

Update on EPRI C-14 Projects

Billy Cox
EPRI Project Manager

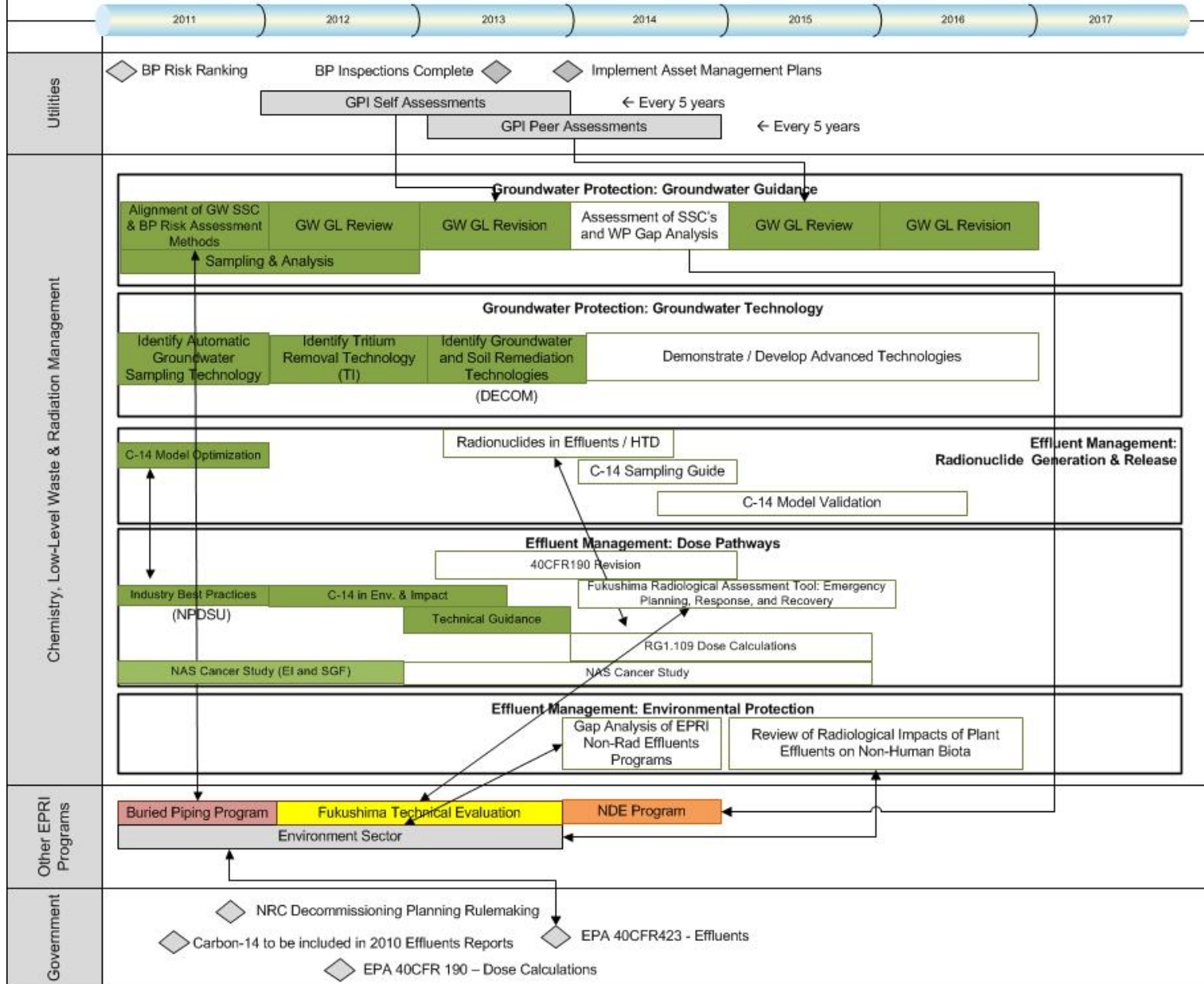
Dr. George Oliver
CN Associates for EPRI

RETS/REMP Workshop
June 25-27
Orlando, Florida

First a Few Changes

- The program name has changed to:
 - “Radiological Environmental Protection” or REP
- Groundwater Protection remains under Karen Kim
 - GW Guidance, GW Technologies and Assessments (also Decommissioning Program and Fukushima lead)
- Effluents Management has transitioned to Billy Cox
 - Radionuclide Generation & Release, Dose Pathways
- Phung Tran continues to coordinate EPRI engagement in the NAS Cancer Study

Radiological Environmental Protection Roadmap



EPRI REP 2013 Effluent Roadmap Projects

- 2013 Funded Projects
 - C-14 Dose pathways, environmental background, improved dose calculation accuracy (continuation of C-14 research)
- 2013 Additional Proposed Projects
 - EPA 40 CFR 190 Revision support (new, through 2014). Seeking emergent issue funds now to begin in 2012.
 - Accurate reporting of radionuclides in effluents including hard to detects (new, through 2014). Identify, evaluate the significance and how to measure.

EPRI Historical Research on C-14 in Effluents

- NP-3840 – Environmental Radiation Doses from Difficult to Measure Nuclides, 1985
- 105715 – Characterization of C-14 Generated by the Nuclear Power Industry, 1995
- 1021106 – Estimation of C-14 in NPP Gaseous Effluents, 2010
- 1023023 – Impact of Operations on C-14 Generation, Chemical Forms and Release, 2011
- 1024827 – C-14 Dose Calculation Methods at NPPs; Best Practices, 2012

C-14 Dose Calculation Methods at Nuclear Power Plants – EPRI Report 1024827

- History And Regulatory Guidance
- A Section Of Equations For C-14 Dose Calculations
- Treatment Of Various Factors – Context Of The Equations
 - Source Term (Inorganic – Organic/Measurements)
 - Atmospheric Dispersion
 - Periods Of Photosynthesis
 - Dose Factors
 - Intake & Ingestion Factors
 - Dose Calculation Periods (Quarterly & Annually)
 - The Annual Report Treatment (Special Sections)

C-14 Dose Calculation Methods at Nuclear Power Plants – EPRI Report 1024827

- Appendix A - Comparison of ICRP-2 & ICRP-72 Dose Factors (Written By: Ken Sejkora)
- Appendix B - Ability to Detect C-14 in Vegetation Resulting From Gaseous Effluents (Provided By: Chris Graham)
 - The C-14 From Gaseous Effluents Indistinguishable From Naturally Occurring C-14

C-14 Dose Calculation Methods Good Practices

- Annual Effluent Report – Voluntary Supplements Describing C-14
- Annual Effluent Report – Reporting C-14 Doses Separately
- Conservative Estimation of C-14 Source Terms
- Voluntary Measurement of C-14 in Effluents
- C-14 Vegetation Ingestion Calculations Limited to Periods of Photosynthesis
- Limiting Batch Releases to Periods Where Photosynthesis is Not Occurring
- Verification of Dose Calculations Using Several Tools

Examples of C-14 Calculated Doses with Critical Organ and Pathway Identified

Plant	Assumed Source Term (Ci/site)	Critical Organ	Critical Pathway	% CO ₂	p factor	Calculated Organ Dose C-14 (mRem)	Total Body (mRem)
PWR	8.9	Child Bone	Ingestion (vegetation)	30	1.0	0.726	0.149
PWR	11.1	Child Bone	Inhalation	100 WGDT*	1.0	8.5E-3	1.6E-3
PWR	20.4	Child Bone	Ingestion (vegetation)	20	.303	4.78	2.25
PWR	20.2	Child Bone	Ingestion (vegetation)	20	.303	0.918	0.296
PWR	22.5	Child Bone	Ingestion (vegetation)	20	.348	0.335	8.78E-02
PWR	10.05	Child Bone	Ingestion (vegetation)	20	1.0	0.800	0.146
PWR	8.36	Child Bone	Ingestion (vegetation)	30	1.0	0.153	3.05E-2
BWR	21.17	Child Bone	Ingestion (vegetation)	90	1.0	2.36	0.471
BWR	18.8	Child Bone	Ingestion (vegetation + milk + meat) Inhalation	100	1.0	0.156	3.6E-2
BWR	17.8	Child Bone	Ingestion (Fruit, grain, non-leafy vegetation)	100	1.0	7.12E-2	1.42E-2

*High Temperature Catalytic Hydrogen Re-Combiners and WGDT Releases In Periods Of No Photosynthesis

2012-2013 New Project C-14 In The Environment

- C-14 Background
 - General Environment
 - World Wide Production
 - Natural And Manmade
 - Contributions From Power Plant Effluents
- Statistical Analysis And Detection Capability
- Pathway Analysis
 - Literature Search Human Pathways
 - Ingestion And Inhalation
- Dose Calculation Analysis
 - Potential Improvements to Dose Calculation Methods

Project Schedule For C-14 Project

- Commence June 2012
- Draft C-14 Background (January, March 2013)
- Draft C-14 Pathway Analysis And Dose Calculation Improvement (June 2013)
- Final Submitted For Review (September 2013)

How Can You Help?

- At Your Plants
 - Environmental Measurements Of C-14 At Your Plants
 - Background C-14 In Vegetation
 - Vegetation Samples To Detect C-14 From Airborne Effluents
 - Effluent Measurements Of C-14
 - Relative Composition Of Organic and Inorganic C-14
 - Total C-14 Measurements

Contact Information

- Billy Cox
 - bcox@epri.com
 - 603-583-2877
- Dr. George Oliver
 - georgeo@msn.com
 - 919-862-4395 (Cell)



Together...Shaping the Future of Electricity