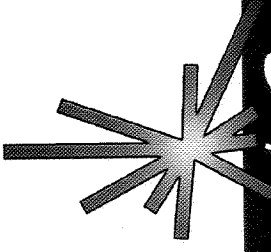
August 2003

Accelerator Readiness Review Plan of Action Revision 3

SPALLATION NEUTRON SOURCE

A U.S. Department of Energy Multilaboratory Project

Argonne National Laboratory • Brookhaven National Laboratory • Thomas Jefferson National Accelerator Facility • Lawrence Berkeley National Laboratory • Los Alamos National Laboratory • Oak Ridge National Laboratory



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Revision 3

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Lawrence Berkeley National Laboratory
Los Alamos National Laboratory
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Revision 3

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ACRONYMS

ARR	Accelerator Readiness Review
ASE	Accelerator Safety Envelope
CASE	Commissioning Accelerator Safety Envelope
CCL	Coupled Cavity Linac
CPP	Commissioning Program Plan
CD	Critical Decision
DOE	Department of Energy
DTL	Drift Tube Linac
FSAD	Final Safety Assessment Document
HEBT	High Energy Beam Transport
PFSAD	Preliminary Final Safety Assessment Document
PSAD	Preliminary Safety Assessment Document
RTBT	Ring to Target Beam Transport
SAD	Safety Assessment Document
SCL	Superconducting Linac
SNS	Spallation Neutron Source

1. INTRODUCTION

The Spallation Neutron Source (SNS) commissioning, from Front End to Critical Decision 4 (CD-4), the end of the construction project, and the transition to operations, will take place under the Department of Energy (DOE) Accelerator Safety Order, DOE Order 420.2 A.

According to the guidance for DOE Order 420.2A, "The basis of DOE approval of Accelerator facility activities remains the contractor submission of Safety Assessment Documents (SAD), an Accelerator Safety Envelope (ASE) and Accelerator Readiness Review (ARR) reports, with subsequent DOE review and approval of the ASE." In addition, the SNS Project Execution Plan requires DOE review and approval of the final SAD (FSAD).

The role of the DOE Field Office is specified in the draft guidance for DOE Order 420.2A. In Section II.A.3 under Accelerator Readiness Review it is stated that: "The role of DOE Field Offices (Operations/Area/Site Offices) in the ARR process is to: 'Request the contractor to prepare a proposed ARR Plan of Action and submit it to DOE for acceptance.'"

This document contains the Plan of Action for the SNS readiness review process. The dates listed in this document are the anticipated schedule dates based on the current SNS baseline project schedule. These dates depend critically on beneficial occupancy dates for conventional facility construction and delivery dates from vendors and partner laboratories. During the fabrication, testing and installation, some changes to these dates may occur. As changes to the SNS project baseline schedule occur, the dates in the Plan of Action will be adjusted.

The specific dates are shown in Appendix A of this document in Microsoft Project Gantt Chart format.

1.1 DESCRIPTION OF THE ARR PROCESS

Facility Description: The SNS baseline design is for a ~1GeV, 1.4 MW pulsed H^-/Proton beam directed to a target that is the source of secondary neutron beams used for scientific research.

Location: Oak Ridge, Tennessee

Program Considerations: The installation schedule requires commissioning tests for modules of the facility at the same time other modules are being installed. Furthermore, experimental beamlines become available sequentially for users.

Type of Accelerator Readiness Review: "Phased." The SNS Readiness Review Plan of Action is presented to the DOE for commissioning in modules. These modules are:

1. Front End (FE)
2. Drift Tube Linac Tank 1 (DTL)
3. Drift Tube Linac Tanks 2-6 (DTL)
4. Coupled Cavity Linac (CCL)
5. Superconducting Linac (SCL)
6. High Energy Beam Transport (HEBT)-Ring to Target Beam Transport (RTBT) to Extraction Dump
7. HEBT-Ring to RTBT to Target and Instruments

Reason for Selection of Type of ARR: Readiness is achieved by using the ARR process at the appropriate times in the project to maximize safety and readiness confidence and to minimize the time to project completion.

2. PREPARATION FOR COMMISSIONING

DOE Order 420.2A contains a list of requirements for the ARR process. This list includes a SAD and an ASE. Adequate training and qualification of personnel, written procedures, an internal safety review system, and a shielding policy must also be demonstrated.

The FSAD review and ARRs are held by the contractor, with review committees of independent experts, as specified in the guidance for DOE Order 420.2A. There will be a DOE observer at each of these reviews. There will also be a formal closeout of each review with the DOE Project. The DOE Project Manager authorizes the contractor to proceed with commissioning of each module.

The Preliminary Safety Assessment Document (PSAD) was approved in October 2001. A revision, the Preliminary Final Safety Assessment Document (PFSAD), was submitted for independent review in January 2002. The report from the independent review of the PFSAD concluded that the document was

adequate to cover the commissioning of the Front End and Linac modules. The FSAD for the Front End and Linac was submitted to DOE and approved in August 2002. The FSAD and ASE will evolve and will be presented once for the first two modules and once again for the third and fourth modules at the appropriate readiness review.

A Plan of Action was submitted to DOE prior to the ARR for the Front End module. Feedback from the Front End module ARR process was incorporated into this revised Plan of Action.

A commissioning program plan (CPP) was also approved by DOE in August 2002.

3. ACCELERATOR AND EXPERIMENTAL SYSTEMS

The ARR process for the Front End module was preceded by review and approval of the FSAD for the Front End and Linac commissioning modules. This FSAD included the Commissioning Accelerator Safety Envelope (CASE) (Rev. 1) for the Front End and Linac.

The ARR process for the HEBT-Ring-RTBT to Extraction Dump will be preceded by a review of the FSAD for the HEBT-Ring-RTBT to Target and Instruments module. This FSAD will include the CASE (Rev. 2) for the HEBT-Ring-RTBT to Extraction Dump. The CASE (Rev. 3) for Target and Instruments will be reviewed prior to the ARR for RTBT to Target and Instruments and will be incorporated into the FSAD at that time.

The following review and commissioning sequence will be followed for each module. It will be described in detail below for the first module consisting of the Front End.

The Front End ARR was conducted by an independent ARR team, with a DOE observer, over a period of approximately seven weeks. The first five weeks of the review period were devoted to preparation of review materials and construction of an ARR web site to allow easy remote access by the reviewers. We intend to build on this documentation, which will shorten the preparation period for subsequent ARRs. The ARR team site visit closeout ended with a "punch list" of items which were to be completed prior to a recommendation for turn on approval.

Following the ARR team site visit closeout, the "punch list" items were addressed and a final ARR team closeout was held. This closeout ended with a recommendation to the DOE Project Manager for authorization to proceed, which was granted on October 30, 2002.

DTL Tank 1 commissioning will follow the same ARR activity sequence as was followed the Front End module. Specifically, prior to the commencement of DTL Tank 1 commissioning activities, a formal contractor ARR site visit and review will take place. Following the site visit, a formal ARR closeout will take place to close out any "punch list" or other items listed as "to be completed prior to commissioning" in the ARR site visit and to include any lessons learned from Front End commissioning. This process will be followed for the other modules, which consist of:

- DTL Tanks 2-6
- CCL
- SCL
- HEBT-Ring-RTBT to Extraction Dump
- HEBT-Ring-RTBT to Target and Instruments

Following RTBT to Target commissioning, CD-4 performance criteria will be achieved using sufficient instrument capability. Additionally, the low power operations safety envelopes for the Accelerator, Target, and Instruments will have been approved. Commissioning of completed Instruments will begin during the low power operation period (following CD-4) when sufficient beam power becomes available.

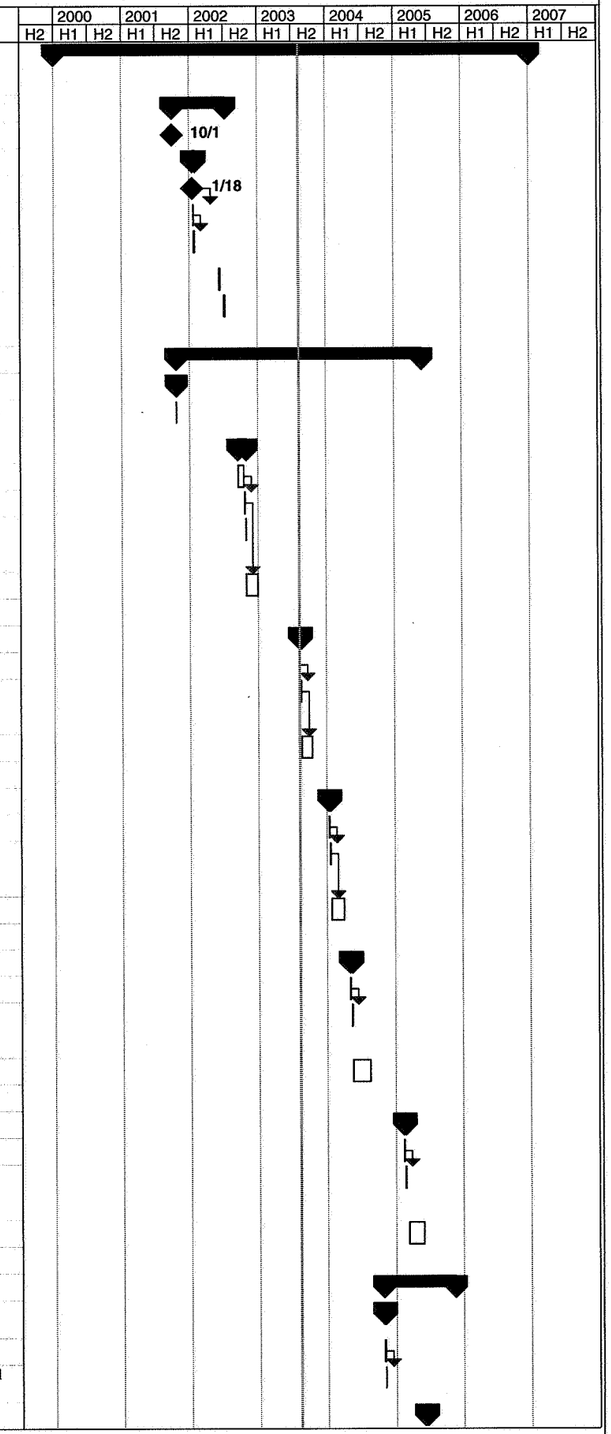
An Operational ARR will take place after CD-4. This review will cover Accelerator Readiness for high power operation.

APPENDIX A

PLAN OF ACTION
GANTT CHART

August 6, 2003

ID	Task Name	Duration	Start	Finish	Details	Reason for Step
1	**Plan of Action**	**1831 days**	**January 3, 2000**	**January 4, 2007**		
2						
3	**Preparation for Commissioning**	**206 days**	**October 1, 2001**	**July 11, 2002**		
4	PSAD Rev#0 Approved	0 days	October 1, 2001	October 1, 2001	Approved	SAD Required by DOE O 420.2A
5	**PFSAD Development**	**10 days**	**January 18, 2002**	**January 31, 2002**		**SAD Required by DOE O 420.2A**
6	PFSAD Issued	0 days	January 18, 2002	January 18, 2002	Issued for Review	SAD Required by DOE O 420.2A
7	Conduct PFSAD Review	2 days	January 23, 2002	January 24, 2002	DOE Project Office observer	SAD Required by DOE O 420.2A
8	Review Team Closeout	5 days	January 25, 2002	January 31, 2002	Closeout with DOE Project Manager; DOE Project Manager Authorization to Proceed	SAD Required by DOE O 420.2A DOE Approval Required in PEP
9	**Plan of Action for Readiness Determination**	**5 days**	**June 10, 2002**	**June 14, 2002**	**DOE PM Acceptance and Feedback**	**Guidance for DOE 420.2A**
10	**Submit Commissioning Program Plan**	**1 wk**	**July 5, 2002**	**July 11, 2002**	**Submit Commissioning Program Plan**	**Guidance for DOE 420.2A**
11						
12	**Accelerator Systems**	**943 days**	**October 23, 2001**	**May 31, 2005**		
13	**FSAD for Front End and Linac (Includes ASE (Rev#1) for Front End and**	**1 day**	**October 23, 2001**	**October 23, 2001**		**SAD Required by DOE O 420.2A**
14	FSAD for Front End and Linac Closeout	1 day	October 23, 2001	October 23, 2001	Closeout with DOE Project Manager; DOE Project Manager Authorization to Proceed	SAD Required by DOE O 420.2A DOE Approval Required in PEP
15	**ARR for Front End**	**33 days**	**September 16, 2002**	**October 30, 2002**		**ARR Required by DOE O 420.2A**
16	Preparation for ARR for Front End	5 wks	September 16, 2002	October 18, 2002		
17	ARR for Front End	5 days	October 21, 2002	October 25, 2002	DOE Project Office observer, Committee turnover of punch list	ARR Required by DOE O 420.2A
18	ARR Closeout	3 days	October 28, 2002	October 30, 2002	Contractor closeout of ARR punch list with DOE Project Manager; DOE Project Manager Authorization to Proceed	ARR Required by DOE O 420.2A
19	**Commission Front End**	46 days	October 29, 2002	December 31, 2002		Commissioning
20						
21	**ARR For DTL Tank 1**	**8 days**	**August 12, 2003**	**August 21, 2003**		
22	**ARR for DTL Tank 1**	3 days	August 12, 2003	August 14, 2003	DOE Project Office observer, Committee turnover of punch list	ARR Required by DOE O 420.2A
23	ARR Closeout	3 days	August 19, 2003	August 21, 2003	Contractor closeout of ARR punch list with DOE Project Manager; DOE Project Manager Authorization to Proceed	ARR Required by DOE O 420.2A
24	**Commission DTL Tank 1**	41 days	August 22, 2003	October 17, 2003		Commissioning
25						
26	**ARR for DTL Tankd 2-6**	**8 days**	**January 13, 2004**	**January 22, 2004**		
27	ARR for DTL Tanks 2-6	3 days	January 13, 2004	January 15, 2004	DOE Project Office observer, Committee turnover of punch list	ARR Required by DOE O 420.2A
28	ARR Closeout	4 days	January 19, 2004	January 22, 2004	Contractor closeout of ARR punch list with DOE Project Manager; DOE Project Manager Authorization to Proceed	ARR Required by DOE O 420.2A
29	**Commission DTL Tanks 2-6**	**49 days**	**January 26, 2004**	**April 1, 2004**		
30						
31	**ARR for CCL**	**10 days**	**May 3, 2004**	**May 14, 2004**		
32	Conduct ARR for CCL	4 days	May 3, 2004	May 6, 2004	DOE Project Office observer, Committee turnover of punch list	ARR Required by DOE O 420.2A
33	ARR Team Closeout	3 days	May 12, 2004	May 14, 2004	Contractor closeout of ARR punch list with DOE Project Manager; DOE Project Manager Authorization to Proceed	ARR Required by DOE O 420.2A
34	**Commission CCL**	68 days	May 17, 2004	August 18, 2004		Commissioning
35						
36	**ARR for SCL**	**9 days**	**February 14, 2005**	**February 24, 2005**		
37	Conduct ARR for SCL	3 days	February 14, 2005	February 16, 2005	DOE Project Office observer, Committee turnover of punch list	ARR Required by DOE O 420.2A
38	ARR Team Closeout	4 days	February 21, 2005	February 24, 2005	Contractor closeout of ARR punch list with DOE Project Manager; DOE Project Manager Authorization to Proceed	ARR Required by DOE O 420.2A
39	**Commission SCL**	58 days	March 11, 2005	May 31, 2005		Commissioning
40						
41	**Ring Systems**	**277 days**	**October 28, 2004**	**November 18, 2005**		
42	**FSAD Issued for HEBT-Ring-RTBT to Target and Instruments (Includes ASE (Rev#2) for HEBT-Ring-RTBT to Extraction Dump)**	**6 days**	**October 28, 2004**	**November 4, 2004**		**SAD Required by DOE O 420.2A**
43	FSAD for HEBT-Ring-RTBT to Target and Instruments issued for Review	5 days	October 28, 2004	November 3, 2004		SAD Required by DOE O 420.2A
44	FSAD for HEBT-Ring-RTBT to Target and Instruments	1 day	November 4, 2004	November 4, 2004	Closeout with DOE Project Manager; DOE Project Manager Authorization to Proceed	SAD Required by DOE O 420.2A DOE Approval Required in PEP
45	**ARR for HEBT-Ring-RTBT to Extraction Dump**	**10 days**	**June 6, 2005**	**June 17, 2005**		**ARR Required by DOE O 420.2A**



ID	Task Name	Duration	Start	Finish	Details	Reason for Step
46	Conduct ARR for HEBT-Ring-RTBT	4 days	June 6, 2005	June 9, 2005	DOE Project Office observer, Committee turnover of punch list	ARR Required by DOE O 420.2A
47	ARR Team Closeout	5 days	June 13, 2005	June 17, 2005	Contractor closeout of ARR punch list with DOE Project Manager; DOE Project Manager Authorization to Proceed	ARR Required by DOE O 420.2A
48	**Commission HEBT-Ring-RTBT to Extraction Dump**	98 days	July 6, 2005	November 18, 2005		Commissioning
49						
50	**Target Systems**	**94 days**	**November 21, 2005**	**March 30, 2006**		
51	**ASE(Rev#3) Target Commissioning and Low Power Operations Approval Sequence**	2 wks	November 21, 2005	December 2, 2005	DOE Project Manager approves;Review Team - Project Office, other Contractor (optional)	ASE Required by DOE O 420.2A
52	**ARR for RTBT to Target and Instruments 2, 4A and 4B**	**20 days**	**December 5, 2005**	**December 30, 2005**		**ARR Required by DOE O 420.2A**
53	Conduct ARR for RTBT to Target and Instruments 2, 4A and 4B	10 days	December 5, 2005	December 16, 2005	DOE Project Office observer, Committee turnover of punch list	ARR Required by DOE O 420.2A
54	ARR Team Closeout	3 days	December 28, 2005	December 30, 2005	Contractor closeout of ARR punch list with DOE Project Manager; DOE Project Manager Authorization to Proceed	ARR Required by DOE O 420.2A
55	**Commission RTBT to Target using one Instrument to CD-4 Requirements**	**42 days**	**February 1, 2006**	**March 30, 2006**		**Commissioning**
56						
57	**CD-4**	**0 days**	**March 30, 2006**	**March 30, 2006**	**Contractor/ORO/SC Recommendation**	**Project Execution Plan**
58						
59	**Low Power Operation**	**75 days**	**March 31, 2006**	**July 13, 2006**		
60	Commission Target at Low Power	65 days	April 3, 2006	June 30, 2006		Commissioning and Low Power Operation
61						
62	**Operational Accelerator Safety Envelope Review Process**	2 wks	March 31, 2006	April 13, 2006	DOE Project Manager approves;Review Team, DOE Project Office, other Contractor (optional)	ASE Required by DOE O 420.2A
63	**Operational ARR**	**65 days**	**April 14, 2006**	**July 13, 2006**		**ARR Required by DOE O 420.2a**
64	Conduct Operational ARR	60 days	April 14, 2006	July 6, 2006	DOE Project Office observer, Committee turnover of punch list	ARR Required by DOE O 420.2A
65	ARR Team Closeout	5 days	July 7, 2006	July 13, 2006	Contractor closeout of ARR punch list with DOE Project Manager; DOE Project Manager Authorization to Proceed	ARR Required by DOE O 420.2A
66	**Accelerator Approved for High Power Operations**	0 days	July 13, 2006	July 13, 2006		ARR Required by DOE O 420.2a
67						
68	**Nuclear Facility**	**1681 days**	**January 3, 2000**	**June 8, 2006**		
69	**PSAR**	**0 days**	**January 3, 2000**	**January 3, 2000**	**Submitted**	DOE O 5480.23 now 10CFR 830.206
70	**PSAR Update**	**10 days**	**August 12, 2002**	**August 23, 2002**	**Focussed on Seismic, Fire and Hg plume; DOE Project Manager Approves**	Verbal Agreement with ORO
71	**PSAR Revision**	**0 days**	**February 13, 2004**	**February 13, 2004**	**DOE Project Manager's Team; DOE Project Manager Approves**	Verbal Agreement with ORO
72	**Startup Notification**	**0 days**	**January 3, 2005**	**January 3, 2005**	**Notification to DOE HQ**	Startup Notification Required by DOE O 425.1C
73	**FSAR**	**116 days**	**April 15, 2005**	**September 23, 2005**	**DOE Project Manager's Team; DOE Project Manager Approves**	**SAR Required by 10CFR 830.206**
74	FSAR Submittal	0 days	April 15, 2005	April 15, 2005		SAR Required by 10CFR 830.206
75	FSAR Review	111 days	April 15, 2005	September 16, 2005	DOE Project Manager's Team	SAR Required by 10CFR 830.206
76	FSAR Closeout	5 days	September 19, 2005	September 23, 2005	DOE Project Manager Approves	SAR Required by 10CFR 830.206
77	**Authorization Agreement**	**109 days**	**September 1, 2005**	**January 31, 2006**	**DOE Project Manager's Team; DOE Project Manager Approves**	**AA Required by DOE M 411.1-1b**
78	Authorization Agreement Submittal	0 days	September 1, 2005	September 1, 2005		AA Required by DOE M 411.1-1b
79	Authorization Agreement Review	108 days	September 1, 2005	January 30, 2006	DOE Project Manager's Team	AA Required by DOE M 411.1-1b
80	Authorization Agreement Closeout	1 day	January 31, 2006	January 31, 2006	DOE Project Manager Approves	AA Required by DOE M 411.1-1b
81	**Target ORR**	**49 days**	**April 3, 2006**	**June 8, 2006**		**ORR Required by DOE O 425.1b**
82	Conduct Target ORR	44 days	April 3, 2006	June 1, 2006		ORR Required by DOE O 425.1b
83	ORR Team Closeout	5 days	June 2, 2006	June 8, 2006	Closeout with DOE Project Manager; TBD Authorization to Proceed	ORR Required by DOE O 425.1b
84	Target Approved for High Power Operation	0 days	June 8, 2006	June 8, 2006		ORR Required by DOE O 425.1b
85						
86	**SNS Approved for High Power Operations**	**0 days**	**July 13, 2006**	**July 13, 2006**		
87						
88	**Instrument Systems**	**200 days**	**March 31, 2006**	**January 4, 2007**		
89	**Commission Instrument 2**	**10 mons**	**March 31, 2006**	**January 4, 2007**	**HEBT-Target-Instrument ARR is a prerequisite**	**Commissioning**
90	**Commission Instrument 4A**	**10 mons**	**March 31, 2006**	**January 4, 2007**	**HEBT-Target-Instrument ARR is a prerequisite**	**Commissioning**
91	**Commission Instrument 4B**	**10 mons**	**March 31, 2006**	**January 4, 2007**	**HEBT-Target-Instrument ARR is a prerequisite**	**Commissioning**