EPRI Alpha Monitoring and Control Guidelines for Operating Nuclear Power Stations, Revision 2 (3002000409)

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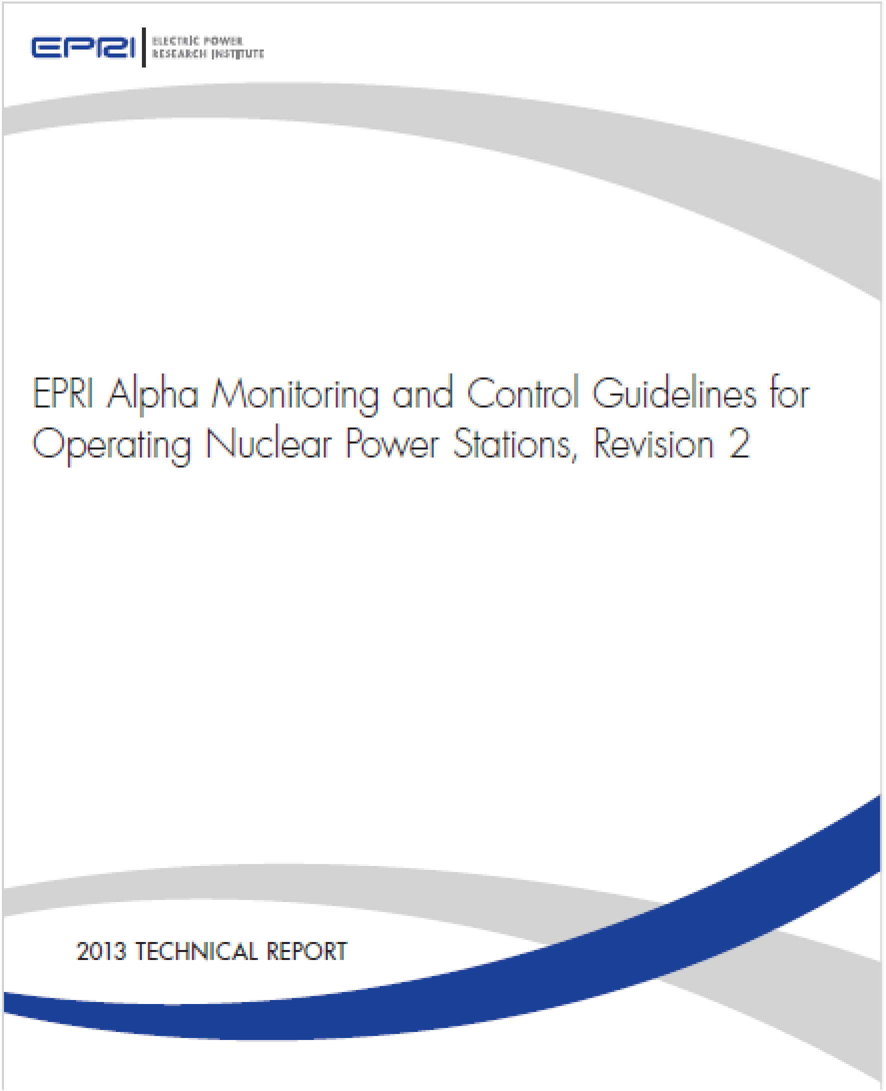
Outline

- Overview of Radiation Management Program
- EPRI Alpha Guidelines:
  - ✓Importance of Alpha
  - ✓History of Guidelines
  - ✓New Guidance
  - ✓Implementation



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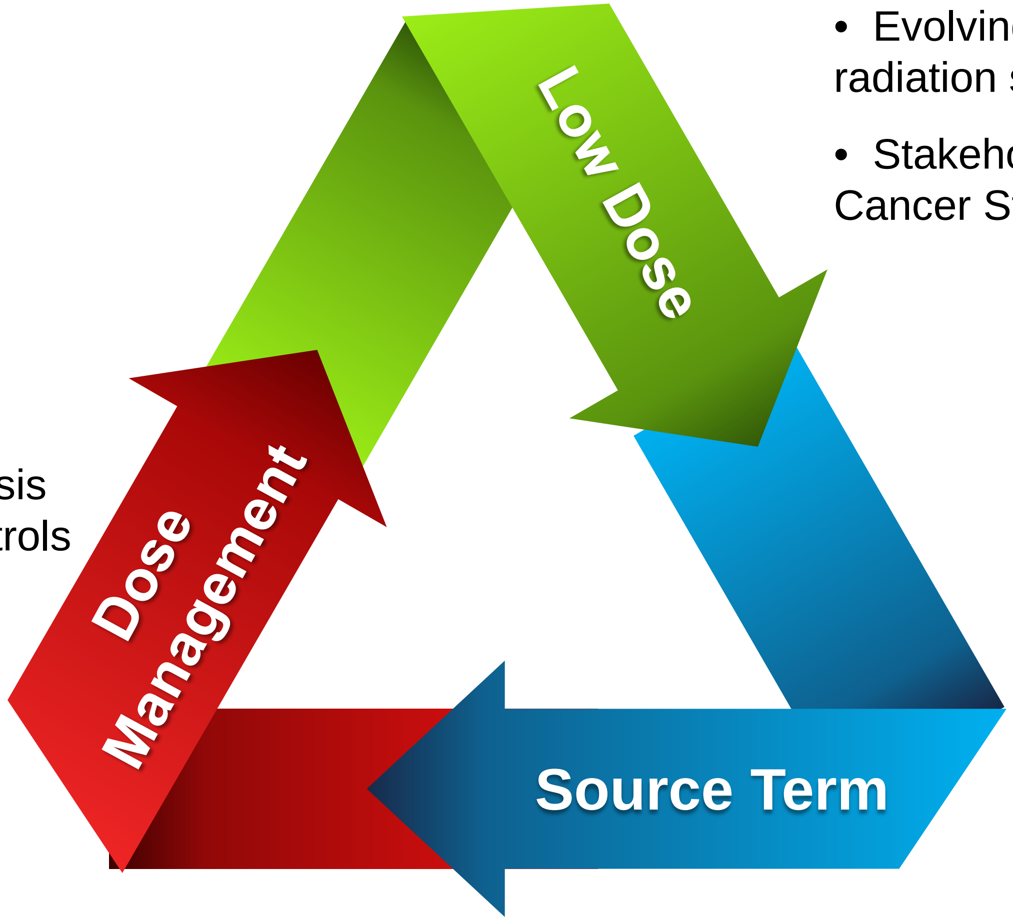
Radiation Management Program Elements



- Evolving science impacting radiation safety standards
- Stakeholder concerns (e.g. Cancer Study)

- Lower dose limits
- More challenging performance goals
- Increased emphasis on radioactivity controls

- Understanding the impact on radiation fields
- Chemical, materials and fuel Impact

Radiation Management Research Plan

Source Term and Radiation Field Basic Science

- Chemistry Impacts on Dose Rates (in progress)
- SRMP/BRAC Revision (in progress)
- Plant Managers' Guides to Co Reduction w/INPO (complete)

Optimization and Dose Reduction Technologies

- Optimization of Cavity Decontamination w/EDF (in progress)
- Reactor Headset Optimization w/NMAC (in progress)

Improved Dosimetry and Planning

- 3D ALARA Planning- Algorithm (complete)
- Lower Lens Dose Limit- Gap Analysis (complete)

RP Program Guides, Guidelines, and Sourcebooks

- Alpha Guideline Revision (complete)
- EDEX Implementation Guide (in progress)
- Lens Dose Monitoring Guide (in progress)

Low Dose Health Effects Research Plan

Cancer Risks

- Evaluation of BEIR VII DDREF Analysis (in progress)
- Recommendations to the National Academies Cancer Risk Pilot Study Committee (in progress)

Non-Cancer Risks

- Scientific Appraisal of Lens Opacity and Cataract Health Studies (in progress)

Why is alpha a concern?

- Present in any plant that has had a fuel leak
- Long half-life
- Invisible to using typical gamma beta instrumentation
- Small amount inhaled = big dose

In summary, alpha is:

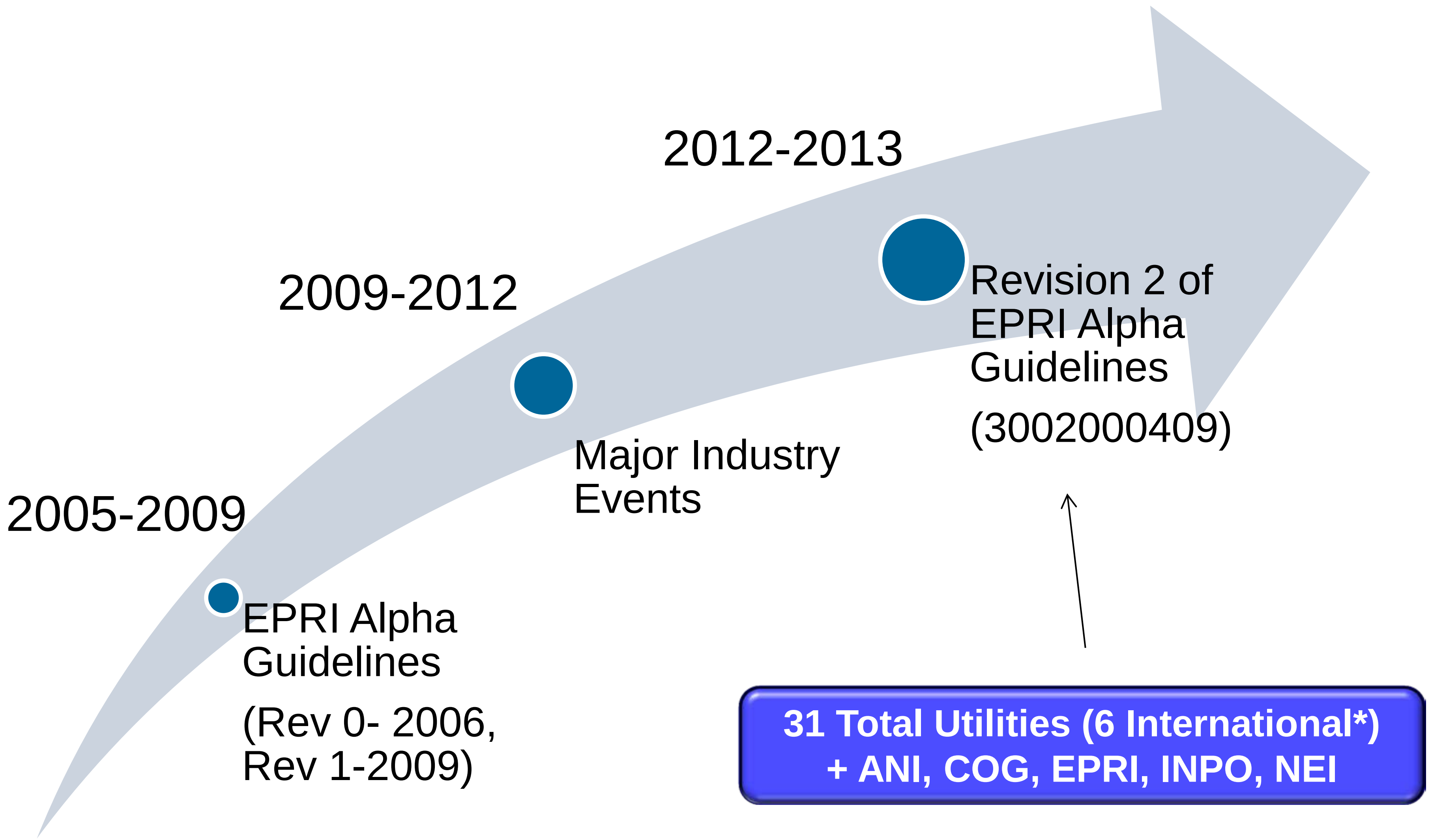
✓Highly hazardous

✓Present in most of our plants

✓Not easily detected

= Events

Alpha Monitoring Guideline, Revision 2 (3002000409)



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Why was a revision needed?

- Ongoing events involving alpha :
  - RP programs focused on beta contamination monitoring, with limited air sampling
  - Exposures from grinding on surfaces
  - Lack of preparation for conduct of bioassay
- Lack of awareness of the impact of historical fuel defects
- Need guidance on how to improve work planning to minimize potential for exposure

Outline of Guideline

- Chapter 1 Introduction
- Chapter 2 Defining the Alpha Source Term (Facility Characterization)
- Chapter 3 Alpha Monitoring
- Chapter 4 Work Controls
- Chapter 5 Individual Monitoring
- Chapter 6 Training
- Several Appendices

Clarified Guidance and Expectations for Implementation

- "Shall" is a requirement
  - **<u>A requirement is in bold text and underlined</u>**
- "Recommend" or "Should" is a recommendation
  - **A recommendation is in bold text**
  - If not implemented, then station must justify with site procedures and guidelines
- "May" or "Consider" is a beneficial practice
  - *Considerations are italicized*
  - No justification is required to not implement
- All guideline statements are marked and numbered using the format [GS-x]

Defining the Alpha Source Term

- Characterize alpha source term:
  - ✓Assess historical and current fuel cladding defects
  - ✓Determining the radionuclide distribution of alpha emitting radionuclides
  - ✓Defining the beta-gamma to alpha ratios
  - ✓Determining the alpha contamination levels in plant areas and systems

Guideline Uses a Risk Informed Approach

- Risk-informed, graded approach to monitoring based on the relative abundance of alpha emitters as compared to the beta gamma emitters

Activity Ratio (βγ/α)	**LEVEL I AREAS[1]** **(Minimal)** **>30,000**	**LEVEL II AREAS** **(Significant)** **30,000 – 300**	**LEVEL III AREAS** **(Elevated)** **<300**
% of dose from alpha in inhaled material	**<10**	**10-90**	**>90**
DAC Fraction Ratio (α/βγ)	<0.1	0.1 – 10	>10
Contamination Survey Action Levels	Count representative[1] smears for α in areas with > 100k dpm/100cm² βγ	Count representative[1] smears for α in areas >20K dpm/100 cm² βγ	Take smears and count specifically for α to adequately evaluate area
	If >100 dpm/100 cm² α, take smears and count specifically for α to adequately evaluate area		
Air Sampling Action Levels	If $f DAC_{\beta\gamma}$ >1, count air samples for α or use Continuous Air Monitors (CAMs) capable of direct alpha activity measurements[2]	If > beta-gamma DAC Fraction shown in Figure 3-1 relative to the ratio, or > "beta-gamma DAC Fraction Action Level" count air samples for α or use Continuous Air Monitors (CAMs) capable of direct alpha activity measurements[2]	Count all air samples for α or use Continuous Air Monitors (CAMs) capable of direct alpha activity measurements[2]
	If beta-gamma to alpha contamination ratio or DAC Fraction Ratio (α/βγ) is higher than expected for assigned Area Level, re-evaluate Area Level Assignment		

1. Representative smears are defined as the number and location of smears that are sufficient to adequately characterize the hazard.
2. When Continuous Air Monitors are used, they are to be capable of detecting 0.3 DAC alpha.

Added Guidance to Improve Work Planning and Control

- **Initial characterization helps with determining the baseline hazard but more is needed to establish proper work controls.**
  - **Actual amount and form of alpha activity found or suspected,**
  - **Risk of worker exposure due to the work activity**

  [GS-22]
- Example:
  - Area with 100 dpm/100cm² alpha contained in dirt or dust may pose a greater threat than 3000 dpm/100cm² alpha contained in an oily film.

Work Control Guidance

1. Risk Assessment
2. Radiological Work Control Considerations
3. Field Monitoring Considerations
4. Personal Dosimetry and Stop Work Controls, Limits, and Authorities
5. Monitoring of Equipment, Materials and Personnel and Selection and Use of Protective Clothing
6. Job Coverage and Communications
7. Investigating Potential Alpha Exposures from Incidents

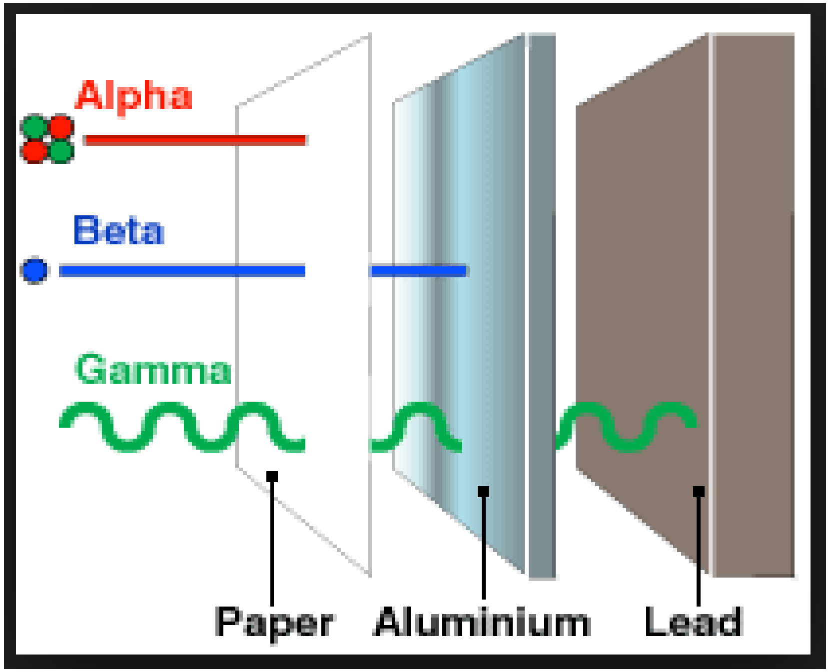
Expanded In-Vitro Bioassay Guidance

- Added more techniques for individual monitoring (excreta)
- Added guidance for developing procedures that address the preparation of excreta samples
- Added example dose calculations based on different publications of ICRP (appendix)

Table 4-1
Individual Monitoring Requirements Based on Potential Dose

Potential Dose [1]	Definition[8]	Action	Techniques which can be used
> 10 mrem CEDE	Screening Level	Confirm dose by other means	Whole body counting, PAS, or excreta measurements
> 100 mrem CEDE	Verification level	Validity of dose assignment to be confirmed by individual monitoring[2]	Excreta measurements are preferred technique[3]
> 500 mrem CEDE	Investigation level	Individual measurements must be taken to define the dose more accurately	Extensive excreta sampling should be conducted[3].

Training is Important!



Alpha: Stopped by a piece of paper…..

contributes to the perception of a low risk

Three Levels of Training:

- **Radiation Worker and General Employee**
  - Training should be commensurate with the level of radiological risk
- **Radiation Protection**
  - Internal exposure potential and measurement challenges
- **Management**
  - Informed of the impact of transuranics (e.g. risk of alpha and tools for worker protection)

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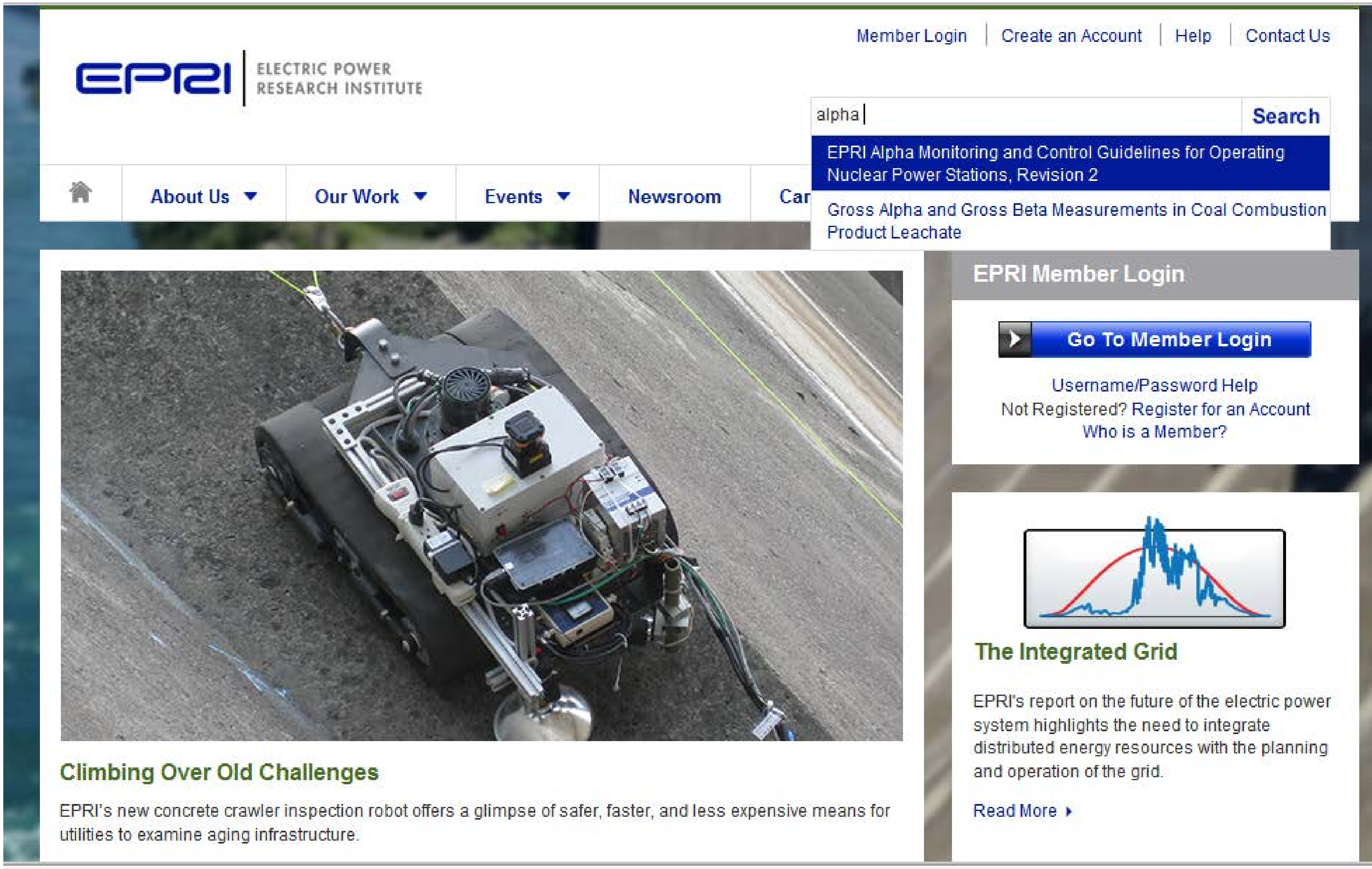
Industry Roll-Out of Guideline Revisions

- To facilitate industry implementation:
  - Two industry webcasts– recording available
  - Joint EPRI/INPO Alpha Workshop (December 4-5, 2013 in Charlotte, NC)
    - EPRI Review of Guideline Changes
    - INPO and ANI Observations and INPO How To
    - Industry OE and Break-out Sessions
    - 60 attendees: >80% U.S. Utility Participation, 2 International
    - Alpha Resource website to be built in 2014

Summary

- ✓All plants should be monitoring and characterizing for alpha contamination
- ✓Moving towards **worldwide** implementation
  - ✓**Interest from US, Swiss and Canadian Regulators**
- ✓Great engagement and participation by industry in developing the necessary revisions
- ✓ Implementation assistance (webcast recordings, workshop proceedings, website, TSG assessment option)
- ✓U.S. plant implementation of new guidance expected by July 1, 2014

Download Report from www.epri.com



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2014 Radiation Safety Program Meetings

Project Meetings

- International Cavity Decontamination Workshop (October 22-23, 2014 Charlotte, NC)

Radiation Management TSG

- Scaffold & Shielding (June 24-27, 2014 Charlotte, NC)
- Remote Monitoring (August 12- 14, 2014 St. Louis, MO – Callaway NPP)
- Source Term Reduction Workshop (September 18-19, 2014 Charlotte, NC)

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