in administrative and/or operational areas other than mining areas.
- **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

⁷ However, the specifications of these vehicles must comply with local legislation and drivers must obey the Site Traffic Plan.

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- **Owned / Leased Vehicle:** vehicles that are owned, or long term leased, which make up the fleet of Vale light motor vehicles.
- **Primary Auxiliary Braking System Speed Retarding (engine brake):** 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 must not extend over 3 consecutive months, regardless of whether it is a single contract or different contracts.
- **Secondary auxiliary braking system (hydraulic retarder + electromagnetic):** 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:

- a) All the operating roads must be identified in the Traffic Plan;
- b) **Physical barriers or protective devices (such as walkways, bumps or lights activated by pedestrians on safe walking paths, among others). Must 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;**
- c) **Speed road signs must be installed at regular intervals indicating maximum allowable speed on the internal roads;**
- d) **Parking areas must be designated for parking light motor vehicles the areas must allow a safe separation from mobile equipment);**
- e) **Traffic routes for the circulation of mobile equipment, vehicles and pedestrians must be clearly identified;**
- f) **The internal roads of permanent facilities must be preferentially paved. The mining areas must be leveled;**
- g) **In underground mining, cutouts must 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:

- a) **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;**
- b) All vehicles must receive the required preventive maintenance as recommended by the manufacturer;
- c) Modifications in motor vehicles must only be done with the formal approval of the manufacturer.

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2.6.3 Specific Requirements according to light motor vehicle:

Specific Requirements ⁸	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) Reverse Sensor or vehicle backup camera	X		X	X	X	X
i) Location and speed monitoring system (telemetry)	X		X	X	X	X
j) Driver drowsiness detection system⁹	(*)		(*)	X	X	X
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 Auxiliary Braking System Speed Retarding (engine brake)					X	X
u) Secondary auxiliary braking system (hydraulic retarder + electromagnetic)						X
v) Emergency exits with single handle opening mechanism					X	X

⁸ 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.

⁹ 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, must 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 must obey the maximum capacity of the vehicle;
 - V. Ensure that all vehicle occupants use the seat belt at all the time while the vehicle is in movement;
 - VI. Respect the speed limits established by the road signs or the legislation;
 - VII. Always have the headlights turned on while the vehicle is in movement;
 - VIII. 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);
 - IX. 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;
 - X. Chock the wheels of vans, minibuses or buses after parking the vehicles;
 - XI. 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;
 - XII. 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;
 - XIII. 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;
 - XIV. In vehicles, baggage must be packed or affixed to ensure the safety of occupants;
 - XV. 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 must be implemented in all operational areas that have mobile equipment circulation and these must include, in synergy with the operational area Traffic Plan:
- I. Formal initial mobilization inspection of the vehicle;
 - II. **Formal inspection of lights, tires and general conditions for each change of the vehicle driver;**
 - III. Fatigue Plan, as per PGS-004099 – 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;**

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- 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 must:

- a) Be trained in RAC 02 according to the Valer 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 Preventive 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 mobile stacker;
- 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

- **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.
- **Large mobile equipment:** equipment with a tare of 45 tons or more.
- **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.
- **Mobile Equipment:** motor-driven equipment used to move, transport, excavate, displace or push materials.
- **Mobile underground mining equipment:** loader, lorry, transporter, roof hoisting and throwing equipment, motor grader, backhoe, drilling rig, scalers, rig - non exhaustive list.
- **Operating routes:** roads, accesses and traffic roads within the mining areas. It's also considered operating routes piers and its access.
- **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.
- **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.
- **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.
- **Restricted Areas (Exclusion Zones):** operational areas where the access of people, vehicles and equipment must be restricted and controlled, primarily to reduce the number of people exposed and the potential of accidents.
- **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.
- **Surface mobile equipment:** motor grader, scraper, backhoe, excavator, tractor, forklift, tire handler, dump trucks, other trucks, drilling rig, skid steer loader - non exhaustive list.
- **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.
- **Telemetry:** wireless data transmission and reception technology designed to remotely monitor mobile equipment and motor vehicles.

3.6 Requirements for installations and equipment

3.6.1 Requirements for mobile equipment operating routes:

- a) Protective berms must 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;

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- 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 must 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;
 - e) In operational areas and mining areas, where there is a significant risk of contact among equipment and people, the following must 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 must have that hazard clearly and visibly signaled;
- c) Mobile equipment with outrigger floats (stabilizer systems) must 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) The use of manned mobile equipment without cabin is not permitted;
- h) All mobile equipment must have laminated glass on the front;
- i) 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 must be used;
- j) Mobile equipment must have audible reverse alarm;
- k) 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;
- l) All mobile equipment must receive the preventive maintenance recommended by the manufacturer;
- m) Modifications to mobile equipment must only be performed after formal approval by the manufacturer.

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3.6.3 Specific requirements according to mobile equipment:

Specific Requirements	Graders	Scrapers	Wheel Loaders	Backhoes	Excavators	Tractors	Forklifts	Tire Handlers	Drills	Dump trucks	Other Trucks
a) Safety belt 03 points.										X ^(a)	X
b) Safety belt 02 points.	X	X	X	X	X	X		X	X		
c) Rollover Protection Structure (ROPS).	X	X	X	X	X ^(b)	X				X	
d) Falling Object Protection Structure (FOPS).	X	X	X	X	X ^(b)	X				X	
e) Windshield Protection Grid (FOG).			X ^(c)	X ^(c)		X ^(c)					
f) Escape and landing alternatives in emergency situations.	X	X	X	X	X	X				X	
g) Proximity alert system between equipment.	X ^(e)	X ^(e)	X ^(e)	X ^(e)						X	X ^(e)
h) Anti-collision system with automatic equipment braking.										X	
i) Front video cameras.										X	
j) Rear video cameras.			X ^(d)		X ^(d)	X ^(d)			X ^(d)	X ^(d)	
k) Sides video câmeras.					X ^(d)	X ^(d)			X ^(d)	X ^(d)	
l) Air-conditioned cabin.	X	X	X	X	X	X	X ^(g)	X	X	X	X
m) Two-way communication radio.	X	X	X	X	X	X	X	X	X	X	X ^(e)
n) Location and speed (telemetry) monitoring systems.										X	X
o) Load monitoring systems.										X	
p) Tire pressure and temperature monitoring systems.			X ^(d)							X	
q) Traction on at least two axes when there are 3 or more axes.											X ^(e)
r) Reflective stickers on sides and rear.							X	X			X
s) Reverse warning light.	X		X			X ^(f)	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 auxiliary braking system speed retarding (engine brake) and secondary auxiliary braking system (hydraulic retarder + electromagnetic)											X ^h
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) Operator drowsiness detection system.										X	X ^(e)
cc) Hydraulic actuation of fork opening and closing.							X ^(g)				

(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

(h) The Secondary Auxiliary Braking System (hydraulic retarder + electromagnetic) is mandatory for equipment with a total gross weight equal or above 30 tons and its use on long and steep slopes.

(*) 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 Dump truck)	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 auxiliary braking system (engine brake) and secondary auxiliary braking system (hydraulic retarder + electromagnetic)									X ^(a)		X ^(a)
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) The Secondary Auxiliary Braking System (hydraulic retarder + electromagnetic) is mandatory for equipment with a total gross weight equal or above 30 tons and its use on long and 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 must 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 over hot parts subjected to the projection of flammable liquids (ex. exhaust ducts, turbines and silencers);
 - III. Diffuser valves for relieving internal tire pressure (wheels with diameter $\geq 39"$);
 - IV. Evacuation system that 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 must 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 must 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 must be implemented in all operational areas that have mobile equipment circulation and these must 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;

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- l) **Operational conditions of automatic fire detection and suppression systems in mobile equipment;**
- m) **Mobile equipment towing or removal, complying with the following priority:**
 - I. **Use of tow truck;**
 - II. **Use of float truck;**
 - 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 chocks¹⁰ 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 (exclusive channel);**
 - II. **They must only be performed if the Operator of the excavator maintains eye contact with all persons performing the activity;**
 - III. **They shall only be carried on 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, must be performed 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 must 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 routes and mining areas must wear reflective clothing or waistcoats;**
- t) **People in underground mining areas must 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.**

¹⁰ 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.

3.8 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) RAC 03, including retraining, according to Valer guideline;
- 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.**

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 and CAR 03 training, 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) Inadequate or non-existent application of lockout and tagout;
- b) Inadequate or non-existent zero energy test;
- c) Absence of a lockout procedure or a procedure that did not identify the requirement to lockout;
- d) Inadequate or non-existent lockout method/procedure;
- e) Gaps in the qualification process;
- f) Replace inadequate or non-existent of the protection devices or of the guarantee of integrity of security conditions;
- g) Inadequate or non-existent work planning/scheduling;
- h) Inadequate or non-existent communication among work groups;
- i) Inadequate or non-existent lockout of potential gravitational energy source;
- j) Inadequate or non-existent temporary change of zero energy state.

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.
- c) Disassembly, removal and assembly of parts of machines, equipment and systems that are steps inherent to the maintenance process. The risks created by any movement of these parts by disassembly, removal or assembly must be dealt with by specific maintenance procedures or SWP - Safe Work Permit.

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 through a chemical reaction subsequently releasing, or absorbing, energy.
- **Electrical energy:** Energy from flow of electrical current as a result of a potential difference between two points in an electrical field.
- **Energized:** Connected to an energy source or containing residual or stored energy.
- **Energy source:** Any electrical, hydraulic, pneumatic, chemical, mechanical, nuclear, gravitational, residual, thermal.

- **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.)
- **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.
- **Hazardous energy treatment:** It is the action by specific methods to prevent a hazardous energy from hurting people, when the isolation of the energy is not possible.
- **Hazardous energy:** Potential energy that if released can result in significant harm.
- **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.
- **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.
- **Local standards:** Formal regional / industrial/ legislated requirements applicable to the operational area that are to be reflected in local procedures.
- **Lockout devices:** A mechanical means of locking equipment or system energy source isolation devices that prevents machinery or equipment from becoming energized.
- **Lockout matrix:** A formal means of identification of energy sources and lockout points associated with machinery, equipment, system or facility isolation.
- **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.
- **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.
- **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.
- **Tag:** Individual warning card fastens on the equipment requiring isolation, lock and tagging and includes name, date, time and reason for lockout.
- **Team:** Group of people involved in performing a activity independent of the company or specialty.
- **Thermal energy:** Energy generated by the kinetic energy of the atoms of a substance.
- **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:
 - 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;

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- 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;**
 - h) Machines or equipment under maintenance or service and which have moving or rotating parts supported by cables or by hydraulic cylinders such as counterweights, pelletizing discs, bucket wheels, truck cabins, etc. that can move through the action of potential gravitational energy must have this risk situation identified in the lockout matrix and properly controlled according to the local procedure in order to prevent unwanted movement;**
 - i) An authorized professional must be designated to verify 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;**
 - 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 must 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;**

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- 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.
- I) 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 RAC 04, including retraining, according to Valer guideline

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:
 - 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.

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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 proportion of critical incidents in Vale occurred during the lifting of 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 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, hoist and any other lifting equipment or lifting system¹¹.

It is understood in the scope of the activity of lifting the preparation and modifications made to the equipment and the load to be lifted.

5.4 Exceptions

The requirements of this RAC do not apply to:

- a) Load transport activities by vehicles or equipment; Example: transport by trucks, trailers, forklifts, etc.
- b) During the maintenance¹² of load lifting equipment while not in use for lifting, except when, in the maintenance activity there is load lifting;
- c) Operation of vehicles designed for lifting loads without being in the lifting activity;
- d) People lifting activity

¹¹ Even it is not listed in this document, any equipment for lifting of load (adapted excavators, for example) of load must comply with the general requirements (not specified for a type of equipment) of this RAC.

¹² 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 and equipment tests.

5.5 Important definitions

- **Accessories:** shackles, synthetic webbing slings, 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.
- **Critical Lifting:** Any lifting that has at least one of the mandatory conditions for the elaboration of a Rigging plan (see item 5.7 - Requirements for procedures, letter 'f').

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 must 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	Monorails ¹³	Electric Hoist	Manual Gantry
a) Load table fixed next to the control Levers	X	X	X				
b) Movement sound alarm	X			X		X ¹⁴	
c) Top lights	X						
d) Grounded structures	X			X	X	X	
e) Outriggers pressure monitoring			X				
f) Outriggers leveling checking system or device		X	X				
g) Extensions and outriggers with hydraulic drive		X	X				
h) End stop limit switch (stopping the equipment when the limit is exceeded)	X		X	X		X	
i) Sensor or device that identifies the loose cable				X		X	
j) Anti-collision sensors ¹⁵				X			
k) Remote control (Joystic) for load movement		X					
l) Inclinometer that prevent lifting of load with improper cable angulation				X			
m) Boom with hydraulic drive		X					
n) Locking casters							X

¹³ The requirements for the monorail are for the structure itself. Equipment (such as trolley with a hoist) that will be supported on the monorail must comply with their specific requirements.

¹⁴ Except for fixed hoist.

¹⁵ Only for two or more overhead crane in the same interspace.

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Specific Requirements	Tower Crane	Vehicle-mounted crane	Other Cranes	Overhead Crane	Monorails ¹⁵	Electric Hoist	Manual Gantry
o) Anemometer	X		X ¹⁶				
p) Emergency button	X	X	X	X		X	
q) Overload sensor, with stop of equipment and audible/visual alarm when rated capacity is exceeded		X	X	X		X	
r) Winch safe brake system	X			X		X	

5.7 Procedural requirements

- a) Isolation of the lifting area must be implemented considering:
 - I. The perimeter of the load travel;
 - II. The boom of the equipment operating area, for boom for cranes;
 - III. The outrigger distance, for equipment with outriggers stabilization.
- b) The use of plastic zebra tape for area isolation is prohibited;
- c) Where lifting activities take place over equipment and facilities, the isolation must take into consideration the magnitude of an unwanted event based on the fall of the load 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;
- e) Local procedure(s) must be defined which include, at a minimum:
 - I. Pre-use inspection of lifting equipment and accessories, (in accordance with the requirements of the respective applicable standards);
 - II. Detailed periodic inspection of lifting accessories in accordance with manufacturers specifications and local legislation;
 - III. Verifications, tests and approval of equipment and accessories at the time of acquisition / procurement before first use.
- f) A Lifting Plan (Rigging¹⁷ Plan) must be developed according to the minimum established in annex II of this document and for critical lifting with crane on wheels/mat, articulated vehicular crane and crane. A Rigging plan should be drawn up if any of the items below apply to lifts:
 - 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;
 - 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;
 - VI. With onboard cranes.
- g) The minimum content of the rigging plan must follow Annex II to this document;

¹⁶ Only for cranes with capacity above 75 ton.

¹⁷ Rigging Plan is considered a specific type of formal and documented planning, with the minimum content established in this document. Lifting activities that do not require a Rigging Plan must also be planned and undergo a risk analysis.

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- h) The maximum capacity of any lifting equipment or device must be not be exceeded;
- i) 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 must be adopted;**
- j) Defective and/or worn lifting accessories must be discarded and disposed of permanently;
- k) Outriggers of cranes must be fully extended for all lifting activities, regardless of the weight of the load;
- l) When not defined in the Rigging Plan, the pads of outriggers must be shimmed with a slab area of at least twice as large as the pad area;**
- m) It is strictly forbidden to for people to directly stabilize (touch) a suspended load. Instead, guide cables must be used whenever stabilization is required;
- n) It is strictly forbidden to place people under a suspended load, considering the risk of falling and movement;
- o) It is forbidden to access an isolated area for load lifting without proper authorization;**
- p) Lifting loads using improvised or adapted equipment (forklift adaptation, for example) not manufactured or designed for this purpose is prohibited, except with the express permission of the manufacturer.**

5.8 Training requirements

- a) Equipment operators must have:
 - I. Valid qualification for driving and operating 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:
 - I. Certification for elaboration of the Rigging plan;
- c) Operators of equipment, signalers and helpers of the lifting activity must have training in RAC 05, including retraining, according to Valer guideline

5.9 Roles and responsibilities

5.9.1 Contract manager:

- a) Ensure all CAR requirements are implemented in his/her areas;
- b) Follows the services suppliers 'safety performance and requirements accomplishment;
- c) Participate in any investigations related to incidents (N1 and N2) involving load lifting activity.

5.9.2 Maintenance Planning and scheduling¹⁸:

- 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;
- b) Provide basic data - identification, weight and dimensions - about the load to be lifted.

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.
- b) 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.

¹⁸ Maintenance, infrastructure and projects.

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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;
- b) Set the inspection plan including frequency according to related regulatory requirements.
- c) Segregate and send for disposal all equipment and device in nonconformance condition.

5.9.6 Maintenance engineering:

- a) Indicate the professional designated 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 'o').

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CAR-06 – CONFINED SPACES:

- **Scope**
 - Entering and working in confined spaces.
- **Plant and Equipment Requirements**
 - Confined spaces must have a permanent and durable signage installed to inform personnel of the hazard.
 - In classified areas (potential for explosion), equipment and electrical devices must be specified and certified for use in these areas.
 - Rescue equipment must be available for emergency situations.
- **Procedural Requirements**
 - Must 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 must be updated inventory/survey of confined spaces (including out of service) with their risks.
 - The confined space entrance must be isolated and sign posted / signalized during the work.
 - Means of preventing atmospheric hazards (e.g. ventilation) must be available during the work.
 - Maintain and monitor acceptable atmospheric conditions at the entrance and during the entire execution of the work.
 - Measuring equipment must be calibrated and tested before each use.
 - An observer person must 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 must have “Confined Space Entry Supervisors” training, including refresher training.
 - Employees that entry and work in confined spaces must have “Confined Space Observer and Authorized Employee” training, including refresher training on a regular basis.

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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 must comply with local legislation or technical standard, taking into account aspects of maintenance and operation.
- Movable type guards must be equipped with interlocking devices.

- **Procedural Requirements**

- Must 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 must have project developed by a qualified professional.
- Machine Guards that are removed must 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 must receive guidance on the risks and control measures during introductory training (indoctrination), basic training for the function, toolbox talks, among others.

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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 must 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 S must 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 must 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 must 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 must:
 - Be designed by a certified professional and must comply with local legislation.
 - Have the required fire protection, lightning protection, and signage.
- Vehicles transporting explosives must be in accordance with local legislation and be provided with the required signage and or warning devices.
 - Underground storage areas must be adequately locked and separated from vulnerable facilities (e.g. mechanical and electrical installations, refuge areas, fuel storage areas etc.).
 - An effective audible warning must 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 must be in place (e.g. use of tag boards).

• Procedural Requirements

- There must 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 must 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 must be controlled.
 - Manufacturer safety guidelines for explosives and accessories must be followed.
 - Explosive materials and accessories must 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 must be worn (e.g. static dissipative or conductive footwear).
 - The transportation from storage area to the place of use must be done identified and signaled vehicles.
 - The responsible person for the activities must 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 must be in place to return the blasting area and must 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 must be stopped immediately, the area must be evacuated, and the concern must be reported to the responsible person for the activities who in turn must adopt of appropriate measures to control the risk.
 - Explosives with compromised conditions, including misfires, must 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 must be trained in "Risks Prevention in Explosives", including refresher training.

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 must be adequately protected and inaccessible to unauthorized persons.
- The equipment, devices and tools that have electrical insulation must be appropriate to the voltage involved.
- Garments and others personal protective equipment must be appropriate to the work and voltage levels. being performed.
- For classified areas (potential for explosion), equipment and devices must be certified for these areas.
- All facilities and working with electricity must 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**

- Must have local procedures for:
 - Working with electricity.
 - Periodic inspection, electrical tests of tools, equipment and devices.
- Formal ATPV - Arc Thermal Performance Value studies must be completed for each operating area.
- Electrical single line diagrams of installations must be available.
- No repairs or alterations must 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 must be held in order to avoid contact with people or equipment during the work.
 - A radio communication between team members must 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 must be prohibited.
 - Work on or near exposed (i.e. not suitably guarded) high voltage energized electrical conductors or circuit parts must not be performed alone.

- **People Requirements**

- For authorization in this CAR, employees who work with electricity must be trained in “Risks Prevention in Electricity”.
- Employees who work in Power Electrical Systems also must be trained in “Power Electrical Systems Safety”, including refresher training.
- Employees must have refresher training in the topics of these trainings.
- All employees who are authorized to carry out electrical work must have a record of their authorization maintained in their employee records.

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11. CAR-11 – MOLTEN METAL:

- **Scope**

- Operational activities in processes with molten metal. Deadline for implementation: December 2016.

- **Plant and Equipment Requirements**

- The facility must be equipped with fire protection and have sufficient emergency exits (at least two from each section).
- Handling and processing areas of molten metal must:
 - Have restricted access by unauthorized persons.
 - Have means of spillage containment.
- Where practicable, automatic shutdown systems must be in place to eliminate the need for operator intervention.
- Molten metal transfer equipment must not be overfilled and transfer routes must 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 must 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 must be limited to dedicated systems (e.g. cooling jackets) and other sources of water (e.g. hoses for cleaning purposes) must be restricted as far as practicable.
- Activities with Molten Metal must, 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 must 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 must, 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 must be protected with appropriate material (safety barriers) wherever practicable.
- Fuel combustion systems must 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 must be met.

Procedural Requirements

- Must 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 must 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 must be continuously monitored.
 - Flammables and combustibles must 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 must be trained in:
 - “Risks Prevention in Molten Metal”, including refresher trainings.

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, outriggers 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

- Furnaces, converters and calciners

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

ANNEX IV - Deadlines specified by requirement and treatment for non-compliance with CAR requirements

1 - Deadline for CAR requirements:

1.1 -Requirements that have had the extended deadlines (Annex V):

For requirements that, due to the need for adaptations or acquisition of equipment and installations, had an extension of deadline, interim measures were defined (Annex V) for the execution of the activity without the requirement until the expiration of the deadline.

1.1.1 - Non-compliance with the interim measures for requirements that had extended deadlines:

In case of non-compliance with the interim measures defined in the Annex V, must follow the exceptional approval flow and adopt at least the conditions below in the period of 1 (one) month from the date of publication of this annex. In case of non-compliance with the interim measures and no implementation of the conditions below the activities must be stopped.

- a) Identification of all equipment and installations that do not comply with the interim measures/requirements;
- b) Development of an action plan to comply with the requirements/ interim measures;
- c) Definition of temporary control measures, which must be reflected in risk analyzes (JHA/JSA);
- d) Presentation of the items above for formal and documented approval by the Executive Manager of HSOR and Executive Manager of Operations/Construction.

1.2- Requirements that did not have extended deadlines:

1.2.1 - Procedural requirements (expired due date on 20/06/2020):

The area must have local procedures for critical activity in accordance with the PNR 000069.

The procedural requirements comply including requirements for critical activity in local procedures and training of the executors.

Critical activities that do not comply the procedural requirements after the date of publication of this annex must be stopped.

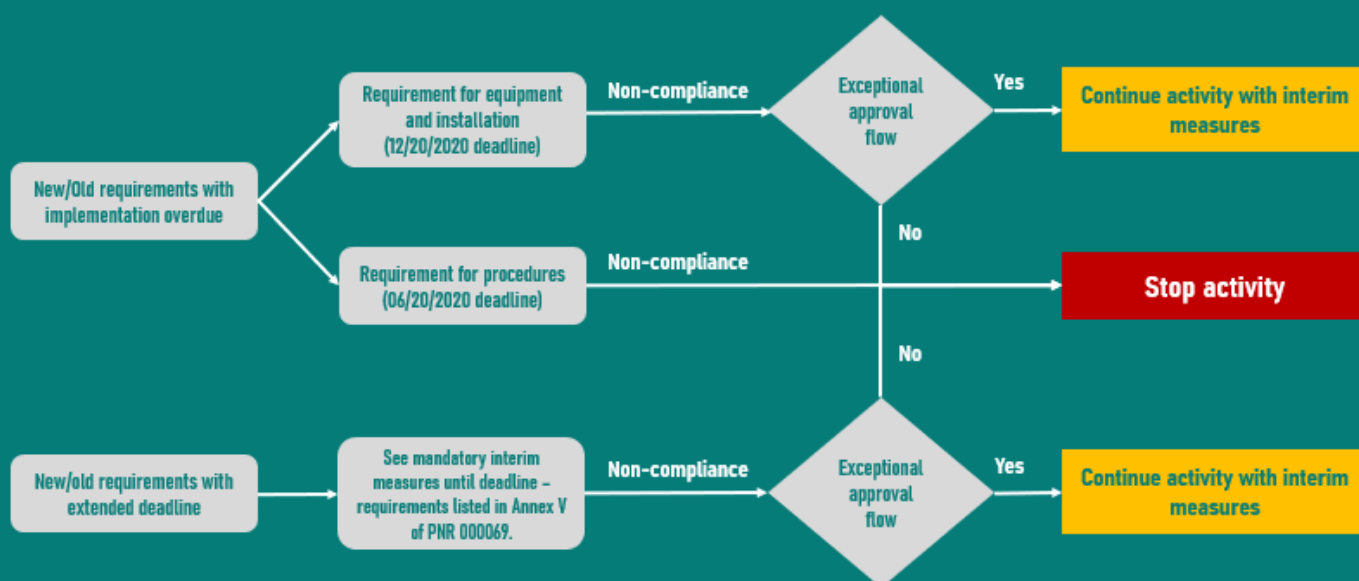
1.2.2 - Equipment and installation requirements (expired due date on 20/12/2020):

In case of non-compliance with the equipment and installation requirements that did not have the due date extended in the Annex V, must follow the exceptional approval flow and adopt at least the conditions below:

- a) Identification of all equipment and installations that do not comply with the interim measures/requirements;
- b) Development of an action plan to comply with the requirements/ interim measures;
- c) Definition of temporary control measures, which must be reflected in risk analyzes (JHA/JSA);
- d) Presentation of the items above for formal and documented approval by the Executive Manager of HSOR and Executive Manager of Operations/Construction.

The items above must be completed in the period of 1 (one) month from the date of publication of this annex and are valid until 30/06/2021, that is the deadline for the implementation of the requirements. In case of non-compliance with the items above or of non-compliance with the requirements until the deadline, activities must be stopped.

Addressing CAR 01-05 non compliances and exceptional approval process



Exceptional approval flow

- Identification of all equipment and installations that do not comply with the interim measures/requirements;
- Development of an action plan to comply with the requirements/ interim measures;
- Definition of temporary control measures, which must be reflected in risk analyzes (JHA/JSA);
- Presentation of the items above for formal and documented approval by the Executive Manager of HSOR and Executive Manager of Operations/Construction.