

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

April 19, 1985

IE INFORMATION NOTICE NO. 85-30: MICROBIOLOGICALLY INDUCED CORROSION OF
CONTAINMENT SERVICE WATER SYSTEM

Addressees:

All holders of a nuclear power reactor operating license (OL) or construction permit (CP).

Purpose:

This information notice is provided to alert recipients of significant corrosion pitting due to microbiologically induced corrosion identified in stainless steel piping sections of a service water system after an extended plant outage. It is expected that recipients will review the information for applicability to their facilities and consider actions, if appropriate, to preclude similar problems occurring at their facilities. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On January 26, 1984, H. B. Robinson Unit 2 was shut down and remained shut down throughout the year to replace the lower assemblies of the steam generator and perform other maintenance work.

On November 19, 1984, Carolina Power and Light Company (CP&L) reported that minor pinhole leaks were found in the heat affected zones of circumferential welds joining 6-inch diameter, Schedule 10, 304 stainless steel piping that provides service water to the four containment chilling units. Visual inspection of the entire system revealed minor leakage at a total of 54 weld joints, 32 inside and 22 outside containment. Further radiographic examination revealed evidence of localized corrosion pitting on the inside surface at many other austenitic piping weld joints of the system. Numerous sleeve assemblies were required to restore integrity of the welds degraded by the corrosion attack.

Discussion:

The licensee's investigation determined that the root cause of the problem was the result of microbiologically induced corrosion (MIC). This is representative of several similar incidents reported in construction and operating plants in past years. A very recent example may be a large number of leaking welds in

8504170240

PDR IAE

850419
Notice 85-030

the Essential Spray Pond Piping System at Palo Verde Unit 2. The licensee's evaluation is currently underway, but their preliminary conclusion is the problem is caused by MIC.


MIC is a form of corrosive action that occurs as a direct, or indirect, result of living organisms in contact with the materials of construction. Microorganisms have been observed in a variety of environments including soils, sediment, natural fresh water (e.g., wells, rivers, lakes), brackish and sea water, as well as oil and other natural petroleum products. Many species may form synergistic cross feeding support systems with other bacteria, fungi, algae and the like to enhance survival under the most adverse conditions. They have been known to tolerate a wide-range of temperatures (-10 to 90°C), pH values of 0 to 10.5, oxygen concentrations from zero to almost 100 percent O₂ and extreme hydrostatic pressure. There are six different classifications of microorganisms containing over 30 species that can be a problem, depending on the geographic location and the environmental conditions.

The metabolic processes of organisms are sustained by chemical reactions. These processes can significantly influence the corrosion behavior of materials by (1) destruction of protective surface films, (2) creating corrosive deposits, and/or (3) altering anodic and cathodic reactions depending on the environment and organism(s) involved.

Several general methods for inhibiting MIC have been employed with varied degrees of success in recirculation systems. Among these methods were an application of protective coatings in conjunction with cathodic protection, corrosion inhibitors, or water chemical treatment such as periodic shock chlorination. However, it is important to correctly diagnose the presence of MIC and the organisms involved before attempting such corrective measures to ensure that no products are formed that themselves have a detrimental effect on the materials. Moreover, if water chemical treatment is used, it is important to ensure that residual chemical levels are maintained within the permissible range of applicable EPA requirements.

Where the above measures are not practical, it has been observed that relatively rapid fluid flow tends to prevent attachment of organisms whereas low flow rates or stagnant conditions favor biofouling and concentration cell corrosion. Thus, cleaning and dry lay up, or periodic recirculation flushing, during extended outages to mitigate known biological activity would appear to be prudent alternatives.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the Regional Administrator of the appropriate NRC regional office or the technical contact listed below.



Edward L. Jordan, Director
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

Technical Contact: William J. Collins, IE
(301) 492-9630

Attachment:
List of Recently Issued IE Information Notices

LIST OF RECENTLY ISSUED
 IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
85-29	Use Of Unqualified Sources In Well Logging Applications	4/12/85	All well logging source licensees
85-03 Sup. 1	Separation Of Primary Reactor Coolant Pump Shaft And Impeller	4/9/85	All power reactor facilities holding an OL or CP
85-28	Partial Loss Of AC Power And Diesel Generator Degradation	4/9/85	All power reactor facilities holding an OL or CP
85-27	Notifications To The NRC Operations Center And Reporting Events In Licensee Event Reports	4/3/85	All power reactor facilities holding an OL or CP
85-26	Vacuum Relief System For Boiling Water Reactor Mark I And Mark II Containments	4/2/85	All BWR facilities having a Mark I or Mark II containment and holding an OL or CP
85-25	Consideration Of Thermal Conditions In The Design And Installation Of Supports For Diesel Generator Exhaust Silencers	4/2/85	All power reactor facilities holding an OL or CP
85-24	Failures Of Protective Coatings In Pipes And Heat Exchangers	3/26/85	All power reactor facilities holding an OL or CP
85-23	Inadequate Surveillance And Postmaintenance And Post-modification System Testing	3/22/85	All power reactor facilities holding an OL or CP
85-22	Failure Of Limitorque Motor-Operated Valves Resulting From Incorrect Installation Of Pinon Gear	3/21/85	All power reactor facilities holding an OL or CP

OL = Operating License
 CP = Construction Permit