BELLA Center Accelerator Safety Self-Assessment Guide and Checklist for the period of Jan 2017 -Dec 2019

Date of Assessment: *2019 May – 2020 May*

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Assisted from RPG by: *Melissa Mannion (MM), Patrick Bong (PB), Sam Hays (SH)*

Scope: Every 3 years, BELLA Center must demonstrate that our self-assessment processes provide an adequate review of our safety systems and compliance with the Accelerator Safety Order. The most recent triennial review was in December 2016. The purpose of our BELLA Center Accelerator Safety Self-Assessment is to maintain our safety systems and help prepare for the next triennial review by identifying any needs for updating documents or resolving safety issues. The assessment scope should include a review of the results of EHS surveillance and a summary of institutional assurance activities reviewed by the Accelerator Radiation Safety Committee since December 2016, referring to the relevant sections of the following documents as needed:

- DOE Order 420.2C
- EHS 703, Institutional Assurance of Accelerator Safety
- EHS 703.1 Documentation for Accelerator Safety Order Compliance Activities
- Safety Assessment Document for Routine Operation, LOASIS Facility (LOASIS LPA SAD) -> now **HTW & kHz-TW SAD**
- BSO LOASIS Accelerator Review (LOASIS LPA ASE) -> still **LOASIS LPA ASE (covering HTW & kHz-TW activity)**
- Safety Assessment Document for Routine Operation, BELLA Facility (BELLA SAD) -> now **PW SAD**
- BSO BELLA Accelerator Review (BELLA ASE) -> still **BELLA PW ASE (covering PW beamline activity)**

Notes on 5/11/2016 - CT: Not applicable (30-34) and closed (38-45) items from the previous review period have been removed from the current list.
Notes on 10/28/2016 - CT: Based on recommendations from RPG, new line item (51) have been added to the list.
Notes on 6/10/2019 - team: Consolidated previous list - based on recommendations from RPG and new items, identified list items to review by RPG/BC, removed previously closed items (48-51).
Notes on 5/12/2020 - CT: updated table based on latest, procedure names and dates of revised documents

BELLA Center Accelerator Safety Self-Assessment Guide

Required safety analysis and credited controls	Assurance Mechanism/ Data Source for LOASIS LPA (now BELLA HTW&kHz-TW)	Assurance Mechanism/ Data Source for BELLA (now BELLA PW)	Changes / Actions Needed/ Reviewers' Comments
1) A documented ASE must define the physical and administrative bounding conditions and controls for safe operations based on the safety analysis documented in the SAD. (DOE Order 420.2C, CRD, 1 ASE #1)	The LOASIS LPA ASE was submitted to BSO in 2010, and conditionally approved on 1/03/2011. A revised ASE has been submitted on 2/28/2011 w/closure of Conditions of Approval, and it was approved on 4/08/2011.	The BELLA ASE was submitted to BSO in May 2012, and it was approved on 6/7/2012.	*No changes - Still valid (CT)*
2) The ASE must be submitted to DOE for approval and may be submitted as a separate document from the SAD. (DOE Order 420.2C, CRD, 1 ASE #1)	The LOASIS LPA ASE was submitted to BSO and was approved.	The BELLA ASE was submitted to BSO and was approved.	*No changes - Still valid (CT)*
3) A SAD represents the technical basis for the ASE, is maintained current and must: a. identify hazards and associated onsite and offsite impacts to workers, the public, and the environment from the facility for both normal operations and credible accidents; (DOE Order 420.2C, CRD, 1 SAD #2)	The original SAD was submitted to BSO in 2010. Updated SAD for HTW upgrade was submitted to BSO in Sep 2017	The original SAD was submitted to BSO in 2012. Updated SAD and Appendix for Thin foil experiments were submitted to BSO in March 2017	*Latest updates (2020) of both SADs based on incorporation of USIs are done by team (JvT, TZ, AJG, SvS). Final edits and sharing with RPG, and collection of appropriate signatures (new version with BELLA Center and new Division Director, etc.) in progress*

4) b. contains sufficient descriptive information and analytical results pertaining to specific hazards and risks identified during the safety analysis process to provide an understanding of risks presented by the proposed operations; (DOE Order 420.2C, CRD, 1 SAD #2)	The SAD contains sufficient descriptive information and analytical results.	The SAD contains sufficient descriptive information and analytical results.	*Yes – assessed and added comments covering the PW and Thin foil experiments by AJG in December 2019 and by SvS in January 2020 for the BELLA PW SAD and to the PW Addendum -> combination of them into one SAD is in progress;* *Yes – assessed and added minor comments covering the HTW and kHz-TW beamlines by JvT and TZ in December 2019 for the HTW and kHz-TW SAD -> final review in progress;*
5) c. provide detailed descriptions of engineered controls (e.g., interlocks and physical barriers) and administrative measures (e.g., training) taken to eliminate, control, or mitigate hazards from operation; (DOE Order 420.2C, CRD, 1 SAD #2)	The SAD contains detailed descriptions of engineering controls and expected results.	The SAD contains detailed descriptions of engineering controls and expected results.	*Yes – assessed and added comments covering the PW and Thin foil experiments by AJG in December 2019 and by SvS in January 2020 for the BELLA PW SAD and to the PW Addendum -> combination of them into one SAD is in progress;* *Yes – assessed and added minor comments covering the HTW and kHz-TW beamlines by JvT and TZ in December 2019 for the HTW and kHz-TW SAD -> final review in progress;*

6) d. include or reference a description of facility function, location, and management organization in addition to details of major facility components and their operation. (DOE Order 420.2C, CRD, 1 SAD #2)	The SAD contains description of the accelerator components and operations.	The SAD contains description of the accelerator components and operations.	*Yes – assessed and added comments covering the PW and Thin foil experiments by AJG in December 2019 and by SvS in January 2020 for the BELLA PW SAD and to the PW Addendum -> combination of them into one SAD is in progress;* *Yes – assessed and added minor comments covering the HTW and kHz-TW beamlines by JvT and TZ in December 2019 for the HTW and kHz-TW SAD -> final review in progress;*
7) Appropriate documentation shall be developed to authorize operations at an accelerator facility as defined in DOE O 420.2C (EHS 703.1 Documentation for Accelerator Safety Order Compliance Activities, 1.2 Scope)	The SAD follows 420.2B, and is in compliance with revision C.	The SAD follows 420.2B, and is in compliance with revision C.	*Yes – no change in document structure since 2016, assessed by CT on 12/20/2019.*
8) The SAD and ASE shall be developed by the accelerator program division, which has line management responsibility for the accelerator. (EHS 703.1 Documentation for	The SAD and ASE include descriptions of responsibilities for the division and line managers.	The SAD and ASE include descriptions of responsibilities for the division and line managers.	*Yes – assessed and added comments by PT on multiple times*

Accelerator Safety Order Compliance Activities, 5.4 SAD/ASE Development)			
9) The SAD and ASE must follow the format established in the IG. Deviation from this format must be approved by the RPG prior to submission of the document for institutional approval (described in EHS Procedure 703)	The SAD and ASE follow the format established in the DOE Implementation Guide (IG).	The SAD and ASE follow the format established in the DOE Implementation Guide (IG).	*Yes – no change in document structure since 2016, assessed by CT on 12/20/2019.*

10) The RSC staffs the ARSC to prepare for the activity. The RSC, in conjunction with RCM, must document a formal charge for each ARSC. (EHS 703, Institutional Assurance of Accelerator Safety Order Compliance, 5.3.2 Institutional Assurance for Nonroutine Assurance Activities)	kHz-TW addition to HTW beamline has be reviewed by RSC in July 2018	Thin Foil Experiment ARSC review performed in 2017 January	*ARSC reviews have been conducted for new beamline proposals (assessed by CT in December 2019).*
11) DOE comments received on SADs and ASEs must be reviewed and responded to by the RCM and the cognizant accelerator program division. Formal responses to DOE comments must be forwarded through the RCM via the EHS Division Office to DOE. (EHS703, Institutional Assurance for of Accelerator Safety Order Compliance, 5.3.2 Institutional Assurance for Nonroutine Assurance Activities)	n.a.	DOE Review of Thin Foil Experiments at PW Beamline has been conducted, RAR has been received by RCM and the BELLA Facility in March 2017.	*No ASE modification was required based on the RAR (assessed by CT in December 2019).*

12) If the SAD review indicates that it adequately addresses all safety hazards, but minor changes are needed for improved documentation, then an administrative update may be issued to the current version of the SAD. This process does not require institutional assurance or ASE review; however, copies of the update must be provided to the RCM and BSO (courtesy copy within thirty (30) days of the update. (EHS 703, Institutional Assurance of Accelerator Safety Order Compliance, 5.3.3 Institutional Assurance for Activities Required on a Defined Interval SAD/ASE Review)	n.a.	DOE Review of Thin Foil Experiments covered by the PW SAD Addendum at the PW Beamline has been conducted, RAR has been received by RCM and the BELLA Facility in March 2017.	*No ASE or further SAD modification was required based on the RAR (assessed by CT in December 2019).*

13) The ASE is reviewed and approved by the DOE Berkeley Site Office (BSO). Any activity violating the ASE must be terminated immediately and DOE / BSO must be promptly notified of the violation and are treated as reportable occurrences. (LOASIS SAD, Section 5.1 Introduction, Accelerator Safety Review)	The LOASIS LPA ASE was submitted to BSO in 2010, and conditionally approved on 1/03/2011. A revised ASE has been submitted on 2/28/2011 w/closure of Conditions of Approval, it was reviewed by BSO, and approved on 4/08/2011.	The BELLA ASE was submitted to BSO in May 2012. It was reviewed by BSO and approved on 6/7/2012.	*No changes, only event is related to Thin Foil addendum in 2017. Base ASE is still valid - Updated records, compared RARs and cover letters (assessed in December 2019 by CT).*

Implementation Procedures	Assurance Mechanism/ Data Source for LOASIS LPA	Assurance Mechanism/Data Source for BELLA	Changes / Actions Needed/ Reviewers' Comments
14) As part of the ARR process, the contractor must demonstrate to the satisfaction of the Field Element Manager that the following processes are in place: a. A Contractor Assurance System that maintains an internal assessment process (DOE Order 420.2C, CRD, 1 ARR #4)	The current Triennial Review of the LOASIS LPA constitutes as part of the internal assessment process of the CAS	The current Triennial Review of BELLA constitutes part of the internal assessment process of the CAS	*Annual QUEST workplace assessment and Accelerator self-assessment – Continually assessed by CT and PT*
15) b. A Facility Configuration Management Program that is related to accelerator safety; (DOE Order 420.2C, CRD, 1 ARR #4)	Approved and current BELLA Center Configuration Control Policy and Checklists.	Approved and current BELLA Center Configuration Control Policy and Checklists.	*Updated the current CCP&C – 5/18/2020 (CT). Potential further update expected w/the involvement of the Lab's CC SME.*

16) c. Credited controls and appropriate administrative processes related to accelerator safety (e.g. training, procedures, etc.). (DOE Order 420.2C, CRD, 1 ARR #4)	Approved and current BELLA Center Procedures related to Accelerator Safety: Procedure on Procedures – BOP-00; Procedure on Training - BOP-12; Procedure on EIC Training - BOP-12-Appx-2; Procedure on Search and Clear - BCOP-10; Procedure on Periodic Interlock Checks – BCHOP-11;	Approved and current BELLA Center Procedures related to Accelerator Safety: Procedure on Procedures – BOP-00; Procedure on Training - BOP-12; Procedure on EIC Training - BOP-12-Appx-2; Procedure on Search and Clear - BOP-10; Procedure on Periodic Interlock Checks - BOP-11;	*Assessed by KN and CT in May 2020* *- Update and re-approval of some static (unchanged) procedures needed* *- better file organization and management (accessible from different directories, easily recognizable by the growing user pool) and cross-referencing are advised*
17) The RCM must be provided with copies of all USI screens performed by an accelerator program division. (EHS 703, Institutional Assurance of Accelerator Safety Order Compliance, 5.3.6 Assured Compliance with Unreviewed Safety Issue Requirements)	Copies of all USI screenings have been provided to RCM, log maintained of total 6 USIs during review period (see Appendix). All USI screenings were negative. One new USI preparation is in progress.	Copies of all USI screenings have been provided to RCM, log maintained of total 3 USIs during review period (see Appendix). All USI screenings were negative. Two new USIs are under considerations and in progress.	*DONE - Checked all GDoc folder documentation by JvT, KN and CT in May 2020 – updated USI Logs*

18) If a potential safety-related discrepancy between the facility and the safety analysis is discovered it shall be documented. (EHS 703.1 Documentation for Accelerator Safety Order Compliance Activities Attachment E)	No discrepancy has been discovered.	No discrepancy has been discovered.	*No changes - Still valid (CT)*
19) A potential increase in consequences shall be evaluated by comparing the anticipated consequences of an accident with the consequences of a same or similar "family" of accident that has already been analyzed. (EHS 703.1 Documentation for Accelerator Safety Order Compliance Activities Attachment E, Q2)	No increase in consequences has been found.	No increase in consequences has been found.	*No changes - Still valid (CT)*

20) Procedures required by the ASE are present, approved and current. (DOE G 420.2-1 reference .II A. 5)	BELLA Center Procedures required by the ASE are present, approved and current: Procedure on Search and Clear - BCOP-10; Procedure on Periodic Interlock Checks – BCHOP-11; BELLA Center Configuration Control Policy and Checklists	BELLA Center Procedures required by the ASE are present, approved and current: Procedure on Search and Clear - BOP-10; Procedure on Periodic Interlock Checks – BOP-11; BELLA Center Configuration Control Policy and Checklists	*Assessed by KN and CT in May 2020* *- Update and re-approval of some static (unchanged) procedures needed* *- better file organization and management (accessible from different directories, easily recognizable by the growing user pool) and cross-referencing are advised*
21) Beam interlock systems are established to prevent personnel exposure. (DOE G 420.2-1 reference I. B. 3a)	BELLA HTW&kHz-TW beam interlock systems designed, reviewed, approved, installed, verified and validated to prevent personnel exposure.	BELLA PW beam interlock systems designed, reviewed, approved, installed, verified and validated to prevent personnel exposure	*YES - Assessed by KN and CT in May 2020*
22) Beam interlock systems are maintained and tested using an approved procedure. (DOE G 420.2-1 reference II. B. 3a)	BELLA HTW Procedure on PPS Annual Review - BCOP-11; tests performed periodically	BELLA PW Procedure on PPS Annual Review - BOP-11; tests performed annually	*YES - Assessed by KN, JvT and CT in May 2020 - better file management (accessible from different directories) and cross-referencing are advised*
23) Controlled Access to exclusion areas, if allowed, is authorized utilizing approved procedures. (DOE G 420.2-1 reference II. B. 3a)	Access to exclusion areas is not allowed	Access to exclusion areas is not allowed	*No changes - Still valid (CT*

Effectiveness of Procedures	Assurance Mechanism / Data Source for LOASIS LPA	Assurance Mechanism / Data Source for BELLA	Changes / Actions Needed/ Reviewers' Comments
24) How effective is the shielding? Does it meet the Shielding Policy; Is it ALARA; Does monitoring confirm shielding calculations? (LOASIS & BELLA ASE – RWA requirements)	Shielding effectively contains radiation during BELLA HTW LPA experiments, proven by on-line telemetry based on monitoring radiation detectors installed inside and outside of TEA	Shielding effectively contains radiation during BELLA PW LPA experiments, proven by on-line telemetry based on monitoring radiation detectors installed inside and outside of TEA	*Based on monitoring by RPG during selected High Power runs and based on always-on-telemetry information no event was observed during the last three year period – confirmed by HPs and CT during RWA renewal processes annually*
25) How well does the BELLA Center Shielding Control Procedure work? (LOASIS & BELLA ASE – OP 02-01)	The 18-month monitoring of the shielding structure has been implemented in Jan 2017 and in July 2018. No degradation or modification have been observed.	The 18-month monitoring of the shielding structure has been implemented in Jan 2017 and in July 2018. No degradation or modification have been observed.	*Reviewed actual checklists by CT on 12/20/2019*
26) How effective are the BELLA Center interlocks? (LOASIS & BELLA ASE)	BELLA HTW LPA Interlock systems provide effective protection of workers via locking out the TEA during experiments and activating shutters if elevated radiation observed by monitoring detectors	BELLA PW LPA Interlock systems provide effective protection of workers via locking out the TEA during experiments and activating shutters if elevated radiation observed by monitoring detectors	*No changes - Still valid, part of daily operation (CT)*

27) How well do the BELLA Center interlock procedures work (design and work control)? (LOASIS & BELLA ASE)	BELLA HTW LPA Interlock procedures are developed via close collaboration with the LBNL interlock engineer and regularly reviewed, modified, if needed based on annual tests	BELLA PW Interlock procedures are developed via close collaboration with the LBNL interlock engineer and regularly reviewed, modified, if needed based on annual tests	*Still valid - Assessed by KN, JvT and CT in May 2020*
28) How effective is the search and secure procedure? (LOASIS & BELLA ASE)	The BELLA HTW LPA Search and Secure procedure is regularly implemented and effectively locks out workers from the TEA during experiments. All search and secure events are logged.	The BELLA Search and Secure procedure is regularly implemented and effectively locks out workers from the TEA during experiments. All search and secure events are logged.	*Still valid - Assessed by KN in May 2020*
29) How well does the Beamline Review process work? (LOASIS & BELLA ASE)	Modification in the beamlines are controlled by the BELLA Center Configuration Control Policy and Checklists: several examples show the appropriate review and authorization process (e.g.: new HTU beamline in CaveB)	Modification in the beamlines are controlled by the BELLA Center Configuration Control Policy and Checklists: examples show the appropriate review and authorization process (e.g.: PW HPD upgrade)	*Still valid - Assessed by KN and JvT in May 2020*
[Items 30-34 identification of exempt and non-exempt accelerators not applicable]	n.a.	n.a.	n.a

Recommendations in the LOASIS LPA ASE Acceptance Report -- December 2010	Assurance Mechanism/Data Source for LOASIS LPA	Assurance Mechanism / Data Source for BELLA	Changes / Actions Needed/ Reviewers' Comments
35) The accident analysis discussion in section 3.5.1 of the SAD should be relocated to Chapter 4, which provides the safety analysis and provides the technical basis for selection of credited controls. [Review and Acceptance Report (LOASIS LPA ASE, Rev 3), 4.2.1 Recommendations]	Update of the SAD was finished in Aug 2017; copies of the updates were provided to RCM and BSO in Sep 2017.	n.a.	*Requested change was made in Rev01 of the HTW LPA SAD in2017 – assessed by CT in May 2020 - CLOSED*
36) The role of the EIC should be clearly defined in chapter 4. [Review and Acceptance Report (LOASIS LPA ASE, Rev 3), 4.2.2 Recommendations]	Update of the SAD was finished in Aug 2017; copies of the updates were provided to RCM and BSO in Sep 2017.	n.a.	*Requested change was made in Rev01 of the HTW LPA SAD in2017 – assessed by CT in May 2020 - CLOSED*
[37 upper bounding radiological inventory/MAR not applicable]	n.a.	n.a.	n.a.

Recommendations in the LOASIS PPS Review – April 2011	Assurance Mechanism/Data Source for LOASIS LPA	Assurance Mechanism / Data Source for BELLA	Changes / Actions Needed/ Reviewers' Comments
[Items 38-45 closed]	n.a.	n.a.	n.a.
46) Training to operate or maintain the safety interlock system should be documented. (9) (LOASIS PPS review, 4/24/11)	Training to operate the safety interlock system has been incorporated into RWA-OJT. Specific training and documentation for authorization of Experimenter-in-Charge (EIC) developed	n.a.	*EIC Training has been established to HTW system, following the process of the PW area – assessed in May 2020 by CT - CLOSED*

Recommendations in the BELLA ASE Acceptance Report – June 2012	Assurance Mechanism/Data Source for LOASIS LPA	Assurance Mechanism / Data Source for BELLA	Changes / Actions Needed/ Reviewers' Comments
47) Include the administrative control establishing the upper bounding radiological inventory as less than thresholds defined in DOE STD 1027-92 which constitute a Hazard Category 3 nuclear facility as an initial condition for BELLA. LBNL should consider specifically citing the 500-millicurie limit specified in the hazard table for event 6a. (DOE BSO Review and Acceptance Report (BELLA ASE, Rev 0), 4.2.1 Recommendations)	n.a.	Update of the SAD is in progress; copies of the updates will be provided to RCM and BSO after finishing the updates.	*After consulting w/RPG, it may be included in the next update of the ASE.*
[Items 48-51 closed in previous cycle]	n.a.	n.a.	n.a.