

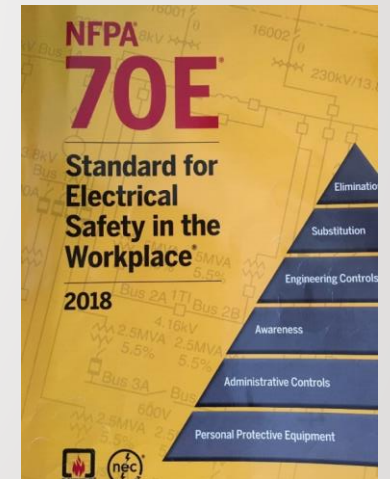
May 2019



# NFPA Electrical Safety Overview



AGS Electrical Safety Program



Dave Nicewicz, Electrical Safety Trainer Consultant

# Dave Nicewicz



- Electrical Safety Consultant and Trainer for AgriSphere, LLC
- Michigan State University alumni
- 36 years of experience in the grain industry
- 19 years with ADM
- Extensive electrical training

**DAVE NICEWICZ**

Electrical Safety Trainer Consultant





Who is AgriSphere, LLC



# AgriSphere, LLC

- Professional Consulting
- Customized Virtual Client Portals
- Cloud-based Solutions and Content
- Advanced Training and Records Management



# OSHA, NFPA 70E & AgriSphere



## Occupational Safety and Health Administration

Started in 1970



## National Fire Protection Association

70E Electrical Safety in the Workplace  
First Published in 1979



## AGS Electrical Safety Program

Electrical Safety Training Module  
Developed in 2018



# Agenda



## ➡ NFPA Electrical Safety Overview

- ➡ Why OSHA & NFPA 70E
- ➡ Outline of AgriSphere Electrical Safety Training Module
- ➡ Examples of AgriSphere Training Content, Derived from NFPA 70E



“Sparky”  
Training Assistant







# Why OSHA & NFPA

- ▶ Some OSHA requirements are all encompassing:
  - ▶ **General Duty Clause** - provide place of employment which are free from recognized hazards that are causing or likely to cause death or serious physical harm to his employees
  - ▶ **1910.333(a)** - “Safety-related work practices shall be employed to prevent electric shock or other injuries ...”
  - ▶ **1910.335(a)(1)(i)** - “... electrical protective equipment that is appropriate for the specific parts of the body to be protected and for the work to be performed.”
  - ▶ **1926.95(a)** - “... protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition ...”



# Why OSHA & NFPA



## ➡ OSHA Rule Changes Can Take Time

- ➡ Change is proposed by OSHA or other party
- ➡ OSHA determines if change is necessary
- ➡ OSHA committee creates specific recommendations
- ➡ Publishes “Notice of Proposed Rule Changes” in National Register
- ➡ Interested parties can submit written arguments and specific evidence
- ➡ Public hearings (if determined necessary)
- ➡ OSHA publishes full text of changes and reasons for adopting those changes
- ➡ Process often takes years
  - ❖ Example – Change to 1910.272 about “walking down grain” took 3 years







# Why OSHA & NFPA

- ▶ OSHA asked NFPA to create new document
  - ▶ Consistent with OSHA standards for those using NFPA 70 – National Electric Code (NEC)
  - ▶ NEC does not have many “safety-related work practices.”
  - ▶ A standard that could be changed periodically to stay consistent with the NEC
  - ▶ NFPA agreed and announced the formal appointment of a new electrical standards development committee in 1976.



# Why OSHA & NFPA



## ➤ NFPA 70E

## ➤ Standard for Electrical Safety in the Workplace

### ➤ 11 Editions Published so far between 1979 & 2018

- 1979 – First edition
- 2000 – Included charts to assist in selecting **protective clothing and PPE** for common electrical tasks
- 2004 – Title was changed to current name
- 2012
  - ❖ Hazard identification and risk assessments clarified and expanded
  - ❖ Changed “Flame Resistant (FR)” to “Arc Resistant (AR)” in regard to PPE & Clothing





# Why OSHA & NFPA

## ➡ Standard for Electrical Safety in the Workplace

- 2015
  - ❖ Changed “hazard analysis” to “risk assessment” throughout the document
  - ❖ Must consider conditions of maintenance as a factor for safety
  - ❖ Equipment owner or their representative is responsible for equipment maintenance
- 2018 – Introduced human factors when addressing risk assessment including human error and human performance



# Why OSHA & NFPA



## ➤ Standard for Electrical Safety in the Workplace

### ➤ Enforcement

- NFPA has no power to enforce these requirements
  - ❖ Considered “consensus standards” created by a group of volunteers with expertise in the subject matter
- OSHA has no power to enforce these standards
  - ❖ Document does not go through the process to be adopted by OSHA
  - ❖ They are not part of the OSHA requirements
- OSHA uses consensus standards as evidence of hazard recognition and availability of a feasible means of abatement
  - ❖ OSHA has offered training on the requirements of 70E in the past





# Why OSHA & NFPA

## ➤ Standard for Electrical Safety in the Workplace

- Have you ever asked an OSHA inspector how to abate a particular hazard?
  - When it comes to electrical safety, NFPA 70E has many answers that clarify the OSHA requirements.
  - Many of those answers are in the AGS Electrical Safety Program and Training!







# NFPA 70E & AgriSphere Training

Examples of AgriSphere Training Modules  
Examples of NFPA 70E Related Content





# “EAST” Electrical Awareness Safety Training

for all employees and management



## NFPA 70E – Annex K

- 98% of all electrical-related deaths result from shock.
- **40%** of those deaths result from contact with overhead lines!!
- Not just electrical workers!

## AgriSphere (AGS) Training

- Warns employees of hazards.
- Defines safety procedures when working near overhead lines.
- Covers electrical workers, painters, maintenance, roofing, and those using ladders and aerial lifts near overhead lines.

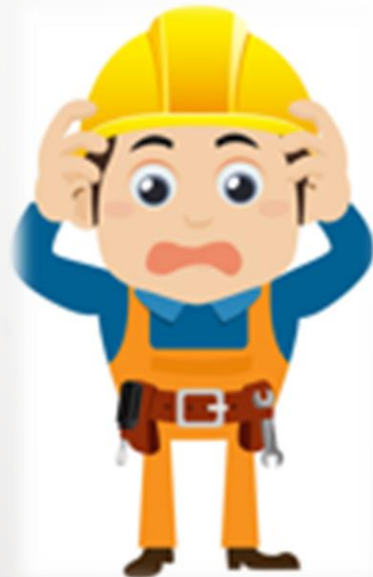
About India





# Overhead Lines are a Serious Shock Hazard!

## SHOCK Risk Assessment



# “EAST” Electrical Awareness Safety Training

for all employees and management



## NFPA 70E-2018: 110.2

- (A) Electrical Safety Training.
  - (1) Qualified Person.
- Trained and knowledgeable in construction & operation of equipment or work method.
- Trained how to identify and avoid the electrical hazards that might be present.

## AgriSphere (AGS) Training

- Defines what it means to be “Qualified” to perform electrical work.
- Defines what it means not to be qualified!
- Informs those who are NOT qualified cannot perform electrical work!!!



# “QWEST 1” Qualified Worker Electrical Safety Training for all “Qualified” electrical workers and their management



## ► List of topics in QWEST 1 Training Module

1. Basics of Electricity
2. Shock Risk Assessment
3. Arc Flash Risk Assessment
4. Management Responsibility
5. Task Specific Training

Notice Shock and Arc Flash are two separate training topics.



# “QWEST 1” Qualified Worker Electrical Safety Training for all “Qualified” electrical workers and their management



## NFPA 70E-2018: 130.4

- Working near Exposed Electrical Hazards.
- Use safety related work practices.
- Conduct **shock risk assessment**: Identify shock hazards, Estimate likelihood & severity, Determine protective measures including PPE.
- Use hierarchy of risk control.
- Document assessment!

## AgriSphere (AGS) Training

- QWEST I training for all Qualified persons performing tasks that do not require the use of a meter.
- Section 2: How to complete & document a Shock Risk Assessment.
- How to Use Hierarchy of Controls: Elimination, Substitution, Engineering Controls, Awareness / Warnings, Administrative, & PPE





# “QWEST 1” Qualified Worker Electrical Safety Training for all “Qualified” electrical workers and their management



## NFPA 70E-2018: 130.5

- **Arc Flash Risk Assessment.**  
(F) Arc Flash PPE.
- One of the following methods shall be used for the selection of Arc Flash PPE & Clothing.
  1. Incident Energy Analysis Method.
  2. Arc Flash PPE Category Method.
- Either but not both shall be used on the same piece of equipment.

## AgriSphere (AGS) Training

- QWEST1 Section 3 covers Arc Flash Risk Assessment.
- Section 3-1 Incident Energy Method
- Maximum Incident Energy **exposure is calculated** (Contractor partner) for each piece of equipment.
- Explains Equipment labeling.
- Explains Basic & Max Protection Packages based on exposure.







# Arc Flash Protection Packages

| BASIC   | MAX  |
|---|--|
| • Arc-rated Clothing and PPE must meet or exceed Incident Energy Level  |  |
| <ul style="list-style-type: none"><li>• Arc-rated Long sleeve shirt and Arc-rated Long pants, and or arc-rated coverall, and or Arc-rated blast suit (Selection Required)</li><li>• Arc-rated outerwear</li><li>• Hard hat, Safety glasses &amp; Ear plugs</li><li>• Leather footwear</li></ul> |  |
| • 1.2 - 12 cal/cm <sup>2</sup>  | • Greater than 12 cal/cm <sup>2</sup>  |
| <ul style="list-style-type: none"><li>• Faceshield &amp; Balaclava or Double Layer Switching Hood</li></ul>   | <ul style="list-style-type: none"><li>• Double Layer Switching Hood</li></ul>  |
| <ul style="list-style-type: none"><li>• Leather Gloves worn with rubber insulating gloves, or</li><li>• Heavy duty leather gloves, or</li><li>• Arc-rated gloves</li></ul>  | <ul style="list-style-type: none"><li>• Leather Gloves worn with rubber insulating gloves, or</li><li>• Arc-rated gloves</li></ul> |





# Arc Flash Analysis

## ➤ Overview of Services for Incident Energy Analysis

- Electrical Engineer site visit to gather data
- Data is analyzed to determine maximum incident energy that could be released during a fault condition for each piece of equipment
- Report issued to facility
- Labels provided for any equipment over  $1.2 \text{ cal/cm}^2$





# Arc Flash Analysis

- Example of Label for Incident Energy

| <b>WARNING</b>  |  |
|---|--|
| <b>Arc Flash and Shock Risk!</b>                              |  |
| <b>ARC FLASH PROTECTION</b>                                   | <b>SHOCK PROTECTION</b>                          |
| <b>Arc-Rated Clothing &amp; PPE Required!</b>                 | <b>Shock Protective PPE &amp; Equipment Req!</b> |
| Incident Energy: <b>35.7 CAL</b>                              | System Voltage: <b>480 VAC</b>                   |
| Arc Flash Boundary: <b>48 in</b>                              | Limited Approach Boundary: <b>42 in</b>          |
| Working Distance Boundary: <b>18 in</b>                       | Restricted Approach Boundary: <b>12 in</b>       |
| Arc <b>PROTECT</b> Package: <b>MAX (12.1 +)</b>               | Insulated Rubber Glove Class: <b>0 (min)</b>     |
| <b>Arc-Rating MUST EQUAL OR EXCEED Incident Energy Level!</b> |  |
| <b>Bus Device:</b>  | <b>PANEL A2</b>                                  |
| <b>Power Supplied By:</b>                                     | <b>MCC #2 / MAIN #5</b>                          |
| <b>Date Performed:</b>  | <b>Nov 29, 2017</b>                              |
| <b>Analysis conducted by</b>                                  |  |



# “QWEST 1” Qualified Worker Electrical Safety Training for all “Qualified” electrical workers and their management



## NFPA 70E-2018: 130.7

- Personal & Other Protective Equipment. (15) **Arc Flash PPE Category Method.**
- Assigns 1 of 4 PPE Category numbers based on type of electrical equipment.
- Defines specific PPE & clothing requirements for each of 4 PPE Categories.

## AgriSphere (AGS) Training

- QWEST1 Section 3 covers Arc Flash Risk Assessment.
- Section 3-2 PPE Category Method.
- **Estimated risk** based on type of equipment.
- 1 of 4 Categories assigned to each piece of equipment, unless no risk.
- Explains the Arc Flash Clothing & PPE Required for all 4 Categories.
- Packages based on exposure.



# Arc Flash Protection Categories



| PPE Categories   | Minimum Arc Rating for Clothing and PPE | Head / Face Protection                         | Hand Protection  |
|--|---|--|--|
| 1  | 4 cal/cm <sup>2</sup>                   | Arc-rated Face Shield                          | <ul style="list-style-type: none"><li>• Heavy-Duty Leather Gloves, or</li><li>• Leather Gloves with Rubber Insulating Gloves</li></ul> |
| 2  | 8 cal/cm <sup>2</sup>                   | Arc-rated Face Shield & Balaclava              |  |
| 3  | 25 cal/cm <sup>2</sup>                  | Arc-Rated Arc Flash Suit Hood & Arc Flash Suit | <ul style="list-style-type: none"><li>• Arc-Rated Gloves, or</li><li>• Leather Gloves with Rubber Insulating Gloves</li></ul>          |
| 4  | 40 cal/cm <sup>2</sup>                  | Arc-Rated Arc Flash Suit Hood & Arc Flash Suit |  |
| <div>1. All other requirements the same but must meet the minimum arc rating required.</div> <div>2. Potential incident energy is estimated.</div> |   |  |  |



# “QWEST 1” Qualified Worker Electrical Safety Training for all “Qualified” electrical workers and their management



## NFPA 70E-2018: 110.2

- Training Requirements. (A) Electrical Safety Training.
- (1)(f) Employer shall determine through regular supervision or annual inspections each employee is complying with requirements.
- (5) Documentation required when employee demonstrates proficiency in work practices required for job.

## AgriSphere (AGS) Training

- QWEST1 Section 4 covers Management Requirements for those who oversee electrical work & who supervise electrical workers
- Explains the **Qualified Worker Authorization (QWA) form** provided by AgriSphere
- Explains other electrical training documentation requirements







# QWA Form

- 5-page **permanent record** for each Qualified Electrical Worker

**QWA**

Qualified Worker's Name



**Part 1. Detailed List of Electrical Technical Skills Qualified Worker Achieved 100% Proficiency during a Performance Review that is Documented & on File with Signature of Evaluator, School, or Company.**

†

|    | Technical Skills – 100% Proficiency Achieved   | Evaluator, School, Company | Date       |
|----|--|----------------------------|------------|
| 1. | Operate starter disconnect, circuit breaker, Start/Stop or HOA switch mounted on panel |                            | 99/99/9999 |
| 2. | Open/close hinged and bolted electrical panel covers with exposed energized parts      |                            |            |
| 3. | Serve as a safety Attendant for Qualified Worker performing live work                  |                            |            |
|    | Perform work within the Limited Approach   |                            |            |



# “QWEST 2” Qualified Worker Electrical Safety Training for all “Qualified” workers who use meters and their management



## NFPA 70E-2018: 130.2

- **Electrical Safe Work Conditions.** (De-Energized Work).
- Energized conductors & parts 50V> electrically safe work condition before employee performs work if:
  1. Employee is within limited approach boundary.
  2. Employee interacts with equipment that an increased exposure to arc flash exists.

## AgriSphere (AGS) Training

- QWEST2 Section 1 covers how to create an “**electrically safe work condition**” in great detail.
- Trained to complete 8 specific steps required in conjunction with lockout procedures.
- This is one of **the most important aspects** of performing electrical work when equipment is to be de-energized!



# “QWEST 2” Qualified Worker Electrical Safety Training for all “Qualified” workers who use meters and their management



## NFPA 70E-2018: 130.1

- **Energized Electrical Work Permit.**  
(Energized Work)
- Permitted if there is:
  1. Increased risk to de-energize.
  2. De-energized work is infeasible.
  3. Equipment is operating as < 50V.
- ❖ Equipment operating condition is normal.

## AgriSphere (AGS) Training

- QWEST2 Section 2 covers the requirements that allows energized work and how to perform work safely.
- Trained to understand all aspects of the energized electrical work permit and permit exceptions.
- Instructed in safety precautions for performing energized “live” work.




# Energized Electrical Work Permit



- Permit provided by AgriSphere (4-part form)



| ENERGIZED ELECTRICAL WORK PERMIT  |   |  AGRISPHERE™<br>REACH HIGHER |   |   |  |   |  |                            |  |                               |  |   |  |  |  |   |   |                                       |   |   |  |   |   |   |  |  |   |
|---|---|---|---|---|--|---|--|----------------------------|--|-------------------------------|--|---|--|--|--|---|---|---------------------------------------|---|---|--|---|---|---|--|--|---|
| <b>Part 1: To be completed by the REQUESTER:</b>  |   |   |   |   |  |   |  |                            |  |                               |  |   |  |  |  |   |   |                                       |   |   |  |   |   |   |  |  |   |
| 1   | Location of Circuit or Equipment:   |   |   |   |  |   |  |                            |  |                               |  |   |  |  |  |   |   |                                       |   |   |  |   |   |   |  |  |   |
| 2   | Description of Work to be Done:   |   |   |   |  |   |  |                            |  |                               |  |   |  |  |  |   |   |                                       |   |   |  |   |   |   |  |  |   |
| 3   | Justification of why the circuit cannot be de-energized or work performed during the next scheduled plant shutdown:   |   |   |   |  |   |  |                            |  |                               |  |   |  |  |  |   |   |                                       |   |   |  |   |   |   |  |  |   |
| 4   | Name & Title of Requester   |   |   |   |  |   |  |                            |  |                               |  |   |  |  |  |   |   |                                       |   |   |  |   |   |   |  |  |   |
| 5   | Date Requested  |   |   |   |  |   |  |                            |  |                               |  |   |  |  |  |   |   |                                       |   |   |  |   |   |   |  |  |   |
| <b>Part 2: To be completed by the ELECTRICALLY QUALIFIED PERSONS doing the work:</b>            |   |   |   |   |  |   |  |                            |  |                               |  |   |  |  |  |   |   |                                       |   |   |  |   |   |   |  |  |   |
| 1   | Job Description:  |   |   |   |  |   |  |                            |  |                               |  |   |  |  |  |   |   |                                       |   |   |  |   |   |   |  |  |   |
| 2   | <table border="1"><thead><tr><th colspan="2">Results from <b>SHOCK</b> risk assessment</th><th colspan="2">Voltage of Exposed Conductors or Parts:</th></tr></thead><tbody><tr><td colspan="2">Limited Approach Boundary:</td><td colspan="2">Restricted Approach Boundary:</td></tr><tr><td colspan="2">SHOCK Protective PPE &amp; Equipment to be used</td><td colspan="2">(Check box and Fill in where required)</td></tr><tr><td><input type="checkbox"/> Class E Hard Hat</td><td><input type="checkbox"/> Voltage Rated Gloves</td><td><input type="checkbox"/> Glove Class:</td><td><input type="checkbox"/> Gloves Inspected</td></tr><tr><td colspan="2">Footwear <input type="checkbox"/> EH <input type="checkbox"/> DH <input type="checkbox"/> Other</td><td><input type="checkbox"/> Dielectric Mat</td><td><input type="checkbox"/> Leather Protector Gloves</td></tr><tr><td colspan="2">Meter: <input type="checkbox"/> Category Rated <input type="checkbox"/> Correct Voltage</td><td><input type="checkbox"/> Insulated Tools</td><td><input type="checkbox"/> Insulated Blanket(s)</td></tr></tbody></table> |   |   | Results from <b>SHOCK</b> risk assessment |  | Voltage of Exposed Conductors or Parts: |  | Limited Approach Boundary: |  | Restricted Approach Boundary: |  | SHOCK Protective PPE & Equipment to be used |  | (Check box and Fill in where required) |  | <input type="checkbox"/> Class E Hard Hat | <input type="checkbox"/> Voltage Rated Gloves | <input type="checkbox"/> Glove Class: | <input type="checkbox"/> Gloves Inspected | Footwear <input type="checkbox"/> EH <input type="checkbox"/> DH <input type="checkbox"/> Other |  | <input type="checkbox"/> Dielectric Mat | <input type="checkbox"/> Leather Protector Gloves | Meter: <input type="checkbox"/> Category Rated <input type="checkbox"/> Correct Voltage |  | <input type="checkbox"/> Insulated Tools | <input type="checkbox"/> Insulated Blanket(s) |
| Results from <b>SHOCK</b> risk assessment   |   | Voltage of Exposed Conductors or Parts:   |   |   |  |   |  |                            |  |                               |  |   |  |  |  |   |   |                                       |   |   |  |   |   |   |  |  |   |
| Limited Approach Boundary:  |   | Restricted Approach Boundary:   |   |   |  |   |  |                            |  |                               |  |   |  |  |  |   |   |                                       |   |   |  |   |   |   |  |  |   |
| SHOCK Protective PPE & Equipment to be used   |   | (Check box and Fill in where required)  |   |   |  |   |  |                            |  |                               |  |   |  |  |  |   |   |                                       |   |   |  |   |   |   |  |  |   |
| <input type="checkbox"/> Class E Hard Hat   | <input type="checkbox"/> Voltage Rated Gloves   | <input type="checkbox"/> Glove Class:   | <input type="checkbox"/> Gloves Inspected         |   |  |   |  |                            |  |                               |  |   |  |  |  |   |   |                                       |   |   |  |   |   |   |  |  |   |
| Footwear <input type="checkbox"/> EH <input type="checkbox"/> DH <input type="checkbox"/> Other |   | <input type="checkbox"/> Dielectric Mat   | <input type="checkbox"/> Leather Protector Gloves |   |  |   |  |                            |  |                               |  |   |  |  |  |   |   |                                       |   |   |  |   |   |   |  |  |   |
| Meter: <input type="checkbox"/> Category Rated <input type="checkbox"/> Correct Voltage         |   | <input type="checkbox"/> Insulated Tools  | <input type="checkbox"/> Insulated Blanket(s)     |   |  |   |  |                            |  |                               |  |   |  |  |  |   |   |                                       |   |   |  |   |   |   |  |  |   |



# “QWEST 1” Qualified Worker Electrical Safety Training



## TASK SPECIFIC TRAINING

### NFPA 70E-2018: 110.2

- **Training Requirements.**
- Skills & techniques to perform various tasks.
- Demonstrate proficiency.
- Documented records retained for employee's employment.

### AgriSphere (AGS) Training

- QWEST1 Section 5 covers 4 specific tasks.
  1. Operating disconnects & breakers.
  2. Hidden dangers near energized parts.
  3. Attendant for qualified workers.
  4. Identify & report electrical hazards.



# “QWEST 2” Qualified Worker Electrical Safety Training



## TASK SPECIFIC TRAINING

### NFPA 70E-2018: 110.2

- **Training Requirements.**
- Skills & techniques to perform various tasks.
- Demonstrate proficiency.
- Documented records retained for employee's employment.

### AgriSphere (AGS) Training

- QWEST2 Section 3 – 7 specific tasks.
  1. Knowledge of starter.
  2. Inspect & use meter.
  3. Alerting techniques.
  4. Reset breaker / replace fuse.
  5. IE Method for equipment operating over 40cal/cm<sup>2</sup>.
  6. Release from live part contact.
  7. Wiring motors & reverse rotation.







# Task-Specific Training Options

- There are two types of task-specific training:
  - Proficiency Evaluation
  - Written Test Evaluation
- Both require 100% completion before allowed to perform task
- Training process:
  - Supervisor assigns personnel to learn task.
  - Trainer uses PPT provided and demonstrations as applicable.
  - Trainee practices task & completes study questions.
  - Trainee takes test – must score 100% and trainer evaluating must be convinced trainee fully understands how to perform task safely.
  - Retest recommended to be given one or more days after day trainee failed the testing



# Task-Specific Training Options



## ▶ Trainer Options:

- ▶ Location Electrician
- ▶ Contract Electrician

NOTE: Trainer must be willing to sign a training certificate for each trainee that passes test stating they have completed the training exactly as the trainer would have and testing and scored 100% correct on the test.



# AGS Electrical Safety Program



- ▶ AgriSphere, LLC has incorporated NFPA 70E-2018 version into their safety program and training requirements
- ▶ Means to provide the latest safety practices and requirements for electrical safety.
- ▶ Excellent method to enhance your electrical safety program and training.



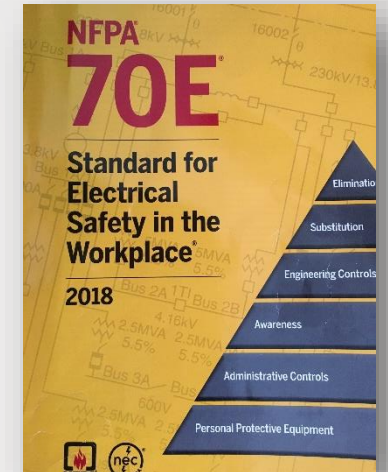


# Summary

- AgriSphere, LLC Overview and Training Program review
- Overview of regulatory agency information and basic requirements
- History of the development of NFPA 70E regulations
- Arc Flash Analysis and Protective Packages
- Task-Specific Training Options
- “EAST” Overview
- “QWEST1” Overview
- “QWEST2” Overview







# AgriSphere, LLC

1.844.4AGSPHR

info@agrisphere.com

[www.agrisphere.com](http://www.agrisphere.com)



- ☐ Professional Consulting Services
- ☐ Safety Programs  
[program development, auditing, training, technical tools]
- ☐ Maintenance Programs
- ☐ Food Safety / Defense (FSMA) Compliance Programs
- ☐ Management Software Solutions



All-Safe°



agPROACTIVE°



agTRACE°



agVR

AN IMMERSIVE TRAINING EXPERIENCE



AGS Electrical  
Safety Program

NFPA 70E NEC Response Program



AGRISPHERE  
TRAINING CENTER



AGRISPHERE  
CLIENT PORTAL



GITRS



blueprint







Thank You!