ELECTRIC POWER RESEARCH INSTITUTE

Efforts on SCC of Spent Fuel Canisters in Marine Environments in RIRP and ESCP

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Background – RIRP on SCC in Marine Environment

- RIRP Issue No. N-10-01
  - Problem Statement:
    There is insufficient data to determine the environmental conditions, and associated time scales, necessary for potential initiation of chloride-induced stress corrosion cracking (SCC) in stainless steel dry spent nuclear fuel (SNF) storage canisters deployed at ISFSI locations.
  - Success Criteria:
    Acquire and document data to determine:
    1. The minimum conditions defining a coastal marine atmosphere where the potential for SCC exists.
    2. The time scales under which SCC could occur, based upon actual atmospheric and cask conditions.

Background - ESCP

- EPRI initiated the Extended Storage Collaboration Program (ESCP) in Nov 2009
  - Extend basis for storage in existing systems well beyond 60 years
    - Inform decision makers
      - NRC Commissioners and staff
      - Blue Ribbon Commission
  - Modeled on prior dry storage license extension research
    - Phase 1: Review current technical bases and conduct gap analysis for storage systems
    - Phase 2: Conduct experiments, field studies, and additional analyses to address gaps
    - Phase 3: Coordinate research that results in a demonstration of a licensed dry storage system loaded with high burnup fuel (>45 GWd/MTHM)

Background – ESCP
SCC in Marine Environment

- Total of 6 “Expert Groups” established in ESCP 2 related to SCC in Marine Environment issue
  - SCC in Marine Environments
  - NDE of cask/canister integrity
- Primary R&D activity
  - In situ NDE of welded canisters
  - Develop and demonstrate NDE techniques
- Work with US vendors/utilities to obtain marine environment data

Background

- RIRP is working a short term regulatory issue supported by technical research
- ESCP is working a long term technical issue to support regulatory decision making
- The two overlap, but have different goals
- ESCP data collection and research is needed to resolve RIRP

Call For Industry Volunteers

- Looking for volunteer sites that are:
  - Willing to participate
    - Access to loaded canisters
    - Inspect loaded canisters
    - Monitor atmosphere
  - Near the coast
  - Low heat load
  - Long storage period
  - Willing to participate

Industry Volunteer Response

- Several sites have expressed interest
  - Lead site identified
    - ISFSI ~ ½ mile from coast
    - Low heat load canisters available
    - Units in storage > 10 years
  - Discussions with 4 other coastal sites
    - Identifying windows of opportunity
    - Both horizontal and vertical systems

Access to Canister

- Preferably through inlet and/or outlet
  - ALARA
  - Less cost
  - More circuitous path
  - May limit activities and scope of examinations
- Evaluating the possibility for some limited inspections with door/lid removed
  - Provides direct access to parts of canister
  - Higher dose
  - More detailed engineering and licensing evaluations required
  - Additional shielding

Scope of Inspections

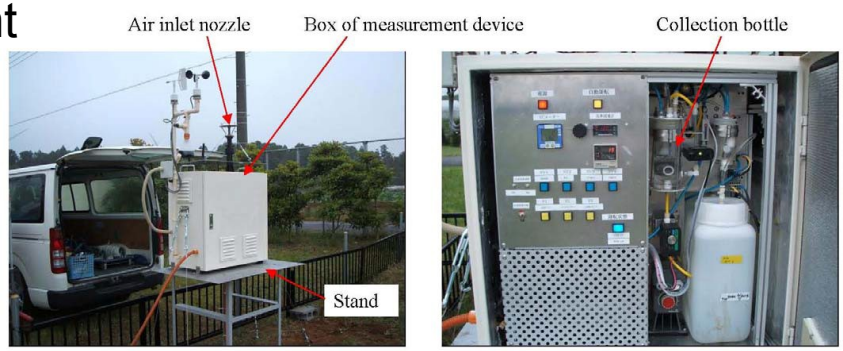
- Visual
- Temperature
  - Area near canister inside cask/module
  - Canister surface if possible
- Humidity
- Surface contaminants
- Area atmospheric conditions

Progress

- 3-D CAD model developed for lead site
- Vendor user's groups have solicited their users
- Potential vendors for tool delivery systems identified
  - Preliminary specification developed
- Various equipment identified and being evaluated
  - Infrared detectors, temperature and humidity instruments
  - Standards for collecting surface samples
  - Conceptual designs for other surface sample collection
- Obtaining OE from previous ISFSI license renewals

Future Plans - ESCP

- Detailed CAD models of other cask designs
- Development of delivery and NDE equipment for other designs
- Deploy CRIEPI atmospheric measurement device(s)
- Ultimate goal
  - Demonstrate NDE on multiple designs
  - Make available to industry
  - Industry continues with additional measurements
  - Correlate local atmospheric conditions to chlorides deposited on canister surface
  - Results feed into determining if actual conditions of SCC exist for loaded canisters



Outside view Inside view

Size(Box of measurement device): 700 × 700 × 400mm
Weight: 60 kg
Power supply: 100V (20A)

CRIEPI Central Research Institute of Electric Power Industry

NEI RIRP Schedule

- Dec 2011 – NRC/Industry Meeting
  - Industry's plans for inspections
  - Outline of what parameters to use for determining if SCC is a concern (e.g. temperature, chloride concentration, distance to salt water, etc)
- Jun 2012 – First inspections
- Dec 2012 – Other inspection(s)
- Apr 2013 – Develop screening criteria to determine if SCC is a concern
- Jun 2013 – NRC meeting to discuss screening criteria

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