

Monitoring beyond the critical 1%

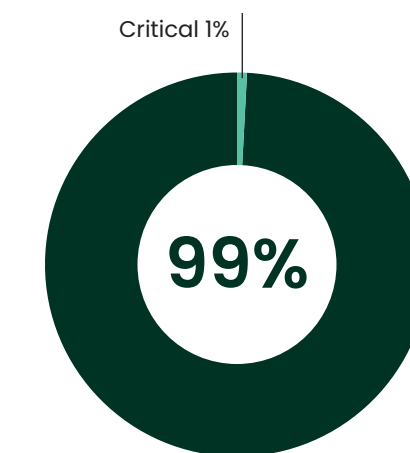
By bringing condition monitoring to the other 99% of rotating machinery, plants could multiply efficiencies, ROI, and cost savings



The financial risks of ignoring balance-of-plant assets

A typical 250,000-barrels-per-day (bpd) refinery has around 10,000 rotating machines. On average, only 1% of those are deemed “critical.” Determining criticality usually means the machine:

- Is un-spared (or not 100% spared)
- Has a substantial direct impact on process stream
- Operates continuously with planned outage intervals (measured in years rather than months)
- Has safety implications if it fails
- Has high downtime costs, i.e. much higher than average of \$260K/hr, usually due to lost production, which can be \$1M/hr or more
- Or is very expensive to repair



Moving beyond the critical few

Your facility may have many or fewer assets, but these ratios generally hold true in terms of the “critical few” and the “less-critical many.” However, your balance-of-plant (BOP) assets can also dramatically impact critical assets.

Critical assets are **individually impactful** because if they fail, production halts instantly. Understandably, most asset health management efforts and budgets are focused on these critical assets—they are usually the best instrumented machines in the enterprise.

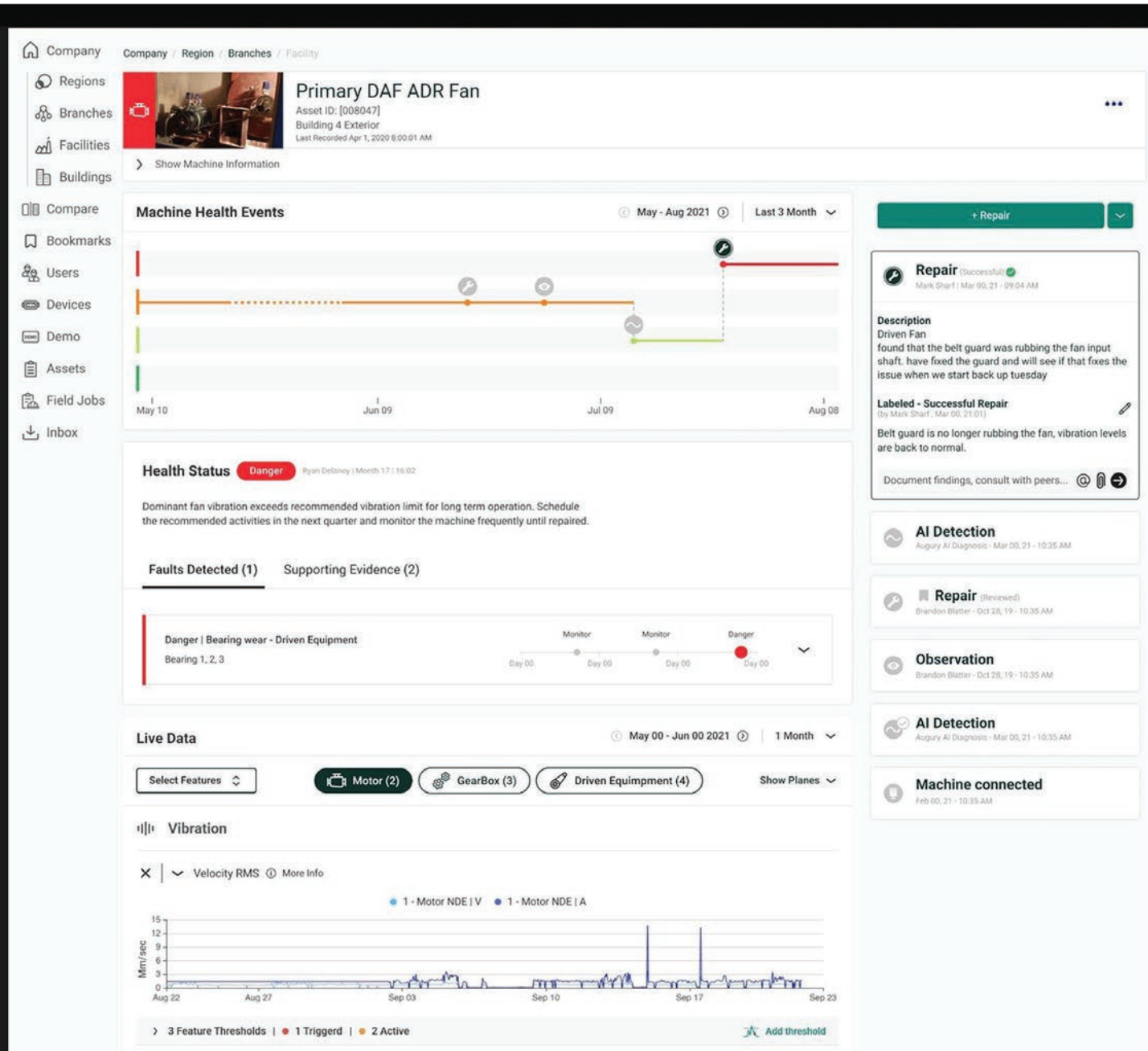
BOP assets—often around 99%—are **collectively impactful**. For example, efficiency losses that manifest in condensers actually start in BOP systems such as vacuum pumps, circulating water pumps, and cooling towers. However, they are under-addressed because the cost of monitoring them has traditionally been too high.

In place of condition monitoring, a laissez-faire approach to balance-of-plant maintenance is more common, often consisting of one or more of these actions:

- Run to failure, which means putting off maintenance until the machine fails
- Manual data collection and human-intensive review of alarms and data
 - Only feasible if collection frequencies are less than 1x per month
 - Not practical if failure modes progress faster than 1x month
 - Asset coverage is limited based on available resources
- Online monitoring with manual review of alarms
 - Often impractical due to the large number of monitored machines—alarm fatigue becomes common
 - Overwhelmed by data, organizations are unable to turn data into actionable information
- Some form of general AI
 - Known as “generic AI,” where data from various sensors is fed into a general-purpose AI model
 - Generally this approach will yield suboptimal results for quite some time because of the long timelines required to clean your own data as well as build and train the model

In general, reliability teams tend to deprioritize BOP monitoring simply because there are too many assets to monitor and too many alarms to make the data meaningful.

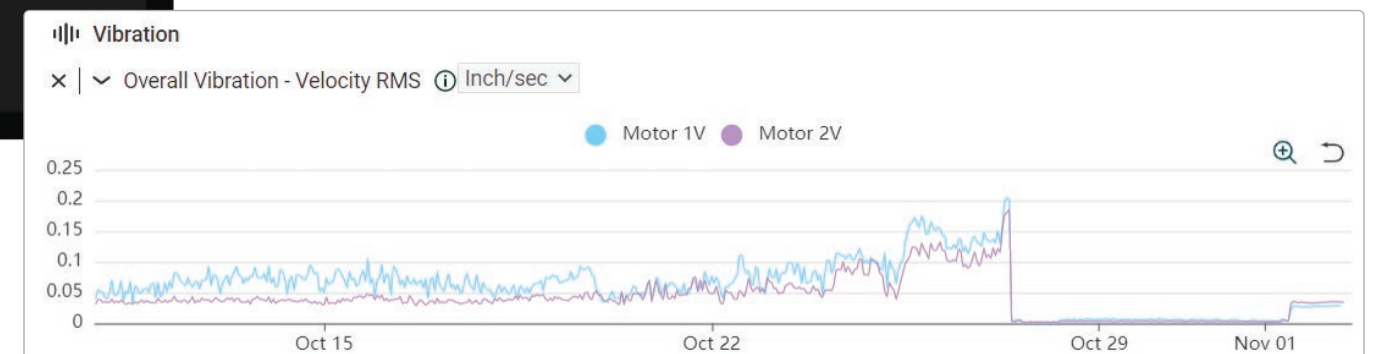
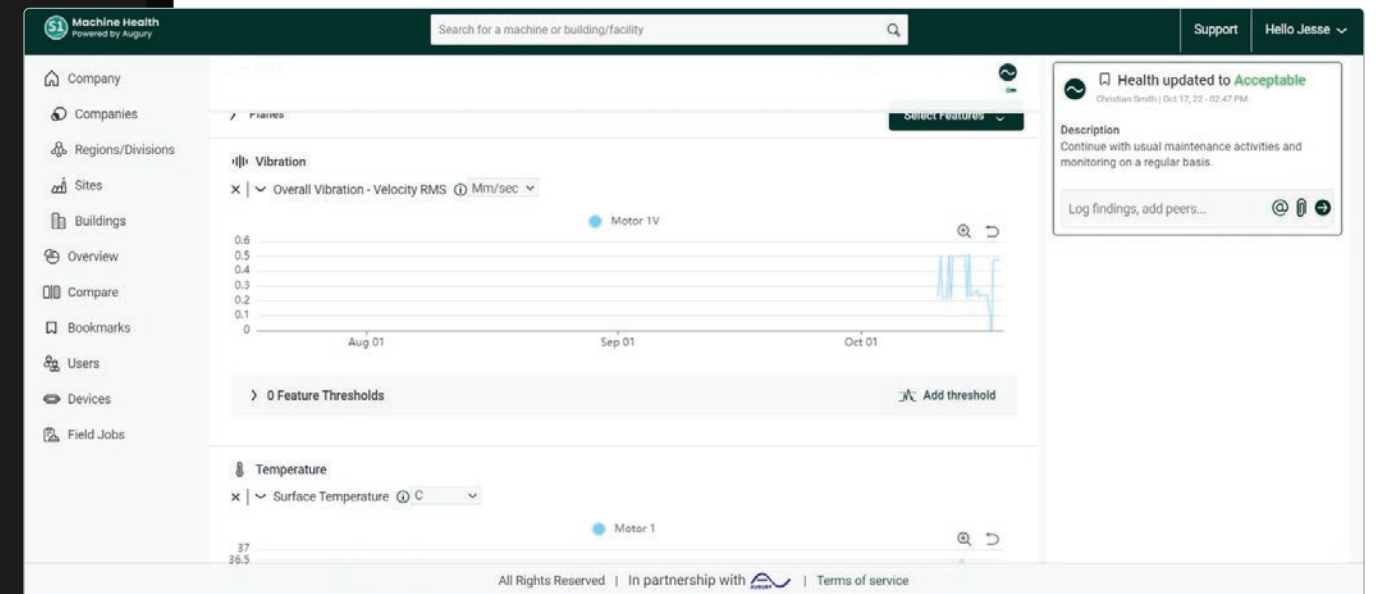
Rethinking your 99% strategy



A more nuanced, scalable approach needs to be implemented to transform the health and performance of your BOP machinery. To be effective, that approach needs to give you the ability to:

- Use prescriptive diagnostics, including root cause analysis and repair recommendations, to rule out threshold-based alerts
- Leverage purpose-built AI to filter for alerts that matter
- Offload to the AI layer as much analysis, diagnosis, and prescriptions as possible to free up team bandwidth
- Combine purpose-built AI with a large library of robust, clean data

As a result, early detection and diagnostics will help teams plan maintenance ahead of time instead of firefighting and facing emergency shutdowns.



Smarter and faster

Why purpose-built AI changes everything

Purpose-built AI is trained on a standardized set of data inputs from known source types. In the context of condition monitoring, this means training the AI to look for patterns in data streams from a known set of machines and condition monitoring sensors.

The advantages of this approach are multifold:

One-time AI training

- Because the AI model is developed on a set of sensors that are used everywhere, the same model can be used wherever the sensor is used. This is known as an AI + IOT solution

Robust data library

- Purpose-built AI is "pre-trained," meaning it is no longer necessary for organizations to invest time and resources in building, training, and deploying AI models. It is also easier to clean, normalize, and standardize the data
- This data library helps teams deploy the solution faster than general purpose AI solutions and show value sooner, often within months

Continuous improvement

- As the sensor is deployed further and wider, datastreams from more sensors in a wider range of operating conditions are ingested and incorporated into the machine learning algorithm, making the AI smarter at identifying more types of failure modes
- Since most AI+IOT solutions are also "hybrid intelligence," whereby a vibration analyst reviews the recommendation, it introduces an additional source of improvement in prescriptions
- Over time, the AI becomes better at identifying failure modes earlier and recommending the appropriate remediation actions

Faster time-to-value and higher ROI

- Using pre-trained, purpose-built AI models makes it possible to deploy faster and detect failures earlier, resulting in short time-to-value and higher ROI versus general-purpose AI, which can take months to deploy and years to deliver value

Health updated to Acceptable
Christian Smith | Nov 02, 22 - 11:36 AM

Description
Continue with usual maintenance activities and monitoring on a regular basis.

Log findings, add peers... @ 📎 ➔

Observation
Taylor Leeson | Nov 01, 22 - 02:37 PM 11:36 AM

Description
Health Inquiries & Questions
Machine has started. please start new baseline for equipment as the motor and gearbox have been changed out.

CS The post repair data looks great. Nice work!
See Translation | 🌐

Nov 02, 22 - 11:36 AM

Log findings, add peers... @ 📎 ➔

Machine Health Powered by Augury

Search for a machine or building/facility

Support Hello Jesse

Company Baker Hughes / Invista

Company

Machines To Notice Region Breakdown

Filter view by: **All Machines (55)** Pending Response Updates Known Issues AI Detections Starred Machines

Health	Last Update	Date	Future Repairs	Required Actions
MH CR - Critical Equipment (55)				
12% MH CR	333/4 C/A UNIT	Kingston, Ont > T-33		☆
8% MH CR	Reactor Feed Pump East	Kingston, Ont > CP -> T13		☆
10% MH CR	9311 BOOSTER PUMP	Kingston, Ont > 9311/12 POLYMER		☆
11% MH CR	Finisher Screw West	Kingston, Ont > CP -> T13		☆

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Overview page
View company stats and compare between company levels

Compare Between
Facilities (21)

Facility	Machines	Health Status
Company 1	200 Machines	22%
Facility 1	49 Machines	71%
Facility 2	49 Machines	70%
Facility 3	49 Machines	65%
Facility 4	49 Machines	55%
Facility 5	49 Machines	50%
Facility 6	49 Machines	28%
Facility 7	49 Machines	18%
Facility 8	49 Machines	10%
Facility 9	49 Machines	10%
Facility 10	49 Machines	10%
Facility 11	49 Machines	10%
Facility 12	49 Machines	10%
Facility 13	49 Machines	10%
Facility 14	49 Machines	10%

Health Status
Current Status - Mar 24, 2021
200 Monitored Machines 32 Machines In Danger
18 Machines In Alarm

Health Status Over Time
2020 - 2021 | 1 Year

Adoption & Behaviour
8 Alerts From March 1 - 31, 2021
56% Addressed Alert Rate 10d Time to Address
11 Repairs & Observations 4 Active Users

Adoption & Behaviour Over Time
2020 - 2021 | 1 Year

8 Alerts From March 1 - 31, 2021

56% Addressed Alert Rate 10d Time to Address

11 Repairs & Observations 4 Active Users

Current Unaddressed Alerts (18)

Bookmarked: Machine Improvement, Successful repair, Successful repair
Nov 2nd, 2022

DT hours avoided: 252
Costs avoided: 4090000 USD


REPLACED MOTOR AND GEARBOX WITH SPARE. PRECISION ALIGNMENT COMPLETE. ALSO REPLACED CARDIN SHAFT WITH SPARE FROM GREARBOX OUTPUT TO PUMP.

Repair (Successful)
Taylor Leeson | Nov 01, 22 - 08:10 AM 11:37 AM

Health updated to Danger
Christian Smith | Oct 26, 22 - 11:48 AM

Health updated to Alarm
Christian Smith | Oct 24, 22 - 10:04 AM

Health updated to Acceptable
Christian Smith | Sep 29, 22 - 03:04 PM



System 1 Machine Health, powered by Augury, built for the energy, oil and gas industry

Bently Nevada's System 1 Machine Health solution is purpose-built AI that works with Ranger Pro condition monitoring sensors. Instead of requiring teams to set up threshold-based alerts or decision-tree-based embedded rules, System 1 Machine Health leverages the collective knowledge of over 150 million hours of machines monitored to recognize failure patterns, diagnose root causes, and prescribe fixes.

By actively filtering in only the alarms that matter, System 1 Machine Health helps reliability teams monitor the 99% balance-of-plant machines with the same level of detail as a human, 24/7/365, without getting overwhelmed with alarm floods or wasting time on fire-fighting.

With System 1 Machine Health, you and your teams will be able to:

- Reduce alarm fatigue and respond faster to alerts that matter
- Focus on necessary maintenance routines and plans, days or weeks ahead
- Lower inventory capital by ordering spare parts only when they are needed
- Free up workers so that they can focus on high-value work
- Eliminate unnecessary downtime and maximize production



Greater insight. Higher efficiency

Increased insight means smarter use of time and resources—better prioritization and less unnecessary field work.



Monitor

Equipment is monitored wirelessly and continuously across thousands of assets



Diagnose

Machine Health AI diagnoses early issues and prescribe corrective actions



Guide

Remote Monitoring Center or BN SSA service reviews diagnostics and issues work orders

Accurate prescriptive alerts and work orders sent directly to user



Act

Corrective action perforated by the technician

Autonomous verification of acceptable condition

Your balance-of-plant assets deserve more. See what System 1 Machine Health can do for your organization by reaching out to a Bently Nevada representative.