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UNITED STATES NUCLEAR REGULATORY COMMISSION

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# Testing to Evaluate State of Charge of Nuclear Grade Lead-Acid Batteries

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# Outline

- Introduction
- Research Project Overview
- Preliminary Observations
- Summary

# NRC - What It Is and What It Does

- Regulatory Mission
  - To license and regulate the nation's civilian use of byproduct, source and special nuclear materials to ensure adequate protection of public health and safety, promote the common defense and security, and protect the environment

- Regulatory Framework
  - Technical Specifications (Technical Specification Task Force-500)
  - Regulatory Guide 1.129, "Maintenance, Testing, and Replacement of Vented Lead-Acid Storage Batteries for Nuclear Power Plants"

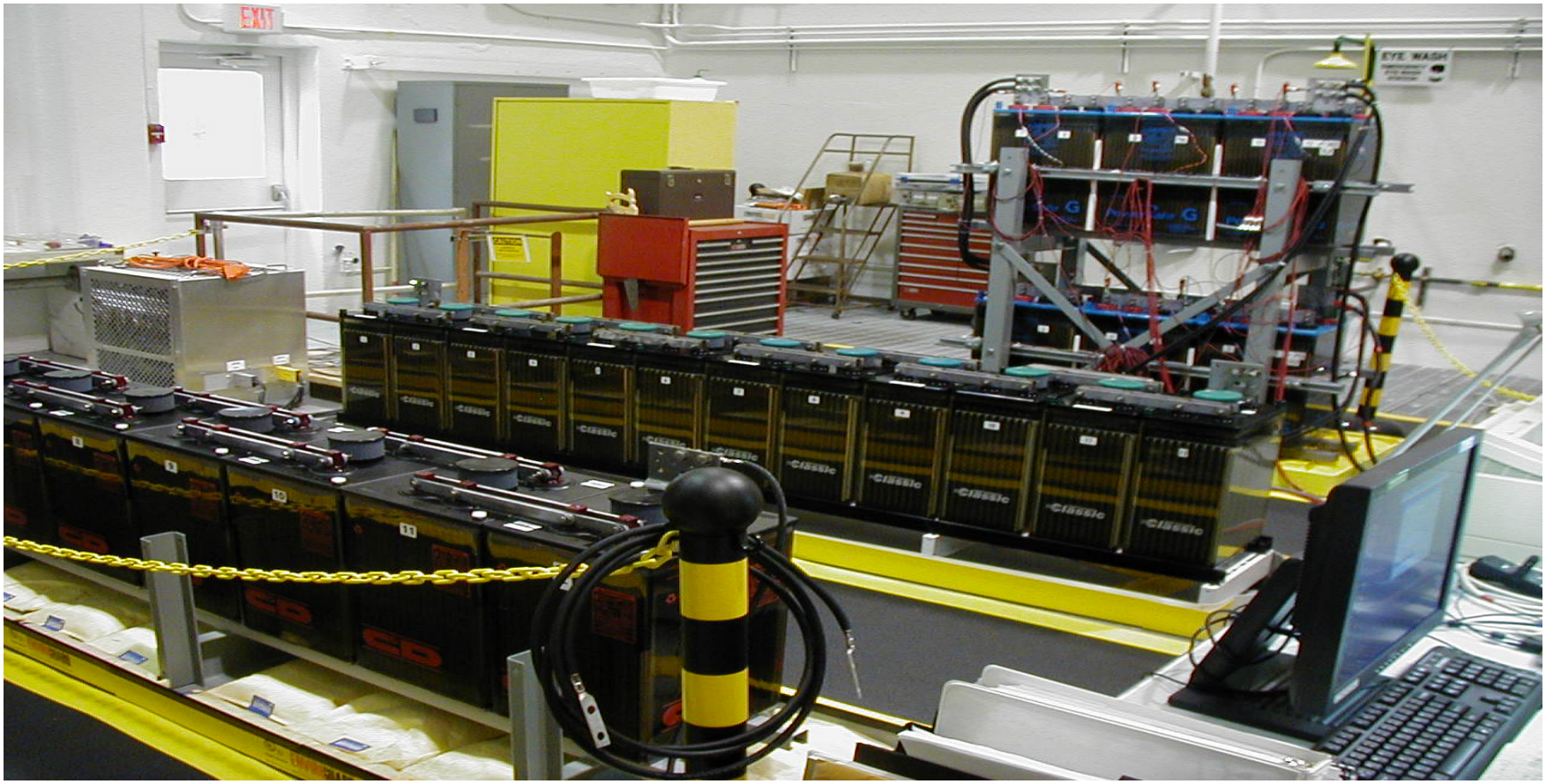
# Research Project Overview

- Objective
  - Verify whether float current monitoring is a suitable method for determining the state-of-charge of a nuclear-grade vented lead-acid battery
- Contractor support
  - Brookhaven National Laboratory
- Schedule
  - Estimated completion date: 12/31/2011

# Test Plan

- Use 3 nuclear-grade batteries
  - Vented lead-calcium
  - 12 cells
- Perform 10 cycles per battery
  - 1 Cycle = 4 hour performance discharge test + Recharge
- Monitor float current and specific gravity during recharge
- Document observations

# Test Arrangement



# Float Current Monitoring

- Two Measurement Methods
  - State-of-the-art float current monitor
  - Calibrated 200 ampere/50 millivolt shunt
- Continuous monitoring
  - Data acquisition systems

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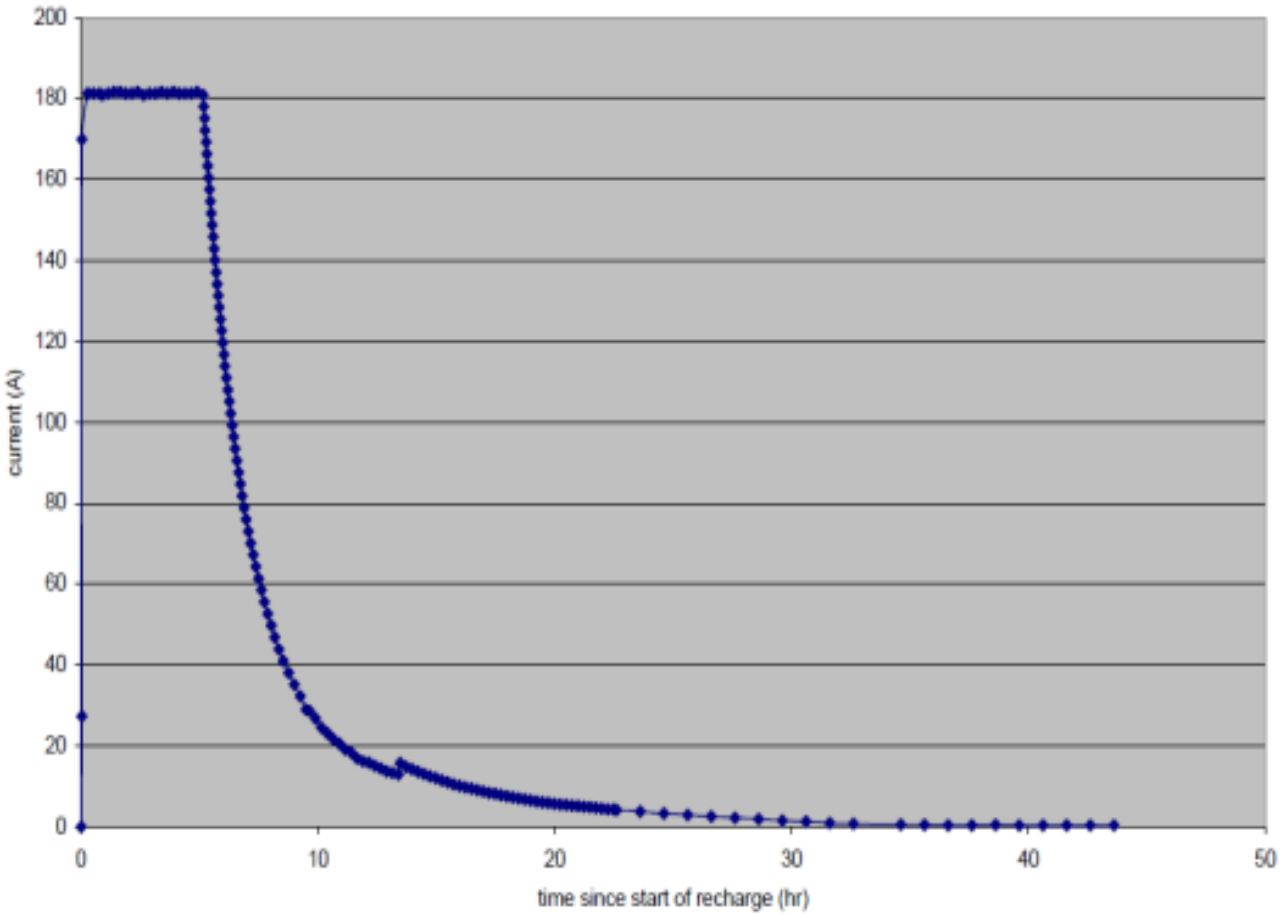
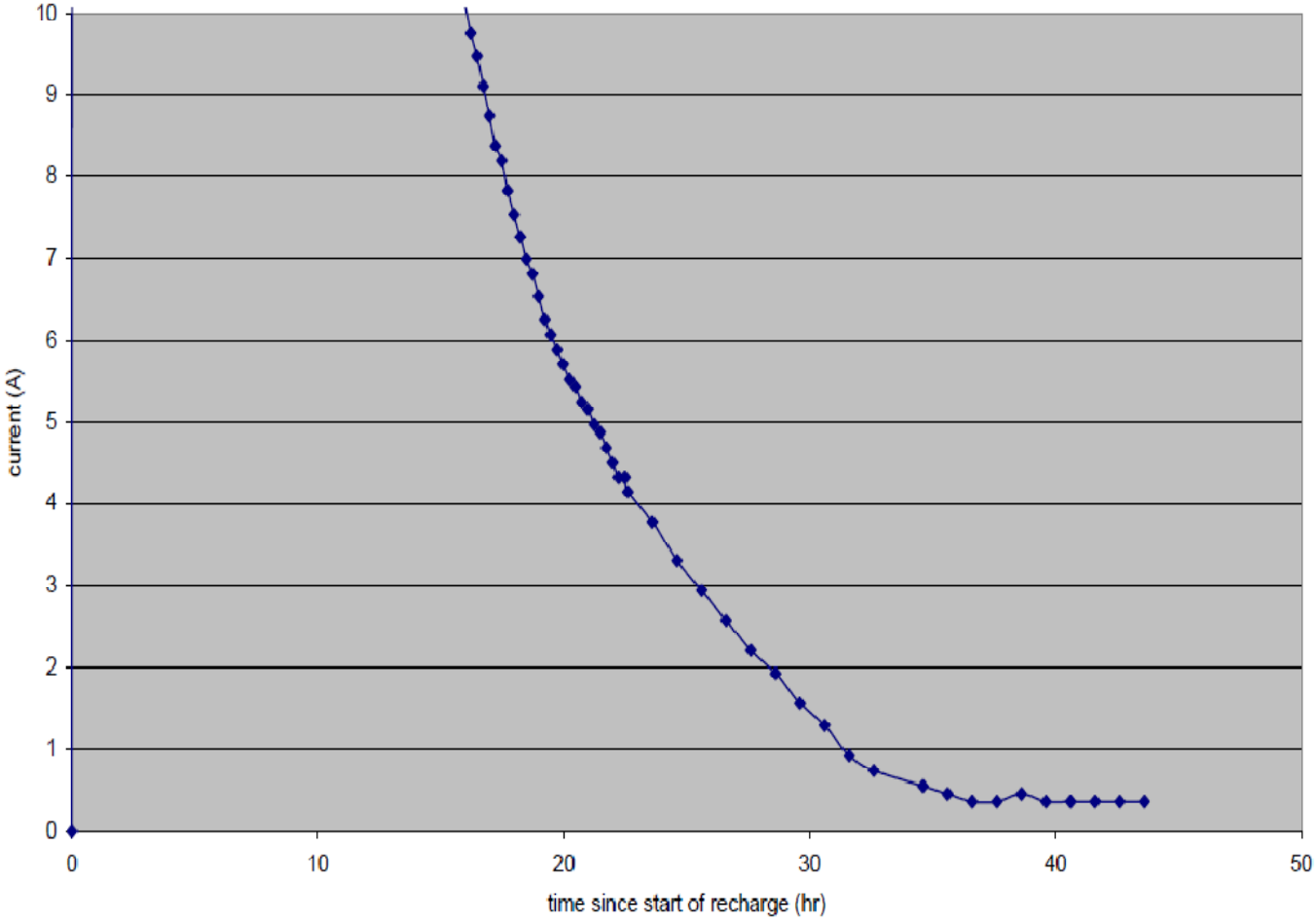
# Specific Gravity Monitoring

- Readings taken with a digital hydrometer
- Readings taken on all cells at the midpoint
- On 2 cells readings taken at 3 points: midpoint, bottom, and above the top of the plates

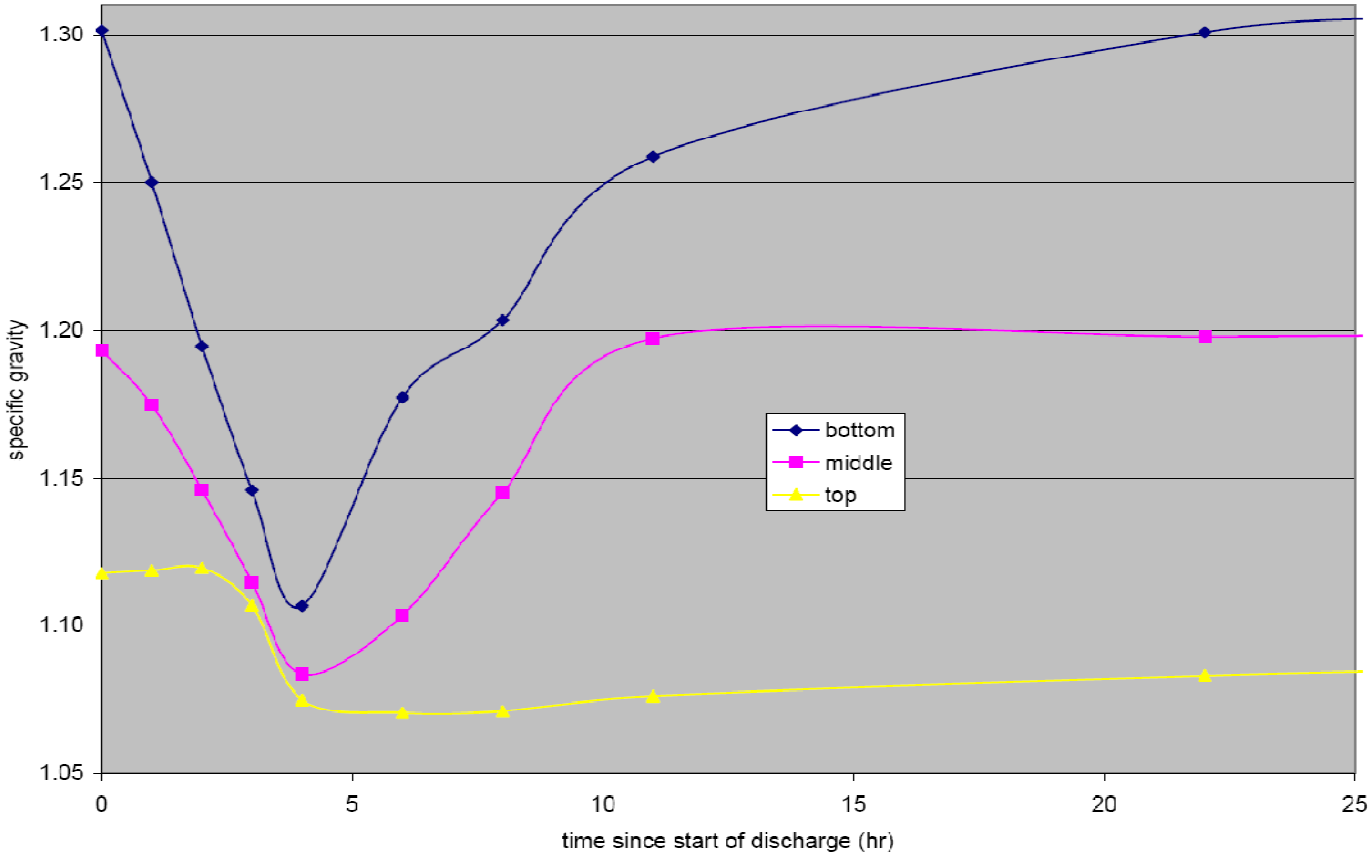
# Recharge Cycle Sample Profile



# Late Cycle Recharge (Point of Stabilization) Sample



# Specific Gravity Vs. Time



# Preliminary Insights

- Results appear consistent among all three battery strings
- Float current appears to stabilize when float current drops below 2.0 amperes
- Midpoint and bottom specific gravity readings respond on recharge within 8-10 hours
- Within 24 hours of start of recharge, indicators such as specific gravity (midpoint and bottom) and float current return to predischarge levels
- Significant stratification exists and progressing with cycling
- Last battery string still undergoing further testing
- Final findings and observations will be issued in a NUREG-CR report

# Path Forward

- Testing is still underway
- Final findings and observations will be issued in a NUREG-CR report
- NRC will evaluate the NUREG-CR report to determine whether any regulatory actions are warranted

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# Questions?