



04



COLLECT DATA

Gather data within the facility to validate the hypotheses put forth by the team.

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ROOT CAUSE ANALYSIS PROCESS STEPS

A systematic approach to uncover the true causes and drive lasting improvement.



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03



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IDENTIFY EVENTS

Identify undesirable events in the facility using human and digital data.

PRIORITIZE EVENTS

Identify the chronic events that account for 80% of the losses within the facility.

BUILD TEAM

Establish a cross functional team and appoint an unbiased RCA Facilitator.

COLLECT DATA

Gather data within the facility to validate the hypotheses put forth by the team.

ANALYZE

Leverage a logic tree approach that will guide the team in assessing root cause hypotheses and utilize data to validate each hypothesis.

COMMUNICATE ACTIONS

Convey RCA findings and corrective actions to stakeholders to ensure root causes are addressed.



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**Better Analysis.
Stronger Reliability.**

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WHAT DATA DO DETECTIVES COLLECT?

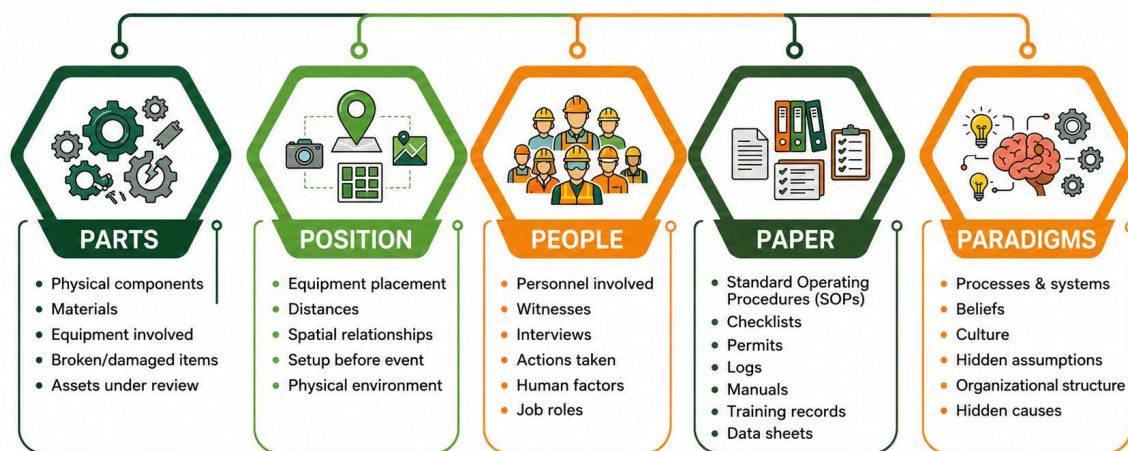


✓ **Facts first. Conclusions later.**

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5 Ps of DATA COLLECTION for RCA (Root Cause Analysis)



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Positional Data

- Functional Location of Failure
- Time of Failure (Day, Shift & Time of Year)
- Weather/Environmental Conditions
- Location of Fractured Parts
- Gauge Readings
- Where Were Relevant Personnel
- Failure Histories (Timing)
- Work Order Histories (Timing)
- Process Historian Trends



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TYPES OF POSITIONAL DATA

NOTES FROM SURROUNDINGS / ENVIRONMENT



LOCATION & OBSERVATIONS

-  Location of failed components
-  Location of employees during the event
-  Visible leaks nearby
-  Excessive vibration nearby
-  Analog gauge readings
-  Lighting of area
-  Review any visual or video during the event (e.g., sheet breaks on a paper machine)



SEARCH FOR CORRELATIONS

-  Events only occur when making a specific product/grade
-  Events are more prevalent during colder months
-  Events are more prevalent with a specific shift
-  The time to failure is consistent from event to event
-  Happens more on piping bends not straight runs
-  Happens more often at certain speeds

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Paper Data

- Procedures
- Training Records
- Procurement Documentation
- Shift Logs
- Maintenance Plans (e.g., PMs)
- Maintenance Histories (e.g., Work Orders)
- Inspection Results (Visual, Predictive, PM)
- Chem & Metallurgical Lab Test Results
- P&IDs / Drawings
- HR Records
- Recent Process Changes
- Recent Storeroom Material Changes
- Recent Changes to Lubrication Suppliers
- Asset Strategies



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Beware of Paper Data Overload



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People Data

- Witnesses
- Maintenance Personnel
- Operations Personnel
- Quality Personnel
- Reliability Technicians
- E & I Personnel
- Mechanics
- Storeroom/Warehouse Personnel
- EH&S Personnel
- Purchasing/Accounting Personnel
- Chem/Metallurgical Lab Personnel
- Leadership/Sponsors/Mgmt. Peo
- Vendors/Suppliers



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Paradigms

- 'Management does not care about safety'
- 'Reliability is a just a Maintenance thing'
- 'Maintenance does not know what they are doing'
- 'Operators do not know how to operate the equipment'
- 'Those alarms are okay to bypass (nuisance)'
- 'It's a design problem, nothing we can do but just keep fixing it when it breaks'



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Parts Data

- Material Samples
- Review of Old vs New Parts
- Residue Samples
- Lubricant Samples
- Failed Parts (i.e. - Bearings, Gears)
- Calibration of Instruments/Gauges
- Samples From Leaking Fluids
- Water Samples
- Raw Material Samples

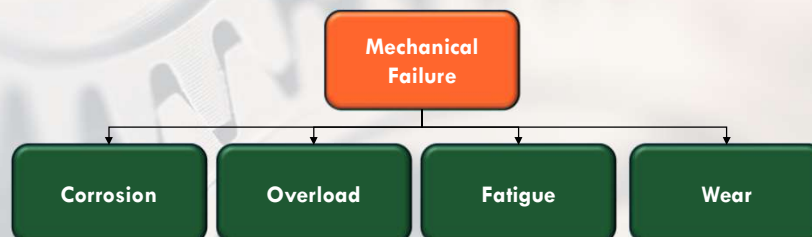


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Common Failures on Mechanical Components



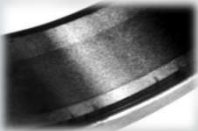
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Quick Lesson in Component Failure Metallurgy 101

Wear



Uniform Loss
of Metal

Corrosion



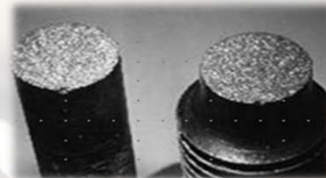
Pitting
(Electrical
Phenomena)

Fatigue



Cyclic Failure

Overload



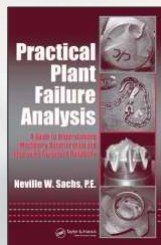
Instantaneous
Fracture

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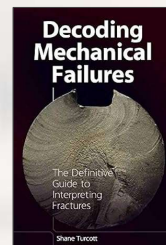
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Great Reference Books for Field Application



Practical Plant Failure Analysis

ISBN: 0849333768



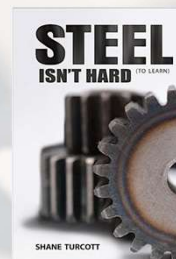
Decoding Mechanical Failures

ISBN: 1777157609



How Components Fail

ISBN: 0871701898



Steel Isn't Hard (to Learn)

ISBN: 978-1777157616

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DATA COLLECTION EXERCISE

Develop a data collect strategy for the chronic failure that was used in the Problem Statement exercise.

Utilize the data collection worksheets that were distributed to document the strategy. Be prepared to share your results with the other teams.

GROUP EXERCISE

- Define the data needed
- Determine data sources
- Plan collection method & timing

Define
Clarify the failure and objectives.

Collect
Identify what data is needed and how to collect it.

Share
Be prepared to share your strategy and results.

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