

# Human Performance Improvement (HPI) and Contract Labor Force Engagement



## 2015 NERC HUMAN PERFORMANCE CONFERENCE

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IMPROVEMENT PROGRAM MANAGER,  
XCEL ENERGY TRANSMISSION



# Human Performance Improvement (HPI) and Contract Labor Force Engagement

- 3 Regions –  
3 major projects
  - NSP – CAPX2020
  - PSCo – SB 07-100
  - SPS – Power for the Plains



## Human Performance Improvement (HPI) and Contract Labor Force Engagement



- Several events involving contract labor force
- Leveraged successes for two groups within Transmission organization
- Developed 3-phase approach to roll-out



- Return On Investment (ROI)
  - Quarterly contractor meetings
    - ✦ Event learning/ lessons shared
    - ✦ Process improvement
    - ✦ Equipment usage

Dominion Virginia Power

Electric Transmission Field Operations  
System Protection

**Human Performance Improvement**

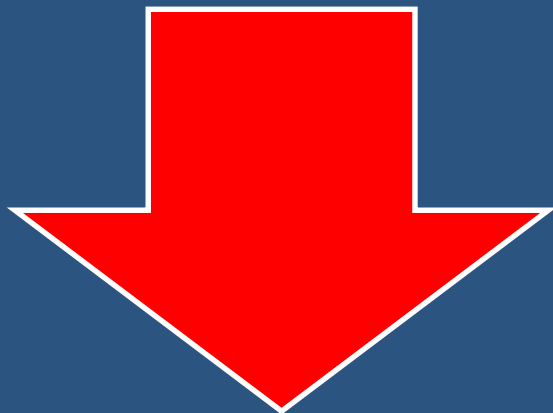
Mike Carden  
Technical Specialist

# Dominion System Protection

- In 2010, Dominion Transmission capital spending began to increase dramatically.



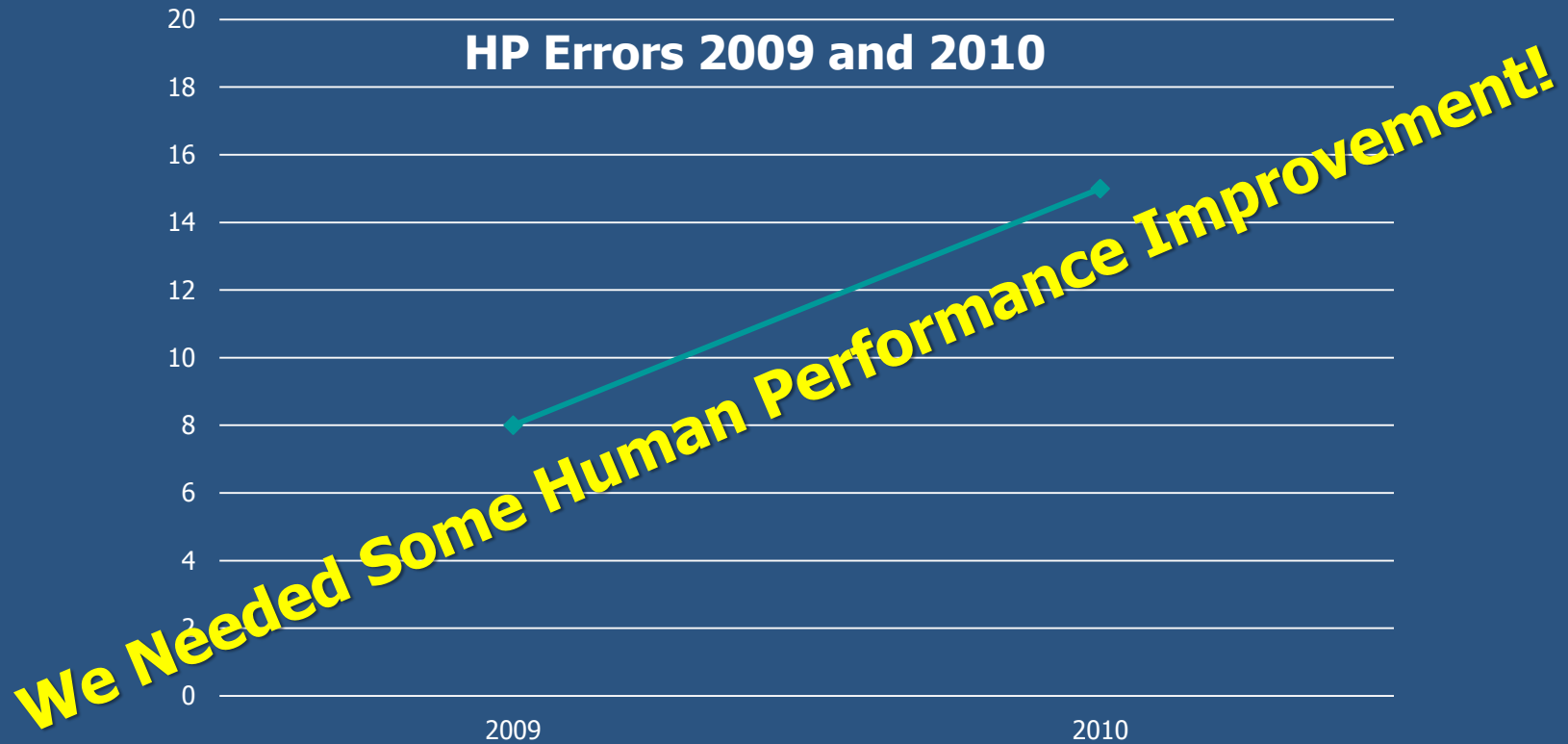
Spending  
Work Hours  
Hiring



Work Force Experience

- Between 2009 and 2010, System Protection's HP error event rate increased by 88 percent.

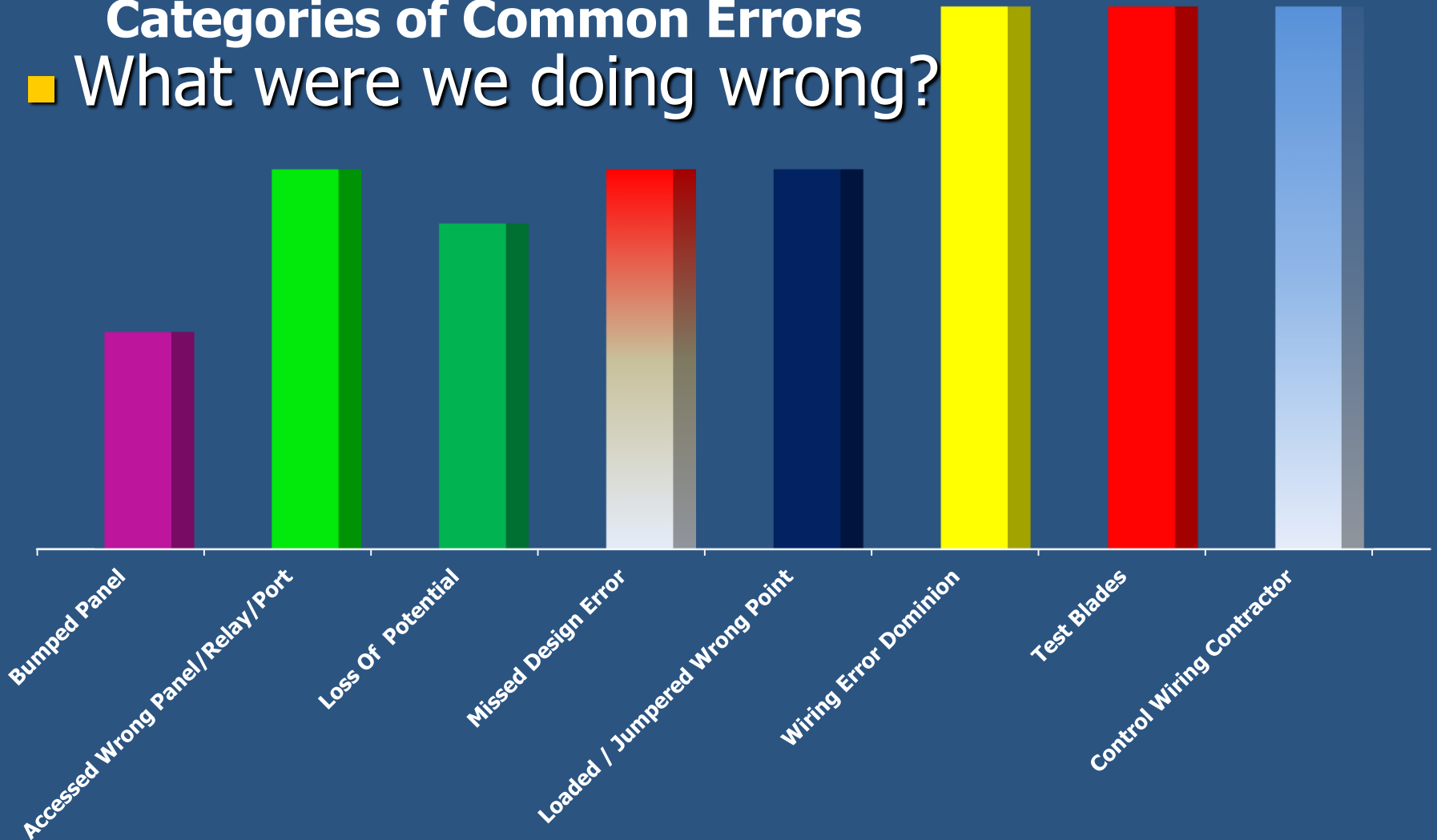
HP Error Event = Inadvertent removal of in-service primary equipment.



# How We Got Started...

## Categories of Common Errors

- What were we doing wrong?





**Electric Transmission**  
**HUMAN PERFORMANCE**



**WORK ZONE KIT**



**Front Panel Barriers  
Using Magnets  
To Secure**



**Rear Panel Barriers  
Using Velcro Straps  
To Secure**



**Use of High Visibility  
Clip Jumper**



**Use of Flame Retardant  
Plastic Sheeting as a  
Barrier**



**Use of Flagging Hangers  
“Testing in Progress” and  
“Do Not Operate”**



**Use of Flagging Hanger  
“Abnormal Condition”**



**Use of Terminal  
Point Barriers**



**Use of  
“STOP - Equipment  
Under Test” Magnet**



**ELECTRIC TRANSMISSION  
WORK ZONE**

**DO NOT OPERATE**

3-way Communication  
Peer Check  
Coaching

**VERIFICATION**

Checklist  
Touch or Point  
Place Keeping Flagging

C.B. NO. 8 BREAKER FAILURE

SEL

C.B. NO. 8 RECLOSER

SEL

**ELECTRIC TRANSMISSION  
WORK ZONE**

**DO NOT OPERATE**

**REVIEW**

- Pre-Job Briefing
- Confirm Terminology
- Operating Exposure
- After Action Review

Panel with various electrical controls, including switches, buttons, and digital displays. The panel is labeled with "ELECTRIC TRANSMISSION WORK ZONE" and "DO NOT OPERATE" signs. It features several digital displays showing "00" and "01", and a row of buttons labeled "STOP" and "RESET".

**ELECTRIC TRANSMISSION  
WORK ZONE**

**DO NOT OPERATE**

3-way Communication  
Peer Check  
Coaching

**VERIFICATION**

Checklist  
Touch or Point  
Place Keeping/Flagging

C.E. NO. 8 RMDAKER FAILURE SEL

C.E. NO. 8 ERIC OLSON SEL

**ELECTRIC TRANSMISSION  
WORK ZONE**

**DO NOT OPERATE**

AWARENESS  
REVIEW  
VERIFICATION

THE BIG 3  
HUMAN PERFORMANCE AREAS

**ELECTRIC TRANSMISSION  
WORK ZONE**

**DO NOT OPERATE**

**REVIEW**

- Pre-Job Briefing
- Confirm Terminology
- Operating Exposure
- After Action Review



**ELECTRIC TRANSMISSION  
WORK ZONE**

**DO NOT OPERATE**

3-way Communication  
Peer Check  
Coaching

**VERIFICATION**

Checklist  
Touch or Point  
Place Keeping Flagging

C.B. NO. 8 BREAKER FAILURE

SEL

C.B. NO. 8 RE-CLOSURE

SEL

**ELECTRIC TRANSMISSION  
WORK ZONE**

**DO NOT OPERATE**

AWARENESS  
REVIEW  
VERIFICATION

THE 3-STEP  
PLAN FOR PERFORMANCE AREAS

**ELECTRIC TRANSMISSION  
WORK ZONE**

**DO NOT OPERATE**

REVIEW

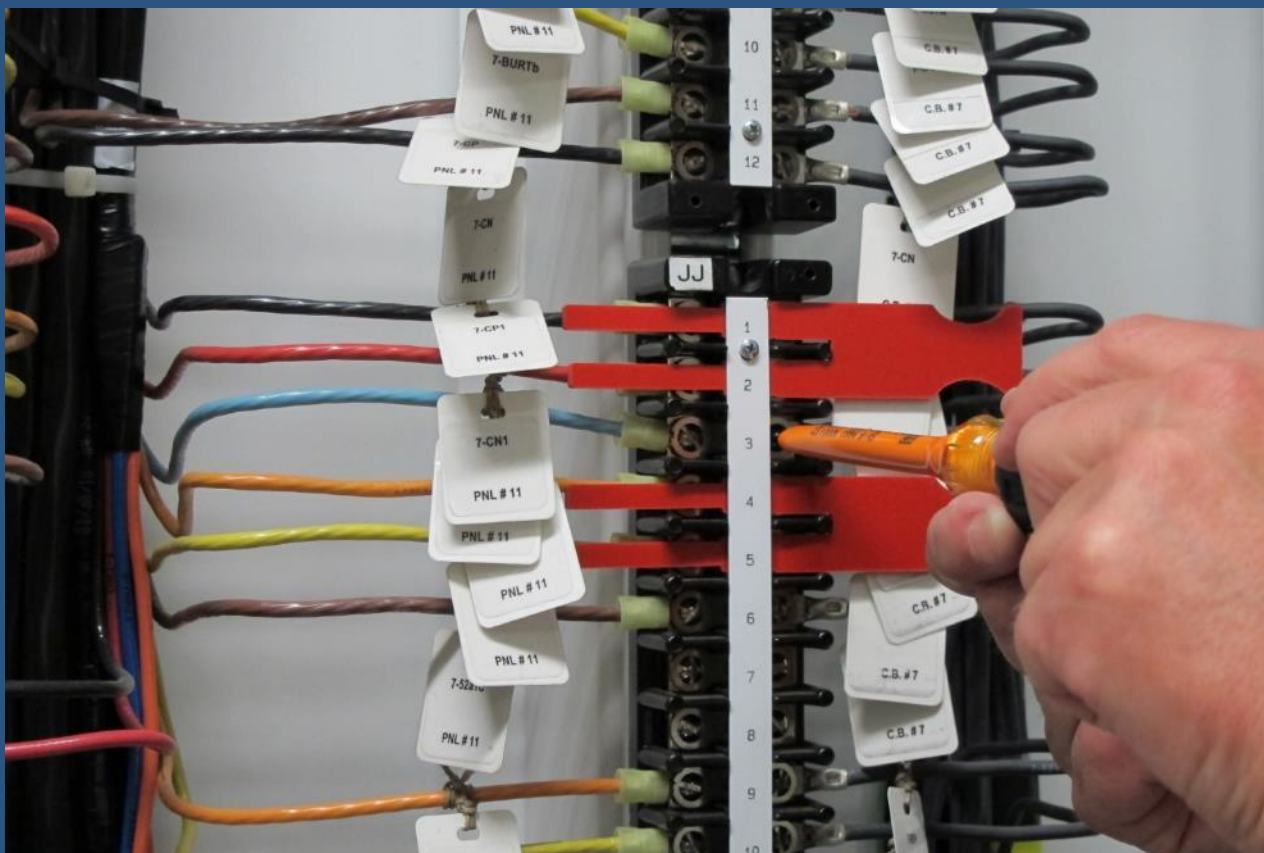
- Pre-Job Briefing
- Confirm Terminology
- Operating Exposure
- After Action Review

WORK ZONE

DO NOT OPERATE

Panel with various electrical components, including switches, meters, and indicator lights.

# Use of Work Zone Barriers



Terminal Point Barriers



**Do these things before you start work**

**Do these things before you start work**

**Do these things before you start work**

**Do these things before you start work**

Using Hangers "Progress" and "Operate"

Use of Hanging Hanger "Abnormal Condition"

Use of Terminal Polar Barriers

Use of "STOP" Equipment Under Test" Magnet

Page 1 of 2

Pre-Job Briefing --- ET Field Operations

Version 2.0.0

Instructions: A Pre-job briefing discussion is required to ensure all workers understand the job scope, hazards, and defenses necessary to create a safe and error-free job completion. The purpose of this form is to document the discussions of the work, the associated tasks, and any critical steps.

Work Location: \_\_\_\_\_ Date: \_\_\_\_\_

Work Description (Examples: Relay Maint, Equip Replacement, etc.): \_\_\_\_\_

OID of Person Leading Briefing: \_\_\_\_\_ Supervisor: \_\_\_\_\_ Type names below of other Attendees (1-9):

1. (Team Leader)	4	7
2	5	8
3.	6	9+

PRIMARY EQUIPMENT WORK ZONE VERIFICATION:

Verify Primary Equipment Work Zone Clearances and Grounding  Not Applicable

Comments/Notes: \_\_\_\_\_

TASK IDENTIFICATION:

Notify Operating Centers  Cable/Wiring Activities  New Installation Checks  Oil/Gas Handling & Proc.

Visual Inspection  Equipment Calibration  HV or Performance Testing  Non-Invasive Activity

Install New Equipment  Operational Checks  Sampling and Diagnostics  Other: \_\_\_\_\_

Primary Equipment Testing  Return to Service Checks  Equipment Repair/Assembly  Other: \_\_\_\_\_

TASK PREPARATION:

Obtain and review drawings or other relevant documentation.  Discuss individual roles and assignments

Consider failure lessons learned during previous personal experiences with this job and location.  Consider probable and worst case consequences should an error occur

Comments/Notes: \_\_\_\_\_



# Monthly Web Cast

## System Protection

### Work Methods and Human Performance

# Great Catch!

A Great Catch, Near Misses, Unusual Situations to Share  
Let Us Know When You Make or See Them  
We Will Share the Information During the Next Webcast

1 hour 54m 41 Secs, 68 Views, 52 Views, 25 Seconds ago (last updated)

On-Minute Outages

On-Minute Outages	68
Outages	52
Outages	25

Major Events

Time	Event
08:00	Transmission - 100KV 100KV 100KV
08:05	Transmission - 100KV 100KV 100KV
08:10	Transmission - 100KV 100KV 100KV
08:15	Transmission - 100KV 100KV 100KV
08:20	Transmission - 100KV 100KV 100KV
08:25	Transmission - 100KV 100KV 100KV
08:30	Transmission - 100KV 100KV 100KV
08:35	Transmission - 100KV 100KV 100KV
08:40	Transmission - 100KV 100KV 100KV
08:45	Transmission - 100KV 100KV 100KV
08:50	Transmission - 100KV 100KV 100KV
08:55	Transmission - 100KV 100KV 100KV
09:00	Transmission - 100KV 100KV 100KV
09:05	Transmission - 100KV 100KV 100KV
09:10	Transmission - 100KV 100KV 100KV
09:15	Transmission - 100KV 100KV 100KV
09:20	Transmission - 100KV 100KV 100KV
09:25	Transmission - 100KV 100KV 100KV
09:30	Transmission - 100KV 100KV 100KV
09:35	Transmission - 100KV 100KV 100KV
09:40	Transmission - 100KV 100KV 100KV
09:45	Transmission - 100KV 100KV 100KV
09:50	Transmission - 100KV 100KV 100KV
09:55	Transmission - 100KV 100KV 100KV
10:00	Transmission - 100KV 100KV 100KV

RTS-2 Bus No. 1, Pri. No. 1 Current & Out									
IA	IB	IC	OUT 2 Spare	OUT 3 Open CT Alarm					
1	3	5	7	9	11	13	15	17	19

No toolbox is complete without Human Performance

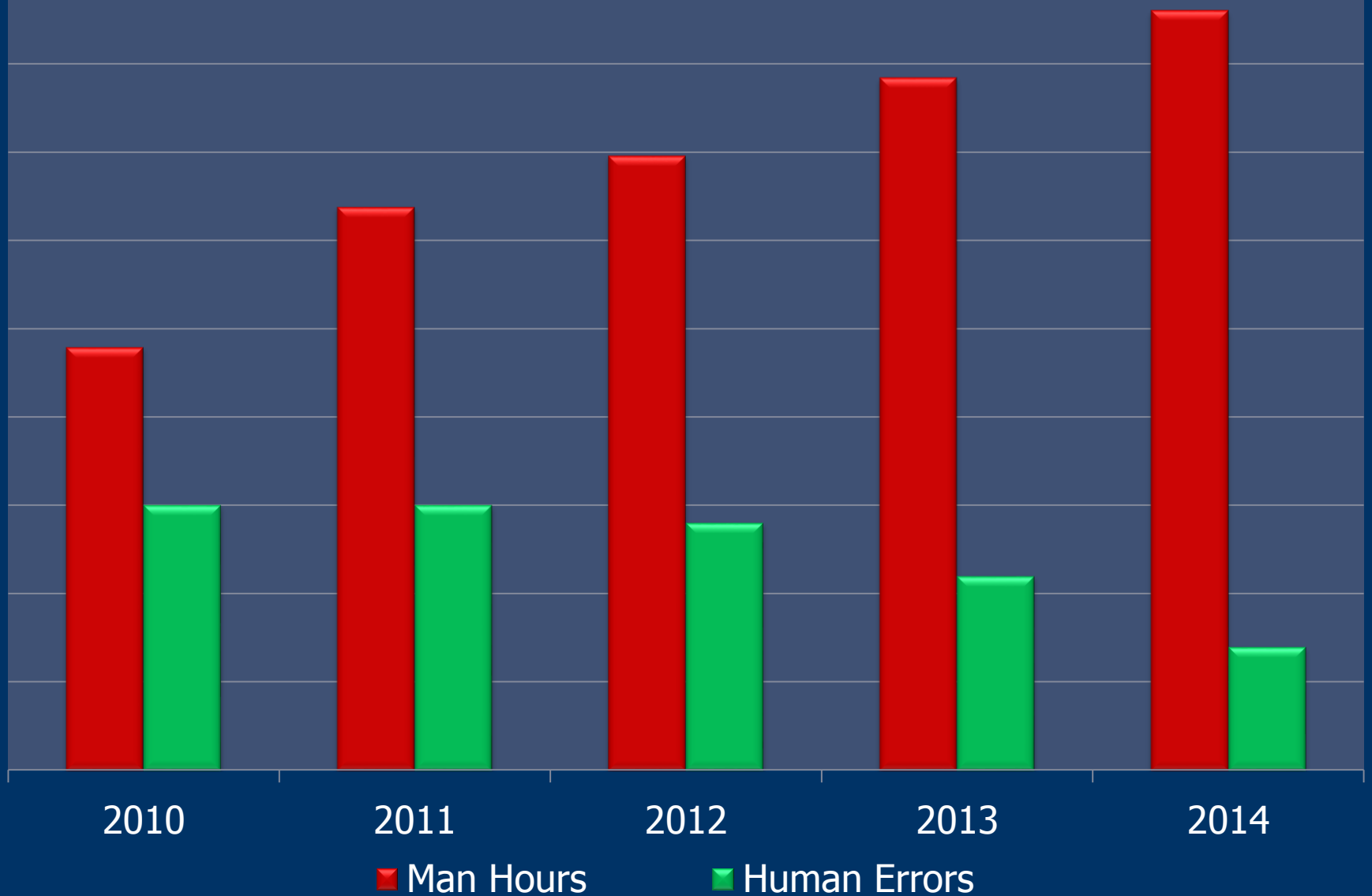
Pre Job Brief

# AWARENESS





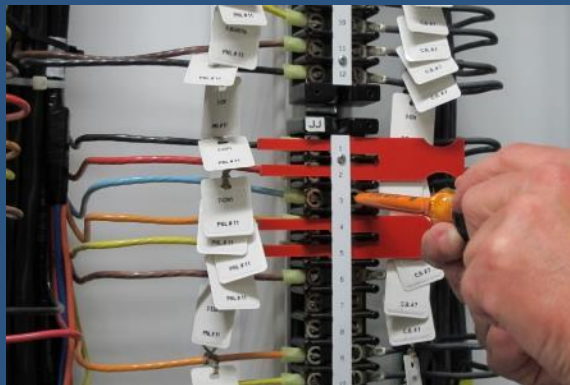
# Dominion System Protection Technical Crews Man Hours vs. Human Error Events



What About the Contractors?

# HP Improvement Using a Contract Labor Force

- Use contract electricians for capital construction and existing control system rebuilds.
- Dominion Substation Electricians are focused on operations and maintenance.



# HP Improvement Using a Contract Labor Force

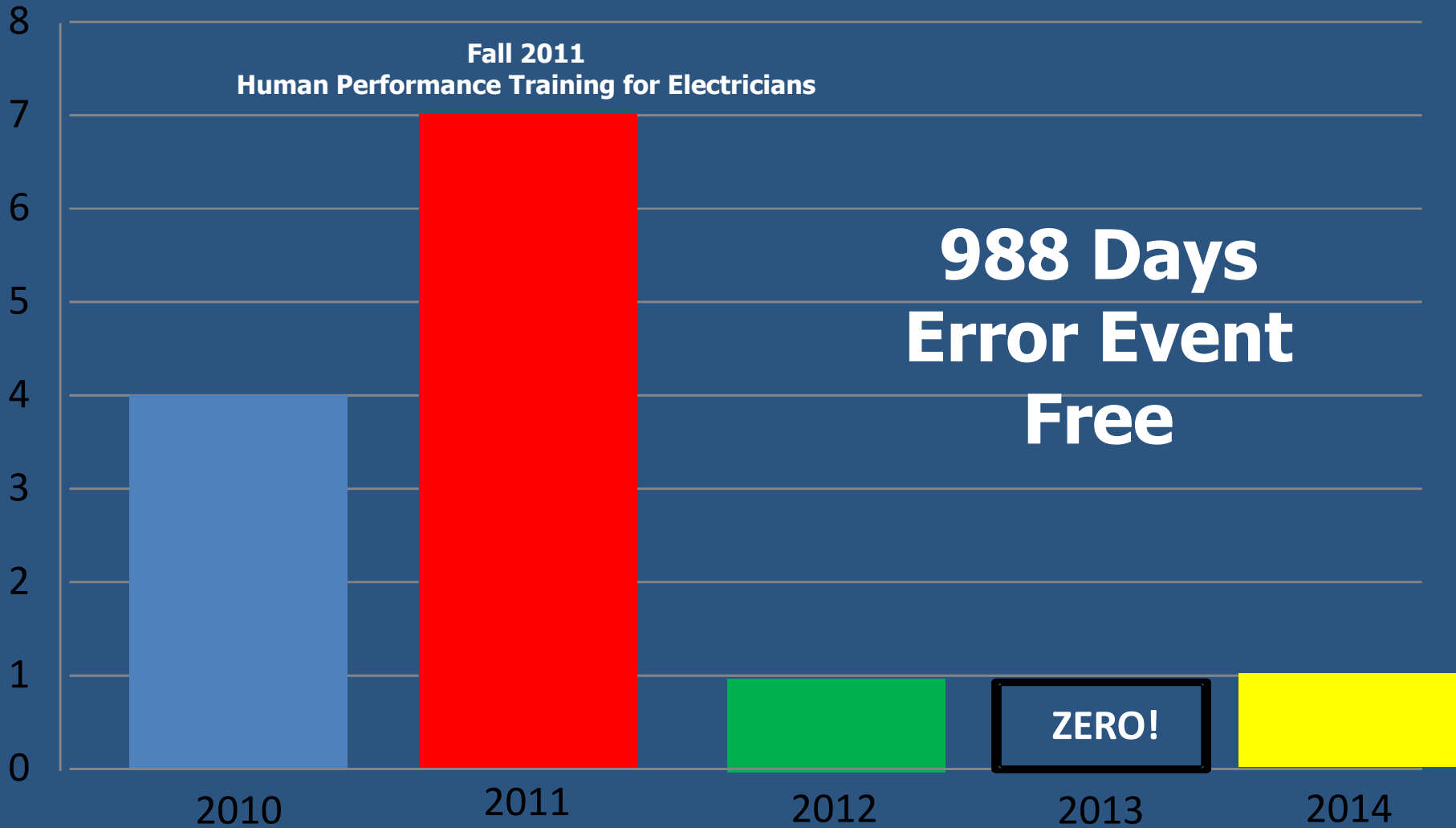
- In 2010, 28 contract electricians.
- In 2014, 92 contract electricians.
- In 2011, contract electrician errors produced a HP error event to our system every 32 working days.



# HP Improvement Using a Contract Labor Force

- Fall 2011, HP training for all contract electricians.
- Displayed the error data....what we do wrong.
- HP tools and physical “defense tools”.
- DC circuitry training and overview of our relay circuitry.
- HP “coach” training for all contractor supervisors.

# Contract Electrician Wiring Errors 2010-2014



# IT'S ALL ABOUT AWARENESS

- What are we doing?
- What mistakes do we make when we're doing it?
- What defenses can we put in place?



# Human Performance Improvement





When Your HP Improvement Culture Takes Root



Awareness  
Reliability

**Everybody Wins!**



Error Events  
Safety Incidents  
Injuries

# Thank You!



**Dominion<sup>®</sup>**