Two changes were made to this record based on the Standards Committee Ballot and are considered editorial in nature.

In Article I-1.1 General, item (b) the words “and ovals” were added.

On Figure I-1.1-3 the upper first two rectangles from input B were combined into a single rectangle with the wording being combined.

The Background file contains a concise summary of the purpose for all changes being proposed to upgrade and clarify Div. 2 Appendix I and it also contains the published version of Div. 2 Appendix I for ready reference for the reviewer.

The changes being proposed for RIM Appendix I are contained in the following items and are presented in the order listed:

**Item #1** This shows the proposed changes to Appendix I-1.1. It is one page long.

**Item #2** These are the new fully integrated flowcharts for the RIM Program. All of the 2019 published flowcharts are to be deleted. There are now 6 flowcharts with newer and more descriptive figure captions. There are 6 pages.

**Item #3** This shows the new text references to the figures in Appendix I that need to be changed to reflect the reordering of the flowcharts and the reduction of flowcharts from originally 7 to just 6 flowcharts. There are 4 pages here.

This ballot is to approve all the changes in Items 1, 2 and 3.
Item #1  This shows the proposed changes to Appendix I-1.1 and is shown below. The proposed changes are shown in red for additions and strike through is used to show deletion

ARTICLE I-1
FLOWCHARTS

I-1.1 General

Figures I-1.1-1 through I-1.1-67 begin on the following page. Throughout the figures, the following symbols are used:

(a) Unshaded circles denote inputs to the RIM Program.
(b) Shaded circles and ovals denote inputs to the MANDE Program.
(c) Unshaded octagons denote outputs for redesign.
(d) Unshaded rectangles denote generic process elements of RIM.
(e) Shaded shapes rectangles denote parts of MANDE process elements.
(f) Diamonds denote decision points.

Thus, all symbols in the flow charts constitute the RIM Program and all shaded symbols in the flow charts constitute the MANDE Program.
ITEM #2 The following 6 pages contain all of the proposed new flowcharts. See Background File for a summary and basis for the changes. These proposed changes fully integrate all the flowcharts and allow them to be printed and aligned in an unambiguous manner to more effectively convey the RIM Process. It needs to be noted:

- **All the original flowcharts are to be deleted and replaced with those on the following 6 pages**
- there are changes to every figure caption,
- there are major changes to several of the flowchart/figures (I-1.1-1 and I-1.1-2),
- there are major rearrangements (but no symbol changes other than some changes in symbol shading) of most of the flowcharts in order for them to be drawn in a form that allows them to be aligned with the other adjacent flowcharts
- Two flowcharts were combined into one flowchart (the old figures I-1.1-4 and I-1.1-5 became the new I-1.1-5)
- The old figure I-1.1-7 has become the new I-1.1-3
- Since all shaded symbols are part of the MANDE Process each symbol was reviewed and if MANDE had a significant involvement in it then the symbol was shaded noting that all symbols in the flowcharts are by default part of the RIM Process.

Because of all of these changes there was no way to easily show them by trying to illustrate them with colors or otherwise on a copy of the original flowcharts. It is best to compare the two versions of the flowcharts side-by-side to see the difference and that is why the original flowcharts are included in the Background File
Figure I.1.1-1 Inputs to the RIMEP for NPP Owner’s RIM Program Development

Note: (1) The term “Plant RI-MANDE tools and insights” refers to the experience gained in deploying risk-informed (RI) ISI methodologies to the Section XI, Division 1 LWR fleet of reactors. This experience will grow as new reactor designs gain operating experience.
Figure I-1.1-2 RIM Program Development and Implementation

A

RIM Program scope definition

Degradation mechanism assessment

Plant and SSC Reliability Target allocation (PRA Modeling)

Initial identification and evaluation of RIM strategies

Evaluation of uncertainties

Finalize RIM strategies for each SSC

Performance monitoring and RIM Program updates

RIM Program Implementation

B

H
Figure I-1.1-3 Process for Identifying the SSCs to be in MANDE Program

1. For each SSC define and perform preservice NDE required for RIM Reliability Targets.
2. All NDE indications evaluated on a fitness-for-service basis.
3. SSC excluded from MANDE Program scope.
4. Sampling of SSC to address the unexpected for defense in depth.
5. SSC in scope of MANDE Program.
6. MANDE needed to meet Reliability Targets or reduce uncertainty.
7. MANDE techniques available for SSC failure modes and damage mechanisms.
8. Develop new MANDE techniques.
9. SSC-redesign process.

B -> C

No

SSC classified as requiring special MANDE treatment?

Yes

SSC classified as passive?

No

Adequate reliability via testing and monitoring?

Yes

Adequate reliability via maintenance and replacement?

No

MANDE needed to meet Reliability Targets or reduce uncertainty?

Yes

No

No

MANDE techniques available for SSC failure modes and damage mechanisms?

Yes

No

H

H
Figure I-1.1-4 Selection of Strategies for SSCs to meet Reliability Targets

For each SSC in MANDE Program scope

Does RIM Involve design elements?
Yes → Document design requirements as part of RIM Program
No →

Does MANDE involve online monitoring?
Yes → Document online-monitoring requirements as part of MANDE Program and apply Mandatory Appendix IV process
No →

Does MANDE include surveillance samples?
Yes → Document and apply Mandatory Appendix IV process, as applicable
No →

MANDE Required

SSC-redesign process

Is effective alternative MANDE available?
Yes →
No →

Does adequate access exist to enable needed MANDE performance?
Yes → Strategy for each SSC fully defined and validated
No →

G

H
Figure I-1.1-5 Upper Half Shows Inputs to MANDEEP for Developing MANDEE Specification and Lower Half Shows Process for Evaluating if Division 1 Requirements Meet MANDEE Specification

- SSC materials, fabrication processes, and geometries
- Degradation processes - known and postulated
- Processes for converting RIM Reliability Targets to performance metrics
- Degradation initiation, location, and growth rates
- Cost-benefit considerations
- NDE Methods
- RIM Reliability Targets for each SSC
- Fabrication flaws
- Monitoring uncertainties
- Critical flaw sizes
- Environmental conditions
- Monitoring methods
  - online monitoring
  - surveillance samples
- Flaw sizes required to be detected

MANDE Expert Panel (MANDEEP)

- Performance needed to be demonstrated for each SSC and flaw/degradation process to meet RIM Reliability Targets (MANDEE Specification)

Do Section XI, Division 1 performance standards for each SSC meet RIM Reliability Targets?

Revise assumptions and perform new calculations to define the acceptance standards

Are all documented assumptions and parameters in Section XI, Division 1 application equal to or more conservative than those used in Division 2 calculations?

Has acceptable performance for MANDEE and testing to meet Mandatory Appendix IV criteria been demonstrated?

Use Section XI, Division 1 acceptance standards
Figure I-1.1-6 Select, Develop and Validate Performance Demonstration Approach to Meet SSC Reliability Target
ITEM #3  The following 4 pages containing all of the changes in Div. 2 text where the flowchart figure numbers need to change in order to reflect the reordering and consolidating of the flowcharts. There is not a Word version available of Division 2 so the approach taken was to show the proposed changes in red.
ARTICLE RIM-2
RELIABILITY AND INTEGRITY MANAGEMENT (RIM) PROGRAM

RIM-2.1 RIM PROGRAM OVERVIEW

RIM-2.1.1 Basis, Objective, and Process

(a) The reliability of a nuclear power plant and its SSCs is determined by the design, fabrication, inspection, monitoring, operation, and maintenance procedures used to build and operate the plant and its SSCs. Each of these aspects contributes in varying degrees to the reliability of the plant’s SSCs. In order for a nuclear power plant to have a level of reliability that will satisfy safety goals, an appropriate combination of these contributors to reliability must be identified and implemented. The objective of the RIM Program is to define, evaluate, and implement strategies to ensure that Reliability Targets for SSCs are defined, achieved, and maintained throughout the plant lifetime.

(b) This Division defines the required elements of the RIM Program for all types of nuclear reactor plants and provides requirements for RIM Program implementation.

(c) The RIM Program shall select the combination of inspection, monitoring, operation, examinations, tests and maintenance requirements that enable the SSCs to meet its Reliability Target in an efficient and cost effective manner.

(d) The process of implementing a RIM Program is illustrated in Mandatory Appendix I, Figures I-1.1-1 through Figure I-1.1-C, and shall include the following process steps:

1. RIM Program scope definition
2. degradation mechanism assessment
3. plant and SSC Reliability Target allocation originating from the probabilistic risk assessment (PRA)
4. identification and evaluation of RIM strategies
5. evaluation of uncertainties
6. RIM Program implementation
7. performance monitoring and RIM Program updates

RIM-2.1.2 Responsibilities

RIM-2.1.2.1 Owner’s RIM Expert Panel (RIMEP). The RIMEP is responsible for the technical oversight and direction of the risk-informed aspects of RIM Program development and implementation.

RIM-2.1.2.2 RIMEP Qualifications. The requirements of Mandatory Appendix VI, VI-1.1 shall apply.

RIM-2.2 RIM PROGRAM SCOPE AND DEFINITION

The Owner shall document the specific list of SSCs to be evaluated for inclusion within the scope of the RIM Program. The scope shall include SSCs whose failure could adversely affect plant safety and reliability. The Owner shall also document the basis for the exclusion of any SSC considered to be outside the scope of the RIM Program.

RIM-2.3 DEGRADATION MECHANISM ASSESSMENT (DMA)

The potential active degradation mechanisms for the SSCs within the RIM Program scope shall be identified and evaluated.

(a) The following conditions shall be considered in the DMA:

1. design characteristics, including material, pipe size and schedule, component type (e.g., standard fittings, elbows, flanges), and other attributes related to the system configuration
2. fabrication practices, including welding and heat treatment
3. operating and transient conditions, including temperatures, pressures, quality of primary and secondary fluids, and service environment (e.g., humidity, radiation)
4. plant-specific, industry-wide service experience and research experience
5. results of preservice, in-service, and augmented examinations and the presence and impact of prior repairs in the system
6. applicable degradation mechanisms, including those identified in Mandatory Appendix VII for the applicable plant type
7. recommendations by SSC vendors for examination, maintenance, repair, and replacement

(b) The criteria used to identify and evaluate the susceptibility of each SSC to degradation mechanisms shall be specified in the RIM Program documentation. The screening criteria found in Mandatory Appendix VII are minimum requirements to be considered but may be augmented by the RIMEP.
MANDATORY APPENDIX IV
MONITORING AND NDE QUALIFICATION

ARTICLE IV-1
INTRODUCTION

IV-1.1 SCOPE

This Appendix provides requirements for performance-based qualification of monitoring and nondestructive examination (MANDE) methods and techniques. It addresses qualification of the personnel, procedures, and equipment. The qualification requirements described herein support the Reliability Targets identified in the Owner's Design Specification based on RIM Reliability Targets for examination of the applicable structure, system, or component (SSC) as required by RIM-2.7.6. This process is described in Mandatory Appendix I, Figures I-1.1-1 through I-1.1-4 and the following paragraphs.

IV-1.2 METHODS

The following NDE and monitoring methods are addressed in this Appendix:
(a) acoustic emission (AE)
   (1) leak detection
   (2) defect and degradation and damage detection
(b) eddy current (ET)
(c) leak testing (LT)
   (1) helium mass spectrometer testing
   (2) halogen dye leak testing
   (3) ultrasonic leak detection
   (4) pressure change testing
   (5) bubble testing
(d) liquid penetrant (PT)
(e) magnetic particle (MT)
(f) online monitoring (e.g., leak detection, vibration analysis, thermal sensors) and additional monitoring methods as determined by the Monitoring and NDE Expert Panel (MANDEEP)
(g) radiographic examination (RT)
(h) ultrasonic examination (UT)
(i) visual examination (VT) (VT-1, VT-2, or VT-3)
(j) surveillance samples

IV-1.3 OWNER'S REQUIREMENTS

IV-1.3.1 General Requirements

The MANDEEP is responsible for the following, consistent with the Reliability Targets established by RIMEP, or as identified in the Design Specification prepared by the Owner, for the applicable SSCs:
(a) fulfilling the requirements of IV-1.3.2
(b) planning of examinations
(c) maintenance of calibration standards
(d) records and record retention

IV-1.3.2 Owner's Monitoring and NDE Expert Panel (MANDEEP)

IV-1.3.2.1 Responsibilities. The MANDEEP shall be responsible for establishing and documenting the following:
(a) the MANDE specification (Figure I-1.1-1)
(b) the level of rigor required for MANDE qualification.
For NDE, reference requirements are as defined for Section V, Article 14.
(c) specific examination requirements, including coverage, frequency, location and volume.
(d) a minimum criteria of MANDE for all SSCs. This shall be based upon the following:
   (1) the Reliability Target value established for individual SSCs
   (2) degradation mechanisms and stressors assigned to the SSC
   (3) the detection capability and associated uncertainty of the MANDE methods proposed for each application
   (4) relevant design and operating factors specific to a given reactor type
This applies to all SSCs in the RIM Program and sampling of other SSCs that may have been exempted but which are deemed essential for defense-in-depth. All of the knowns, assumptions, decisions, and the technical basis for the process chosen shall be documented in the MANDE Specification.
ARTICLE IV-2
PROCEDURES, EQUIPMENT, AND PERSONNEL REQUIREMENTS

IV-2.1 BASIC QUALIFICATION (FIGURES I-1.1-1 THROUGH I-1.1-7)

The MANDEEP shall establish programmatic procedures to control personnel qualification in accordance with the following:

(a) the ASME Nondestructive Examination and Quality Control Central Qualification and Certification Program (ANDE-1) Standard, or
(b) the national or international central certification program required by the regulatory and enforcement authorities having jurisdiction at the plant site,
(c) for methods or techniques not addressed by (a) or (b) above, the Owner's program for NDE personnel qualification shall apply,
(d) where personnel qualification programs for MANDE methods exist, the MANDEEP shall review for acceptance. Where qualification programs do not exist or are not acceptable, the MANDEEP shall specify qualification requirements. These qualification requirements shall be based on performance-based qualification principles similar to those included in the ANDE-1 Standard.

IV-2.2 METHOD/TECHNIQUE PERSONNEL-SPECIFIC QUALIFICATIONS

IV-2.2.1 Data Acquisition Personnel

Personnel performing only data acquisition shall have received specific training, and shall be qualified in accordance with the Owner's procedures for the applicable equipment operation and data recording tasks. These qualification requirements shall be based on performance-based qualification principles similar to those included in ASME ANDE-1.

IV-2.2.2 Data Evaluation Personnel

Personnel performing evaluation of examination data shall have received specific training in the data evaluation techniques used in performance demonstration and shall successfully complete the performance demonstration required in Article IV-4.
ARTICLE IV-3
RELIABILITY-BASED QUALIFICATION OF MONITORING AND NDE (MANDE) METHODS AND TECHNIQUES

IV-3.1 GENERAL

The MANDEEP shall be responsible for determining the performance demonstration requirements for each SSC to reach the Reliability Target, based on applicable flaw damage mechanisms, degradation processes, and frequency of examination.

IV-3.2 DETERMINATION OF THE QUALIFICATION REQUIREMENTS

To establish the requirements for qualification of a MANDE method and technique for an SSC, the MANDEEP shall consider factors relevant to maintaining the Reliability Target including the following:
(a) materials and fabrication processes
(b) part geometry
(c) stress analysis, including the effect of known or postulated fabrication flaws
(d) known and postulated degradation mechanisms
(e) flaw/condition initiation and growth rates
(f) critical flaw size or condition extent (e.g., material loss)
(g) minimum flaw size or condition extent required for detection
(h) sizing accuracy (i.e., length, depth, flaw separation, remaining ligament, etc.)
(i) flaw location and coverage of examination
(j) sample size and distribution
(k) frequency of examination
(l) probability of detection and false calls
(m) accuracy of the MANDE technique

IV-3.3 QUALIFICATION PROCESS

IV-3.3.1 General

The qualification of a MANDE method supports the Reliability Target for the SSC determined as a result of consideration of the factors listed in IV-3.2. The achieved reliability of the MANDE method shall be then considered by the MANDEEP in determining any additional controls needed to achieve the necessary Reliability Target of the SSC.

IV-3.3.2 SSC MANDE Specifications (Figure I-1.1-4)

A MANDE Specification is required for the qualification of monitoring and NDE for each SSC. The MANDE Specification is a document describing the MANDE methods, techniques and required performance to be used for a specific SSC. It shall include a reference to the supporting Technical Justification, which shall include the principles of the technique as applied to the SSC, an explanation of the procedure, including the equipment to be used, and any relevant laboratory and field experience.

IV-3.3.3 MANDE Technical Justification (Figure I-1.1-6)

For each method and technique identified in the MANDE Specification, a Technical Justification shall be prepared. For NDE, reference requirements are as defined for Section V, Article 14. In addition, the Technical Justifications shall specifically address the application of the method and technique to each SSC for which it is identified in the MANDE Specification.

IV-3.3.4 Levels of Rigor (Figure I-1.1-6)

(a) The MANDEEP is responsible for establishing the levels of rigor required for qualification for each SSC based on the Reliability Target required. For NDE, reference requirements are as defined for Section V, Article 14.
(b) A High Level of Rigor is generally required to support a probabilistic risk assessment (PRA) and includes a sufficient number of test specimens to effectively quantify uncertainties, estimate sizing error distributions and determine a Probability of Detection (POD) for specific degradation mechanisms or flaw types, locations and sizes.

IV-3.3.5 Qualification of NDE Methods and Techniques (Figure I-1.1-6)

The qualification process for each NDE Method and Technique shall be defined in a written procedure approved by the MANDEEP. The written procedure shall include the test specimen requirements and essential variable ranges bounding the qualification. Essential variables shall include but are not limited to hardware, equipment settings, operational input values, and software