

# Sanford

## Underground Research Facility



**SCIENCE**

**EXPERIMENT IMPLEMENTATION PROGRAM**

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## Version Control

Responsible Person	Document Control Number	Document Version	Publication Date	Description of Change
Jaret Heise	Document-34478	1	08/22/2010	Initial release.
Jaret Heise	Document-34478	2	07/30/2016	Update categories and descriptions based on current practices and terminology, also update formatting.
Jaret Heise	Document-34478	3	12/11/2016	Further clarification of process, including Experiment phase and associated implementation requirements as well as further clarification of Sanford Laboratory department responsibilities.
Jaret Heise	Document-34478	4 (CCR-446)	06/06/2017	<b>Configuration Control Starts:</b> Various refinements, including ESH review of all Experiment proposals. Clarification on ESH and Science roles regarding Experiment Hazard Assessment Summary. Add integration section: Prioritizing Resources and Managing Conflict. Additional details on pressure vessel documentation and hoisting and rigging.
Jaret Heise	Document-34478	5 (CCR-463)	10/09/2018	Add definitions section; consolidate and elaborate on various definitions. Add roles and responsibilities section; clarify responsibilities throughout. Update Experiment phases and clarify types of activities that can be performed in each. Update EPS descriptions to align with new form rolled out in April 2018. Add MOU review at least every 5 years. Add NEPA reference. Provide further resolution on categories of reviews. Streamline authorizations and clarify deliverables to Sanford Lab and Experiment. Add implementation flow chart. Remove integration topics (move to different document). Provide clarifications throughout and incorporate comments from various stakeholders.

## 1. INTRODUCTION

Integral to the Sanford Laboratory's institutional mission is the advancement of compelling underground, multidisciplinary research. This document describes the framework for implementing an experiment in an effective and efficient manner at the Sanford Laboratory.

## 2. SCOPE

The Experiment Implementation Program applies to all groups seeking to perform research activities at the Sanford Laboratory, encompassing elements concerning compliance, safety and quality. While the level of review and extent of documentation is intended to be commensurate with the scope, complexity and risks associated with a given Experiment, the same general process applies regardless of discipline or location (either surface or underground). Experiment activities are conducted with authorization from Sanford Laboratory as outlined below.

## 3. DEFINITIONS

**Collaboration:** A group of partners pursuing common goals associated with a specific Experiment at Sanford Laboratory. Members of a Collaboration can include (but are not limited to):

- i. Researchers (including faculty, staff and students);
- ii. Engineers;
- iii. Technicians;
- iv. Educators.

Individuals can be a member of more than one Collaboration, but separate documentation requirements may apply.

**Experiment:** A defined set of activities described by one or more of the following broad categories:

- i. Basic research (including partnerships with industry) in science, technology, engineering and mathematics as well as fine arts (STEAM);
- ii. Commercial research and development activities in STEAM fields;
- iii. Other technical activities (including some types of training or professional development).

Experiments can include activities underground and/or on the surface.

**User:** An individual requiring Sanford Laboratory access and/or resources who is connected with one or more Experiments at Sanford Laboratory. Users can include:

- i. A formal member of a Collaboration (note that not all members of a Collaboration are necessarily Users);
- ii. A researcher (including faculty, staff or student), engineer, technician or educator affiliated with an Experiment as sponsored by the Collaboration;
- iii. An individual otherwise associated with an Experiment such as a temporary worker (e.g., intern), vendor or contractor as sponsored by the Collaboration.

## 4. ROLES & RESPONSIBILITIES

High-level roles and responsibilities are described below; see Section 12 for more details regarding specific program elements.

**4.1. Laboratory Director:** Establish a formal relationship with an Experiment.

**4.2. Science Director:**

1. Provides efficient and effective management of the Experiment Implementation Program;
2. Ensures Users are informed of and comply with Sanford Lab policies and procedures, and are aware of hazards and protocols in their workspaces;
3. Convenes review committees (including both internal and external personnel) to review Experiments as warranted;
4. Assigns Experiment Point of Contact for each Experiment;
5. Authorizes various stages of Experiment implementation.

**4.3. Department Directors:** Review Experiment proposals and other documentation.

**4.4. Experiment Point of Contact:** Member of the Science department who assists with navigation of the Experiment Implementation Program and reviews Experiment proposals and other documentation.

**4.5. Environment, Safety & Health Department:**

1. Review hazard and quantitative analyses;
2. Provide User training and evaluate external training;
3. Review and approve inventory items as appropriate;
4. Participate in and in some cases conduct reviews.

**4.6. Engineering Department:**

1. Review hazard and quantitative analyses as appropriate;
2. Review and approve inventory items as appropriate;
3. Participate in reviews as appropriate.

**4.7. Facility Infrastructure Department (Operations):**

1. Provide cost estimates;
2. Review hazard and quantitative analyses as appropriate;
3. Review, approve and coordinate inspections for inventory items as appropriate;
4. Manage Facility Transition Plan and participate in other reviews as appropriate.

**4.8. Underground Access Department (Operations):**

1. Provide cost estimates;
2. Review hazard and quantitative analyses as appropriate;
3. Participate in reviews as appropriate.

**4.9. Contracts & Business Services:** Review Experiment relationship documents.

**4.10. Collaboration:**

1. Ensure Experiment is conducted in accordance with provisions of the Experiment Implementation Program;
2. Disseminate relevant information and expectations related to the Experiment Implementation Program to Users.

## **5. EXPERIMENT PHASES**

In general terms, an Experiment has the following phases: proposal, active, pre-installation, installation, commissioning, operation and decommissioning. Depending on the scope of the Experiment, only the first few phases may be appropriate as detailed below.

**5.1. Proposal:** All Collaborations must provide documentation describing the proposed Experiment and required interfaces with the facility. Experiment representatives are encouraged to contact the Sanford Laboratory as early as possible as conceptual plans are developing for projects envisioned for the facility. Ideally, communication would begin when projects are seeking funding to ensure that the Sanford Laboratory can meet expectations, including access to specific facilities or locations. In addition to understanding an Experiment's facility requirements, documentation reviewed during the Proposal phase is used to determine the feasibility of an Experiment for implementation at the Sanford Laboratory. Site-selection trips to facilities or locations are possible (with appropriate training and acknowledgement/waivers) but no work may be performed during this phase (i.e., no activities that require a written hazard analysis).

**5.2. Active:** In this phase, formal agreements are in place and space is formally allocated for a fixed period of time, subject to the availability of funding for both the facility and the Experiment. All Experiments must meet the requirements in this phase; however, some Experiments not installing significant equipment or equipment for long periods of time and/or with only low-hazard activities (e.g., basic biological sampling) may not need to advance beyond this phase. Site-selection trips to facilities or locations are possible during this phase (with appropriate training and acknowledgement/waivers). For Experiments that will move on to subsequent phases (e.g., installing significant equipment, etc.), limited, relatively low-hazard work (possibly still requiring a hazard analysis per the Sanford Laboratory work planning and controls chapter) may be performed at this stage at the discretion of the Science Director (or designee).

**5.3. Pre-Installation:** Prior to the installation of significant equipment or equipment for long periods of time and/or work activities requiring multiple ESH documents (hazard analysis/work planning and controls, inventories, quantitative analyses, etc.) that constitute the Installation phase of the Experiment, Sanford Laboratory shall formally authorize the proposed activities.

**5.4. Installation:** Significant Experiment activities onsite at Sanford Laboratory begin following authorization at the end of the Pre-Installation phase. Hazard analysis/work planning and controls apply per Sanford Laboratory policy; some low-hazard activities may be authorized in previous stages as described above.

- 5.5. Commissioning:** After the Installation phase, some activities may be performed, and some equipment may be operated, in order to test and otherwise commission aspects of an Experiment. Hazard analysis/work planning and controls apply per Sanford Laboratory policy. While Commissioning may be viewed as an intermediary phase, it is possible that many or all of the project hazards will be encountered during this phase, with the corresponding documentation requirements.
- 5.6. Operation:** In this phase, the Experiment is aiming to meet its primary goals. Hazard analysis/work planning and controls apply per Sanford Laboratory policy; all project hazards will have been encountered in the activities leading up to and including this stage. If applicable, a facility Certificate of Occupancy is necessary by this stage of the Experiment (note that it may be required for prior phases based on hazard assessment, the Facility Transition Management Plan and the Authority Having Jurisdiction).
- 5.7. Decommissioning:** During this phase, the Experiment completes the removal of all Experiment equipment and restores the site to its initial condition unless formal agreement is reached on certain specific exceptions. Hazard analysis/work planning and controls apply per Sanford Laboratory policy.

## 6. PROJECT DOCUMENTATION

Specific documentation is required in order to identify interfaces with the facility and address any hazards within the Sanford Laboratory approval framework. The documents that establish and define a relationship between an Experiment and Sanford Laboratory are outlined below.

**6.1. Expression of Interest:** An Expression of Interest (EOI) reflects that a Collaboration has contacted Sanford Laboratory expressing interest in conducting an Experiment at the facility but does not establish a formal relationship. EOIs can come in various forms, but must be written (as opposed to verbal). While there is no formal template for the EOI, the Experiment Planning Statement (see Section 6.2) serves as a useful guideline for the EOI even though many details may not be available.

- 1. Support Letter:** Requests for support letters require that at least an initial draft Experiment Planning Statement (see Section 6.2) be completed. If Sanford Laboratory determines that an Experiment can be performed both technically and safely at the facility, the Laboratory Director will issue a formal letter to support a funding request. In return Sanford Laboratory requests a copy of the final proposal narrative for our records. Experiments are welcome at Sanford Laboratory even without prior interactions or a prior support letter.
- 2. Cost Estimate (Initial):** Requests for cost estimates require that at least an initial draft Experiment Planning Statement (see Section 6.2) be completed. In order to meet project goals, initial site-preparation details should be discussed, and there may be associated costs that need to be reflected in any funding proposal. As resources are available, Sanford Laboratory personnel may be able to assist with the development of cost estimates for performing work at the facility (including nominal estimates for contracted services).

**6.2. Experiment Planning Statement:** The Experiment Planning Statement (EPS) is used by Sanford Laboratory to understand whether an Experiment is feasible based on Experiment



requirements as well as critical interfaces between the Experiment and the facility. EPS elements include the following: project description (including purpose, scientific merit and scope), funding status (including duration of award(s)), personnel (including which institutions intend to have personnel onsite), lists of equipment and various inventory items (ultimately incorporated into dynamic inventories as outlined in Section 7.2), space and infrastructure needs (including location/depth, site preparations and environment as well as required services and logistics), description of hazards and integrated safety management, personnel access requirements, project schedule, operational considerations and an initial decommissioning plan. Sanford Laboratory maintains a form for the EPS (see References section).

Additional EPS documents or other technical documents may be subsequently required to describe significant activities beyond the baseline scope outlined in an initial EPS (especially if the new activities present new types of hazards).

Sanford Laboratory will use the EPS to indicate any additional requirements, such as an Experiment Hazard Assessment Summary document (see Section 7.1.1), quantitative analyses (see Section 7.1.2) and review(s) (see Section 8). Groups requesting significant Sanford Laboratory resources or significant changes to the capacities and/or capabilities of the facility may be subject to external review and evaluation, which will be indicated as well (see Section 7.5).

The completed EPS will indicate reviews by the Science, Operations (Underground Access and Facility Infrastructure), Engineering and ***Environment, Safety and Health (ESH)*** Directors (or respective designees). Reviews by ***other Sanford Laboratory*** departments may be requested based on specific interfaces (e.g., Information Technology) and it may be appropriate for external groups to review EPS documentation. The SURF Laboratory Director will sign for final acceptance of the EPS.

**6.3. Memorandum of Understanding:** The Memorandum of Understanding (MOU) establishes a baseline relationship between the Experiment and the South Dakota Science and Technology Authority (Operator of the Sanford Underground Research Facility). The MOU outlines general expectations of both the Sanford Laboratory and the Experiment, including insurance requirements, adherence to the applicable requirements defined in the ESH Manual (see References section), and a nominal decommissioning plan. Expectations relating to environment, safety and health, site access, material handling and operations, and physical infrastructure are also addressed. Details regarding reporting requirements and publications are also included in the MOU; a separate document is required for specific intellectual property agreements. The MOU may be signed by Experiment representatives (PI or supervisor) or institutional administrators. Sanford Laboratory maintains a template for the MOU (see References section).

The MOU document will be updated as necessary if significant changes are proposed to the baseline or to capture significant expectations. The MOU specifies particular sites (facilities and location(s), both on the surface and underground) for Experiment activities, and any significant change in that scope requires an update to the MOU. MOUs will be reviewed at least every five years.

The MOU is reviewed by the Science Director (or designee) and is signed by the Sanford Laboratory Director. The fully-executed MOU document is the formal allocation of space at the Sanford Laboratory for the duration specified in the MOU. Occupancy of shared

laboratory space(s) is coordinated by the Sanford Laboratory, and any conflicts will be managed and resolved by the SDSTA (see also Section 12).

**6.4. Access:** There are various requirements for Users to access and perform work at the Sanford Laboratory as outlined below. Additional information for visitors is also available via the Sanford Laboratory public website (see References section).

1. **Access Request:** User information will be collected by Science department personnel or Experiment representatives to support various elements such as training, ID access badging and IT accounts.
2. **Acknowledgement of Risk and Waiver:** Prior to undertaking any Experiment activities at Sanford Laboratory, Users are required to sign the “Acknowledgement of Risk” and “Release, Agreement Not to Sue and Waiver” documents (see References section).
3. **Insurance:** Evidence of both general liability and Workers’ Compensation coverage is required from each institution with Users at the Sanford Laboratory. Sanford Laboratory insurance requirements are specified in the MOU. Sanford Laboratory will deny site access to individuals who do not have current and acceptable insurance coverage. Onsite Experiment personnel are also asked to provide personal and institutional contacts to expedite any emergency communication. Insurance coverage is reviewed by the Contracts and Business Services Manager. The Sanford Laboratory Risk Manager will assess liability requirements and provide any waivers as appropriate.

**6.5. Decommissioning Plan:** A plan for how the Experiment will be decommissioned is required prior to commencement of activities at Sanford Laboratory. General decommissioning requirements are outlined in the MOU and an initial decommissioning plan is required in the EPS document (initial decommissioning details can also be added to the MOU as a separate attachment). Prior to the end of an Experiment, a more detailed description of decommissioning is required according to the Experiment Decommissioning Plan template (see References section). The final Experiment Decommissioning Plan is reviewed and accepted by the Underground Access, Facility Infrastructure, Engineering, ESH and Science Directors (or respective designees).

**6.6. Services Agreement(s) (if applicable):** The Sanford Laboratory offers a basic level of support to all Experiments, which is often sufficient for smaller Experiment groups with modest requirements (see Experiment Integration & Support in References section). Requirements beyond the general level of support are specified in separate services agreements. A General Services Agreement (GSA) outlines respective responsibilities (especially those with financial implications) for the Sanford Laboratory and the Experiment for each facility or location with significant Experiment occupancy. GSA documentation is updated annually, typically in alignment with the Sanford Laboratory DOE operations funding fiscal year (Oct 1 – Sep 30). The GSA lists the Sanford Laboratory overhead rate as well as other applicable formal charges or fees. Contracts may be needed for specific labor or non-labor arrangements (e.g., labor requiring Sanford Laboratory to backfill capacity, site-preparation activities and materials, etc.) based on cost estimates provided by the Operations and/or Engineering departments. Projects or specific institutions with fiduciary responsibilities within a project may wish to supplement GSAs with contracts that specify particular funding amounts. Services agreements (GSA and/or contracts) are reviewed by

the Science Director (or designee) and the Contracts and Business Services Manager; the agreements are signed by the Laboratory Director.

1. **National Environmental Policy Act (if applicable):** Before federal funds awarded to an Experiment can be expended to affect the environment at the Sanford Laboratory, there may need to be formal consideration of the National Environmental Policy Act (NEPA). This may include an environmental assessment (EA), environmental impact statement (EIS). Alternatively, the scope of Experiment actions may qualify for a categorical exclusion, for which neither an EA nor an EIS is normally required. Experiment representatives should check with their federal agency program manager.

## 7. ENVIRONMENT, SAFETY AND HEALTH

All activities performed at Sanford Laboratory must be conducted in a manner that ensures protection of personnel (workers and the public), equipment and the environment. Project goals must be accomplished safely by following a process of integrated safety management.

**7.1. Hazard Analysis:** Per the Sanford Laboratory Work Planning & Control chapter, work planning and hazard analysis are required for all work at the facility, including Experiment activities.

1. **Experiment Hazard Assessment Summary (if applicable):** For projects with significant hazards, the completed EPS document will indicate that an Experiment Hazard Assessment Summary (EHAS) is required. The EHAS lists Experiment hazards for all relevant sites and for all phases of the project with associated control measures and mitigation strategies identified for each hazard. The mitigation measures are not expected to be in place when the EHAS is developed, rather the EHAS communicates the Experiment's plan. Sanford Laboratory maintains a template for the EHAS (see References section); similar reports required by other external agencies may be acceptable such as the DOE Hazard Analysis Report (HAR).

The EHAS document is reviewed by Science and ESH personnel (nominally the Experiment Health & Safety Manager); review by subject matter experts (such as Operations, Engineering and other ESH personnel) may also be warranted and will be coordinated by the Science Experiment Point of Contact (or alternate Science representative). The final reviewed version of the EHAS is formally received by the Science Director (or designee).

2. **Quantitative Analysis (if applicable):** Some Sanford Laboratory policies and procedures relevant to Experiment activities require quantitative analysis for hazards such as oxygen deficiency hazards (ODH) and pressurized or mechanical systems.

Quantitative analyses are reviewed by ESH (nominally the Experiment Health & Safety Manager) and Engineering representatives; review by subject matter experts (such as Operations and other Engineering and ESH personnel) may also be warranted and will be coordinated by the Science Experiment Point of Contact (or alternate Science representative). The final reviewed version of an Experiment's quantitative analysis report is formally received by the corresponding Science Experiment Point of Contact (or alternate Science representative).

3. **Certifications (if applicable):** Engineering documentation is required for some equipment such as pressure and mechanical systems, and hoisting & rigging equipment.
4. **Procedures:** Experiments are required to document work steps and associated hazards and mitigations (precautions, procedures, controls and safe work practices) in a procedure per the Sanford Laboratory work planning and controls chapter of the ESH Manual (see References section). Forms are available for a job hazard analysis (JHA) or standard operating procedure (SOP); other formats are acceptable provided the above elements are sufficiently addressed and acceptable to Sanford Laboratory.

Experiments are responsible for developing and performing an internal review and approval of their procedures. Experiment approval authorizes members of the Collaboration to conduct tasks outlined in the procedure pending Sanford Laboratory oversight approval, which mainly ensures compliance with the Sanford Laboratory ESH Manual. Per Sanford Laboratory work planning and controls, workers are released to perform work according to approved procedures following a review of those procedures and any related requirements such as training, permits, etc. during a toolbox talk prior to performing work.

All Experiment procedures are reviewed by Sanford Laboratory ESH and Science representatives; review by subject matter experts (such as Operations, Engineering and other ESH personnel) may also be warranted and will be coordinated by the Science Experiment Point of Contact (or alternate Science representative). The Science Experiment Point of Contact (or alternate Science representative) approves corresponding Experiment procedures. At least one Experiment representative also signs procedures as an approver.

**7.2. Inventories:** Experiments are required to maintain inventories of items with safety implications (some of which require inspections), including chemicals, electrical equipment, hoisting & rigging equipment, pressure vessels and radioactive materials. The Science Experiment Point of Contact (or alternate) ensures relevant details are communicated for approvals or inspections as necessary and provides oversight to ensure the inventories are maintained by Experiment representatives. Specific additional considerations are addressed below (also note that associated training may be required; see Section 7.3).

1. **Chemicals:** All chemicals (including compressed gases and cryogenic materials) must be approved by ESH (Environmental Manager and Industrial Hygienist) and added to a chemical inventory before they can be brought onto Sanford Laboratory property. The inventory shall include the name of the responsible person, arrival date at Sanford Laboratory, storage information (quantities, locations and containment descriptions) and an indication of whether the chemical is considered hazardous waste. Approved chemicals must have a recent Safety Data Sheet (SDS) on file. Sanford Laboratory maintains an inventory template for chemicals (see References section). Personnel with Experiments using chemicals should be familiar with the Hazard Communication policy in the Sanford Laboratory ESH Manual. Other relevant Sanford Laboratory ESH Manual policies may include Waste Management,

- Lead (Pb) Program, Compressed Gases, Cryogenic System and Oxygen Deficiency Hazards (ODH).
2. **Electrical Equipment:** All electrical equipment requires an inspection (nominally performed by Sanford Laboratory Operations or Engineering representatives) prior to use on Sanford Laboratory property. The inventory shall include information such as the model and serial number of equipment as well as voltage, current, power consumption, the location of use and the equipment owner. The inventory will also reflect the date of Sanford Laboratory inspections (if available, documentation of inspection/testing by other organizations should be provided). Sanford Laboratory maintains an inventory template for electrical equipment (see References section). Personnel with Experiments using electrical equipment should be familiar with the Electrical Safety and the Lockout/Tagout policies in the Sanford Laboratory ESH Manual.
  3. **Hoisting & Rigging Equipment:** Experiment-owned hoisting and rigging equipment may need to be inspected on a regular basis. The Sanford Laboratory Operations (Facility Infrastructure) department coordinates inspections and requires that an inventory of equipment be maintained for each Experiment. The inventory shall include a description of the items (manufacturer, model and serial number, if applicable) as well as location. Personnel with Experiments using hoisting and rigging equipment may need to be familiar with the Cranes and Hoists policy and the Slings, Rigging Hardware and Below-The-Hook Devices policy in the Sanford Laboratory ESH Manual; additional hoisting and rigging requirements are available in the Sanford Laboratory Construction ESH Manual (see References section).
  4. **Pressure Vessels:** Pressure vessels (including owned, leased and/or rented units) need to be inspected regularly. The Sanford Laboratory Operations (Facility Infrastructure) department coordinates inspections and requires that an inventory of equipment be maintained for each Experiment. The inventory shall include information such as a description of the equipment, including manufacturer, model, serial number, manufacture/purchase date, institution owner, certificate of authorization number, national board number and any supporting documentation, including a copy of the ASME certificate. Items entered in the Sanford Laboratory database will be assigned an asset ID. Sanford Laboratory maintains an inventory template for pressure vessels (see References section). Personnel with Experiments using pressure vessels may need to be familiar with the Compressed Gases policy and the Cryogenic System policy in the Sanford Laboratory ESH Manual; additional pressure requirements are available in the Sanford Laboratory Construction ESH Manual (see References section).
  5. **Radioactive Materials:** All radioactive materials (including NRC-exempt sources) must be approved by the Sanford Laboratory Radiation Safety Officer (RSO) and included on an inventory. The inventory shall include the isotope, manufacturer, physical description, activity, owner, primary emission, arrival date and storage location. Sanford Laboratory maintains an inventory template for radioactive materials (see References section). Personnel with Experiments using radioactive materials should be familiar with the Radiation Safety policy in the Sanford Laboratory ESH Manual. Transportation of radioactive sources to or from Sanford Laboratory property must be coordinated with the SURF RSO, and only individuals

approved by the Sanford Laboratory RSO are authorized to handle radioactive sources on Sanford Laboratory property. Note that new radioactive sources may need to be added to the Sanford Laboratory NRC license, and license amendments can take up to 90 days.

**7.3. Training:** Some ESH hazards associated with the Experiment may be mitigated through training. The Experiment is required to identify, manage and track training for all Collaboration personnel, including task-specific training (see also the EHS Training chapter of the ESH Manual).

1. **Sanford Laboratory Training:** Sanford Laboratory provides some general safety and awareness training (“General Safety – Basic” and associated Annual Refresher Training for those individuals performing work onsite for 40 hours or more per year) as well as site-specific training for facilities or locations accessed by Experiment personnel. Full credit for general safety training is not given for MSHA or OSHA certification. Sanford Laboratory also provides some oxygen deficiency hazard and chemical awareness training (including lead) and some on-the-job training related to topics such as fall protection and hoist operation.
2. **Experiment Training Plan (if applicable):** For some topics (e.g., pressure safety), the Experiment must arrange to provide training for its personnel and manage equivalences if there are various options to receive the training; such training must be acceptable to Sanford Laboratory (reviewed by ESH department, with formal receipt by the Science department).
3. **Recordkeeping:** Sanford Laboratory tracks training that it provides. However, since additional Experiment resources may be needed in order to provide some required training, Sanford Laboratory training records may not be complete. Experiment representatives must be able to provide proof of training if requested by Sanford Laboratory and ensure that onsite Experiment personnel are current on all required training. An example of a matrix used for tracking personnel training is maintained by the Sanford Laboratory (see References section).

## 8. REVIEWS

Various types of reviews support Experiment activities, including reviews of facilities as well as Experiment equipment and processes, and they are intended to be commensurate with the associated hazards. Considerations for safety reviews are outlined in the Sanford Laboratory ESH Manual and include the following: computer or PLC control systems that have safety implications for personnel, property or the environment, cryogen systems, electrical systems (equipment that is non-commercial, modified or operated at greater than 600 V), significant quantities of combustibles and smoke-generating materials (including cable insulation, liquid scintillator, etc.), flammable gases or gas mixtures, custom/modified tools or equipment, lasers (> Class 3b), mechanical hazards, pressure/vacuum systems, radiation hazards, significant chemicals including lead (Pb) and other toxic materials. Additional classification of hazards can also be found in the Sanford Laboratory work planning and controls chapter; multiple high-risk hazards may warrant additional reviews. All hazards are reviewed by appropriate ESH and Science personnel, with other Sanford Laboratory resources identified as appropriate (e.g., Engineering, Operations, etc.).

## 8.1. Facility Reviews

1. **Facility Transition Management:** Following changes to Sanford Laboratory facilities a facility transition management plan is developed (see References Section), in which the facility status is reviewed to ensure that the facility will support Experiment equipment and activities. This review may take place in a staged manner, aligned with different phases. Experiments may propose activities prior to the formal Certificate of Occupancy being issued by the Authority Having Jurisdiction (AHJ), which for Sanford Laboratory is the City of Lead. The Facility Transition Manager coordinates with the AHJ to determine requirements for phased occupancy; the formal Certificate of Occupancy is required by the Operation phase (and possibly sooner based on assessment).
2. **ESH Facility Review:** Sanford Laboratory ESH personnel may conduct a facility review such as a “Pre-Startup Safety Review” (see References section).
3. **Site-Specific Materials:** Science personnel are responsible for coordinating with Sanford Laboratory representatives (ESH, Engineering, Operations, etc.) to review and compile site-specific materials prior to significant Experiment activities in a given location or facility. In some cases, interpretations of Sanford Laboratory policy may be necessary, and Science representatives will also review and facilitate Sanford Laboratory consideration of requested policy waivers (e.g., PPE waivers for certain activities/areas based on risks and hazards) or specific policy interpretations.

**8.2. Walk-Through Inspection:** The Science Director (or designee) may coordinate a walk-through inspection prior to one or more phases of an Experiment’s implementation, typically to review hardware installations and ensure hazards are appropriately described and accounted for in documentation. Collaborations are also encouraged to conduct their own walk-through inspections, leveraging institutional expertise in relevant areas.

**8.3. Monitoring:** The standard Sanford Laboratory work planning and control process may specify that Sanford Laboratory experts be present to monitor activities during particular steps or processes. In addition, the Science Director (or designee) may coordinate a similar level of oversight during certain activities.

**8.4. Readiness Reviews:** Reviews to assess various categories of readiness may be useful throughout the course of an Experiment, including (but not limited to) the specific reviews listed below.

1. **Safety Readiness Review:** The Science Director will convene a Safety Readiness Review Committee for complex projects or those with significant hazards. One or more reviews may be held for a given Experiment and may align with specific stages or locations. A charge to the review committee will be developed by the Science Director and recommendations or action items resulting from reviews are tracked using Sanford Laboratory database tools. As necessary, the Science and ESH Directors determine which recommendations need to be closed to support authorization for a specific phase of Experiment implementation; review recommendations are closed with concurrence by both the Science and ESH Directors.
2. **Operation Readiness Review:** Prior to entering the Operation phase of an Experiment, a review of activities from previous phases will be conducted by the Experiment to

assess topics such as lessons learned, incidents and associated corrective actions, procedures, training, configuration control, ergonomics, housekeeping, critical spares and maintenance planning, and ongoing staffing and Collaboration support. Typically, the Operation Readiness Review is conducted by the Experiment with Sanford Laboratory personnel as observers. Recommendations are tracked and closed by the Experiment with input from Sanford Laboratory as appropriate.

**8.5. External Evaluation Review(s):** Sanford Laboratory may convene an external advisory committee to review and evaluate Experiments when appropriate. Sanford Laboratory resources are limited, and, as needed, allocation of space and resources will be prioritized using Sanford Laboratory-developed criteria such as technical readiness, scientific impact, exploitation of Sanford Laboratory's unique characteristics, etc.

## 9. AUTHORIZATION

At a basic level, all work at Sanford Laboratory is performed according to the work planning and controls described in the Sanford Laboratory ESH Manual, in which hazard analyses for tasks are reviewed, authorized and released to be performed (also see Section 7.1.4).

**9.1. Authorization To Proceed:** To manage and provide appropriate oversight for the installation of significant equipment and any associated significant hazards, a formal Authorization-To-Proceed (ATP) is issued by the Science Director (or designee).

- 1. Initial Installation of Significant Equipment at Location or Facility:** A formal ATP will be issued for the installation of significant equipment at a location or facility in conjunction with various implementation elements prepared in the Pre-Installation phase such as project documentation (i.e., maintaining Active status), the Experiment Hazard Assessment Summary document, quantitative analyses, safety readiness review recommendations, procedures with significant hazards and/or special mitigations, special training, etc. An ATP will be issued for the installation of significant equipment at each separate location or facility, and as appropriate the ATP will reflect the status of the facility transition plan for new or renovated facilities.
- 2. Activities Requiring Multiple Implementation Elements:** A formal ATP will be issued for subsequent activities or phases that involve a combination of implementation elements, such as a new or significantly updated EPS and/or Experiment Hazard Assessment Summary document(s), quantitative analyses, safety readiness review recommendations, procedures with significant hazards and/or special mitigations, special training, new facility systems or infrastructure. An example of an activity requiring an ATP is cryogen use since it requires an ODH analysis, procedures (both facility and Experiment), special training, various inventories, facility sensors/calibrations, and possibly review recommendations. Other examples could include operation of equipment with significant hazards such as mechanical, pressure, radiation, etc.

Sanford Laboratory maintains a template of the generic authorization request memo (see References section). The Experiment request is evaluated by the Science Experiment Point of Contact. It is not necessary that all work planning elements be complete to receive over-arching authorization. For instance, some procedures may still be under review at the time of the authorization request, with the expectation that work steps for



those procedures are not authorized until the procedures are approved using the standard work planning and control approval process that includes Science and ESH representatives as well as subject matter experts as appropriate.

Following identification of the hazards for an Experiment (nominally once the Experiment Hazard Assessment Summary document has been finalized) and in conjunction with the review process as appropriate, a list of authorization steps for subsequent activities or phases will be formally developed by the Science Director (or designee) with input from Experiment representatives.

## 10. EXPERIMENT PHASES AND IMPLEMENTATION REQUIREMENTS

Different elements of the implementation documentation described above serve as the basis for authorization at different phases of an Experiment. Documentation related to activities and hazards associated with a given Experiment phase is reviewed by various Sanford Laboratory resources as described throughout this document (also see Section 11 for a summary). In addition, for each phase and for authorization step(s) associated with significant hazard(s) within phases, the main project documentation as well as ongoing operational documentation (such as training documents and various inventories) is reviewed to verify that information is complete and up-to-date. A summary of implementation requirements for each Experiment phase is presented in Table 1.

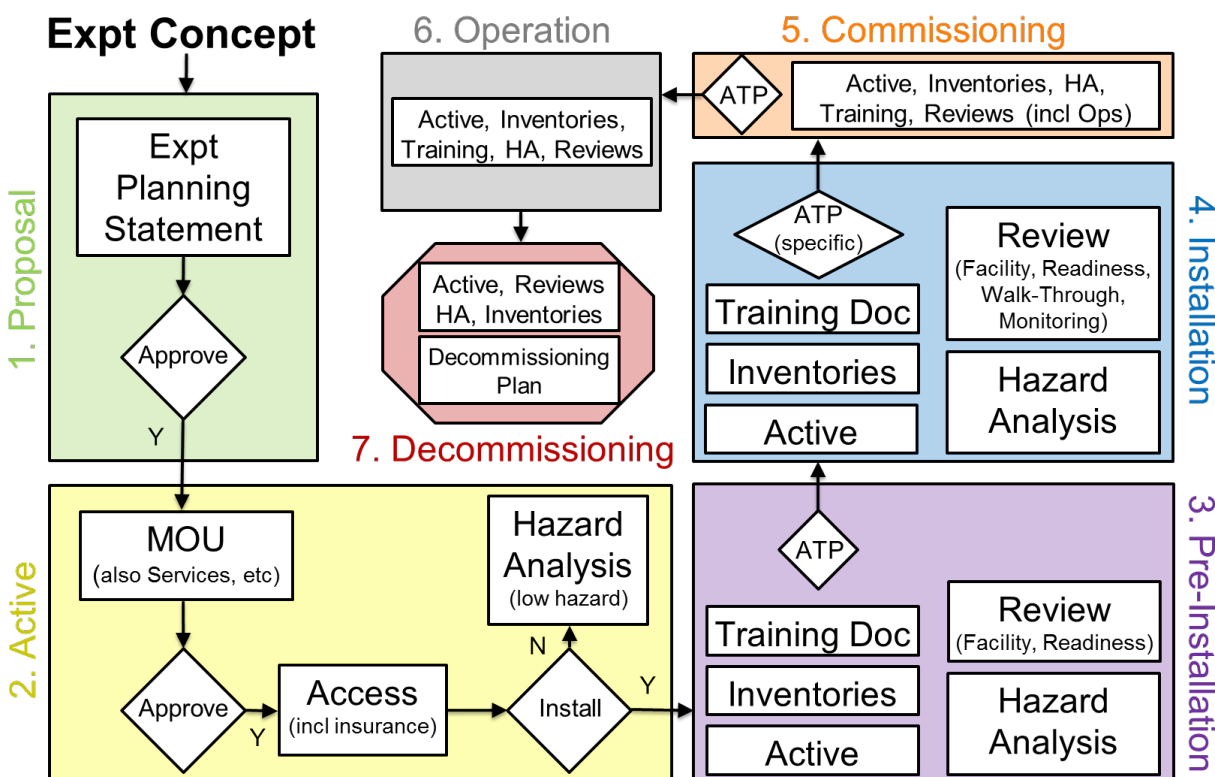
Experiment Phase	Implementation Elements	
	Deliverable to SURF	Deliverable to Experiment
<b>1. Proposal</b>	Experiment Planning Statement (EPS)	EPS receipt, incl training, additional documentation and/or review requirements <i>Optional:</i> Support Letter, Cost Estimate (Initial) for funding proposal
	Review: External evaluation (if applicable)	Yes/no
<b>2. Active</b>	Memorandum of Understanding (MOU)	Space allocation per agreement
	Services Agreement(s), NEPA (if applicable)	Services per agreement/contract
	Access: access request, acknowledgement/waiver, insurance	Training (per EPS and access request)
	Hazard analysis: procedure(s)	Approval to perform low-hazard work per work planning & controls
<b>3. Pre-Installation</b>	Project documentation renewals: MOU, services agreements(s), insurance; update EPS as necessary	Maintain “Active” status
	Hazard analysis (as applicable per EPS): EHAS, quantitative analyses, certificates, procedures(s)	Acceptance

	Training plan (if applicable per EPS)	Acceptance
	Inventories (as applicable): chemical, electrical, hoisting & rigging, pressure vessel, radiation	Approvals prior to shipping (chemicals, radioactive materials), prior to use (electrical, hoisting & rigging, pressure vessels)
	Reviews (if applicable): Facility (Transition, ESH), Safety Readiness; associated recommendations	Recommendations and associated tracking
	Request for Authorization: Initial Activities for Specific Facility	Authorization To Proceed: Initial Activities for Specific Facility; occupancy (possibly limited)
<b>4. Installation</b>	Project documentation renewals: MOU, services agreements(s), insurance; update EPS as necessary	Maintain “Active” status
	Hazard analysis (as applicable per EPS): Quantitative analyses, certificates, procedures(s)	Acceptance
	Training plan (if applicable per EPS)	Acceptance
	Inventories (as applicable): chemical, electrical, hoisting & rigging, pressure vessel, radiation	Approvals prior to shipping (chemicals, radioactive materials), prior to use (electrical, hoisting & rigging, pressure vessels)
	Reviews (if applicable): Facility (Transition, ESH), Safety Readiness, Walk-through, Monitoring; associated recommendations	Recommendations and associated tracking
	Request for Authorization: Various (activities requiring multiple implementation elements)	Authorization To Proceed: Various (activities requiring multiple implementation elements); occupancy (possibly limited)
<b>5. Commissioning</b>	Project documentation renewals: MOU, services agreements(s), insurance; update EPS as necessary	Maintain “Active” status
	Hazard analysis (as applicable per EPS): Quantitative analyses, certificates, procedures(s)	Acceptance
	Training plan (if applicable per EPS)	Acceptance
	Inventories (as applicable): chemical, electrical, hoisting & rigging, pressure vessel, radiation	Approvals prior to shipping (chemicals, radioactive materials), prior to use (electrical, hoisting & rigging, pressure vessels)
	Reviews (if applicable): Facility (Transition, ESH), Safety Readiness, Walk-through, Monitoring, Operation Readiness; associated recommendations	Recommendations and associated tracking
	Request for Authorization: Various, including Operations	Authorization To Proceed: Various, including Operations

<b>6. Operation</b>	Project documentation renewals: MOU, services agreements(s), insurance; update EPS as necessary	Maintain “Active” status
	Hazard analysis (as applicable per EPS): Quantitative analyses, certificates, procedures(s)	Acceptance
	Training plan (if applicable per EPS)	Acceptance
	Inventories (as applicable): chemical, electrical, hoisting & rigging, pressure vessel, radiation	Approvals prior to shipping (chemicals, radioactive materials), prior to use (electrical, hoisting & rigging, pressure vessels)
	Reviews (if applicable): Facility (Transition, ESH), Safety Readiness, Walk-through, Monitoring; associated recommendations	Recommendations and associated tracking
	Request for Authorization: As needed based	Authorization To Proceed: As needed
<b>7. Decommissioning</b>	Project documentation renewals: MOU, services agreements(s), insurance	Maintain “Active” status
	Hazard analysis (as applicable): Procedures(s)	Acceptance
	Inventories (as applicable): chemical, electrical, hoisting & rigging, pressure vessel, radiation	Approvals prior to shipping (chemicals, radioactive materials)
	Reviews: Walk-through, Monitoring; associated recommendations	Recommendations and associated tracking
	Experiment Decommissioning Plan	Acceptance

**Table 1.** Details of Sanford Laboratory implementation deliverables for each Experiment phase.

A flow chart highlighting key implementation elements required in various Experiment phases is shown in Figure 1. Experiments that plan to install significant equipment are managed through additional phases that include associated Authorizations To Proceed (ATP), culminating in acceptance of the Experiment Decommissioning Plan.



**Figure 1.** Summary of Sanford Laboratory implementation elements for each Experiment phase. Experiments not installing significant equipment may not need to advance past the Active phase. The Installation and Operations phases have associated Authorizations to Proceed (ATPs); other ATPs may be associated with specific facilities, equipment, significant hazards or other stages that require multiple implementation elements.

## 11. SUMMARY OF IMPLEMENTATION RESPONSIBILITIES

A summary of Experiment Implementation Program elements and associated Sanford Laboratory responsibilities is included in Table 2.

Implementation Element	Department Responsibility	
	Review	Approval/Oversight
<b>Project Documentation</b>		
<b>1. Experiment Planning Statement (EPS)</b> , also support letter and initial cost estimate	Science, Operations, Engineering, ESH; Contracts & Business Services (initial cost estimate)	Lab Director (EPS, support letter); Operations/Engineering (initial cost estimate)

<b>2. Memorandum of Understanding (MOU)</b>	Contracts & Business Services, Science	Lab Director
<b>3. Services Agreements</b> (incl General Services Agreement (GSA), contracts)	Science, Contracts & Business Services, Operations/Engineering (cost estimates); others as appropriate	Lab Director
<b>4. Insurance</b>	Contracts & Business Services, Science	Lab Director (Risk Manager)
<b>5. Decommissioning Plan</b>	Initial plan (see EPS, MOU); Final plan: ESH, Operations, Engineering, Science	Initial plan (see EPS, MOU); Final plan: ESH, Operations, Engineering, Science
<b>Environment, Safety &amp; Health</b>		
<b>1. Hazard Analysis:</b>		
<i>a. Experiment Hazard Assessment Summary (EHAS)</i>	ESH, Science; other subject matter experts as appropriate	Science (oversight)
<i>b. Quantitative Analyses</i> (incl ODH, pressure, mechanical, etc.)	ESH, Engineering; other subject matter experts as appropriate	Science (oversight)
<i>c. Procedures</i> (incl JHAs / SOPs)	ESH, Science; other subject matter experts as appropriate per Work Planning & Controls	Science (also Experiment)
<b>2. Inventories:</b>		
<i>a. Chemical</i>	Science (communication), ESH (review)	ESH (approval), Science (oversight)
<i>b. Electrical Equipment</i>	Science (communication), Operations/Engineering (inspection)	Operations/Engineering (approval), Science (oversight)
<i>c. Hoisting &amp; Rigging Equipment</i>	Science (communication), Operations (inspection)	Science (oversight)
<i>d. Pressure Vessel</i>	Science (communication), Operations (inspection)	Science (oversight)
<i>e. Radioactive Material</i>	Science (communication), Radiation Safety Officer (review), Science (review)	Radiation Safety Officer (approval), Science (oversight)
<b>3. Training</b>	ESH	Science (site-specific for Experiment areas, oversight)
<b>Reviews</b>		
<b>1. Facility: Transition, ESH, Site-Specific</b>	Transition: AHJ, Operations, Subject Matter Experts (incl Science, ESH, Operations, Engineering) ESH: ESH, Subject Matter Experts (incl Science, ESH, Operations, Engineering) Site-Specific (for Experiment areas): Science, ESH, Subject	Transition: Operations, Science (coordination) ESH: ESH, Science (coordination) Site-Specific (for Experiment areas): Science

	Matter Experts (incl Science, ESH, Operations, Engineering)	
<b>2. Walk-Through Inspection</b>	ESH, Subject Matter Experts (incl Science, ESH, Operations, Engineering)	Science (coordination/oversight)
<b>3. Monitoring</b>	ESH, Subject Matter Experts (incl Science, ESH, Operations, Engineering)	Science (coordination/oversight)
<b>4. Readiness Reviews: Safety, Operation</b>		Safety: Science (committee selection, report), ESH & Science (recommendation closure) Operation: As appropriate
<b>5. External Evaluation</b>		Lab Director & Science (committee selection, recommendation closure), Science (report)
<b>Authorization</b>		
<b>1. Initial Installation of Significant Equipment at Location or Facility</b>	Various representatives as outlined above for specific elements	Science
<b>2. Activities Requiring Multiple Implementation Elements</b>	Various representatives as outlined above for specific elements	Science

**Table 2.** Summary of Sanford Laboratory department formal responsibilities for the Experiment Implementation Program.

## 12. PRIORITIZING RESOURCES AND MANAGING CONFLICT

A number of documents and tools exist for identifying needs for limited resources at Sanford Laboratory:

- Memorandum of Understanding: As noted in Section 6.3, the MOU includes a statement that occupancy of shared laboratory space(s) is coordinated by Sanford Laboratory and any conflicts will be resolved by the SDSTA. An MOU is signed by all Experiments.
- Science Integration: A number of forums exist to promote discussion at various levels, including electronic mailing lists and regular scheduled meetings. In particular, discussion of issues related to conflicts for resources is encouraged. See also Experiment Integration & Support in References section.
- Coordination: Members of the Sanford Laboratory staff (typically members of the Science department) are assigned to act in a coordination role either as the Laboratory Coordinator or as the Experiment Point of Contact. In both cases, the individuals in those roles manage resources and the potential for conflict. See also Experiment Integration & Support in References section.
- Online databases: Online tools have been developed to manage the transportation of personnel and materials (see also Experiment Integration & Support in References section). The Trip Plan database is used to manage cage occupancy (limited to 28

people for the Yates Shaft) as well as the total underground population (see Access to Underground Memos in References section). The Underground Access Director has indicated the following priorities that apply to both the Yates and Ross Shafts: Sanford Laboratory personnel responsible for operations/maintenance/safety, Experiment personnel, new construction, and finally optional trips such as tours. The Yates Manifest database is used to manage the transportation of materials, especially limited opportunities for using the main access shaft.

The Science Director (or designee) will endeavor to manage conflicts with Experiment groups. The Sanford Laboratory Director has oversight responsibility for all facility resources and will adjudicate issues that cannot otherwise be resolved. Specific instances may require the Laboratory Director (or designee) to define allocations of the total underground occupancy to specific groups when occupancy numbers near the underground personnel limit per the Sanford Laboratory Facility Access chapter of the ESH Manual.

## 13. REFERENCE AND RELATED DOCUMENTS

### 13.1. References

- Experiment Implementation Program (this document, <http://sanfordlab.org/researchers/proposal-guidelines>; also Document-34478)
- Experiment Planning Statement Form <http://www.sanfordlab.org/researchers/proposal-guidelines>; also Document-34460
- Experiment Memorandum of Understanding Template <http://www.sanfordlab.org/researchers/proposal-guidelines>; also Document-69417
- Sanford Laboratory ESH Manual <http://www.sanfordlab.org/esh>; also Collection-15104
- Visitor Information: <http://sanfordlab.org/facility/visitor-information>
- Acknowledgement of Risk and Waiver: <http://sanfordlab.org/document/riskwaiver>; also (Document-132332)
- Experiment Decommissioning Plan Template (Document-125942)
- Experiment Integration and Support (Document-135416)
- Experiment Hazard Assessment Summary Template (Including Worksheet) (Document-98635)
- Work Planning & Controls (Document-73320)
- Hazard Analysis form (Document-70150); also Job Hazard Analysis form (Document-71800), Standard Operating Procedure form (Document-71464)
- Chemical Inventory Template (Document-58346)
- Electrical Equipment Inventory Template (Document-82383)
- Hoisting & Rigging Inventory Template (Document-150399); also Construction EHS Manual (Document-88061)
- Pressure Vessel Inventory Template (Document-138142); also Construction EHS Manual (Document-88061)
- Radioactive Materials Inventory Template (Document-82391)
- Experiment Training Matrix Example (Document-98644)
- Facility Transition Management Plan (Document-98261)
- Pre-Startup Safety Review (Document-73331)
- Experiment Authorization To Proceed Request Memo Template (Document-127061)

- Access to Underground Memos (Collection-13097)

### 13.2. Related Documents

None

## APPENDIX

Schematic showing routes for communication and authorization. Solid lines indicate formal responsibility; informal communication is also encouraged between different groups.

