

# Fission Products Analysis

## Background

The Fission Products Analysis (FPA) 1.0.0 code uses expert system data algorithms to determine the number of leaking fuel rods in pressurized water reactor (PWR) cores. This Westinghouse-developed software code assists utilities in the evaluation and monitoring of their fuel integrity by incorporating decades of Westinghouse expertise with analyzing primary-side coolant activity data into a user-friendly and robust executable code. In addition to determining the number of leaking rods, FPA 1.0.0 is also able to determine the burnup of those rods to aid in locating the specific leaker. FPA 1.0.0 is Westinghouse's third generation coolant activity evaluation code and can be run by utility personnel with minimal coolant activity experience. Introductory training for this code is provided with code delivery.

Results from Number of Leaking Rods Calculation			Plant alpha: AAA						
Wed, 18 Jan 2012 09:01:28 EST			Cycle: 23						
			Sample selection basis: Month: 2009-03 (Modified)						
<b>Inputs</b>									
<b>Parameters</b>			<b>Samples</b>						
Power Sharing Factor	1.000		activities of each isotope in $\mu\text{Ci/g}$						
Power	100.0 %		I-131	I-133	I-134	I-135	Xe-133	Xe-135	
Letdown	63.0 gpm		1	1.83E-3	7.93E-3	1.10E-2	1.02E-2	2.43E-1	5.20E-2
Gas Cleanup Rate	0.000E00 1/s		2	1.71E-3	8.55E-3	1.15E-2	1.11E-2	3.72E-1	8.28E-2
Effective Burnup in Tramp	50000.0 MWD/MTU		3	1.53E-3	7.51E-3	1.10E-2	9.95E-3	2.02E-1	4.57E-2
Init. Enrichment of Tramp	0.0072 frac		4	1.74E-3	8.73E-3	1.23E-2	1.21E-2	2.46E-1	5.60E-2
<b>Outputs</b>									
<b>Number of Leaking Rods</b>			<b>Output Parameters</b>						
	Normal	Tight	Open	Burnup in Leaking Rods: 42942.8 MWD/MTU Calculated					
from Xenon	1	3	1	Beta: 2.349E-05 1/s					
from Iodine	0	5	0						
<b>Solution Information</b>									

Example output from number-of-leaking-rods calculation

## Description

The FPA 1.0.0 system relies upon fission-product diffusion-release methodology together with empirically-developed fuel leaking correlations. FPA 1.0.0 has the capability of evaluating Xe-133 noble gas measurement data together with four iodine nuclide measurement data to provide assessment of the number of leaking rods. An estimate of the burnup of the leaking fuel is also provided by using correlations of Cs-137 to Cs-134 ratios. In addition, FPA 1.0.0 tracks and displays other fuel integrity parameters, primary isotopic activity levels, isotopic ratios, Institute of Nuclear Power Operations (INPO) Fuel Reliability Indicator (FRI) and others.

FPA 1.0.0 will be released in October 2013 and offers:

- State-of-the-art methodology
- Increased functionality, including a graphical interface, data storage, plotting and professional output reports
- Automated expert system data algorithms based on more than 30 years of coolant chemistry expertise
- Introductory one-day site-specific training with code delivery

## Methodology

- Offers smart automatic iodine, xenon and cesium data selection for any time period
- Calculates number of leaking rods based on type of defects
- Provides burnup calculations for entire cycle
- Calculates iodine and noble gas INPO FRI
- Offers tool for burnup correction based on cesium decay
- Generates tabular reports for monthly reporting

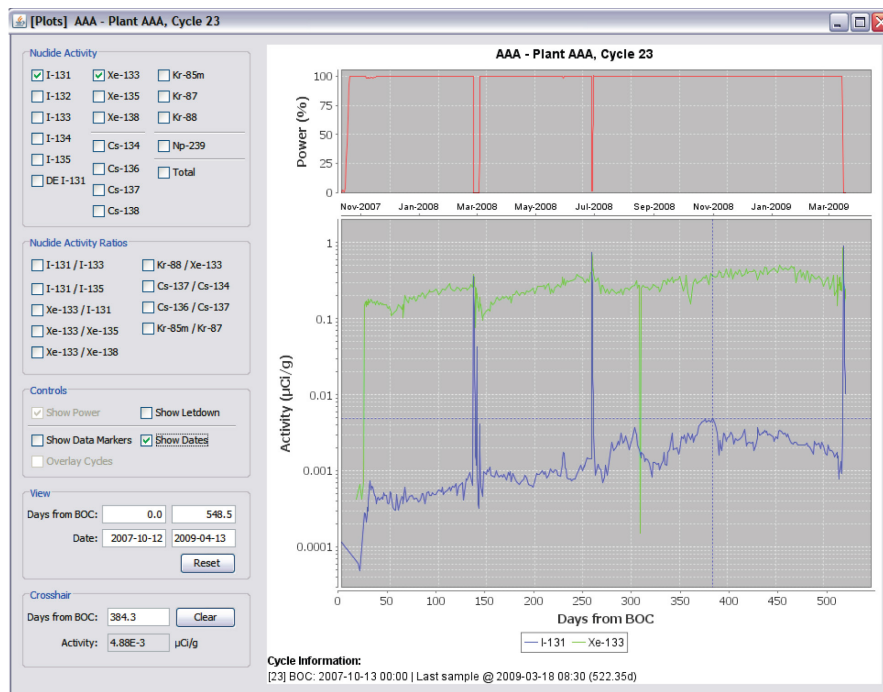
## Features

- Graphical interface runs on Windows® operating system
- Plots all key isotopes and ratios
- Offers data entry via Excel® template file with easy import of fission product data

- Offers easy instant-search and sort capabilities of saved datasets, calculations and reports
- Saves calculations and reports as Excel, PDF, HTML and many other formats
- Stores data on either local file or networked file
- Fully supports all Westinghouse standard and international system of units

## Benefits

- Reduces utility time performing daily and monthly coolant activity data evaluations
- Allows utility personnel with minimal experience and introductory training to perform coolant activity analysis
- Helps utility to determine monthly iodine and noble gas samples for required INPO FRI calculations
- Allows plots and tabular reports to be added directly to documentation



Screenshot showing the plotting interface

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