

Advanced Photon Source

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Change Control for Radiation Safety Shielding

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Change Control for Radiation Safety Shielding

1. INTRODUCTION

1.1. Purpose

This document establishes the policy and procedures for change control for Radiation Safety Systems (RSS) at the Advanced Photon Source (APS). These requirements ensure the integrity of the shielding that protect personnel from exposure to unacceptable levels of ionizing radiation, even as changes are made to the shielding.

1.2. Acronyms

ACIS	Accelerator Control and Interlock System
CCCL	Configuration Control Component List
CCSM	Critical Components System Manager
CCWP	Configuration Control Work Permit
CO	Accelerator Systems Chief of Operations
FC	Floor Coordinator
HP	Argonne Health Physics personnel
MCR	Main Control Room
PDRC	PSC Design Review Committee
PSS	Personnel Safety System
RSS	Radiation Safety System

1.3. Definitions

Change Control is a process to maintain consistency between designs, configurations, and documentation as a configuration is modified.¹

Configurations are the physical, functional, and operational characteristics of systems, components, or parts of an existing facility or operation.¹

Configuration Management is the process to establish and document the design requirements and physical configuration of a facility (physical, functional, and operational) and to ensure they remain consistent and documented.¹ At the APS, the phrase **configuration control** of RSS is often used interchangeably with configuration management of RSS.

A **Configuration Control Work Permit (CCWP)** is the document that identifies: the scope of RSS work; authorizations; validations; stop points; approvals for RSS entry into,

¹ Definition adapted from DOE Standard, Configuration Management, DOE-STD-1073-2003.

or return to, service; and, when posted, alerts personnel that RSS work is authorized and in progress.

Engineering Changes are modifications or replacements of existing systems or devices with equipment in which the design has been modified (e.g., replacing obsolete equipment) *and* the modification has the potential to affect the radiation safety performance of the device.

One-For-One Replacement is replacement of a failed device or subcomponent with an identical part.

Radiation Safety Systems (RSS) prevent exposure of personnel to unacceptable levels of ionizing radiation.

For the purposes of this policy, RSS include:

- 1) Shielding – the hardware that stops, for safety purposes, the propagation of radiation (e.g., lead, tungsten, copper, steel, or concrete absorbers in shutters, stops, apertures, collimators, transport, and enclosures);
- 2) Hardware that positions the shielding – supports and controllers through actuators (e.g., support tables, clamps, actuators, pneumatic systems, and control boxes);
- 3) Personnel safety interlocks (ACIS and PSS), from Programmable Logic Controllers (PLCs) to monitored radiation safety devices (e.g., shielded door/shutter/stop position switches; interlock control cabinets, enclosures and wiring; emergency stop (crash) buttons; radiation monitors interfaces; particle beam current monitors and associated wiring, etc.;

PSC Design Review Committee (PDRC) can clarify RSS interfaces.

Shielding covers are part of the RSS. RSS does not include other hardware that may be mounted on a RSS, where the presence or absence of the hardware does not impact the radiation protection provided (e.g., a diagnostic flag, a vacuum gauge, or vacuum pump).

Equipment required to protect a RSS component, the absence of which could compromise a RSS (e.g., a mask required to protect a safety shutter) is part of the RSS.

RSS Work is any manipulation or alteration of RSS, other than operation of the device with ACIS or PSS interlocked controls (e.g., opening or closing interlocked shutters or shielded enclosure doors, or positioning an interlocked mode shutter are not RSS work). Moving or removing a RSS component that is part of an accelerator system or beamline is *RSS work* and a CCWP is required. Relocating a RSS component prior to installation or after removal from an accelerator system or beamline is not *RSS work*.

Troubleshooting is non-invasive (does not alter function of the safety system) diagnostic work that does not bypass or compromise normal operation of the RSS. (A CCWP is not required for RSS troubleshooting.)

1.4. Scope

Configuration management includes five elements:

- Design requirements
- Work Control
- Change Control
- Document Control
- Assessments

This document addresses the third element—change control—and is limited to changes in RSS.

This document applies to all APS RSS and:

- a) Establishes requirements to initiate, perform, close out, and document RSS Work.
- b) Describes the change control process throughout the life of a RSS device.
- c) Provides step-by-step procedures for RSS workflow, including:
 - Identification
 - Inspection, verification, and tagging
 - Installation
 - Work on installed systems
 - Removal or decommissioning.

This document does not provide:

- a) Step-by-step RSS work procedures for performing specific tasks.
- b) Procedures for engineering design, design review, or procurement.
- c) Detailed procedures for managing CCWPs.

2. POLICY

All RSS at the APS shall be labeled and subject to controls that ensure the configuration of the system is known, documented and that all subsequent changes are controlled and tracked. RSS shall be under configuration control through the life cycle of the system, including acceptance, assembly, installation, validation, operation, modification, and decommissioning.

During on-site assembly and QA, materials shall be appropriately secured to ensure that their integrity is maintained.

When assembly is complete and the parameters critical to providing radiation protection have been validated, the shielding is considered RSS.

RSS shall be clearly identified (red tagged) to alert employees that authorization is required to work on the system.

All RSS work shall be authorized through a Configuration Control Work Permit (CCWP).

2.1. RSS Identification

Design and review processes identify: 1) required shielding and 2) requirements and specifications that are essential to the performance of the shielding (e.g., materials, overall dimensions, dimensions of apertures, and alignment tolerances). All new RSS or engineering changes of RSS must be approved per the “[APS Design Review](#)” procedure ([APS 000031](#)) prior to the authorization of the RSS work.

RSS Receipt Verification

RSS are typically purchased through Argonne Procurement and require an Argonne Acceptance Criteria List (ACL). The specifications critical to radiation protection (typically identified in the design reviews) should be included on the ACL and verified by a Laboratory Certified Receipt Inspector.

For RSS not procured through Argonne (e.g., procured by a CAT member’s home institution), an ACL must be developed as part of the design review process and the RSS verified by a Laboratory Certified Receipt Inspector.

2.2. Configuration Control Work Permits

A Configuration Control Work Permit (CCWP) must be approved and posted prior to beginning work on RSS.

Workers are responsible for verifying that a CCWP is posted prior to starting the RSS work, limiting their work to the approved scope.

A CCWP will remain posted until the work, including validations and radiation surveys are completed, and the facility is returned to operational status.

For RSS installed in the front end or beamline, a Floor Coordinator posts the CCWP in the beamline end cabinet. For RSS installed in the accelerator, A CO or designee posts the CCWP in the MCR.

For work on a RSS component that is not installed, a CCWP will be attached to the RSS as a traveler (see Appendix).

During work on installed RSS, facilities will be secured to ensure no beams will be allowed in the work area except to be temporarily brought on-line for system validations (e.g., interlock testing and radiation surveys).

If shielding validation with beam is required and the validation cannot be completed by the end of the run, within ten days of the end of the run the CCWP will be closed out and replaced with an administrative restriction form (“pink sheet” defining operational limits and restrictions.)

CCWP resources

- For Beamline and Front End RSS work: Floor Coordinators (AES-EFOG)
- For Accelerator RSS Work: ASD/CCSM
- CCWP template ([APS 1192911](#))
- CCWP Instructions ([APS 1192930](#))

2.3. Work Planning and Procedures

All RSS work will be performed per approved group Work Control Documents. Procedures should be at a level of detail that meet facility work planning and control standards.

Non-routine RSS work without a standing approved procedure will be done according to a step-by-step procedure for the particular task and require the same level of management approval as a formal APS procedure. These may be submitted as:

- A stand-alone job-specific procedure
or
- A short procedure description included in the “Work Description” of the work request or in the scope of work section of the CCWP. Typically, this applies for simple tasks; the description of the task, including the step-by-step procedure, must fit the text box.

Refer to APS Policy and Procedure “[Work Planning and Control at the APS](#)” ([APS 1432773](#)).

2.4. Beamline RSS Work

The APS Engineering Support (AES) Division is responsible for all work on beamline RSS. This responsibility encompasses the labor for alignment, validation, maintenance, repair, and modification of any beamline RSS component. Material costs for the work are the responsibility of beamline management. AES may cover incidental costs at its discretion.

Beamline personnel may work on RSS only with the written authorization of the APS Deputy ALD for Operations or designee for the specific scope of work. The request, with the scope of work and procedure or checklist attached, is submitted to the Deputy ALD

via a FC; the PDRC Chair will review the request; if authorized, a FC will submit the CCWP on behalf of the user and oversee the work.

2.5. Safety Interlock Work

The APS Safety Interlock Group is responsible for all work on the beamline and accelerator safety interlock systems (PSS and ACIS respectively). This responsibility encompasses the labor for the installation, validation, maintenance, repair, and modification of any PSS or ACIS component/system.

2.6. Suspend Work / Stop Work / Unreviewed Safety Issue

In every element of RSS work:

- Work shall be **paused** immediately if
 - any ambiguity exists in work authorization or work procedure
 - any change is made to the approved scope of work
- All personnel have both the authority and the responsibility to **stop work** if there appears to be an imminent safety hazard. Per Argonne policy ([LMS-POL-1](#)):
 - Individuals who exercise stop-work authority are to immediately report their action to the Division Director or other line supervisor,
 - Work may not resume until the responsible Division Director has verified that appropriate hazard control measures are in place and that the individual who stopped the work concurs with the corrective action.
- If an inconsistency between the approved design, the physical installation, or documentation is found, work will be paused or stopped.
 - If the inconsistency is not within, or potentially not within, the scope of the hazard analysis of the SAD (SAD Section 4), the inconsistency shall be referred to APS Safety Manager for evaluation as a potential **Unreviewed Safety Issue (USI)** (see [APS procedure APS 1185831](#) and Argonne procedure [LMS-PROC-188](#)).
 - If the inconsistency does not present any hazards beyond those already analyzed in the SAD, the inconsistency shall be referred to the system/facility-responsible Division's management (Director, Deputy Director, or Associate Director) for resolution.
 - If there is a question about a potential USI or the SAD, contact an ESH Coordinator for help.

2.7. Documentation

Ensuring that workers have the documents they need to do their work properly and safely is a responsibility shared by all personnel involved in the RSS work. The Job Coordinator provides the overall plans; the Supervising Engineer provides detailed work instructions, which may include: work procedures, drawings, schematics, and specifications.

At the completion of the RSS work, records of the affected systems must be updated to maintain consistency between the facility configuration and documentation.

2.8. Removal from Service

When an RSS device is removed from service, it may: a) remain under configuration control (i.e., still a RSS device) and placed in secure storage for future use or b) removed from configuration control (no longer a RSS). See Section 3, Procedure E-RSS Removal.

2.9. Roles and Responsibilities

Job Coordinator

- Is required for all RSS work.
- Is cognizant of the full scope of work and is the individual that is responsible for getting the work done.
- Makes arrangements for, or is aware of, all of the different tasks that need to be done to complete the job. If APS technician support is needed, works with supervising engineer(s), coordinates workers/groups and ensures proper work and hazard controls are in place. Ensures all groups have the documents needed for the job.
- For new or modified RSS designs, ensures that the design is approved.
- Creates a CCWP for the RSS work.
- Prior to start of work, ensures the CCWP is approved and posted.
- Prior to bringing into operation or returning to service, ensures validations are completed and the RSS is ready to safely return to service
- Ensures facility records are updated as needed.
- Assignment:
 - For new installations, projects, and engineering changes, the Responsible Engineer is the Job Coordinator.
 - For beamline routine maintenance, a Floor Coordinator is the Job Coordinator
 - For front end routine maintenance, a Floor Coordinator or a Supervising Engineer is the Job Coordinator
 - For accelerator routine maintenance, a CO or a Supervising Engineer is the Job Coordinator.

Supervising Engineer

- Assigns and supervises technicians for RSS work
- Ensures up-to-date documentation is available to workers.
- Ensures the quality of the work
- Prior to approving a CCWP to start work

- Ensures work assignments are within the scope of the work requests and the CCWP
- Hazard controls are in place
- Prior to approving to close-out the CCWP
 - Ensures work and validations are complete and the RSS is ready to safely return to service
 - Updates facility records as appropriate to the work

FC (beamlines and frontends) and CO (accelerator systems)

- Administer CCWPs:
 - Prior to the start of work, makes sure approvals and authorizations are in place to start the work.
 - Secures systems to ensure no beams are permitted in work areas.
 - Posts the CCWP.
 - Provide independent monitoring of RSS work to help ensure work meets safety standards.
 - After the work is completed:
 - Confirms work and validations are complete and RSS is ready to bring into or return to service
 - Validations signed-off on CCWP
 - Put system on-line
 - Archive closed-out CCWPs
- Generating and placing RSS labels
- Maintaining and posting beamline configuration controlled component lists (CCCL).

Providing enclosure access for others, opening and closing labyrinths and mini-enclosures, per procedures, the FC or CO may act as Job Coordinator and administer the associated CCWP.

In other cases, if a FC or CO is the Job Coordinator, the CCWP will be administered by another FC or CO (i.e., can't provide independent monitoring of their own work).

Critical Components System Manager (CCSM) or Designee

- Provide an additional level of independent oversight for work that involves new shielding designs or engineering changes to RSS - appointed by the deputy ALD (DALD) for operation.

Deputy ALD for Operations

- Authorizes new installations.

- May authorize beamline personnel to perform RSS work.

3. PROCEDURES

Prerequisite Actions - Identification of RSS components

If the RSS work involves a new installation or an engineering change:

- The Job Coordinator ensures designs are approved per “[APS Design Review](#)” procedure ([APS_000031](#)). For new hardware, the design review identifies parameters critical to radiation protection.
- Design Review Committee Chair, generates or updates the list of all of the RSS components in the approved design (i.e., the beamline CCCL or machine component RSS listing for front ends and accelerator systems) as needed.

A – Work on RSS

Step	Responsible Person	Action
A1	Job Coordinator	<ol style="list-style-type: none"> 1. If the work involves an engineering change that has the potential to affect the radiation safety performance of the device, confirm approvals from design and readiness reviews. 2. Request/coordinate the work with the technical groups.
A2	Supervising Engineer for groups providing services	Enter group’s work requests.
A3	Job Coordinator	Submit CCWP for the RSS work (refer to Section 2.2, CCWP Resources)
A4	FC/CO or designee	When all approvals have been granted: <ol style="list-style-type: none"> 1. Secure facilities to ensure there will be no beam in the work area. 2. Complete the authorization of the CCWP and post the CCWP (i.e., RSS work authorized). 3. Starts monitoring of work (see Roles & Responsibilities).
A5	Supervising Engineer & Technical Groups	Complete the work.
		[Continue with RSS Validation procedure]

B – RSS Validation

Step	Responsible Person	Action
B1	Job Coordinator	Arrange for validations without beam (e.g., operational & interlock testing).
B2	Supervising Engineer & Technical Groups	Perform and complete validations and sign-off CCWP.
No-beam validations		
B3	Job Coordinator	When all no-beam validations are complete and the RSS is ready for safe operations or a HP radiation survey, sign-off CCWP. If not a new design or engineering change, skip to step B5.
B4	CCSM	For new designs or engineering changes: after confirming validations complete and RSS ready for safe operations, sign-off on CCWP.
B5	FC/CO or designee	a) Confirm all no-beam validations are complete and signed-off and RSS ready for safe operations. b) If an HP radiation survey is not required, skip to step B10 or If an HP radiation survey is required, make arrangements for the survey and continue with next step.
Validations requiring beam		
B6	FC/CO or designee	With appropriate controls in place for HP radiation survey, unsecure facilities (e.g., provide APS beam enable). For Beamline and Front End RSS Work the FC will create and post an EFOG Type C Survey Form detailing the survey requirements (refer to APS _1414320), de-post the CCWP.
B7	HP	Complete radiation survey with beam. If survey successful (i.e., no excessive dose rates), for Accelerator RSS work sign-off CCWP authorization to return to on-line status and skip to step B10, for Beamline and Front End RSS work, sign the EFOG Type C Survey Form and skip to step B10. Or If survey not successfully completed (e.g., radiation leak found, elevated dose rates, or measurements not complete), continue with next step.
B8	FC/CO or designee	Re-secure system to ensure there will be no beam in the work area.

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Step	Responsible Person	Action
B9	Job Coordinator	Take corrective actions. When ready to resume validation return to step B6.
Bring into or return to on-line status		
B10	FC/ CO or designee	<ol style="list-style-type: none"> 1. Sign-off authorization to return to on-line status (For Beamline and Front End RSS work the EFOG Type C Survey Form, for Accelerator RSS work the CCWP). 2. De-post the CCWP or EFOG Type C Survey Info Form. 3. Return system to operational status. 4. Update the CCCL or accelerator systems RSS inventory as appropriate 5. Check completed CCWP into ICMS.

C – Receipt Verification and Tagging New RSS

Step	Responsible Person	Action
C1	Job Coordinator	<ol style="list-style-type: none"> 1. Confirm approvals from design and readiness reviews. 2. Request/coordinate the receipt verifications with the Receipt Inspector and the technical groups (refer to Argonne QA procedures).
Receipt Inspections and pre-installation work (steps C2a and C2b) can be done in parallel		
C2a	Receipt Inspector	Verify RSS conforms to ACL (if nonconforming, exit procedure and refer to Argonne QA procedures or APS QA Representative for guidance).
C2b	Supervising Engineer for groups providing services	Complete pre-installation assembly work (e.g., installation of PSS) and validations
C3	Job Coordinator	When validations and work is complete, request RSS tags for each RSS item from FC or CO.
C4	FC/CO or designee	<p>If the RSS is to be installed promptly provide RSS tags for destination beamline or accelerator system</p> <p>Or</p> <p>If the RSS is to be installed at a later time, provide traveler RSS tags (See Appendix for examples of RSS tags.)</p>
C5	Job Coordinator	Arrange for installation or placement in secure storage.
[Continue with New RSS Installation Procedure]		

D – New RSS Installation

Step	Responsible Person	Action
D1	Job Coordinator	<ol style="list-style-type: none"> 1. Confirm approvals from design and readiness reviews. 2. Request/coordinate RSS installation work with the technical groups.
D2	Supervising Engineer for groups providing services	Enter group's work requests.
D3	Job Coordinator	Submit CCWP for the RSS installation work
D4	FC/CO or designee	<p>When all approvals have been granted:</p> <ol style="list-style-type: none"> 1. Secure facilities to ensure there will be no beam in the work area. 2. Complete the authorization of the CCWP and post the CCWP (i.e., RSS work authorized). <p>Starts monitoring of work (see Roles & Responsibilities).</p>
D5	Supervising Engineer for groups providing services	Complete RSS installation work, validate, and sign-off CCWP
D6	FC/CO or designee	<ol style="list-style-type: none"> 1. As needed, replace Traveler RSS tags with permanent RSS tags 2. Update the CCCL or accelerator systems RSS inventory. 3. Delineate RSS interfaces.
		[Continue with RSS Validation procedure]

E – RSS Removal

Step	Responsible Person	Action
E1	Job Coordinator	<ol style="list-style-type: none"> 1. Confirm approvals from design and readiness reviews. 2. Request/coordinate the RSS removal work with the technical groups.
E2	Supervising Engineer for groups providing services	Enter group's work requests.
E3	Job Coordinator	Submit CCWP for the RSS work.
E4	FC/CO or designee	<p>When all approvals have been granted:</p> <ol style="list-style-type: none"> a) Secure facilities to ensure there will be no beam in the work area. b) Complete the authorization of the CCWP and post the CCWP (i.e., RSS work authorized). c) Start monitoring of work (see Roles & Responsibilities).
E5	Supervising Engineer & Technical Groups	Complete the RSS removal work.
E6	FC or CO or designee	<p>For components that will no longer be used as RSS</p> <ul style="list-style-type: none"> • Remove RSS tags. • Update beamline CCCL or accelerator systems RSS inventory. <p>[continue with step E7]</p> <p>Or</p> <p>For component that may be re-used as RSS without re-verification (i.e., reinstalled as a RSS elsewhere or set aside for future use):</p> <ul style="list-style-type: none"> • Exchange RSS tag with a Traveler RSS tag (specifying new location, if known). • Update the beamline CCCL or accelerator systems RSS inventory. <p>[continue with step E7]</p>
E7	Job Coordinator	<ol style="list-style-type: none"> 1. Update design and facility installation records as appropriate. 2. Arrange for each component that may be re-used as RSS to be installed at the new location or placed in a secure storage area with the Traveler RSS tag clearly visible.
E8	Job Coordinator	If the beamline or accelerator system that the RSS was removed from is to be returned to operations: continue with step A1

4. REFERENCES

[DOE G 420.2-1A](#) - Accelerator Facility Safety Implementation Guide for DOE O 420.2C: Safety of Accelerator Facilities

[APS Design Review Procedure \(APS_000031\)](#)

Gibson, J.M. "APS Responsible for All Work on Beamline Radiation Components"
June 28, 2006 ([APS 1183117](#))

[LMS-PROC-143: Radiation Safety Interlock Systems](#)

LMS-PROC-200: Non-Experimental Work Planning and Control

5. DOCUMENTS/RECORDS CREATED BY THIS PROCEDURE

The documents/records listed below will be created in the execution of this procedure and must be retained as indicated.

Description of Document/Record (Custodian	Storage Location and Medium	Retention Requirement
Configuration Control Work Permit (CCWP) (APS_1192911)	Floor Coordinator or CO OR DESIGNEE	ICMS, electronic	5 years

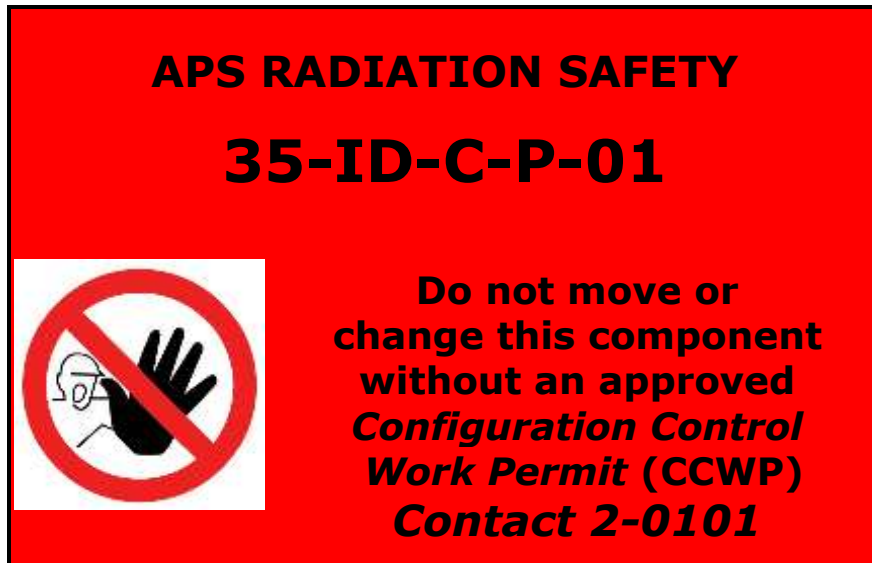
6. FEEDBACK AND IMPROVEMENT

If you are using this procedure and have comments or suggested improvements for it, please go to the [APS Policies and Procedures Comment Form](#)* to submit your input to a Procedure Administrator. If you are reviewing this procedure in workflow, your input must be entered in the comment box when you approve or reject the procedure.

Instructions for execution-time modifications to a policy/procedure can be found in the following document: Field Modification of APS Policy/Procedure ([APS 1408152](#)).

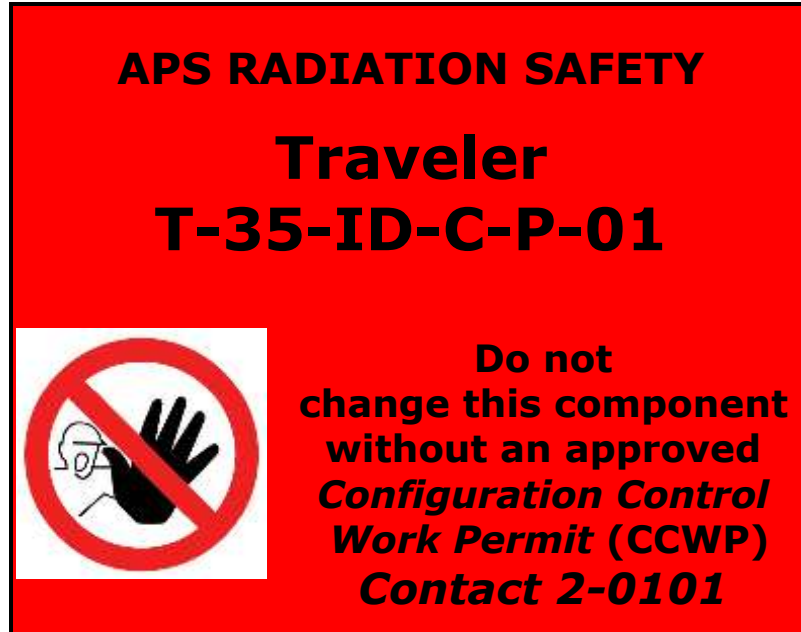
* <https://www.aps.anl.gov/Document-Central/APS-Policies-and-Procedures-Comment-Form>

Appendix – Sample RSS Tags



The contact 2-0101 on this sample is the telephone extension for the on-duty Floor Coordinator.

An example of a Traveler RSS tag, destination determined:



This is an example of a pre-installation tag for a device that designates where it will ultimately installed ((35-ID-c)).

An example of a Traveler RSS tag for a component that will be placed in secure storage without its installation location determined (e.g., a spare).



An example of a PSS RSS Tag

