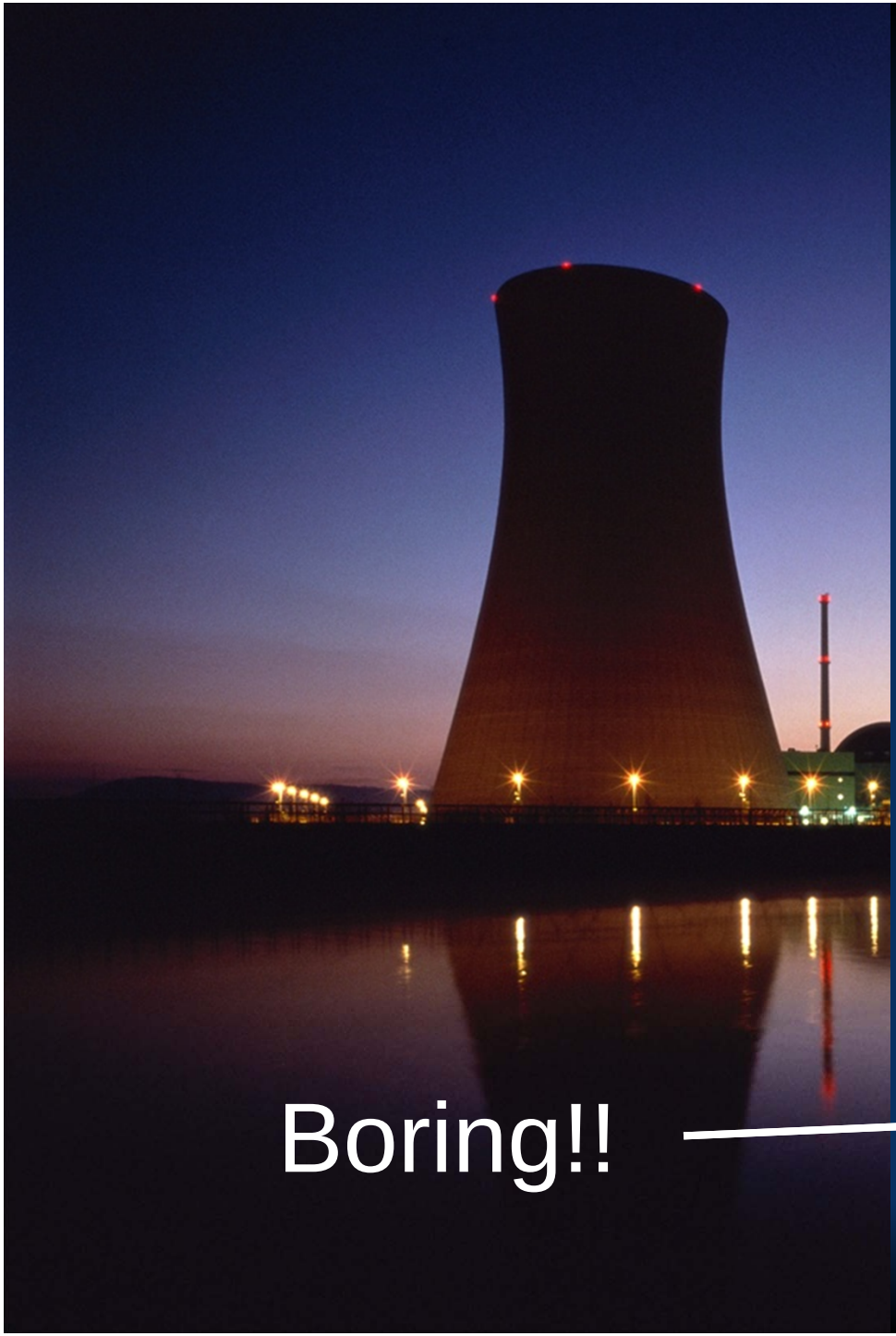


CURTISS WRIGHT Flow Control Company NETCO

Long Term BORAL Corrosion Performance

NEI Used Fuel Management Conference

M. Eyre

Boring!!

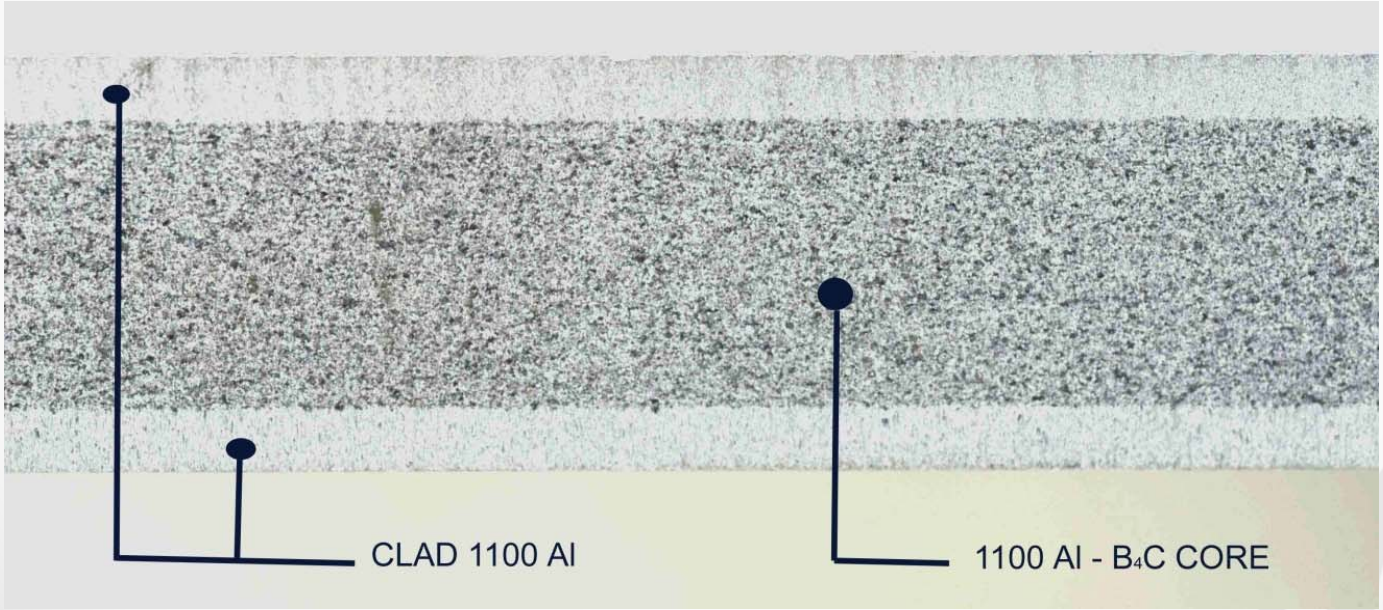
BORAL

Description

- Aluminum metal matrix cermet
  - Hot rolled composite sheet
  - Core of boron carbide and 1100 aluminum
  - Cladding of 1100 aluminum

What's a "cermet"?

A composite composed of ceramic and metallic materials.



BORAL Applications

- Provide criticality control
- Fuel storage and transportation
- Neutron absorber panels enclosed in rack/basket cells
- Wet pool
- Dry spent fuel casks (storage/transport)
- New fuel transport

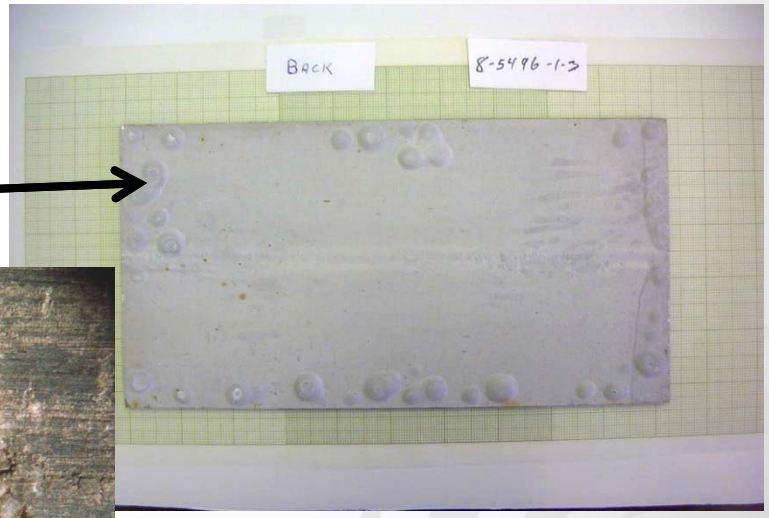
What absorbs the neutrons?

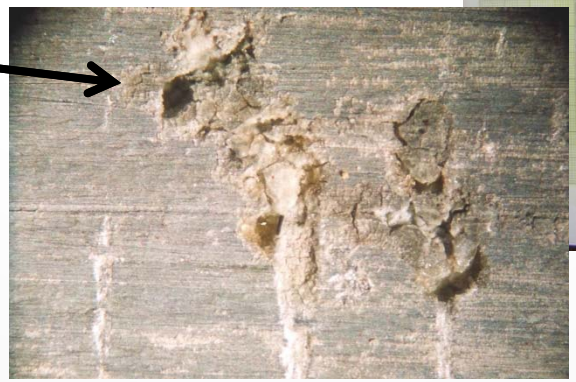
Boron, specifically B10 which is 20% of naturally occurring boron.

Performance Concern

- Neutron absorbing materials have a direct impact on safety
- Prevent the occurrence of inadvertent criticality events in the SFP
- NRC staff has identified this issue as potentially safety significant
- Boral specific concerns
  - Blistering
  - Pitting
  - General corrosion

Were some of these bullets taken from Emma Wong's presentation?





Boral Testing

- AAR qualification (1977-1978)
- AAR mechanical property testing (1993-1994)
- EPRI cask drying testing (2003-2004)
- Plant surveillance testing - ongoing
- Long term accelerated corrosion
  - Project approval – spring 2012
  - Material characterization, bath setup – summer/fall 2012
  - Corrosion test start January 2013

Ancient history!!

What's being done now?!

Oh….

Long-Term Corrosion Testing

Sponsored by EPRI

- Elevated temperature – 195°F (90.5^{o}C)
- Five year duration
- Encapsulated and general coupons
  - “Encapsulated” simulates stainless wrapper plate
- BWR & PWR environments
- Material in test population
  - AAR archive material
  - Ceradyne new production
  - Plant archive material

Why 5 year?

Gain insight into future performance of BORAL.

So, I can quit my site surveillance program?

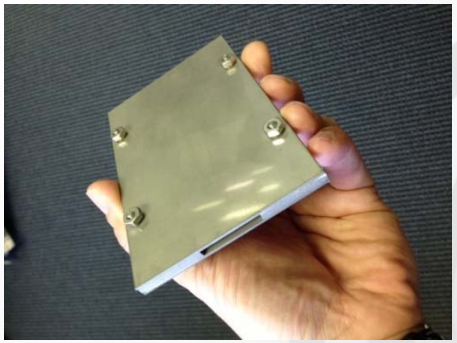
No…

Rats!!

Test Population and Test Schedule

Coupon Type/Test	1 year	2 year	3 year	4 year	5 year
BWR/PWR					
Un-encapsulated AAR	6	6	6	6	6
Un-encapsulated Ceradyne – AAR process	6	6	6	6	6
Un-encapsulated Ceradyne – Ceradyne process	6	6	6	6	6
Encapsulated AAR	6	6	6	6	6
Encapsulated Ceradyne – AAR process	6	6	6	6	6
Encapsulated Ceradyne – Ceradyne process	6	6	6	6	6
Encapsulated Utility Archives					10

Can you read that? I can't read it!
What's a "capsule"?



Oh,

Scope of Coupon Tests

Test	Pre-Test Characterization	Post-Test Characterization
Visual Inspection	✔	✔
High resolution photography	✔	✔
Dimensions	✔	✔
Dry weight	✔	✔
Neutron attenuation	✔	✔
Blister characterization	✔	✔
Surface characterization via metallography for:		
Oxide film	✔	✔
Pit size and depth	✔	✔

Blah,
Blah,
Blah…

Testing Progress

- Test started January 11 2013
- First coupons to be withdrawn and tested January 2014
- Routine chemistry monitoring – measured parameters
  - Temperature
  - pH
  - Conductivity
  - Chlorides, fluorides, sulfates, aluminum and boron

I think “routine” means he doesn’t know how often…

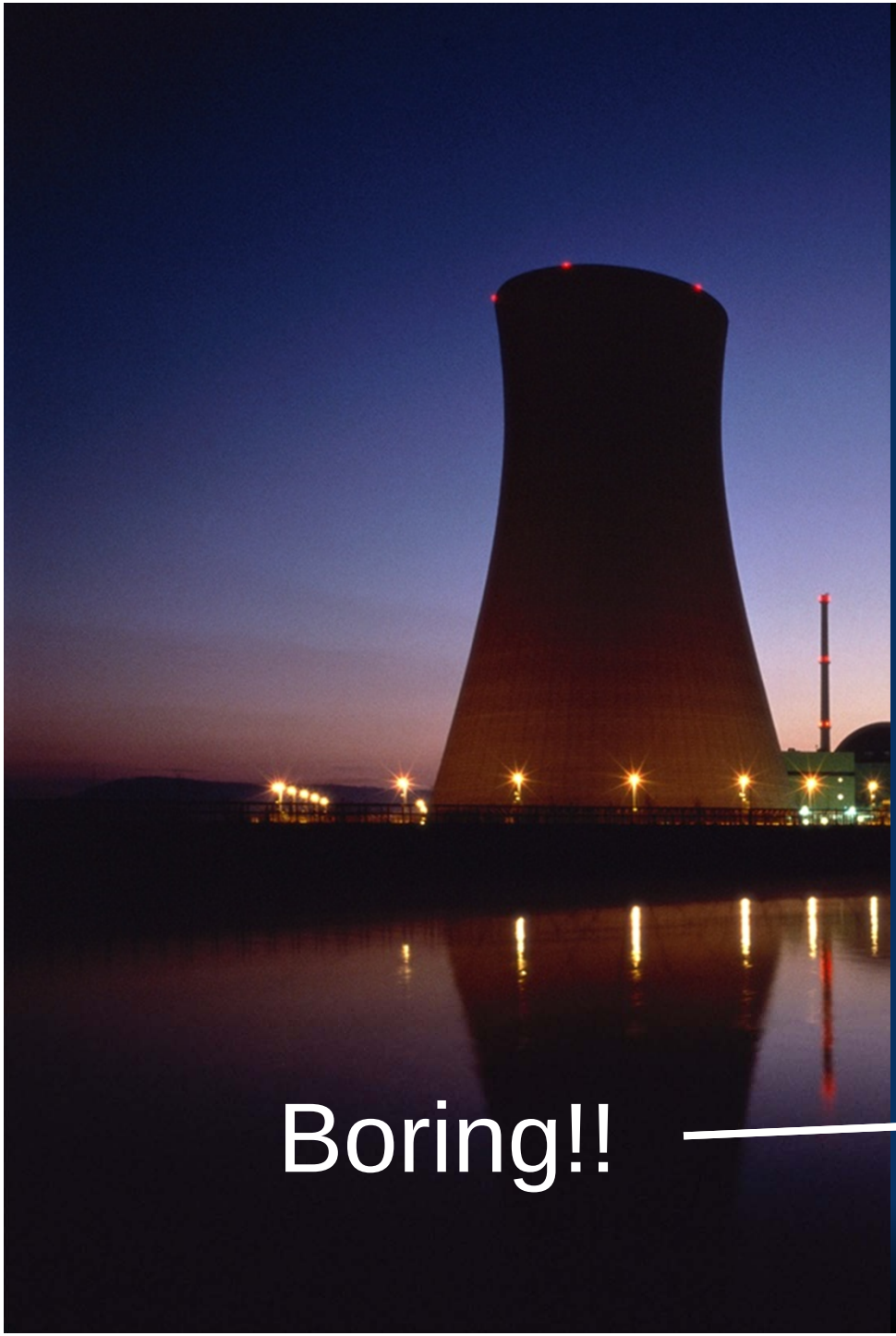
Reporting results

- Annual informal report (progress presentation) to EPRI Neutron Absorber Users Group (NAUG)
  - NAUG meetings historically in early August
- Final formal report as EPRI publication at the end of the five year test

Formal like this?

Questions?

Expect the best from NETCO



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