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RELIABILITY CENTERED MAINTENANCE (RCM)

FACILITIES MAINTENANCE SERVICES

NASA Ames Research Center
MOFFETT FIELD, CA 94035-1000

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RCM DEFINITION AND PHILOSOPHY

- Maintenance strategy that methodically develops the optimum mix of preventive, predictive, reactive, and proactive maintenance practices
- Integrate maintenance practices to take advantage of their respective strengths in order to maximize system availability and efficiency while minimizing life cycle costs
- NASA Reliability Centered Maintenance (RCM) Guide For Facilities and Collateral Equipment
  - http://www.hq.nasa.gov/office/codej/codejx/Assets/Docs/RCMGuideMar2000.pdf

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PREDICTIVE MAINTENANCE OUTLINE

- Predictive Testing and Inspection (PT&I)
- Acceptance of New/Rebuilt Equipment
- Failure Modes and Effects Analysis (FMEA)

PREDICTIVE MAINTENANCE (PdM) - 1

- Predictive Maintenance (PdM) based on Predictive Testing and Inspection (PT&I) technologies available and Failure Modes and Effects Analysis (FMEA)

- Develop a PdM program under the firm fixed-price contract and implement on-site
  - Take into consideration risk of production loss if equipment fails
  - Possible cost savings
  - Regulatory requirements

  - Primary Goals
    - In- line with best industry practices
    - Economically beneficial

PREDICTIVE MAINTENANCE (PdM) - 2

- Predictive Testing and Inspection (PT&I)
  - Contractor is responsible for performing PT&I as part of its recurring services under the firm fixed price portion of the contract (para. C5.3.B.1)
  - Contractor shall have experience in vibration analysis and thermography at a minimum of Level I certification (para. C1.2.P.8)
  - PT&I Technologies are outlined in Attachment J-C1.6
  - The Contractor may substitute PT&I for time based PM
  - The Contractor may use PT&I results to document proposed changes that reduce (or increase) the current work load

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IN-HOUSE PT&I TECHNOLOGIES IN USE

- Technology
  - Periodic Vibration Analysis
  - Oil & Wear Particle Analysis
  - Thermography
  - Motor stator analysis & electrical surge testing
  - Motor Current Signature Analysis
  - Airborne Ultrasonics
- Application
  - All Rotating Equipment
  - Critical & Low Speed Equipment
  - Electrical Components, Heat Insulation, mech. Components
  - Motor stator and insulation breakdown
  - Motor rotor bars, eccentricity
  - Steam trap, compressed gases, vacuum leaks

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CURRENT EQUIPMENT MONITORED

- Examples of Current Equipment Types Being Monitored
  - Boilers and Boiler Fans
  - Chillers and Chilled Water Pumps
  - Mixing Pumps
  - Air Handlers
  - Critical Electric Motors
  - Sewage Pumps
  - Electrical Substation Equipment

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DATA COLLECTION AND EVALUATION

- Work orders are generated by MAXIMO®
- Route is downloaded to machinery analyzer
- Data is collected and downloaded into RBMWare® software
- After analysis, completed work order is returned to MAXIMO®

Continuous evaluation of program effectiveness to optimize maintenance program

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PT&I TO DATE

- Total Buildings Analyzed 135
- Buildings Chosen for PT&I 45
- PT&I Installation Complete 45
- Active Routes and Data Collection 45

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PREDICTIVE MAINTENANCE (PdM) - 3

- Acceptance of New and Re-built Equipment
  - Shall participate in the acceptance process of newly installed equipment of value
    - Verified to standards set forth in APD 8830.1, Reliability-Centered Maintenance (RCM) Program for Institutional Equipment
    - Improve initial equipment condition
    - Eliminate Installation defects
- Failure Modes and Effects Analysis (FMEA)
  - Shall perform as part of the on-going RCM/PdM program
  - Shall contain the following information
    - Address functional failure
    - Dominant failure modes
    - Failure cause and effect including root cause analysis
    - Recommended actions to eliminate or prevent reoccurrence

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OVERSIGHT

- Oversight for the RCM Program is provided by the Plant Engineering Branch JCM Program Office
- The Plant Engineering Branch will use PT&I technologies to review work performance and PT&I and FMEA data collected by contractor personnel