



NUREG-0800

## U.S. NUCLEAR REGULATORY COMMISSION STANDARD REVIEW PLAN

### BRANCH TECHNICAL POSITION 7-10 —

### GUIDANCE ON APPLICATION OF REGULATORY GUIDE 1.97

### REVIEW RESPONSIBILITIES

**Primary** — Organization responsible for the review of instrumentation and controls

**Secondary** — None

**Review Note:** The revision numbers of Regulatory Guides (RG) and the years of endorsed industry standards referenced in this branch technical position (BTP) are centrally maintained in Standard Review Plan (SRP) Section 7.1-T (Table 7-1). Therefore, the individual revision numbers of RGs (except RG 1.97) and years of endorsed industry standards are not shown in this BTP. References to industry standards incorporated by reference into regulation (IEEE Std 279-1971 and IEEE Std 603-1991) and industry standards that are not endorsed by the agency do include the associated year in this BTP. See Table 7-1 to ensure that the appropriate RGs and endorsed industry standards are used for the review.

Draft Revision 6 – August 2015

#### USNRC STANDARD REVIEW PLAN

This Standard Review Plan (SRP), NUREG-0800, has been prepared to establish criteria that the U.S. Nuclear Regulatory Commission (NRC) staff responsible for the review of applications to construct and operate nuclear power plants intends to use in evaluating whether an applicant/licensee meets the NRC's regulations. The SRP is not a substitute for the NRC's regulations, and compliance with it is not required. However, an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide an acceptable method of complying with the NRC regulations.

The standard review plan sections are numbered in accordance with corresponding sections in Regulatory Guide (RG) 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)." Not all sections of RG 1.70 have a corresponding review plan section. The SRP sections applicable to a combined license application for a new light-water reactor (LWR) are based on RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)."

These documents are made available to the public as part of the NRC's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Individual sections of NUREG-0800 will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience. Comments may be submitted electronically by email to [NRO\\_SRP@nrc.gov](mailto:NRO_SRP@nrc.gov).

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## A. BACKGROUND

This branch technical position (BTP) provides additional guidelines for reviewing an ~~applicant/licensee's~~ applicant's or licensee's accident monitoring instrumentation. These guidelines are based on reviews of ~~applicant/licensee~~ design submittals by applicants or licensees that contained approved interpretations and alternatives for the guidance identified in Regulatory Guide RG 1.97.

Revisions 2, 3, and 4 of Regulatory Guide RG 1.97 are currently in effect. Plants licensed prior to before June 2006 committed to follow either Revision 2 or 3, both titled "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident." Both ~~revisions~~ Revisions 2 and 3 of Regulatory Guide RG 1.97 prescribe a detailed list of variables to monitor and specify a comprehensive list of design and qualification criteria to be met by the instrumentation monitoring each variable. Revision 4, "Criteria for Accident-Monitoring Instrumentation for Nuclear Power Plants," endorses, with exceptions and clarifications, Institute of Electrical and Electronics Engineers (IEEE-) Standard (Std-) 497-2002, "IEEE Standard Criteria for Accident Monitoring

Revision 5—March 2007

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Instrumentation for Nuclear Power Generating Stations," IEEE Std. 497-2002 establishes flexible, performance-based criteria for the selection, performance, design, qualification, display, and quality assurance of accident monitoring variables.

#### 1. Regulatory Basis

##### 10 CFR

Title 10 of the *Code of Federal Regulations* (10 CFR) 50.34(f)(2)(xvii) requires in part that instrumentation be provided to measure, record, and read out in the control room: containment

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pressure, containment water level, containment hydrogen concentration, containment radiation intensity (high-level), and noble gas effluents.

10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 13, "Instrumentation and Control," requires in part that instrumentation be provided to monitor variables and systems over their anticipated ranges for accident conditions, as appropriate, to assure adequate safety.

GDC 19, "Control Room," requires in part that a control room be provided from which actions can be taken to maintain the nuclear power unit in a safe condition under accident conditions, including loss-of-coolant accidents. It also requires that equipment, including the necessary instrumentation, be provided at appropriate locations outside the control room and that such equipment have a design capability for prompt, hot shutdown of the reactor.

GDC 64, "Monitoring Radioactivity Releases," requires in part that means be provided to monitor (1) the reactor containment atmosphere, (2) spaces containing components for recirculation of loss-of-coolant accident fluids, (3) effluent discharge paths, and (4) the plant environs for radioactivity that may be released from postulated accidents.

## 2. Relevant Guidance

### Regulatory Guide

RG 1.97 describes a method acceptable to the U.S. Nuclear Regulatory Commission (NRC) staff for providing instrumentation to monitor variables for accident conditions.

Plants that obtained an operating license after June 2006 should reference the guidance of Regulatory Guide RG 1.97, Revision 4.

For plants with operating licenses issued before June 2006, Regulatory Guide RG 1.97, Revisions 2 and 3, are still effective. Licensees of these plants may, however, convert to the criteria of Revision 4 or use the criteria of Revision 4 when performing modifications that do not involve a conversion. The guidance contained in Regulatory Position 1 of Regulatory Guide RG 1.97, Revision 4, should be followed in these cases. See the "Conversion to Revision 4" discussion in section B.3 of this BTP for additional information.

## 3. Purpose

The purpose of this BTP is to provide additional guidance for NRC reviewers to verify that the previously cited regulatory bases are met by an applicant's or licensee's submittal. This BTP's objectives are:

### To clarify

- Clarify the staff position on accident monitoring instrumentation, and
- Identify alternatives acceptable to the staff for satisfying the guidelines identified in Regulatory Guide RG 1.97.

## B. BRANCH TECHNICAL POSITION

### 1. Introduction

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~~Applicant/~~

~~Applicants or~~ licensees have provided design submittals to the staff containing interpretations of guidelines identified in ~~Regulatory Guide~~RG 1.97. In some cases, ~~applicant/applicants or~~ licensees have requested relief from selected guidelines. When the ~~applicant/applicants or~~ licensee provided adequate justification, the staff has accepted alternatives to implementing specific provisions of Revisions 2 and 3 of ~~Regulatory Guide~~RG 1.97. The ~~NRC~~ staff documented the basis for this acceptance in various safety evaluation reports (SERs). Staff positions and clarifications applicable to various classes of plant designs emerged from these evaluations. These positions include identification of specific designs acceptable to the staff for instrumentation to assess plant and environs conditions during and following an accident.

## 2. ~~Information to be~~ Reviewed

~~The~~

Standard Review Plan (SRP) Section 7.5 describes the information to be reviewed for accident monitoring instrumentation ~~is described in Standard Review Plan (SRP) Section 7.5.~~

## 3. ~~Acceptance Criteria~~

The design and qualification criteria identified in ~~Regulatory Guide~~RG 1.97 should be supplemented by the considerations outlined below:

### ~~Environmental Qualification~~

~~The staff has interpreted~~ 10 CFR 50.49(b)(3), "Certain ~~post-accident monitoring equipment,~~" ~~has been interpreted by the staff~~ Post-Accident Monitoring Equipment," as follows:

For plants using Revisions 2 or 3 of ~~Regulatory Guide~~RG 1.97, accident monitoring equipment that falls within the scope of Category 1 or 2 equipment should be environmentally qualified as required by 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants," or the ~~applicant/ or~~ licensee should provide an acceptable alternative for complying with 10 CFR 50.49(b)(3).

For plants using Revision 4 of ~~Regulatory Guide~~RG 1.97, accident monitoring equipment identified as Type A, B, or C in accordance with that guide should be environmentally qualified as required by 10 CFR 50.49. Type D variables should be environmentally qualified for the particular ~~accident's~~ postulated environment at the installed location in accordance with the ~~plant's~~ licensing basis. Licensees converting to Revision 4 or performing modifications based on Revision 4 may reference previously accepted alternatives as their basis for deviations from the environmental qualification criteria in Revision 4.

### ~~Seismic Qualification~~

For plants using Revisions 2, 3, or 4 of ~~Regulatory Guide~~RG 1.97, if a ~~reactor's~~ licensing basis does not include a commitment to ~~Regulatory Guide~~RG 1.100, "Seismic Qualification of Electric Equipment for Nuclear Power Plants," and credit is taken for original equipment in meeting the guidelines identified in ~~Regulatory Guide~~RG 1.97, installation of the original equipment in conformance with the licensing basis for seismic qualification is

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acceptable, provided the other guidelines identified in ~~Regulatory Guide~~RG 1.97 and this BTP are satisfied. However, for all reactors, new instrumentation that is installed to satisfy ~~Regulatory Guide~~RG 1.97 or to replace original equipment for which credit was taken in satisfying ~~Regulatory Guide~~RG 1.97 should satisfy the seismic qualification guidelines identified in ~~Regulatory Guide~~RG 1.97100.

#### Redundancy

For Category 1 variables under Revisions 2 and 3 of ~~Regulatory Guide~~RG 1.97, no single failure should prevent the operators from being presented information necessary to determine the safety status of the plant and to maintain the plant in a safe condition following an accident. Channels provided to monitor a Revision 2 or 3 Category 1 variable do not need to meet this criterion during channel maintenance, test, or calibration, provided the duration of such testing satisfies the applicable requirements of the licensing basis. For example, the time interval required for a test, calibration, or maintenance operation could be shown to be so short that it would have an insignificant effect on the overall availability of the accident monitoring instrumentation system.

~~This BTP does not supplement Regulatory Guide 1.97, Revision 4 and IEEE Std. 497-2002 guidance on this topic.~~

#### Independence of Redundant Instrumentation

For plants using Revisions 2, 3, or 4 of ~~Regulatory Guide~~RG 1.97, if a reactor licensing basis does not include a commitment to ~~Regulatory Guide~~RG 1.75, "Criteria for Independence of Electric Systems," and credit is taken for original equipment in meeting the guidelines identified in ~~Regulatory Guide~~RG 1.97, installation of the original equipment in conformance with the licensing basis requirements for separation and independence is acceptable, provided the other guidelines identified in ~~Regulatory Guide~~RG 1.97 and this BTP are satisfied. However, for all reactors, new instrumentation that is installed to satisfy ~~Regulatory Guide~~RG 1.97 or to replace original equipment for which credit was taken in satisfying ~~Regulatory Guide~~RG 1.97 should satisfy the separation and isolation guidelines in ~~Regulatory Guide~~RG 1.9775.

#### Display and Recording

Revisions 2 and 3 of ~~Regulatory Guide~~RG 1.97 state in part that if direct or immediate trend or transient information is essential for operator information or action, the recording should be continuously available on dedicated recorders. Otherwise, the information may be continuously updated, stored in computer memory, and displayed on demand. For the latter non-essential applications, the use of Category 2 computers or dedicated Category 2 recorders is acceptable for recording Category 1 information, provided the Category 1 instrumentation is isolated from the Category 2 instrumentation using qualified isolation devices. Guidance on the application and qualification of isolation devices is provided in SRP BTP 7-11.

~~This BTP does not supplement Regulatory Guide 1.97, Revision 4 and IEEE Std. 497-2002 guidance on this topic.~~

#### Range

Deviations from the range values identified in Revisions 2 and 3 of ~~Regulatory Guide~~RG 1.97 may be acceptable if supported by analyses demonstrating that the indication would

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with appropriate margins for any design basis event or accident for which the instrumentation might be required for operator information. An appropriate margin should include allowance for analytical uncertainties and instrumentation uncertainties. However, ~~Regulatory Guide~~RG 1.97 identifies that, for a limited number of functionally significant variables (e.g., containment pressure, primary system pressure), instrument ranges should extend beyond values that the selected variables can attain under limiting conditions. Guidance on uncertainties is provided in ~~SRP BTP 7-12~~.  
~~SRP BTP 7-12~~.

The ranges and footnotes for radiation and meteorological instrumentation that are provided in Revision 3 of ~~Regulatory Guide~~RG 1.97 should be applicable for plants using Revision 4 of ~~Regulatory Guide~~RG 1.97. Applicants and licensees using Revision 4 should document differences from the Revision 3 ranges and footnotes for radiation and meteorological instrumentation.

#### Minimizing Measurements

To the extent practicable, the same instruments should be used for accident monitoring as are used for normal operations of the plant. In cases in which a single display may indicate the reading of more than one instrument, the intent of this recommendation is met if the same variable and same display are used for accident monitoring even though the sensor(s) providing the signal are different.

#### Alternate Instrumentation

The use of alternate instrumentation to monitor variables different from those identified in ~~Regulatory Guide~~RG 1.97, Revisions 2 and 3, is acceptable, provided that all three of the following criteria are met:

- a-(1) The alternate instrumentation fulfills the purpose of the variables identified in ~~Regulatory Guide~~RG 1.97.
- b-(2) The alternate instrumentation conforms to the design and qualification criteria for the variables identified in ~~Regulatory Guide~~RG 1.97.
- e-(3) No credit is taken by the applicant or licensee in post-accident procedures, emergency operating procedures, or functional recovery guidelines for indication of the variables identified in ~~Regulatory Guide~~RG 1.97 for which the alternative instrumentation is proposed.

Revision 4 of ~~Regulatory Guide~~RG 1.97 does not identify specific variables to be displayed; therefore, this topic does not apply to Revision 4.

#### Guidance for Boiling Water Reactor (BWR) and Pressurized Water Reactor (PWR) Variables

Table 1, BWR Variables, and Table 2, PWR Variables, of ~~Regulatory Guide~~RG 1.97, Revision 2, and Table 2, BWR Variables, and Table 3, PWR Variables, of ~~Regulatory Guide~~RG 1.97, Revision- 3, identify guidelines for the range, design and qualification category, and purpose for specific BWR and PWR variables. For selected BWR and PWR variables identified in the tables, acceptable deviations or clarifications are identified in Tables 1 and 2, respectively, of this BTP. Tables 1 and 2 of this BTP list

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~~Regulatory Guide~~RG 1.97 variables and types of deviations from ~~Regulatory Guide~~RG 1.97 guidelines (e.g., deviations with respect to category, redundancy, range, direct measurement), and provide a summary of the acceptance guidelines or clarification associated with the deviations.

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Revision 4 of ~~Regulatory Guide~~RG 1.97 does not identify specific variables; therefore Tables 1 and 2 of this BTP do not apply to Revision 4.

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#### Conversion to Revision 4

Applicants ~~or~~ licensees of reactors that are committed to either Revision 2 or 3 of ~~Regulatory Guide~~RG 1.97 may voluntarily convert the ~~plant's~~plant's entire accident monitoring program to the criteria of Revision 4 of ~~Regulatory Guide~~RG 1.97. Conversion means revising the commitment for the ~~plant's~~plant's entire accident monitoring program from the current licensing basis (either Revision 2 or 3) to the guidance in Revision 4. The conversion to Revision 4 could include physical changes (e.g., replacing an instrument), licensing changes (e.g., technical specification changes), changes in variable types and associated design and qualification criteria, changes in the function or purpose of the variable, and changes in the range being monitored. This conversion should be supported by a complete analysis of the ~~plant's~~plant's accident monitoring program against all of the criteria in Revision 4.

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The applicant ~~or~~ licensee should document the results of the analysis in a table format that includes for each variable the following: variable name, current type, current function or purpose, current range, proposed type, proposed function or purpose, proposed range, and any criteria that would be changed. For variables for which there is a proposed change in type or purpose, the applicant ~~or~~ licensee should document the rationale for the change.

#### Modifications Using Revision 4

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Applicants ~~or~~ licensees of reactors that are committed to either Revision 2 or 3 of ~~Regulatory Guide~~RG 1.97 may voluntarily use the criteria of Revision 4 of ~~Regulatory Guide~~RG 1.97 to perform modifications that do not involve a conversion. The applicant ~~or~~ licensee should first perform an analysis to determine the complete list of variables and their associated types in accordance with the selection criteria of Revision 4. Without such an analysis, there would not be a means to correlate Revision 4 criteria being applied to the modification of variables that have been previously licensed to the criteria of Revision 2 or 3.

The applicant ~~or~~ licensee should document the proposed modifications in a table format that includes for each variable the following: variable name, current type, current function or purpose, current range, proposed type, proposed function or purpose, proposed range, and any criteria that would be changed. For variables for which there is a proposed change in type or purpose, the applicant ~~or~~ licensee should document the rationale for the change.

Licensees may make modifications within the ~~plant's~~plant's current licensing basis without referencing Revision 4 of ~~Regulatory Guide~~RG 1.97.

#### 4. Review Procedures

~~The~~ SRP Section 7.5, Section III, describes the review procedure for accident monitoring instrumentation ~~is described in SRP Section 7.5, subsection III.~~

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**Table 1. For BWRs: Acceptable Deviations and Clarifications to Revisions 2 and 3 of Regulatory Guide 1.97**

**Table 1. For BWRs: Acceptable Deviations and Clarifications to Revisions 2 and 3 of Regulatory Guide 1.97**

Variable	Deviation	Acceptance Guidelines/Clarification
Neutron flux	<ul style="list-style-type: none"> <li>Category</li> <li>Equipment qualification</li> <li>Redundancy</li> <li>Power source</li> <li>Quality assurance</li> <li>Range</li> </ul>	<p>Except for applications submitted after January 13, 1993 (which should satisfy the guidelines identified in <del>Regulatory Guide</del> RG 1.97), the design criteria identified in NEDO-31558-A, "Position on Nuclear Regulatory Commission (NRC <del>Regulatory Guide</del>) RG 1.97, Revision 3, <del>Requirement</del> Requirements for Post-Accident Neutron Monitoring System," are an acceptable alternative to Category 1 criteria.</p> <p>Pursuant to these <del>alternate</del> alternative criteria, the applicant/licensee should perform a plant-specific evaluation of the electrical power distribution to the neutron monitoring system (including the recorders) to verify that the instrument power is not lost during design basis events.</p>
Coolant level in reactor vessel	<ul style="list-style-type: none"> <li>Range</li> <li>Redundancy</li> </ul>	<p>If redundant channels of Category 1 instrumentation cover the fuel zone and the wide range (i.e., all manual and automatic trip functions), a single channel of Category 3 upset range instrumentation (from the upper end of the wide range to the top of the vessel or centerline of the main <del>steamline</del> steam line) is acceptable for detection of water carryover.</p>
Core temperature	N/A	<p>This RG 1.97 Rev. 2 &amp; 3 Table 2, "BWR Variables," lists core temperature as a Type B and Type C variable <del>is not necessary for satisfying the guidelines identified in Regulatory Guide 1.97, perused to provide diverse indication of reactor vessel water level. However, NUREG-0737, Supplement 1, "Clarification of TMI Action Plan Requirements: Requirements for Emergency Response Capability," Section 6.1b later clarified, "BWR incore thermocouples and continuous offsite dose monitors are not required pending their further development and consideration as requirements." The aforementioned development and considerations were not complete as of the publication of Rev. 3 of RG 1.97. Therefore, it is an acceptable deviation to not include Core Temperature as measured by qualified incore thermocouples as a RG 1.97 Rev. 2 or Rev. 3 variable.</del></p>
Drywell sump and drywell drain sumps level	<ul style="list-style-type: none"> <li>Category</li> <li>Direct measurement</li> </ul>	<p>Category 3 instrumentation (e.g., flow instrumentation) is an acceptable alternative to Category-1 instrumentation for this variable if it can be shown that:</p> <ul style="list-style-type: none"> <li><del>a. (a)</del> For small leaks, the alternate instrumentation will not experience a harsh environment; <del>and</del></li> <li><del>b. (b)</del> For larger leaks, the sumps fill promptly and the sump drain lines isolate due to the increase in drywell pressure, negating the need for the measurement; <del>and</del></li> <li><del>c. (c)</del> Drywell pressure and temperature indication can be used to detect leakage into the drywell; and</li> <li><del>d. (d)</del> The instrumentation neither automatically initiates nor alerts the operator to initiate operation of a safety system in a post-accident situation.</li> </ul>
Primary containment isolation valve position	Redundancy	<p><del>Redundant</del> A redundant position indication for each active containment isolation valve is not necessary because the valves are redundant. Likewise, position indication is not necessary for valves within the operator's cognizance that are normally closed and remain closed after an accident, and that are administratively controlled.</p>
Primary system safety relief valve positions, including automatic depressurization system	Category	<p>Category 3 safety relief valve (SRV) position indication is an acceptable alternative to Category 2 instrumentation for this variable, provided that a plant-specific evaluation documents that the analysis of NEDO-33160, "Regulatory Relaxation for the Post Accident SRV [Safety Relief Valve] Position Indication System," applies to the plant and that the requirements of NUREG-0737, Item II.D.3, and 10</p>

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**Table 1. For BWRs: Acceptable Deviations and Clarifications to Revisions 2 and 3 of Regulatory Guide 1.97**

Variable	Deviation	Acceptance Guidelines/Clarification
(ADS) or flow through pressure in valve lines		CFR 50.34(f) continue to be met.

**Table 1 (cont.). For BWRs: Acceptable Deviations and Clarifications to Revisions 2 and 3 of Regulatory Guide 1.97**

Variable	Deviation	Acceptance Guidelines/Clarification
Primary system safety relief valve positions, including ADS or flow through pressure in valve lines	Category	Category 3 safety relief valve position indication is an acceptable alternative to Category 2 instrumentation for this variable, provided that a plant-specific evaluation documents that the analysis of NEDO-33160, "Regulatory Relaxation for the Post Accident SRV [Safety Relief Valve] Position Indication System," applies to the plant and that the requirements of NUREG0737, Item II.D.3, and 10 CFR 50.34(f) continue to be met.
Radioactivity concentration or radiation level in circulating primary coolant	N/A	A continuous post-accident monitor is not necessary.
Containment and drywell hydrogen concentration	Category	In accordance with 10 CFR 50.44, Category 3 instrumentation is acceptable for diagnosing the course of beyond design basis accidents.
	Range	For plants in which credit is taken for Class 1E hydrogen ignitors, the range recommendations may be relaxed if analysis shows that the instrumentation will remain on scale through all design basis events with adequate margin for uncertainties.
Containment and drywell oxygen concentration	Category	In accordance with 10 CFR 50.44, Category 2 instrumentation is acceptable for verification of the status of an inerted containment.

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	Range	The range recommendation may be relaxed if it can be shown that the instrumentation will perform adequately during all accident and post-accident conditions.
Suppression chamber and drywell spray flows	Direct measurement	The use of <del>residual heat removal (RHR)</del> flow, suppression chamber temperature and pressure, and drywell temperature and pressure are acceptable alternatives if it can be shown that (1) use of these variables can accurately and reliably measure the effectiveness of the drywell and suppression chamber spray in a timely manner, and (2) the position of the spray throttling valves can be monitored and the sprays adequately controlled from the control room using the <del>alternate</del> alternative variables.
Standby liquid control system (SLCS) flow	Direct measurement	Measurement of SLCS pump discharge pressure and SLCS storage tank level may be acceptable as an alternative indication that the SLCS pump is operating and that SLCS flow is occurring.
Reactor building or secondary containment area radiation	Category	Area radiation monitors located in Mark III containments and in primary containments of other BWRs may be Category 2 as an alternative to Category 1 monitors. Area radiation monitors located in reactor building secondary containments for Mark I and Mark II plants and in other plant areas may be Category 3 in lieu of Category 2.

**Table 1 (cont.). For BWRs: Acceptable Deviations and Clarifications to Revisions 2 and 3 of Regulatory Guide 1.97**

Variable	Deviation	Acceptance Guidelines/Clarification
Standby liquid control system (SLCS) flow	Direct measurement	Measurement of SLCS pump discharge pressure and SLCS storage tank level may be acceptable as an alternate indication that the SLCS pump is operating and that SLCS flow is occurring.
Reactor building or secondary containment area radiation	Category	Area radiation monitors located in Mark III containments and in primary containments of other BWRs may be Category 2 as an alternative to Category 1 monitors. Area radiation monitors located in reactor building secondary containments for Mark I and Mark II plants and in other plant areas may be Category 3 in lieu of Category 2.
Radiation exposure rate/variables used to monitor airborne radioactive materials released from plant	Category	If the instrument is located in a mild environment and is not part of a safety system, Category 3 instrumentation is acceptable in place of Category 2 instrumentation.

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~~Table 2. For PWRs: Acceptable Deviations and Clarifications to Revisions 2 and 3 of Regulatory Guide 1.97~~

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**Table 2. For PWRs: Acceptable Deviations and Clarifications to Revisions 2 and 3 of Regulatory Guide 1.97**

Variable	Deviation	Acceptance Guidelines/Clarification
Neutron flux	Environmental qualification	A non-environmentally qualified instrument is acceptable if qualified core exit thermocouples and reactor containment/coolant system (RCS) hot and cold leg temperature indications are provided in conjunction with directions in emergency procedures for operator action to assure/ensure that boric acid injection is occurring.
RCS pressure (Combustion Engineering [CE] reactors)	Range	A range of 0–3,000 psig is an adequate alternative to 0–4,000 psig if analysis is presented or referenced in the final safety analysis report (FSAR) that shows that pressure will remain on scale for all design basis transients and accidents. However, if an anticipated transient without scram (ATWS) analysis indicates that pressures exceeding FSAR values are possible, an expanded range of the Category 1 instrumentation should be provided.
Containment sump level	Range	Separate narrow-range instrumentation is not required if the wide-range instrumentation satisfies the guidelines of Regulatory Guide RG 1.97 and is of sufficient range and accuracy to monitor the sump operation for all design basis conditions.
Containment isolation valve position	Redundancy	RedundantA redundant position indication for each active containment isolation valve is not necessary because the valves are redundant. Likewise, position indication is not necessary for valves within the operator's cognizance that are normally closed and remain closed after an accident, and that are administratively controlled.
Radioactivity concentration or radiation level in circulating primary coolant	N/A	A continuous post-accident monitor is not necessary.
Containment hydrogen concentration	Category	In accordance with 10 CFR 50.44, Category 3 instrumentation is acceptable for diagnosing the course of beyond design basis accidents.
	Range	ForIn plants infor which credit is taken for Class 1E hydrogen ignitors, the range recommendations may be relaxed if analysis shows the instrumentation will remain on scale through all design basis events with adequate margin for uncertainties.

**Table 2 (cont.). For PWRs: Acceptable Deviations and Clarifications to Revisions 2 and 3 of Reg. Guide 1.97**

Variable	Deviation	Acceptance Guidelines/Clarification
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Accumulator tank level and pressure	Category	The safety function of the accumulator is performed passively by opening the discharge check valve when RCS pressure is lower than the tank pressure. Therefore, Category 3 instrumentation is an acceptable alternative to Category 2 if there are no operator actions that depend on use of this instrumentation for accident mitigation.
Accumulator isolation valve position	Category	A Category 3 position indication is acceptable if the accumulator isolation valves are locked-open, and motor-operated valves (i.e., power to the motor operators is disabled during normal operation) and cannot change position during an accident.
Pressurizer heater status	Indication	At a minimum, status indication should be provided for pressurizer heaters governed by the technical specification (i.e., heaters required to be served by emergency power).
Quench tank temperature and pressure	Range	Pressure relief of the tank via rupture disk limits the temperature of the tank contents to saturated steam conditions (less than 750°F). Therefore, it is acceptable if the upper-range value includes (with adequate margin) the saturation temperature corresponding to the tank rupture disk relief pressure (e.g., a rupture disk relief pressure of 100 psig corresponds to 328°F saturation temperature). Likewise, an upper-range value less than the design pressure of the tank is acceptable if the upper-range value covers (with adequate margin) the rupture disk relief pressure.
Steam generator level (wide-range)	Redundancy	For the wide-range level, two-loop plants should have two channels of instrumentation per loop, but three- and four-loop plants may have one channel of instrumentation per loop.
Steam generator pressure	Redundancy	If steam generator pressure is identified as a Type A variable, two-loop plants should have two channels of instrumentation per loop, but three- and four-loop plants may have one channel of instrumentation per loop.
Containment atmosphere temperature	<ul style="list-style-type: none"> <li>Category</li> <li>Direct measurement</li> </ul>	Category 3 instrumentation is an acceptable alternative to Category 1 if it is shown that this instrumentation is considered to be backup instrumentation, (i.e., if containment atmosphere temperature is not used in any post-accident procedures, emergency procedures, or functional recovery guidelines, and Category 1 containment pressure instrumentation is available as primary instrumentation-).
Containment sump water temperature	Direct measurement	As an alternative to Category 2 containment sump water temperature instrumentation, either Category 2 residual heat removal heat exchanger inlet or outlet temperature instrumentation is an acceptable alternative for determining containment cooling status.  In plants for which the containment cooling function is provided by the recirculation spray system, either Category 2 recirculation spray system heat exchanger inlet or outlet temperature instrumentation is an acceptable alternative.

**Table 2 (cont.). For PWRs: Acceptable Deviations and Clarifications to Revisions 2 and 3 of Regulatory Guide 1.97**

Variable	Deviation	Acceptance Guidelines/Clarification
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Containment sump water temperature	Direct measurement	As an alternative to Category 2 containment sump water temperature instrumentation, either Category 2 residual heat removal heat exchanger inlet or outlet temperature instrumentation is an acceptable alternative for determining containment cooling status.  In plants in which the containment cooling function is provided by the recirculation spray system, either Category 2 recirculation spray system heat exchanger inlet or outlet temperature instrumentation is an acceptable alternative.
Makeup flow/letdown flow/ volume control tank (VCT) level	Category Direct measurement	Category 3 instrumentation is an acceptable alternative to Category 2 instrumentation if the charging and letdown lines are isolated with an accident signal and no credit is taken for indication of these variables in post-accident procedures, emergency procedures, or functional recovery guidelines.
Radiation exposure rate and variables used to monitor airborne radioactive materials released from plant	Category	If the instrument is located in a mild environment and is not part of a safety system, Category 3 instrumentation is an acceptable alternative to Category 2 instrumentation.

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BTP 7-10-13

Revision 5 - March 2007

BTP 7-10-20

Draft Revision 6 - August 2015

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**PAPERWORK REDUCTION ACT STATEMENT**

The information collections contained in the Standard Review Plan are covered by the requirements of 10 CFR Part 50 ~~and, and~~ were approved by the Office of Management and Budget, approval number 3150-0011 ~~10 CFR Part 52, and were approved by the Office of Management and Budget, approval number 3150-0011 and 3150-0151.~~

**PUBLIC PROTECTION NOTIFICATION**

~~The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.~~

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**BTP Section 7-10**  
**Description of Changes**

**BTP 7-10, “Guidance on Application of Regulatory Guide 1.97”**

This -14 BTP Section affirms the technical accuracy and adequacy of the guidance previously provided in BTP 7-10, Revision 5, dated March 2007. See ADAMS Accession Number ML070550082.

The main purpose of this update is to incorporate the revised software Regulatory Guides and the associated endorsed standards. For organizational purposes, the revision number of each Regulatory Guide and year of each endorsed standard is now listed in one place, Table 7-1. As a result, revisions of Regulatory Guides and years of endorsed standards were removed from this section, if applicable. For standards that are incorporated by reference into regulation (IEEE Std 279-1971 and IEEE Std 603-1991) and standards that have not been endorsed by the agency, the associated revision number or year is still listed in the discussion.

Added additional background information to Table 1 for the “Core Temperature” variable and reformatted Tables 1 and 2.

Additional changes to this BTP section in this revision were editorial.

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Space After: 0 pt, Line spacing: single, No bullets or numbering, Keep with next, Tab stops: 0.29", Left

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Left: 1", Right: 1", Top: 1", Bottom: 1", Suppress Endnotes, Header distance from edge: 1"

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Indent: Hanging: 0.5", Right: 0", Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.25" + Indent at: 0.5", Keep with next, Tab stops: -1", Left

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