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REAL TIME IN-SITU GAMMA SPECTROSCOPY AT PRAIRIE ISLAND NUCLEAR PLANT

January 10th 2017

OVERVIEW

The in-situ gamma spectroscopy program at Prairie Island uses radionuclide characterization data to support the Nuclear Promise by providing a real time picture of plant conditions for enhanced decision making.

This presentation covers:

- Program Introduction
- Reactor Coolant System Cleanup Monitoring
- Early Indications of Component Failure
- Radioactive Waste Controls
- Questions & Answers

PROGRAM INTRODUCTION

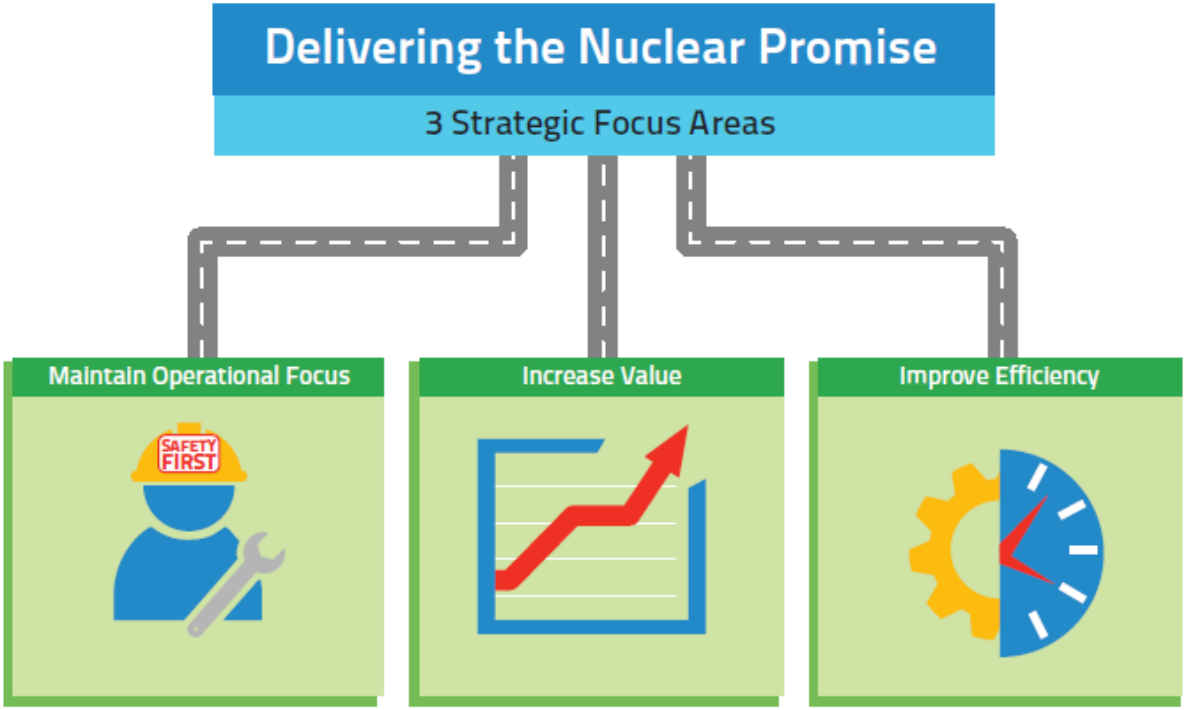
The program uses temporary monitors situated near process piping to perform continuous in-situ gamma spectroscopy measurements. The monitors use a Cadmium Zinc Telluride (CZT) crystal to provide high resolution spectroscopy without the need for cryogenic cooling.

PROGRAM INTRODUCTION

Spectroscopy data uploads in real time to the plant's remote monitoring system. Combined with preloaded efficiency curves and operational data, the program quantitatively determines the various radionuclide concentrations in process piping.

PROGRAM INTRODUCTION

Determining radionuclide concentrations in real time with temporary monitors provides a methodology to evaluate the radiological performance of various plant processes outside of chemistry sampling locations. The program at Prairie Island aims to leverage this information to support the Nuclear Promise.



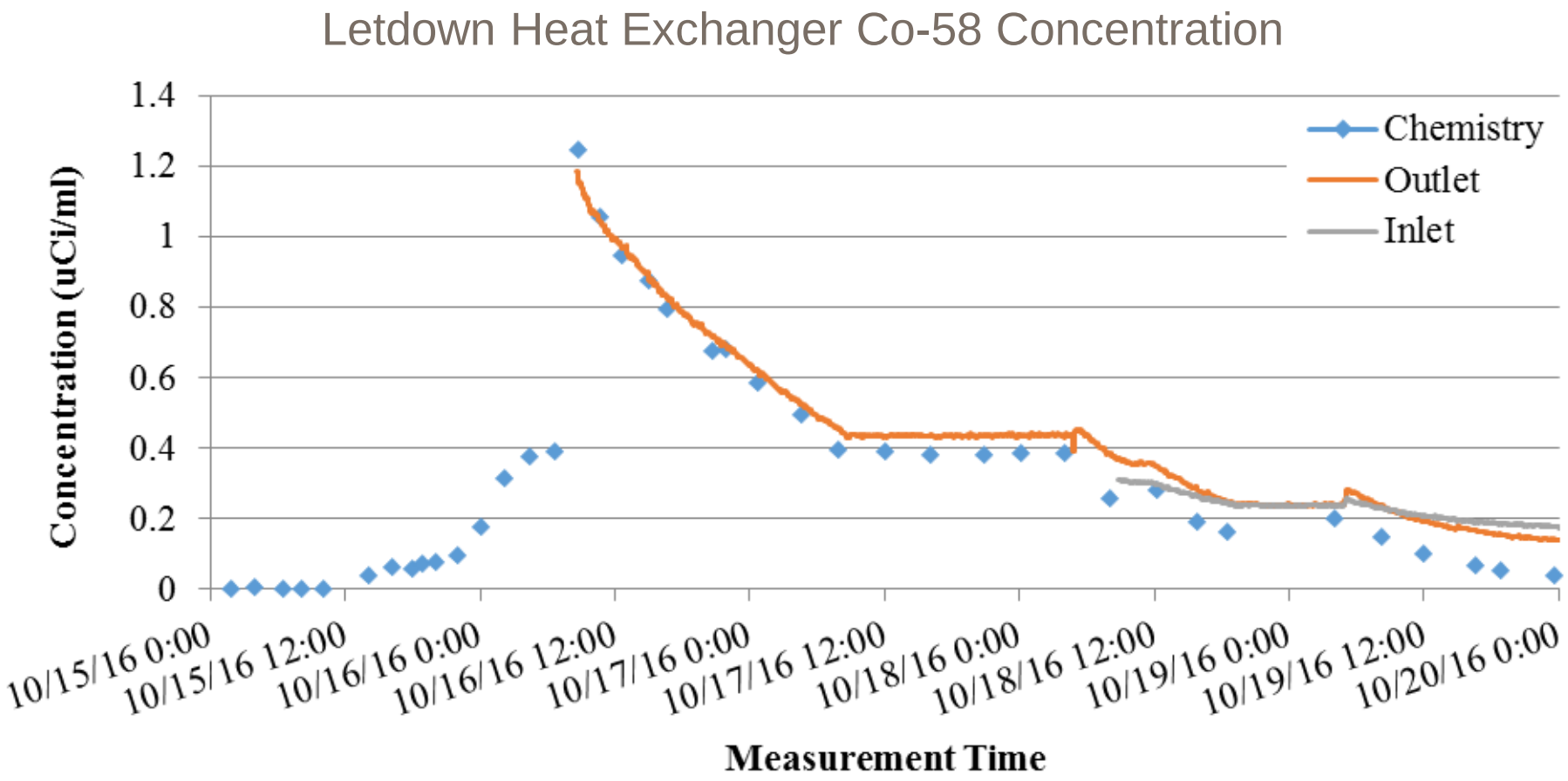
REACTOR COOLANT SYSTEM CLEANUP

The in-situ gamma spectroscopy system was deployed during a refueling outage to observe cleanup of the RCS after forced oxidation. Two process systems were monitored:

- Letdown Heat Exchanger Inlet and Outlet
- Residual Heat Removal Letdown and Return Lines

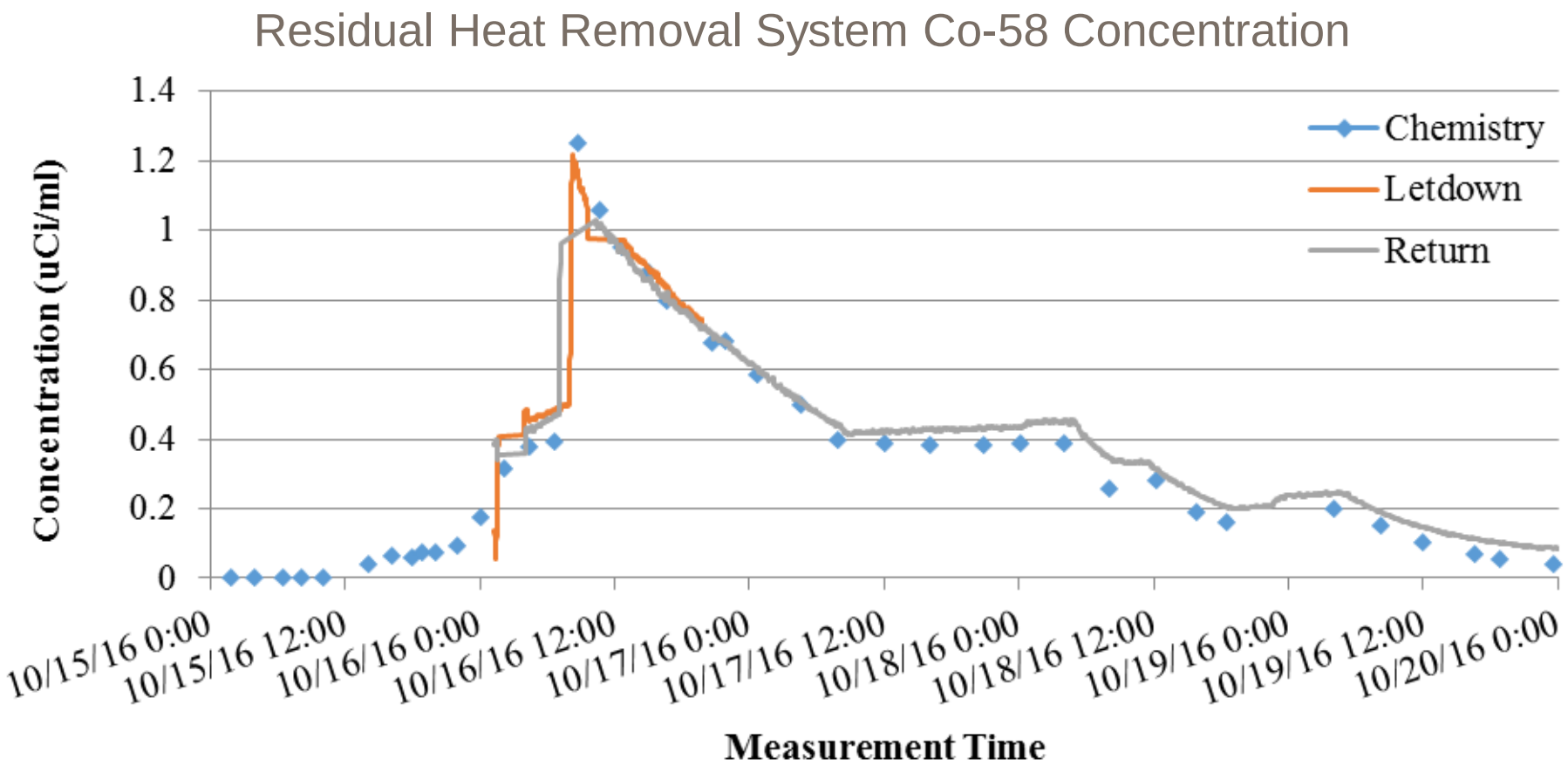
Chemistry sampling of the RCS occurs near the outlet of the Letdown Heat Exchanger and sample results were used as validation of the in-situ system calibration.

REACTOR COOLANT SYSTEM CLEANUP



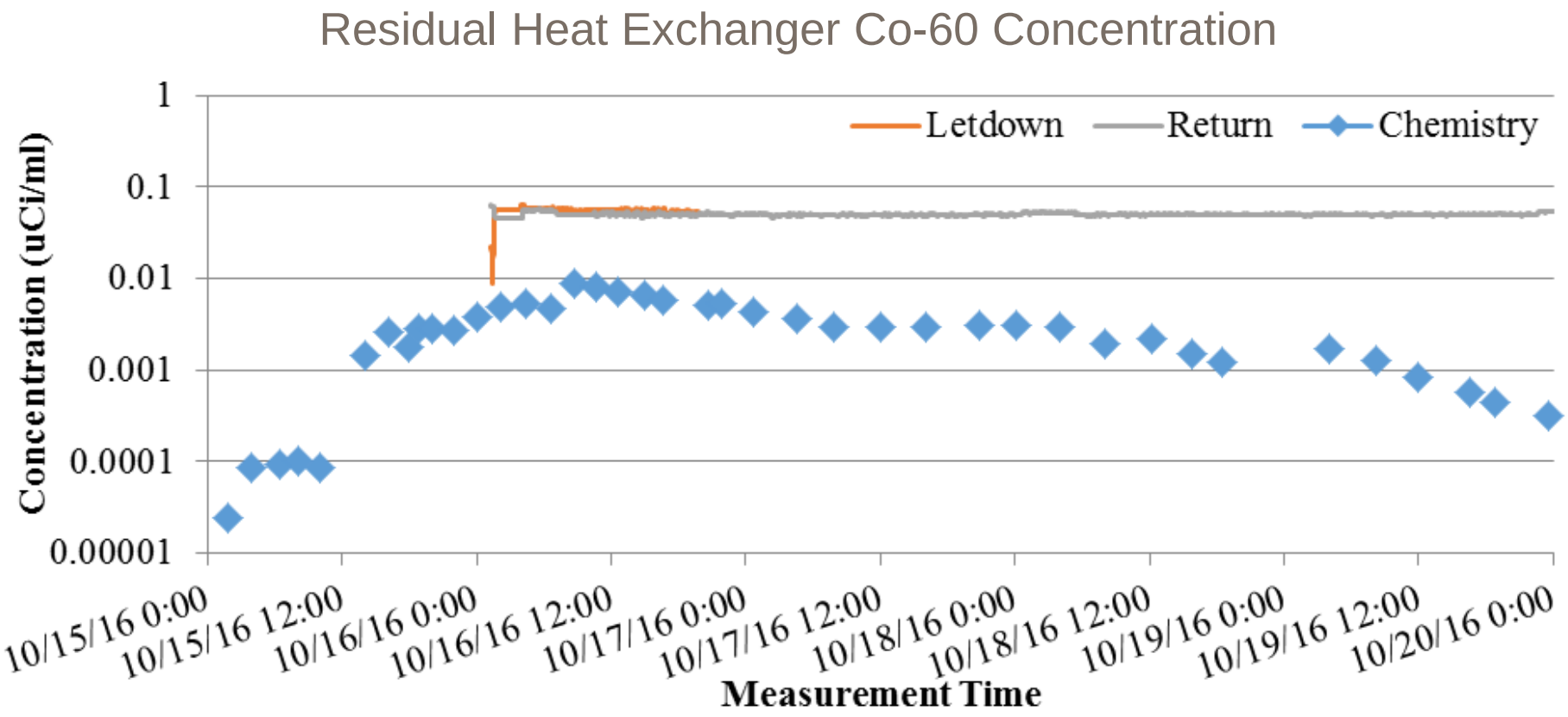
Logistical challenges delayed installation of the Inlet monitor.

REACTOR COOLANT SYSTEM CLEANUP



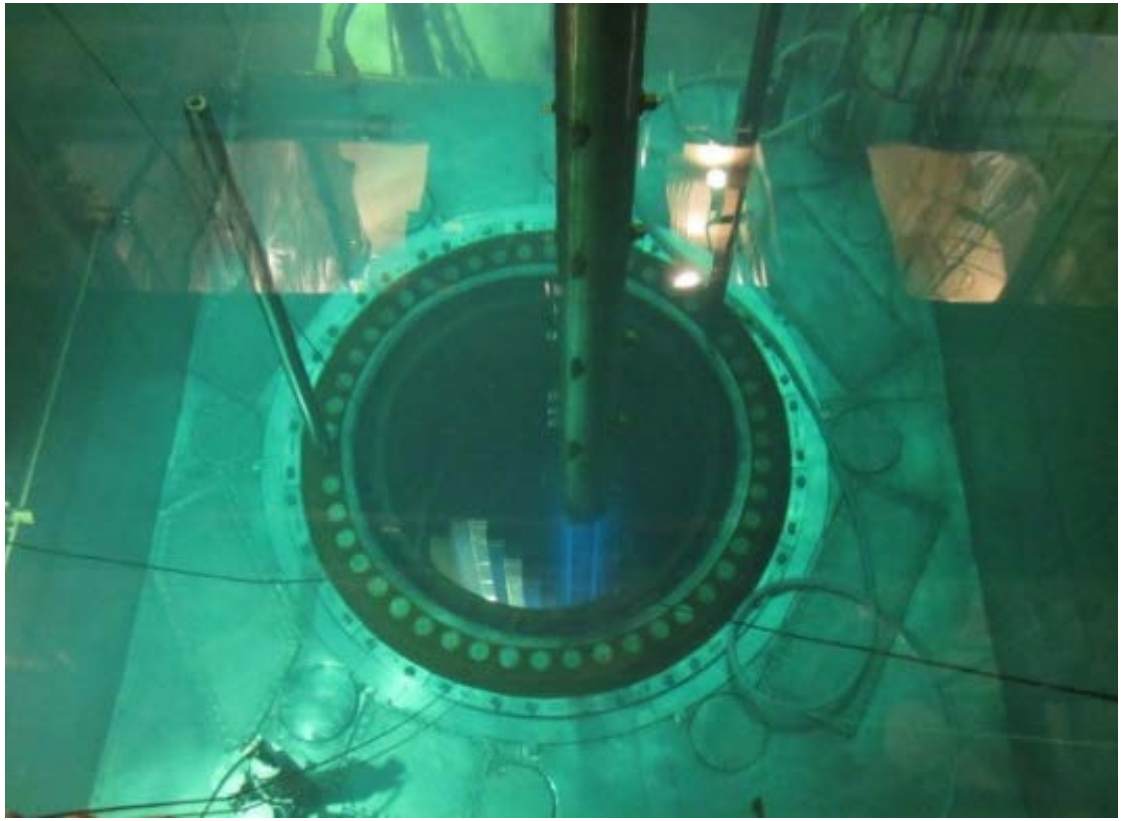
Missing data is indicated by straight lines within the dataset

REACTOR COOLANT SYSTEM CLEANUP



REACTOR COOLANT SYSTEM CLEANUP

Real time monitoring of primary dose contributor concentrations in the RCS during forced oxidation cleanup reduces the need for chemistry sampling and provides a real time correlation with operating parameters.



REACTOR COOLANT SYSTEM CLEANUP

Conclusions drawn from in-situ monitoring system results:

- Agreement with chemistry samples for Co-58 concentrations
- Consistency between different process systems demonstrates that the chemistry Letdown samples are representative of the overall RCS system for Cobalt
- Residual Heat Removal results for Co-60 concentration illustrates plate out on the process piping that masks movement of low levels of activity.
- Knowing when cleanup goals are achieved can save up to 2 hours of critical path time, equating to a savings of $83,333 per refueling outage.

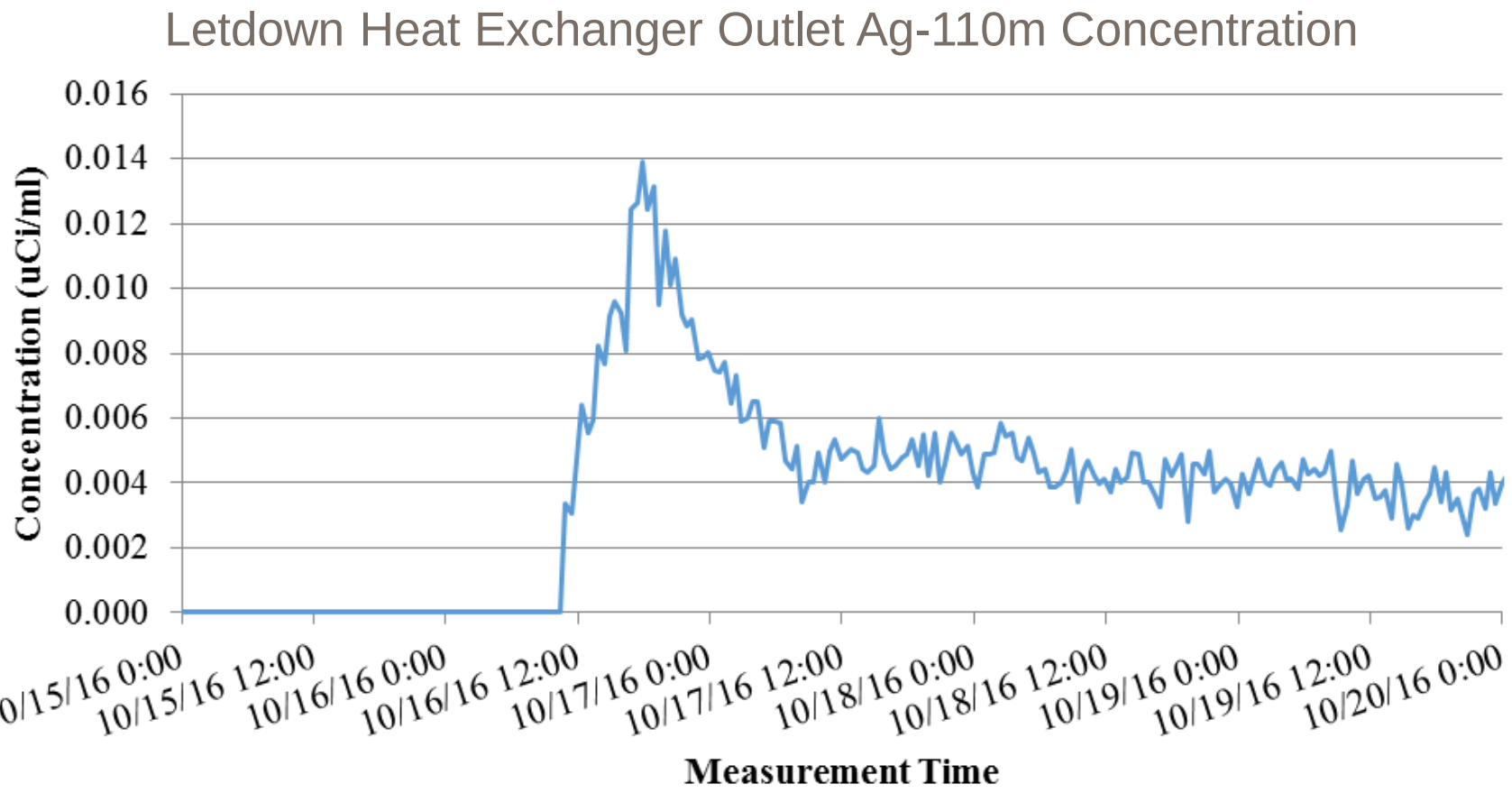
COMPONENT FAILURE EARLY INDICATIONS

In-situ monitoring of various process systems allows for early detection of radionuclides prone to plate out. The program aims to provide monitoring for fuel failure, primary to secondary leakage, and silver contamination of the RCS.

During forced oxidation Ag-110m was detected in the RCS Letdown by the in-situ system but was not identified in chemistry samples. Ag-110m preferentially deposits in cold points of auxiliary systems heat exchangers, and may plate out in piping before being sampled by chemistry.

The most likely root cause for Ag-110m within the RCS is leakage from the neutron-absorbing alloy (Ag-In-Cd) contained in control rods or wear from silver plated pressure vessel seals.

COMPONENT FAILURE EARLY INDICATIONS



RADIOACTIVE WASTE CONTROLS

By utilizing this equipment as a integrator on resin bed inlets and outlets, the total radionuclide activity in the bed can be quantified. Having a known source term provides significantly more reliable information for ALARA planning and provides an avenue to reduce radiological shipping risk by changing resin beds before they reach Class B levels.

SUMMARY

The in-situ gamma spectroscopy program at Prairie Island uses radionuclide characterization data to support the Nuclear Promise by providing a real time picture of plant conditions for enhanced decision making.

- Reactor Coolant System Cleanup Monitoring
  - Characterize Multiple Process Systems
  - Correlation with Operating Conditions
- Early Indications of Component Failure
  - Silver Leakage
- Radioactive Waste Controls
  - Enhanced ALARA Planning
  - Reduced Resin Cost

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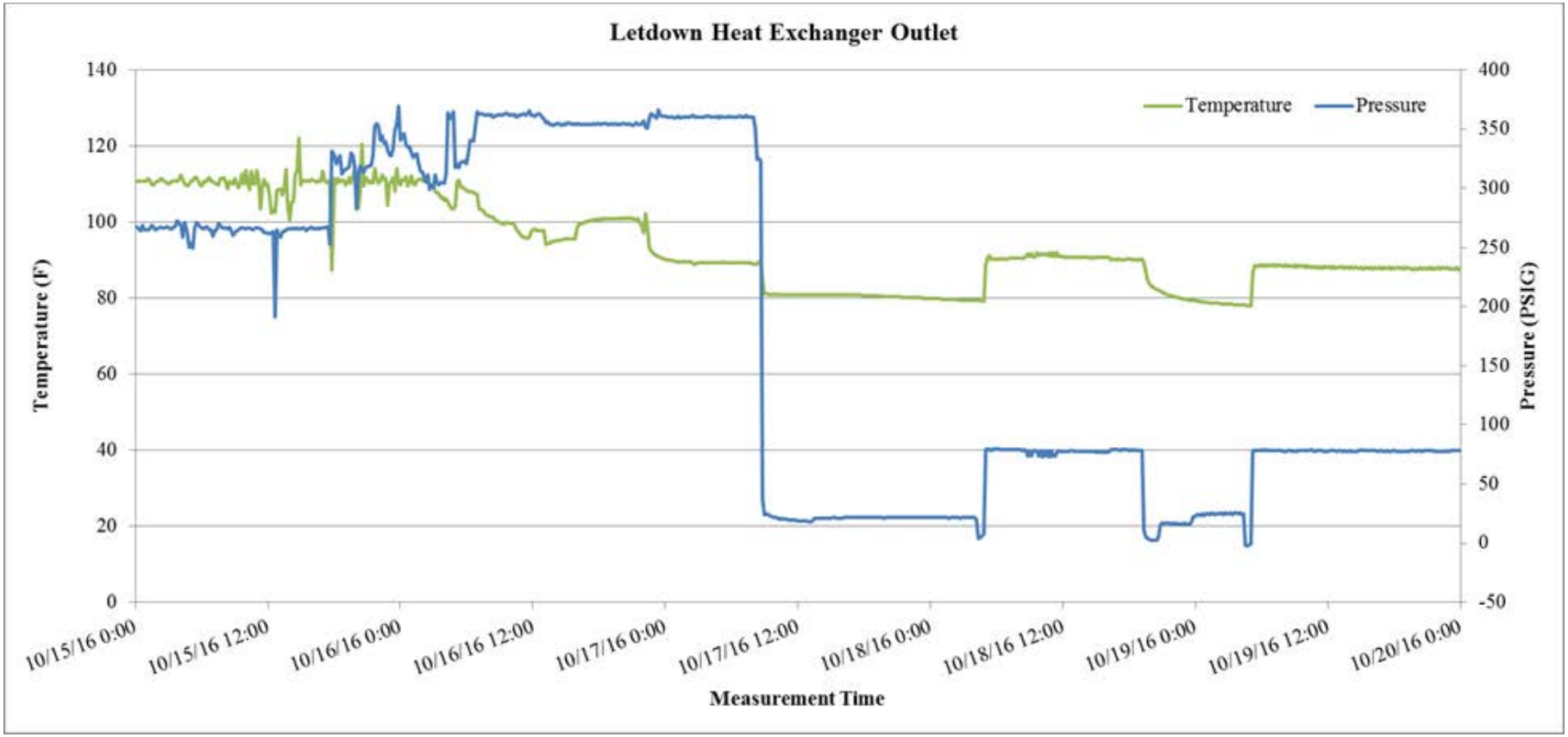
QUESTIONS

ATTACHMENTS



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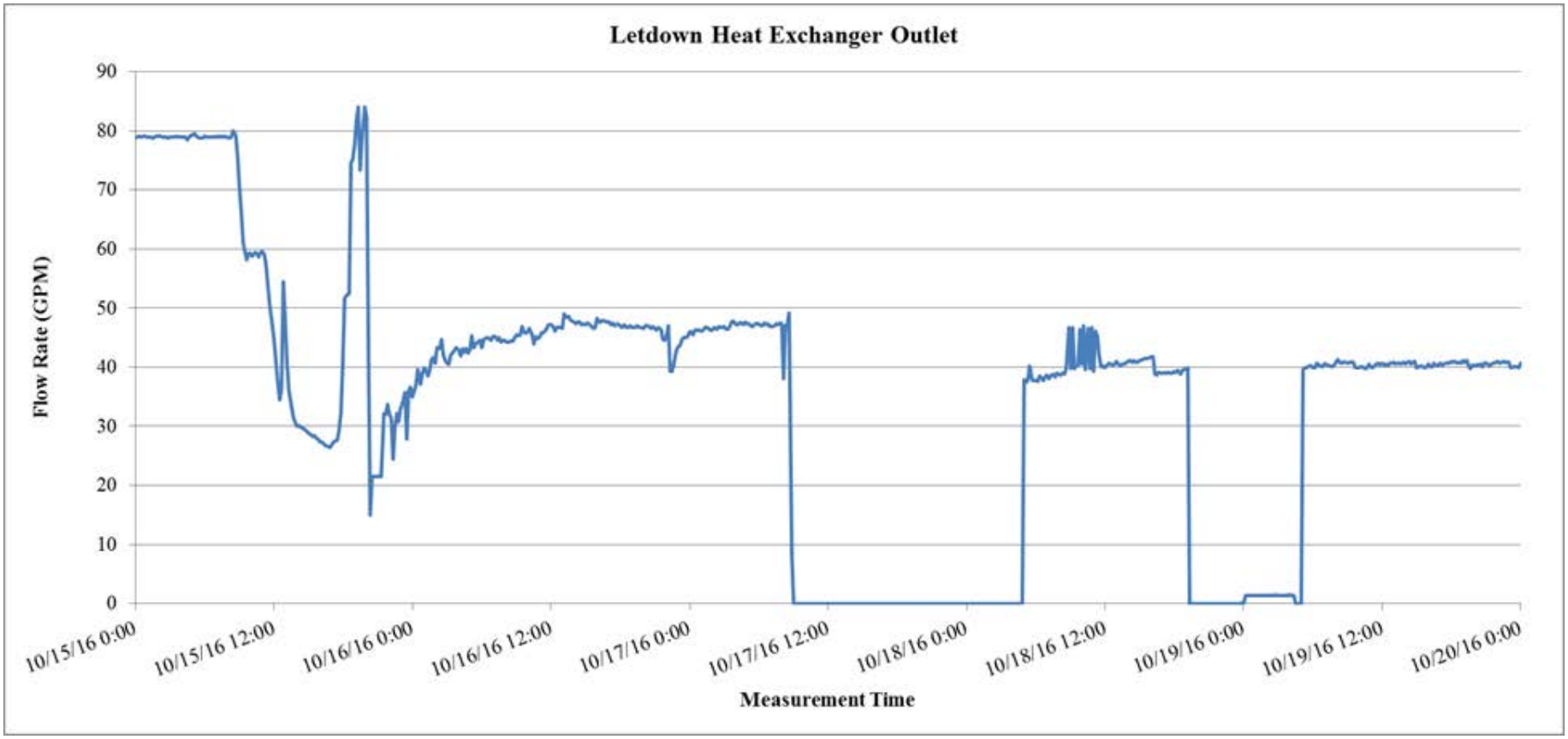

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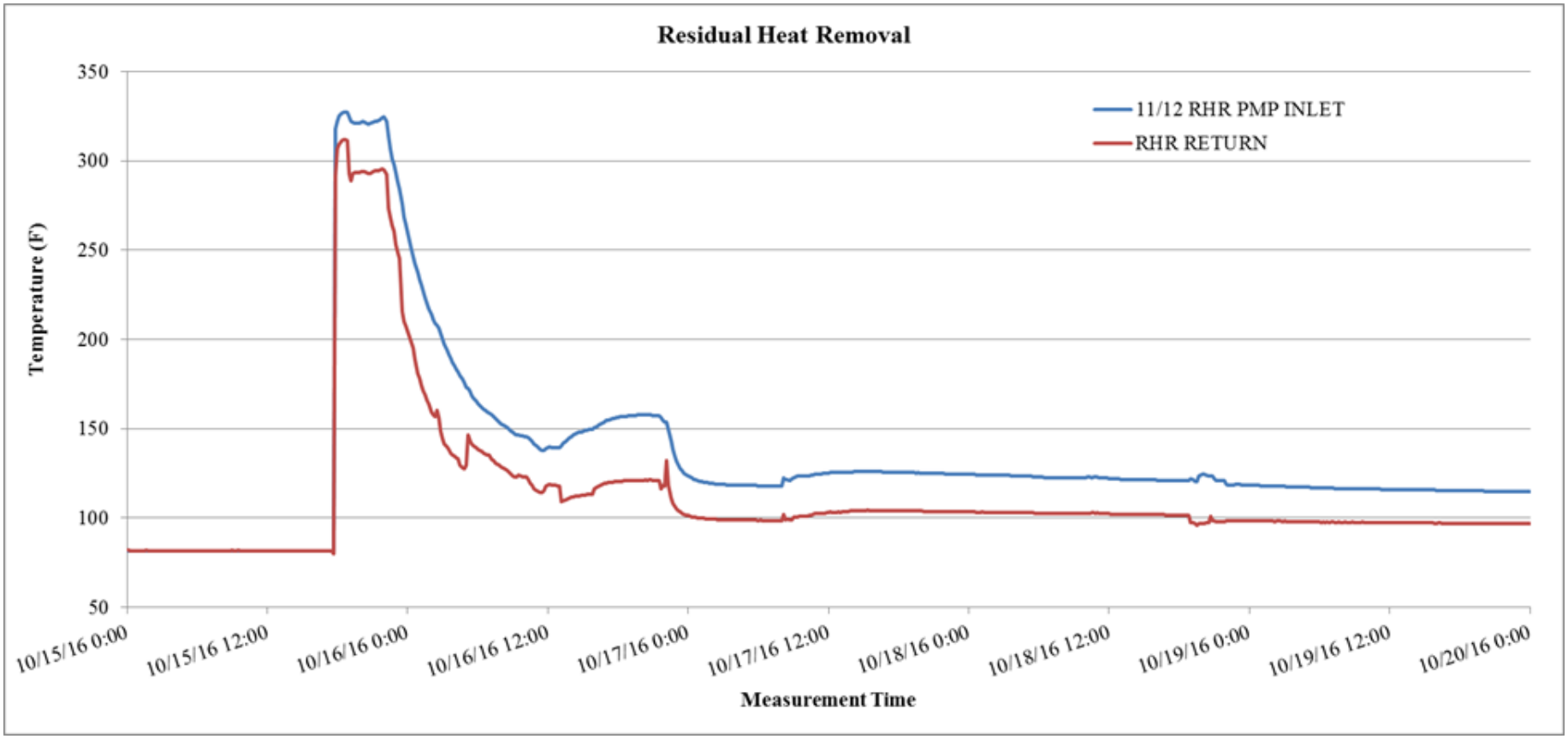

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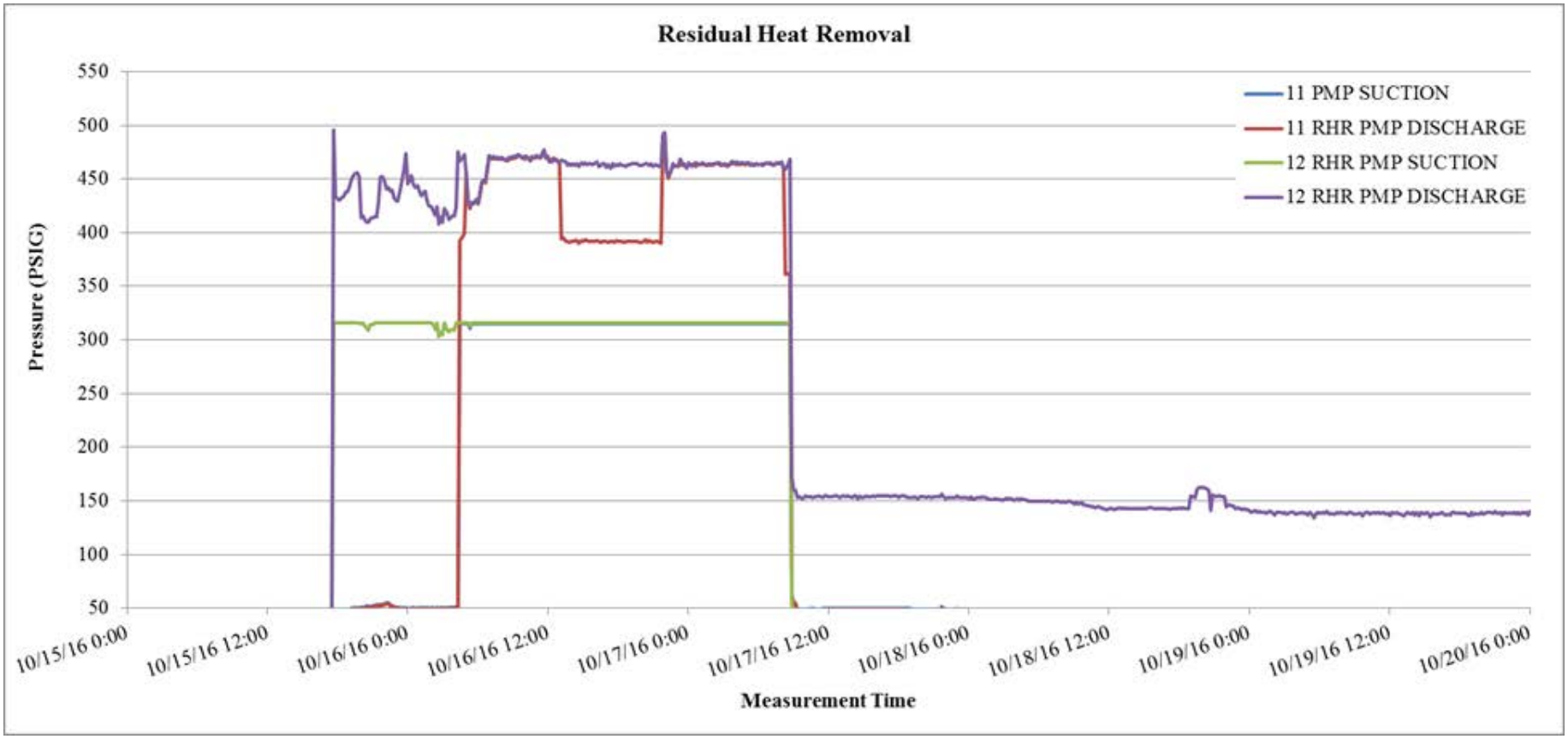

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