


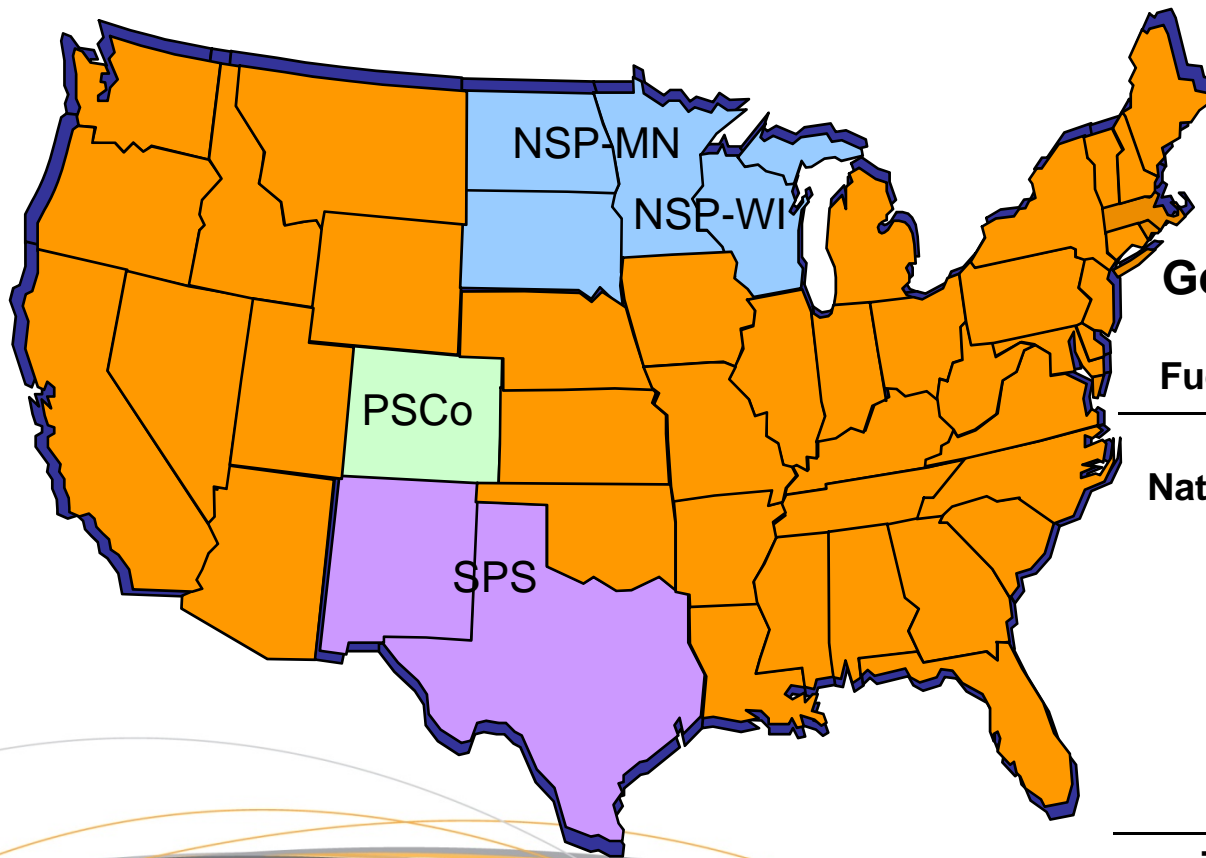
# Value Received: Xcel Energy's Use of Boiler Explosive Cleaning Guides

**VP Technical Services  
Mark D Freeman**

**EPRI Generation Council Meeting  
Scottsdale, Arizona  
February 23, 2012**



# Xcel Energy's Footprint



## Generation Units Owned

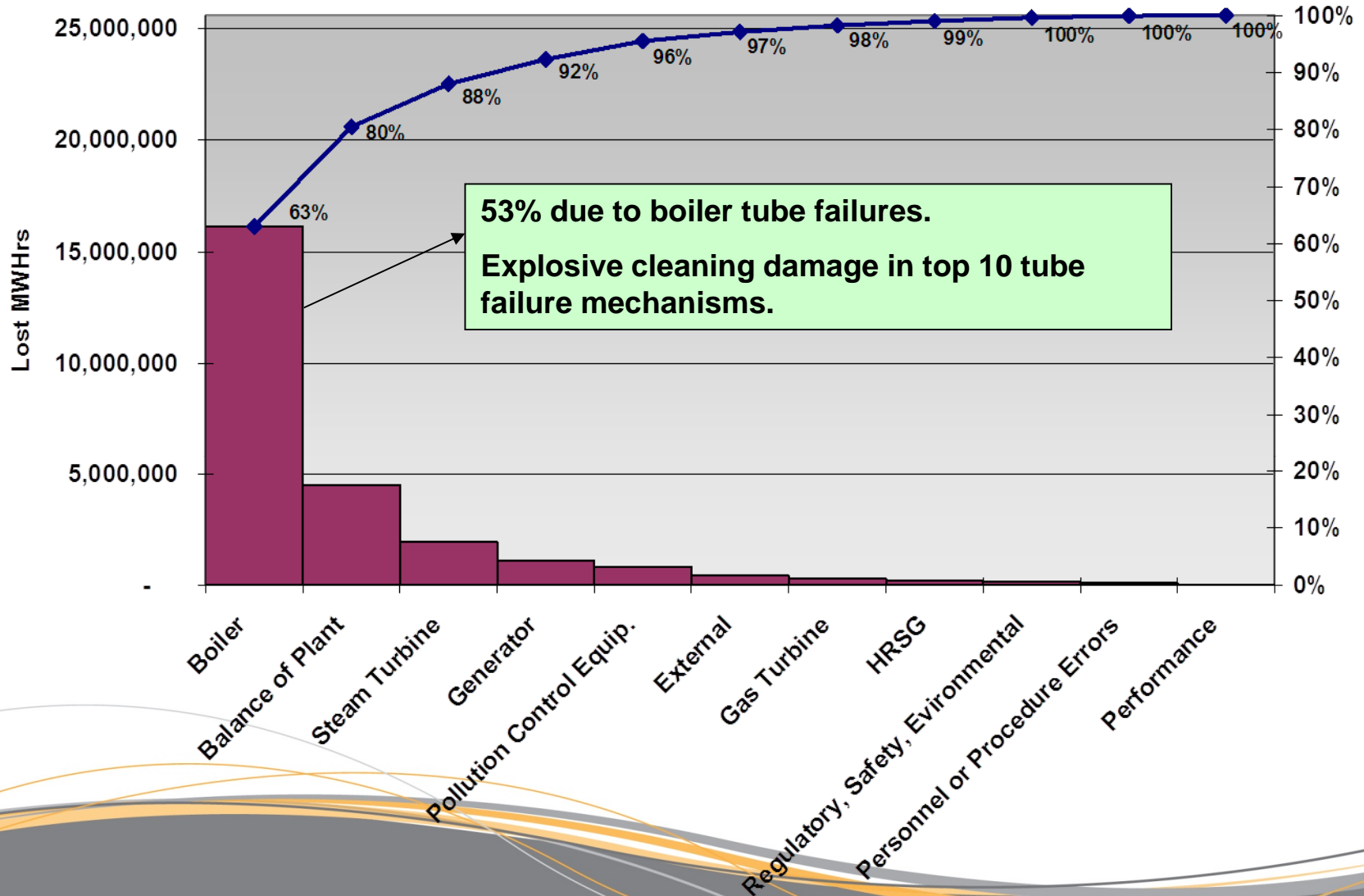
Fuel Type	Units	NMC
Coal	42	9541 MW
Natural Gas	63	6008 MW
Nuclear	3	1679 MW
Oil	6	10 MW
Hydro	79	624 MW
RFD	6	53 MW
Wind	238	327 MW
Solar	4	76 KW
<b>Total</b>	<b>441</b>	<b>18,241 MW</b>

# Background

- Many coal units experience slagging.
- Explosives used to remove and control slag.
  - Advantages –
    - ✓ Less cleaning time
    - ✓ Enhanced personnel safety
    - ✓ Reduced scaffolding
  - Disadvantages –
    - ✓ Tube damage not commonly detected during cleaning
    - ✓ Varied time frame for failures
    - ✓ Significant cause of failures



# Xcel Energy's Experience (2003 - 2007)

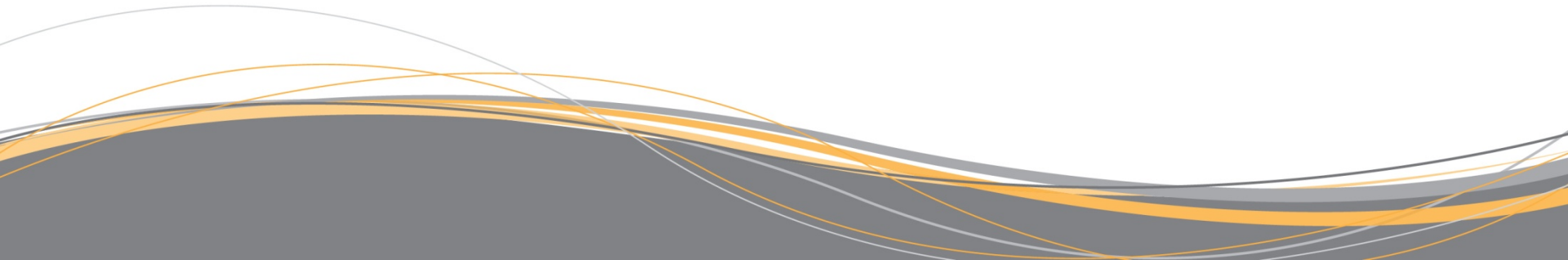


# EPRI Boiler Project Overview

- **Project dates: May 2007 thru May 2010**
- **Seven utilities participated**
- **Primary contractor – Colorado School of Mines**
- **Goals of the project –**
  - **Characterize the damage mechanism**
    - ✓ **Determine explosive parameters that lead to ID initiated brittle type cracking**
  - **Develop practices to minimize or eliminate explosive-related damage**
- **Final report – “Evaluation of Explosive Cleaning Damage in Ferritic Boiler Tubes”, EPRI Report 1022262**



# EPRI Boiler Project Overview

- **Major Findings... tubes susceptible to –**
    - **Accumulated blasting damage**
    - **Explosive charge type, amount, orientation, standoff distance, etc.**
    - **Service age of boiler tubes including number of starts and cycling operation**
- 

# EPRI Boiler Project Overview

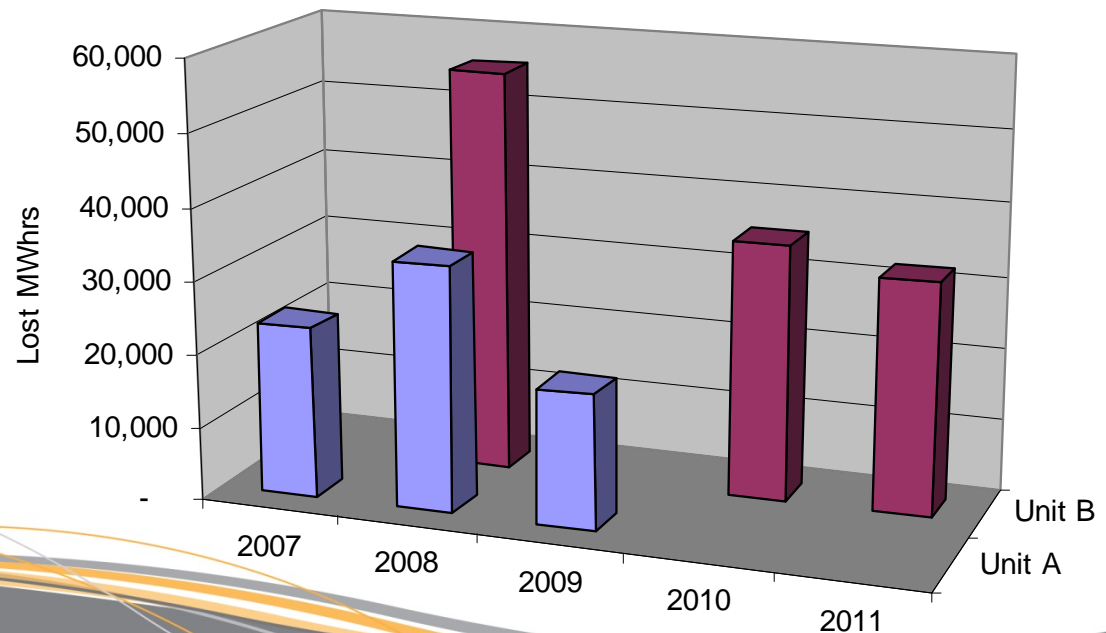
## ➤ Recommendations –

- **Charge type – dynamite best, avoid detonating cord and binary explosives**
- **Charge size – smaller multiple charges are better than one large charge**
- **Charge orientation – standoff distance at least 4X the charge diameter, charge orientation of 0 to 30 degrees**
- **Good processes – document location and specifics, perform UT or RT inspections of cleaned areas**



# Xcel Energy's Actions and Early Results

- **Developed and deployed boiler explosive cleaning procedures.**
- **Setting expectations with contractors.**
- **Documenting explosive cleaning locations and specifics.**
- **Performing NDE on cleaned areas.**







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