

Transcript

Process variability is still the silent killer in mining operations — but it doesn't have to be.

Segment 1: Setting the Scene

Why process variability is still the silent killer in mining operations

Back in 2007 when I started as a graduate metallurgist in the Mount Isa Mines copper smelter we were experiencing fluctuations in feed grades, throughput, deleterious minerals and approaches to how the operators ran the furnaces. Almost 20 years later and not much has changed, the same fundamental challenges exist in concentrators, smelters and refineries the world over.

Variability creeps in quietly. It doesn't always trigger alarms. Sometimes the fluctuations are there and sometimes they're not so you react to the symptoms rather than treating the root cause.

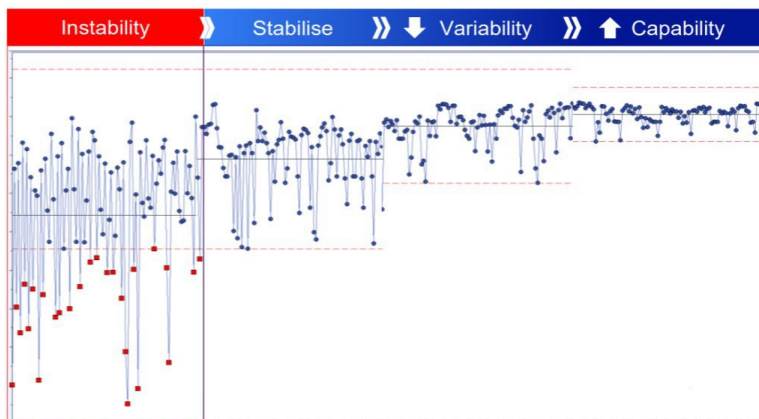
Sometimes fluctuations overlap and combine to chip away at throughput, recovery, costs and stability. Over time they compound to a point where achieving annual targets is no longer possible. The silent killer of performance.

This is especially true in plants where data is fragmented. Instruments drift without regular calibration. Lab results come in hours later. Process trends are siloed. Manual logs live in notebooks or spreadsheets. And the people who used to “just know” what’s going on? They’ve retired or moved on.

So what happens? Teams firefight. They rely on gut feel. They tweak setpoints based on yesterday’s problems. And over time, this reactive culture becomes normal, even though it’s costing thousands in lost opportunity every day.

This isn’t about criticism. It’s about recognising that variability is a systems issue. It’s built into the way we collect data, communicate across departments, and make decisions under pressure.

The good news? It’s fixable. But it starts with acknowledging that variability isn’t just noise, it’s a signal. And if we can learn to see it clearly, understand what’s causing it, we can start to control it. Back at Mount Isa Mines we controlled variability through process control standards, standard work instructions and training. We have better tools now.



In the next segment, we’ll look at how operational alignment, and a shared view of the process, can help teams move from reactive to proactive.

Takeaways:

- Variability is often invisible but always impactful.
- Fragmented data leads to reactive decisions.
- Loss of experience = loss of insight.
- Variability is a systems issue - not just an operator issue.

Segment 2: Operational Alignment & Culture

Getting everyone on the same page: why standardisation matters

I remember sitting in the morning production meeting when I was at Ernest Henry Mine and listening to the concentrator supervisor use the word 'stability' more than ten times in two minutes when explaining the previous 24 hours of (missed) production. As anyone that has operated a plant knows, process stability is a key driver to maximising production, enhancing safety and reducing waste. So, how do you achieve process stability and the flow on benefits to production, safety and efficiency? Managing variability is a good place to start on your pursuit of operational excellence.

Process variability isn't just from ore variability, misalignment is also a major contributor. Different departments often operate with different priorities, different data sources, and different mental models of what "good" looks like. The metallurgy team might be focused on recovery, operations on throughput, and maintenance on asset health. All valid - but when those goals aren't aligned, you get friction, inefficiency, and missed opportunities.

Interdepartmental misalignment is compounded by intradepartmental misalignment. When you have multiple crews, each with multiple operators who do things slightly differently and who all think their way is the best, you have no chance of achieving a stable circuit let alone a stable plant. The problem is when everyone is doing something different, you never know what is the right way and what is the wrong way. At least when everyone does everything the same way, you will very quickly discover if something is incorrect. While it may take a little longer, when you do things the same way and evolve that standard approach overtime, you will discover the best way.

When I was working at PASAR in the Philippines we went through a process of collaborative learning. Not just metallurgists educating operators about the theory but operators educating metallurgists about the practice and the reality. It was about getting everyone on the same page. We developed process maps, fishbones, cause and effect analyses, control plans, KPIs, process control standards, logsheets, dashboards, reports, procedures and TARPs. It was an investment but worth it because everyone's voice was heard and people could see their contributions codified and reflected in process control standards, procedures and TARPs. The problem we couldn't solve at that time was all those artefacts were on paper or in a cumbersome document management system you couldn't quickly access.

That is where visualising the relevant information in real time becomes powerful. When frontline staff have access to real time insights, contextualised alerts, and guided workflows, they can make better decisions faster. It's not about replacing experience - it's about accelerating it. You're giving people the confidence to act, not just react.

Digital tools also help bridge the gap between experience levels. A seasoned metallurgist might intuitively spot a trend in the data and connect the root cause, but a newer operator might need that insight surfaced more directly, through colour-coded alerts, notifications, or contextual annotations. The key is not just having data, but making it usable. When you surface insights in a way that's intuitive and shared, you reduce noise, increase trust, and create a culture of alignment.

In the next segment, we'll explore how digital tools can empower frontline operators - especially those who are still building their experience.

Takeaways

- Misalignment creates inefficiency and friction.
- Standardising fosters collaboration.
- Digital tools bridge experience gaps.
- Shared insights = better decisions, faster.

Segment 3: Empowering the frontline

Bridging the experience gap: helping operators make better decisions

Let's talk about the people who live closest to the process - our operators. They're the ones in the field 12 hours a day, making real-time decisions, responding to alarms, adjusting setpoints, and keeping the plant running. I remember a grey-haired, ex-pat control room operator at Kansanshi Smelter in Zambia. He used to come in on night shift, smile and nod during the handover, wait for the day shift crew to leave, open a few displays, adjust some settings, put his feet up, and relax. To put that into context, that was a highly automated smelter with the control designed by Mipac and not all smelters will be the same. But here's the challenge: not every operator has the same level of experience to get the plant humming and transferring tribal knowledge isn't easy.

The reality is, we're operating in a time of changing societal expectations. It's harder and harder to attract and retain people in mining. When experienced operators retire or move on, they take years of intuition with them. And newer operators, even if they're sharp, often don't have the same gut feel for how the plant behaves under different conditions. That's where variability creeps in - not because people aren't trying, but because they're working without a clear decision support framework.

Imagine coming off the farm and into a complex processing plant where the crew is under-staffed and you're expected to pull your weight from the get go. That's the reality for a lot of frontline teams. They're expected to make fast, high-impact decisions with limited context, fragmented data, and limited guidance.

That is where intuitive tools can make a huge difference.

For example, instead of a generic alarm that says “high pH,” imagine a system that shows where the deviation started, what conditions contributed, how other process outcomes might be affected by pulling different levers and what similar events looked like last week. That’s decision support. It’s not automation - it’s augmentation.

And it’s not just about the tools - it’s about the culture. When the SAG mill stops turning, there are multiple disciplines who can play a role to get the plant running again, not just operations. When operators feel supported, when they know their voice is heard, they’re more engaged. They ask better questions. They take ownership. And they become part of a continuous improvement loop, not just the last line of defence.

To sum up, we can’t expect to accelerate closing the experience gap just via training but we can empower inexperienced operators with the right digital tools. And when you do that, you unlock a huge source of untapped value.

Next, we’ll look at how to turn siloed data into actionable insight.

Takeaways

- Experience gaps lead to inconsistent decisions.
- Tribal knowledge is hard to transfer.
- Intuitive tools accelerate learning.
- Decision support = confidence + consistency.

Segment 4: Data is the new gold

From siloed data to actionable insight: what good looks like

So far, we’ve talked about insights and decision support - but that’s not possible if your data is stuck in silos. Most of the plants I walk into have a control system that stores alarm and events, a historian that stores time-series process information, an SQL database that stores assays, an ERP that stores financial information, a whiteboard full of tasks, a book of operator observations and a collection of fragile excel files that struggle to do everything from run the morning meeting to perform the end of month metal accounting. A huge amount of data is collected but it’s often scattered across different timeframes, formats and platforms that don’t talk to each other. That makes it hard to connect the dots - and even harder to act on the insights.

Here’s a common scenario: flotation recovery is dropping but the OSA is offline because the Met Tech forgot to complete a routine task and the lab feed assays won’t be back for another couple of hours. The mining department flagged a change in blend on night shift but the message is buried in the paper logbook. By the time someone pieces it all together, the opportunity to intervene has passed.

It’s not just about having data - it’s about making it usable, timely, and contextual.

Contextualised data means you're not just looking at numbers - you're seeing relationships. You can trace a change in recovery back to a reagent dosing event, or connect a deterioration in SAG mill power draw to a missed media addition. It's about turning raw data into operational insight.

Digital tools that integrate multiple data sources play an integral role. When lab data, control system data, and manual inputs all feed into a single view, you eliminate blind spots. You reduce lag. And you empower teams to act in the moment - not after the fact. Digital tools allow you to structure data around assets and processes, so you're not just looking at data - you're obtaining insight.

Digital tools allow you to build templates, apply analytics, and visualise performance in a way that's meaningful to operators, maintainers, engineers, and managers alike.

This kind of integration doesn't have to be complex. It just has to be intentional. And when done right, it becomes the foundation for proactive control and continuous improvement.

In the next segment, we'll explore how this data foundation can help shift production meetings from reactive to forward-looking.

Takeaways

- Siloed data delays decisions.
- Interoperability reduces blind spots.
- Contextualised data reveals relationships.
- Integration enables structured insight.

Segment 5: Future-Focused Operations

Stop talking about yesterday: how to make production meetings forward-looking

Let's shift gears and talk about mindset - specifically, being reactive vs proactive. No longer being addicted to the adrenaline of responding to a crisis and celebrating the break down hero. Instead, being structured and forward looking.

As a Metallurgy Superintendent, the most frustrating thing was arriving in the morning and discovering that the plant had underperformed all night because a problem wasn't identified or the frontline weren't enabled to solve the problem in the moment. At many sites, that realisation doesn't occur until the morning production meeting.

Instead of the morning production meeting being proactive and future focussed, these meetings are dominated by yesterday's problems. We ask questions about what went wrong, why something didn't get done and what needs fixing. Sometimes the questions can't be answered because the information isn't available. Too often, these problems could have been solved in the moment and don't need a collection of disciplines coming up with a solution.

To be future focussed we need time and space. So the question is: how do we make these meetings forward-looking?

The answer is solving problems before or as they happen. A common approach is Short Interval Control, or SIC. The typical SIC approach breaks shifts into small time blocks of approximately 2 to 4 hours and encourages teams to get together, assess performance, identify deviations, and take corrective actions. Today's digital tools no longer require a defined time period and a common meeting place. Instead, deviations to optimum performance can be detected as they happen, relevant stakeholders can be alerted and prompted with response plans. Collaboration can effectively happen remotely within the tool and escalation triggers can be built in if the deviation hasn't been resolved within an acceptable timeframe. A summary of what was done to resolve the deviation can be historised and used to improve the response plan and accelerate resolution in the future.

Instead of waiting until tomorrow to fix today's issues, SIC helps teams course-correct during the shift. But for SIC to work, you need interoperability and visibility. You need to know what's happening now - not just what happened yesterday. That means having access to live data, contextual insights, and clear performance targets.

When we solve problems in the moment, we no longer need to spend time in the morning production meeting talking about the past and can instead focus on the future. How do we catch-up to our annual targets. Even better, how do we exceed our annual targets.

We've seen this result in unexpected, intangible benefits. All of a sudden engagement increases, crews start working as a team, operators start providing constructive feedback because they feel heard. All of a sudden, the fly-wheel is spinning and you're on your way to establishing a continuous improvement culture.

This kind of cultural shift doesn't happen overnight. But when it does, it creates a more agile, resilient operation - one that's focused on improvement, not just accountability.

In our final segment, we'll wrap up by asking: what does operational excellence look like for your plant? And how do you define your own "Golden State"?

Takeaways:

- Most meetings focus on yesterday's problems.
- SIC enables real-time course correction.
- Stability enables proactive planning.
- Culture shift = engagement + agility + resilience.

Section 6: Wrap up

What's your Golden State? defining operational excellence for your site

We've covered a lot today - from the hidden cost of variability to the power of insights, decision support, and proactive planning.

But here's the real question: What does operational excellence look like for your plant?

Every plant is different. Different ore bodies, different teams, different constraints. But the principles are the same: clarity, alignment, and confidence in decision-making.

So ask yourself:

- Do you know what "good" looks like for your plant?
- Is the necessary information available to the right people when they need it?
- Can your team see the same version of reality?
- Are your operators empowered to act - not just react?
- Do you celebrate the breakdown hero or the team that never has a breakdown?
- Are your meetings driving improvement, or just reporting issues?

Defining your own "Golden State" means setting a clear vision for performance - and building the systems and culture to support it. It's not about chasing perfection - that's impossible but excellence isn't. Excellence is about knowing what matters, measuring it well, and acting on it consistently.

Most sites define their Golden State in terms of uptime, grade, recovery, throughput, energy usage, water consumption and consumables spend. For some sites these variables are more important than others. Guaranteed that every site will have different targets. The point is: they're yours to define. And once you do, you can start aligning your people, processes, and tools to achieve them.

If you're curious about how other sites are tackling these challenges - or if you'd like to explore what your Golden State might look like - we'd love to chat.

Takeaways:

- Operational excellence is site-specific.

- Define what “good” looks like for your team.
- Align people, processes, and tools.
- Reach out to explore your Golden State.

About Mipac

[Mipac](#) is a global leader in operational technology, control systems, and engineering services. With over 28 years of experience and more than 720 projects delivered worldwide, Mipac partners with mineral processing operations to improve performance through automation, digitalisation, and data-driven decision-making. Their solutions are trusted by some of the world’s largest mining companies.

About Dominic Stoll

[Dominic Stoll](#) is the Solutions Manager at Mipac, where he leads the Software and Optimisation teams. With a background in minerals process engineering, Dom brings over 15 years of global site experience across Australia, Kazakhstan, Zambia, and the Philippines. His practical insights as a former metallurgist and superintendent shape Mipac’s approach to solving real-world operational challenges.

About Mipac MPA

The [MPA suite](#) is a modular software platform designed to help mineral processing teams visualise plant performance, detect deviations in real time, and respond with confidence. It includes tools like [Golden State](#), [Digital TARP](#), Production Monitor, and [Logsheets](#) — all built to reduce variability, support Short Interval Control, and drive operational excellence.