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RCM and the O&M Strategic Plan at Sandia National Labs

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Agenda

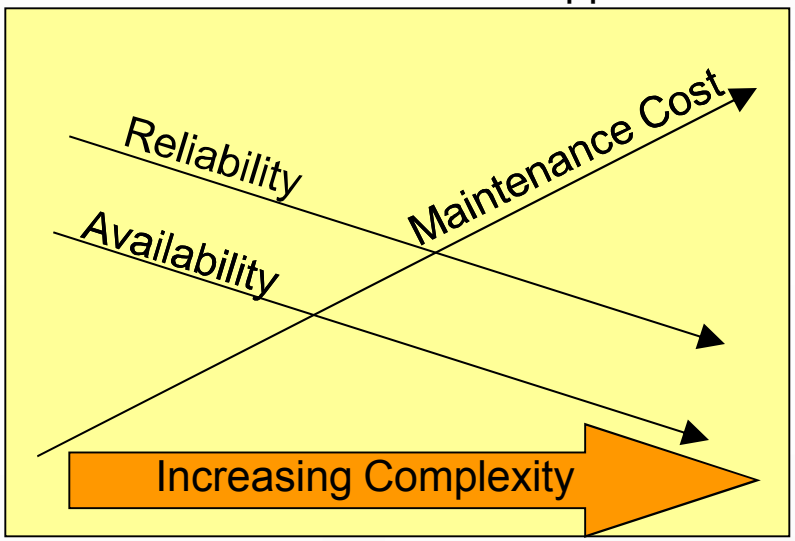
- **Reliability Centered Maintenance**
  - History
  - Definition
  - At Sandia
- **O&M Strategic Plan**
  - Guiding Principles
  - Strategies
  - Expected Results

History of RCM

- Commercial Airline Industry 1950's–1960's

- Task Force

Traditional Maintenance Approach



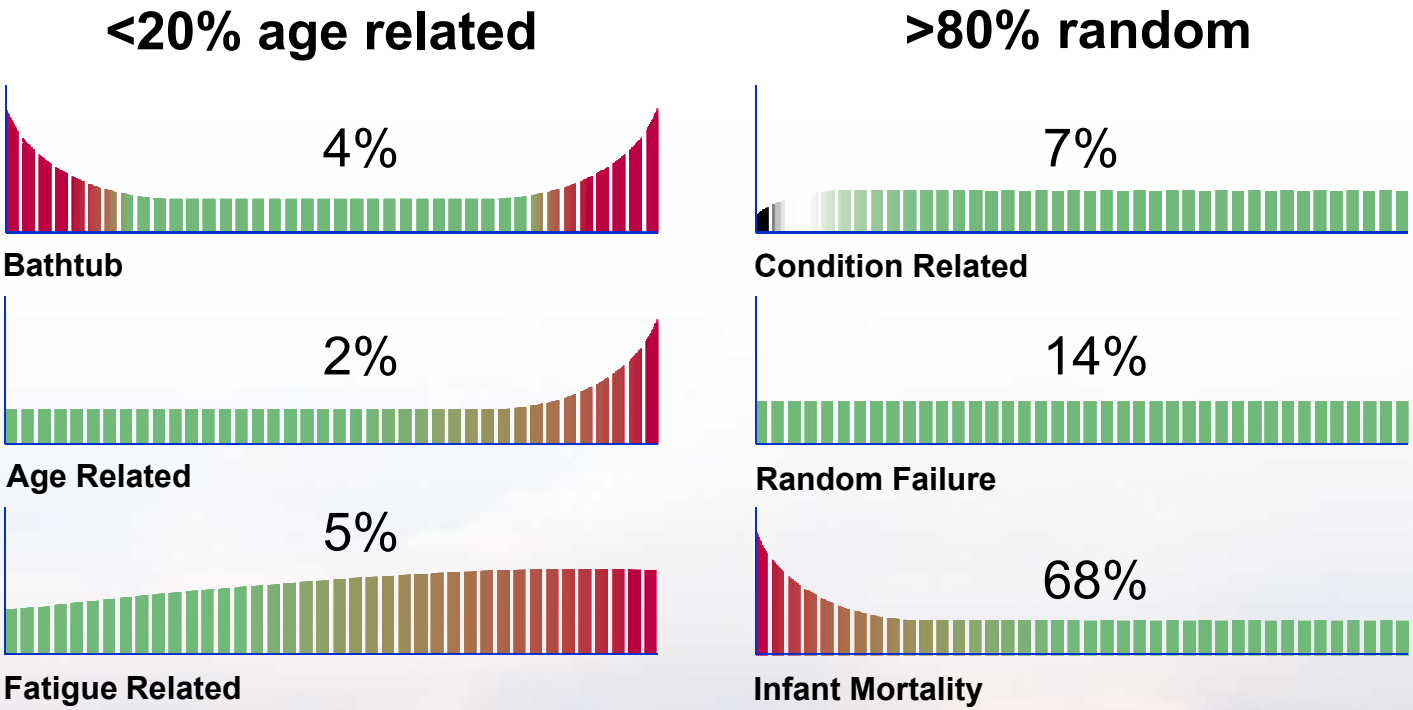
1978: Nowlan & Heap report, *Reliability-centered Maintenance*

1980 - present: MSG-3 for all major types of civil aircraft, also adopted by military

1992: *RCM2* by John Moubray (industrial application)

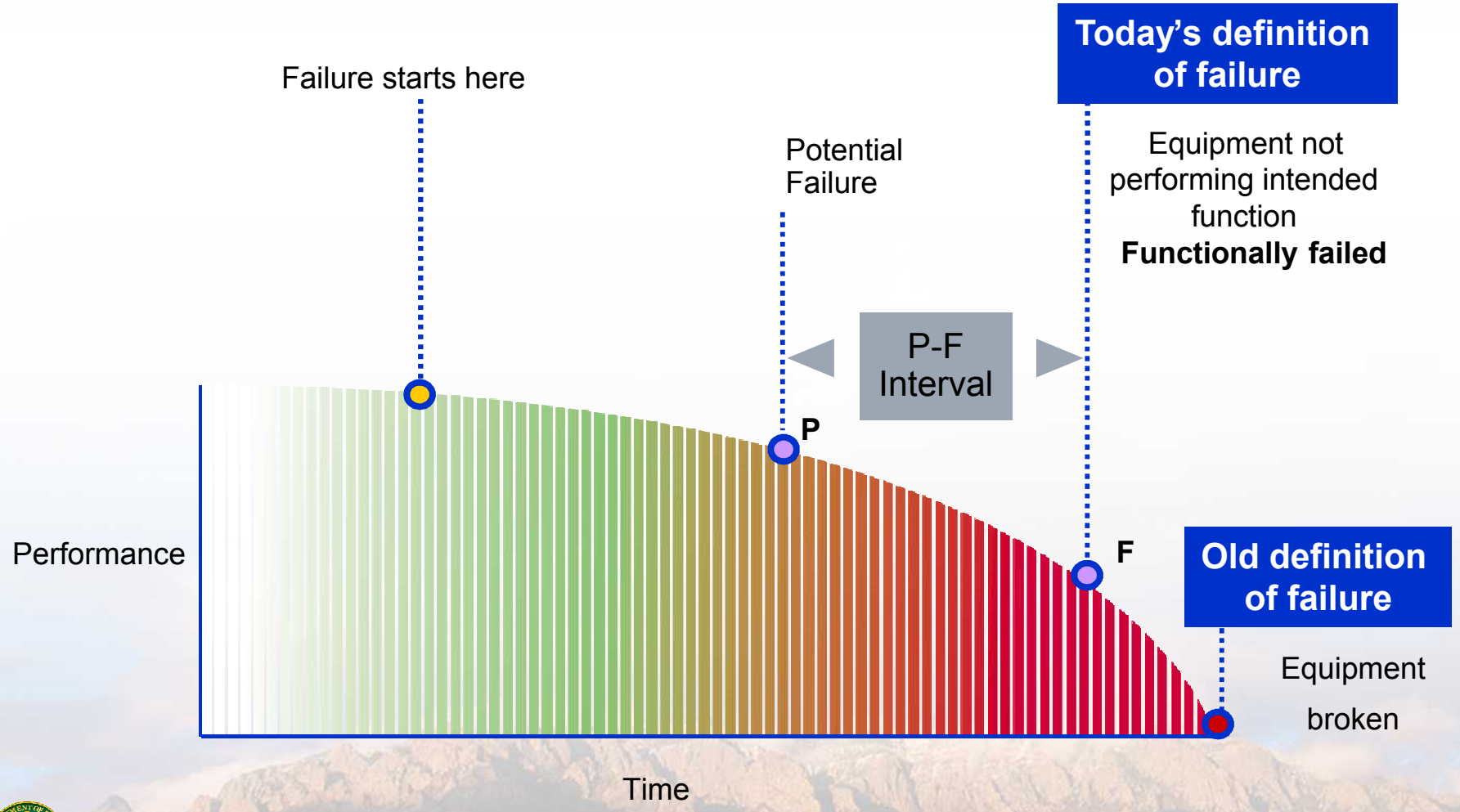
The Reality of Failure

- There are six failure patterns



The majority of failures are random, not age related

Today's Definition of Failure



Tool: Reliability-centered Maintenance

- **"A process used to determine what must be done to ensure that any physical asset continues to do *whatever its users want it to do* in its *present operating context*."**
- **SAE JA1011 Standard for RCM**
- **DOE recognizes RCM as O&M Best Practice**

7 Basic Questions of RCM

1. What are the functions of the asset?
2. In what ways does it fail to fulfill its functions?
3. What causes each functional failure?
4. What happens when each failure occurs?
5. In what way does each failure matter?
6. What can be done to predict or prevent each failure?
7. What should be done if a suitable proactive task cannot be found?

What RCM Achieves:

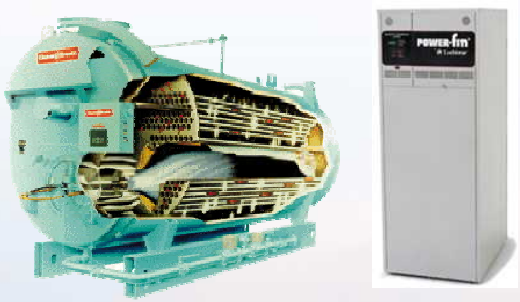
- Optimized maintenance plan including PdM & PM
  - *The right maintenance at the right time*
- Proactive operator tasks
- Design modifications that eliminate or reduce risk of safety, environmental, or operating consequences of failure
- Understanding of functions, capabilities, and performance expectations
- And, of course…MORE RELIABLE EQUIPMENT!

Sandia's RCM Experiences

Acid Exhaust System

- Increased System Reliability
- Eliminated Single Points of Failure
- Prevented Operational Downtime

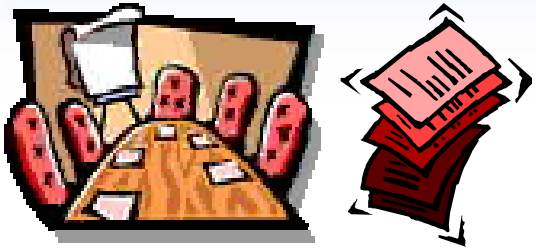
Networked Fire Alarm System



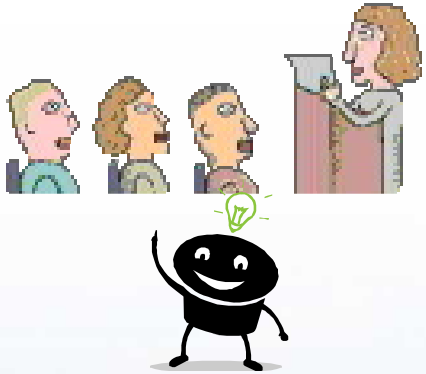
Heating Water System

Source Elevator System

Optimizing RCM



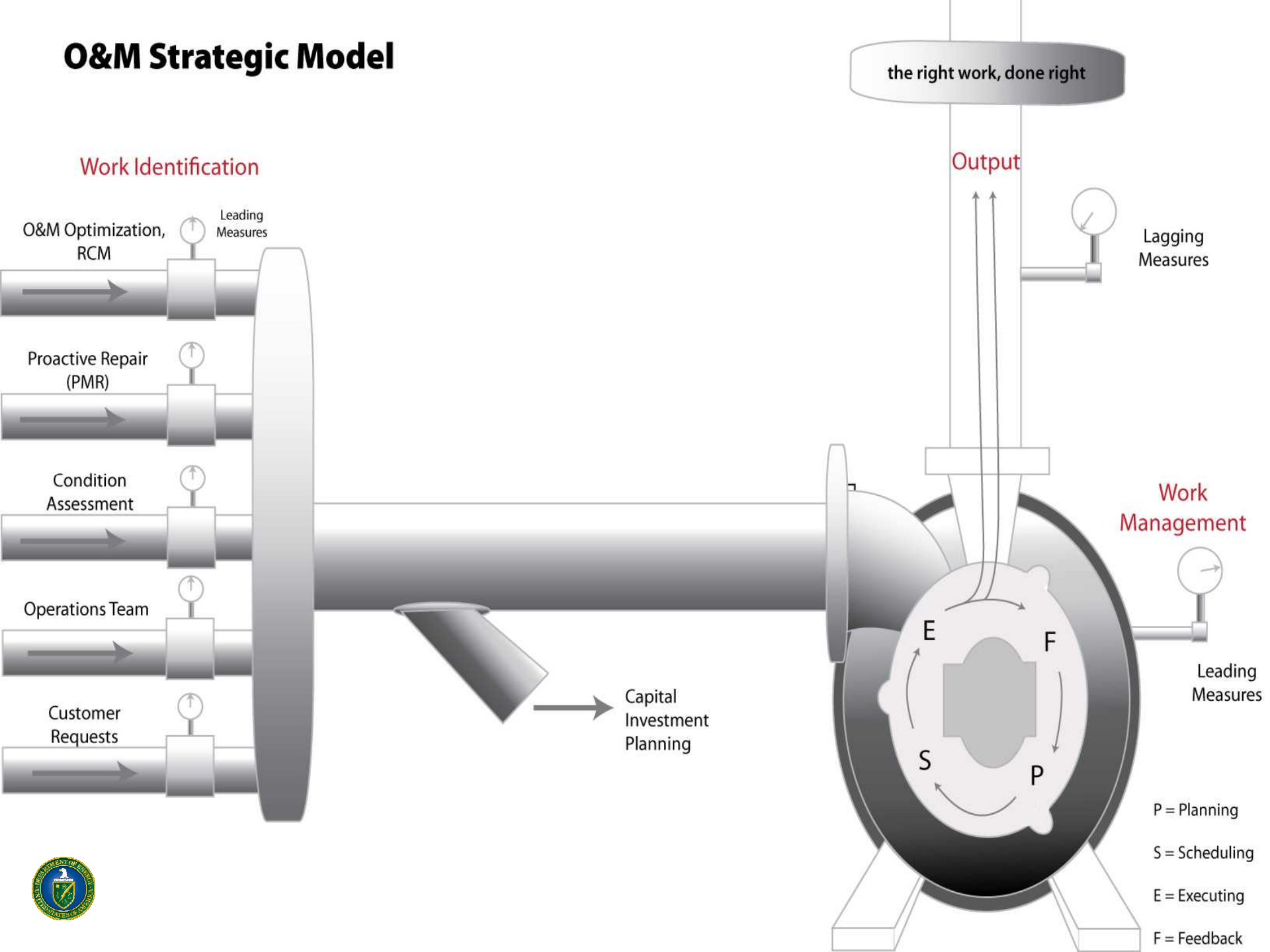
- **Perform full-blown RCM for critical systems**



- **Apply RCM concepts in daily maintenance decisions**
  - Educate workforce in RCM
  - Think about operating context, failure modes, and consequences

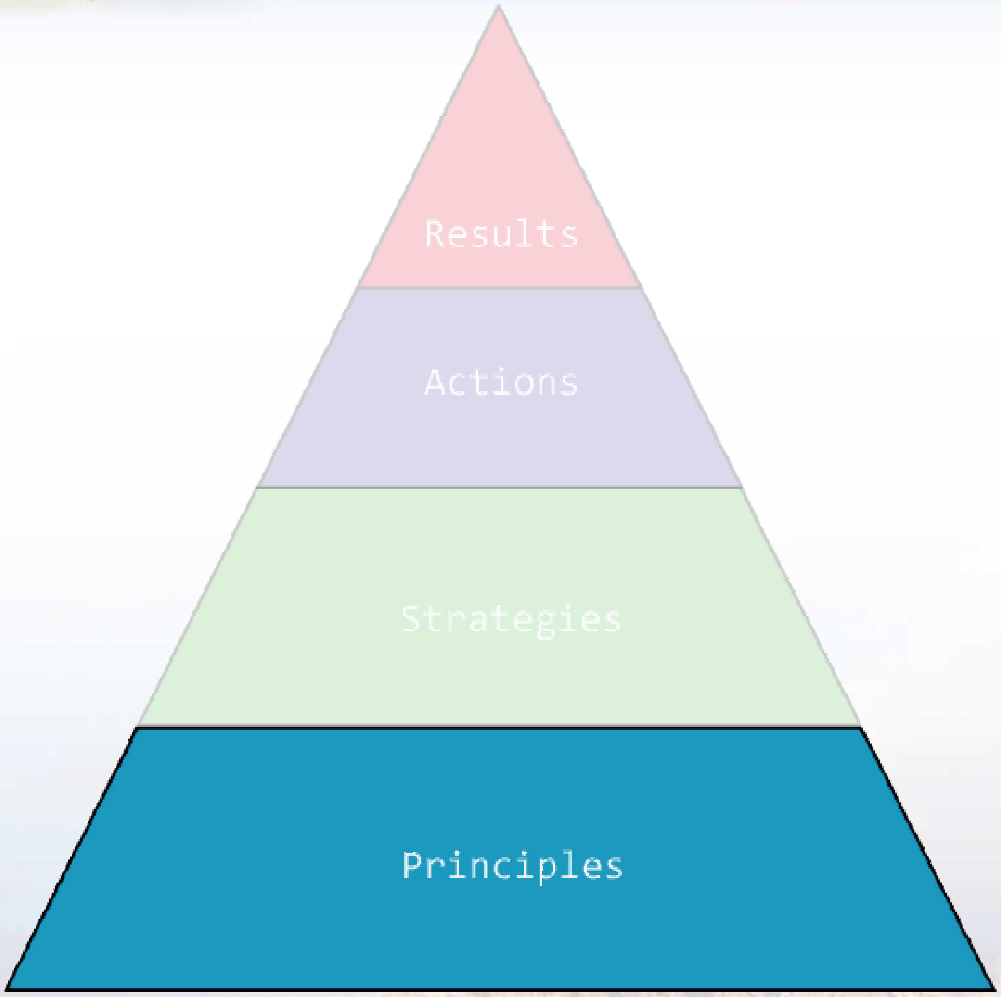
- **Incorporate RCM principles into O&M Strategic Plan**

O&M Strategic Model



O&M Strategic Plan

O&M Guiding Principles



- O&M activities should be based on consequences of failure within the operating context. (Use RCM concepts.)
- Reliability and maintainability requirements and best practices should be included in planning and project development processes.
- RCM should be applied to critical systems.

O&M Strategies

- O&M Activities:
  - Work Identification Processes
  - Work Management Processes
- O&M Budgeting and Capital Investment
- Design for Reliability and Maintainability
- O&M Staffing Allocation and Core Competencies

O&M Actions

- Implement and Integrate Processes
  - RCM
  - O&M Optimization
  - Condition Assessment
  - Planning
  - Scheduling
- Make Data Driven Business Decisions
  - Budget Allocation
  - Capital Investments
  - Staffing Allocation

Expected Results

- 10–15% Productivity improvement
- Savings of 10-20% of maintenance labor hours
- More of the O&M budget available to target improvements in Facility Condition Index (FCI)

QUESTIONS?

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Back Up Slides

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Sandia's RCM Experiences

- **Acid Exhaust System**
  - Reduced Risk of System Failure (Safety and Operational consequences)
  - Reduced annual corrective maintenance hours from 138 in FY06 to Zero in FY07, FY08, and FY09.
  - Identified single point of failure, mitigated risk, and recommended permanent solution (being installed now)
- **Fire Alarm System**
  - Reduced "false alarms" which cause costly evacuations
  - Prevented 1-2 day evacuation by identifying and obtaining critical spare for network card
- **Heating Water System**
  - Reduced PM hours on fire-tube boilers by 60%.
  - Developed operator tasks and PM plan for modular boilers which can be applied to many installations
- **GIF Source Elevator System**
  - Reduced frequency of PM tasks from 6 months to 1 year
  - Established predictive maintenance task which identified overheating cabinet and prevented potential electrical failure or fire.