

Startup Plan

Tritium Process Station

Lawrence Livermore National Laboratory

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Acronym List

APL	associate program leader
CAP	corrective action plan
DBATS	Dedicated Box Air Treatment System
DOE	U. S. Department of Energy
ES&H	environment, safety, and health
FM	facility manager

FSP	Facility Safety Plan
ITS	Issues Tracking System
LLNL	Lawrence Livermore National Laboratory
LSO	Livermore Site Office
MAD	Master Activity Database
MSA	management self assessment
NNSA	National Nuclear Security Administration
OSP	operational safety plan
POD	plan-of-the-day meeting
PV-18	pressure vessel
RA	readiness assessment
RGA	residual gas analyzer
RI	responsible individual
SSC	structure, system, or component
TFM	Tritium Facility Modernization project
TPS	Tritium Process Station
WAL	weekly activity list

1.0 Introduction

The Tritium Process Station (TPS) is a new glovebox system installed in Building 331, the Tritium Facility, at Lawrence Livermore National Laboratory (LLNL). The TPS will provide enhanced tritium handling capability to a variety of customers. The system was developed from existing gloveboxes manufactured at the U. S. Department of Energy's (DOE's) Mound site but never put into operation. A cleanup cart for tritium operations originally manufactured at Mound, with a history of only minimal use, is also part of the TPS.

This Startup Plan defines the systematic process and controls that complies with the requirement of DOE order 425.1C and will guide operations immediately after the authorization to operate is received to support a smooth, deliberate, and controlled transition into unrestricted routine operations.

Following receipt of authorization to operate, tritium will be carefully introduced into the TPS by means of the phased approach described in this document. Fortunately, hydrogen

(protium) and or deuterium are excellent non-radioactive surrogates for tritium that have been used extensively before startup to fully qualify most aspects of TPS operation. Prior to commencing this post-authorization Startup Plan, the TPS will have been pressure tested with inert gases (He), and piping conditioned with deuterium. At this point, the

system's adequacy for use with hydrogen will have been demonstrated. This plan will commence with the addition of radioactive gases into the TPS. The introduction of tritium does provide the opportunity for the first realistic performance test of TPS gas detritiation systems (DBATS). Exercising these systems is emphasized in the graded and

systematic approach to full operations described below.

OSP 331.099, Attachment 4, *Tritium Processing Station Equipment Line-up*

OSP 331.099, Attachment 5, *Quarterly Interlock Check Procedure for Tritium Process Station, B331, Room 157*

TPS startup will be conducted in a phased approach involving the following four phases:

Phase 1: Initial Tritium Introduction (low concentration)

Phase 2: Comprehensive Process Manifold and Procedure Exercise

Phase 3: Detritiation System Performance Verification

Phase 4: U bed Full Capacity Storage

Following satisfactory completion of the four startup phases, the TPS shall require authorization by the APL (Tritium Program) and the B331 Facility Manager (FM) before proceeding to unrestricted, routine operation.

4.0 Roles and Responsibilities

4.1 The Associate Program Leader (APL) (Tritium Program) shall:

- Recommend TPS startup to the B331 FM.
- Ensure this Startup Plan is developed, approved and implemented.
- Ensure the TPS OSP and operating procedures are developed, approved, and available prior to TPS operation.
- Ensure TPS operators complete training required for TPS operation.
- Ensure appropriate management oversight is present during TPS startup in accordance with this Plan.
- Conduct plan-of-the-day (POD) meetings. The POD meeting can serve as the pre-job briefing.
- Authorize progression past a specific hold point in this Startup Plan upon successful outcome of steps leading up to the hold point.
- Recommend unrestricted, routine TPS operation following completion of this Startup Plan.

4.2 The Tritium Facility (B331) Facility Manager (FM) shall:

- Authorize TPS startup.
- Develop a corrective action plan (CAP) for post-start findings from the TFM management self assessment and readiness assessments.
- Ensure B331 Safety Basis requirements are met prior to startup.

- Designate in writing those individual who will serve as management oversight and specifically identify oversight responsibilities. Provide a list of each individual's qualifications.
 - Authorize unrestricted, routine TPS operation following successful completion of this Startup Plan.
- 4.3 The TPS Responsible Individual (RI) shall:
- Conduct pre-job briefings for activities for which the POD meeting does not fulfill the function of a pre-job briefing.
 - Ensure that the required management oversight is present prior to commencing pre-job briefings, tests, or operations activities.
- 4.4 The TPS operators shall:
- Complete training required for TPS operation.
 - Comply with the approved OSP and operating procedures for TPS.
 - Perform TPS startup in accordance with this Plan.
- 4.5 The Health and Safety support shall:
- Attend all pre-job briefings associated with TPS startup.
 - Be present at the start of each TPS activity addressed in this Plan.
 - Ensure hazard controls for TPS operation are properly implemented.

5.0 Prerequisites

Prior to initiation of TPS startup, the prerequisites listed below shall be completed. Completion of these prerequisites will be documented on Attachment A.

- The Safety Basis for the TPS has been approved and implemented.
- Conditions of Approval included in the NNSA-LSO approval of the TPS Safety Basis have been met.
- Authorization to operate the TPS has been received from the B331 FM.
- Pre-start findings from the TPS MSA and RA have been resolved.
- Post-start findings from the TPS MSA and RA have been reviewed and determined not to impact safe operation.
- MAD and ITS items have been reviewed by the APL and no items will adversely impact safe operation.

- Maintenance backlog has been reviewed by the APL and no items will adversely impact safe operation or operability/reliability of safety SSCs.
- TPS operator training meets OSP and training plan requirements
- The rate-of-rise test (SRP-B331-4.1.1/4.1.2) has been satisfactorily completed within its required periodicity.
- Minimum staff required for TPS operation is present.

6.0 Startup Requirements

6.1 General Requirements

- ___ 6.1.1 TPS startup shall commence only upon notification of readiness by the APL and authorization by the B331 FM.
- ___ 6.1.2 Each TPS startup activity shall be scheduled on the Weekly Activities List (WAL).
- ___ 6.1.3 Management oversight is required during the initial performance of each activity (i.e., first use) defined in this plan. Subsequent performance of activities previously conducted under this plan (e.g., TPS glovebox startup) do not require repeat management oversight unless they are part of another evolution
- ___ 6.1.4 During TPS startup, a post-job lessons learned debrief shall be held following the completion of each phase.

6.2 Phase 1: Initial Tritium Introduction (low concentration)

To minimize the risk of unanticipated release of tritium during the initial deliberate system operation, a mixture of tritium and deuterium with a nominal composition

will be introduced into the TPS.

(b)(2)High

(b)(2)High

(b)(2)High
risk will be approximately 320 Ci

the total tritium quantity at

(b)(2)High

(b)(2)High

The work flow in this section shall be performed in sequence during the

first performance of this section. For subsequent iterations, the steps may be completed in any order deemed appropriate by the qualified TPS operator. Steps are to be performed at least once but may be performed as often as required by the APL to provide assurance of operator performance, procedure adequacy, and equipment operability.

___ 6.2.1 Place the TPS glovebox into operation in accordance with OSP 331.099, Attachment 2.

___ 6.2.2 Start the data logger. Choose a recording time appropriate for this operation, and change the default sample time only if required. Use of scrolling chart graph display is optional. Set up as needed.

___ 6.2.3

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___ 6.2.5

___ 6.2.6

___ 6.2.7

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— 6.2.14

— 6.2.15

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— 6.2.16

— 6.2.17 Repeat steps 6.2.15 through 6.2.16 as many times as necessary to ensure that the tritium-deuterium mixture becomes homogeneous.

HOLD POINT

FM Approval: _____ Date: _____

Procedural inadequacies, equipment deficiencies, and operator performance issues are to be resolved prior to proceeding with Phase 2.

6.3 Phase 2: Comprehensive Process Manifold and Procedure Exercise

Phase 2 consists of the performance of a number of evolutions in accordance with the specific instructions found in the TPS operating procedures. All evolutions are to be performed at normal operating pressures.

To minimize the risk of unanticipated release of tritium during the initial deliberate system operation, a mixture of tritium and deuterium with a nominal composition

will be introduced into the TPS.

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(b)(2)High

risk will be approximately 320 Ci

the total tritium quantity at

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The work flow in this section may be completed in any order deemed appropriate by the qualified TPS operator. Evolutions 6.3.1 through 6.3.14 are extracted from OSP 331.099, Attachment 2. Grayed out steps in this section indicate that those steps have already been performed (some multiple times) during the process of loading and spiking the U bed with tritium.

For example, **spiking the U-bed with tritium** involves performing the following evolutions: 6.3.1 through 6.3.5 and 6.3.7 through 6.3.11. Evolution 6.3.6 is essentially equivalent to 6.3.7 on a different location. The remaining steps should be performed at least once but may be performed as often as necessary to provide assurance of operator performance, procedure adequacy, and equipment operability.

HOLD POINT: Obtain approval from APL or designee before performing each evolution listed in this section.

~~6.3.1 Evacuate Load/Unload Manifold~~

~~6.3.2 Evacuate Storage/Purify Manifold~~

~~6.3.3 Evacuate RGA~~

~~6.3.4 RGA Calibration~~

~~6.3.5 Mass Spectrometer Sample Volume (MSSB) Operation~~

~~6.3.6 Load/Unload Component from TPS Glovebox~~

~~6.3.7~~

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~~6.3.8~~

6.3.9. Generate Pressure in Uranium Containment Bed

6.3.10. Circulate U Bed Gas through S & P Manifold for Mixing

APL Approval: _____ Date: _____

6.3.11 Load Pd bed from previously loaded U bed.

APL Approval: _____ Date: _____

6.3.12 Generate Pressure in Pd Containment Bed.

APL Approval: _____ Date: _____

6.3.13 Circulate Pd Bed Gas through S & P Manifold for Mixing.

APL Approval: _____ Date: _____

6.3.14 Vacuum Gas Storage Tank Pump Down (need Off-Gas Collection System Vessel).

This completes Phase 2 of TPS startup. At this point the APL for Tritium Program and the B331 Facility Manager shall confer with management oversight present during performance of Phase 2 TPS startup and evaluate Phase 2, including consideration of equipment and operator performance and the adequacy and completeness of procedures. (b)(2)High

(b)(2)High

HOLD POINT: Obtain approval from APL and FM before proceeding to Phase 3.

Mgmt Oversight Recommendations: _____

APL Approval: _____ Date: _____

FM Approval: _____ Date: _____

Procedural inadequacies, equipment deficiencies, and operator performance issues are to be resolved prior to proceeding with Phase 3.

6.4.1 DBATS System

necessary to stop the evolution for any reason, then the TPS glovebox and DBATS system shall be returned to their normal condition, and the test shall be restarted at step 6.4.1.1.

- ___ 6.4.1.1 Start up the TPS glovebox in accordance with OSP 331.099, Attachment 2.
- ___ 6.4.1.2 Start the data logger. Choose a recording time appropriate for the operation, and change the default sample time only if required. Use of scrolling chart graph display is optional. Set up as needed.
- ___ 6.4.1.3 Manually startup DBATS in accordance with OSP 331.099, Attachment 2.
- ___ 6.4.1.4
- ___ 6.4.1.5 (b)(2)High
- ___ 6.4.1.6 Record the decrease in tritium activity versus time with the

APL Approval: _____ Date: _____

FM Approval: _____ Date: _____

Procedural inadequacies, equipment deficiencies, and operator performance issues are to be resolved prior to proceeding with Phase 4.

6.5 Phase 4: Filling a U Bed to Full Capacity

Phase 4 consists of a tritium transfer from an approved transfer vessel and the subsequent filling of a storage vessel. For the evolutions comprising Phase 4, pure tritium gas will be used.

___ 6.5.1 Place the TPS glovebox into operation in accordance with OSP 331.099, Attachment 2.

___ 6.5.2

___ 6.5.3

(b)(2)High

HOLD POINT: Obtain approval from APL or designee before proceeding.

Mgmt Oversight Recommendations: _____

APL Approval: _____ Date: _____

___ 6.5.4

(b)(2)High

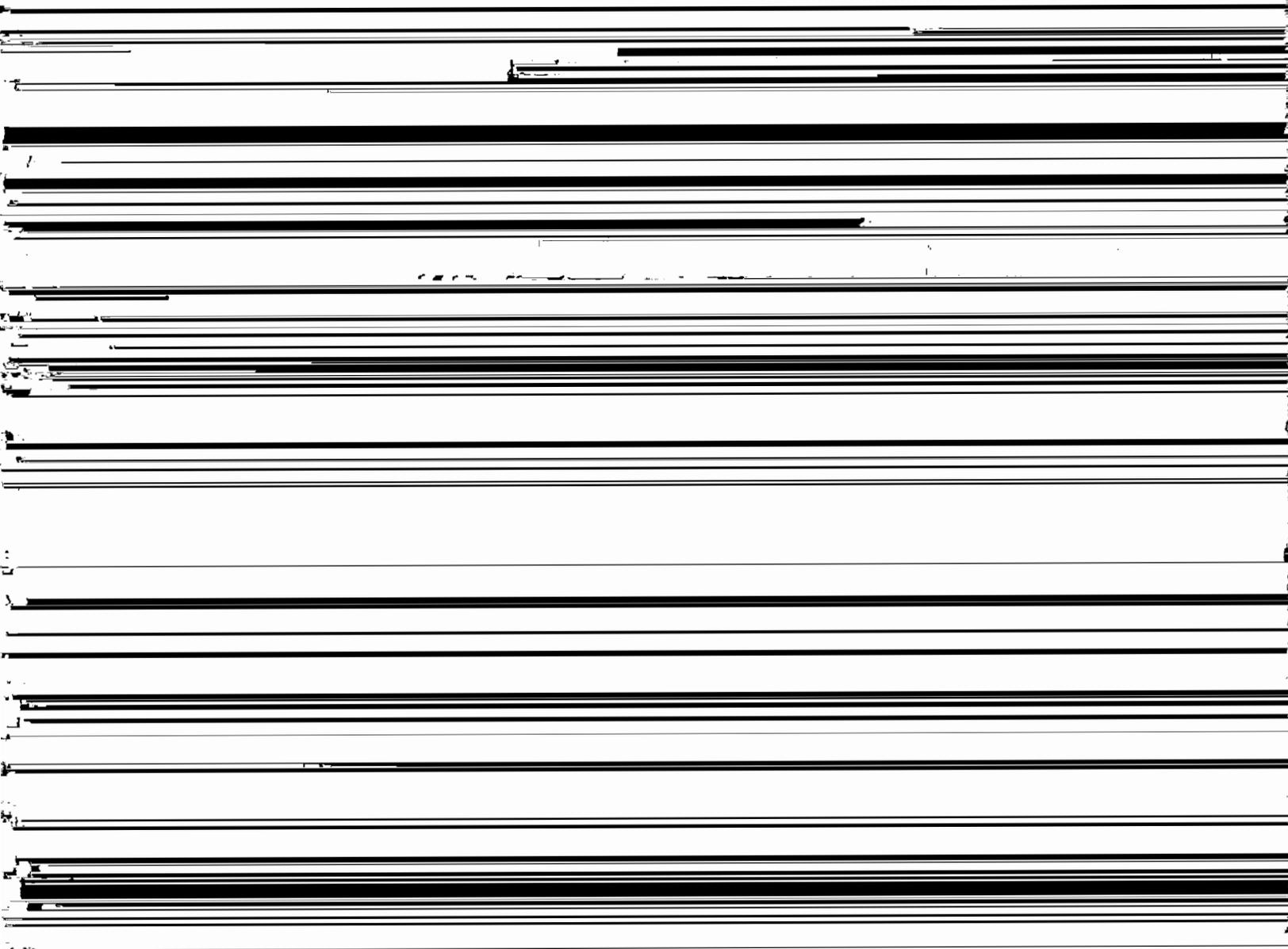
(b)(2)High Choose a recording time appropriate for the operation.

___ 6.5.5 Start up and calibrate the RGA per OSP 331.099, Attachment 2.

___ 6.5.6

___ 6.5.7

(b)(2)High

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- ___ 6.5.8
 - ___ 6.5.9
 - ___ 6.5.10 (b)(2)High
 - ___ 6.5.11
 - ___ 6.5.12
 - ___ 6.5.13 Sample the residual gas mixture in the manifold with the integral RGA in accordance with OSP 331.099, Attachment 2. Note the ^3He content and the residual hydrogen(s) content if any.
 - ___ 6.5.14 Shut down the RGA in accordance with OSP 331.099
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8.0 References

- 8.1 DOE-STD-3006-2000, *Planning and Conduct of Operational Readiness Reviews.*
- 8.2 UCRL-AM-133867, ES&H Manual, Document 51.4, *Startup and Restart of Nuclear Facilities*
- 8.3 OSP-331.099, *Tritium Process Station*
- 8.4 OSP 331.099, Attachment 1, *Load and Unload Components from TPS Glovebox*
- 8.5 OSP 331.099, Attachment 2, *Tritium Process Station Operations*
- 8.6 OSP 331.099, Attachment 3, *Tritium Process Station and Clean-up Cart Alarm Response*
- 8.7 OSP 331.099, Attachment 4, *Tritium Processing Station Equipment Line-up*
- 8.8 *Tritium Process Station* OSP 331.099, Attachment 5, *Tritium Process Station Quarterly Interlock Check Procedure for Tritium Process Station, B331, Room 157*

ATTACHMENT A

Prerequisite Checklist			
No.	Requirement	Criteria	Signature/Date
1	The Safety Basis for the TPS has been approved.	Approval letter from NNSA-LSO received by facility.	<hr/> B331 Facility Manager
2	The Safety Basis for the TPS has been approved.	Approval letter from NNSA-LSO received by facility.	

ATTACHMENT B

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Management Oversight Guidance Checklist

Prior to TPS Startup perform the following:

- Review applicable portions of the DSA/TSRs
- Review the B331 FSP and OSP 331.099
- Review previous TPS log entries

CAUTION

If proceeding with the evolution will create an unsafe condition or will violate the DSA or procedures, exercise stop work authority.

During the evolution, observe the adequacy of the following:

Procedure Status	<ul style="list-style-type: none"> ▪ Are procedures the latest revision? ▪ Are procedures authorized working copies? ▪ Are procedures available to appropriate personnel?
Procedure Adherence	<ul style="list-style-type: none"> ▪ Are procedure steps completed in appropriate sequence? ▪ Can procedure steps be performed as written? ▪ Are data, initials, and signoffs filled in appropriately? ▪ Are procedures being referred to during use as necessary or