ASME Boiler and Pressure Vessel Code

Subcommittee XI/Subgroup on Water-Cooled Systems

Working Group/Containment (WG/C)

Subsection IWL Commentary

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Subsection IWL Commentary

Notice

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ASME Boiler and Pressure Vessel Committee
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Subsection IWL Commentary

Background

With publication in the Federal Register on January 7, 1994 (59 FR 979) of the NRC proposed rulemaking to incorporate by reference into 10 CFR 50.55a Subsections IWE and IWL, the ASME received comments from the industry regarding the requirements of those subsections. The Working Group on Concrete Containment (WG/CC) has considered each of the comments submitted, and changes have been made to Subsection IWL as a result of the comments received. Since the requirements for examination of the post-tensioning system contained in Subsection IWL are essentially the same as the guidelines provided in Regulatory Guide 1.35, Rev. 3, "Inservice Inspection of Ungrouted Tendons in Concrete Containment Structures," approximately one-fourth as many comments were submitted regarding Subsection IWL as Subsection IWE. The main difference between the regulatory guide and Subsection IWL is that Subsection IWL addresses examination of the concrete containment structure. There were three areas in general which the comments addressed: 1) the VT-1C and VT-3C examinations of concrete; 2) the responsibilities of the Registered Professional Engineer; and 3) verification of the examinations by an inspector.

There are two purposes for writing this commentary. The first is that users of standards that have been developed by other societies have found commentaries to be very useful. Many questions of intent or interpretation are averted by having the rationale for rules and requirements. The second purpose of this commentary arises from the format of Subsection IWL. As changes have been made to the requirements of Subsection IWL and these changes were discussed with ASME members outside of the working group, it became apparent that users of the ASME Code expected a certain format. Because Subsection IWL was not written in exactly the same format as the requirements for Class 1, Class 2, and Class 3 examinations, much confusion resulted. Very early in the development of Subsection IWL, it was recognized that Class CC was very different in many respects from other classes addressed by the ASME Code. However, it was believed that rules should be developed using the existing accepted format of Section XI. With publication of the proposed NRC rule and the subsequent feedback, it was realized that a format which allowed the Owner more discretion in the development of a containment ISI program and flexibility in performing the containment examinations would better address industry needs; i.e., the end product would be a program which detected containment degradation before margins were seriously eroded, and the program would not be burdensome for the Owner.

This commentary is periodically revised as Code changes are approved. It is the intent of the Working Group/Containment (WG/C) that this commentary be published annually, and that each publication include references to Committee actions affecting Subsection IWL that were the basis for commentary changes.

References

1. ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWL, 1992 Edition with the 1992 Addenda through the 1998 Edition with the 2000 Addenda.
2. ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWL, 2001 Edition with the 2002 Addenda.

ARTICLE IWL-1000
SCOPE AND RESPONSIBILITY

IWL-1100 SCOPE

Subsection IWL addresses the examination and repair/replacement of the reinforced concrete and the post-tensioning systems of concrete containments. Examination of the metal liner of a concrete containment is addressed by Subsection IWE.

IWL-1200 ITEMS SUBJECT TO EXAMINATION

IWL-1210 EXAMINATION REQUIREMENTS

IWL-1220 ITEMS EXEMPT FROM EXAMINATION

ARTICLE IWL-2000
EXAMINATION AND INSPECTION

IWL-2100 GENERAL

The requirements of IWA-2210 and IWA-2300 do not apply. IWA-2210 addresses requirements for visual, VT-1, VT-2, and VT-3 visual examinations which are not applicable to IWL. Personnel qualification requirements specified in IWA-2300 do not apply because the Responsible Engineer (IWL-2320) is responsible for training and qualification of concrete examination personnel. The Working Group - Containment believes that this individual is capable of ensuring that the necessary training and personnel qualification requirements are met.

Historical Information:

1. IWL-2100 was revised in the 1998 Edition to delete all references to the Inspector. Prior to the 1998 Edition, IWL-2100 required that examinations be verified by an Inspector (Authorized Nuclear Inservice Inspector).

   Some commenters questioned verification of the examinations by the Authorized Nuclear Inservice Inspectors (ANII) when the inspectors did not have the requisite training or experience. With the lack of concrete construction in the recent past, ANIIs would not be able to meet the experience requirements of ASME N626, Part N626.2. There has only been one containment built using an ANI. Because the ASME and NRC process requires verification of the examination process by a third party, the ANIIs cannot be simply written out of the process. The WG/CC decided to define the ANII role as a verification of procedures and paperwork. The RPE is qualified to perform oversight of the examinations, and the ANII is not required for verification of concrete containment examinations. The advice of ANIIs was sought in forming this position, and the ANIIs agreed with the intent of the committee.

2. Interpretation #XI-1-98-05, File #IN97-027 clarifies that it is not a requirement of IWA-2120 or IWL-2100 that an ANII possess a National Board C endorsement in order to perform Class CC inspections. A "C" endorsement indicates that the inspector has had appropriate training related to examination of structural concrete.

Date Revised: *9-18-02*

IWL-2200 PRESERVICE EXAMINATION

Historical Information:

1. Interpretation #XI-1-95-64, File #IN97-014 clarifies that it is not a requirement of IWL-2200 that a structural integrity test be performed following a repair/replacement activity. However, for modifications where the design pressure of the containment is increased, the system pressure test required by IWL-5000 shall be conducted at the new design basis accident pressure, Pa.

2. Interpretation #XI-1-98-26, File #IN97-013 clarifies that it is not the intent of IWL-2200 to require preservice examination of post-tensioning systems be performed in accordance with IWL-2500. Preservice examination requirements for post-tensioning systems are specified in IWL-2220. IWL-2200 was revised to delete reference to IWL-2500 in the 1998 Edition.

Date Revised: 9-18-02

IWL-2210 EXAMINATION SCHEDULE

IWL-2220 EXAMINATION REQUIREMENTS

IWL-2220.1 Concrete

IWL-2220.2 Unbonded Post-Tensioning Systems

IWL-2230 PRESERVICE EXAMINATION OF REPAIR/REPLACEMENT ACTIVITIES

IWL-2300 VISUAL EXAMINATION, PERSONNEL QUALIFICATION, AND RESPONSIBLE ENGINEER

IWL-2310 VISUAL EXAMINATION AND PERSONNEL QUALIFICATION

General visual examinations are performed to assess the general condition of concrete surfaces.

Detailed visual examinations are performed to

- Assess adverse concrete conditions initially identified by general visual examination
- Assess the condition of concrete surfaces affected by repair/replacement activities. This examination would normally satisfy the preservice examination requirements specified in IWL-2220.1(a) and IWL-2510(a) (which directs the Owner to IWL-2310(b)).
- Assess the condition of concrete surrounding anchorages of tendons selected for examination in accordance with IWL-2520. Detailed examinations are not required to be performed on 100% of tendon anchorage areas, unless necessary to evaluate conditions initially detected by the general visual examination required by IWL-2510.
- Assess the condition of tendon wires or strands on those tendons subject to examination in accordance with IWL-2523
- Assess the condition of anchorage hardware, including bearing plates, anchorheads, wedges, buttonheads, and shims for those tendons subject to examination in accordance with IWL-2524

These examinations are performed under the direction of the Responsible Engineer. While it is the ultimate responsibility of the Owner to define qualification requirements for personnel performing general or detailed visual examinations, it is the specific

responsibility of the Responsible Engineer (IWL-2320) to ensure that concrete examination personnel are trained and qualified to perform concrete examinations.

Please note that it is the intent of IWL to allow the Responsible Engineer to perform both general and detailed visual examinations.

Historical Information:

1. In order to conform with Section XI requirements for visual examination (i.e., the requirements in IWA-2000), Subsection IWL had previously referenced the VT-1 and VT-3 examinations but called them VT-1C and VT-3C to signify that these were examinations of a concrete structure. Not only was the "C" designation confusing to users of Section XI, but many other comments were received regarding the use of the VT standards in examining a containment structure. Many commenters believed that the visual examination requirements for illumination levels and distances would preclude the ability to demonstrate that remote visual examination was equivalent to direct visual examination. One commenter pointed out that the visual examination of a containment is intended to uncover indications of significant conditions over a large area in a generally benign environment. IWA-2210 specifies that the VT-3 examiner be able to distinguish a lower case letter 0.125 inches high on the surface being examined.

   The requirements for a VT-3C examination have been replaced with a "general visual examination," and the requirements for a VT-1C examination have been replaced with a "detailed visual examination." The general visual examination of a concrete surface is performed to indicate the general condition of the containment. In order to assist in the performance of a general visual examination to identify the types of concrete deterioration and distress that can occur, reference is made to ACI 201.1R. Contained in ACI 201.1R is a checklist for making a survey of the condition of concrete, and photographs and descriptions of various distress manifestations.

   The Working Group - Containment has proposed changing IWL-2310(a) to include reference to ACI 349.3R. ACI 349.3R provides additional information on various degradation mechanisms that can impact the performance of containments. For example, differential settlement, and degradation of mild steel reinforcement and post-tensioning systems is described. It is the committee's intent that the only applicable sections of ACI 349.3R are those that relate to degradation mechanisms. Information contained in ACI 349.3R on evaluation procedures and acceptance criteria were developed for nuclear power plant concrete structures other than containments; however, this information can be of assistance in resolution of the significance of observed areas of concrete deterioration and distress. As part of the proposed change to IWL-2310(a), the text "defined" is to be changed to "described" because it is felt that information contained in ACI 201.1R and 349.3R provides more of a description of the potential forms of deterioration and distress than a strict definition. (See WG/C-L #00-03, SGWCS #01-06, ISI #02-09, MC/BC #BC02-2384 for more detailed information).

   The purpose of the general visual examination is to detect signs of deterioration. A detailed visual examination is then performed to determine the magnitude and extent of the deterioration. Alternative lighting and resolution requirements have been added to Subsection IWL to be used in lieu of the requirements of IWA-2000. It was determined that the lighting and resolution requirements contained in IWA-2000 (referenced in earlier versions of Subsection IWL), which were developed for use in Class 1, 2, and 3 examinations, are not suitable in many instances for use in performing containment examinations. For example, the requirements of IWA-2000 are used to detect flaws in piping. Containment concrete deterioration such as spalling and discoloration can be detected with less resolution and lighting. Because of the diversity in containment

conditions with regard to resolution and lighting needs, the ASME has given the Registered Professional Engineer (discussed below under IWL-2320) the authority to determine these program requirements.

2. Interpretation #XI-1-98-31, File #IN98-004 clarifies that the Responsible Engineer (IWL-2320) is responsible for approval, instruction, and training of concrete examination personnel. This interpretation clarified that this responsibility does not reside with the Level III Instructor required by IWL-2310 (ANSI/ASME CP-189), unless this individual also happens to be the Responsible Engineer.

3. WG/C-L #00-03, SGWCS #01-06, ISI #02-09, MC/BC #BC02-2384. Working Group - Containment agenda for 9/10/02 meeting indicate that this action has been approved. Publication expected in 2003 Addenda.

4. VT-1C and VT-3C examination requirements were removed from IWL-2310 in the 1997 Addenda.

Date Revised: 9-18-02

IWL-2320 RESPONSIBLE ENGINEER

Subsection IWL requires that a Registered Professional Engineer (RPE) experienced in evaluating the inservice condition of structural concrete and knowledgeable in the design and construction of concrete containments be responsible for the containment concrete examination activities.

The two predominant questions have been asked concerning the requirement to use a Registered Professional Engineer:

1) Why was a Registered Professional Engineer (RPE) needed (other subsections have no such requirement); and

2) Did the RPE actually have to perform the required examinations.

In the development of the concrete containment examination requirements, the committee believed that a RPE was necessary for several reasons. Concrete is a far different material than those addressed by Class 1, Class 2, and Class 3 requirements. Assessment of concrete condition is as much art as science, and it takes someone with the appropriate experience and background to conduct such a structure condition assessment. In addition, because the RPE is responsible for the development of plans and procedures, training of personnel, and either performance of the examinations or direction of the performance of the examinations by qualified examination personnel, the requirements of Subsection IWL are much less prescriptive than they otherwise would be without this critical oversight.

Historical Information

1. IWL-2320(e) was added in the 1997 Addenda to clarify that the Responsible Engineer is responsible for reviewing pressure test procedures for such tests to be performed following completion of concrete containment repair/replacement procedures. This change was made because IWL-5250 had been revised in the 1997 Addenda to require this.

2. Interpretation #XI-1-98-31, File #IN98-004 clarifies that the Responsible Engineer (IWL-2320) is responsible for approval, instruction, and training of concrete examination personnel. This interpretation clarified that this responsibility does not reside with the Level III Instructor required by IWL-2310 (ANSI/ASME CP-189), unless this individual also happens to be the Responsible Engineer.

Date Revised: 9-18-02

IWL-2400 INSERVICE INSPECTION SCHEDULE

IWL-2410 CONCRETE

IWL-2410(d) was added in the 2002 Addenda to clarify that concrete surfaces affected by repair/replacement activities shall be examined 12 months (+/- 3 months) following completion of the repair/replacement activity.

Historical Information

1. WG/C-L #97-02, SGWCS #01-02, ISI #01-09, MC/BC #01-08/01-362. This action addresses changes made to IWL associated with modifications to the inservice inspection schedule for containment surfaces affected by repair/replacement activities. The Working Group - Containment believed that many repair/replacement activities have a significant effect on the containment structure and that the existing requirements of IWL (prior to the 2002 Addenda) were not adequate to address "augmented examination" requirements following repair/replacement activities. IWL-2410(d) was added as part of this action.

Date Revised: 9-18-02

IWL-2420 UNBONDED POST-TENSIONING SYSTEMS

IWL-2421 Sites With Multiple Plants

IWL-2421 allows an Owner to modify the examination schedule and scope for the inservice inspection of unbonded post-tensioning systems. The modifications apply to sites that have 2 or more plants (units) meeting the criteria specified in IWL-2421(a).

IWL-2421 does not permit the modification of examination schedule or scope for containment concrete visual examinations required by Table IWL-2500-1, Examination Category L-A, Concrete.

Historical Information

1. IWL-2421 was revised in the 1997 Addenda to apply to sites with more than 2 plants. Prior to the 1997 Addenda, IWL-2421 addressed "Sites With Two Plants" and did not contain guidance or requirements on how these provisions could be applied to sites with 3 or more plants. Additional consideration was given to the fact that the ASME Code is used internationally, and although there are few plants in the U.S. with more than 3 units, a number of foreign facilities have plants with more than 2 units. Licensees attempting to utilize provisions of IWL-2421 prior to the 1997 Addenda could apply the schedule and scope modifications to 2 of the 3 plants at a site. The third plant would have to comply with the scope and schedule applicable for a site with only one plant.

Date Revised: 9-18-02

IWL-2500 EXAMINATION REQUIREMENTS

IWL-2510 SURFACE EXAMINATION

IWL-2510(a): The word "defined" is to be changed to "described" and a reference to ACI 349.3R is to be added in conjunction with changes in the action listed below. These changes are being made to maintain consistency with similar proposed changes to IWL 2310(a). The wording change was made to be more accurate; i.e., the ACI documents are good references which should be used, but they are not requirements.

Historical Information:

1. WG/C-L #00-03, SGWCS #01-06, ISI #02-09, MC/BC #BC02-2384. Working Group - Containment agenda for 9/10/02 meeting indicate that this action has been approved. Publication expected in 2003 Addenda.

Date Revised: 9-18-02

IWL-2510(b): This paragraph requires that tendon anchorage areas be examined using a detailed visual examination method in accordance with IWL-2310(b). However, there has been considerable confusion as to whether IWL-2510(b) requires an Owner to perform a detailed visual examination on 100% of anchorages during each inspection. The Working Group - Containment has discussed this issue and has decided that it was not the intent of IWL-2510(b) to require this 100% examination. The intent was that this detailed visual examination be performed on those tendons subject to examination in accordance with IWL-2520. If adverse conditions were observed during the performance of these examinations on tendons selected for examination, the intent is that the Responsible Engineer shall determine whether any additional anchorages (those not selected for examination in accordance with IWL-2520) need to be examined. If the Responsible Engineer determines that additional anchorage areas need to be examined, then a detailed visual examination would be required.

Historical Information:

1. Paragraph IWE-2510(b) was added in the 1997 Addenda.

Date Revised: 9-18-02

IWL-2520 EXAMINATION OF UNBONDED POST-TENSIONING SYSTEMS

IWL-2521 Tendon Selection

IWL-2521(a): The requirement to randomly select tendons is derived from the parallel provision in Revision 3 of Regulatory Guide (R.G.) 1.35. The R.G. provision was based on the experiences with examination of fixed tendons and comments from the industry professionals on earlier versions of the guide. The sample size requirement in Table IWL-2521-1 is also based on similar provisions in the R.G. During the development of the various versions (Rev. 1, Rev. 2, and Rev. 3) of the R.G., there was an extensive

discussion related to the sample size of the tendons that could ensure a reasonable confidence in the prediction of the tendon forces. A crude and purely statistical consideration to ensure 95% confidence that no more than 5% of the tendons could be defective (defined as tendons whose measured prestressing forces are lower than the predicted values) would require a sample size of 63 tendons selected randomly during each inspection. This was considered as too costly a proposal for the relatively passive (as compared to, for example, pumps and valves) component of nuclear plants. After a number of discussions between the regulatory staff and the industry engineers, including some from the working group, it was decided to examine the tendons as required in the Table IWL-2521-1. Such low numbers (4% in the early years, and 2% later on) was justifiable because a number of other parameters such as tendon anchorage areas, condition of corrosion protection medium, and condition of tendon elements are to be examined to ensure the integrity of the prestressing system.

IWL-2521(b): Monitoring the lift-off force of a common tendon in each group provides data regarding time-dependent variation in the common tendons. If properly monitored, the common tendon lift-off forces would provide clues regarding the potential behavior of other tendons in the respective groups. It should be noted that if the common tendon lift-off force falls below its acceptance criterion, chances are that other tendons in the group would be experiencing similar time-dependent behavior. In the case where the lift-off force in the common tendon is considerably above its predicted force, it still may be that the other tendons in that group are experiencing low time-dependent losses due to breakage of a prestressing element or cracks in the anchorage components, for example.

IWL-2521(c): When the prestressing elements are kept in desired tension by means of wedging, or swaging, there may not be adequate length of shims, or lead-in prestressing elements, to facilitate detensioning of tendons for examination of prestressing elements. Thus, for this type of prestressing system, it will be necessary to predetermine sufficient number of tendons in each group that would facilitate detensioning, either by providing an appropriate length of shim stack or lead-in prestressing elements.

(A note for the WG: It will be a good idea to require some definite percentage of the tendons in a group which could be detensioned. This would apply to all new plants that are designed with a predesignated number of tendons which can be detensioned. The percentage of tendons (or number of tendons) that should be detensionable should be equal the number that would normally require detensioning during the expected service life of the containment for plants whose tendons are normally detensionable. At least 3 additional detensionable tendons should be required so that these may be used as "Common" tendons.)

Date Revised: 9-18-02

IWL-2521.1 Exemptions

IWL-2521.1(c): If visual examinations (IWL-2524) or corrosion protection medium examinations (IWL-2525) can be performed on a tendon that has been designated as exempt, then these examinations are required and shall be performed.

For example, if an obstruction prevents sufficient access for equipment to perform lift-off (force measurement) testing, then the tendon may be designated as exempt. However, if the obstruction is such that access is sufficient to perform IWL-2524 and IWL-2525 examinations, these examinations shall be performed on the exempt tendon. In addition, a substitute tendon shall be selected, and all examinations required by IWL-2522, IWL-2524, and IWL-2525 shall be performed on the substitute tendon.

Another example in which the provisions of IWL-2521.1 would apply would be the case in which only one end of a tendon is inaccessible (i.e., end embedded in concrete or otherwise completely obstructed). In this case, if the Owner's program requires that lift-off (force measurement) testing be performed from both ends of a tendon, then a substitute tendon shall be selected, and all examinations originally required for the exempt tendon shall be performed on the substitute tendon. IWL-2524 and IWL-2525 examinations shall also be performed on the accessible end of the exempt tendon.

Date Revised: 9-18-02

TABLE IWL-2521-1, NUMBER OF TENDONS FOR EXAMINATION

For new plants, the percentage of tendons of each type that are required to be examined may be reduced from 4% to 2% starting with the 10 year inspection, provided the acceptance criteria of IWL-3221.1 (tendon force and elongation measurements) have been met during each of the last three inspections (1, 3, and 5 year inspections).

For existing plants, the percentage may be reduced from 4% to 2% when the acceptance criteria of IWL-3221.1 have been met during each of the last three inspections. For those plants that, prior to September 9, 1996, had performed post-tensioning system examinations in accordance with Regulatory Guide 1.35 and had demonstrated compliance with this criteria for the past 3 inspections, the 2% figure could be used for examinations after September 9, 1996. For those plants that had not yet demonstrated compliance with this criteria by September 9, 1996, the sample size shall remain 4% until this criteria can be met.

Once a plant has taken advantage of this sample size reduction, examination results during future inspections must continue to meet the acceptance criteria of IWL-3221.1. Otherwise, the sample size must then revert back to 4% until three successive inspections have been performed in which the acceptance criteria of IWL-3221.1 have been met.

Historical Information:

> Table IWL-2521-1, footnote (2) was revised in the 1997 Addenda. Prior to the 1997 Addenda, this reduced sample size could be used when the acceptance criteria of IWL-3221.1 have been met "during each of the earlier inspections". For plants where this criteria had not been met at least once (3 successive inspections where the acceptance criteria had been met), it was unclear whether

these plants could ever utilize this provision to reduce the tendon sample size. Because the intent was to have demonstrated at least three successful inspections, the wording of footnote (2) was changed to "for the last three inspections".

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TABLE IWL-2521-2, AUGMENTED EXAMINATION REQUIREMENTS FOLLOWING POST-TENSIONING SYSTEM REPAIR/REPLACEMENT ACTIVITIES

This table was added in the 2002 Addenda to address modifications to the post-tensioning system examination scope and schedule for those containments affected by repair/replacement activities.

Historical Information:

WG/C-L #97-02, SGWCS #01-02, ISI #01-09, MC/BC #01-08/01-362. This action addresses changes made to IWL associated with modifications to the inservice inspection schedule for containments affected by repair/replacement activities. The Working Group - Containment believed that many repair/replacement activities have a significant effect on the containment structure and that the existing requirements of IWL (prior to the 2002 Addenda) were not adequate to address "augmented examination" requirements following repair/replacement activities. Table IWL-2521-2 was added as part of this action.

Date Revised: 9-18-02

IWL-2522 Tendon Force and Elongation Measurements

IWL-2523 Tendon Wire and Strand Sample Examination and Testing

IWL-2523.1 Tendon Detensioning and Sample Removal

IWL-2523.2 Sample Examination and Testing

IWL-2523.3 Retensioning

IWL-2524 Examination of Tendon Anchorage Areas

IWL-2524.1 Visual Examination

A detailed visual examination is required on tendon anchorage areas.

Historical Information:

IWL-2524.1 was revised in the 1997 Addenda. Prior to the 1997 Addenda, a VT-1 visual examination was required. Note that IWL-2524.1 had required a VT-1 visual examination for tendon anchorage concrete. This should have required that a VT-1C examination be performed.

Date Revised: 9-18-02

IWL-2524.2 Free Water Documentation

IWL-2525 Examination Of Corrosion Protection Medium And Free Water

IWL-2525.1 Samples

IWL-2525.1(a): Many utilities have found that variances from one end of a tendon to the other (120 feet to 485 feet) can be significant. Therefore, samples are required to be collected from both tendon ends.

Free water should be excluded from the grease sample so as not to influence the water content test specified by Table IWL-2525-1. The purpose of the Table IWL-2525-1 water content test is to determine whether water has become chemically combined with the grease.

IWL-2525.1(b): The purpose of water analysis is to determine sources as well as potential harm to the system (non-neutralization level).

Note: The Working Group - Containment may want to consider whether provisions should be added to address situations where an insufficient volume of grease is available for collection and testing. One option would be to require that an evaluation be performed when corrosion protection medium sample size is not sufficient for testing. This evaluation shall consider whether the tendon sheath contains sufficient grease to protect the tendon, and whether collection of grease from an adjacent tendon is necessary.

Date Revised: 9-18-02

IWL-2525.2 Sample Analysis

IWL-2525.2(a): These provisions are necessary to obtain consistent and repeatable testing results.

IWL-2525.2(b): The Owner shall be responsible for establishing acceptance criteria for pH testing of free water samples as none is provided in IWL.

Date Revised: 9-18-02

IWL-2526 Removal and Replacement of Corrosion Protection Medium

IWL-2526(a): The purpose of this requirement to measure the amount of grease removed and the amount replaced is to determine whether the as-found tendon sheath had lost any grease.

Owners are cautioned to carefully consider the effects of thermal expansion when pressure pumping grease into tendon sheaths.

Date Revised: 9-18-02

TABLE IWL-2525-1, CORROSION PROTECTION MEDIUM ANALYSIS

Water Content

The evaluation for water is continued the same as in Regulatory Guide 1.35, and the limit has not changed (i.e., 10% water content). The fact that water content greater than 10% has occurred doesn't mean, however, that the tendon system is distressed. This is a limit well below degradation and is used to initiate an evaluation if moisture levels are found.

Historical Information:

The 10% maximum acceptance limit was added in the 1993 Addenda.

Date Revised: 9-18-02

Water Soluble Chlorides, Nitrates, and Sulfides

The limit here is 2½ to 5 times original permitted level in place of 2 ppm or 4 ppm maximum. The purpose here is to initiate an evaluation if levels are exceeded. The testing method listed in the notes present on the table are for guidance to the tester so consistent repeatable results can be obtained from surveillance to surveillance as well as to original and new replacement grease test results. These notes are important and must be followed as changes from these steps can cause large variations in test results.

Multiple Test Methods

For water soluble chlorides and nitrates testing, the first listed method is the manufacturer requirement method. The additional listed methods are alternate methods which are available and an acceptable way to test the grease.

For water soluble sulfides testing, the listed test methods are actually the same test method (but use different numbers). The original designation is listed first with current designation following as APHA changed its numbering system.

The base number (also referred to as neutralization number) is a test being completed to determine if grease is breaking down in composition. The base number was used in original product to control the consistency of the material. However, there are three versions of Viscosity grease used in North America in containment, as well as Sanchen (NO-OX-ID"CM") grease. The original version was 2090-P, followed by 2090-P2, and the current 2090-P4. All versions are compatible and only 2090 P4 is available now for replacement grease. The 2090-P did not have an original neutralization number report and 2090-P2 was 3, but both must be greater than zero.

Acceptable versions of the referenced standard(s) listed in Table IWL-2525-1 are found in Table IWA-1600-1.

Date Revised: 9-18-02

ARTICLE IWL-3000
ACCEPTANCE STANDARDS

IWL-3100 PRESERVICE EXAMINATION

IWL-3110 CONCRETE SURFACE CONDITION

IWL-3111 Acceptance by Examination

IWL-3112 Acceptance by Evaluation

IWL-3113 Acceptance by Repair/Replacement Activity

IWL-3120 UNBONDED POST-TENSIONING SYSTEM

IWL-3200 INSERVICE EXAMINATION

IWL-3210 SURFACE CONDITION

IWL-3211 Acceptance by Examination

IWL-3212 Acceptance by Evaluation

IWL-3213 Acceptance by Repair/Replacement Activity

IWL-3220 UNBONDED POST-TENSIONING SYSTEMS

IWL-3221 Acceptance by Examination

IWL-3221.1 Tendon Force and Elongation

IWL-3221.1(a): It is recognized that the requirement that the average of measured tendon forces in a group to be greater than the minimum required prestress for that group, in itself, is not sufficient to provide any idea about the time-dependent behavior of the tendons. However, it raises a red flag, in that it indicates more than the predicted life-time losses in the measured tendons. The acceptance criteria in (b) and (c) provides a starting point for the evaluation of such abnormal behavior.

IWL-3221.1(b): Because of the small sample size, progressively increased examination is required when the prestressing force in any selected tendon falls below its acceptance criterion [(b)(2) and (b)(4)]. Though requirements are not set when the measured prestressing forces in one or both the adjoining tendons fall below the acceptance criterion (i.e., 95% of the predicted prestressing level), the Responsible Engineer should evaluate the severity of the deficiency (including root cause determination), and decide the size and selection of the additional tendons to be examined.

IWL-3221.1(b)(3) was added to address acceptance criteria for those tendons subject to augmented examination in accordance with Table IWL-2521-2.

Historical Information:

1. IWL-3221.1(b)(3) was added in the 2002 Addenda. Existing paragraph IWL-3221.1(b)(3) was renumbered as IWL-3221.1(b)(4).
2. WG/C-L #97-02, SGWCS #01-02, ISI #01-09, MC/BC #01-08/01-362.

Date Revised: 9-18-02

IWL-3221.1(c): This criterion provides a means to integrate the results of all prior examinations to predict the future trends in tendon behavior. Though the requirement only refers to the evaluation for the next scheduled examination, the Responsible Engineer should assess if the trend will affect the predicted prestressing forces for the life of the plant.

IWL-3221.1(d): This criterion is meant to compare the elongation measurements taken during (at least two equally spaced intermediate measurements between the existing prestressing force and zero) detensioning and those taken during retensioning. The large difference in elongation measurements at the same load could indicate ineffectiveness of some of the prestressing elements in the tendon. The measurements taken during earlier tensioning may be used for comparison.

(Note for the working group: This criterion should be rewritten to reflect the intent).

IWL-3221.2 Tendon Wire or Strand Samples

IWL-3221.3 Tendon Anchorage Areas

IWL-3221.4 Corrosion Protection Medium

A large percentage of grease loss could be problematic and should be evaluated. The 10% criterion is large enough to account for volume changes due to thermal expansion/contraction of grease. Owners should be aware that 10CFR50.55a currently requires reporting conditions where this criterion is not met for any tendon.
Date Revised: 9-18-02

IWL-3222 Acceptance by Evaluation

IWL-3223 Acceptance by Repair/Replacement Activity

IWL-3300 EVALUATION

IWL-3310 EVALUATION REPORT

Historical Information:

IWL-3310(b) was added in the 1997 Addenda. When items on one plant (unit) with examination results fail to meet the acceptance standards of IWL-3100 or IWL-3200, this change requires that an Owner evaluate other plants at the site to determine whether the identified condition(s) are applicable to other plants (units) at the site.

Date Revised: 9-18-02

ARTICLE IWL-4000
REPAIR/REPLACEMENT ACTIVITIES

IWL-4100 GENERAL

Concrete repairs are not well defined in IWL, and Owners have had some difficulty in determining when the requirements of IWL-4000 apply. A number of actions have been taken in recent years to provide some clarification as to which types of activities are subject to the requirements of IWL-4000. Most of these actions have involved adding or clarifying exemptions in IWL-4110.

Historical Information:

1. IWL-4100 was revised in the 2002 Addenda. This revision helped to clarify which provisions of Subsection IWA apply to IWL repair/replacement activities.
2. WG/C-L #98-01, SGWCS #00-05, ISI #00-07, MC/BC #BC01-352.

Date Revised: *9-18-02*

IWL-4110 SCOPE

IWL-4100 has been revised to clarify which types of activities on concrete containments are not subject to the requirements of IWL-4000. Activities affecting the outermost portion of the concrete (primarily cosmetic and maintenance activities) are typically exempt from the requirements of IWL-4000. Types of activities that may be exempt include those affecting anchorage end caps and their fasteners, seals and gaskets, sealants and coatings, corrosion-protection media, activities such as concrete anchor installations (under certain conditions), and cosmetic restoration or maintenance of concrete surfaces. These exemptions are consistent with those described in IWA-4120(b)(5). The Responsible Engineer is required to approve activities affecting concrete to ensure that the activities are non-structural and are not required to correct conditions that are unacceptable for continued service. Repair of concrete beneath bearing plates is not exempted and shall comply with the requirements of IWL-4000.

Historical Information

1. Interpretation #XI-1-98-59, File #IN99-002 clarifies that it is not the intent of IWL-4000 to require that installation of concrete expansion anchors be subject to the requirements of IWL-4000 if the installation affects only the cover concrete external to the outermost layer of reinforcing steel or the post-tensioning system.
2. WG/C-L #98-01, SGWCS #00-05, ISI #00-07, MC/BC #BC01-352.

Date Revised: *9-18-02*

IWL-4120 REPAIR/REPLACEMENT PROGRAM

IWL-4180 DOCUMENTATION

This paragraph was added in the 2002 Addenda and clarifies that the Owner shall maintain concrete test reports for repair/replacement activities affecting concrete. This provision had not been addressed previously.

Historical Information

WG/C-L #98-01, SGWCS #00-05, ISI #00-07, MC/BC #BC01-352.

Date Revised: 9-18-02

IWL-4200 REPAIR/REPLACEMENT PLAN

IWL-4210 RESPONSIBLE ENGINEER

IWL-4220 CONCRETE

Paragraph (a) was revised to require that the condition of concrete surfaces requiring repair/replacement activities shall be documented.

Historical Information

1. WG/C-L #98-01, SGWCS #00-05, ISI #00-07, MC/BC #BC01-352.

Date Revised: 9-18-02

IWL-4230 REINFORCING STEEL
IWL-4240 POST-TENSIONING SYSTEM
Because welding should not be performed on tendon wires or anchor heads, IWL-4240 was revised to limit welding to bearing plates and provide a precautionary statement to protect the other items of the post-tensioning system from welding activities.

Historical Information

1. WG/C-L #98-01, SGWCS #00-05, ISI #00-07, MC/BC #BC01-352.

Date Revised: 9-18-02

IWL-4300 EXAMINATION

ARTICLE IWL-5000
SYSTEM PRESSURE REQUIREMENTS

IWL-5100 SCOPE

IWL-5200 SYSTEM TEST REQUIREMENTS

IWL-5210 GENERAL

IWL-5210 describes types of repair/replacement activities for which a system pressure test is not required. IWL-5210(b) allows an Owner to prepare an Engineering Evaluation Report in lieu of performing a system pressure test, if the condition of the containment satisfies the original design criteria both prior to, and during, the performance of the repair/replacement activity. IWL-5210(b) was revised in the 2002 Addenda to clarify that the containment must satisfy the original design criteria prior to, and during performance of the repair/replacement activity.

Historical Information

1. WG/C-L #98-01, SGWCS #00-05, ISI #00-07, MC/BC #BC01-352.

Date Revised: 9-18-02

IWL-5220 TEST PRESSURE

The test pressure is specified as Pa (Design Basis Accident Pressure). IWL-5000 does not require that this test be conducted at an elevated pressure, as would be required for a Structural Integrity Test. IWL does not specify that a Structural Integrity Test be performed following completion of a repair/replacement activity.

Historical Information:

Interpretation #XI-1-95-64, File #IN97-014 clarifies that it is not a requirement of IWL-2200 that a structural integrity test be performed following a repair/replacement activity. However, for modifications where the design pressure of the containment is increased, the system pressure test required by IWL-5000 shall be conducted at the new design basis accident pressure, Pa.

Date Revised: 9-18-02

IWL-5230 LEAKAGE TEST

If the repair/replacement activity affects the pressure retaining metallic shell of the containment, the Owner is cautioned to ensure that the pressure test requirements of IWE-5000 are also met. For large portions of concrete containments affected by repair/replacement activities (such as repair following Steam Generator replacement), it is often possible to perform a single pressure test (10CFR50, Appendix J, Type A Test) that satisfies both IWE-5000 and IWL-5000.

Date Revised: 9-18-02

IWL-5250 TEST PROCEDURE AND EXAMINATIONS

Historical Information

1. IWL-5250 was revised in the 1997 Addenda to clarify that the Responsible Engineer is responsible for reviewing pressure test procedures and authorizing the performance of the pressure test following completion of concrete containment repair/replacement procedures. This change was made in part because the Responsible Engineer is required to assess whether concrete that has been placed in conjunction with repair/replacement activities has had sufficient time to cure. Also, it is a requirement of IWL-5250 that examinations be performed prior to the start of pressurization, at test pressure, and following completion of depressurization. This review to be performed by the Responsible Engineer is intended to ensure that the Responsible Engineer has the authority and control necessary to successfully complete these activities.

Date Revised: *9-18-02*

IWL-5260 CORRECTIVE ACTION

IWL-5300 REPORT

ARTICLE IWL-7000
REPLACEMENTS

This Article has been deleted. The requirements of IWL-4000 now apply.

Historical Information:

IWL-7000 was deleted in the 1995 Addenda.

Date Revised: 9-18-02