

# SACADA for HRA

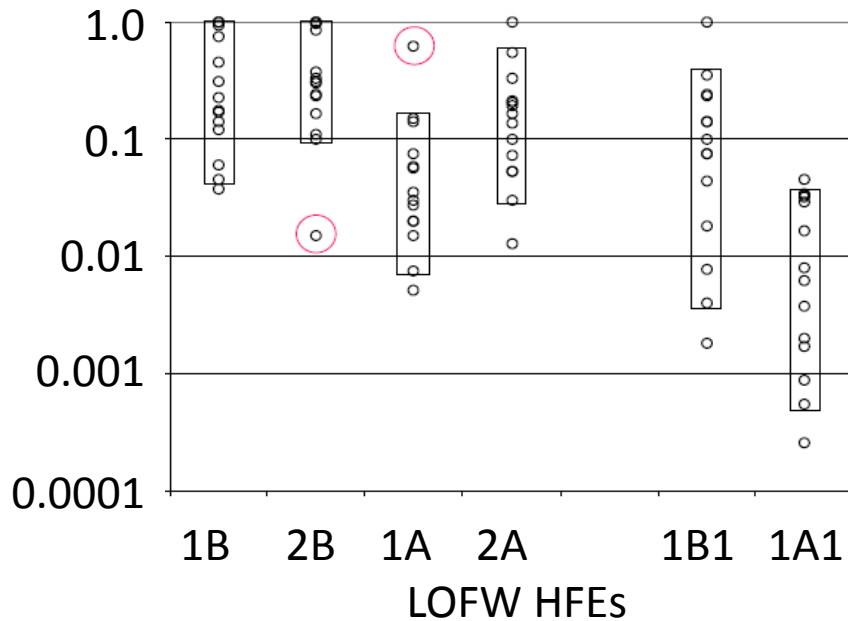
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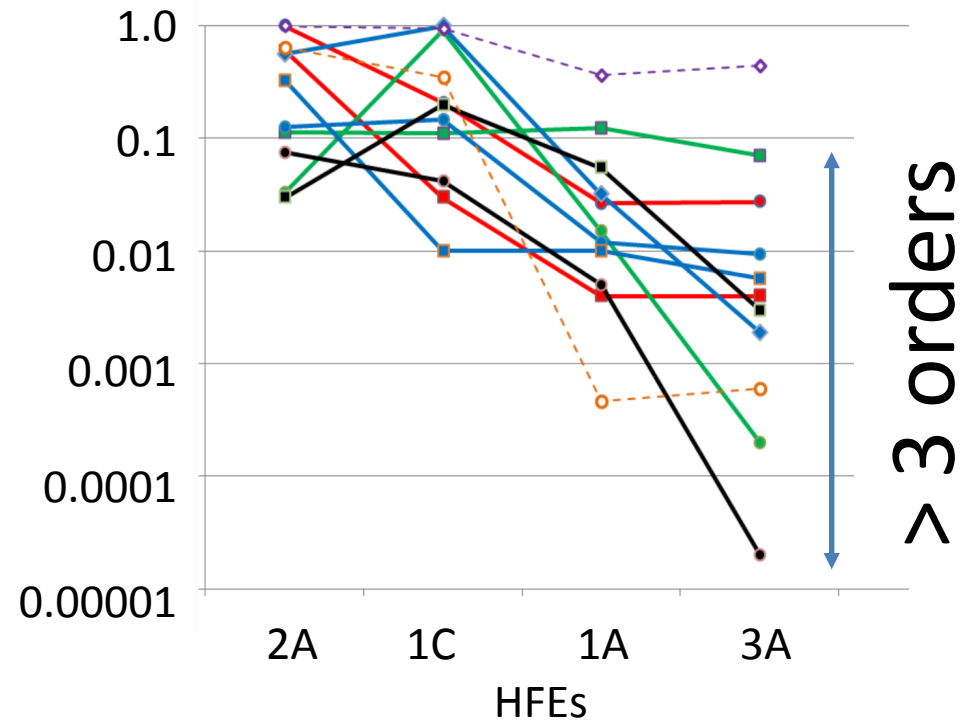
Presented at the HRA Data Workshop  
March 15-16, 2018

# Lack Data, Large Variability

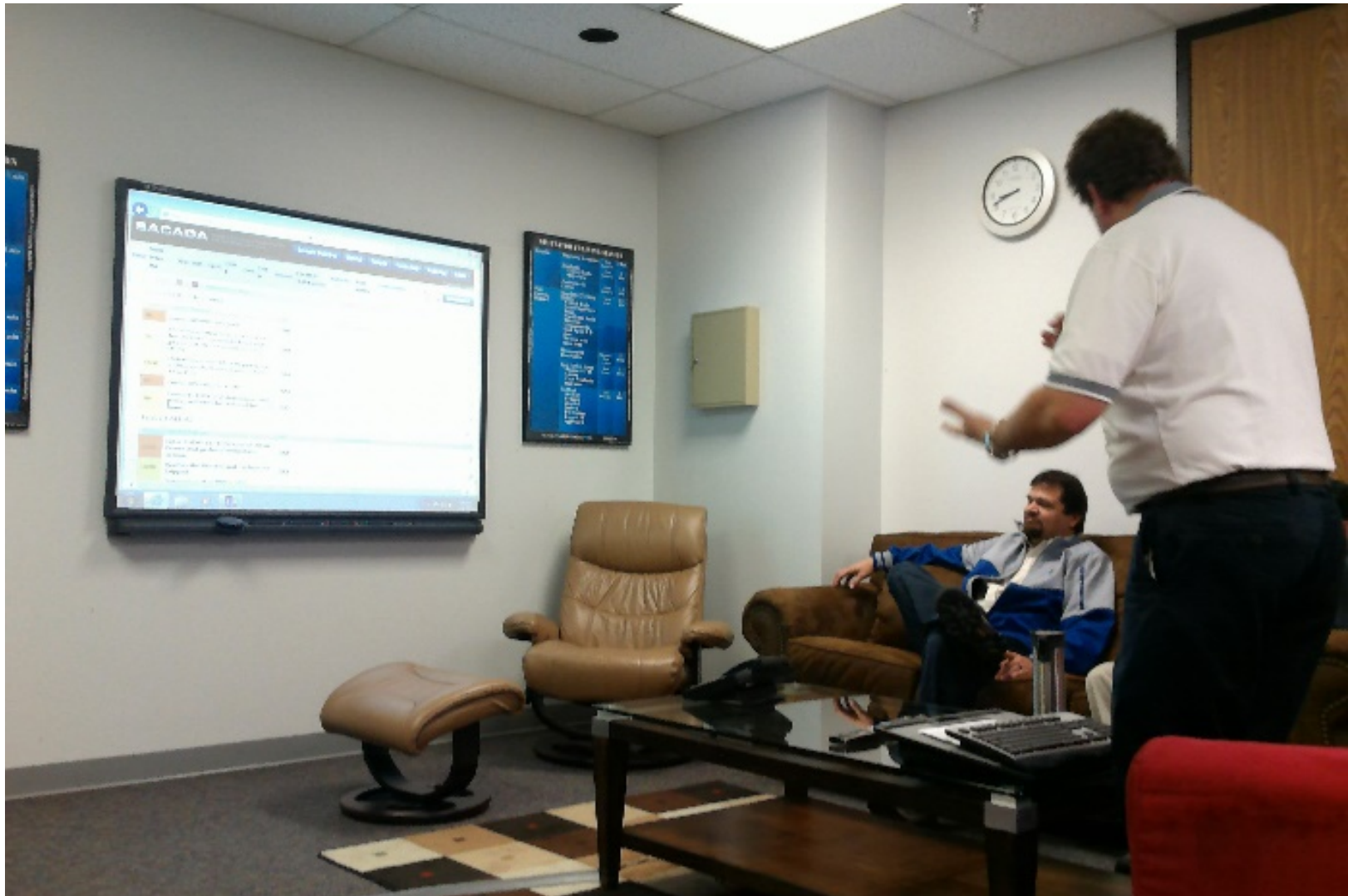
## International HRA Empirical Study



## US HRA Empirical Study

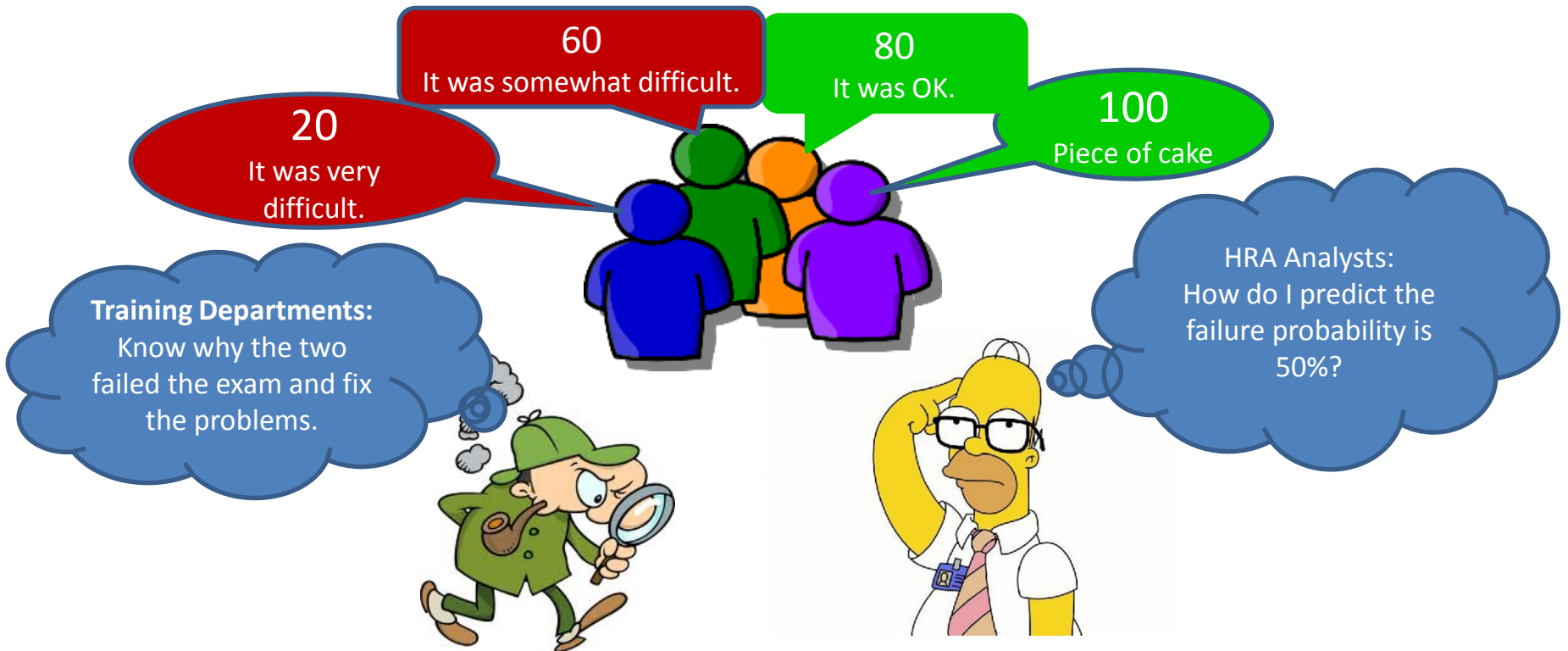


# SACADA Approach – Partnering with NPPs' Training Departments



# Establish a Win-Win Partnership

Four students took the same exam. The results are:



# Differences

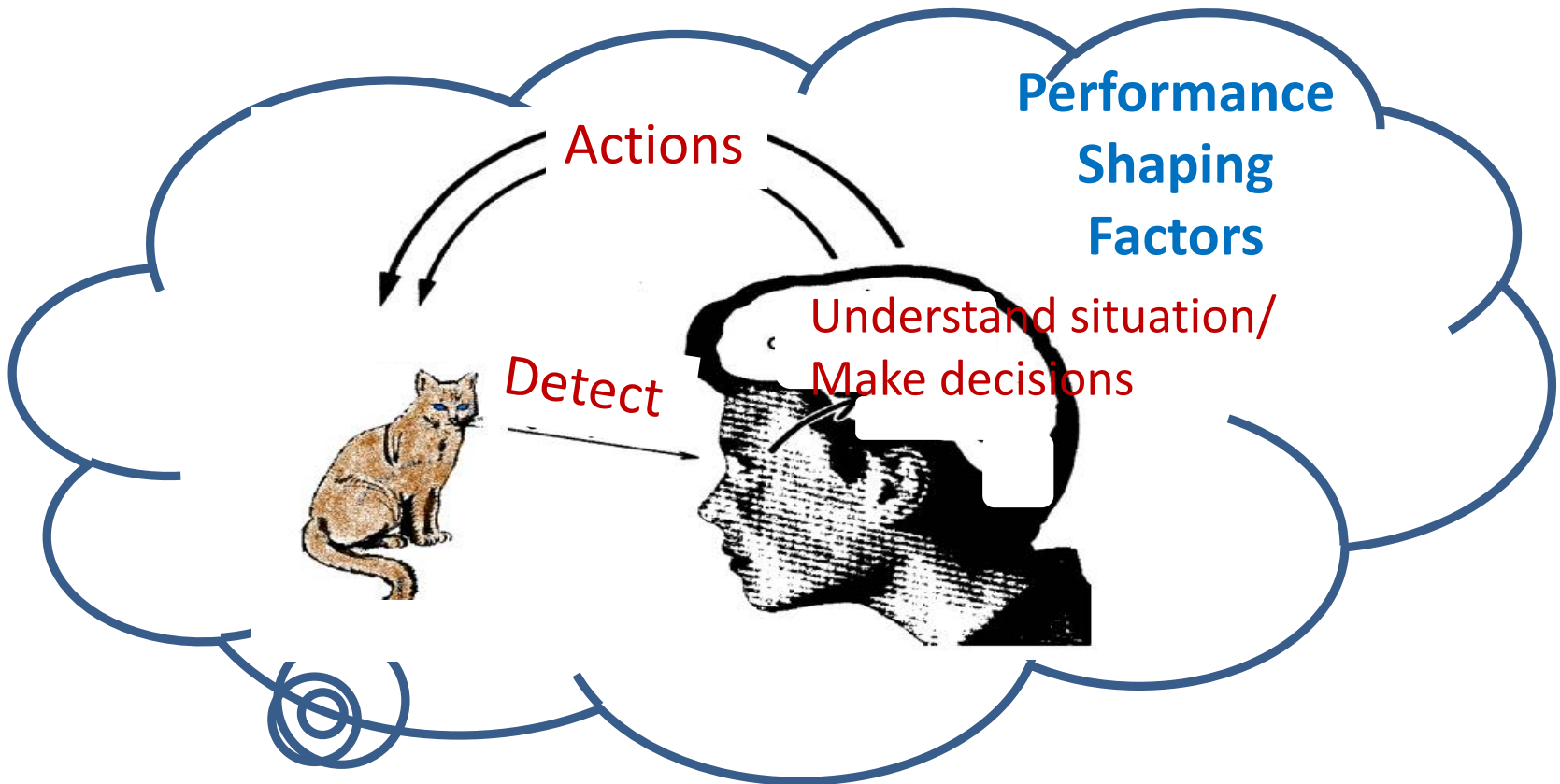
## **Training Department**

- Improve performance
- Retrospective analysis
- Individual/crew-specific performance
- Tend to be task oriented
- Deterministic

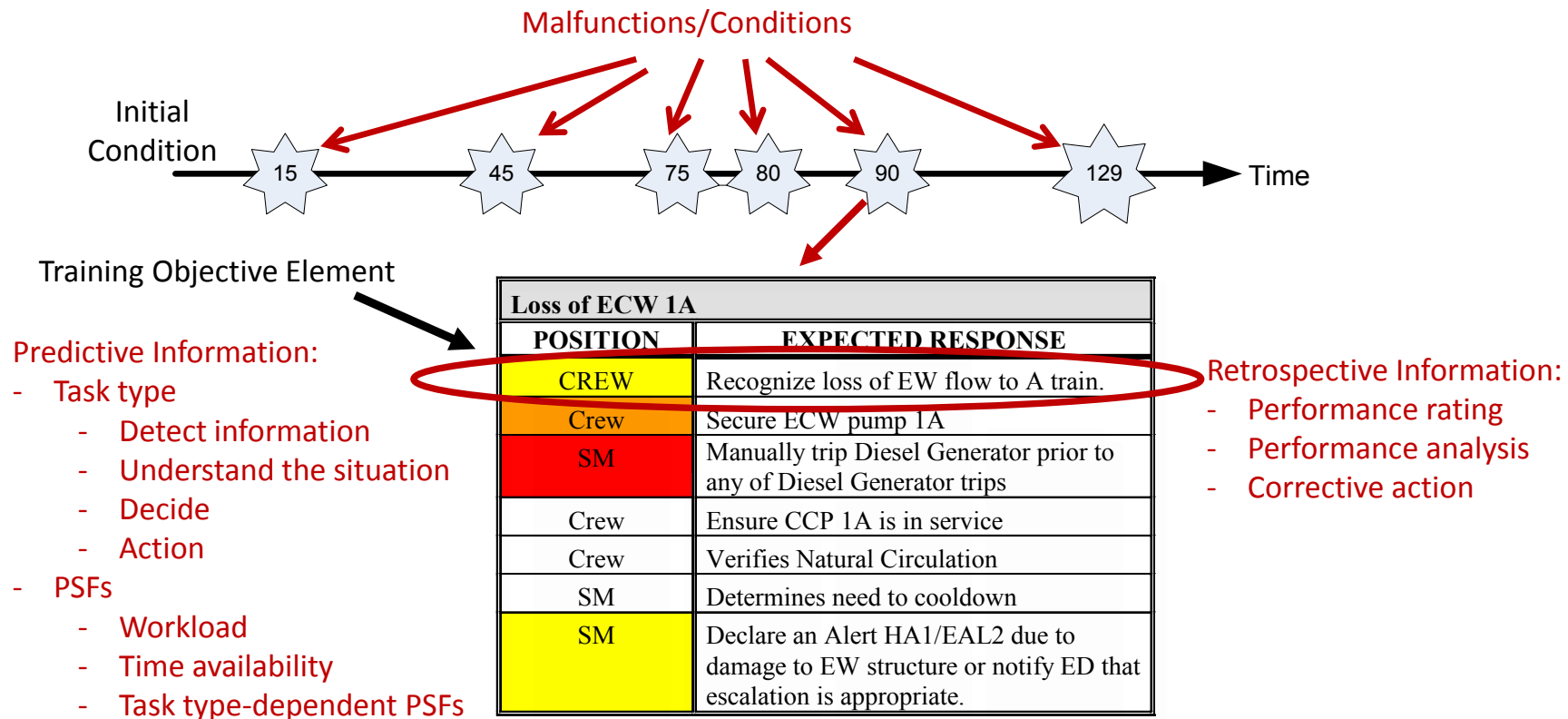
## **HRA Analysts**

- Predict performance
- Predictive analysis
- Statistical performance
- Desire to be human centered
- Probabilistic

# HRA's Human Centered Model



# One Data Point, Two Types of Information for Operator Training and HRA



# Beef Up Training Departments' Interests

- Computerization to reduce simulation preparation efforts
- Mobile device for flexibility in data collection
- Instant emails to improve crew performance communication
- Data output to identify crew performance issues

**SACADA** Scenario Authoring, Characterization, and Debriefing Application

Scenario Selection Debrief Reports Export Forum-FAQ Authoring Admin

Language English - US Account Logout About

Plant: Example Plant Year: 2017 Cycle: Cycle 1 Crew: Test A Scenario: RST 216.17 - CPE Scenario Instructor: Instructor Generic Comments/Info:

Select Scenario Add Scenario Copy Current Scenario Plant: Example Plant Year: 2017 Cycle: Cycle 1 Scenario: RST 216.17 - CPE Scenario

☒ Add Malfunction | Import Malfunction | Malfunctions: 12 Items

☐ Add Element | Import Element | ECO activity

☐ Add Element | Import Element | No. 12 Condensate Pump Trip

☒ Add Element | Import Element | Fire in No. 12 Condensate Pump Motor

Position	Expected Response	Context
US	Enter POP04-ZO-0008, Fire/Explosion	✓ ✎ 🗑
CREW	Activate the fire alarm, make the announcement, and call out the Fire Brigade	✓ ✎ 🗑
SM	Review 0ERP01-ZV-IN01 for Emergency Plan Classification (None required)	✓ ✎ 🗑

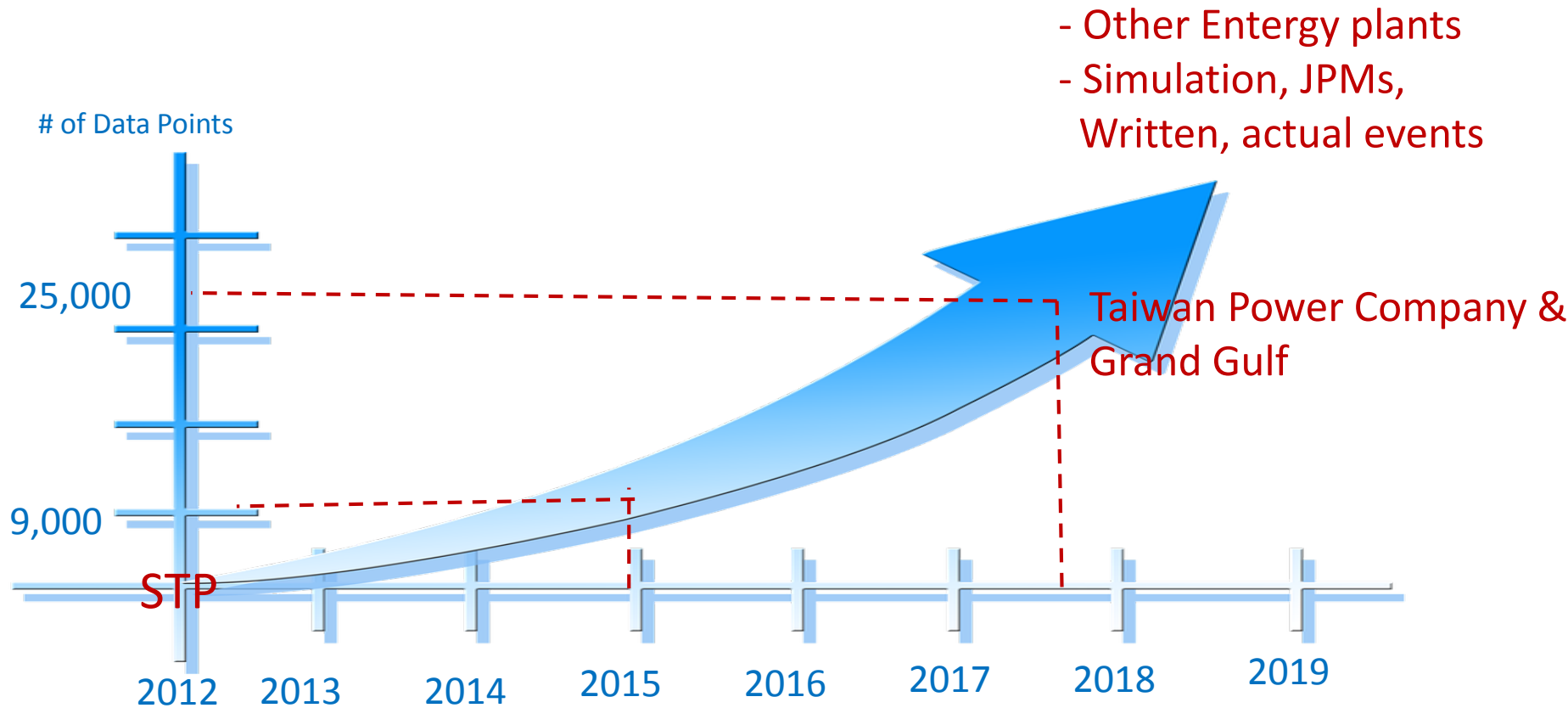
☒ Add Element | Import Element | Injured Fire Brigade Member



# Data Output to Identify Performance Issues

3	Row Labels	Sum of SAT+	Sum of SAT	Sum of SAT Δ	Sum of UNSAT	Sum of Total
4	<b>SG Tube Rupture in 1B Steam Generator</b>	<b>3</b>	<b>200</b>	<b>4</b>	<b>1</b>	<b>208</b>
5	Completes isolation of ruptured S/G:•Isolates AFW & Main FW to ruptured S/G.•Isolate	0	13	0	0	13
6	Depressurize RCS to meet SI termination criteria before either of the following occur:	0	13	0	0	13
7	Diagnose SGTR in B SG	0	13	0	0	13
8	Direct a reactor trip and safety injection based on increasing RCS leakage.	0	13	0	0	13
9	Directs/initiates RCS cooldown.	0	13	0	0	13
10	Directs/stops RCS cooldown and maintains < target temperature.	0	13	0	0	13
11	Enters POP05-EO-EO00, Reactor Trip or Safety Injection.	0	12	1	0	13
12	Identifies during addendum 5 performance, The B train Essential chiller trip, and secure	0	13	0	0	13
13	Identifies ECW pump 1B discharge pressure is low (shaft shear)	2	11	0	0	13
14	Manually Trip Diesel Generator prior to any of the following occurring:•Diesel Generatc	0	13	0	0	13
15	other items to discuss	0	13	0	0	13
16	Performs Immediate actions of 0POP05-EO-EO00, including RNO actions for Throttle Val	1	9	3	0	13
17	Properly select and maintain target temperature for cooldown based on the chart provi	0	13	0	0	13
18	Refers to 0ERP01-ZV-IN01, Emergency Classification. Declares an Alert Based on SGTR g	0	13	0	0	13
19	Terminate SI and control RCS pressure and makeup flow so that RCS pressure is at SG Pr	0	12	0	1	13
20	Transitions to EO30 SGTR.	0	13	0	0	13
21	<b>Loss of 250VDC</b>	<b>1</b>	<b>78</b>	<b>1</b>	<b>0</b>	<b>80</b>
22	Enters 0POP04-DC-0001	0	14	0	0	14
23	Enters 0POP04-DC-0001 Loss of 250V DC Power	0	6	0	0	6
24	Responds to 1POP09-AN-03M2 250VDC trouble, notes no chargers on the bus	1	18	1	0	20
25	Reviews CIP of 0POP04-DC-0001 regarding required additional action on a Main Generat	0	14	0	0	14
26	Reviews CIP of 0POP04-DC-0001 regarding required additional action on a Main Generat	0	6	0	0	6
27	Transfers Aux busses to Standby transformers	0	20	0	0	20

# SACADA Data and Quantity



# SACADA Data for HEP Estimates

- Three NRC contractors will present their methods of how to use SACADA data to estimate HEPs in this workshop
  - Each contractor should demonstrate how to use SACADA data to estimate an HFE's HEP
- Encourage you to critique their methods
  - Please focus on method, not numbers
- Your opinions will shape the NRC's HRA data research

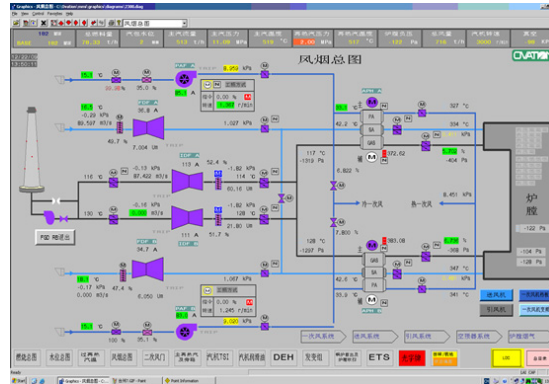
# SACADA Operation Experience

- Aim for a practical long term data collection
  - Plant staff collect data instead of researchers
- Benefit to the plant operator training
  - Computerization to Reduce effort, improve training effectiveness and efficiency, and not increase operation cost
  - Flexible operation, e.g., use mobile device to accomodate different debriefing styles
- Think ahead on how the collected data will be used to inform HEP estimates

# “New” Data Domains



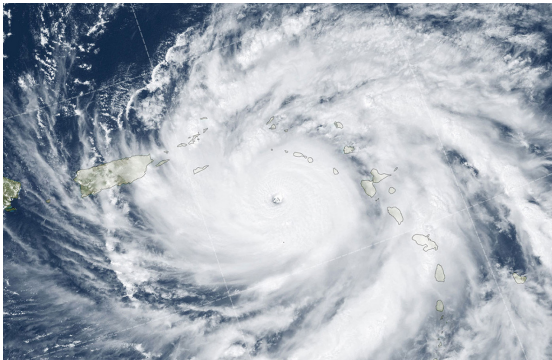
Severe Accidents



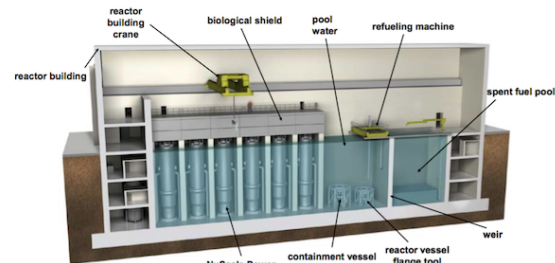
Digitalized Controls



Portable Equipment



Extreme Hazards



Small Modular Reactors



Actual Events

# Enhance Collaboration

- Each organization has its own method to collect human performance information from HRA
  - Validation: Can the results be compared?
  - Aggregation: Can Bayesian updated be applied?
- Share the data collection tools
- Understand each others' data needs and methods
  - Is it feasible to have a commonly accepted method and tool (may be for each data domain)?