THE 4TH INTERNATIONAL TOPICAL MEETING ON
NUCLEAR THERMAL HYDRAULICS, OPERATIONS AND SAFETY
April 6-8, 1994, Taipei, Taiwan

EVALUATION OF PRACTICALITY OF ASME CODE, SECTION XI

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ABSTRACT

Many nuclear power plants have found that it is impractical or unduly burdensome to comply with some ASME Boiler and Pressure Code provisions and have sought relief from those provisions from the Nuclear Regulatory Commission. An Electric Power Research Institute (EPRI) project is evaluating such Code provisions and alternatives to them that will meet the safety intent of the Code with less burden on utilities. The methodology is to extract data from an on-line data base of relief requests since 1980, analyse the data to identify burdensome provisions for which there are satisfactory alternatives, and recommend changes in the Code to the ASME.

INTRODUCTION

Efforts to reduce O&M costs at US plants by improving plant maintenance sometimes requires substantial effort to obtain and analyze data required for development of an optimum maintenance program.

This paper addresses an example of such an effort: a project funded by the Electric Power Research Institute (EPRI) to reduce problems in inspections and tests of plant systems and components by appropriate revisions to Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (hereafter, the Code).

BACKGROUND

Section XI of the Code provides rules for inservice inspections (ISI) and inservice tests (IST) and references other rules for IST published in the ASME Operations and Maintenance Code. Section XI rules are incorporated periodically into regulations of the Nuclear Regulatory Commission (NRC), which are the principal drivers of safety-related inspection and test programs at US nuclear power plants.

For most US plants, compliance with some Section XI rules is impossible, or possible only at high costs, because of difficulties rooted in plant design, such as configuration of components. Utilities may obtain relief from such provisions by submitting requests to the NRC, demonstrating that (1) a proposed alternative to the examination or test prescribed by the Code would provide an acceptable level of quality and safety, or (2) compliance with the specified requirements would result in hardship or unusual difficulties without a compensating benefit to the level of quality or safety. NRC approval of the relief allows the utility to revise its maintenance program accordingly.

Historically, preparation of a request for relief has required several weeks of professional effort, with costs charged to O&M. In 1989, EPRI initiated a project to reduce that effort by developing and operating a system allowing on-line access to records of relief requests submitted by US utilities and acted upon by the NRC since 1980. The system (known as ARRIS, for Automated Relief Request Information System) is updated regularly so that users have access to new information soon after it is published.

RATIONALE AND WORK PLAN FOR CURRENT PROJECT

Even at reduced levels of effort, relief requests impose unnecessary costs on utilities. About 90% of the 4000 requests recorded in ARRIS through 1992 were approved in whole or in part by the NRC. This indicates that inspections and tests other than those specified by Code rules can provide adequate protection of public health and safety. EPRI initiated a project to address this aspect of the O&M problem in 1993. The project is to:

- Identify Code Section XI provisions that have been found to be impracticable or unduly burdensome by plants required to comply with them,
- Rank those provisions by degree of impracticality or burden to the industry as a whole,
- Select a reasonable number of provisions with the highest levels of industry-wide impracticality or burden, and
- Propose revisions to those provisions designed to reduce levels of industry-wide impracticality or burden while meeting the safety intent of the Code (beginning with two test cases).

The initial steps in the project involved research to identify impracticable or unduly burdensome Code provisions. Ranking and selection of provisions to be revised is to be completed in early 1994. The two test case proposals for Code revisions are scheduled for submission to the ASME in the Fall of 1994.

PROJECT STATUS AT END-DECEMBER 1993

Identification of Code Provisions:

Research began with extraction of data from the 4000 ARRIS records into a working database of about 5100 records (some ARRIS records address more than one Code provision). Combining records dealing with the same Code provision into summary records showed that, since 1980, utilities have requested relief from about 750 provisions of Code versions published from 1974 through 1986[a].

Although past impacts on O&M costs have been substantial, changes to most of the 750 Code provisions would have little impact on future O&M costs for reasons of timing:

- US nuclear plants are required to update to a more recent Code version after each ten years of operation (this may be more than ten calendar years because of extended outages). Changes to older Code versions would benefit relatively few plants for relatively few years.
- Changes to Code provisions based on recommendations from this project could not become effective before 1996, even with expedited handling, and are not likely to become effective before 1997. ASME approval of proposed changes ordinarily takes about a year; NRC approval and incorporation of changes into its regulations about two years.
- By 1996, a few plants may still be committed to Code versions published before 1983. Almost all, however, will be committed to Code versions published in 1983 or later, and changes to provisions in these Code versions will offer the greatest benefits to the industry as a whole.

There were 77 summary records citing provisions in Code versions from the 83S83 Code version through the 1986 Edition. Distribution among Section XI Subsections and Mandatory Appendices is shown below.

IWA General Requirements	: 5
IWB Requirements for Class 1 Components	: 24
IWC Requirements for Class 2 Components	: 11
IWD Requirements for Class 3 Components	: 1
IWF Inservice Inspections and Testing of Component Supports	: 2
IWP Inservice Testing of Pumps	: 12
IWV Inservice Testing of Valves	: 21
Appendix III (specific rules for Ultrasonic Examinations)	: 1

The distribution shows that the two major areas of difficulty in compliance with Code provisions are Inservice Inspections of Class 1 or Class 2 Components (IWA and IWB) and Inservice Testing of Pumps and Valves (IWP and IWV). These two areas account for almost 90% of the 77 summary records, with about equal numbers of records for each of the areas.

Analysis of Industry-Wide Impacts:

Measures of impacts for the industry as a whole were considered to be numbers of plants in which compliance was a problem, numbers of times problems in compliance were experienced, and costs of each attempt or repeated attempts at compliance.

The summary records contained numerical data for the first two of these measures. Analysis showed that no more than two plants requested relief from more than half of the provisions, and no more than two requests for relief were submitted for over half of the

[a] A Code "version" is a new Edition of the Code or an Edition with Addenda through a certain point. Code Editions are published at three-year intervals. Addenda were published twice a year from 1974 through 1988, once a year thereafter. Notation for Code versions consists of abbreviated identification of the Edition and Addenda; e.g., 74--- indicates the 1974 Edition without Addenda, 74S75 indicates the 1974 Edition with Addenda through Summer 1974.

provisions. Dropping those provisions left 36 (three of which met only one of the criteria for retention) that appeared to have had higher than average impacts on the industry as a whole. They were distributed as follows:

IWB Requirements for Class 1 Components	: 9
IWC Requirements for Class 2 Components	: 4
IWD Requirements for Class 3 Components	: 1
IWF Inservice Inspections and Testing of Component Supports	: 1
IWP Inservice Testing of Pumps	: 8
IWV Inservice Testing of Valves	: 13

Inservice Tests of Pumps and Valves accounted for almost 60% of these high impact Code provisions; Inservice Inspections of Class 1 and 2 Components about 36%. It seems clear that these are the major areas in which Code requirements affect O&M costs. In this project, however, only provisions for Inservice Inspections of Class 1 and Class 2 Components are being considered further[b].

In this project, indicators of total costs were considered to be references in ARRIS records to problems in access, configuration of components, materials, and radiation exposure, as well as direct references to monetary costs. Review of ARRIS records showed that all of the five indicators of costs were cited by one or more plants for most of the Class 1 and 2 inspections. (Less than five of the indicators were cited in most of the records of Inservice Tests of Pumps and Valves. Total costs to the industry for the two areas, however, may be roughly the same because of the number of tests of pumps and valves in comparison to the number of inspections of Class 1 and 2 components.)

[b] Although Inservice Tests of Pumps and Valves is an area of high impact on O&M costs, a structural change in the Code since 1986 places those Code provisions outside the current scope of this project. Subsections IWP and IWV of Section XI no longer contain specific provisions for testing component supports, pumps, and valves. Instead, they require that these tests be conducted in accordance with rules of the ASME Operations and Maintenance (O&M) Code (i.e., a separate publication, not a part of the Boiler and Pressure Vessel Code addressed in this project).

Further ranking according to impact of individual provisions requires input from utilities regarding validity of the work to this point and further information on costs of compliance with Code provisions.

Solicitation of Input from Utilities:

Some of the problems in compliance with the 36 provisions summarized above have been eliminated by changes in the Code since 1986. A Code Case now allows leak testing as an alternative to 10-year hydrostatic tests of Class 1 and 2 Components, and a similar change for Class 3 Components is under consideration by the ASME.

Selected utilities are now being asked to respond to validate the list of high-priority provisions show below, identification of provisions utilities believe should be considered with or in place of those listed, and information on costs of compliance with the provisions.

IWB-2500, "Examination and Pressure Test Requirements"
- Table IWB-2500-1
  - Item B1.11 RV Shell Welds, Circumferential
  - Item B1.40 RV Head-to-Flange Weld
  - Item B3.90 RV Nozzle-to-Vessel Welds
  - Item B8.20 Pressurizer Integrally Welded Attachment
  - Item B9.11 Piping NPS 4 or Larger, Circumferential Welds

IWC-2500, "Examination and Pressure Test Requirements"
- Table IWC-2500-1
  - Item C1.10 Pressure Vessel Shell Circumferential Welds
  - Item C2.21 Nozzles w/o Reinforcing Plate in Vessels > 1/2" Nominal Thickness
  - Item C3.30 Pumps, Integrally Welded Attachments
  - Item C5.21 Piping Welds > 1/5" Nominal Wall Thickness for Piping > or = NPS 2 and = or < NPS 4, Circumferential Weld

CONCLUSIONS

The level of effort represented by this project is beyond that reasonably to be expected from a single utility. The data considered to this point were collected by a continuing effort over a several-year period. Initial analysis of data has involved a great deal of professional effort and there will be further effort in analysis of industry-wide costs after participating utilities have provided their input.

At this point, it seems clear that Inspections of Class 1 and Class 2 Components are the areas in which the levels of impracticability and burden of Section XI provisions are highest. The nine Code provisions listed above appear to be high-priority candidates for revision.

Further information and conclusions will be available by the time of the technical session for which this paper was prepared.