Vale ESG Webinar

Tailings and Dam Management

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1

Opening remarks

Eduardo Bartolomeo,
Chief Executive Officer

De-risking Vale through dam safety

De-risking

- Brumadinho
- Mariana
- ***Dam safety***
- Production resumption

Reshaping

- Focus on core business
- Elimination of cash drains
- Accretive growth opportunities
- Cost efficiency

Re-rating

- ***Benchmark in Safety***
- ***Best-in-class reliable operator***
- Talent-oriented organization
- Leader in low carbon mining and ESG practices
- Reference in creating and sharing value

Solid cash flow generation

Discipline in capital allocation

Strong governance and oversight for TSF[1] management…

Executive compensation

35-60%

of short-term variable compensation tied to Health & Safety, Operational Risk and VPS targets

The Safety and Operational Excellence Office has ***NO TARGET*** *tied to production or financial metrics*

… supported by tailored executive compensation

[1] TSF stands for Tailings Storage Facility, with criteria agreed by the International Council on Mining and Metals' Tailings Advisory Group in response to the Church of England information request, which may differ from the Brazilian National Mining Agency criteria. [2] A requirement by the Global Standard Industry on Tailings Management.

2

Risk management model

Carlos Medeiros,
Executive Vice President of Safety and Operational Excellence

The risk management model fosters the office‘s independence

1st Line of Defense		2nd Line of Defense	3rd Line of Defense	External Sentinels		
Business Units		*Safety & Operational Excellence*	*Internal Audit*	*Engineer of Record*	*Independent Audits*	*TSF Safety Review*
1st Layer	2nd Layer					
Geotechnical **Operational** Area	Geotechnical **Matrix** Area	**Geotechnics Area**	Compliance Office (Internal Audit and Whistleblower Channel)	▪ TSF safety inspections and performance assessment ▪ Cover 100% of Vale's TSFs[1]	▪ Public Prosecutors' technical advisors ▪ ***Independent Tailings Review Boards (ITRB)***	▪ Periodical technical review by external engineering firm

Safety & Operational Excellence (2nd Line of Defense):

- Authority to stop any given operation if necessary
- Development of a new and transformed Tailings & Dams Management System
- Risk management methodologies and process
- Ensure best practices to continually monitor mine waste facilities
- Support to the EoR implementation
- Implement the GISTM

Independent Tailings Review Boards (ITRB):

- ITRB provide third-party advice on all phases of the tailings impoundment
- Act as external reviewers to the three lines of defense
- ITRBs appointed to all Operational Systems in Brazil

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[1] TSF stands for Tailings Storage Facility.

The flow of information ensures visibility of critical issues to top management

Office's reporting routine

- ***Half-year reports*** *to the Board of Directors*
- ***Half-year reports*** *to the Fiscal Council*
- ***Monthly reports[1]*** *to the Operational Excellence and Risk Committee,* ***which reports monthly to the Board of Directors***
- ***Weekly reports*** *to the Executive Board*
- ***Ad-hoc reports*** *whenever a risk out of the tolerable limit is identified*

Conservative approach to TSF safety management

- Reclassification of TSFs[2] based on updated knowledge of structures and safety conditions
  E.g. Xingu TSF (previous classified as drained pile)
- Evacuation of Self-Rescue Zones related to TSFs at Emergency Level 2 (ahead of the Brazilian legislation)
  E.g. Forquilhas I, II and Grupo TSFs
- Emergency level protocol activated before lack of reliable information
  E.g. Área IX TSF

Non-exhaustive list

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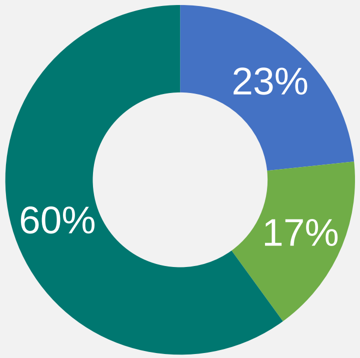
[1] Considers 26 thematic reports in 9 months within a year. [2] TSF stands for Tailings Storage Facility.

Best practices roll-out supports key achievements

Upstream TSF De-characterization

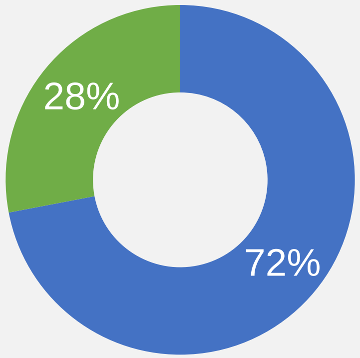
% of upstream TSFs²



- Completed by 2021
- Estimate for 2022
- In progress

HIRA¹ for TSFs

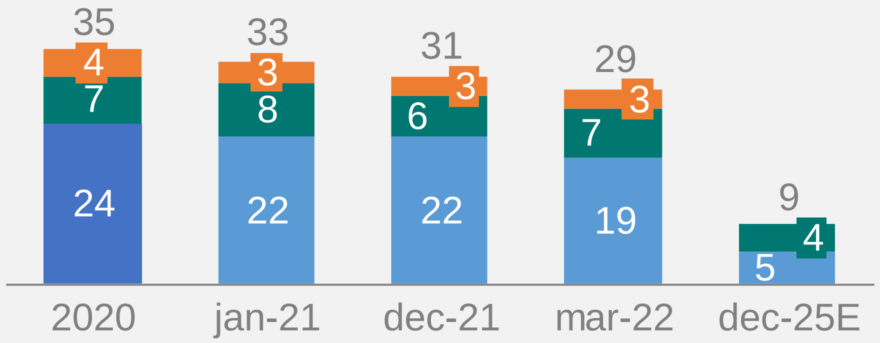
% of TSFs³ with HIRA



- Implemented by 2021
- Estimate for 2022

Structures at emergency level

No. of structures



- Level 1
- Level 2
- Level 3 (critical safety conditions)

¹ HIRA stands for Hazard Identification and Risk Assessment methodology. ² TSF stands for Tailings Storage Facility. ³ Includes Vale's own facilities and excludes non-operated joint ventures.

Commitment to the
Global Industry Standard on Tailings Management

Vale

2020
- 1st self-assessment based on the principles (Sep 2020)
- The GISTM is launched, based on 15 principles (Aug 2020)

2021

~60% adherence[1]

- Gap-assessment based on the conformance protocol (Nov 2021)
- The 77 auditable requirements for adherence are made public (May 2021)

2022

~90% adherence (target)[2] [3]

- External audit
- Gap treatment

2023
- In line with the industry commitment
- All tailings facilities with “Extreme” or “Very high” potential consequences must be compliant by Aug 2023

2025
- All tailings facilities not in a state of safe closure must be compliant by Aug 2025

[1] Based on the results of the self-assessment conducted in December 2021, which had the 77 auditable requirements as main source and encompassed 58 Tailings Storage Facilities (TSFs). [2] Based on the external audit results. Structures held by joint-ventures are not included. [3] Considering TSFs with “Extreme” or “Very high” potential consequences.

3

Tailings and dam management

Rafael Bittar,
Geotechnical Director

Our Tailings Management Strategic Pillars

- Implementation of a new and transformed Tailings & Dams Management System (TDMS)
- Vale will comply with the Global Industry Standard for Tailings Management
- Eliminating Upstream TSFs - De-characterization Program
- New Way to Operate - New projects to reduce the reliance on TSFs
- Co-products: recycling dry tailings to sustainably increase production capacity

Understanding the TDMS[1]

Cultural transformation focused on Transparency, Leadership and Performance

Technical
Method
VPS
Leadership

CULTURAL TRANSFORMATION AND KEY BEHAVIORS

POLICIES & COMMITMENTS

TECHNICAL: Normative Standards and Procedures

ORGANIZATIONAL: Roles, Responsibilities and Authorities

TECHNOLOGICAL: Systems and Technologies

Routine	Performance	Risk
Continuous Check of Operational Discipline	Continuous Check of the Tailings & Dam Geotechnical Performance	Failure Modes and Critical Controls Mapping

[1] TDMS stands for Tailings and Dam Management System.

Understanding the TDMS[1]

POL-0037 establishes guidelines and commitments

Policy for Dam Safety and Geotechnical Mining Structures VALE

POL-0037-G | Rev.: 00-08/10/2020 | DCA 108/2020 | PUBLIC

Guidelines:

Given the existing Safety Management context for these critical assets and Vale's goals, the following directives were defined:

- Design and operate tailings storage facilities, water reservoirs and sediment dams, mine waste storage facilities, amongst other earth structures such as open pits, stacks and underground works, such that potential failures are prevented, monitored and mitigated, and that risks be always reported to the company's senior leadership. Vale's objective is for these assets to count with critical control actions in place so that risks are prevented and mitigated.
- Keep the facilities and structures physically stable throughout all the critical earth structure's life cycle, starting at its construction and during its operation, decommissioning, closure and post-closure.
- Implement the Safety Management System so that dams, earth structures and other mine waste storage facilities are built and/or raised following a detailed engineering design, under the supervision and with the acknowledgement of the Engineer of Record – EoR – and that these structures are operated following the mining dams' operation, maintenance and surveillance manuals, also called the OMS Manual.
- Handle and/or dispose of tailings solid particles as well as the process or impounded water only within the tailings storage or mine waste storage facility's designated areas, minimizing the formation of supernatant water. Proceeding with these actions outside the designated areas requires prior and clear approval from the Business Executive Board and the Safety and Operational Excellence Executive Board, as well as, where applicable, from public administration authorities.
- Fulfill the objectives of the Safety Management Systems for tailings storage facilities and geotechnical mining structures that aim to protect life, the communities, the integrity of infrastructure and processes, the availability and quality of water, and, generally, the environment protection, in order to ensure the inspection and monitoring of water reservoirs, tailings storage facilities and sediment dams in addition to open pits, stackings and underground mines, not only respecting the Company's internal procedures, but chiefly the applicable standards. Therefore, the assignation and contracting of engineering services, external review and consultancy services must prioritize quality, ethics and not the cost of such services.
- Maintain a Safety Management System that allows for an effective level of governance in routine activities and with a level of strict compliance regarding the critical assets' performance in agreement with the national and international technical standards hereby referenced; thus, this System will keep adequate and active communication, dialogue with society and engaging the surrounding communities in agreement with the AA 1000 Stakeholders Engagement Standard-2015, the IFC Stakeholder Engagement Handbook or following the industry's best practice standards similar to the aforementioned standards.
- Ensure that all components of the Safety Management System for dams and mine waste storage facilities are designed with continuous improvement elements, using and applying the best available technology and best practices according to international institutions (MAC and ICMM) and, at the same time, in the technical realm, the best practices of the Institutions (CDA, ANCOLD, ICOLD and LOP).
- Design and operate all Vale's earth structures with the adequate licenses, following the pertinent local legislation and engaging the communities.
- Maintain and disclose to the interested parties a preparedness and contingency plan for response to emergencies regarding the critical earth structures and geotechnical assets based on the best practices and best available expertise and in compliance with legislation in effect. The plans must be periodically tested through simulations and must be kept updated taking into account the communities and affected people.

Policy for Dam Safety and Geotechnical Mining Structures VALE

POL-0037-G | Rev.: 00-08/10/2020 | DCA 108/2020 | PUBLIC

Commitment to the Safe Management of Tailings and Water Dams and Geotechnical Mining Structures:

Vale's operations are mainly guided by the following commitments:

- Implementing diverse controls aimed at managing the water in tailings storage facilities, from the design phase to the operation of the project. This must be achieved using hydraulic works to convey surface water runoff out of the impoundment and avoiding the interference of tailings or sediments at the spillways' inverts.
- Tailings disposal must consider guidelines or operational parameters in the planning sequence that cause or favour displacing water ponding away from the tailings storage facility dam's upstream slope in agreement with the Detailed Engineering Design, Design Criteria, Normative Standard, Technical Specification or OMS Manual.
- Reclaim, in the most efficient way, the water used in the production processes with the use of thickening circuits to reduce the volume of water that would be transported together or separately with the tailings; thus, prioritizing water recirculation at the process plant itself before reaching the storage facility or similar installation, so that water flow and ponding is avoided wherever the Detailed Engineering Design or OMS Manual does not specify it.
- Follow the safety conditions and best practices hereby mentioned (ICOLD, CDA and/or ANCOLD) exclusive for water reservoirs' embankments and hydropower dams, whether these are planned either for mineral processing or for environmental control or for power generation.
- Improve, via the governance hereby established for dam safety and geotechnical mining structures as well as the independence and technical rigour of the Management Systems that support the quality of critical assets, a compulsory follow up to be carried out on a permanent and documented basis by the Engineer of Record (EoR) for the critical asset's every single stage of the life cycle, i.e. from design to closure.
- Develop staff members in a professional manner, so that they achieve the appropriate training for each key function in the activities for geotechnical, hydrotechnical, dewatering and mining processes, based on efficient communication and specific training, in order to ensure that employees with relevant experience understand their responsibilities and, so, ensure direct, transparent communication with an appropriate sense of urgency at all levels of the organizational structure. Therefore, personnel training and continuing education will be carried out to keep the level of knowledge up to date regarding the earth structures as well as the improvement of the practice linked to the most rigorous engineering techniques.
- Implement, at all stages of the asset's life cycle, geotechnical risk controls and activities tied with identified geotechnical monitoring based on the studied failure modes and their associated consequences. In the event of changes related to performance caused by internal or exogenous factors, a new engineering and risk assessment should take place as soon as possible. Risks must be periodically assessed in a specific way in order to measure the effectiveness of controls for each critical earth structure. These must count with an opinion in writing from the specialist in charge designated by Vale and the EoR in order to certify that such earth structures are operated in a disciplined manner, maintained and under surveillance, with updated and accessible information, and that the historical registry of the earth structure is properly stored and available in accordance with international quality standards.
- Implement the Safety Management System for tailings dams and mine waste storage facilities, amongst similar systems, for the critical control of geotechnical risks. The scope of this System is applicable to every single stage of the asset's life cycle, comprising the various design phases: from construction to operations, to closure and post-closure.

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[1] TDMS stands for Tailings and Dam Management System.

Understanding the TDMS[1]

Global standards operational procedures

POL-0037: Policy for Dam Safety and Geotechnical and Mining Structures

PNR-000096: Vale Tailings and Dams Management System (TDMS)

PNR-000118: TDMS Implementation Guidelines

Performance

- PNR-000074: OMS Manual
- PNR-000075: Technical Quality Assurance (QA) and Quality Control (QC)
- PNR-000076: As-built Reports
- PNR-000097: Tailings and Water Management Facilities Guidelines for Performance Monitoring
- PNR-000102: Closure Planning for Tailings Storage Facilities
- PNR-000106: Terms of Reference for Engineer of Record
- PNR-000107: Terms of Reference for Independent Technical Review Boards
- PNR-000108: Standard Practice for Dam and TSF Safety Reviews
- PNR-000109: Safety Inspections of Dams and Tailings Storage Facilities
- PNR-000110: Standards for Site Wide Water Management Plans for Dams and TSFs
- PNR-000111: Standard Guidelines for the Design of Hydraulic Structures for Dams and TSFs

Risk

- PNR-000073: Consequence Classification for Dams and Tailings Storage Facilities
- PNR-000100: HIRA for Geotechnical Structures
- PNR-000129: Guidelines for Dam Breach Analysis
- PNR-000071: Dewatering Technology Selection
- PGS-004086: Guidelines for Emergency Response for Mining Dams
- PGS-004255: Management of Change for Tailings Storage Facilities

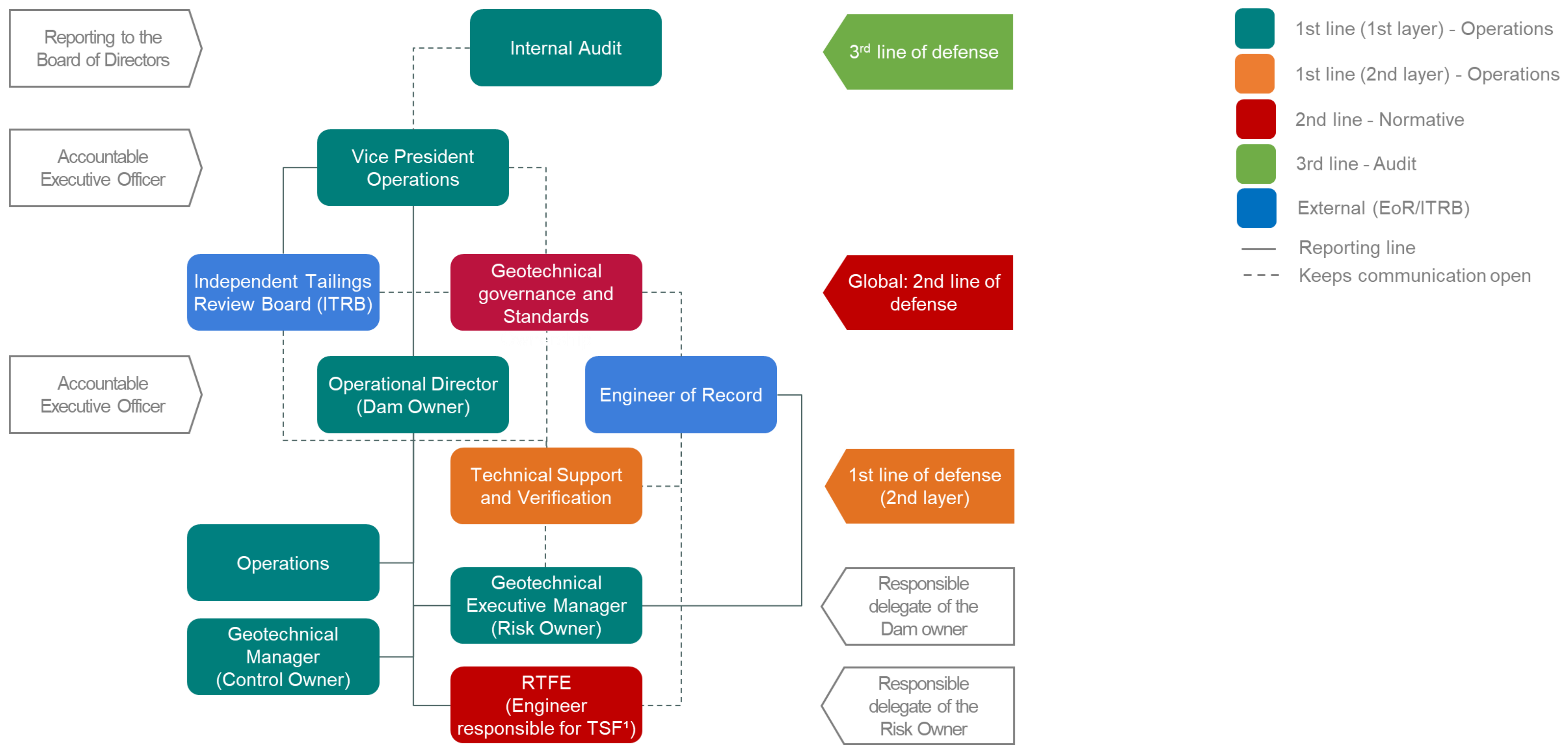
Routines

- PNR-000030: Basic Geotechnical Guidelines (BGG)
- PGS-004524: Roles and Responsibilities TDMS BMNA
- PGS-004525: Papéis e Responsabilidades TDMS BMSA
- PGS-004526: Roles and Responsibilities TMDS PTVI
- PGS-004527: Roles and Responsibilities TDMS Coal
- PGS-004528: Roles and Responsibilities TMDS Energy Canada
- PGS-004529: Roles and Responsibilities TMDS Energy Indonesia

[1] TDMS stands for Tailings and Dam Management System.

Understanding the TDMS[1]

Organizational structure and the role of senior leadership



[1] TDMS stands for Tailings and Dam Management System. [1] TSF stands for Tailings Storage Facility.

Understanding the TDMS[1]

Monthly TSF performance assessed by the EoR[2]

- All TSFs with extreme, very high, and high consequences need to have a designated EoR
- The EoR is responsible for periodic TSF safety inspections
- *Monthly TSF Performance Assessment is publicly disclosed at Vale ESG portal since 1Q21*

Structure	Municipality	Mine	Monthly Performance
Barragem 5 - Mutuca	Nova Lima	Mutuca	
Barragem 7 (Ferrous)	Jeceaba	Viga	
Barragem 7B	Nova Lima	Águas Claras	
Barragem Alcindo Vieira	Itabira	Cauê	
Barragem Azul	Parauapebas	Manganês Azul	
Barragem B3	São Gonçalo do Rio Abaixo	Brucutu	
Barragem B3/B4	Nova Lima	Mar Azul	

Geotechnical Performance Condition Classification Table for TSFs

- Satisfactory without restriction
- Satisfactory with restriction, without compromising safety
- Satisfactory with restraint, possibly compromising safety
- Unsatisfactory
- Not applicable / No data

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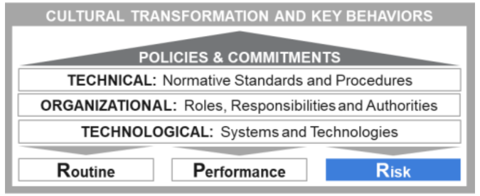
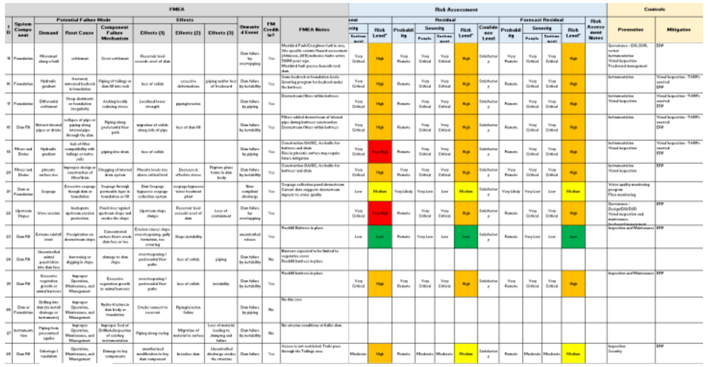
[1] TDMS stands for Tailings and Dam Management System. [2] EoR stands for Engineer of Record.

Understanding the TDMS[1]

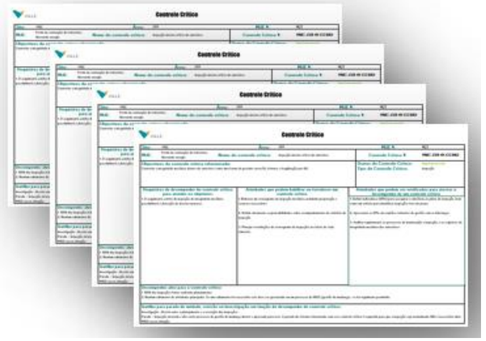
HIRA[2] deliverables



1 FMEA[3], MUE[4], Risk Assessment, Controls



2 Critical Controle One Pagers



3 Risk Matrix

Severity	Very Remote	Remote	Unlikely	Likely	Very Likely	Total
Very Critical	12	18	17	1	0	49
Critical	5	13	6	1	0	26
Severe	3	4	1	1	0	9
Moderate	1	2	2	1	0	5
Low	1	2	2	0	0	5
Very Low	1	0	0	0	0	1
Total	23	40	28	4	0	95

4 Action List

Action No.	Description	Reason/Origin	Timeline
1	**Conduct Hydrogeology Study:** Determine the cause of the high heads in the left abutment. The local hydrogeology is not well understood.	Elevated Risk due to adverse conditions	30-Aug-22
2	**Interim Risk Controls:** Implement the following interim risk controls until the hydrogeology study can be completed. A. Implement inverted filter downstream of the toe of the dam. B. Install pressure relief wells in the left abutment to reduce artesian heads. C. Beach tailings U/S of the dam to reduce the gradients from the reservoir. D. Reduce the normal operating water level in the reservoir. E. Update HIRA, critical controls, TARPs etc. as necessary.	Interim Risk Reduction	31-Dec-21
3	**Conduct the following Additional Slope Stability Analyses:** A. Effective stress analysis with cohesion intercept equal to 0, i.e. c' = 0 kPa. B. Undrained analysis using pseudostatic analysis C. Deformation study. D. Evaluate and update the critical sections (CC2), instrumentation (OMS) and TARPs (OMS) as appropriate.	Improve risk understanding	31-Dec-22
4	**Calculate Earthquake Induced Settlement of Colluvium Layer**	Improve risk understanding	31-Dec-21
5	**Install Additional Information:** Install vibrating wire piezometers in existing standpipe piezometers to obtain real-time piezometric data for dam.	Risk Reduction	30-Nov-22
6	**Downstream Slope Surface Drainage:** Evaluate the erosion damage that could occur during the 1:1,000 and 1:10,000 yr floods. Dedesign the drainage system if damage is unacceptable.	Improve risk understanding	30-Jun-21
7	**Active/Inactive Fault Verification:** Determine if the fault in the bottom of the valley where the dam is located is active or not.	Improve risk understanding	31-Dec-21

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[1] TDMS stands for Tailings and Dam Management System. [2] HIRA stands for Hazard Identification and Risk Assessment. [2] FMEA stands for Failure Mode and Effect Analysis. [4] MUA stands for Material Unwanted Event.

Good performance of geotechnical assets during the heavy rains in Minas Gerais[1]

Challenge

- +750mm rains recorded in January
  - 650mm in just 12 days
  - Around 300mm in 2 days

Performance

No significant issue identified in any given Tailings Facility

- The rainy preparation plans, developed and implemented in advance, worked very well as an important tool to prevent and minimize risks associated to the heavy rains
- Good level of preparedness from ops and corporate teams, reflecting tailings management improvements
- Continuous improvement: learnings and points of improvement to be incorporated in the next plans

Points of attention related to erosion in access, small slope failures, natural slopes, backup dams with water retention

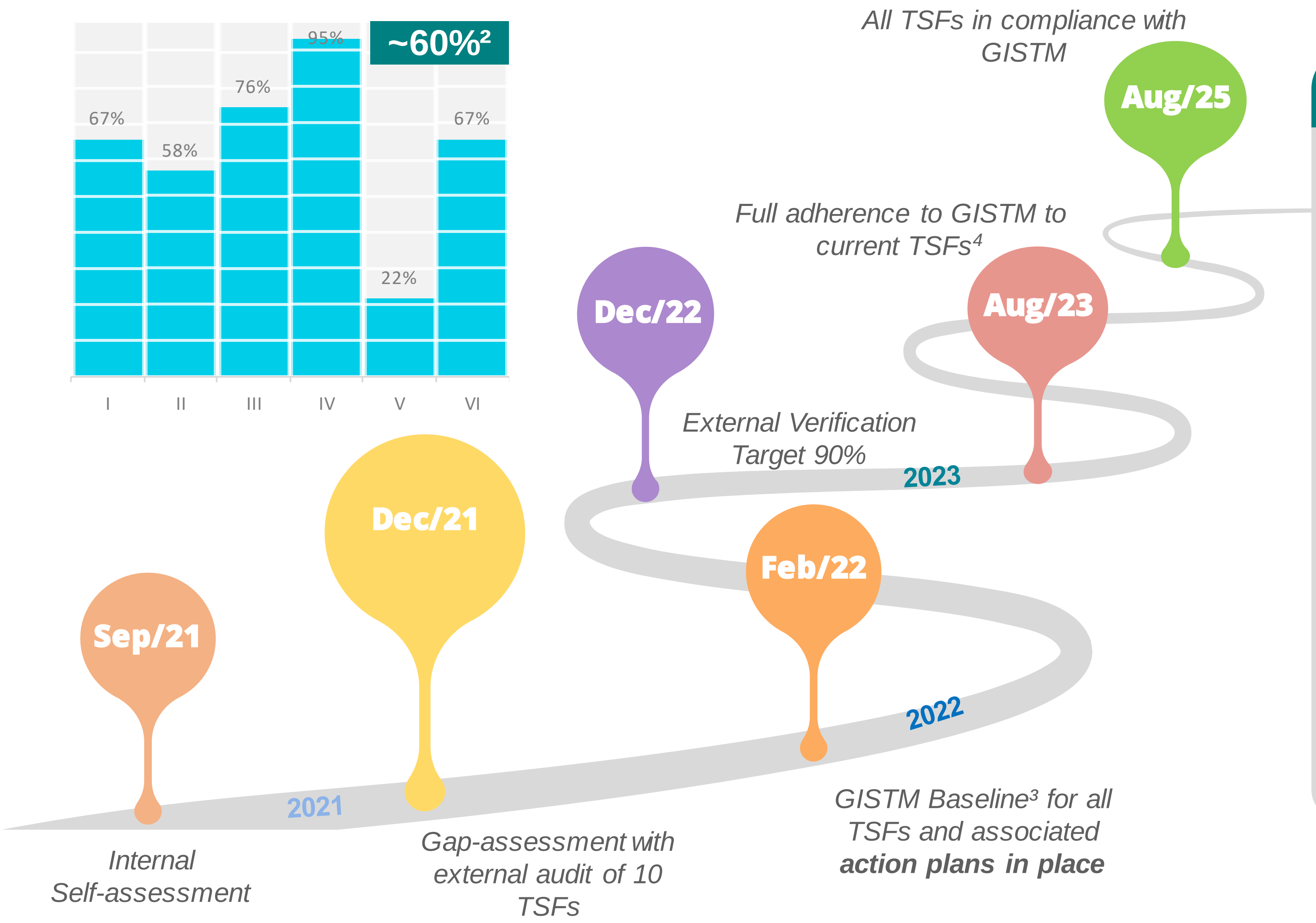
Trigger response plans and alerts system

Geotechnical Monitoring Center

- Real time piezometers monitoring
- Video analytics with artificial intelligence
- Geophones to measure TSFs response to seismic
- Radars ensure fast response and precision
- Satellite, drone imagery and sound alarms

[1] In January 2022.

GISTM[1] Journey and the commitment to compliance

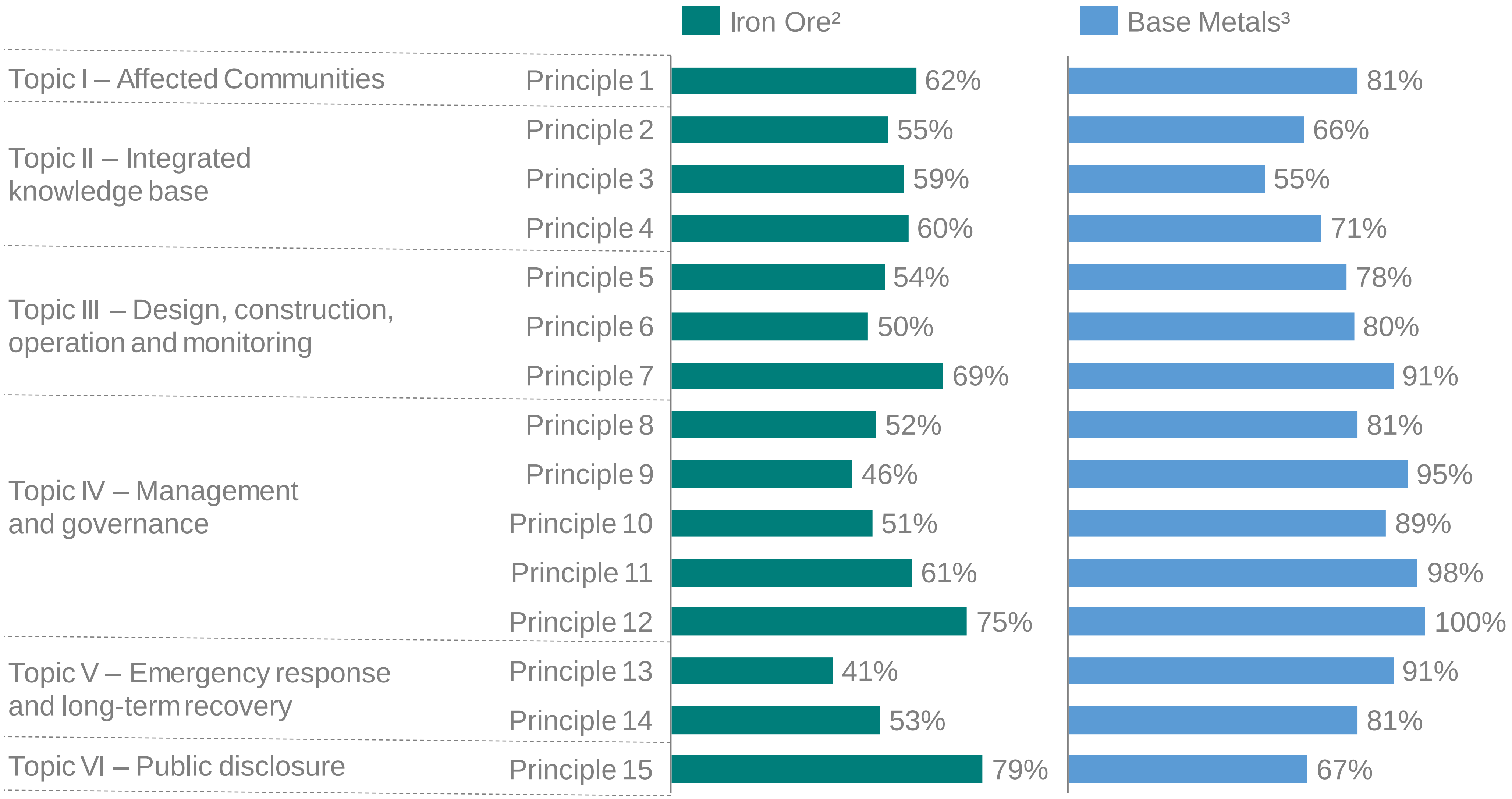


Common gaps and focus areas

- **Climate change** incorporated in the facility design
- **Seismic studies**
- **Social community engagement** and communication
- **AE** engagement
- **Design Basis Report**
- **Succession plan** for key role holders in the TSF safety matter
- Establishment of mechanism to **recognize, reward, and protect** employees who identify and report opportunities for improving TSF management
- **Closure plan**

[1] GISTM stands for Global Industry Standard on Tailings Management. [2] On average, considering the 41-iron ore TSFs results (lower results). [3] GISTM public disclosure in March/2022. [4] Tailings Storage Facility with criteria agreed by the International Council on Mining and Metals' Tailings Advisory Group in response to the Church of England information request, which may differ from Brazilian National Mining Agency criteria.

Self-assessment[1] to drive actions for full adherence to GISTM



[1] Dated December 2021. [2] Encompassing 41 TSFs. [3] Encompassing 17 TSFs.

Concrete steps towards GISTM implementation

Non-exhaustive examples

Affected communities[1]

- Grievance Global Standard released on October 30, 2020
- Human Rights Global Policy and Global Standard Procedure for engagement with Indigenous People and Traditional Communities
- Brazilian legislation requires FPIC
- All process that requires PAEBM review has an Indigenous and Quilombola component

Integrated knowledge base

- The PAEBM[1] registers the project-affected people (socio-economic and environmental)
- The most at-risk groups are also identified
- Probabilistic seismicity hazards and climate change assessments being performed
- TSF break studies under review, following best practices

Design, construction, operation & monitoring

- Consequence of failure classification being reviewed in accordance with GISTM
- Addressing brittle failure modes with conservative design criteria (implementation of backup dams for the critical upstream TSF)
- Design Basis Report prepared by EoR's
- HIRA to assess risks and critical controls, geotechnical monitoring centers with TARPS[3]

Management and governance

- Policies, systems and accountabilities completely reviewed
- ITRB and EoR appointed
- Multi levels of review implemented
- Geotechnical knowledge portal implemented
- Organizational culture with VPS enforcement
- Ombudsman channel with whistleblower protection

Emergency response and long-term recovery

- PAEBM[1] publicly disclosed
- Engagement with public sector agencies in post-failure response strategies
- Brumadinho reparation enabling participation of the affected people in the restoration and recovery works and ongoing monitoring activities

Public disclosure and access to information

- GISTM implementation commitment disclosed at the ESG Portal
- ESG Portal under frequent review to accommodate all the TSF and information requested
- Monthly EoR reports publicly disclosed

[1] Emergency Action Plans for Mining Dams.

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Community engagement in preparation and response for emergency situations

Emergency Action Plans for Mining Dams (PAEBM)[1] publicly disclosed[2] and ***fully aligned with principle 13 of GISTM***

- **Emergency response training** with communities close to TSFs
- Partnership with the local Civil Defense Agency to **ensure appropriate conditions for simulations** and emergency protocols activations
- **Alarm sirens** placed in strategic areas to trigger emergency protocols
- **Teams and communication channels dedicated** to the dialogue with communities
- In case of mandatory removal, **full support to reestablish living and working conditions** to those affected

[1] Technical document required by the National Policy for Dam Safety – PNSB. [2] Available at: http://www.vale.com/brasil/PT/aboutvale/servicos-para-comunidade/minas-gerais/Paginas/Projetos.aspx

4

Upstream TSF De-characterization

Eliminating upstream TSFs[1] in Brazil

Upstream TSF De-characterization Program

- 7 eliminated since 2019
- 2 completed in 2021
- 23 remaining

Completion by 2035

[1] TSF stands for Tailing Storage Facility.

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Precautionary approach to address brittle failure modes

Construction of **backup dams (containment dams)** downstream critical TSFs and **removal of population** at risk

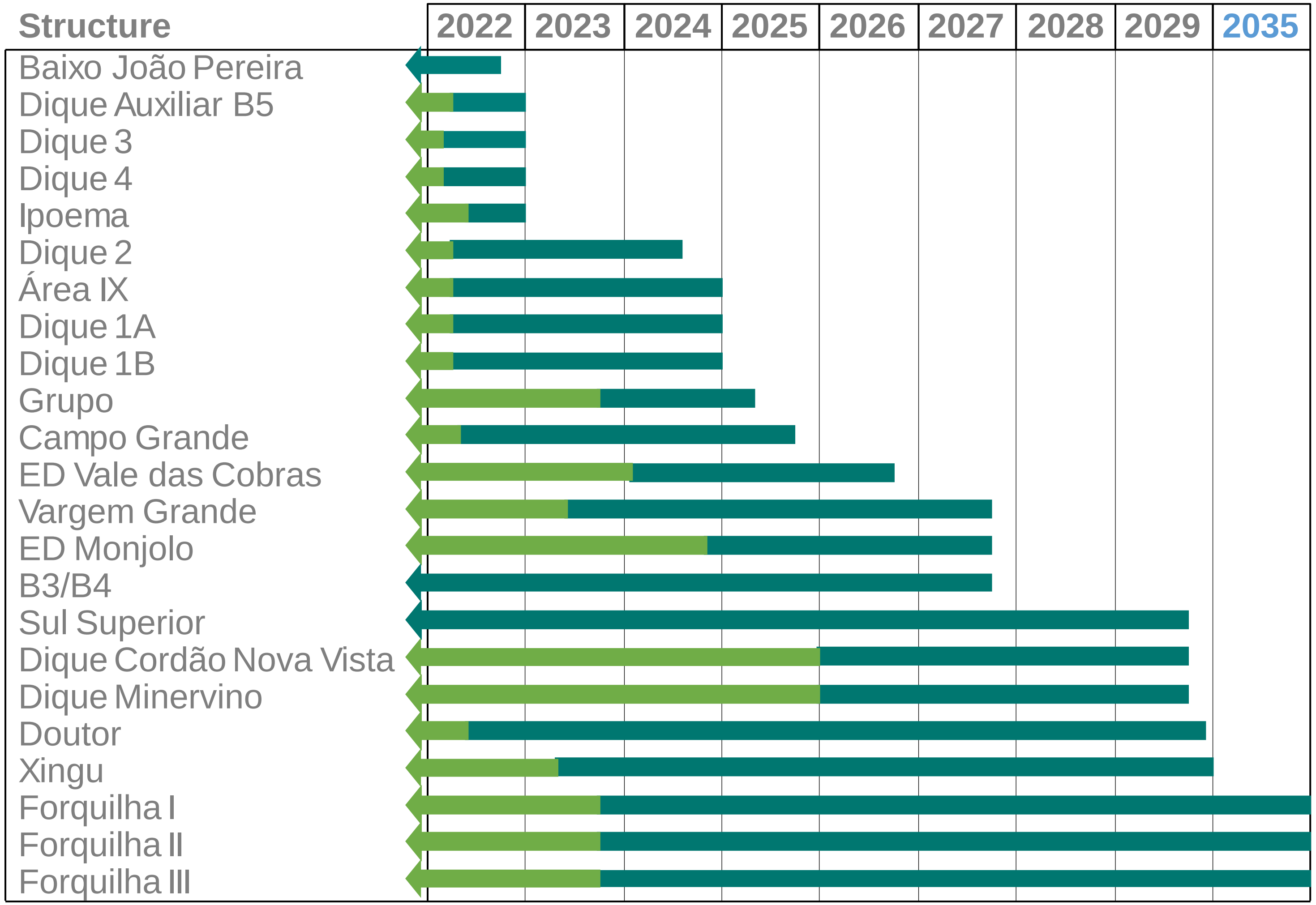
ECJ Fábrica
95m height | 330m length

Use of **remotely operated equipment** to remove tailings in critical TSFs

ECJ B3/B4
33m height | 221m length

ECJ Sul Superior
36m height | 330m length

Updated and transparent program's timeline



De-characterization works in progress:

- Baixo João Pereira, B3/B4, Dique 3, Dique 4, Sul Superior

Engineering in progress:

Conceptual engineering:

- Dique 1A, Dique 1B, ED Monjolo, ED Vale das Cobras, Forquilha I, Forquilha II, Forquilha III, Ipoema

Basic engineering:

- Área IX, Grupo

Detailed engineering:

- Campo Grande, Dique 2, Dique Auxiliar B5, Dique Cordão Nova Vista, Dique Minervino, Doutor, Vargem Grande, Xingu

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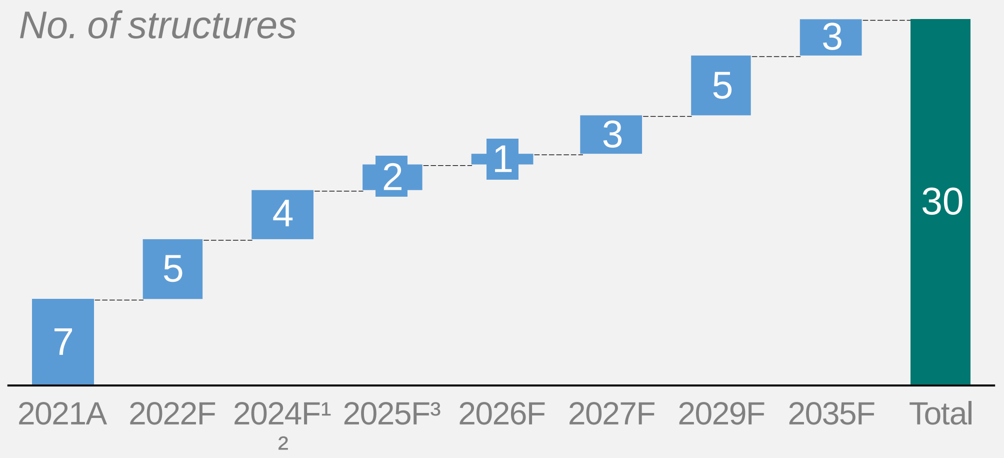
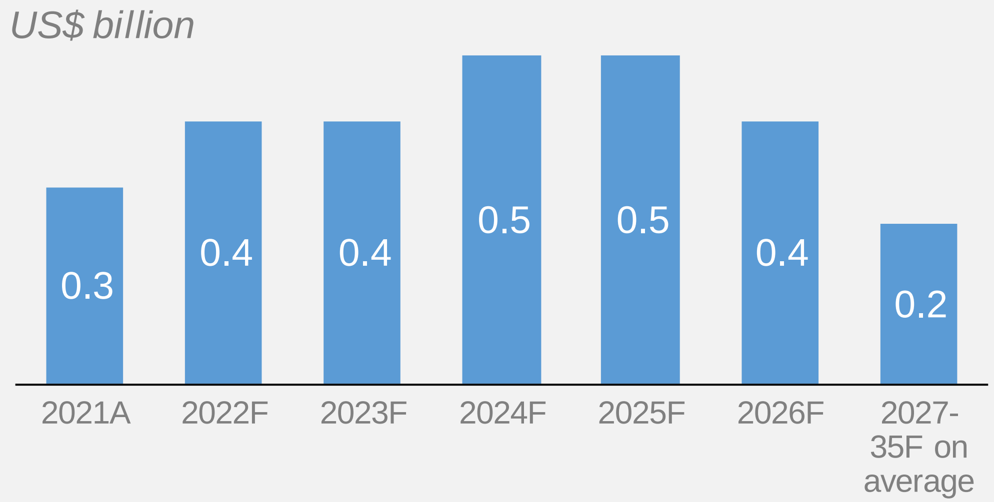
Revised provisions according to project pipeline

Elimination of upstream TSFs per year



Program's cash outflow[1]



[1] Estimated cash outflow for 2022-2035, given BRL-USD exchange rate at 5.5805. Values presented without adjustment to present value. The 2027-35 average cash outflow is of US$ 240 million.

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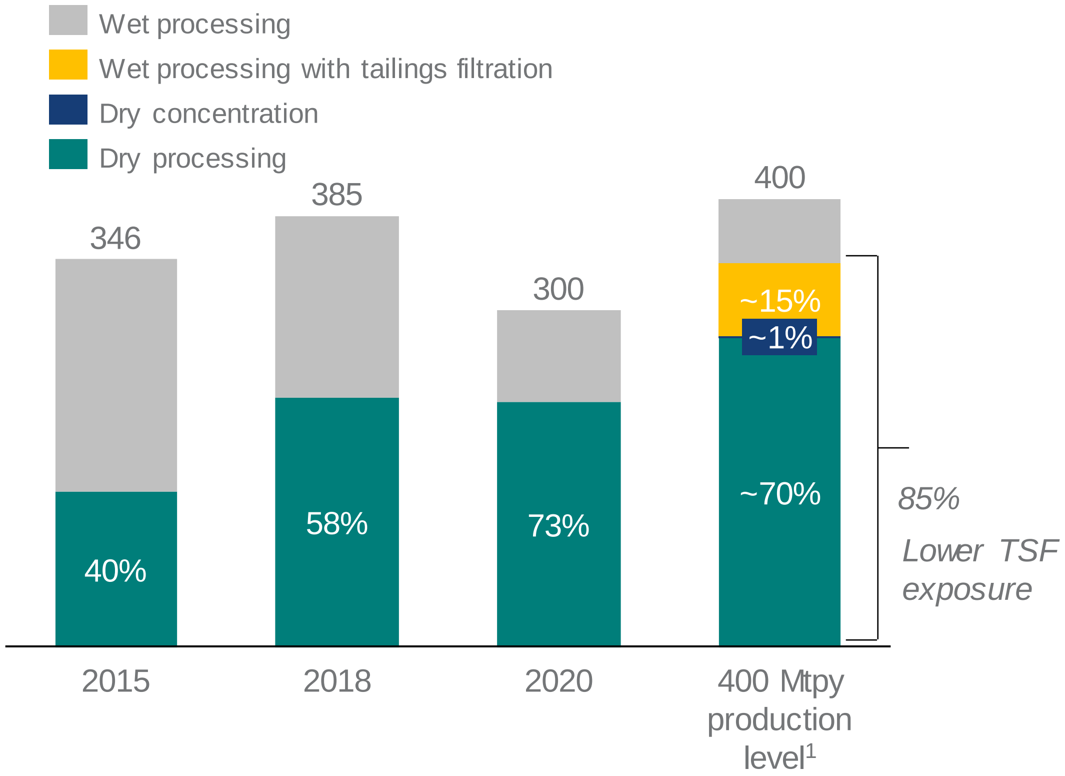
5

Moving from wet to dry tailings

New projects to **reduce the reliance** on TSFs

Iron ore production by method

Mt



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[1] Considers a time horizon after the implementation of the highlighted initiatives. The production method share over the years will depend on assets availability and production plan

Co-products: recycling dry tailings to sustainably increase production capacity

- Less area required to dispose dry tailings[1]
- Co-products operations in place at Brucutu and plans for Viga in 2022[2]
- Sand as a raw material for industry (around 1.0 Mt sales[3] committed to 2022)
- Multiple uses under development (e.g. bricks, green tires, quartz)
- Circular economy: shared value with communities[4]

[1] Tailings from current production. [2] Operations in Itabira and Vargem Grande are under analysis for the future. [3] Sales and donations. [4] As an example, the creation of local industries and jobs creation.

6 Closing remarks

On track for eliminating exposure to TSF failure risk

Upstream TSF De-characterization Program in progress

Optimized governance supporting risk management

Best practices to improve tailings and dam performance

Processing solutions to replace TSFs

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