

850 Center Way
Norcross, GA 30071

Phone: 770-453-1410
Fax: 770-453-1411
www.pd-engineers.com
Email: sales@pd-engineers.com



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City of Hampton Breaks Ground

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The official groundbreaking ceremony for the Bear Creek Wastewater Pollution Control Plant took place in Hampton, Georgia on May 16, 2008. This new plant is an exciting milestone in the growth of the City of Hampton, and Patterson & Dewar Engineers, Inc. (P&D) is pleased to be a part of project's success through our design of the electrical utility infrastructure for the Bear Creek Plant. P&D client engineer, Chris Hammond, and P&D senior engineering assistant, Robert Penna successfully worked together on the project, an effort the City of Hampton has been trying to get off the ground since the early 1990s.

The new facility will treat approximately 1.75 million gallons per day of wastewater, adding approximately 1500 kW to Hampton's electrical system. Choate Construction Company was awarded the construction management contract, estimated to be approximately \$10 million and the plant construction is estimated to take approximately 2 to 3 years to complete. Bids for the electric utility construction of the P&D design were received in April and Pike Electric, Inc. was awarded the contract estimated to be \$210,000.

NESC Arc Flash Assessment Update

By Gary Grubbs, PE, Bonita Martin, PE, and JB Franklin, PE

One of the hottest (no pun intended) ongoing debates among utility engineers, operating personnel, and safety professionals in today's list of "must-do" projects is the Arc Flash Assessment.

The Reason: NESC Rule 410.A.3

"Effective as of January 1, 2009, the employer shall ensure that an assessment is performed to determine potential exposure to an electric arc for employees who work on or near energized parts or equipment. If the assessment determines a potential employee exposure greater than 2 cal/cm² exists, the employer shall require employees to wear clothing or a clothing system that has an effective arc rating not less than the anticipated level of arc energy."

The Players:

- ✓ NESC Rule 410.A.3
- ✓ OSHA 29 CFR 1910.269
- ✓ NFPA 70E
- ✓ IEEE 1584
- ✓ RUS, PSC & other regulatory entities



Recent P&D Arc Flash Assessment Class

Utilities must follow the NESC if their states vote to adopt it into state law. However, although it may not be codified, it is reasonable to expect the NESC to be used as a standard in a court of law. So, if legal proceedings should ever follow, the NESC will be used either for or against the utility. NESC Part 410 gives no info regarding how to calculate incident energy, we must look elsewhere.

Recommendations for system voltages ≥ 1000V:

- ✓ Purchase one of the generally accepted assessment tools.

- ✓ BEFORE purchasing an arc assessment module for system modeling software you already utilize, ensure the arc flash calculations are appropriate for utility applications.
- ✓ DO NOT use arc software that only calculates based on IEEE 1584 or NFPA 70E ~ refer to Table 1, as IEEE 1584 and NFPA 70E are not applicable at all utility voltages.

Method	Results	Clothing
NFPA 70E™	Not confirmed > 600V	N/A
IEEE 1584™	5.5 cal/cm ²	Class 2
Lee Method™	5.497 cal/cm ²	Class 2
ArcPro™	0.34 cal/cm ²	Class 0
Duke Heat Flux™	0.112 cal/cm ²	Class 0

Table 1: (NEETRAC®): Method / Result Comparisons

Recommendations for system voltages < 1000V:

- ✓ Make use of IEEE 1584-based calculations for assessment of secondary systems
- ✓ DO NOT make use of the NESC Rule 410.A.3, Exception 2's default of 4 cal/cm². Instead, do the calculations, as we often find them to be greater than 4 cal/cm² at voltages below 1000V.

Incident Energy and PPE:

Arc Flash calculations determine the amount of Incident Energy (Arc Energy) and is defined as:

"The amount of energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. Incident energy is measured in joules per centimeter squared (J/cm²) or calories per centimeter squared (cal/cm²)."

Once the value of incident energy is determined, appropriate PPE can be chosen ~ Table 2 & 3.

Arc Flash Calculation Assumptions:

- ✓ Fault current limits (how high and how low)
 - Do NOT overstate the level of fault current, as higher fault currents often result in faster clear-

ing times for protective devices due to the inverse time characteristic of tripping curves.

- Too high fault currents will falsely lead one to conclude the protective device will trip more quickly than it would with a lower fault current.
- ✓ Non-reclose option available on all reclosers.
- ✓ Proper function of all protective devices (maintenance practices are crucial).
 - How does the arcing fault end? It ends when the upstream protective device opens and interrupts the fault current.
 - The faster the upstream protective device opens the circuit and removes the fault, the better. A compromise must be struck between service continuity and acceptable arc flash hazard levels.
 - Two arc durations must be determined for each protective device:
 - ⇒ Clearing time for max arc current.
 - ⇒ Clearing time for min arc current (much longer time, thus potentially higher incident energy).
 - For relay operated circuit breakers, the breaker opening time must be added.
 - Recloser opening time must also be added to control response time.
 - Fuse total clear times must be used.

✓ Working distances

Fault	Clearing (cycles)	NESC Table	ArcPro®	Clothing System*
4000A	8.8	4 cal*	0.61 cal*	"1" vs "0"
140A	700	12 cal*	0.13 cal*	"3" vs "0"
210A	200	12 cal*	0.20 cal*	"3" vs "0"

* "Clothing System" column compares clothing required by NESC vs ArcPro meth-

Table 2: NESC vs. ArcPro Clothing Required Down-Line of a L70 "C"

Arc Hazard Assessment Procedures:

1. Collect System Data
2. Determine Bolted Fault Currents
3. Determine Arc Duration

4. Select Working Distances
5. Determine Incident Energy
6. Organize Results
7. Investigate Mitigation Options

Mitigation Examples:

- ✓ Non-reclosing set on all reclosers.
- ✓ Work permits required for energized lines.
- ✓ Changing relay settings, e.g. instantaneous tripping.
- ✓ Replace relays with electronic ones that allow "hot line" settings to be implemented during work on an energized line.
- ✓ Use of cover-up. NOTE: While "cover-up" is being implemented, appropriate PPE must be worn. Procedures must be in place to ensure "cover-up" always stays in place.
- ✓ Increase work-distances. All personnel not absolutely essential to work tasks should remain a safe distance from energized parts.
- ✓ De-energize and ground-out before working.

Risk Category		
Cat.	Cal/cm ²	Clothing
0	(2)	Untreated cotton
1	4	FR shirt & FR pants
2	8	Cotton underwear plus FR shirt & FR pants
3*	25	Cotton underwear plus FR shirt & FR pants
4*	40	Cotton underwear plus FR shirt & FR pants

* Hard hat, switching hood and ear protection required for Cat. 3 and greater

Table 3: NFPA 70E, Table 3-3.9.3³

OSHA has proposed an Appendix F to 1910.269 to contain definitions of these clothing systems. However, this is not yet approved and it is unclear if and when that approval might take place.

Recent Publications & Papers:

- Distribution System Arc-Flash Calculations Case Studies Summary; CRN® 08-01; July, 2008
- Arc Flash Assessment Module for WindMill® by Greg Shirek, P.E.; July, 2008

SPCC Plans—Periodic Reviews

By John Humphrey

If you wish to receive P&D's newsletter, uPDate, by e-mail, please let us know. Send an e-mail to sales@pd-engineers.com

The EPA has set the deadline for completion, certification, and implementation of all Spill Prevention, Control and Countermeasure (SPCC) Plans to be July 1, 2009. This is a key date for our clients who have not completed or started their SPCC Plan.

There are also other key dates, which are not widely known. Those dates occur every 5 years. The regulation governing SPCC Plans (40 CFR 112) states that each plan shall be reviewed at least every 5 years following the initial certification. The current rule states that any SPCC Plan, or part thereof, that was initially certified by a Professional Engineer, be reviewed and recertified by a Professional Engineer. It should be noted that the PE performing the recertification does not need to be the same PE that performed the initial certification, only that the PE has a good knowledge of the SPCC Rule, of the SPCC Plan in question, and of the facility(ies) it will cover.

Many of our clients that have SPCC Plans that have been certified are either due to have their plans recertified or are nearing that time. Make sure you review the status of your SPCC Plan so that the implementation and recertification requirements are met. If there are any questions regarding the SPCC rulings or plans, please contact Jerry Crawford or John Humphrey at 770-453-1410 or e-mail at jhumphrey@pd-engineers.com or jcrawford@pd-engineers.com.

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