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Clemson University

Energy Innovation Center

**Safety Manual**

**SM-01**

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# Scope

This manual outlines the policies, procedures and protocols to assist in the development and maintenance of a safe working environment within the Energy Innovation Center.

## References

This Safety Manual has been developed to align with federal, state and local regulations, such as OSHA, NFPA, and EPA guidelines.

# Safety Policy

The Energy Innovation Center is committed to providing a safe and healthful environment for visitors, students, faculty, and staff. Clemson promotes a proactive Environmental, Health and Safety (EHS) culture within the realms of education, research, and testing, where everyone is responsible for the safety and health of others as well as themselves. The participation of employees, students, and contractors provides support to the EHS process through a continuous improvement cycle. Actively practicing and adhering to the EHS protocols will lead to an improved environment free from recognized hazards.

Management and supervisors will lead safety efforts by example and provide material and logistical support. Everyone is empowered, expected, and encouraged to participate in safety and health efforts. EHS excellence can only be achieved through teamwork. Together, we will take every reasonable action to control our risk.

Improving our EHS process by conforming to the best practices known is reflective of our operations. EIC’s EHS matters arise from specific factors associated within the unique environment of research. This environment warrants regular attention and action to assure our EHS effort is one that is understood, appropriate, and effective.

# System Implementation

The EIC safety system utilizes a continuous improvement model to ensure that the system procedures and processes are properly aligned with the safety objectives of the system as well as federal, state and local regulations. This continuous improvement model involves four steps: Plan, Do, Check, Act. This safety manual will define the requirements of each of these steps to ensure the highest quality of the safety system.



Figure 1: The continuous improvement cycle utilized as part of the safety system.

**Identify: Opportunities and Weaknesses**

* Employee feedback
* Solicit non-employee feedback
* Safety Culture
* Risk Register

**Plan: How to Implement the Changes**

* Policy and procedures
* Safety Manual, Standard Operating Procedures, Forms
* External consulting

**Execute: Action Items**

* Train employees
* Identify roles and responsibilities
* Deliberate implementation steps

**Review: System Verification**

* Field work audits
* Safety walkthroughs
* Program audits

## Document Management

The document management strategy involves the hierarchy of documents as outlined in Figure 2. The hierarchy illustrates that the Safety Manual (SM) is the primary document with the Standard Operating Procedures (SOPs) referenced. To enable the procedures and documentation of the safety system, there are Forms associated with SOPs and the subsequent records the completed forms create.

## Document Locations

Figure 2: Safety System Hierarchy of Documents

### Safety Manual

The current revisions of the Safety Manual, Standard Operating Procedures, and Forms will be stored under the Safety Manual library on the EIC SharePoint site: [https://clemson.sharepoint.com/teams/EIC/Safety Manual/](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual)

### EHS Records

#### All records of completed forms are stored under the EHS Records library on the EIC SharePoint site: [https://clemson.sharepoint.com/teams/EIC/Safety Records/](https://clemson.sharepoint.com/teams/EIC/Safety%20Records)

### Safety Audits

#### All audits will be recorded in the Audits list of the EIC SharePoint site: <https://clemson.sharepoint.com/teams/EIC/Lists/Internal%20Audits/AllItems.aspx>

### Incident Investigation and Near Miss Reports

All incident investigation and near miss reports will be stored un-modified on the safety steering committee SharePoint site. Abridged versions of the reports approved for release by the SSC shall be placed into the EHS Records library on the EIC SharePoint site and any action items from the Incident Investigation and Near Miss report shall be documented and tracked in the RACI/PAR list.

# Roles and Responsibilities

## EIC Director

* Serves as the oversight of the complete safety program at the EIC
* Provides the resources required to implement the safety program
* Commits the personnel time required to implement the safety program
* Accountable for ensuring audits of the safety program are scheduled and completed
* Accountable for ensuring all employees have the training and records required

## Safety Steering Committee

* Responsible for approval of the Safety Manual, Standard Operating Procedures, and Forms
* Responsible for maintaining the EIC risk register
* EIC Director serves as a member of the Safety Steering Committee
* The Lowcountry Safety Manager serves as a member of the Safety Steering Committee

## Lowcountry Safety Manager

* Assists in the continuous improvement of the safety system
* Assists in developing and coordinating the training for the safety program
* Ensures that all training is available to employees as required by supervisors
* Responsible for entering the training records into the database for all employees
* Assists in developing and coordinating system audits

## Supervisor

* Defines the training requirements of their employees
* Responsible for ensuring employees attend and complete training as required
* Periodically reviews the training status for all of their employees
* Conducts and documents periodic observations of employees working to ensure compliance with this safety program

## Employee

* Responsible for compliance with all aspects of the safety program
* Responsible for completing hazard and risk assessments associated with their work
* Perform work only to the level of training provided
* Report safety concerns to their supervisor and/or EIC Director
* Perform any delegated duties related to safety from their supervisor and/or EIC Director

## Students

* Responsible for compliance with all aspects of the safety program
* Perform work only to the level of training provided
* Report safety concerns to their supervisor and EIC Director

## Non-employees

* Responsible for adhering to the Non-Employee Safety Checklist
* Responsible for their own safety

# Standard Operating Procedures

## Barricades and Signage

[SOP-051-EIC Barricades and Signage](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/SOP-051-EIC%20Barricade%20and%20Signage.docx)

Purpose:

This Barricade and Sign Standard Operating Procedure is to define the design, application and use of signs and barricades and the color of these devices at the EIC. These devices are intended to be used to define specific hazards of a nature such that failure to designate them may lead to accidental injury or property damage.

## Bloodborne Pathogens

[SOP-052-EIC Bloodborne Pathogens](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/SOP-052-EIC%20Bloodborne%20Pathogens.docx)

Purpose:

The Energy Innovation Center is committed to the safety and health of its employees by prohibiting the infection and spread of bloodborne pathogens. Therefore, the following Bloodborne Pathogens Safety Program is presently in effect and regular review takes place to assure effectiveness.

Forms:

[F-058-EIC Hepatitis B Waiver](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/F-058-EIC%20Hepatitus%20B%20Waiver.docx)

## Confined Space Entry

[SOP-053-EIC Confined Space Entry](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/SOP-053-EIC%20Confined%20Space%20Entry.docx)

Purpose:

The Energy Innovation Center is committed to the safety and health of its employees. Therefore, employees are provided with confined space and permit required confined space training to be able to distinguish between the two.

## Crane and Rigging

[SOP-054-EIC Crane and Rigging](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/SOP-054-EIC%20Crane%20and%20Rigging.docx)

Purpose:

This Crane and Rigging Standard Operating Procedure is to establish safe work practices and inspection procedures to help ensure that the operation of overhead cranes, as well as the contractor community, are protected from potential hazards associated with the movement of equipment and material using a crane, hoist, rigging and related equipment.

Forms:

[F-056-EIC Crane Inspection Checklist](https://clemson.sharepoint.com/teams/SafetySteeringCommitee/Shared%20Documents/Safety%20System%20Documents/Safety%20Policies%20and%20Programs/Archive/OLD%20SAFETY%20DOCUMENTS-SEE%20EIC%20SM/F-056-EIC%20Crane%20Inspection%20Checklist.docx)

[F-057-EIC Critical Lift Plan](https://clemson.sharepoint.com/teams/SafetySteeringCommitee/Shared%20Documents/Safety%20System%20Documents/Safety%20Policies%20and%20Programs/Archive/OLD%20SAFETY%20DOCUMENTS-SEE%20EIC%20SM/F-057-EIC%20Critical%20Lift%20Plan.docx)

## Electrical Safety

[SOP-055-EIC Electrical Safety Program](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/SOP-055-EIC%20Electrical%20Safety%20Program.docx)

Purpose:

This program establishes work standards to reduce hazardous electrical exposures to personnel and ensure compliance with regulatory requirements applicable to electrical systems. Working on equipment in a de-energized state is required unless de-energizing introduces an increased hazard or is infeasible. This program ensures that only qualified electrical workers perform electrical work and defines how to safely perform this work.

Forms**:**

[F-050-EIC Staff QEW Qualification](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/F-050-EIC%20Staff%20QEW%20Qualification.docx)

[F-051-EIC Student QEW Qualification](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/F-051-EIC%20Student%20QEW%20Qualification.docx)

[F-052-EIC Electrical Lab Project Assessment](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/F-052-EIC%20Electrical%20Lab%20Project%20Assessment%20Form.docx)

[F-053-EIC Electrical Safety Task Analysis](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/F-053-EIC%20Electrical%20Safety%20Task%20Analysis%20.docx)

[F-054-EIC Complex Lockout](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/F-054-EIC%20Complex%20Lockout.docx)

[F-055-EIC Energized Work Permit](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/F-055-EIC%20Energized%20Work%20Permit.docx)

[F-063-EIC Lock Removal](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/F-063-EIC%20Lock%20Removal.docx)

## Fall Protection

[SOP-056-EIC Fall Protection](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/SOP-056-EIC%20Fall%20Protection%20Procedure.docx)

Purpose:

The Fall Protection Standard Operating Procedure is to help employees identify, evaluate, control, and reduce exposures to fall hazards. Fall Protection is the process of protecting employees when working in elevated situations. Whenever possible the best fall protection is to engineer out the fall hazard.

## Safety Task Analysis

[SOP-057-EIC Safety Task Analysis](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/SOP-057-EIC%20Safety%20Task%20Analysis.docx)

Purpose:

The purpose of this procedure is to establish the necessary requirements and components for implementing an effective Safety Task Analysis (STA) program at the EIC facility. An effective STA program will reduce the potential for incidents and/or injuries via safe work procedure development.

Forms**:**

[F-060-EIC Safety Task Analysis](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/F-060-EIC%20Safety%20Task%20Analysis.docx)

## Spill Prevention Containment and Countermeasures

[SOP-058-EIC Spill Prevention Containment and Countermeasures](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/SOP-058-EIC%20Spill%20Prevention%20Containment%20and%20Countermeasures.docx)

Purpose:

The purpose the procedure is to define the actions necessary to comply with EPA standards in accordance with the established Spill Prevention, Control and Countermeasures Plan for the EIC.

## Hot Work

[SOP-059-EIC Hot Work](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/SOP-059-EIC%20Hot%20Work.docx)

Purpose:

The objective of this program is to prevent personal injury as well as property damage at CURI by providing specific protocol regarding Hot Work and to ensure that each employee is adequately trained and fully aware of safety procedures associated with Hot Work. CURI is dedicated to the protection of our employees and property from loss. It is our responsibility to provide a safe working environment, and the employees share the responsibility of working safely.

## Reporting Systems and Incident Investigations

[SOP-060-EIC Reporting Systems and Incident Investigations](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/SOP-060-EIC%20Reporting%20Systems%20and%20Incident%20Investigations.docx)

Purpose:

Clemson Universities Energy Innovation Center (EIC) is committed to the safety and health of its employees, faculty and guests by investigating any and all events that may have caused loss or almost resulted in loss. In addition, the hazard reporting process within this Standard Operating Procedure defines efforts to correct identified exposures. This is important to prevent exposures and incident recurrence. The following protocol is presently in effect and an effort of responding, resolving and reassessing will take place to assure effectiveness.

Forms**:**

[F-064-EIC Incident Report Form](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/F-064-EIC%20Incident%20Report%20Form.docx)

## Non-Employee Visitors and Contractors

[SOP-061-EIC Non-Employees Visitors and Contractors](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/SOP-061-EIC%20Non-Employees%20Visitors%20and%20Contractors.docx)

Purpose:

The purpose of this protocol is to outline the necessary actions and steps to assure successful safety communication between the EIC and visitors, non-employees, and contractors.

Forms**:**

[F-062-EIC Visitor Tour](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/F-062-EIC%20Visitor%20Tour.docx)

[F-061-EIC Non-Employee Pre-Work Checklist](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/F-061-EIC%20Non-Employee%20Pre-Work%20Checklist.docx)

## Access Control

[SOP-062-EIC Access Control](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/SOP-062-EIC%20Access%20Control.docx)

Purpose:

This policy is to unify and enhance the personal safety of the EIC community as well as provide adequate security of university and customer property. A successful program is dependent upon every member of the community being diligent in the stewardship of physical access devices and situationally aware of their surroundings. The implementation of physical access controls must be balanced with the university’s commitment as an open and welcoming place to study, teach, research, and collaborate.

## Powered Industrial Truck

[SOP-063-EIC Powered Industrial Trucks](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/SOP-063-EIC%20Powered%20Industrial%20Trucks.docx)

Purpose:

The purpose of this procedure is to reduce the risk of physical injury or property damage in areas where powered industrial trucks are in operation.

Forms**:**

[F-066-EIC Powered Industrial Truck Inspection Form](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/F-066-EIC%20Powered%20Industrial%20Truck%20Inspection%20Form.xlsx)

## Personal Protective Equipment

[SOP-064-EIC Personal Protective Equipment](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/SOP-064-EIC%20Personal%20Protective%20Equipment.docx)

Purpose:

In order to protect each person that works or visits the Energy Innovation Center, we will take action for compliance with regulations and protection of people. Appropriate protective equipment is required in areas where there may be a risk of injury or exposure to hazardous substances or conditions. This program defines how the EIC is to achieve objectives to protect people from various hazards encountered in the areas where they may work or visit.

Forms**:**

[F-069-EIC PPE Assessment Form](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/F-069-EIC%20PPE%20Assessment.docx)

## Machinery, Tools, and Welding Operation

[SOP-065-EIC Machinery Tools and Welding Operation](https://clemson.sharepoint.com/teams/EIC/Safety%20Manual/SOP-065-EIC%20Machinery%2C%20Tools%20and%20Welding%20Operation.docx)

Purpose:

The purpose of this procedure is to address the EIC requirements for the operation of machinery, hand tools, portable powered tools, ladders, welders and cutters.

* Subpart D: Ladders, Rolling Stairs and Scaffolding
* Subpart O: Machinery and Machine Guarding
* Subpart P: Hand and Portable Powered Tools
* Subpart Q: Welding, Cutting and Brazing

## Emergency Action Plan

[Emergency Action Plan](file://ces-curi.clemson.edu/curi/curi/Safety%20CURI/EHS%20Programs/Emergency%20Action%20Plans/)

Purpose:

This program establishes minimum guidelines to prevent injury, loss of life or property damage due to emergency situations and/or proper procedures to follow to respond to such an event here at the CURI campus. This plan will prepare employees for dealing with emergency situations and meet regulatory requirements.

# Training and Qualifications

The tables below outline the training courses and the qualifications, authorizations, and certifications needed for successful implementation of the safety system.

## Training Requirements

Table 1: Safety System Training Courses

|  |  |
| --- | --- |
| Training Topic | Interval |
| Arc Flash Hazard and Controls | 3 years |
| Barricade and Signage | 3 years |
| Basic Electricity | Once |
| Bloodborne Pathogens | 1 year |
| Certified Crane Operator | 2 years |
| Contractor Management | 3 years |
| CPR and First Aid | 2 years |
| Crane & Rigging | 3 years |
| Electrical Safety | 3 years |
| Emergency Action Plan | 2 years |
| Ergonomic Controls | 3 years |
| Fall Protection | 3 years |
| Forklift | 3 years |
| Hand tool safety | 3 years |
| Hazard Communication  | 1 years |
| Heat Stress | 2 years |
| Hot Work | 2 years |
| Lockout | 3 years |
| Orientation | Once |
| Personal Protective Equipment | 3 years |
| Portable Fire Extinguishers | 1 year |
| Aerial Lifts | 3 years |
| Release methods | 1 year |
| Safety Task Analysis | 3 years |
| Shop Safety | 3 years |
| Spill Prevention Countermeasures and Control | 1 year |

## Qualifications, Authorizations, and Certifications

Table 2: Qualifications, Authorizations, and Certifications Table

|  |  |  |
| --- | --- | --- |
| Qualification | Guiding SOP | Method |
| Qualified Electrical Worker (QEW) | Electrical | Internal Training |
| Qualified Student Electrical Worker (QSEW) | Electrical | Internal Training |
| Designated Crane Operator | Crane and Rigging | Internal Training |
| Certified Crane Operator | Crane and Rigging | External Certification |
| CPR and First Aid | Electrical | External Certification |
| Powered Industrial Trucks |  | Internal Training |
| Fall Protection |  | Internal Training |

# System Verification

System verification is accomplished through both procedure audits of the Safety Manual, Standard Operating Procedures and Forms on a revolving 36 month interval as well as field work audits to ensure the procedures are being appropriately applied to achieve a safe working condition for everyone at the EIC.

## Procedure Audits

Table 3: Safety System Procedure Audit Table

|  |  |  |
| --- | --- | --- |
| Program Procedures | Audit Interval (Months) | Audit Responsibility |
| SM-01 Safety Manual  | 36 | Safety Steering Committee |
| SOP-051-EIC Barricade and Signage | 36 | Safety Steering Committee |
| SOP-052-EIC Bloodborne Pathogens | 36 | Safety Steering Committee |
| SOP-053-EIC Confined Spaces | 36 | Safety Steering Committee |
| SOP-054-EIC Crane and Rigging | 36 | Safety Steering Committee |
| SOP-055-EIC Electrical Safety | 36 | Safety Steering Committee |
| SOP-056-EIC Fall Protection | 36 | Safety Steering Committee |
| SOP-057-EIC Safety Task Analysis | 36 | Safety Steering Committee |
| SOP-058-EIC Spill Prevention Control and Countermeasures | 36 | External |
| SOP-059-EIC Hot Work | 36 | Safety Steering Committee |
| SOP-060-EIC Reporting Systems and Incident Investigations | 36 | Safety Steering Committee |
| SOP-061-EIC Non-Employee Visitors and Contractors | 36 | Safety Steering Committee |
| SOP-062-EIC Access Control | 36 | Safety Steering Committee |
| SOP-063-EIC Powered Industrial Truck | 36 | Safety Steering Committee |
| SOP-064-EIC Personal Protective Equipment | 36 | Safety Steering Committee |
| SOP-065-EIC Hand and Power Tools | 36 | Safety Steering Committee |

## Field Audits

Table 4: Field Work Audit Table

|  |  |  |
| --- | --- | --- |
| Field Audits | Audit Interval (Months) | Audit Responsibility |
| QEW Field Work Audit | 12 | Individual QEWs |
| Lockout Program and Procedure Audit | 12 | Designated QEW |
| PPE Assessment | 12 | Lowcountry Safety Manager |
| Annual SPCC Review | 12 | Lowcountry Safety Manager |
| Monthly SPCC Inspections | 1 | Lowcountry Safety Manager |
| Monthly Fire Extinguisher Inspection | 1 | Building Security Coordinator |
| Annual Emergency Lighting and Exit Signage Inspection | 12 | Building Security Coordinator |
| Access Control Lists | 6 | Building Security Coordinator |
| Quarterly Safety Audit | 3 | Assigned by EIC Director |

# Revision History

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Revision | Date | Summary of change | Author | Approver |
| A | 5/18/2021 | Initial Revision | J. Curtiss Fox | Kurt RayburgDarrick PetersKonstantin BulgakovMeredyth CrichtonJesse LeonardCurtiss FoxRandy Collins Jim Tuten |
|  |  |  |  |  |