



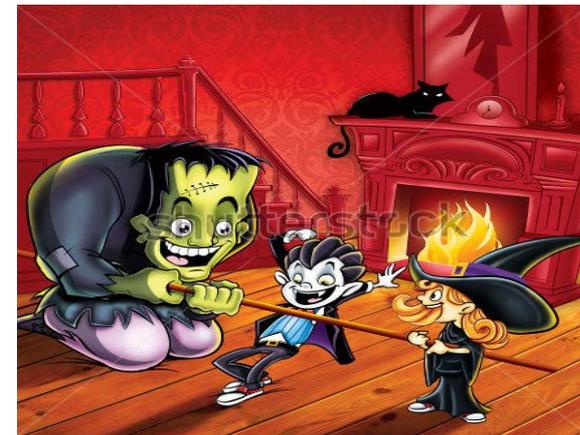
# Fermi Dose - Road to Top Quartile

Comprehensive Strategy / Activities – No Single Magic Bean  
Never Ends – Never a Final Victory

- Changing Excellence Bar – If others are getting better then you are getting worse
- Changing technologies
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- Ever changing plant (aging, up-rates, modifications, chemistry)

EPRI Key Strategy Areas

- Reducing Source Material
- Controlling Activation and Transport
- Controlling Out-of-Core Deposition
- Decontamination



How low can you go????

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	Outage	On-line
2009	106.851	41.995
2010	94.663	51.827
2011	N/A	24.080
2012	116.564	28.409
2013	N/A	*26.147

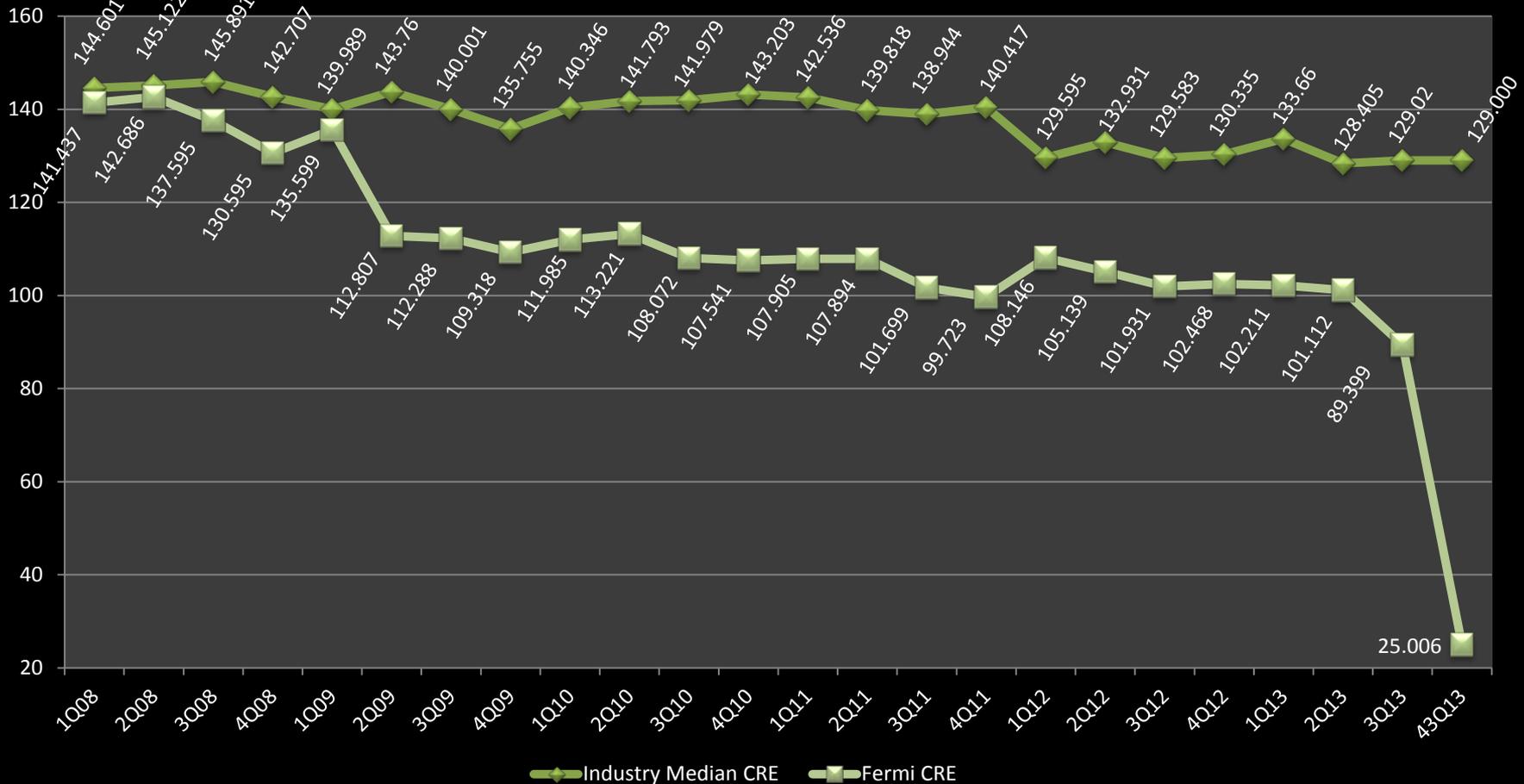
\* ED dose

# Fermi 2 CRE Vs. Industry Median

## Annualized by Plant Cycle (INPO Data – BWRs)



Fermi CRE vs Industry Median INPO Data - BWRs  
Normalized to Operating Cycle





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## Key Focus Areas

- Physical Plant
- Processes
- People / Engagement



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The Plant – eliminating / reducing source material (stellite)

- Replaced 20 CRBs in RF01
- Replaced remaining 165 CRBs in RF02
- Valve seats in condensate feedwater system valves replaced (1992-1996)
- Removed stellite containing LP turbine blades in RF05
- Replaced stellite components on 17 targeted system check valves in RF05
- Removal of stellite in HP turbine (1997)
- RWCU pump impellers replaced with electro polished (2000)



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## Processes

- Implemented use of depleted zinc following RF04
- Implemented Hydrogen water Chemistry following RF05
- RWCU use strategy maintains Co removal efficiency greater than 95%
- Restricted HWC changes (dialing up / down)
- Implemented On-line Noble Chemistry (2011)
  - HWC reduction of 95 scfm to 11 scfm (10 rem/year reduction)
- Station ALARA Committee (SAC) Effectiveness
  - Work plan challenges (400 mrem on-line / 1000 mrem outage)
  - Monthly dose goal approval
  - 5-year dose reduction plan approval and oversight
- Implemented Station ALARA sub-committee
  - Internal challenge for work groups with monthly goal > 50 mrem
  - Monthly presentation at SAC on previous month dose deltas  $\pm$  20%
  - Develop and challenge outage SAC presentations



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## Processes – Work Management Integration

- Work management procedure identifies high/med radiological risk activities
- Targeted implementing procedures/work packages contain RP sign-offs
- RPM required signature for all scope change forms
- RP required quorum member for modification process meetings
- RP / ALARA activities embedded in modification process procedures
- T-17 – identify work >400 mrem or med/high risk
- T-9 – confirm scope, initiate integrated walkdown, initiate ALARA planning
- T-6 confirm scope, drive status of integrated walkdown, draft ALARA plan
- T-4 ALARA transfer to RP Ops, assigns techs, finalize RWP/ALARA plans
- T-2 verify all plans and radiological controls in place
- T-2 all work groups discuss dose plan/high risk activities for the week
- Work groups discuss dose deltas at daily station brief
- T+1 all groups discuss dose performance/deltas and actions to correct
- Emergent dose approval required for all dose not approved at monthly SAC
  - FLS 10 mrem, RPM 25 mrem, Plant Manager 100 mrem, SAC 400 mrem



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## Processes - Outage specific

- Chemistry controls
- Contingency plan (72 hour SAC)
- Electro polishing of RCWP surfaces during construction
- Control of Rx flood-up and drain activities
- Key RP activities must be in schedule
  - Shielding sequencing
  - Flushing activities / sequence
  - RCWP flushes
  - Cavity vacuum
  - Cavity decon and support activities
  - Tri-Nuc preparedness and use



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## Engagement / People

- Rewards and recognition
- Dose Visibility
  - Daily briefs
  - Scope meetings / forms
  - Trip Tickets
  - Outage orientations
  - Incentive plans
  - Outage prep meetings
  - Annual appraisals
  - Integrated into T-week processes



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## Engagement / People – Examples

- Scaffold activities top of torus (2 rem/year)
  - Scaffold supervisor and Engineering
- Contaminated ducting following valve failure (5 rem)
  - Maintenance
- Torus dose rate challenge following RF15 (2.5 rem/year)
  - Chemistry and operations
    - Strategic use of torus water mgmt during surveillance activities (HPCI, Core Spray)

# CO<sub>2</sub> Remediation of Contamination HVAC Ducting



## Initial Conditions

- Equipment malfunction resulted in contamination of 1600 ft of HVAC ducting with a water/resin mix.
- Dried resin slurry inside ducting up to 150,000 dpm/100 cm<sup>2</sup>
- The contamination occurred along the entire length of exhaust ducting from the RadWaste Basement to the exhaust plenum.
- Much of ducting in radwaste processing areas controlled as High and Locked High Radiation Areas
- Ducting located in overhead areas with limited access

# CO<sub>2</sub> Remediation of Contamination HVAC Ducting



## Dry Ice/CO<sub>2</sub> Technology

This technology provided for decontamination of the ducting significantly below the cost of alternative options that would involve replacement of large parts of ducting and disposal of large quantities of radioactive waste.

- Manual or robotic applications (minimal maintenance/scaffold support required)
- CO<sub>2</sub> removal technology coupled with HEPA collection
- Strategic exit and entry points (limited breach points)
- No process water and minimal dry active waste generation
- Contamination levels below 1000 dpm/100 cm<sup>2</sup> with most <500 dpm/100 cm<sup>2</sup>
- No safety issues, no airborne events, no HRA/LHRA events, completed for 243 mrem



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## 2013 Key Learning – Use of Mock-ups

- TIP Replacement
  - Access points
  - Travel paths
  - Equipment use and sizing
- Removal of 70 filters from SFP
  - Personnel placement
  - Proficiency with tooling and maneuvers
  - Match marking
- RWCU pump seal replacement
  - Integrated (maintenance, RP, RW) JIT (disassembly, transport, re-assembly)
  - Hold points, body positioning, focal areas, beta controls
- Receipt and loading of new 2200 curie source into new irradiator
  - Receipt, loading, transport
    - Matchmarking floor and irradiator, escape paths, rigging length, tools, travel path



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## Next Steps

- EPRI Assessment
  - 34 valves risk ranked for stellite removal
  - Jet pump wedges risk ranked for stellite removal
  - Next generation resin / applications
  - Targeted system / area decontamination
  - Installation of clean-out taps
  - Permanent and temporary shielding applications
  - CZT applications
  - RWCU modifications to allow enhanced outage use



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RP has to be the driver / energy

- Expertise
- Reward
- Boot
- Push / Pull
- Poke / Prod

