Revision Number	Revision Description	Revised By	Revision Date
New			
1	New Procedure		10/15/2019
	Reviewed Procedure	G. Dawson	12/10/2020
	Updated Procedure with Electrical Rescue Plan	G. Dawson	05/11/2021
2	Updated information from former BMEHS.002.007 Electrical Safety. In addition, this procedure replaces the former BMEHS.002.033 Energized Electrical Work.	G. Dawson	6/09/2021

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4.12.1 Reference to Superior Document

North American Implementation Document **N-ID-OSA 036** and North American requirements document **N-R-OSA 001**: *Occupational Safety*, Section 1.7.10:

Electrical Safe Work

4.12.2 Purpose

The purpose of this document is to establish requirements for an Electrical Safe Work Program (ESWP) at BASF Beaumont and for BASF employees, Contingent Employees, and Contractor Employees performing tasks with Electrical Hazards.

4.12.3 Definitions

Arc Flash Hazard
a dangerous condition associated with the possible release of energy caused by an electric arc. An arc flash hazard may exist when energized electrical conductors or circuit parts are ex- posed or when they are within equipment in guarded or enclosed condition, provided a person is interacting with the equipment in such a manner that could cause an electric arc. See BMEHS-002.002: *Personal Protective Equipment*, Appendix B: Tasks with Arc Flash Hazard Potential for examples of activities that could pose an arc flash hazard. **NOTE:** Under normal operating conditions, enclosed energized equipment that has been properly installed and maintained is not likely to pose an arc flash hazard.

Arc Flash Risk Assessment
a study investigating a worker's potential exposure to incident energy, conducted to determine the arc flash protection boundary and the appropriate protective clothing and equipment

BASF technical guideline **N-G-EI 915** outlines methods, assumptions, and deliverables.

Arc-Rated or **Arc Rating**
the value attributed to materials that describes their performance to exposure to an electrical arc discharge

The arc rating is expressed in cal/cm^2 (J/cm^2) and is derived from the determined value of the arc thermal performance value (ATPV) or energy of break open threshold (EBT) (should the material system exhibit a break open response below the ATPV value). Arc rating is reported as either ATPV or E_{BT}, whichever is the lower value.

NOTE: Arc-rated clothing or equipment indicates that it has been tested for exposure to an electric arc. Flame-resistant (FR) clothing without an arc rating has not been tested for exposure to an electric arc. All arc-rated clothing is also flame-resistant (FR). ATPV, E_{BT}, and breakopen response are defined in ASTM F1959/F1959M: *Standard Test Method for Determining the Arc Rating of Materials for Clothing*.

Boundary, Arc Flash Protection
When an arc flash hazard exists, this is an approach limit at a distance from a prospective arc source within which a person could receive a second degree burn if an electrical arc flash were to occur. Informational Note: A second degree burn is possible by an exposure of unprotected skin to an electric arc flash above the incident energy level of 1.2 cal/cm^2 (5 J/cm^2).

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3. Definitions continued

Boundary, Limited Approach
This is a distance from exposed energized electrical conductors or circuit parts within which a shock hazard exists. See BMEHS-000.022: *Personal Protective Equipment*, Appendix A: *Approach Boundaries for Shock Protection*.

Boundary, Restricted Approach
This is a distance from an exposed energized electrical conductor or circuit part within which there is an increased likelihood of shock, due to electrical arc-over combined with inadvertent movement, for personnel working near the energized electrical conductor or circuit part. See BMEHS-002.022: *Personal Protective Equipment*, Appendix A: *Approach Boundaries for Shock Protection*.

Contingent Employee
A non-BASF employee for whom BASF provides supervision of his or her day-to-day activities and direction as to how an activity is to be performed.

Contractor Employee
An individual engaged by or through a third party to perform services principally for the third party and whose day-to-day activities are directed by the third party, not by BASF.

Current
Electrical current is measured in amperes (amps). The measurement used in relation to electric shock is the millampere (ma, 0.001 ampere).

De-energized
Disconnected from all energy sources and containing no residual or stored energy; free from any electrical connection to a source of potential difference and from electrical charge; not having a potential different from that of the earth.

Electrical Hazard
A dangerous condition such that contact, or equipment failure can result in electric shock, arc flash burn, thermal burn, or blast.

Electrically Qualified Person
A worker who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify and avoid the hazards involved with the specific tasks the person will perform
NOTE: A person is “qualified” regarding certain equipment or tasks in the workplace, but not necessarily all electrical equipment or tasks.

Electrically Safe Work Condition
A state in which an electrical conductor or circuit part has been disconnected from energized parts, locked/tagged in accordance with corporate procedure **BMEHS-002.005: *Control of Hazardous Energy – Lock, Tag and Try*,** tested to ensure the absence of voltage, and grounded when determined necessary.

3. Definitions continued

Emergency Situation
For the electrical safe work program, an "emergency situation" is one that meets the following conditions:

4.12.3.1 interrupts life-support equipment
4.12.3.2 de-activates emergency alarm systems
4.12.3.3 shuts down hazardous location ventilation equipment
4.12.3.4 creates an imminent threat to personnel or environmental safety

Energized
Electrically connected to, or is, a source of voltage.

Exposed
Non insulated energized electrical equipment located such that an individual could accidently come in contact via any body part or tool.

Incident Energy
The amount of energy impressed upon a surface, a certain distance from the source, generated during an electrical arc event. Incident energy is expressed in calories or joules per centimeter squared (cal/cm^2 or J/cm^2).

Over-dutied
condition when the short circuit ampacity is greater than the interrupting and/or withstand rating of the electrical equipment.

Overhead Power Line
Electrical conductors that are not supported in conduit or cable tray systems regardless of voltage and whether they are insulated or uninsulated conductors
They are typically aerial cables supported by independent poles or supports connected to buildings.

Personal Protective Equipment (PPE)
Equipment worn to protect the eyes, face, head, hearing, lungs, body, and extremities from injury or illness resulting from chemical exposure and physical hazards.

Informational Note: The minimum electrical PPE requirements are intended to protect a person from arc flash and shock hazards. While some situations could result in burns to the skin, even with the protection selected, burn injury should be reduced and survivable. Due to the explosive effect of some arc events, physical trauma injuries could occur. The PPE requirements do not address protection against physical trauma other than exposure to the thermal effects of an arc flash.

Resistance
Resistance is any condition that retards current flow. It is measured in ohms..

Shock Hazard
A dangerous condition associated with the possible release of energy caused by contact or proximity to energized electrical conductors or circuit parts.

Shock Risk Assessment
A study conducted to identify the voltage to which personnel will be exposed, the limited and

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3. Definitions continued

restricted approach boundaries, and the appropriate protective measures, including protective clothing and equipment to minimize the possibility of electric shock to personnel.

Single-Line Diagram
A diagram that shows by means of single lines and graphic symbols the course of an electric circuit or system of circuits and the component devices or parts used in the circuit or system.

Unqualified Person
A person who is not an electrically qualified person.

Voltage
Voltage is measured in volts (v). Low voltage is normally 600 v or less. Potentially hazardous fvoltage is between 24 v and 600 v. Potentially lethal voltage is 50 v and above.

Voltage, Nominal
A nominal value assigned to a circuit or system for conveniently designating its voltage class (e.g., 120/240 volts AC, 480Y/277 volts AC, 125 volts DC) NOTE: The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment.

Watt
Watt is the quantity of electricity that is consumed. It is determined by multiplying volts times amps.

Working On (energized electrical conductors or circuit parts)
Intentionally coming into contact with energized electrical conductors or circuit parts with the hands, feet, or other body parts with tools, probes, or with test equipment, regardless of the personal protective equipment (PPE) a person is wearing.

There are two (2) categories of "working on:" *Diagnostic* (testing) is taking readings or measurements of electrical equipment with approved test equipment that does not require making any physical change to the equipment. *Repair* is any physical alteration of electrical equipment (such as making or tightening connections, removing or replacing components, etc.).

4. Requirements

4.1 General Safe Work Requirements

4.1.1. All electrical equipment and tools must be designed for the classification of the area in which they are installed or used. Intrinsically safe equipment can be used in any classified area as it is not capable of releasing sufficient electrical or thermal energy to cause ignition.

4.1.2. All portable electrical equipment and tools used by workers shall have power supplied through a portable ground-fault circuit interrupter (GFCI) or through a GFCI type circuit breaker.

4.1.3. No extension cord, tools or electrical equipment shall be used if the ground prong has been removed from the three prong plug or the means of grounding has been defeated.

4.1.4. Electrical grounding and bonding shall be provided and regularly tested

4.1.5. All electrical equipment must be locked-out and tagged-out before any work is performed on the equipment.

4.1.6. All current carrying devices should be enclosed by a cabinet, within a room, building or fenced area. Warning signs must be installed near all entrances to these cabinets or areas and entrances must be locked.

4.1.7. Use electrical equipment only for the purposes and under the conditions for which it is intended

4.1.8. All switches must have approved voltage and ampere ratings compatible with intended use.

4.1.9. Inspect and test overcurrent devices frequently (at least monthly) to ensure they are in good working order.

4.1.10. In control equipment, arrange switchboards with lockout capabilities for both AC and DC circuits. Instruments will be readable, easily accessible, well lighted, locked when not in use, arranged logically, and guarded against accident shock.

4.1.11. Electrical motors will be mounted so they do not interfere with the normal movement of personnel or materials.

4.1.12. Motors will be regularly maintained and protected from excessive dust, stray oils, moisture, misalignment, vibration, overload, and friction.

4.1.13. Extension cords will be inspected before every use for wear, fraying, or breakage in the line and taken out of service if defects are found.

4.1.14. Splicing extension cords is not permitted.

4.1.15. Do not connect or disconnect extension cords with an electrical load on.

4.1.16. Only trained and experienced personnel will install, test, and repair grounds.

4.1.117. Do not use double-insulated tools where there is water and a ground loop present or where dampness, steam, or potential wetness can occur. In these conditions, they must be protected by a GFCI.

4.1.18. Do not install standard electrical equipment in locations where flammable gases, vapors, dusts, or other easily ignitable materials are present. Sparks and electrical arcs can originate from such equipment causing fires and explosions, along with serious injuries.

4.1.19. Before inspections, electrical equipment will be deenergized, whenever possible, and the systems locked and tagged (see Lockout/Tagout/Try Procedure). Rotating and intermittent-start equipment will be disconnected and blocked before being inspected

4.1.20. Inspectors will be thoroughly trained and properly protected before inspecting high-

voltage equipment.

4.1.21. Only trained and experienced electricians will make repairs on electrical circuits and apparatus.

4.1.22. For maintenance work, use only high-grade electrical equipment listed as standard by a qualified authority.

4.1.23 Maintenance workers must observe all safety practices (such as lockout/tagout) and use appropriate protective gear.

4.2 Equipment Installation

4.2.1 Existing electrical equipment must meet applicable national and local code requirements.

4.2.2 Existing electrical equipment shall meet the BASF Technical Rule(s) regarding equipment labeling per **N-R-EI 050M.**

4.2.3 When situations are recognized that do not meet applicable national and local code requirements or where personnel are required to interact with equipment with incident energy greater than 40 cal/cm^2 at the working distance, a temporary management of change (MoC) must be used and appropriate interim actions taken until the final resolution can be implemented.

- Common non-compliance issues include but are not limited to the following:
  - over-dutied equipment
  - working clearance
  - tap rule violations
  - cable sizing
  - protective device coordination
  - GFEP – ground fault equipment protection
  - cable tray loading
  - transformer protection
  - area classification compliance
  - equipment labeling

4. Requirements continued

4.2 Equipment Installation continued

4.2.3 continued

- Suggested interim actions for over-dutied equipment or equipment where personnel are required to interact with incident energy greater than 40 cal/cm^2 at the working distance are shown below:
  - Communicate the hazard to affected personnel.
  - Limit personnel traffic around equipment.
  - Use remote starting/racking equipment to allow tasks to be performed at a greater distance from arc flash source.
  - De-energize equipment upstream of equipment. For example, de-energize at the primary side of a transformer instead of at the secondary feeder breaker.

4.2.4 Any new or modified electrical equipment shall be installed to meet BASF Mandatory Technical Rules and applicable national and local codes.

4.3 Maintenance

4.3.1 Single-line diagrams and panelboard schedules shall be maintained to accurately represent the installed electrical equipment.

4.3.2 Installed electrical equipment shall be maintained in accordance with manufacturer's recommendations, applicable BASF Technical Rules, and industry codes and standards.

4.3.3 Maintenance shall be documented**.**

4.3.4 Maintenance documentation shall be retained in accordance with BASF Records Management Policy, **BC037**, record class code FAC1060.

4.4 Demolition

Before demolition activities begin a thorough review of potentially energized sources in accordance with **N-G-EI-605**, Annex 30 and **N-G-EI 645**, Cable Cutting for Demolition or Repair for 600V or Less.

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4. Requirements continued

4.5 BASF and Contingent Workers Training

4.5.1 Before performing tasks with electrical hazards, personnel shall receive training.

4.5.1.1 Individual workers shall be assigned to one of the training levels defined in Appendix A (Electrical Training Matrix). Assignment shall be based on electrical hazard potential of tasks the worker is authorized to perform.

4.5.1.2 In cases where initial training was delivered by a supplier other than the BASF-approved suppliers listed in Appendix A, the course outline, means used to verify understanding, and the supplier's contact information must be submitted for approval. In cases where approval is not granted, personnel must receive training from one of the BASF approved suppliers listed in Appendix A as soon as possible.

4.5.2 Retraining shall be performed at intervals not to exceed three years. Additionally, personnel shall receive additional training or retraining if any of the following conditions exist:

- Supervision or field audits (see 4.12) indicate the worker is not complying with the electrical safe work program.
- Whenever new technology, new types of equipment, changes to job duties or changes in procedures are necessary.
- The worker's job duties change, such that a higher training level is required.

4.5.3 Personnel who will be conducting field audits (see 4.12) must have training equal to or greater than the level being audited.

4.5.4 BASF employees and contingent employees who are unqualified persons shall successfully complete an electrical safety computer-based training module every three (3) years.

4.5.5 Training required by this document must be documented. Training documentation shall be maintained according to BASF Records Management Policy, **BC037** record class code HUM1300. Documentation must include the following:

- trainee's name
- date(s) of attendance
- content of the training
- means used to verify understanding

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4. Requirements continued

4.6 BASF and Contractor Employers' Responsibilities

4.6.1 BASF shall inform contractor employers of the following:

- Known hazards that are related to the work performed by the contractor employer, and that might not be recognized by the contractor employer or its employees.
- Information about the facility's installation that the contractor employee needs to complete arc flash and shock risk assessments.

4.6.2 The contractor employer shall advise BASF of the following:

- any unique hazards presented by the work performed by the contractor employer
- hazards identified during work by the contractor employer that were not communicated by BASF
- the measures taken by the contractor employer to correct any violations to the facility ESWP, and to prevent such violation from recurring in the future

4.6.3 The contractor employer shall ensure each contractor employee is in- formed of the information BASF shared with the contractor employer relevant to the tasks they perform and has received training for the work they will perform**.**

4.7 Electrically Safe Work Condition

4.7.1 Energized parts to which workers may be exposed shall be placed in an electrically safe work condition before working on or near them, unless de-energizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations. Energized parts that operate at fewer than 50 Volts to ground need not be de-energized if there will be no increased exposure to electrical burns or to explosion because of electric arcs.

4.7.2 A switching plan shall be developed to create an electrically safe work condition for all equipment operating at greater than 1,000 volts. **See N- G-EI-610.**

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4. Requirements continued

4.8 Electrical Work Assessment and Energized Electrical Work Permit (EWA/EEWP)

4.8.1 When work requires a Safe Work Permit or Authorization Log (see N-ID- OSA 024, Safe Work) and involves a potential electrical hazard (arc flash or shock hazard), an electrical work assessment using Section I of Appendix B (Electrical Work Assessment/Energized Electrical Work Permit) shall be completed.

4.8.2 Based on the results of the electrical work assessment, the energized electrical work permit (EEWP) in Section II of Appendix B shall be completed, reviewed, and approved as shown in Appendix C (Electrical Work Assessment / Energized Electrical Work Permit Workflow and RACI). A copy of the approved EEWP shall be reviewed by persons performing the work prior to starting work activities and available at the work location.

4.8.3 The EWA/EEWP is not required in emergency situations**.**

4.9 Electrical Safety-Related Work Practices

4.9.1 Approach Boundaries for Shock (limited and restricted approach) and Arc Flash, shall be identified for the work being performed:

- The limited approach and restricted approach boundaries are found in BMEHS-002.022: *Personal Protective Equipment*, Appendix A: *Approach Bound- Areas for Shock Protection*.
- The arc flash boundary shall be based on calculations as defined in BASF Technical Rule **N-P-EI 915** or, for DC voltage equipment without calculations, the arc flash boundary is found in BMEHS-002.022: *Personal Protective Equipment*, Appendix C Arc Flash PPE and Arc Flash Boundaries for Direct Current (dc) Systems. NOTE: For equipment where calculations have been performed the arc flash boundary will be on the equipment label.

4.9.2 Barricades

- Barricades shall be used in conjunction with safety signs, in accordance with the site program (See **BMEHS: *General Safety Rules***), where it is necessary to prevent or limit access to work areas containing energized conductors or circuit parts.
- *Conductive barricades shall not be used.*
- Barricade placement must meet the following requirements:
  - at a distance that is the greater of the arc flash boundary or the limited approach boundary for the electrical equipment
  - If the work being performed is inside a building, but the arc flash boundary or limited approach boundary extends beyond the door of the building, then temporary signage shall be placed on the door to restrict entry into the area.

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4. Requirements continued

4.9 Electrical Safety-Relate Work Practices continued

4.9.3 Attendants

- *If barricades or signage do not provide sufficient warning and protection from electrical hazards, an attendant shall be stationed to warn and protect workers.* The attendant is to provide manual signaling and alerting to keep persons outside a work area where they might be exposed to electrical hazards.
- Attendants are required for the following work:
  - un-barricaded excavation work that may contact energized under-ground electrical equipment
  - un-barricaded work on overhead power lines
  - work within an area with exposed energized electrical equipment with fences removed or gate(s) open

4.9.4 Look-Alike Equipment

Where work performed on equipment that is in an electrically safe work condition exists in the same work area with energized equipment that is similar in size, shape, and construction, one of the following alerting techniques shall be used to prevent the electrically qualified person from interacting with the wrong equipment: safety signs and tags, barricades and/or attendants.

4.9.5 Additional Electrically Qualified Person

An additional electrically qualified person shall be required for tasks that re-quire an EEWP.

- The additional electrically qualified person must be wearing the same level of PPE as the person performing the electrical task or the proper level of PPE to de-energize the circuit, whichever is more protective.
- It is recommended, the additional electrically qualified person perform no other task, be in line-of-sight of the person(s) performing the electrical task, and preferably outside the arc flash boundary.

4.10 Personal Protective Equipment (PPE)

See **BMEHS-002.022: *Personal Protective Equipment*** for PPE requirements related to electrical tasks.

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4. Requirements continued

4.11 Overhead Electrical Lines and Equipment

See Appendix D for Safety Practices for Overhead Underground Electrical Lines.

4.11.1 When work is to be performed within the limited approach boundary of overhead electrical lines (Use the "exposed moveable conductor" column in BMEHS-002.022: *Personal Protective Equipment*, Appendix A: *Approach Boundaries for Shock Protection* to determine the limited approach boundary for overhead power lines.), one of the following actions shall be taken:

4.11.1.1 Place the line in an electrically safe working condition before work is started.

4.11.1.2 Use protective measures, such as guarding, isolating, or insulating. These precautions shall prevent workers from contacting lines directly with any part of his or her body or indirectly through conductive materials, tools, or equipment.

4.11.2 For vehicular and mechanical equipment, see **BMEHS-002-025: *Powered Mobile Platforms*** and **BMEHS-002-037: *Cranes and Derricks*** for requirements related to use near overhead power lines.

4.12 Underground Electrical Lines

See Appendix D for Safety Practices for Overhead and Underground Electrical Lines.

4.12.1 Prior to starting excavation work, the work area must be reviewed for underground electrical lines.

4.12.2 If electrical lines are identified during the pre-work review process, then complete the electrical work assessment (4.7).

4.12.3 If electrical lines are discovered during the excavation process, all work shall stop until the identity of the electrical lines is determined and appropriate actions taken to ensure safe work can continue.

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4. Requirements continued

4.13 Field Audits of Electrically Qualified Person(s)

4.13.1 Field audits shall be performed to verify each BASF and contingent electrically qualified person is working in accordance with this ESWP. Audits shall be performed at intervals not to exceed one (1) year.

4.13.2 The audits shall be performed by Beaumont site trainers (ES1) or I&E employees (ES01-ES03) that have completed the appropriate training level (see 4.5.3).

Recommended auditor training level:

Auditor Training Level	Auditee Training Level
ES4	ES4, ES2 or ES1
ES3	ES3, ES2 or ES1
ES2	ES2 or ES1
ES1 Trained Trainer	ES1

4.13.3 The field audits shall be documented using the field audit form in Appendix E. Field audit document shall be retained in accordance with BASF Records Management Policy, **BC037**, record class code HUM1300.

5. Responsibilities

5.1 Beaumont Site Leadership
Has primary responsibility for implementation of this procedure.

5.2 EHS Manager
Has primary responsibility for the initiation, re-issuance, administration, and/or interpretation of this procedure.

5.3 Beaumont Site Employees
Have primary responsibility for adherence to procedure including identifying deficiencies in the procedure, and identifying, reporting and correcting activities not in compliance with the procedure.

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6. Supplement

6.1 References

BC037	*Records Retention Policy*
N-G-EI 605	Electrical TJA Guideline
N-G-EI 610	Power Switching Guideline
N-G-EI 645	Cable Cutting for Demolition or Repair for 600V or less
N-P-EI 915	Electrical Study – Short Circuit & Coordination and Arc Flash Study Guideline
N-R-EI 050 M	Electrical Design Requirements
N-S-EI 051	Electrical Design Practices
BMEHS-002.025	*Powered Mobile Platforms*
BMEHS-002.022	*Personal Protective Equipment*
BMEHS-002.005	*Control of Hazardous Energy Sources*
BMEHS-002.026	*Safe Work*
BMEHS-002.037	*Cranes and Derricks*
BMEHS-002.012	*Grounding & Bonding*

6.2 Attachments

Appendix A Electrical Training Matrix, Decision Flowchart, Course Details, and Approved Suppliers

Appendix B Electrical Work Assessment / Energized Electrical Work Permit

Appendix C Electrical Work Assessment / Energized Electrical Work Permit Workflow and RACI

Appendix D Safety Practices for Overhead and Underground Electrical Lines

Appendix E Field Audit Form

Appendix F Rescue Plan

Appendix G Example Rescue Plan

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6.3 Abbreviations

AC	**a**lternating **c**urrent
ATPV	**a**rc **t**hermal **p**erformance **v**alue
cal	**cal**ories
cm	**c**enti**m**eters
DC	**d**irect **c**urrent
EBT	**e**nergy of **b**reak-**o**pen **t**hreshold
EEWP	**e**nergized **e**lectrical **w**ork **p**ermit
FR	**f**lame-**r**esistant
J	**j**oules
OSHA	**O**ccupational **S**afety and **H**ealth **A**dministration
PPE	**p**ersonal **p**rotective **e**quipment
V	**v**olt

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