EPRI
Electric Power
Research Institute

Keywords:
Boiling water reactor
Core spray
Repair
Stress corrosion cracking
Vessel and internals

EPRI TR-106893
September 1996

BWR Vessel and Internals Project

Internal Core Spray Piping and Sparger Repair Design Criteria (BWRVIP-19)

Prepared by
BWRVIP Repair Committee
and
GE Nuclear Energy

NON-PROPRIETARY INFORMATION

NOTICE: This report contains the non-proprietary information that is included in the proprietary version of this report. The proprietary version of this report contains proprietary information that is the intellectual property of BWRVIP utility members and EPRI. Accordingly, the proprietary report is available only under license from EPRI and may not be reproduced or disclosed, wholly or in part, by any Licensee to any other person or organization.

REPORT SUMMARY

BWRVIP Vessel and Internals Project

Internal Core Spray Piping and Sparger Repair Design Criteria (BWRVIP-19)

The Boiling Water Reactor Vessel and Internals Project (BWRVIP), formed in June, 1994, is an association of utilities focused exclusively on BWR vessel and internals issues. This BWRVIP report documents criteria which can be used to design a repair for cracks which have been known to occur in BWR core spray piping.

INTEREST CATEGORIES

Piping, reactor, vessel & internals
Licensing and safety assessment

KEYWORDS

Boiling water reactor
Core spray
Repair
Stress corrosion cracking
Vessel and internals

BACKGROUND A number of BWR plants have experienced stress corrosion cracking in the core spray piping which is located internal to the reactor pressure vessel. A variety of mechanical and welded techniques have been proposed to repair the cracks. Since a large number of concerns need to be addressed in designing such a repair, it is useful to have these criteria set down in a comprehensive document.

OBJECTIVE To compile a core spray piping and sparger repair design criteria that can be used to perform repair design and that can be submitted to the appropriate regulatory agencies for approval of a generic design process.

APPROACH The project team assembled a draft document that discussed all elements which need to be considered in designing a repair to the core spray piping or spargers. These items include: design objectives; structural evaluation; system evaluation; materials, fabrication and installation considerations; and, required inspection and testing. The draft was then reviewed in depth by BWRVIP utility representatives as well as third party contractors. The final report incorporates comments received during that review.

RESULTS The document provides general design acceptance criteria for the temporary or permanent repair of core spray piping and spargers. Repairs designed to meet these criteria will maintain the structural integrity of the core spray system under normal operation as well as under postulated transient and design basis accident conditions.

EPRI PERSPECTIVE The criteria listed in the report define a standard set of considerations which are important in designing a core spray piping repair. It is intended that these criteria will be submitted to the USNRC and, possibly, non-US regulators, for their approval. Regulatory acceptance of these generic criteria will significantly reduce the utility effort required to obtain approval for plant-specific repairs.

PROJECT
WOB501
EPRI Project Manager: Warren Bilanin
Nuclear Power Group
Contractor: General Electric

For ordering information about this report, call the EPRI Program Manager at (415) 855-2340.

For membership information, call (415) 855-2514.

BWR Vessel and Internals Project

Internal Core Spray Piping and Sparger Repair Design Criteria (BWRVIP-19)

TR-106893
Research Project B501

Final Report, September, 1996

Prepared by:

BOILING WATER REACTOR VESSEL AND INTERNALS PROJECT REPAIR COMMITTEE

GE NUCLEAR ENERGY

Prepared for

BOILING WATER REACTOR VESSEL & INTERNALS PROJECT and
ELECTRIC POWER RESEARCH INSTITUTE
3412 Hillview Ave.
Palo Alto, California 943040

DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITIES

This report was prepared by the organization(s) named below as an account of work sponsored or cosponsored by the BWR Vessel and Internals Project (BWRVIP) and the Electric Power Research Institute, Inc. (EPRI). Neither BWRVIP, EPRI, any member of EPRI, any cosponsor, the organization(s) named below, nor any person acting on behalf of any of them:

(a) makes any warranty or representation whatsoever, express or implied, (i) with respect to the use of any information, apparatus, method, process or similar item disclosed in this report, including mechantability and fitness for a particular purpose, or (ii) that such use does not infringe on or interfere with privately owned rights, including any party's intellectual property, or (iii) that this report is suitable to any particular user's circumstance, or

(b) assumes any responsibility for any damages or other liability whatsoever (including any consequential damages, even if BWRVIP, EPRI or any EPRI representative has been advised of the possibility of such damages) resulting from your selection or use of this report or any information, apparatus, method, process or similar item disclosed in this report.

Organization(s) that prepared this report:

BOILING WATER REACTOR VESSEL AND INTERNALS PROJECT REPAIR COMMITTEE

GE NUCLEAR ENERGY

ORDERING INFORMATION

Requests for copies of this report should be directed to the BWRVIP Program Manager, 3412 Hillview Ave., Palo Alto, Ca. 94304, (415) 855-2340.

ABSTRACT

The Boiling Water Reactor Vessel and Internals Project (BWRVIP) was formed in June 1994 as a utility-directed initiative to address BWR vessel and internals issues. This criteria document was developed by the Repair Technical Subcommittee of the BWRVIP.

This document provides the general design acceptance criteria for temporary and permanent repair of internal core spray piping and spargers. It is provided to assist BWR owners in designing repairs which maintain the structural integrity of the internal core spray piping and spargers during normal operation and under postulated transient and design basis accident conditions for the remaining plant life or other service life as specified by the plant owner.

Issuance of this document is not intended to imply that repair of internal core spray piping and spargers is the only viable method for resolving cracking in internal core spray piping and spargers. Due to variation in the material, fabrication, environment and as-found condition of individual internal core spray piping and spargers, repair is only one of several options that are available. The action to be taken for individual plants will be determined by the plant licensee.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF FIGURES

16

ABOUT BWRVIP

The BWR Vessel and Internals Project (BWRVIP) is an association of utilities owning and operating boiling water reactors. The project is focused exclusively on reactor vessel and vessel internals issues in operating plants. Objectives of the BWRVIP are to lead the BWR industry toward generic resolution of vessel and internals integrity and operability issues; to identify or develop generic, cost-effective strategies from which each operating plant will select the most appropriate alternative; to serve as the focal point for the regulatory interface with the industry on BWR vessel and internals integrity and operability issues; and to share information among members. EPRI manages the technical program on behalf of the utility members of the BWRVIP.

ABOUT EPRI

Electricity is increasingly recognized as a key to societal progress throughout the world, driving economic prosperity and improving the quality of life. The Electric Power Research Institute delivers the science and technology to make the generation, delivery, and use of electricity affordable, efficient, and environmentally sound.

Created by the nation's electric utilities in 1973, EPRI is one of America's oldest and largest research consortia, with some 700 members and an annual budget of about $500 million. Linked to a global network of technical specialists, EPRI scientists and engineers develop innovative solutions to the world's toughest energy problems while expanding opportunities for a dynamic industry.

EPRI. *Powering Progress*

Printed on recycled paper (50% recycled fiber, including 10% postconsumer waste) in the United States of America.