



Integrated Management Systems in the Mining Sector **HANDBOOK**



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the European Union



Website

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About this Handbook

This handbook has been developed by LOMARTOV S.L. as part of the European project PERmanent MAGnet Network for the European Transition ([PERMANET](#), Grant Agreement ID. 101178444).

PERMANET is an EU-funded project that aims to establish an innovative network of EU actors to ensure a resilient supply of Rare Earth Permanent Magnets (REE PM) in Europe.

Within PERMANET, this handbook contributes to the sustainability assessment activities of Hub 1 (Sustainable REE Supply Hub) and Hub 2 (Circular REE Innovation Hub), supporting the mining sector in improving environmental, quality, occupational health & safety, and sustainability performance through the implementation of Integrated Management Systems aligned with internationally recognised standards.



This document is intended as a practical guide for implementing the latest versions of **ISO 9001**, **ISO 14001**, **ISO 45001**, **UNE 22480**, and **UNE 22470** within the mining sector. It represents a first step towards the development of an Integrated Management System aligned with quality, environmental, health and safety, and sustainable mining requirements.

The Handbook is organised into different implementation stages and action levels, presented as individual chapters. Each chapter explains the main objectives and requirements associated with a specific area of the management system.

To support practical implementation, each chapter includes a compliance checklist together with key actions and recommendations.

A practical, fictitious example is provided to illustrate how the requirements may be applied in real operational contexts.

The document can be used as a practical implementation guideline, a self-assessment and gap analysis tool, and a basis for continual improvement. It also supports organisations in progressively aligning existing systems with an integrated management approach adapted to mining activities.

IMS in PERMANET

PERMANET EU Context and REE Value Chain

PERMANET aims to establish a resilient, sustainable and circular European Rare Earth Element (REE) permanent magnet value chain through three interconnected technological Hubs covering primary REE supply, circular recovery and recycling, and permanent magnet production and testing.

Within this framework, **Hub 1 – Sustainable REE Supply** focuses on securing and diversifying REE sources from strategic deposits and mining tailings, while improving access, resource efficiency and environmental performance.

Mining and mineral processing therefore constitute the starting point of the PERMANET value chain.

These activities can face important management challenges, including variable site characteristics, strict quality and traceability requirements, environmental impacts, safety risks, regulatory compliance, and the need to coordinate multiple operational and sustainability objectives within a single system. Key challenges associated with primary REE extraction include:

- **Complex processing and high environmental burdens** – Primary REE production can require multiple energy- and reagent-intensive stages (e.g. solvent extraction of both light and heavy REE).
- **Tailings and residue management** – Large volumes of mineral-processing residues and tailings must be safely managed to minimise risks related to land occupation, water contamination and dust generation. Extraction and separation processes can involve significant water use and chemical consumption.
- **Management of associated hazardous elements** – REE-bearing minerals such as monazite may contain thorium and other naturally occurring radioactive materials (NORM), requiring appropriate characterisation, handling and control.



PERMANET

Rare Earth Element Sources

PERMANET Hub 1

PERMANET Hub 1 explores different REE sources to strengthen and diversify European supply, while this Handbook provides a common management framework for the environmental, quality, safety and traceability challenges associated with them.

Strategic REE deposits

Primary geological key resources containing economically relevant concentrations of rare earth elements.

Mining tailings

Secondary resources generated by previous mining and mineral processing activities. Tailings may still contain recoverable REEs and offer opportunities for resource efficiency and waste valorisation.

Monazite concentrates

Mineral concentrates rich in REEs, typically obtained through beneficiation of monazite-bearing ores. They can serve as feedstock for downstream hydrometallurgical extraction and refining processes.

REE concentrates from iron ore

REE-bearing concentrates recovered as secondary streams from iron ore processing. These non-conventional sources can contribute to diversifying supply while improving overall resource utilisation.

An integrated management approach can support the diversification of Europe's primary REE supply and the development of greater EU-based production capacity. At the same time, **PERMANET LCA results** highlight the **significant environmental impacts that can be associated with current primary REE supply chains (China)**, including climate-change and land-use burdens. This creates an opportunity to develop new European REE production under stronger environmental, quality, safety and traceability requirements, **using the IMS as a framework for continual improvement and more responsible sourcing of virgin REEs.**

Foreword

1

Why implement an Integrated Management System?

Management systems ensure compliance, safety, and quality, while reducing risks and promoting continual improvement. In mining, where multiple standards are complex to implement, an Integrated Management System enables efficient and coordinated management across quality, environment, safety, and sustainability. It reduces duplication and enhances overall performance, competitiveness, and environmental protection.

2

Why use this document?

This document provides a practical first guide to applying ISO and UNE standards for sustainable mining. It integrates multiple standards into a unified approach, focusing on common elements and adapting them to mining activities. The handbook supports improved working methods, regulatory compliance, risk reduction, and efficient implementation, while saving time, facilitating audit preparation, and offering an all-in-one solution.

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Chapter 1

Scope

This document defines the scope of a practical and easy-to-implement handbook designed to support mining organisations in adopting an integrated management approach. It brings together the most relevant and up-to-date standards applicable to the EU mining sector, providing a comprehensive yet accessible framework. The aim is to offer an “all-in-one” solution that enables companies to efficiently implement and manage quality, environmental, safety, and sustainability practices within a single, coherent system. This approach is structured following the Plan–Do–Check–Act (PDCA) cycle, ensuring continual improvement and effective operational control.



Chapter 2

Terms and Definitions

Compliance Obligations – Legal and other requirements the organisation must meet.

Continual Improvement – Recurring activity to enhance performance.

Corrective Action – Action to eliminate the cause of a non-conformity.

Environmental Aspect – An element of activities that can interact with the environment.

Hazard – A source with the potential to cause injury or harm.

Integrated Management System (IMS) – A unified system combining quality, environmental, and health and safety management.

Interested Parties (Stakeholders) – Individuals or organisations affected by or able to influence the organisation.

Life Cycle – Consecutive and interlinked stages from raw material acquisition through production, use, end-of-life treatment and final disposal.

Non-conformity – Failure to meet a requirement.

Operational Control – Procedures and measures ensuring processes are carried out under defined conditions.

Risk – The effect of uncertainty on objectives, considering likelihood and impact.

Risk Assessment – Process of identifying, analysing, and evaluating risks.

Chapter 3

Normative References

ISO 9001 – Quality management systems: requirements for ensuring consistent product and service quality and customer satisfaction*.

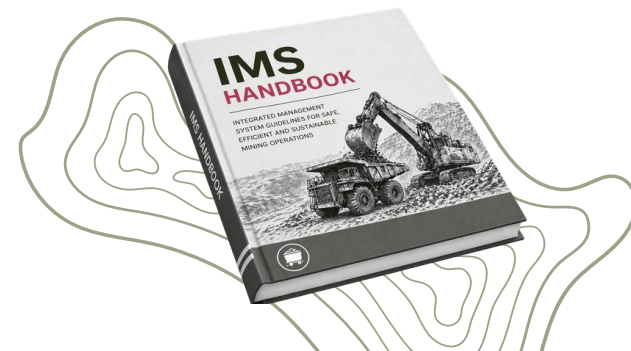
ISO 14001 – Environmental management systems: requirements for managing environmental responsibilities and improving environmental performance*.

ISO 45001 – Occupational health and safety management systems: requirements for preventing work-related injury and ill health and promoting safe workplaces.

UNE 22480 – Sustainable mining - mineral processing - metallurgy management system. Requirements.

UNE 22470 – Sustainable mining - mineral processing - metallurgy management system. Indicators.

*ISO 9001:2026 and ISO 14001:2026 are the latest published editions and have been incorporated into this Handbook. Relevant changes are highlighted throughout the document. *With grey colour additions and changes in ISO 9001 and with red colour additions and changes in ISO 14001.*



Chapter 4

Context of the Organisation

This section requires the organisation to define its purpose and understand internal and external issues that are relevant to it and that influence its ability to achieve the intended outcomes of its management system.

- ☐ Determine the internal and external context of the organisation in relation to the quality, environmental, economic, social aspects, occupational risks and safety.
- ☐ **Scope must reflect a life cycle approach. Identify relevant environmental conditions that may affect, or be affected by, the organisation, including climate change, pollution, natural-resource availability, biodiversity and ecosystem health.** New
ISO 14001
- ☐ Identify the needs and expectations of stakeholders: customers, suppliers, regulators, community, employees, etc.
- ☐ Determine aspects that reflect significant economic, environmental, safety, health risks, social, and quality aspects as well as risks and opportunities. New
ISO 9001
- ☐ Define the scope of the management systems: which activities, products, and services are included.
- ☐ Management system reflects previously identified aspects.
- ☐ Establish, implement, maintain, and improve a sustainable mining-mineral-metallurgical management system that must be **documented, maintained, reviewed, and improved.** New
ISO 14001
- ☐ Ensure the system is aligned with the organisation's strategic direction.
- ☐ Determine whether climate change is a relevant external or internal issue and consider climate-related requirements of relevant interested parties. New
ISO 9001

Example

GreenRock

GreenRock Aggregates Ltd is a globally operating mining company with a diverse, high-quality portfolio of operations, projects and exploration activities across five countries on four continents. They pursue value-creating opportunities involving minerals, where they can leverage existing assets, shareholdings, skills and experience.

Mission/Goal: The overall aim of GreenRock Aggregates Ltd's strategy is to generate sustainable cash flow improvements and returns over the longer term and, in so doing, to create and preserve value for all their stakeholders.

Stakeholder Group	Role / Interest	Examples
Employees	Safe working conditions, job security, training	Plant operators; Maintenance technicians
Leadership	Strategic performance, compliance, risk management	CEO; Operations Director
Customers	Product quality, reliability of supply	Construction companies; Cement producers
Suppliers	Fair contracts, long-term partnerships	Equipment providers; Chemical suppliers
Regulatory & Safety Bodies	Legal compliance, safety performance	Labour inspectorate; Environmental agency

Chapter 5

Leadership

The top management needs to demonstrate leadership and commitment with respect to the IMS and ensure its effectiveness and integration into the organisation's business processes.

☐ Management shows commitment and leadership related to the IMS.

☐ Promote quality, safety, **environmental protection** and sustainability as cooperative values.

New
ISO 14001

☐ **Active top management involvement with monitoring for improvement, emphasizing resource conservation and ecosystem protection in policy and regularly reviewing the environmental policy.**

New
ISO 14001

☐ Establish clear company policies that integrate IMS values.

☐ Ensure that responsibilities and authorities for relevant roles are assigned and communicated.

☐ Document, communicate, and periodically review and update the policies.

☐ Promote a quality culture and ethical behaviour across the organisation.

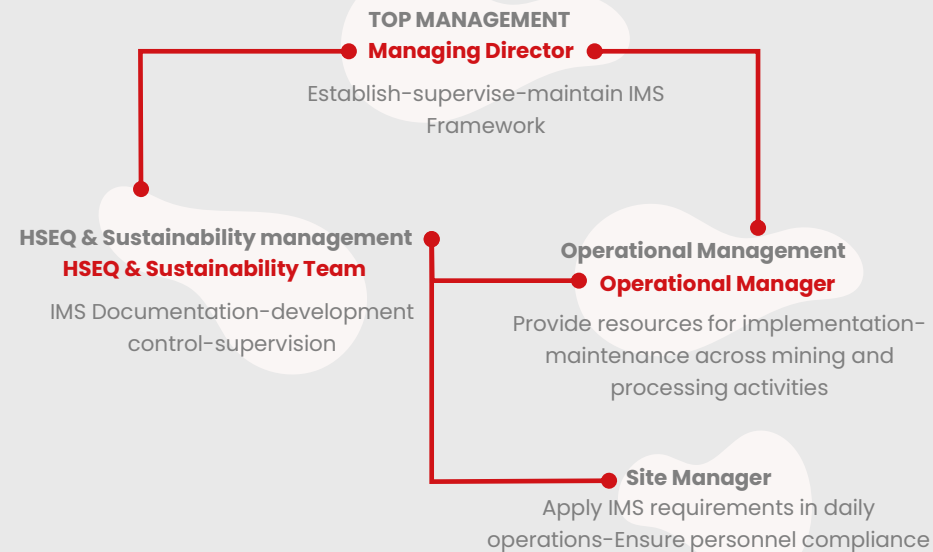
New
ISO 9001



Example

GreenRock

Accountability for the development, implementation and maintenance of the Integrated Management System (IMS) at GreenRock Aggregates Ltd is defined in the IMS Responsibilities Organisation Chart.



Internal communication is achieved through meetings, toolbox talks, training sessions, notice boards, intranet postings, performance reports, objectives and KPI reviews, and recorded minutes.

External communication is conducted through the company website, meetings and correspondence with customers, suppliers and regulatory authorities, audits and inspections, & other relevant formal communications.

Chapter 6

Planning

Implement an action plan within the IMS to address the objectives, risks, and opportunities. Planning is an essential part to the “Plan-Do-Check-Act” cycle.

- ☐ Define environmental aspects and associated impacts within the control or influence of the organisation, **considering a life-cycle perspective and normal, abnormal and emergency conditions.** New
ISO 14001
- ☐ Identify applicable legal and compliance requirements related to the IMS. Example: the national regulatory framework governing NORM management.
- ☐ Define a methodology for hazard identification from routine and non-routine activities and situations.
- ☐ Define health, safety, quality, and environmental objectives of IMS.
- ☐ Consider policy and objectives, risks and opportunities in planning of IMS.
- ☐ Plan different actions for objectives risks and opportunities (what will be done, what is needed, who, when, how it will be measured). New
ISO 9001
- ☐ **Detailed clarification of emergency and abnormal situations within the action plan. Emergency situations are now separated from abnormal operations.** New
ISO 14001
- ☐ Plan and control significant IMS changes, considering their purpose, potential consequences, resources, responsibilities, communication and effectiveness. New
ISO 9001



Example

GreenRock

GreenRock Aggregates Ltd applies a structured risk-based approach to planning, based on the principles of ISO 31000. Risk management is implemented using a multi-layered control model to ensure that risks are identified, assessed and controlled at strategic, operational and task levels.

Risk	Action
Presence of hazardous materials in extracted rock	Geological assessment and controlled blasting procedures
Breakdown of critical mobile or fixed plant equipment	Preventive maintenance programme and spare parts management
Incorrect grading or quality of aggregates	Operator training and routine material testing
Dust and noise emissions affecting nearby communities	Water spraying systems, noise control measures and monitoring
Vehicle collisions within the quarry	Traffic management plan and operator training
Non-compliance with environmental permit conditions	Compliance monitoring and internal audits

Chapter 7

Support

This section describes the requirements ensuring that the IMS can operate effectively and be maintained over time.

- ☐ Provide necessary resources for the IMS (human, natural, financial, technological and others). New
ISO 9001
- ☐ Determine competences needed and guarantee qualification of personnel via education, training and experience supported by documented evidence. New
ISO 9001
- ☐ Guarantee awareness of personnel regarding the IMS, policies, objectives, and applicable procedures. **Communication must empower employees to contribute to continual improvement.** New
ISO 14001
- ☐ Define means of internal and external communication.
- ☐ Document and control in an accessible manner relevant IMS information and update regularly.



Example

GreenRock

GreenRock Aggregates Ltd ensures that employees and contractors are competent for their roles. Job descriptions define responsibilities and required skills. Personnel are selected through a controlled hiring process and receive general and task-specific training.

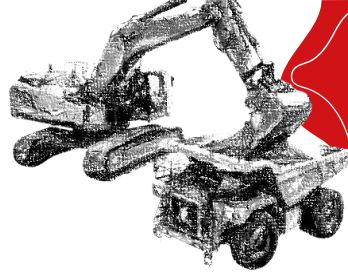


Safety information is reinforced through:



Chapter 8

Operation



Effective implementation and control of operational processes to ensure that quality, environmental, health and safety, and sustainability requirements are met in daily mining and mineral processing activities and integrated into routine organisational operations.

- ☐ Process control through defined criteria, implementation, documentation, and management of externally provided processes and suppliers.
- ☐ Operational procedures and acceptance criteria established for normal and non-routine activities, with records maintained to demonstrate operational control.
- ☐ Controls implemented for environmental aspects and OH&S risks, prioritizing elimination or substitution of hazards and applying engineering controls or work reorganisation.
- ☐ Complement with administrative measures (including training) and appropriate personal protective equipment.
- ☐ Emergency preparedness and response procedures established and periodically tested. **Emergency preparedness must align with risk planning.**
- ☐ **Improve operational control to ensure the resilience and sustainability of the value chain.**

New
ISO 14001

New
ISO 14001



Example

GreenRock

At GreenRock Aggregates Ltd., operational procedures define the normal crushing and screening process, including maximum feed size and conveyor speed limits. A separate non-routine procedure is applied during maintenance shutdowns, requiring lock-out/tag-out, isolation of electrical panels, and inspection approval before restarting the plant.

Indicator	Description	Frequency
Conveyor Speed Monitoring	% of operating time conveyors remain within approved speed range (1.8–2.2 m/s) – Target ≥ 99%	Continuous / Hourly review
Daily Equipment Inspection	100% of daily inspection checklists completed and recorded in the site database	Daily
Crusher Load Monitoring	Operating time of crusher within safe limits (stop at least 1h/day)	Daily
Wastewater Sent to Treatment	Volume of process wastewater directed to treatment system (m ³ /month)	Monthly



Equipment Inspection Completion



Maintenance Shutdown Procedure Completion



Conveyor Speed

Chapter 8.1

Operation–Sustainability

Environmental and sustainability management in mining should translate identified environmental aspects into operational controls, measurable indicators and continual improvement actions. Particular attention should be given to resource and energy consumption, water use, chemical and material inputs, emissions, waste and residue management, land disturbance and rehabilitation. For REE mining and processing, these aspects are particularly relevant due to the complexity of extraction and separation processes

- ☐ **Energy and climate:** Identify and monitor the energy needs of key operations, optimise equipment efficiency, and reduce the environmental impact of electricity and fuel consumption.
- ☐ **Water management:** Control water consumption, reuse and discharge, particularly in beneficiation and processing stages where water demand can be significant.
- ☐ **Chemical use:** Optimise reagent consumption, recovery and substitution to reduce both environmental impacts and operational risks.
- ☐ **Tailings and residues:** Characterise, store and manage residues safely, recognising that hard-rock REE mining can generate large volumes of tailings, and apply specific controls to potentially hazardous or NORM-bearing streams.
- ☐ **Land and biodiversity:** Define operational limits for land disturbance and integrate progressive rehabilitation and restoration into mining procedures, while considering the long-term requirements and guidance of ISO 21795 for mine closure and reclamation.

PERMANET Sustainability Insights

PERMANET WP7 results can guide development of sustainable operational practices.

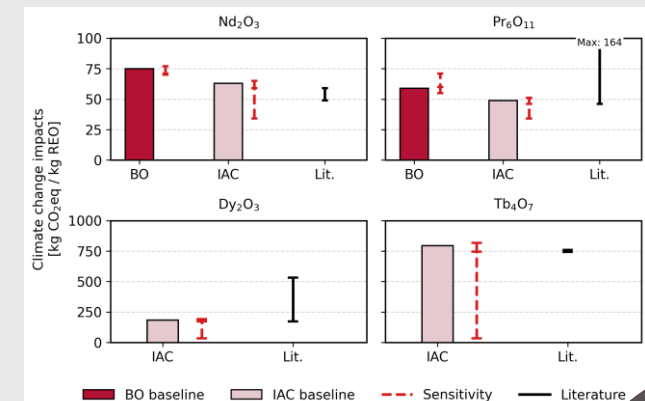
PERMANET-specific LCA results highlight sustainability hotspots, guiding efforts during the roll-out of an IMS

The deposit-type, mining and processing route strongly influences sustainability performance.

As an example, hard-rock bastnäsite–monazite mining and processing and ion-adsorption clay extraction involve different operations, reagent needs, energy demand and environmental burdens.

Chemical-intensive processing is a key environmental hotspot.

Across the preliminary PERMANET routes assessed, chemical consumption is one of the main drivers of environmental impacts, particularly in solvent extraction stages. Operational control should therefore pay particular attention to processes with high reagent demand, focusing on consumption reduction, recovery, substitution and efficient dosing.



Climate-change impacts of primary rare earth oxide production for Nd₂O₃, Pr₆O₁₁, Dy₂O₃ and Tb₄O₇ under the PERMANET benchmark assessment. Source: PERMANET Public Factsheets developed by LOMARTOV.

Chapter 8.2

Operation–Safety

Safe mining and mineral-processing operations require hazard identification, risk assessment and appropriate operational controls in line with ISO 45001. Particular attention should be given to equipment-related hazards, physical exposures, chemical handling and, where relevant, NORM-related risks. Operational controls should be adapted to the specific mining activity, process conditions and identified risk level.

Safety Area	Key Operational Controls / Risks
Mining & mobile equipment	Vehicle movements; excavation and slope stability; blasting where applicable
Processing equipment	Crushers, mills and conveyors; moving machinery; electrical isolation and lock-out/tag-out
Dust & physical exposure	Mineral dust; noise and vibration; heat exposure; confined spaces. Prioritise elimination, engineering and organisational controls before relying on personal protective equipment, following ISO 45001 principles.
Chemical processing	Acids, alkalis and extraction reagents; chemical storage and transfer; spill prevention
NORM*	Radiological characterisation; controlled handling and storage; worker and area monitoring where required. Where NORM is relevant, specific radiological protection requirements may apply; see Annex – NORM Materials and the PERMANET approach to NORM management.

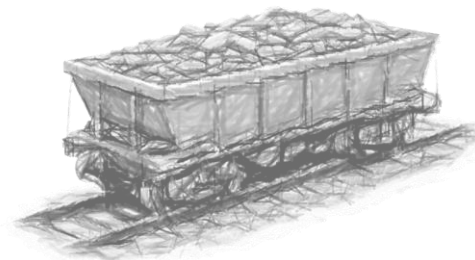
Key operational safety areas and representative controls for mining and mineral-processing activities.

Chapter 8.3

Operation–Quality

Quality management in mining and mineral processing should ensure that materials, process outputs and final products consistently meet defined technical, customer and regulatory requirements. Operational quality control should focus on material characterisation, process stability, reliable measurement, traceability, acceptance criteria and control of non-conforming outputs. For REE operations, quality control is particularly important because variations in mineralogy, REE composition, impurities and recovery efficiency can affect downstream separation, refining and permanent-magnet production.

Quality Area	Key Operational Controls
Material characterisation	Define and verify relevant material properties, including mineralogy, REE content and key impurities. Example: Monitor the share of batches fully characterised and completion of required analyses.
Process control	Establish operating criteria and monitor key process parameters to maintain consistent recovery, stability and product quality. Example: Track REE recovery yield and operating time within defined process limits.
Product specifications & release	Define acceptance criteria for concentrates, intermediates and final products, and verify conformity before transfer or release. Example: Track batches meeting specification and non-conforming batches.



Chapter 9

Performance Evaluation

Monitor and review the system to verify that processes achieve the intended quality, environmental, health & safety, and sustainability objectives and related indicators.

- ☐ Define what will be monitored and measured, the evaluation criteria and appropriate indicators for environmental, quality, safety and sustainability performance. Include real-time metrics.
- ☐ Compliance with legal and other requirements (compliance obligations) periodically evaluated.
- ☐ Internal audits planned and performed with defined criteria and documented results. Internal audits must assess all aspects of IMS.
- ☐ Non-conformities identified and recorded.
- ☐ Management review performed periodically to evaluate system's effectiveness.
- ☐ Decisions and actions derived from evaluation are communicated, implemented, and tracked.
- ☐ Life cycle assessment of key processes performed, and performance indicators defined.
- ☐ Demonstrate results and effectiveness, not just compliance.

New
ISO 14001

New
ISO 9001

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ISO 14001

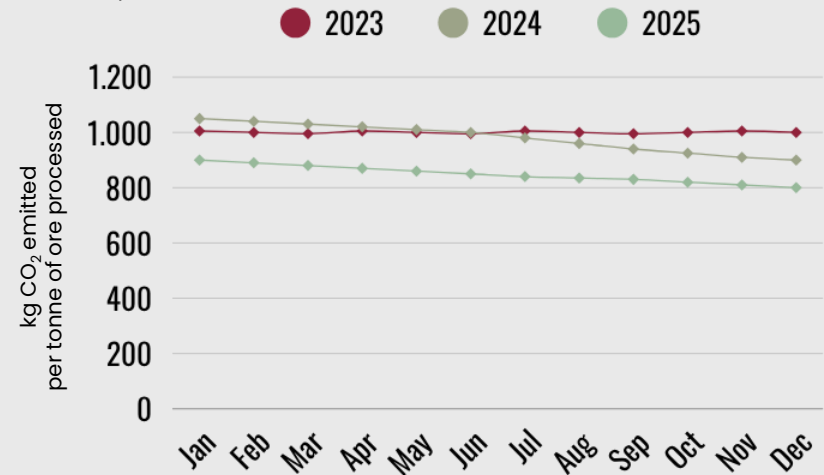
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ISO 14001

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ISO 14001

Example

GreenRock

At GreenRock Aggregates Ltd., the company monitors monthly indicators including carbon footprint per ton processed, for which a reduction target has been established and periodically evaluated, number of safety incidents, and percentage of shipments meeting quality specifications. An internal audit identifies incomplete maintenance records, and during the management review the company decides to introduce a digital inspection form and additional supervisor checks to improve monitoring and performance.



GreenRock's monthly CO₂ emissions intensity performance, measured in kg CO₂e per tonne of ore processed, for 2023–2025.

In 2024, new operational and efficiency measures were introduced, leading to a gradual reduction toward the company's target. In 2025, these measures were intensified, further lowering emissions.

Chapter 10

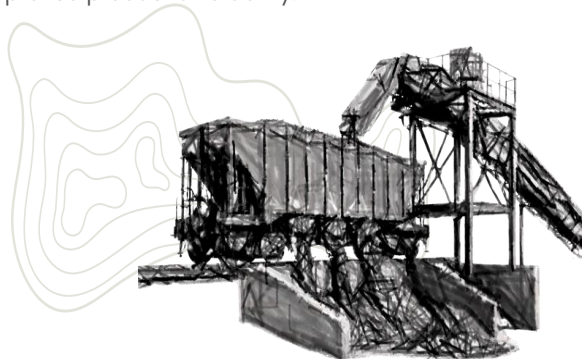
Improvement

Correcting problems and enhancing processes to continually increase system effectiveness and performance.

- ☐ Corrective actions implemented to address detected operation errors.
- ☐ Root cause analysis performed before defining actions.
- ☐ Effectiveness of corrective actions verified **and improvement in the structure of corrective actions and their direct link to performance evaluation findings if needed.**
- ☐ Potential undesired effects are addressed through risk-based planning and appropriate preventive controls.
- ☐ Opportunities for improvement identified from audits, monitoring and worker feedback.
- ☐ Changes are implemented in a controlled and documented manner, contributing to improved production stability.

New
ISO 14001

New
ISO 9001



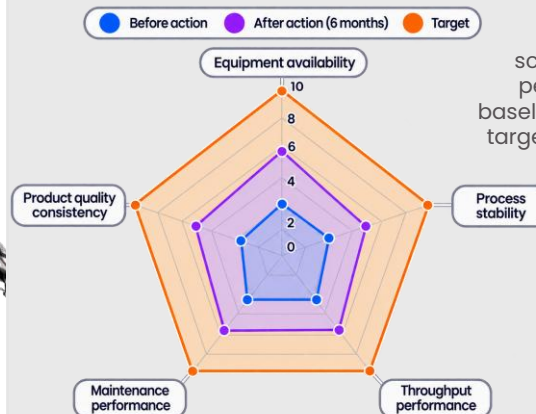
Example

GreenRock

After repeated conveyor belt failures, GreenRock Aggregates Ltd. performs a root-cause analysis and discovers excessive material moisture. The company installs a pre-screening stage and updates maintenance procedures, reducing breakdowns.

Interconnection with 9. *Performance evaluation*

Aspect	Before Action	Root Cause Identified	Actions	After Action
Conveyor Failures	12 failures per month	Excessive material moisture	Install pre-screening stage	4 failures per month
Downtime	30 hours per month	Wet material causing blockages	Update maintenance procedures	10 hours per month
Maintenance Interventions	20 interventions per month	Build-up on belt system	Preventive cleaning schedule	8 interventions per month

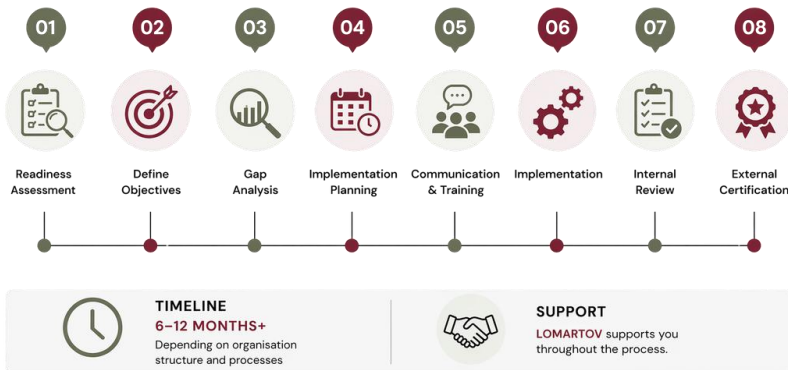


This radar chart shows how GreenRock can monitor improvement in a specific operational process. The crushing and screening process is assessed across five performance dimensions, comparing the baseline, the results after six months, and the target performance to identify progress and remaining gaps.

Chapter 11

Next Steps

With this handbook as a guide, organisations can follow a structured approach to implement an Integrated Management System (IMS) effectively.



PERMANET Next Steps

IMPLEMENTATION ROADMAP

This Handbook provides a practical IMS implementation roadmap for mining and REE value chains. The framework on the left presents the general implementation pathway, while the following actions illustrate its proposed application to each PERMANET Hub 1 participants.

1. Define Scope & Context

Each Hub 1 participant defines the scope of its IMS based on its activities, processes, REE sources, sites, stakeholders and applicable requirements.

2. Define Objectives

Define objectives of IMS, targets for quality, H&S, environment and sustainability, and timelines for implementation.

3. Gap Analysis - Map Risks & Opportunities

Assess quality, safety, environmental, sustainability and NORM-related risks and opportunities, considering PERMANET results.

4. Develop IMS Procedures

Develop or update the procedures and operational controls needed for the participant's own activities, including traceability, emergency response and compliance.

5. Implement & Train

Deploy procedures, assign responsibilities and train relevant personnel. Keep communication between different levels of organisation and follow IMS Responsibilities Organisation Chart.

6. Monitor Performance

Track KPIs, legal compliance, operational performance and sustainability results, including feedback from PERMANET pilots and Hubs.

7. Audit & Review

Perform internal audits and management reviews to identify gaps, improvement needs and changes required by evolving EU regulations and standards.

8. Improve, Replicate & Scale

Integrate lessons from PERMANET, expand circularity and traceability, support replication and scale-up across future industrial Hubs.

Annex

NORM* materials

Naturally Occurring Radioactive Materials (NORM) are radioactive substances that occur naturally in the Earth's crust, mainly associated with radionuclides from the uranium and thorium decay series. In most geological materials these radionuclides are present at low concentrations, but mining and mineral processing activities can mobilise, separate or concentrate them, increasing their relevance for occupational and environmental management.

In the mining sector, NORM may be present in ores, mineral concentrates, process residues, tailings, dusts and wastewater streams. This is particularly relevant for some REE-bearing minerals, such as monazite, which may contain naturally occurring uranium and thorium. NORM should be considered throughout material characterisation, operational control, worker protection, environmental monitoring, residue management and regulatory compliance.

Within the EU, NORM is addressed under Council Directive 2013/59/Euratom, which establishes the Basic Safety Standards for protection against ionising radiation. Specific notification, authorisation, exemption, monitoring and waste-management requirements are then implemented through national legislation and competent authorities.

*Although included in the Annex, NORM management is strongly connected to the IMS through its links with operational control, safety, environmental management, compliance and monitoring



Annex

PERMANET approach to NORM

1

Applicable Regulatory Framework: PERMANET established a framework to comply with Spanish NORM regulations. As several materials exceeded exemption levels, radiological controls were required under Article 99 of Real Decreto 1217/2024, including a Radiological Protection Programme (RPP), monitoring, waste management and reporting procedures.

2

Exposure assessment and monitoring: Radiological Impact Assessment performed before material handling activities. Monthly personal dosimetry and area monitoring were implemented in the laboratory and storage areas. Measured doses during 2025 remained extremely low, with personal dosimetry records reporting 0 mSv/month and area measurements remaining below expected limits.

3

Waste and residue management: Raw materials, intermediates, residues and effluents were radiologically characterised. Controlled storage, shielding, access control and monitoring were implemented, with the Radiological Protection Programme defining requirements for handling and managing NORM residues.

4

Reporting and Administrative Obligations: Compliance was supported through required declarations, radiological assessments, implementation of the Radiological Protection Programme and updates for pilot-scale activities. Periodic visits by the authorised Radiological Protection Technical Unit were conducted to verify compliance and validate radiological assumptions.

5

Lessons Learned: Early radiological characterisation, conservative impact assessment, engineering controls, authorised radiological protection support and systematic worker training enabled safe and compliant processing of monazite concentrates. PERMANET also identified regulatory gaps in the transport, processing and waste management of NORM materials, highlighting the need for a more harmonised European framework alongside industrial scale-up.

Annex

Last Reviews

Recent and upcoming revisions to key ISO and UNE standards place greater emphasis on sustainability. This Handbook has been developed in line with the latest published versions of ISO 9001:2026 and ISO 14001:2026, together with ISO 45001:2018/Amd 1:2024 and the relevant UNE sustainable mining standards. This IMS ensures that organisations are aligned with both current requirements and expected updates, covering all essential elements for effective implementation.

- ☐ **ISO 9001 – Quality Management Systems**
Latest version: ISO 9001:2026
Update status: Draft developed in 2024, 2025, new version published September 2026
<https://www.iso.org/standard/62085.html>
- ☐ **ISO 14001 – Environmental Management Systems**
Latest version: ISO 14001:2026
Update status: New version revised during 2024, 2025 and published in the first half of 2026
<https://www.iso.org/standard/14001>
- ☐ **ISO 45001 – Occupational Health and Safety Management Systems**
Latest version: ISO 45001:2018
Update status: Confirmed (review completed in 2024)
<https://www.iso.org/standard/63787.html>
- ☐ **UNE 22480 – Sustainable Mining Management System**
Latest version: UNE 22480:2025
Update status: Updated in 2025
[UNE 22480](#)
- ☐ **UNE 22470 – Mining Operations Safety**
Latest version: UNE 22470:2025
Update status: Updated in 2025
[UNE 22470](#)

INTEGRATED MANAGEMENT SYSTEMS TOWARDS MINING SECTOR SUSTAINABILITY HANDBOOK

This HANDBOOK provided a structured and practical pathway towards the implementation of an Integrated Management System in the mining sector. By aligning internationally recognised standards, it supports organisations in improving performance, ensuring compliance, and advancing sustainability.



LOOKING AHEAD



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