EPRI | ELECTRIC POWER RESEARCH INSTITUTE

EPRI BWR Sampling Summary

1022671

EPRI BWR Sampling Summary

1022671

Technical Update, March 2011

EPRI Project Manager
S. Garcia

ELECTRIC POWER RESEARCH INSTITUTE
3420 Hillview Avenue, Palo Alto, California 94304-1338 ▪ PO Box 10412, Palo Alto, California 94303-0813 ▪ USA
800.313.3774 ▪ 650.855.2121 ▪ askepri@epri.com ▪ www.epri.com

DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITIES

THIS DOCUMENT WAS PREPARED BY THE ORGANIZATION(S) NAMED BELOW AS AN ACCOUNT OF WORK SPONSORED OR COSPONSORED BY THE ELECTRIC POWER RESEARCH INSTITUTE, INC. (EPRI). NEITHER EPRI, ANY MEMBER OF EPRI, ANY COSPONSOR, THE ORGANIZATION(S) BELOW, NOR ANY PERSON ACTING ON BEHALF OF ANY OF THEM:

(A) MAKES ANY WARRANTY OR REPRESENTATION WHATSOEVER, EXPRESS OR IMPLIED, (I) WITH RESPECT TO THE USE OF ANY INFORMATION, APPARATUS, METHOD, PROCESS, OR SIMILAR ITEM DISCLOSED IN THIS DOCUMENT, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, OR (II) THAT SUCH USE DOES NOT INFRINGE ON OR INTERFERE WITH PRIVATELY OWNED RIGHTS, INCLUDING ANY PARTY'S INTELLECTUAL PROPERTY, OR (III) THAT THIS DOCUMENT IS SUITABLE TO ANY PARTICULAR USER'S CIRCUMSTANCE; OR

(B) ASSUMES RESPONSIBILITY FOR ANY DAMAGES OR OTHER LIABILITY WHATSOEVER (INCLUDING ANY CONSEQUENTIAL DAMAGES, EVEN IF EPRI OR ANY EPRI REPRESENTATIVE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES) RESULTING FROM YOUR SELECTION OR USE OF THIS DOCUMENT OR ANY INFORMATION, APPARATUS, METHOD, PROCESS, OR SIMILAR ITEM DISCLOSED IN THIS DOCUMENT.

Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by EPRI.

The following organization, under contract to EPRI, prepared this report:

Finetech, Inc.

THE TECHNICAL CONTENTS OF THIS DOCUMENT WERE **NOT** PREPARED IN ACCORDANCE WITH THE EPRI NUCLEAR QUALITY ASSURANCE PROGRAM MANUAL THAT FULFILLS THE REQUIREMENTS OF 10 CFR 50, APPENDIX B AND 10 CFR PART 21, ANSI N45.2-1977 AND/OR THE INTENT OF ISO-9001 (1994). USE OF THE CONTENTS OF THIS DOCUMENT IN NUCLEAR SAFETY OR NUCLEAR QUALITY APPLICATIONS REQUIRES ADDITIONAL ACTIONS BY USER PURSUANT TO THEIR INTERNAL PROCEDURES.

This is an EPRI Technical Update report. A Technical Update report is intended as an informal report of continuing research, a meeting, or a topical study. It is not a final EPRI technical report.

NOTE

For further information about EPRI, call the EPRI Customer Assistance Center at 800.313.3774 or e-mail askepri@epri.com.

ACKNOWLEDGMENTS

The following organization, under contract to the Electric Power Research Institute (EPRI), prepared this report:

Finetech, Inc.
959 Route 46 East, Suite 403
Mountain Lakes, NJ 07054

Principal Investigator
M. Jarvis

This report describes research sponsored by EPRI.

The cooperation of the following utilities/BWR stations in providing data and information for this report is greatly appreciated:

BKW FMG Energie AG	Mühleberg
Comisión Federal de Electricidad	Laguna Verde
Constellation Nuclear	Nine Mile Point
Detroit Edison	Fermi 2
Energy Northwest	Columbia
Entergy	FitzPatrick, Grand Gulf, Pilgrim, River Bend, Vermont Yankee
Exelon	Clinton, Dresden, LaSalle, Limerick, Peach Bottom, Oyster Creek, Quad Cities
First Energy	Perry
Iberdrola	Cofrentes
Kernkraftwerk Leibstadt	Leibstadt
Nebraska Public Power District	Cooper
Nextera Energy	Duane Arnold
Nuclenor	Santa Maria de Garoña
Progress Energy	Brunswick
PSEG LLC	Hope Creek
Southern Nuclear Operating Company	Hatch
Susquehanna LLC	Susquehanna
Taiwan Power	Chinshan, Kuosheng
Tennessee Valley Authority	Browns Ferry
Vattenfall	Ringhals 1
Xcel Energy	Monticello

This publication is a corporate document that should be cited in the literature in the following manner:

EPRI BWR Sampling Summary. EPRI, Palo Alto, CA: 2011. 1022671.

ABSTRACT

The report documents BWR sampling practices for key reactor water and feedwater parameters. It includes information on analysis methods and sampling frequencies and compliance with recommended sampling frequencies described in *BWRVIP-190: BWR Vessels and Internals Project, BWR Water Chemistry Guidelines—2008 Revision*.

Keywords

BWR
Chemistry
Sampling

CONTENTS

LIST OF FIGURES

1
INTRODUCTION

This report summarizes sampling frequencies and methods for 35 U.S., 2 Mexican, 8 European, and 4 Taiwanese BWRs. This annual report is intended for use by chemistry managers and staff as a benchmarking tool to support efforts to optimize resources while maintaining excellence in chemistry monitoring. Responses to a request for updated information were received from 40 of the 49 stations.

Abbreviations Used in This Report

AA	Atomic Absorption Spectroscopy
CST	Condensate Storage Tank
IC	Ion Chromatography
ICP	Inductively Coupled Plasma
LRW	Liquid Radwaste
MS	Mass Spectroscopy
MU	Plant Demineralized Makeup Water
PUV	Post-UV
VA	Voltammetric Analysis
XRF	X-ray Fluorescence

2
COMPLIANCE WITH RECOMMENDED SAMPLING FREQUENCIES IN BWR WATER CHEMISTRY GUIDELINES

The percentage of plants meeting or exceeding recommended sampling frequencies in *BWRVIP-190: BWR Vessel and Internals Project, BWR Water Chemistry Guidelines – 2008 Revision* is shown in Figure 2-1.

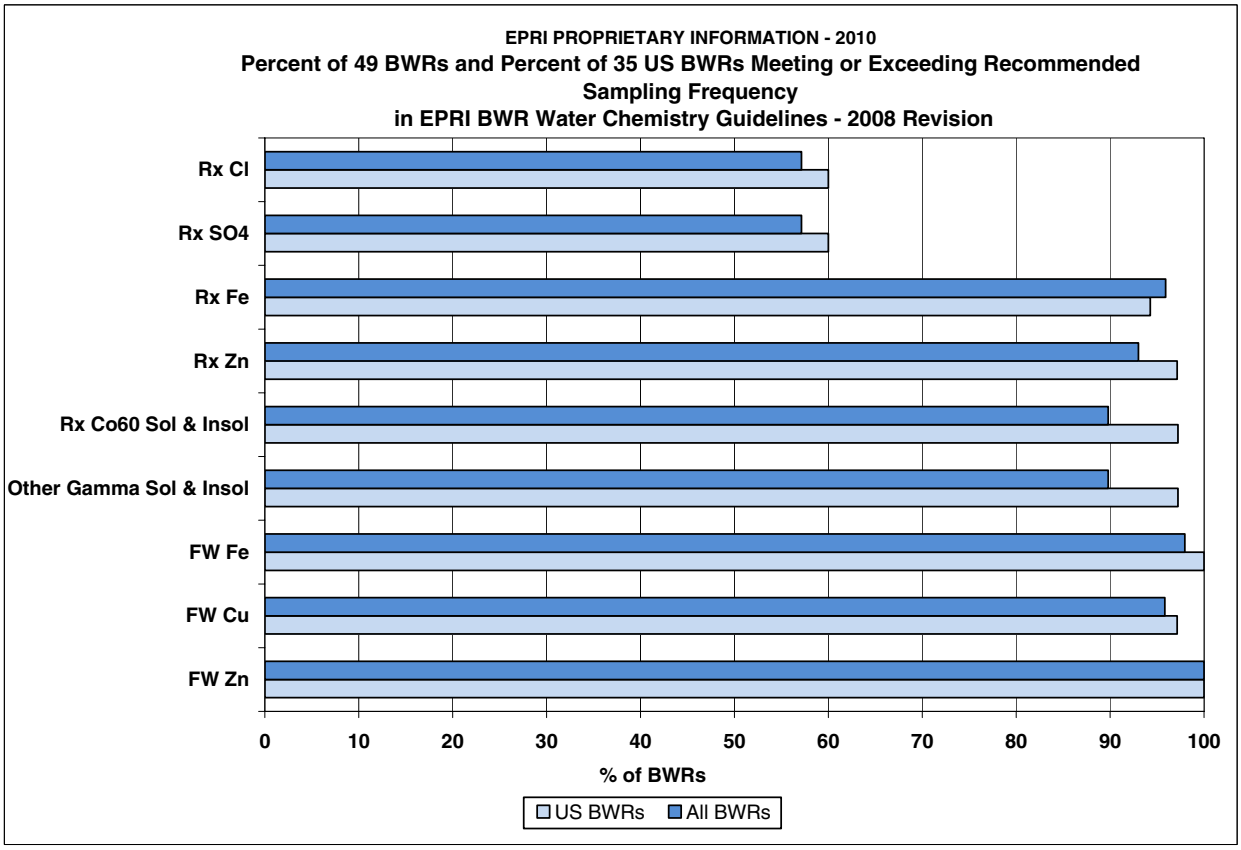

Figure 2-1
BWR Compliance with Recommended Sampling Frequencies

3
BWR SAMPLING PRACTICES

Information on BWR sampling practices is provided in Figures 3-1 through 3-20.

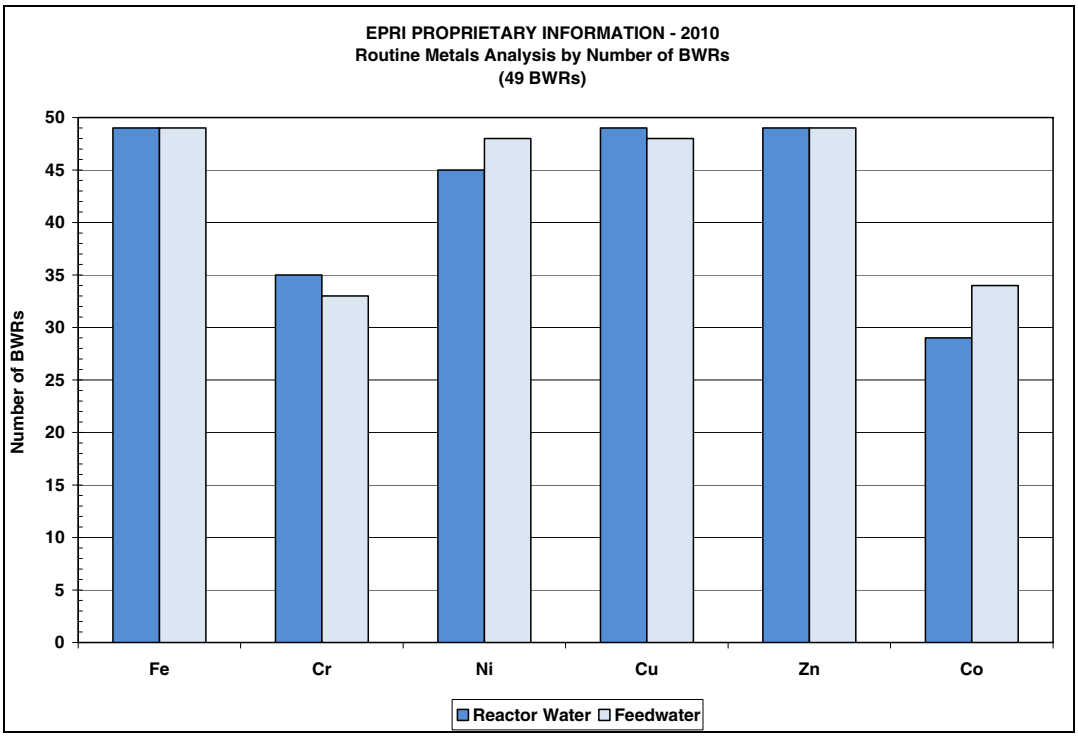

Figure 3-1
Routine Metals Analysis by Number of BWRs

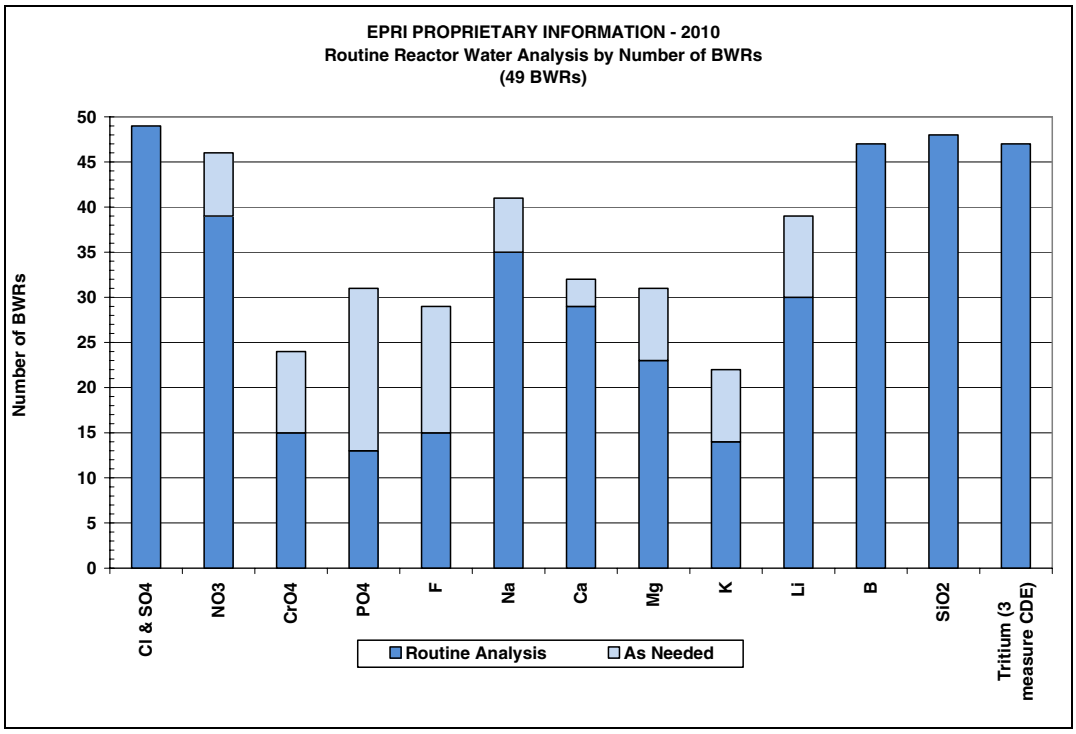

Figure 3-2
Routine Reactor Water Analysis by Number of BWRs

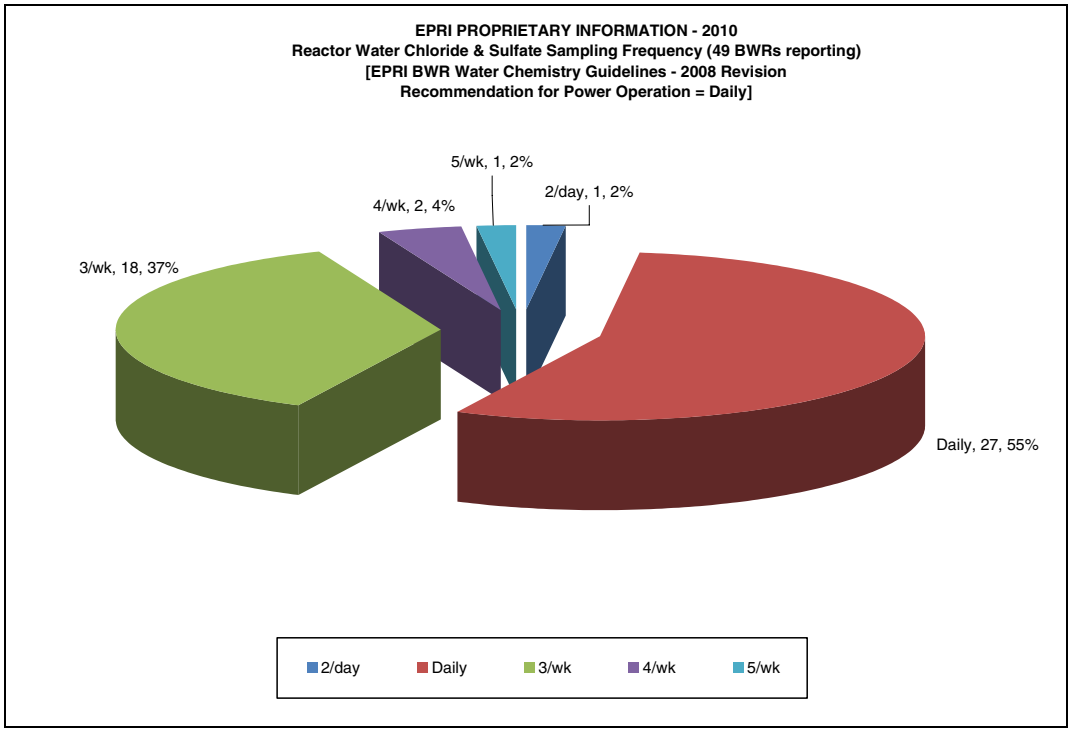

Figure 3-3
Reactor Water Chloride and Sulfate Sampling Frequency

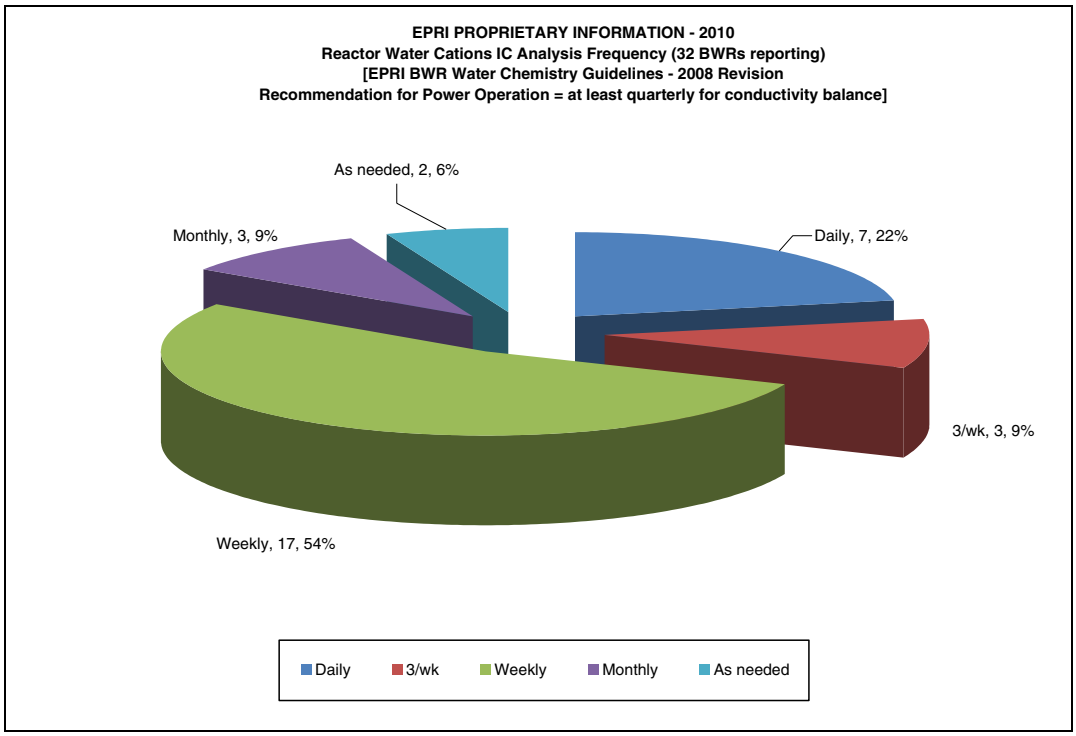

Figure 3-4
Reactor Water Cations IC Analysis Frequency

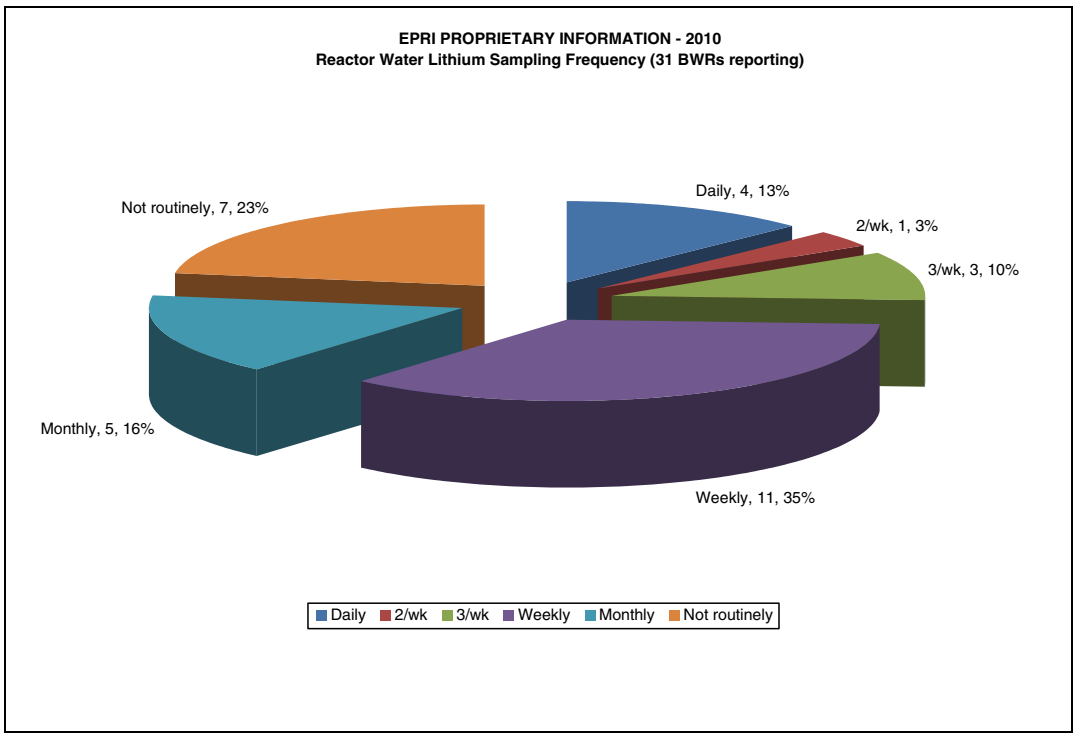

Figure 3-5
Reactor Water Lithium Sampling Frequency

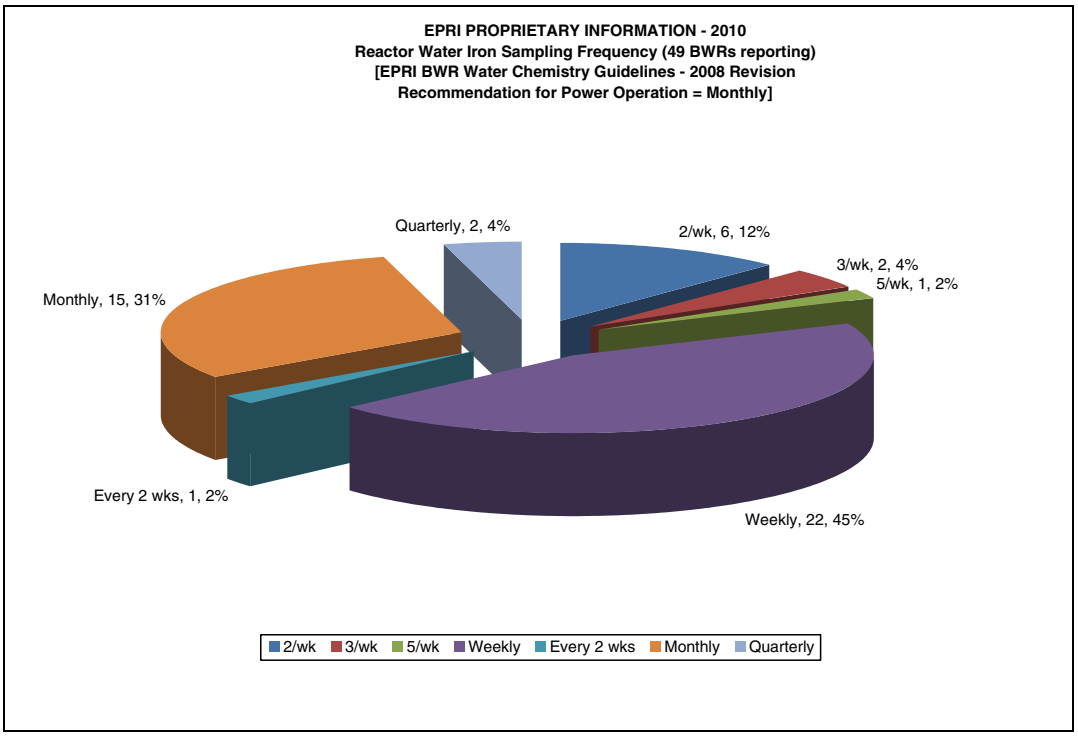

Figure 3-6
Reactor Water Iron Sampling Frequency

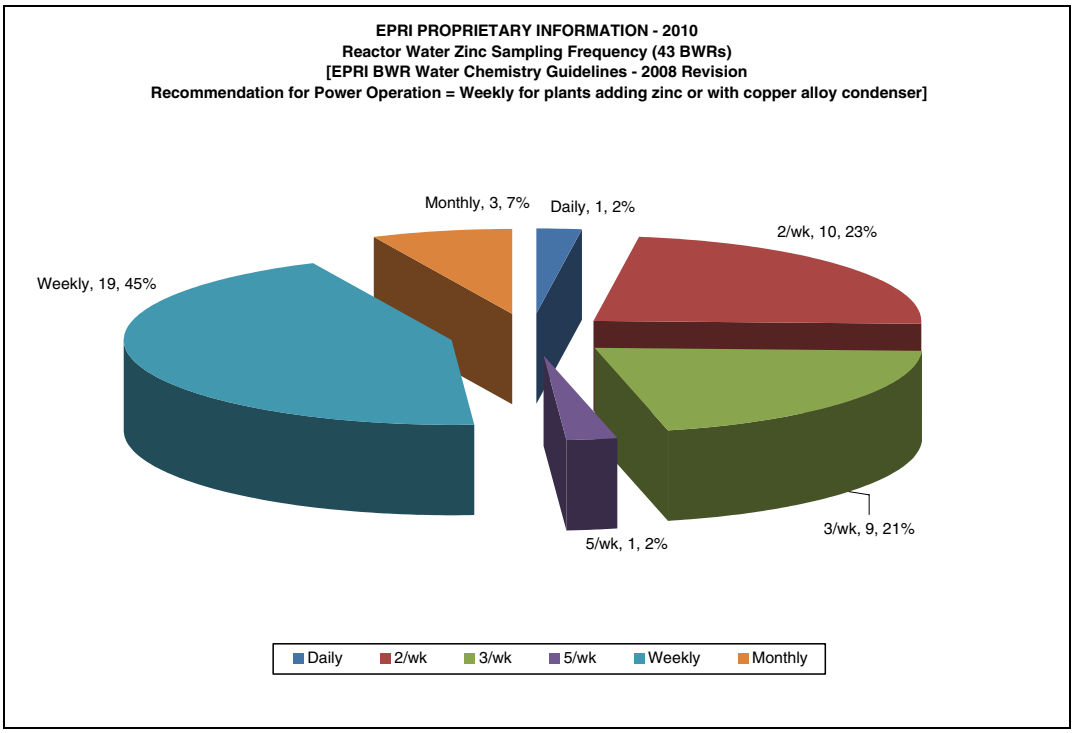

Figure 3-7
Reactor Water Zinc Sampling Frequency

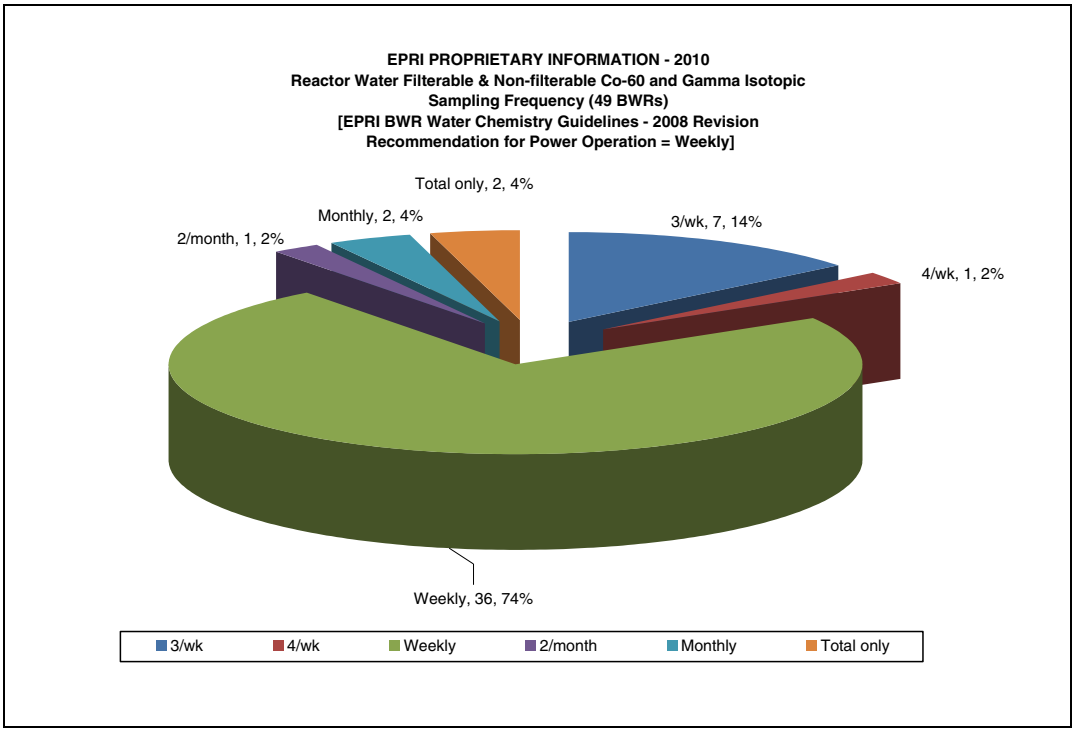

Figure 3-8
Reactor Water Co-60 and Gamma Isotopic Sampling Frequency

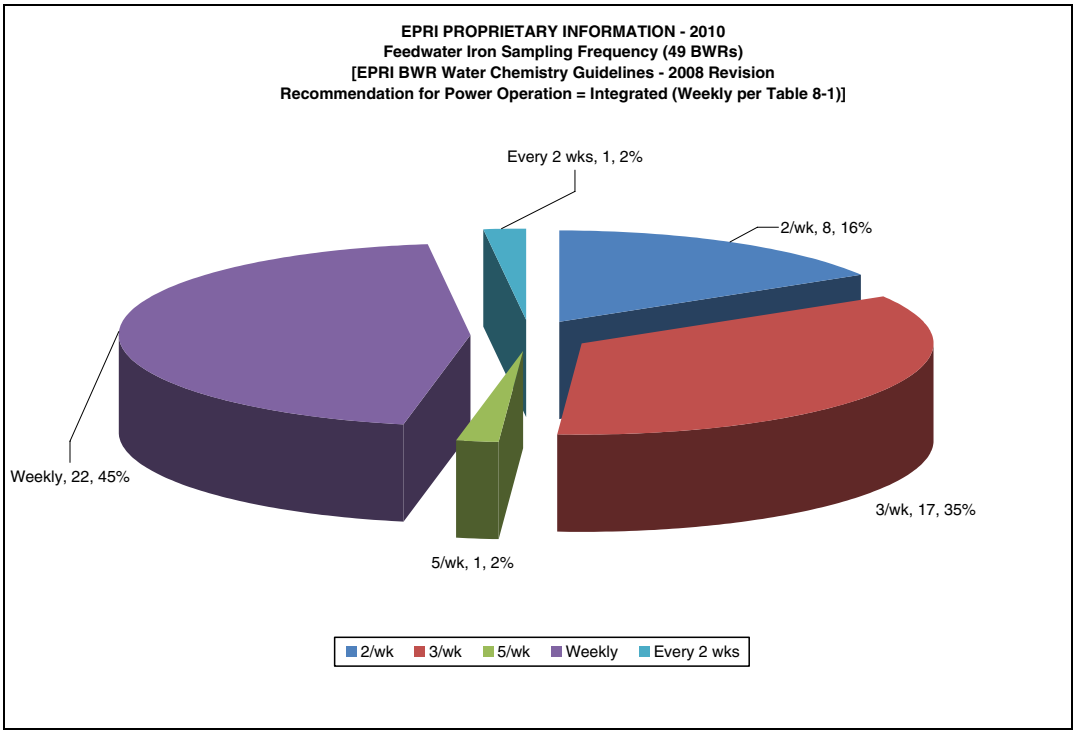

Figure 3-9
Feedwater Iron Sampling Frequency

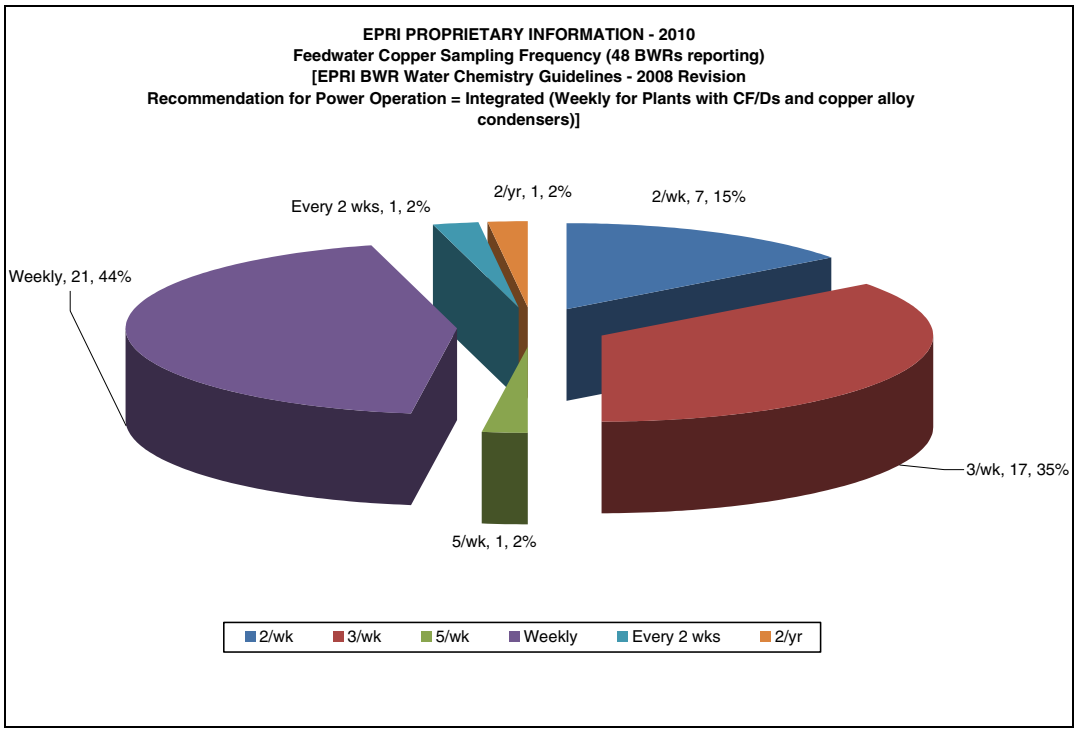

Figure 3-10
Feedwater Copper Sampling Frequency

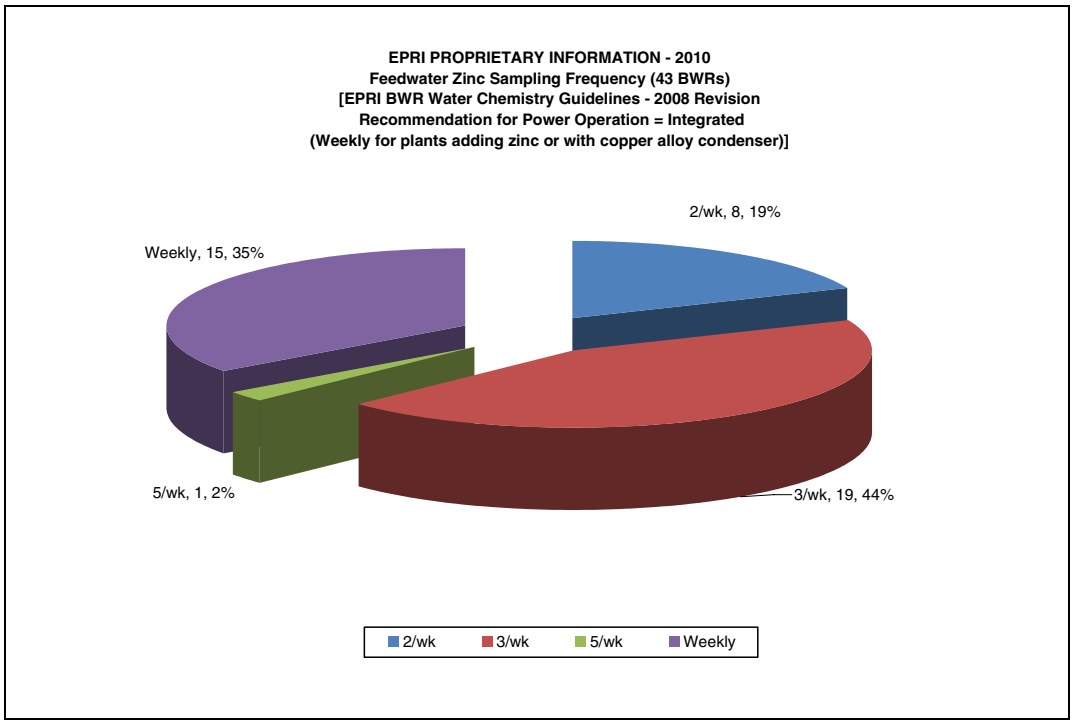

Figure 3-11
Feedwater Zinc Sampling Frequency

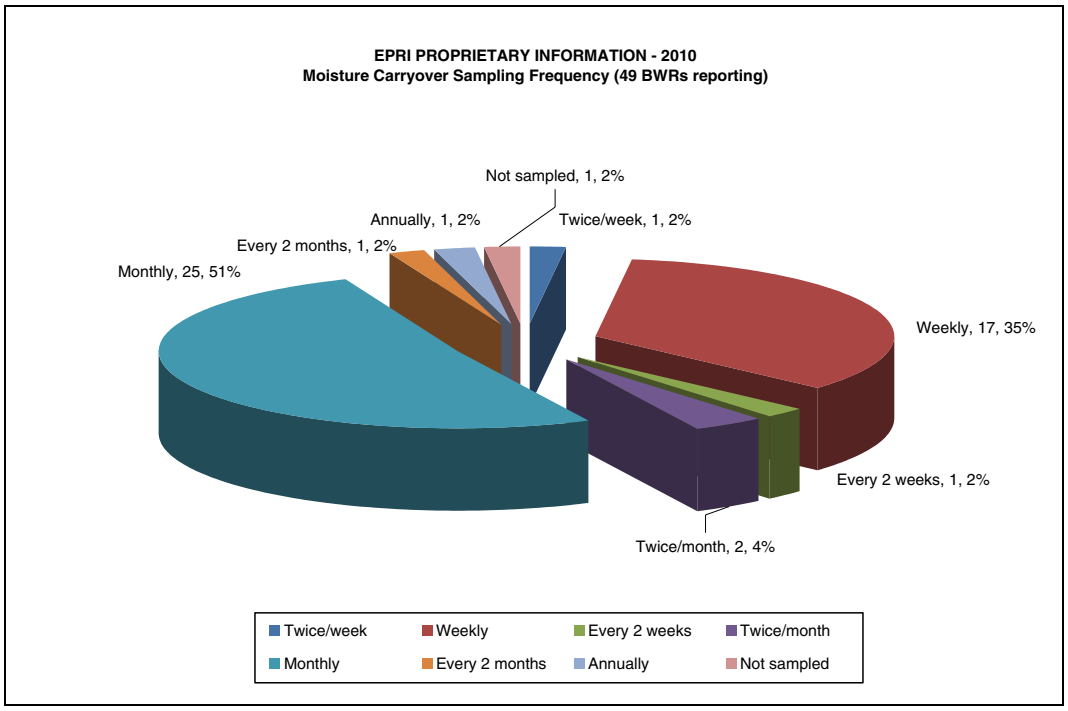

Figure 3-12
Moisture Carryover Sampling Frequency

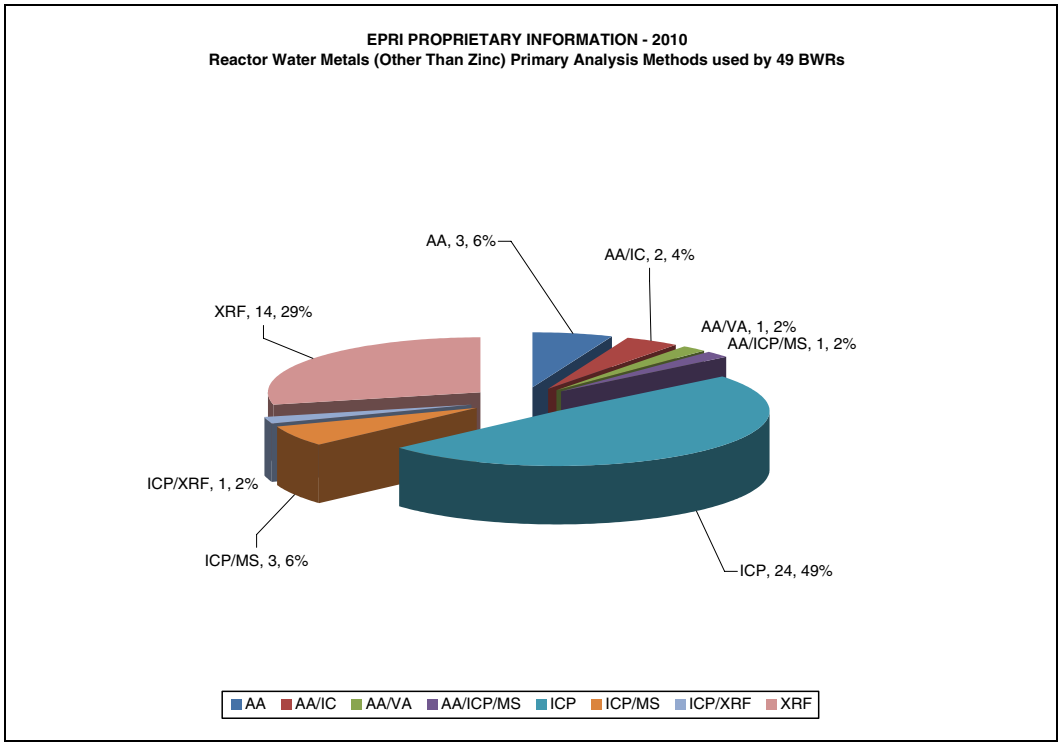

Figure 3-13
Reactor Water Metals Analysis Method

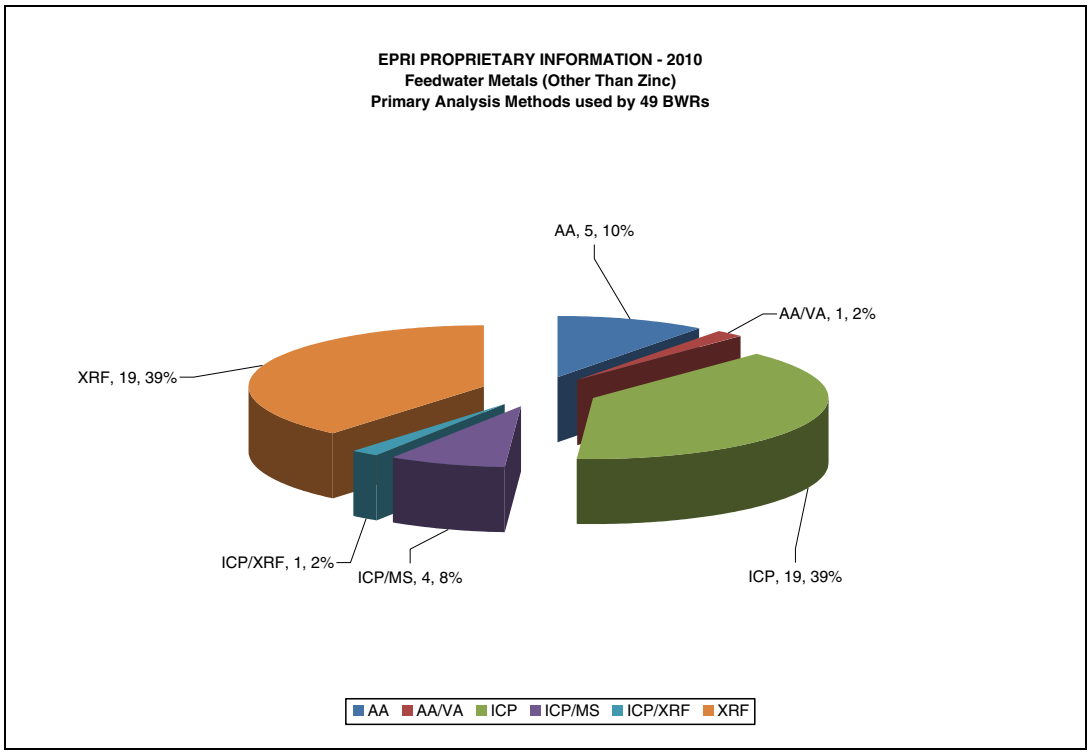

Figure 3-14
Feedwater Metals Analysis Method

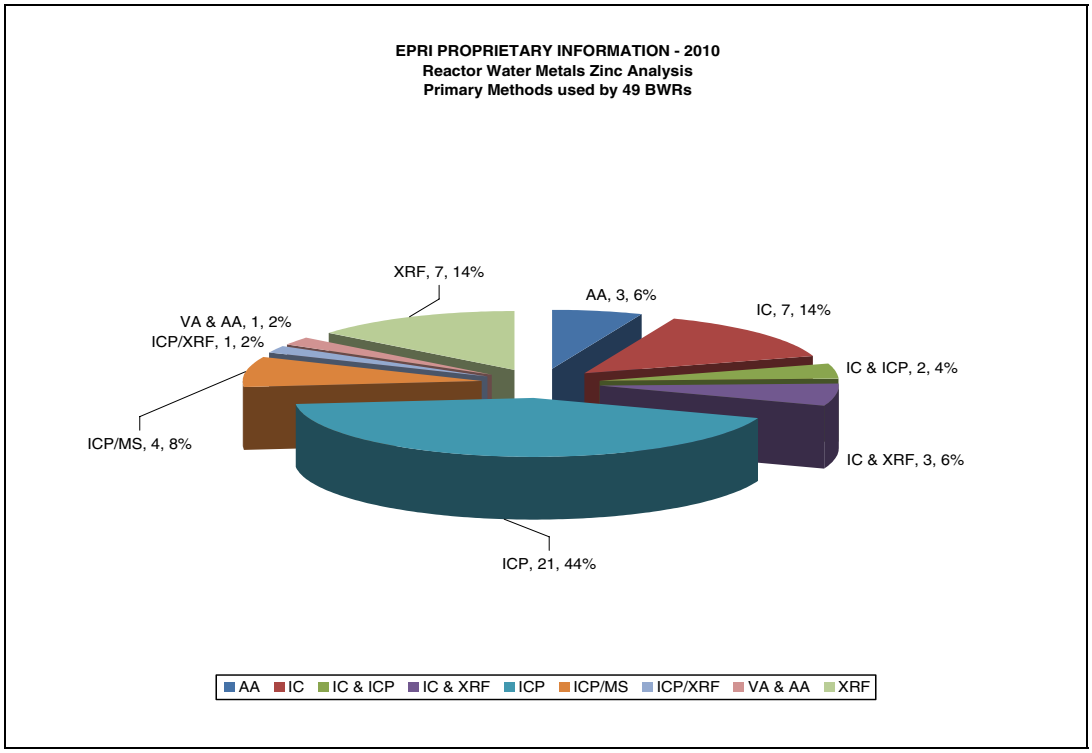

Figure 3-15
Reactor Water Zinc Analysis Method

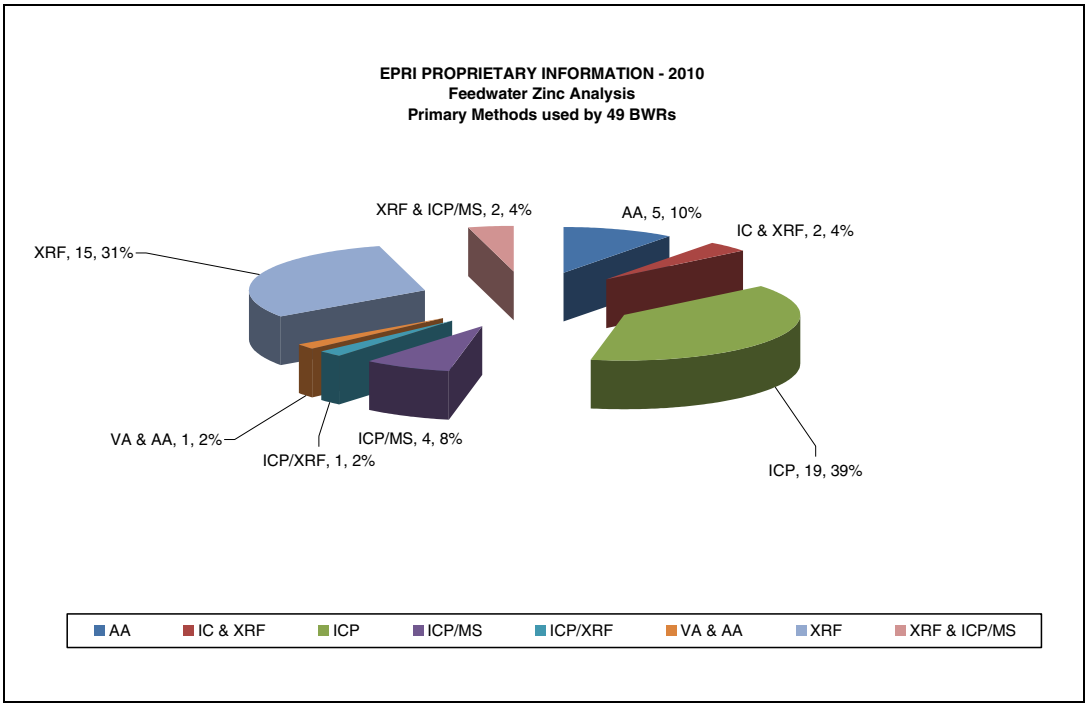

Figure 3-16
Feedwater Zinc Analysis Method

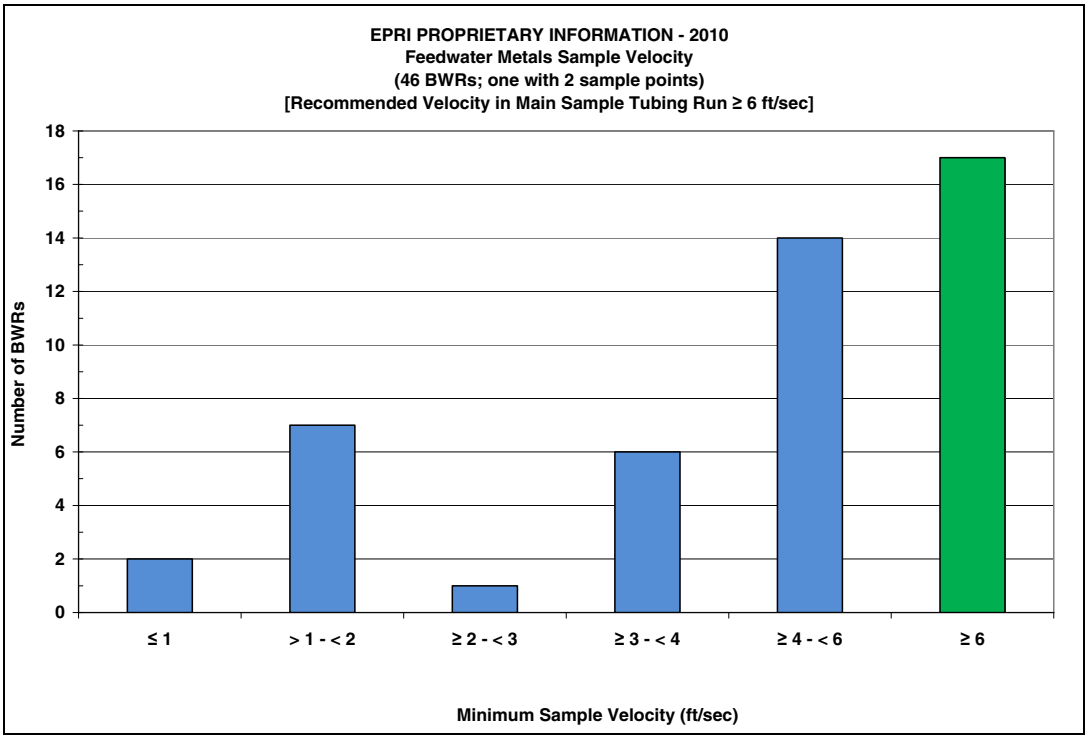

Figure 3-17
Feedwater Metals Sample Velocity

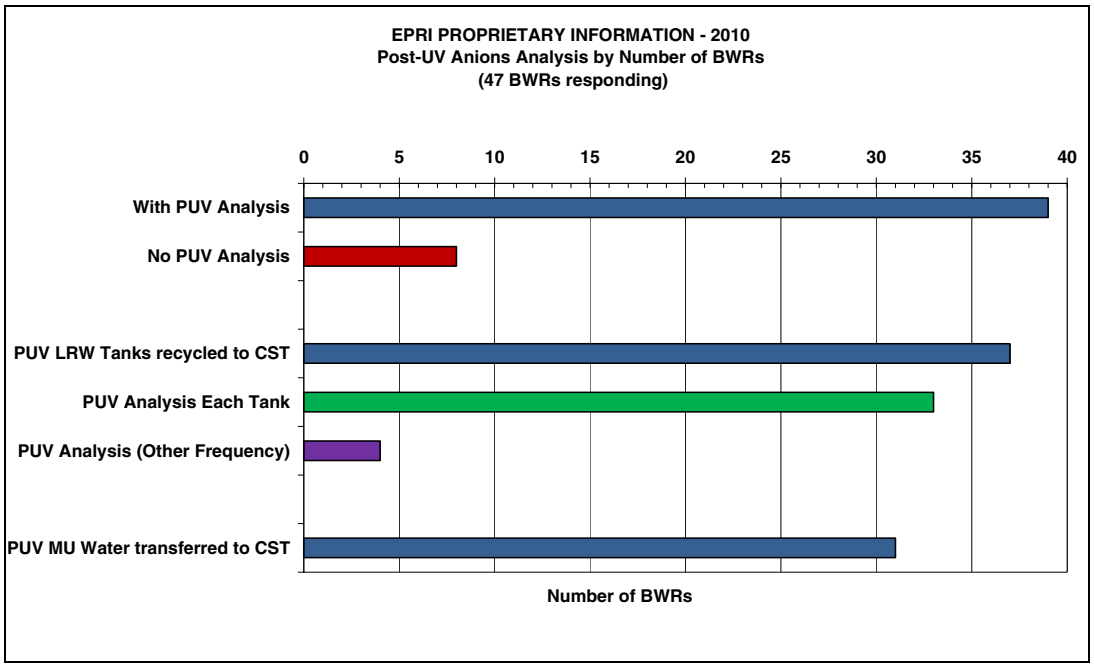

Figure 3-18
Post-UV Analysis Practices

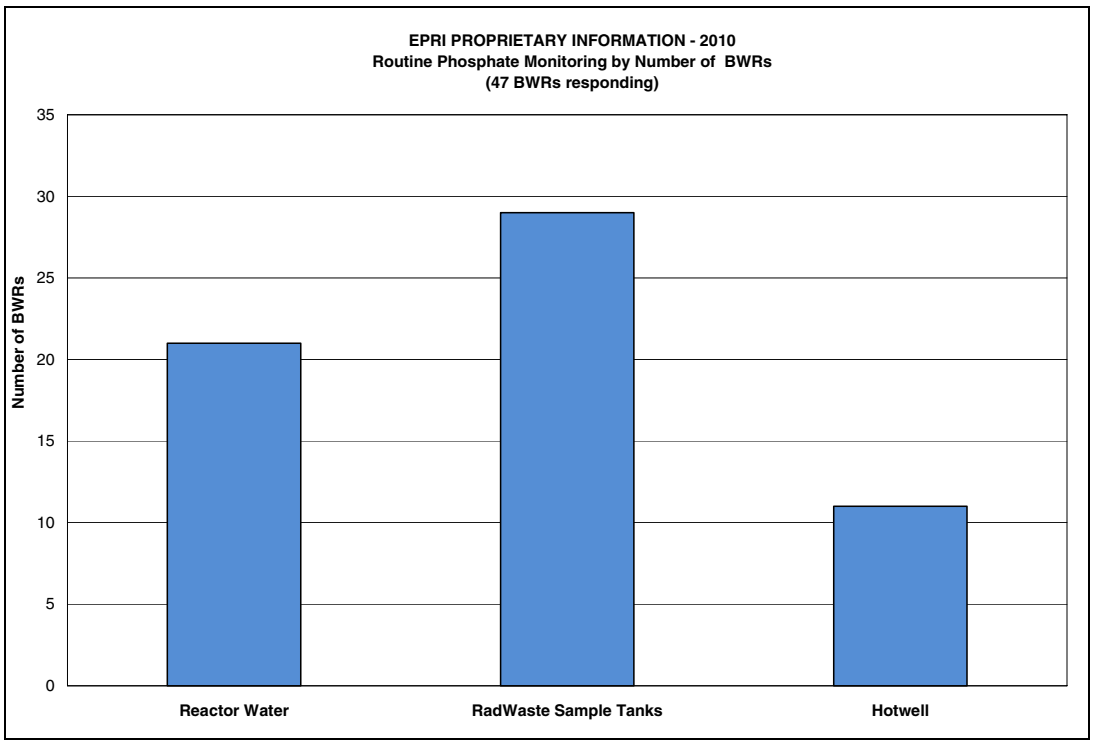

Figure 3-19
Phosphate Monitoring

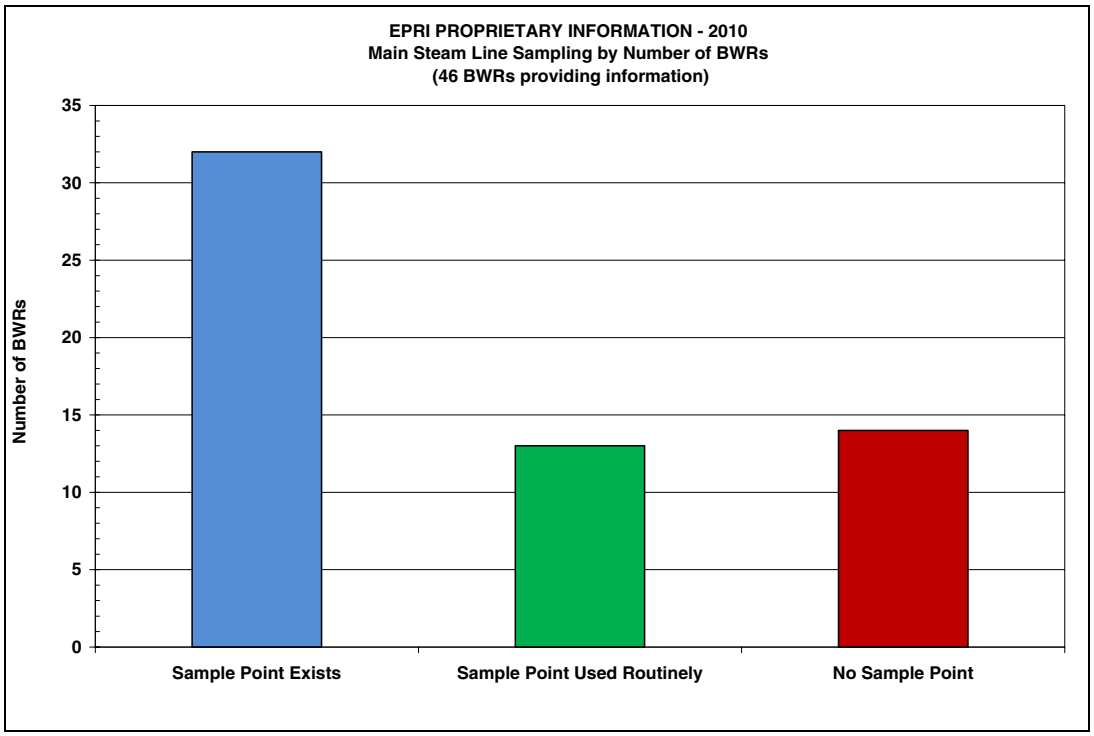

Figure 3-20
Main Steam Line Sampling

Export Control Restrictions

Access to and use of EPRI Intellectual Property is granted with the specific understanding and requirement that responsibility for ensuring full compliance with all applicable U.S. and foreign export laws and regulations is being undertaken by you and your company. This includes an obligation to ensure that any individual receiving access hereunder who is not a U.S. citizen or permanent U.S. resident is permitted access under applicable U.S. and foreign export laws and regulations. In the event you are uncertain whether you or your company may lawfully obtain access to this EPRI Intellectual Property, you acknowledge that it is your obligation to consult with your company's legal counsel to determine whether this access is lawful. Although EPRI may make available on a case-by-case basis an informal assessment of the applicable U.S. export classification for specific EPRI Intellectual Property, you and your company acknowledge that this assessment is solely for informational purposes and not for reliance purposes. You and your company acknowledge that it is still the obligation of you and your company to make your own assessment of the applicable U.S. export classification and ensure compliance accordingly. You and your company understand and acknowledge your obligations to make a prompt report to EPRI and the appropriate authorities regarding any access to or use of EPRI Intellectual Property hereunder that may be in violation of applicable U.S. or foreign export laws or regulations.

The Electric Power Research Institute Inc., (EPRI, www.epri.com) conducts research and development relating to the generation, delivery and use of electricity for the benefit of the public. An independent, nonprofit organization, EPRI brings together its scientists and engineers as well as experts from academia and industry to help address challenges in electricity, including reliability, efficiency, health, safety and the environment. EPRI also provides technology, policy and economic analyses to drive long-range research and development planning, and supports research in emerging technologies. EPRI's members represent more than 90 percent of the electricity generated and delivered in the United States, and international participation extends to 40 countries. EPRI's principal offices and laboratories are located in Palo Alto, Calif.; Charlotte, N.C.; Knoxville, Tenn.; and Lenox, Mass.

Together…Shaping the Future of Electricity

1022671

Electric Power Research Institute
3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 • USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com