

Federal Energy Management Program (FEMP) Operations and Maintenance Best Practices Guide

Greg Sullivan, PE, CEM
Pacific Northwest National Laboratory
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Pacific Northwest National Laboratory

Presentation Overview

- ❖ Operations and Maintenance Best Practices Guide (O&M BPG) genesis
- ❖ O&M BPG goals
- ❖ O&M BPG layout and content
- ❖ Current status
- ❖ Future delivery

Acknowledgements

- ❖ PNNL co-authors: Ray Pugh, Aldo Melendez
- ❖ PNNL graphics/editing staff: Dave Payson, Kathy Neiderheiser, Cindy Gregg
- ❖ FEMP visionaries: Ab Ream, Beth Shearer

O&M BPG Development: For whom, why, and how?

- ❖ Target audience - Federal O&M/energy/facility managers and practitioners
 - ✓ Understaffed and being "squeezed"
 - ✓ Movement towards "contracted services"

Question: private sector similarities?

O&M BPG Development: For whom, why, and how?

- ❖ Recognition that O&M is a “resource”
 - ✓ Compares well with other efficiency-related activities
 - ✓ Should be considered as the “*first*” option before capital upgrade
 - Low-cost nature of opportunity
 - Measures usually done with in-house staff
 - Can have immediate payback (no sharing of savings)
 - Minimum upfront cost/time for design, bids, evaluation, etc.

O&M BPG Development: For whom, why, and how?

- ❖ Based on interaction with Federal staff
 - ✓ FEMP O&M Management workshop
 - ✓ On-going work at various sites
- ❖ Literature searches
- ❖ Equipment vendors
- ❖ Industry experts

O&M BPG Development:

DISCLAIMER

- ❖ This guide is NOT the universe of O&M
- ❖ This guide is not a “cookbook”
- ❖ We recommend modifications only within *“manufacturer’s specification”* and guidelines
 - ✓ *“Manufacturer’s specification”* supercede BPG recommendations

O&M BPG Development: *DISCLAIMER*



Actions and activities recommended in this guide should only be attempted by trained and certified personnel. If such personnel are not available, the actions recommended here should not be initiated.



O&M BPG: Layout and Contents

- ❖ Chapter 1 - Info
- ❖ Chapter 2 - Rational for enhanced O&M
- ❖ Chapter 3 - O&M Management issues
- ❖ Chapter 4 - CMMS
- ❖ Chapter 5 - Maintenance programs
- ❖ Chapter 6 - Maintenance technologies
- ❖ Chapter 7 - O&M procedures

O&M BPG: Layout and Contents

- ❖ Chapter 8 - O&M Horizons
- ❖ Chapter 9 - 10 steps to *Operational Efficiency*

- ❖ *Appendix A - Glossary*
- ❖ *Appendix B - Federal contact list*
- ❖ *Appendix C - O&M orgs./trade groups*
- ❖ *Appendix D - Suggestion form*

O&M BPG Chapter 3: O&M Management

- ❖ OMETA concept
- ❖ Measuring your O&M program
 - ✓ Metrics to consider
- ❖ Program implementation
 - ✓ Develop a path for success
- ❖ Selling O&M to management
 - ✓ Language of the decision makers
 - ✓ Educate the management chain



O&M BPG Chapter 4: Computerized Maintenance Management Systems

- ❖ **CMMS capabilities**
 - ✓ Know what you want
- ❖ **CMMS selection**
 - ✓ Know what you can afford
 - Installation costs, staff time, upkeep
- ❖ **CMMS pitfalls**
 - ✓ Selection, training, commitment
- ❖ **Benefits**
 - ✓ Optimization

O&M BPG Chapter 5: Maintenance Programs

- ❖ Program types, advantages/disadvantages
 - ✓ Reactive maintenance
 - ✓ Preventive maintenance
 - ✓ Predictive maintenance
 - ✓ Reliability centered maintenance (RCM)
- ❖ Guidance in RCM program development
 - ✓ Steps to design

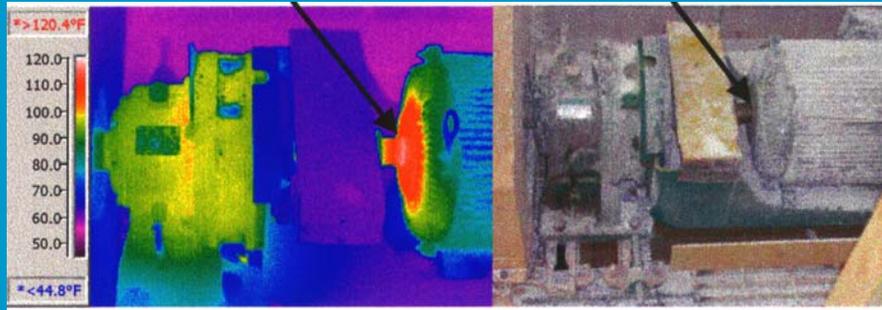
O&M BPG Chapter 6: Predictive Maintenance Technologies

- ❖ Present equipment descriptions and operating principles
 - ✓ Operation of technology
 - ✓ Applications
 - ✓ Cost effectiveness/typical paybacks
 - ✓ Case studies

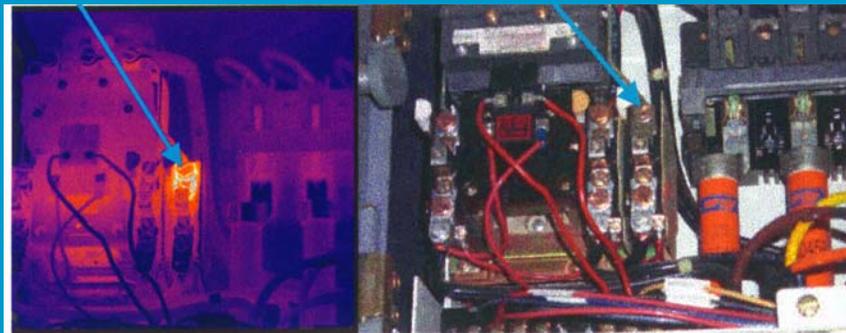
O&M BPG Chapter 6: Predictive Maintenance Technologies

- ❖ Presented by technology with costs and case studies
 - ✓ Thermography
 - ✓ Oil analysis
 - ✓ Ultrasonic analysis
 - ✓ Vibration analysis
 - ✓ Motor analysis
 - ✓ Performance trending

O&M BPG Chapter 6: Thermography



Motor bearings



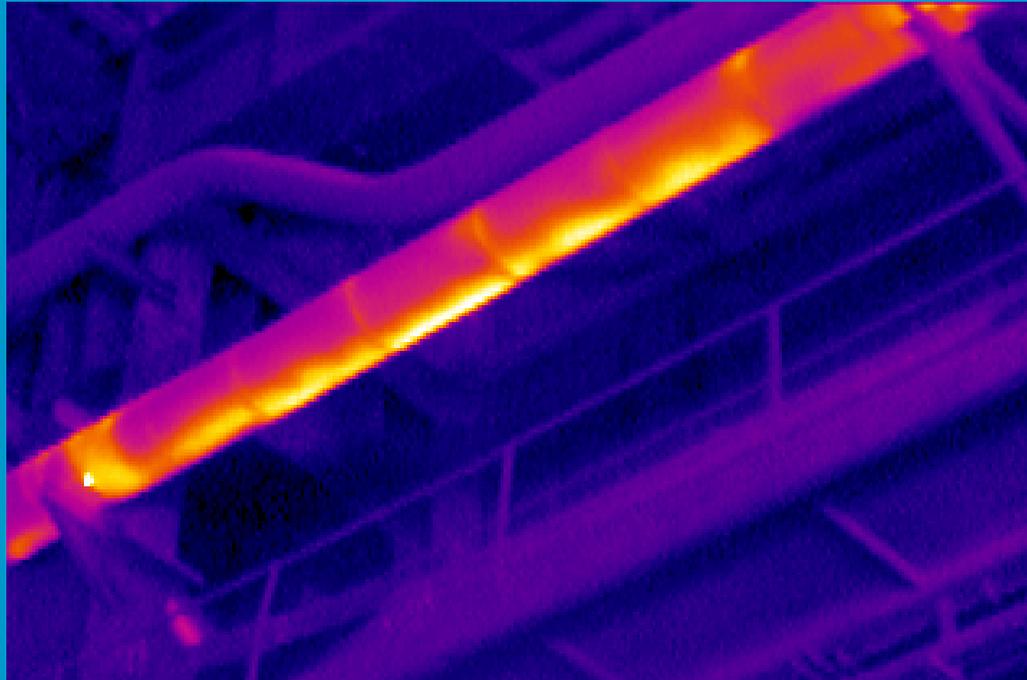
Electrical contacts

O&M BPG Chapter 6: Thermography



Trending of a motor coupling

O&M BPG Chapter 6: Thermography



Insulation differences

O&M BPG Chapter 7: O&M Ideas for Major Equipment Types

- ❖ Present equipment descriptions and operating principles
 - ✓ Key components, failure modes
 - ✓ Cost/efficiency
 - ✓ Recommended O&M activities
 - Maintenance checklists
 - ✓ Safety issues

O&M BPG Chapter 7: *Safety Issues*

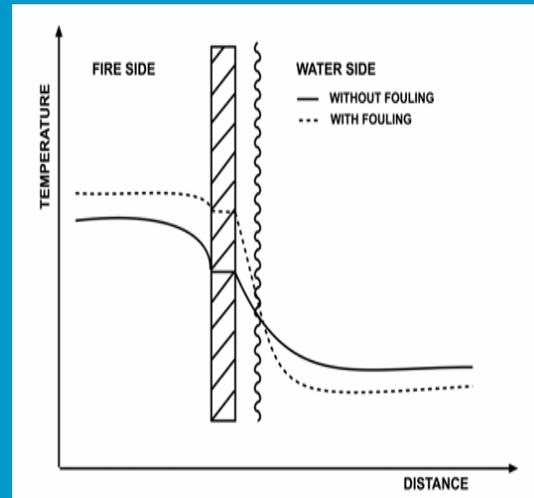
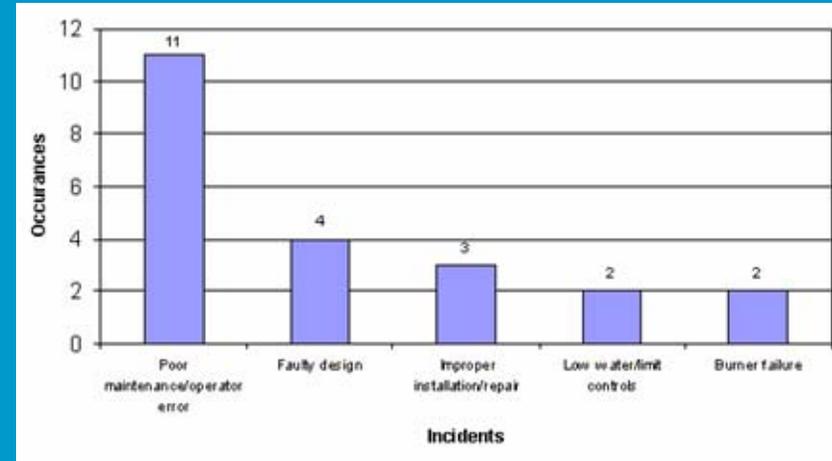
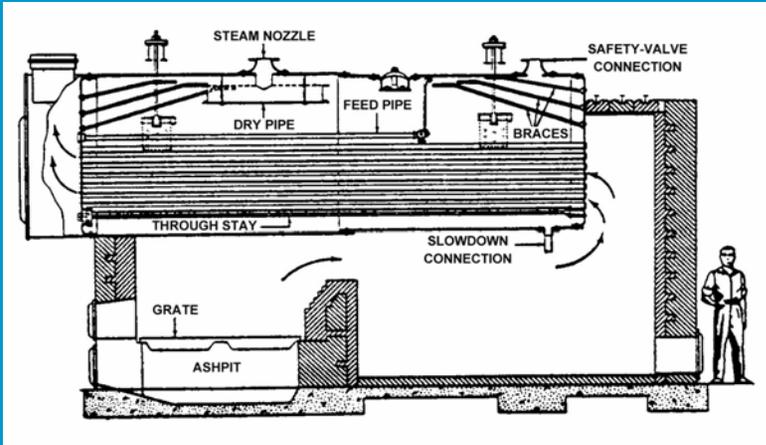
CAUTION

IF YOU THINK OSHA IS
A SMALL TOWN IN
WISCONSIN:
**YOU'RE IN
TROUBLE!**

O&M BPG Chapter 7: O&M Ideas for Major Equipment Types

- ❖ Boilers
- ❖ Steam traps
- ❖ Chillers
- ❖ Cooling towers
- ❖ Energy Management Systems
- ❖ Pumps
- ❖ Fans
- ❖ Electric motors
- ❖ Air compressors
- ❖ Lighting

O&M BPG Chapter 7: O&M Ideas for Major Equipment Types – Boilers



Battelle

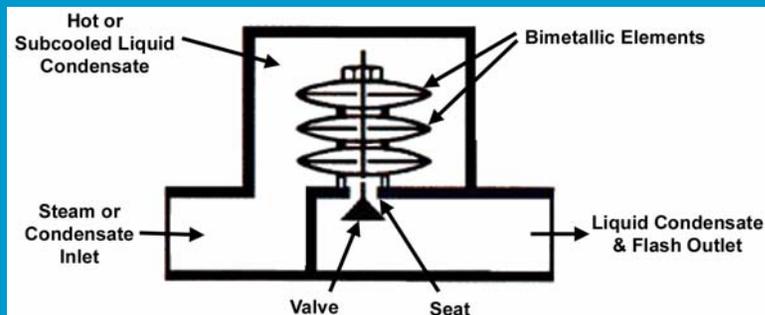
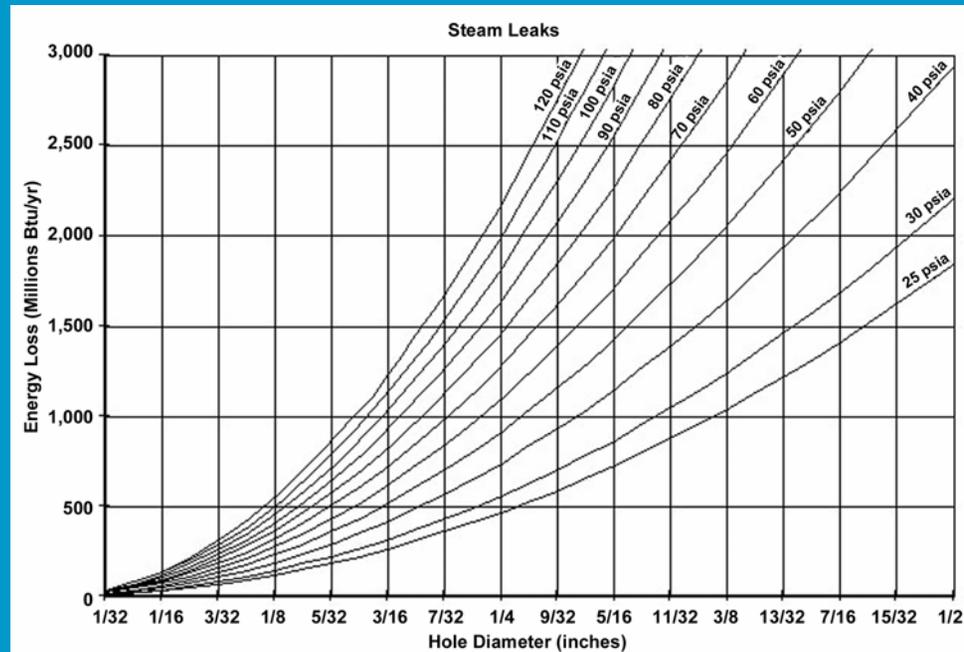
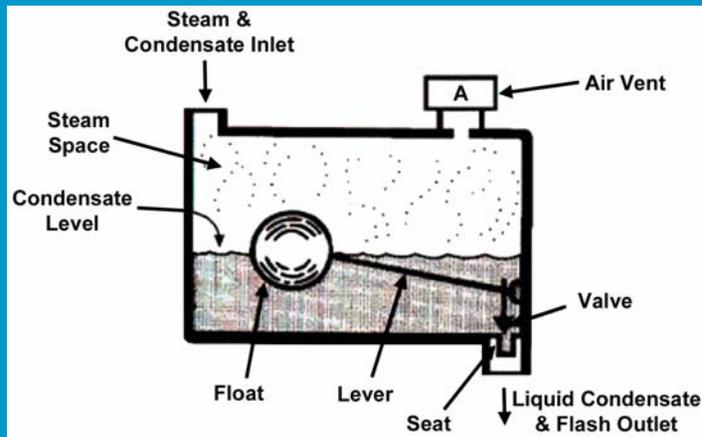
Reprinted with permission of The Boiler Efficiency Institute, Auburn, Alabama.

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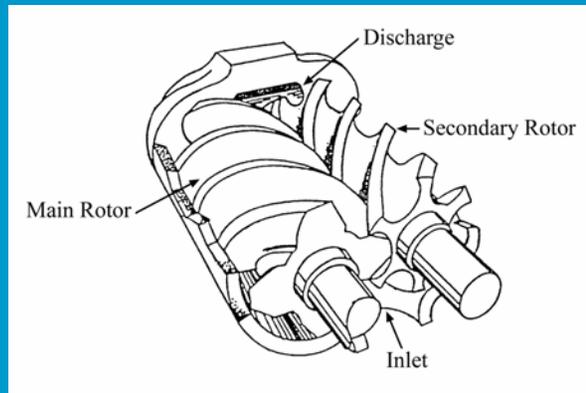
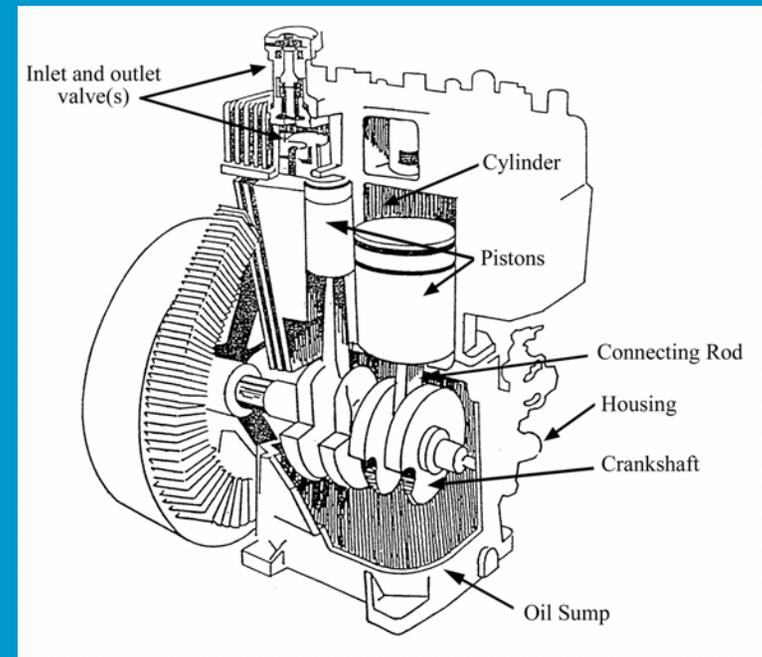
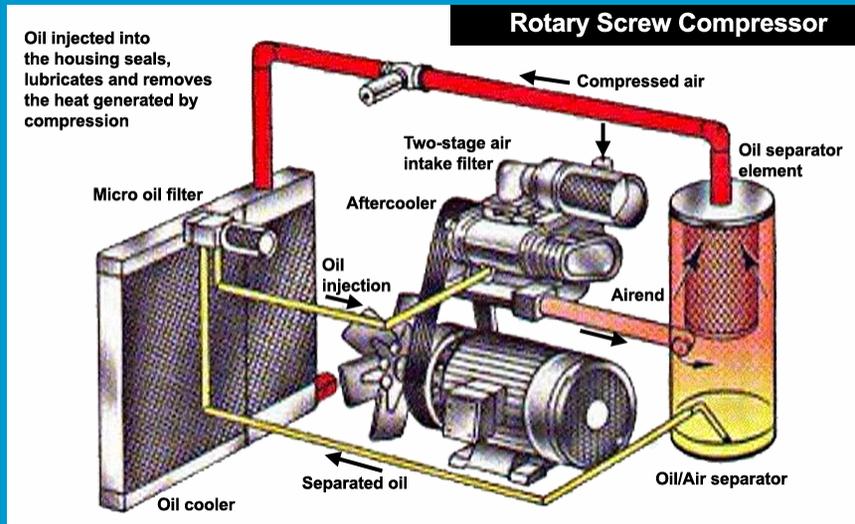
O&M BPG Chapter 7: O&M Ideas for Major Equipment Types – Boilers

Description	Comments	Maintenance Frequency			
		Daily	Weekly	Monthly	Annually
Boiler use/sequencing	Turn off/sequence unnecessary boilers	X			
Overall visual inspection	Complete overall visual inspection to be sure all equipment is operating and safety systems are in place	X			
Follow manufacturer's recommended procedures in lubricating all components	Compare temperatures with tests performed after annual cleaning	X			

O&M BPG Chapter 7: O&M Ideas for Major Equipment Types – Steam Traps



O&M BPG Chapter 7: O&M Ideas for Major Equipment Types – Air Compressors



O&M BPG Chapter 8: O&M Frontiers

❖ New tools and technologies

- ✓ HVAC Service Assistant
- ✓ Decision Support through Operations and Maintenance (DSOM[®])
- ✓ Performance and Continuous Commissioning analysis Tool (PACRAT[®])
- ✓ Whole-Building Diagnostician (WBD)

O&M BPG Chapter 9: Ten Steps to *Operational Efficiency*

- ❖ Ten-step process to operations and maintenance serenity
 - ✓ Increasing management awareness... tracking O&M activities
 - ✓ I.D. troubled equipment/systems... addressing ONE of these systems
 - ✓ Operate this ONE system efficiently... purchase/contract some form of diagnostics capability
 - ✓ Complete project and highlight success... Begin again!

O&M BPG: Next Steps and Future

- ❖ Release 1 currently available

- ✓ Hard copy
- ✓ CD ROM version (pdf. Of hard copy)
- ✓ FEMP web site:

www.eere.energy.gov/femp

- ❖ Release 2 to include updates and new sections

- ✓ O&M contracting
- ✓ Metering for O&M

- ❖ Considering development of an "interactive" web/training version of guide

FEMP O&M BPG Contact

Greg Sullivan

PNNL

gp.sullivan@pnl.gov

FEMP website

www.eere.energy.gov/femp

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