SAIMM Tailings Conference Update: SANS 10286

MINE RESIDUE STANDARD

4 March 2026

Re-Cap
One Key Topic

Re-Cap

Drafting Team and Timelines

Why Update SANS10286?

Alignment of SANS 10286 with GISTM

Tailings Sub-committee – drafting team

South African Institute of Civil Engineering
Geotechnical Division
Tailings Sub-committee

- Mining Houses (x2)
- Consultants/Specialists – civil, geotechnical, environmental/social (x11)
- Operating Contractors (x1)
- Universities (x2)
- Minerals Council (x2)
- SAIMM/SAICE and SANS (x3 part-time)
- Other Parties invited but not involved
  - DMRE, DWS, DEA

SANS 10286 - Update on Timing

- Started in February 2021
- First Draft by end March 2022
- SANS internal approval process = June 2025
- Issued to Stakeholders for review / public comment = August 2025 (30 days)
- Comments incorporated = December 2025
- SANS said it will issue for 2nd round of public comments = March 2026
- Final date for publication – depends on stakeholder review comments and SANS (26 June 2026 all being well)

Why Update SANS?

- SANS 10286 has measured up well to international standards for TSFs since 1998 – so why update it?
- Certain aspects have been surpassed by wider and more rigorous requirements.
- Major Failures have occurred (1994 & 2022 - RSA, 2014 - Canada, 2015 & 2019 - Brazil),
  - Increasing frequency and consequences (and continue to happen)
  - Larger and more TSFs being built
  - Occurred in developed mining jurisdictions, despite good guidance/legislation in place
  - GISTM born
  - ICMM commitment
- Mining Industry Legacy – must improve (pressure from Investors & Insurers)


SkySat Imagery of the Jagersfontein / Charlesville Failure on 2022/09/11 at 6am
Imagery acquired on 2022/09/12 at 8am
Enlargement A
Enlargement B
Enlargement C
Enlargement D
N
Jagersfontein TSF (Free State, RSA)
– Sept 2022
University of the Witwatersrand
School of Civil and Environmental Engineering
prepared by
Dr. Luis Alberto Torres-Cruz
Mr. Christopher O'Donovan
Imagery provided by Planet Labs PBC
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Alignment of SANS 10286 with GISTM

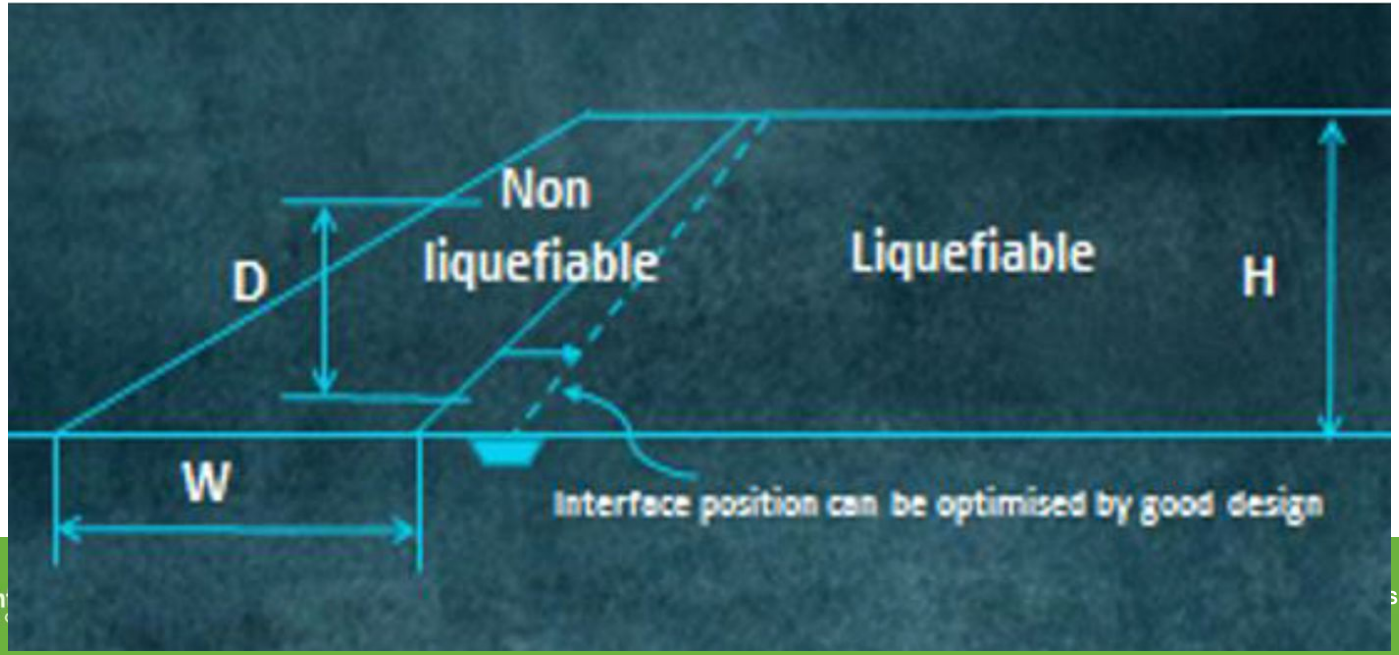
- Why align with GISTM?
- South Africa is unique with its upstream TSF – SANS 10286 was adequate?
  - Can we accept a lower standard?
  - Do we want TSF failures in RSA?
  - Won't it cost the mining industry more, and affect jobs?
  - If a TSF fails, a judge will ask why we were not using the best available guidance/standards available to us?

Alignment of SANS 10286 with GISTM

- SANS Structure (ISO)
  - Aims – to be retained
  - Principles – adopt GISTM plus relevant SANS text
  - Requirements – adopt GISTM plus relevant SANS text
- GISTM – woven into SANS
  - 6 Topics, 15 Principles and 77 Requirements
- Legislation was not included/updated – TSF design and operation must comply with the regulations (and any changes to them)
- Guidelines (Appendices) – not retained. Reference is made to key international ones
- New terms have been added to match GISTM glossary

Key Topic – Stability of Upstream TSFs

- Stability Analyses
  - No FoS is given in GISTM, however SANS now includes recommended industry target minimums similar to ANCOLD & ICOLD
  - Drained, undrained {peak and residual strengths}, & seismic analyses required
  - 10 Rules for Upstream TSFs to be checked and evaluated



Saaiplaas TSF – April 1993

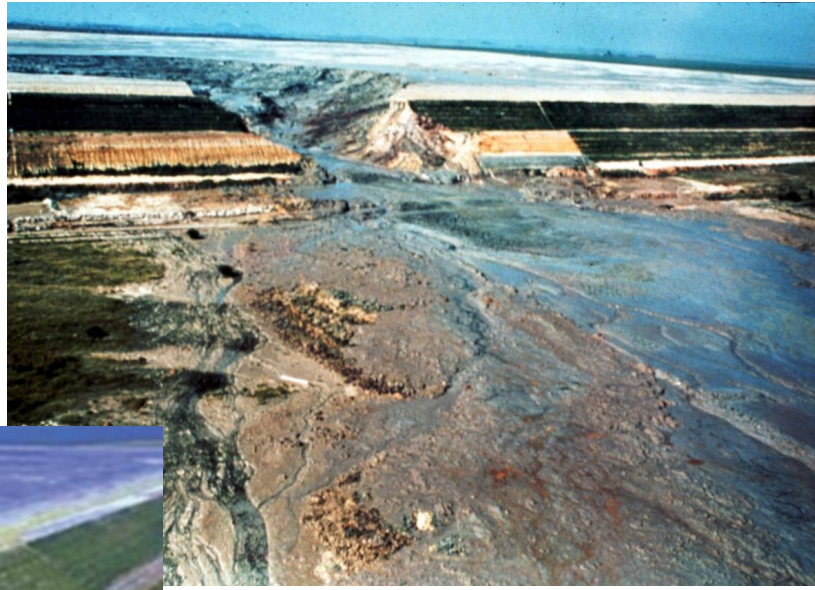
High RoR – 4m/yr
Heavy rain (small pond)

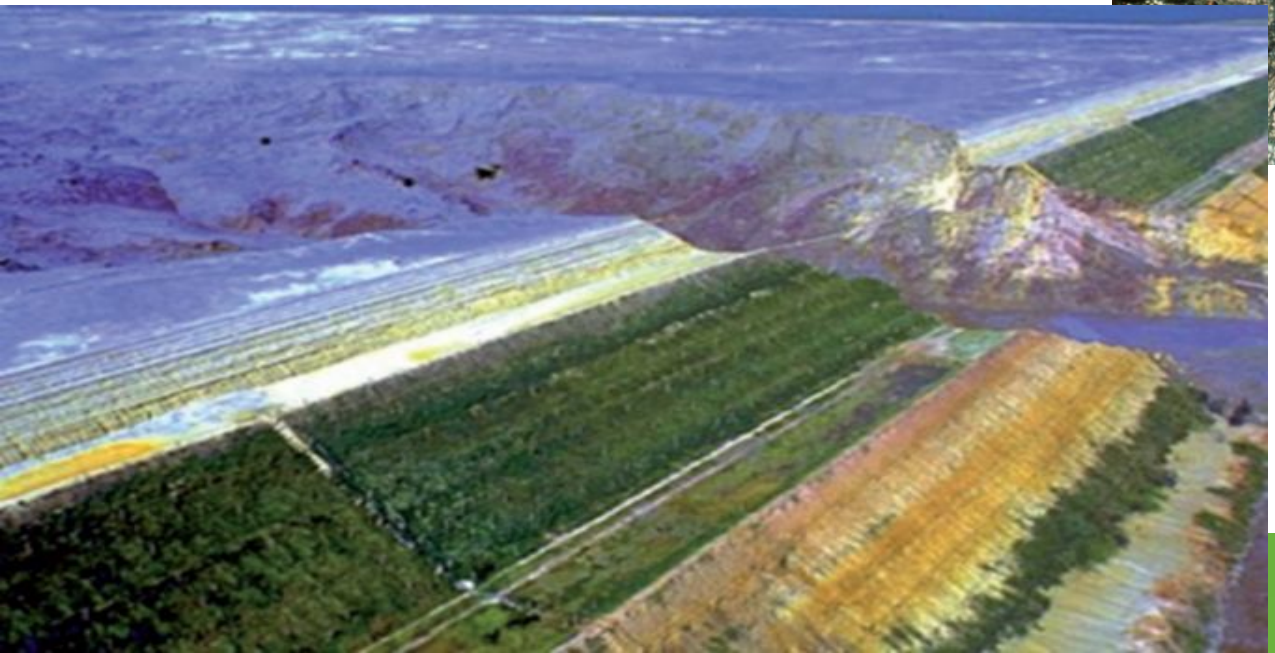
Large sloughing failures (x3)
(static liquefaction)

Merriespruit TSF – April 1994

Liquefaction - Extensive water and mud flow

Failure triggered first version of SANS 10286
- 17 people died (7-9pm)
- Multiple houses damaged
- Some environmental damage





Key Topic – Stability of U/S TSFs

DESIGN, CONSTRUCTION, OPERATION AND MONITORING OF THE TAILINGS FACILITY

TOPIC III

PRINCIPLE 4 **DEVELOP PLANS AND DESIGN CRITERIA FOR THE *TAILINGS FACILITY* TO MINIMISE RISK FOR ALL PHASES OF ITS *LIFECYCLE*, INCLUDING CLOSURE AND POST-CLOSURE.**

Requirement 4.6 Identify and address brittle failure modes with conservative design criteria, independent of trigger mechanisms, to minimise their impact on the performance of the *tailings facility*.

If contractive tailings/foundation materials exist, the potential for brittle behaviour must be investigated

Key Topic – Stability of U/S TSFs

DESIGN, CONSTRUCTION, OPERATION AND MONITORING OF THE TAILINGS FACILITY

TOPIC III

PRINCIPLE 4 — **DEVELOP PLANS AND DESIGN CRITERIA FOR THE *TAILINGS FACILITY* TO MINIMISE RISK FOR ALL PHASES OF ITS *LIFECYCLE*, INCLUDING CLOSURE AND POST-CLOSURE.**

Requirement 4.7

Existing *tailings facilities* shall conform with the Requirements under Principle 4, except for those aspects where the *Engineer of Record (EOR)*, with review by the *ITRB* or a *senior independent technical reviewer*, determines that the upgrade of an existing *tailings facility* is not viable or cannot be retroactively applied. In this case, the *Accountable Executive* shall approve and document the implementation of measures to reduce both the probability and the consequences of a *tailings facility* failure in order to reduce the risk to a level *as low as reasonably practicable (ALARP)*. The basis and timing for addressing the upgrade of existing *tailings facilities* shall be risk-informed and carried out as soon as reasonably practicable.

Key Topic – Stability - Target FoS

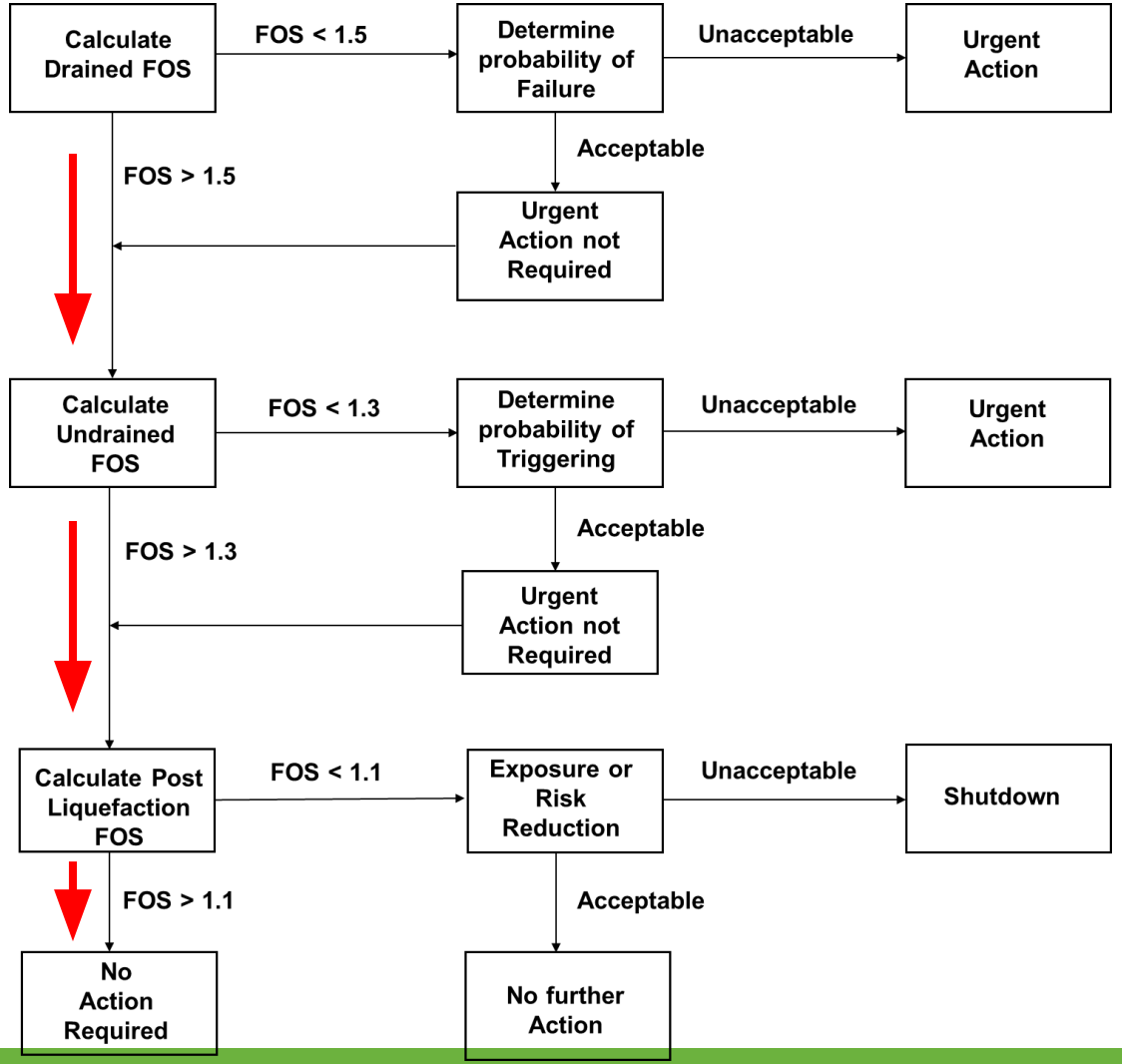
- Risk Management
  - Where target FoS are not achieved – ALARP is allowed – Risk Informed Approach. However, this is not justification for “unsafe” TSFs (new or existing upstream TSFs).
  - The AE and EoR must take accountability for managing this process with ITRB over-sight.
- Failure Modes and Effects or Bow-tie Risk Assessment must be in place
- Critical controls and TARPs to be put in place

Key Topic – Stability - Target FoS

Loading condition	Target FOS
Prior to commencing of deposition for drained and undrained behaviour	1,3
Long term (operational and closure) for drained behaviour	1,5
Long term (excluding triggers) for peak undrained behaviour	1,3 to 1,5
Post seismic or residual shear strength	1,1
Pseudo static	1,1

Stability Check Process Flow

New target FoS

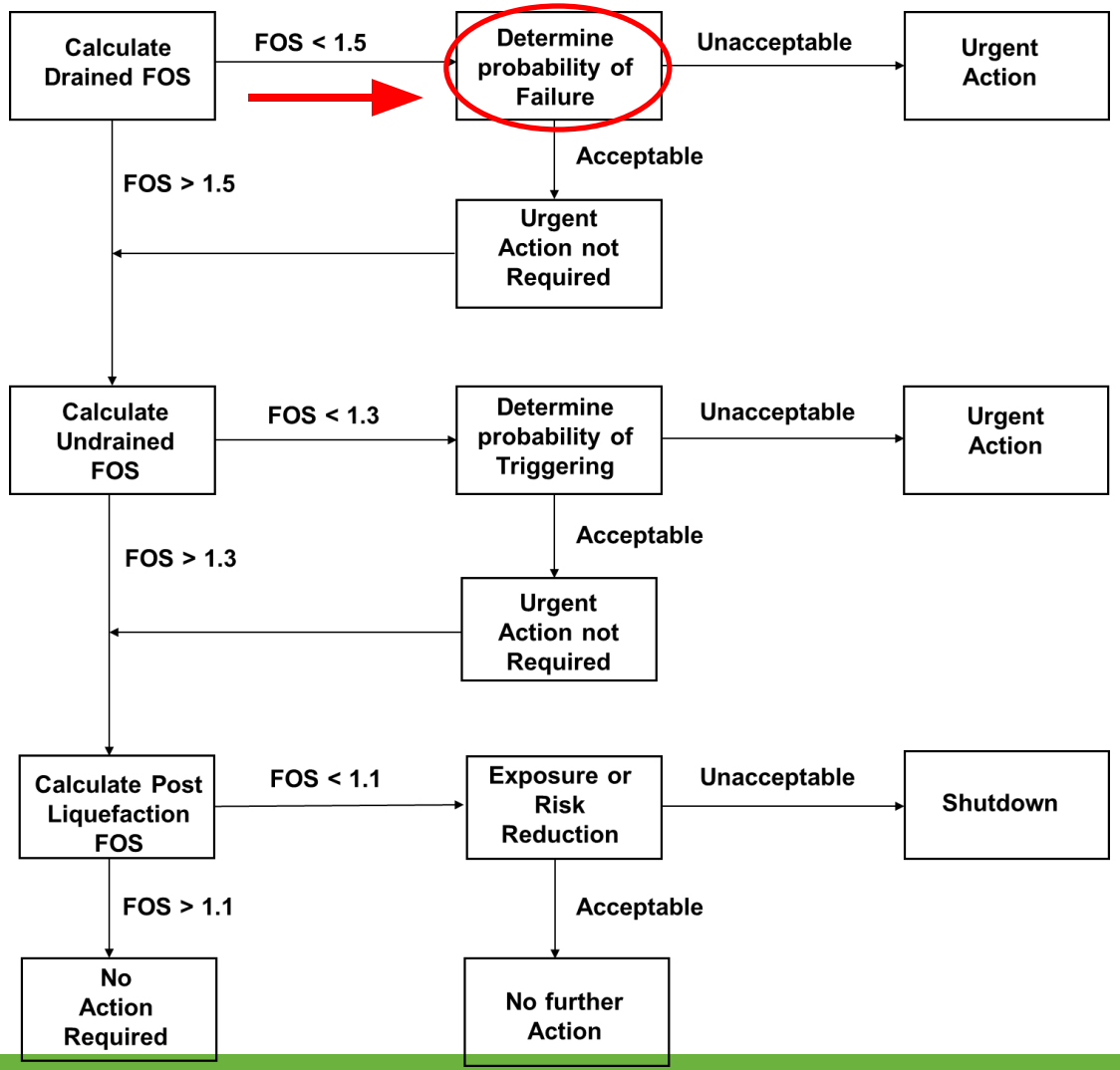


Stability Check Process Flow

New target FoS

Probability of Failure

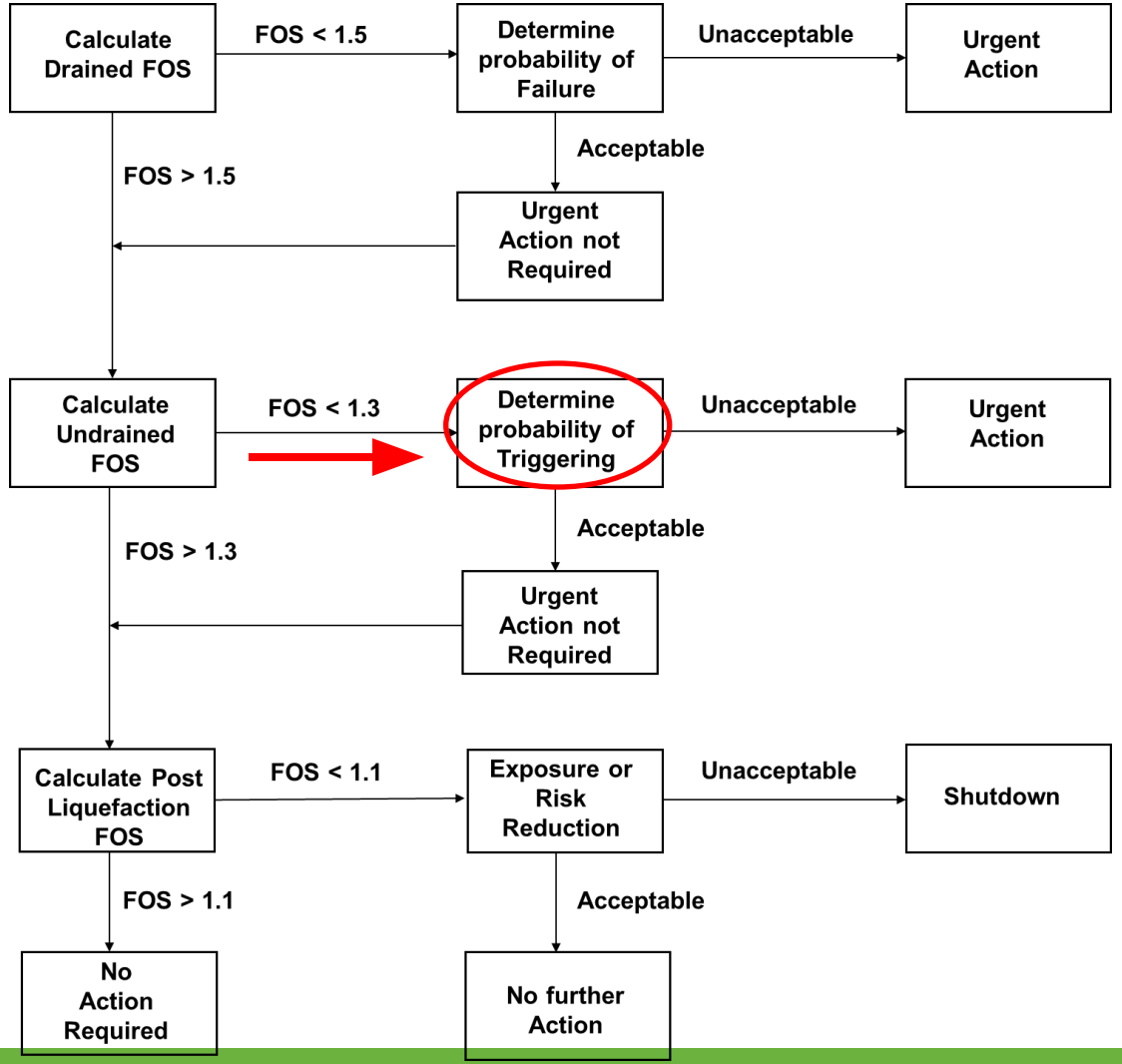
- Steep slopes
- High RoR
- High Phreatic level
- Weak foundation
- Existing toe seepage
- Narrow wall zone
- No under-drains
- Located on Dolomite
- Water stored on TSF
- Layering in wall zone



Stability Check Process Flow

New target FoS

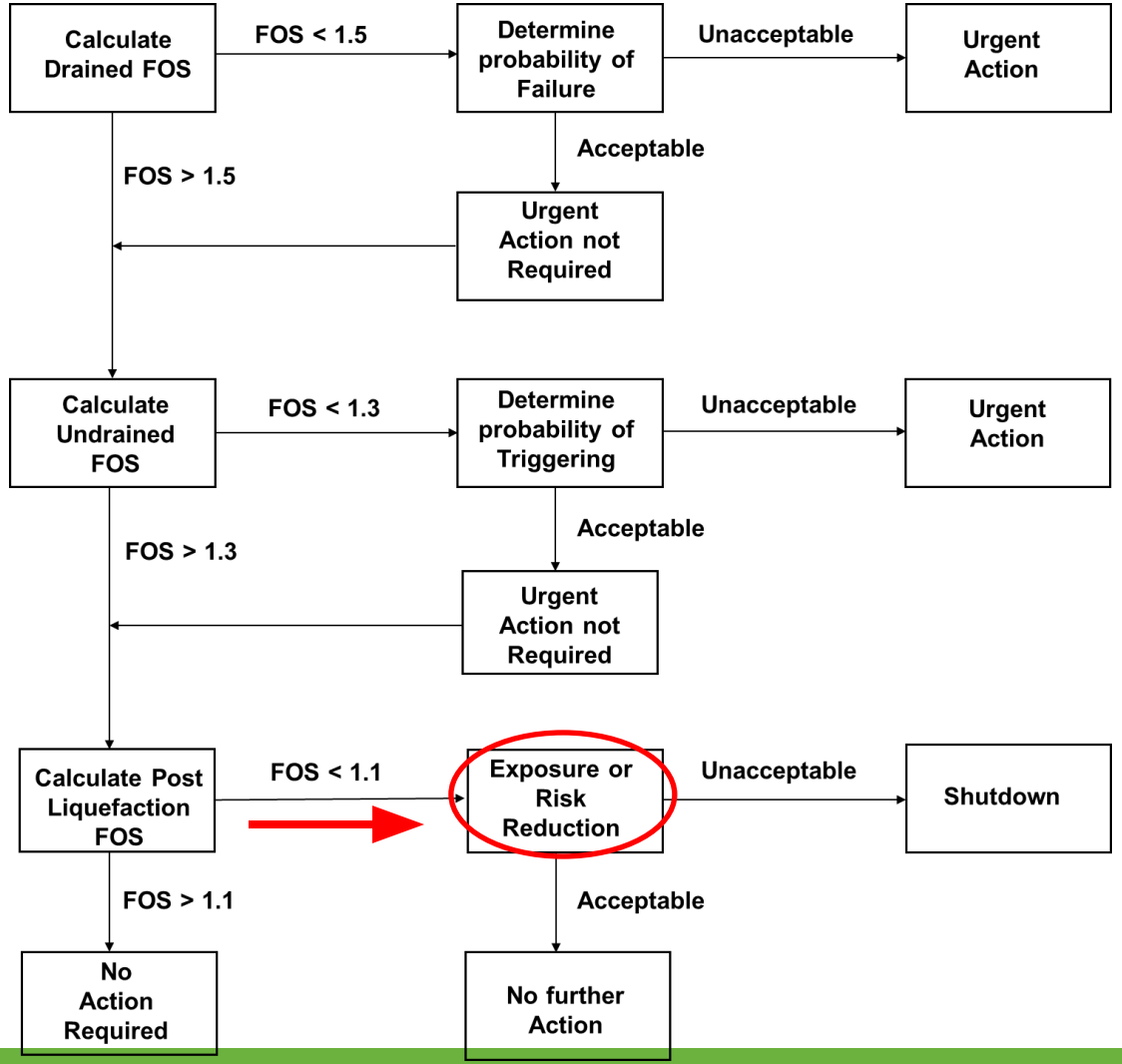
Probability of Triggering
- Seismic event
- Elevated seepage
- Rising phreatic level
- Excess pore pressures
- High RoR
- Sinkhole



Stability Check Process Flow

New target FoS

Exposure/Risk Reduction
- Buttress
- Reduce production or RoR
- Relocate D/S community
- Slumping vs flow failure
- Build new TSF



Way forward

- SANS 10286 – 1998 / 2013 has been superseded by GISTM and needs to align with it.
- Upstream TSFs are allowed – but require more rigorous designs, operation and monitoring
- Mines / Operators – should prepare for updated SANS 10286 - plus local regulations
- Consultants – should design / analyse to achieve compliance or ALARP
- Government / Industry bodies – need to support it, as it is in the best interests of the country (safety and health).
- If the updated SANS Code is “rejected” for any reason, the drafting committee would consider asking SAICE / SAIMM to support them in issuing it as a Profession / Industry best practice document

Vale (Feijao / Brumadihno) - Brazil
Upstream TSF Failure – January 2019


Let us never forget
May this not be allowed to happen in South Africa
We must change for the better

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Chair - Tailings Sub-committee