NRW Risk Management Process under ISO 31000:2018

Case Study of an Indonesian Regional Water Utility

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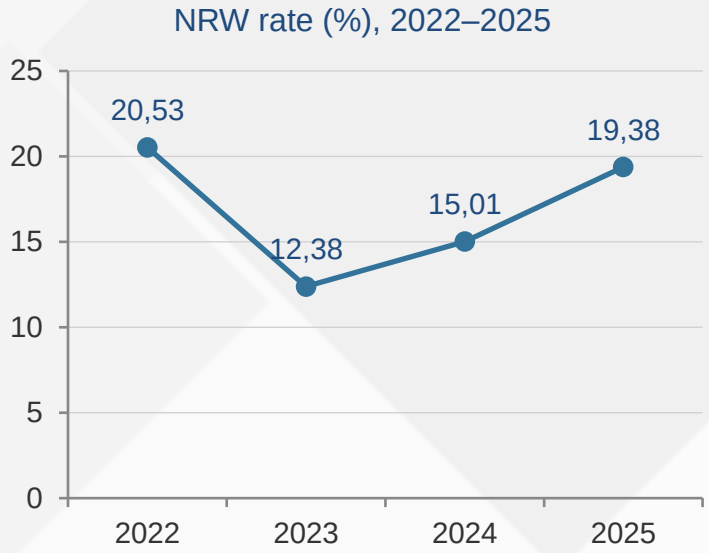
Why NRW Matters

NRW Rate, 2025

19.38%

Service Coverage, 2025

29.27%



- NRW fell to 12.38% in 2023, then climbed back to 19.38% in 2025.
- The improvement was achieved but not sustained – a risk process question.

The Puzzle and the Gap

NRW Volume, 2024 (BPKP)

2,482,884 m³

Recorded Commercial Losses

0%

NRW studies
measure losses, not the risk process

ISO 31000 studies
stop before monitoring and review

Governance studies
assess GCG, not the risk cycle

- All 2024 NRW was attributed to pipe leakage; no commercial loss was recorded.
- No study yet follows the full ISO 31000 cycle in a regional water utility.

ISO 31000:2018 as the Lens

Research question

How has the implementation of the NRW risk management process at Perumda Air Minum X been evaluated against ISO 31000:2018?

- **6.2 Communication & consultation**
- **6.3 Scope, context & criteria**
- **6.4 Risk assessment**
- **6.5 Risk treatment**
- **6.6 Monitoring & review**
- **6.7 Recording & reporting**

- Process clauses 6.2–6.7 are the criteria; Clause 5.2 and the principles cut across.
- Each clause rated: conforming, partially conforming, or weakly conforming.

Research Method

Design

Case Study

Analysis

Thematic and Open Coding

Interviews
Director, SPI, risk management, internal audit, distribution, billing, customer relations

Documents
2025 risk policy, risk register, EKM 2025, BPKP 2024, Q1-2026 monitoring report

Trustworthiness
Source and method triangulation, member checking

- Semi-structured interviews with document elicitation using the risk register.
- Open, axial and selective coding (Braun & Clarke, 2006; Creswell & Poth, 2018).

A Conformity Gradient

5.2 Leadership & commitment	Policy and SIMARI exist; two-person audit; tight budget
6.2 Communication & consultation	Tiered reporting; no cross-divisional NRW forum
6.3 Scope, context & criteria	No physical/commercial split; three NRW thresholds
6.4 Risk assessment	680 risks, 49 owners; commercial losses unidentified
6.5 Risk treatment	Pressure tactics; treatment plans not used consistently
6.6 Monitoring & review	Semi-annual review; IKPMR 54.70; no audit of effectiveness
6.7 Recording & reporting	Annual formal report; systems not integrated

Partially conforming Weakly conforming

Design stages hold up; learning stages fall short

The Main Answer

The process is formally established but only partially implemented: Perumda Air Minum X records its NRW risk, but does not yet learn from it.



Commitment on paper



Partial risk picture



Tactical treatment



Open feedback loop

- Four themes explain why the 2023 gain was not retained.

Commitment on Paper

Internal Audit Staff

2 people

Risk Evaluation Method

Self-Assessment



Evidence: Directors' Regulation 4/2025 and SIMARI exist, but budget limits training, inspection and system work.

Theory: formal structure loosely coupled to practice (Meyer & Rowan, 1977).

- Commitment is expressed as rule-making rather than resourcing (Clause 5.2).

A Partial Risk Picture

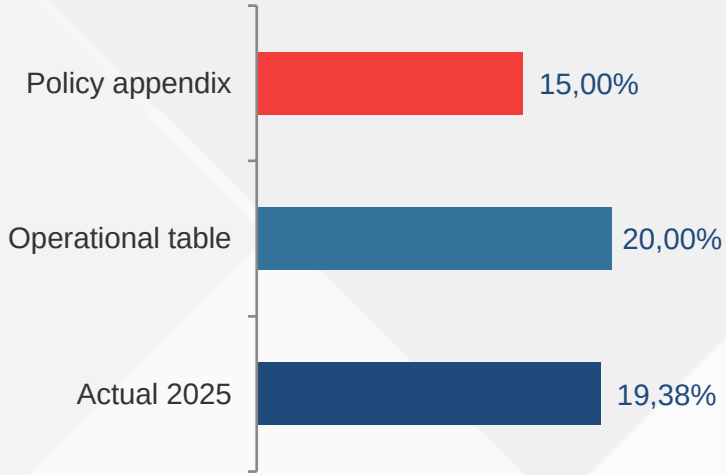
NRW Tolerances in One Policy

15% · 20% · ±5%

Commercial-Loss Category

None

Is 19.38% within tolerance?



- The same 2025 rate breaches one tolerance and meets another.
- The “zero” commercial loss is a measurement silence, not a result.

Tactical Treatment

New Programme Behind 2023 Gain

None

Leak Complaints from Third-Party Works

> 1,000 / yr



“I deliberately rate NRW high so that it gets included in the budget.”

– Risk owner, Transmission & Distribution

- Gains rested on pressure equalisation and night patrols, without treatment plans.
- When a rating becomes a budget request, assessment and treatment are entangled.

An Open Feedback Loop

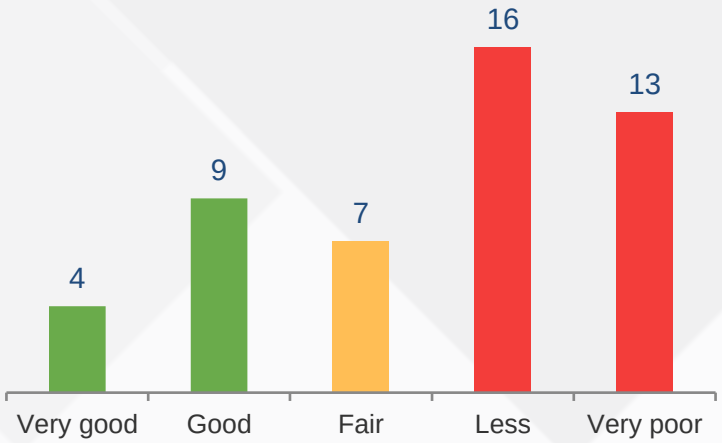
Average Compliance Index (IKPMR)

54.70

Formal Risk Report to Directors

Annual

49 risk owners by IKPMR, Q1 2026



- Very-high risks fell from 58 to 25 while NRW kept rising.
- Records improve, outcomes do not: continual improvement is not operating.

What We Now Understand



Conformity gradient

Judge ISO 31000 by whether the learning loop closes, not by documents.



Zero as a signal

A reported zero commercial loss diagnoses weak context and assessment.



Ratings as budgets

Resource scarcity couples assessment to budgeting and distorts the risk profile.

- Extends ISO 31000 evaluation in Indonesian utilities into monitoring, reporting and improvement.

Implications for Practice

Split NRW
Quarterly water balance: physical vs commercial losses

One tolerance
Single NRW threshold with escalation trigger

NRW KRIs
Monthly NRW %, leaks/km, reading-error rate, zero-use accounts

Real treatment plans
Owner, budget, deadline; protect NRW maintenance funds

Quarterly reporting
To directors and supervisory board; add outcome measures to IKPMR

Integrate data
Link SIMARI with billing, metering and SCADA

- Regulators and auditors: require evidence on commercial losses, not a default zero.

Limitations and Next Steps

Limitations

- Single utility: analytic, not statistical, generalisation
- Governing-body view partly via proxy and documents
- Only one quarterly monitoring report available
- Clause ratings rely on evaluator judgement

Future Research

- Multi-case comparison to test the conformity gradient
- Longitudinal tracking of the NRW risk cycle
- Quantify revenue impact of commercial losses
- Test whether IKPMR predicts outcomes

Conclusion

- ISO 31000 conformity is partial, strongest in design and weakest in learning stages.
- Sustaining NRW gains requires closing the loop from monitoring to treatment.
- Conformity is about closing the loop, not having the documents.



Thank you

Questions and feedback are welcome