SACADA for HRA

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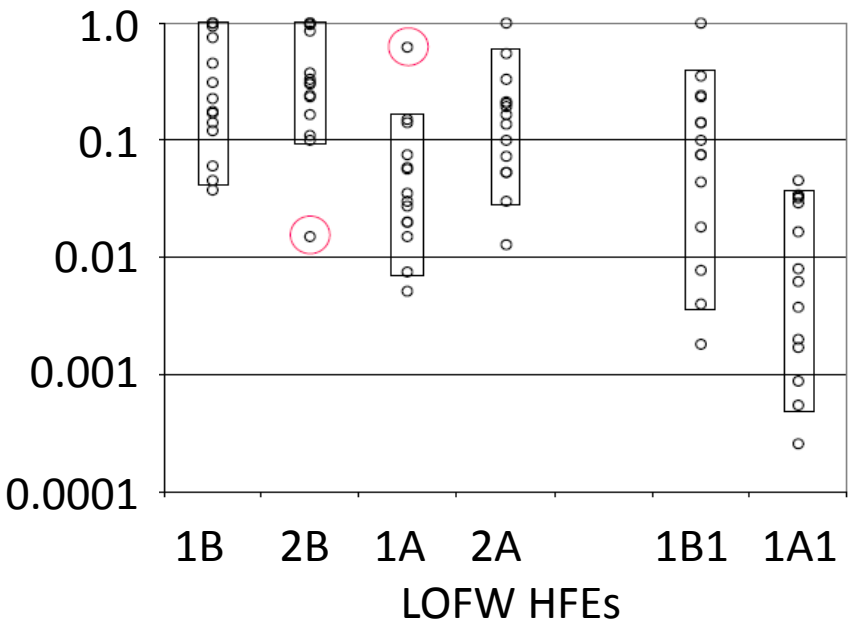
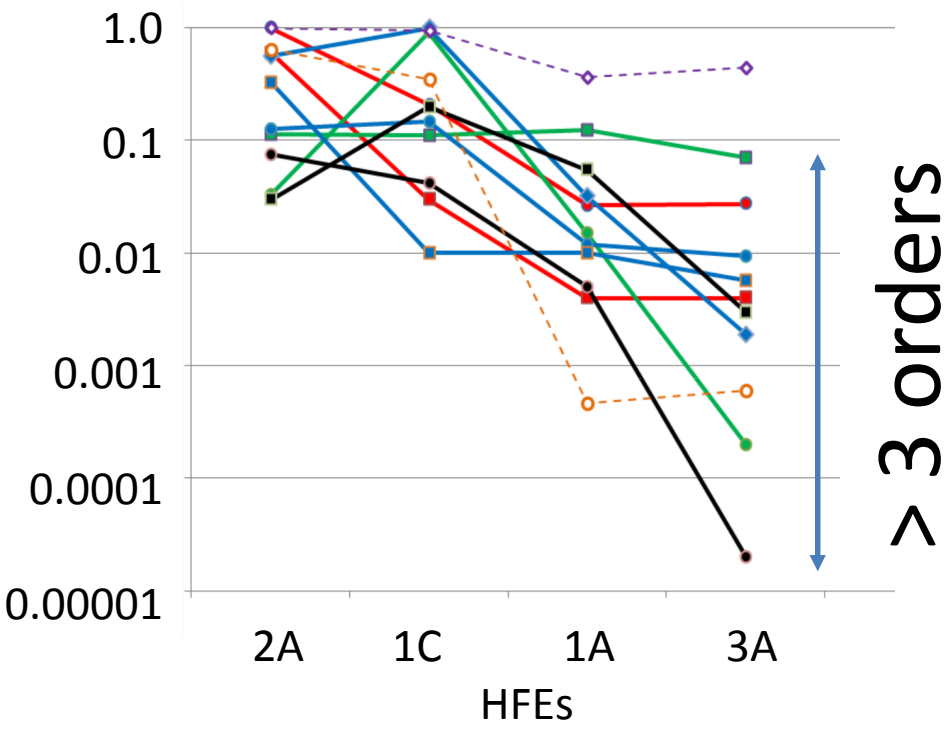
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Lack Data, Large Variability

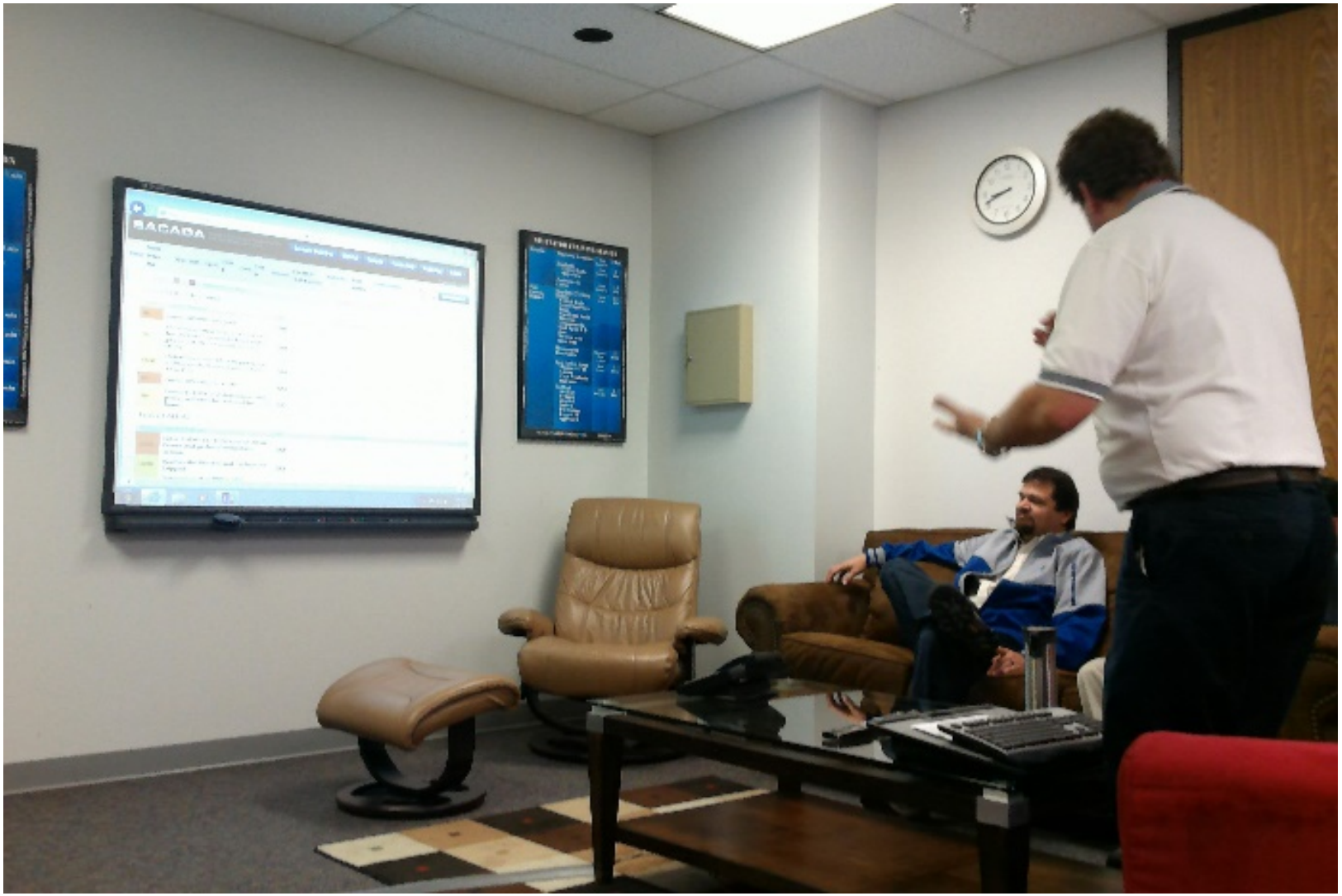
International HRA Empirical Study



US HRA Empirical Study

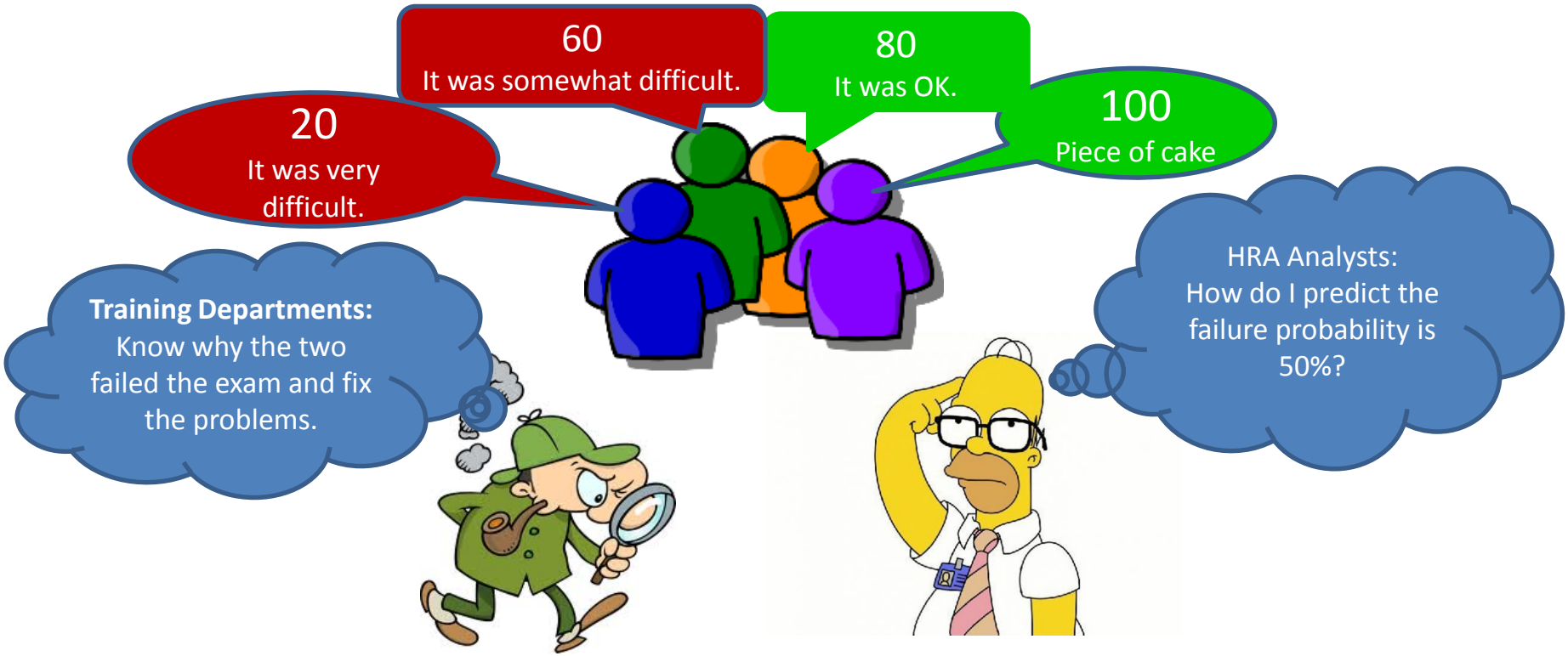


SACADA Approach –
Partnering with NPPs' Training Departments



Establish a Win-Win Partnership

Four students took the same exam. The results are:



Differences

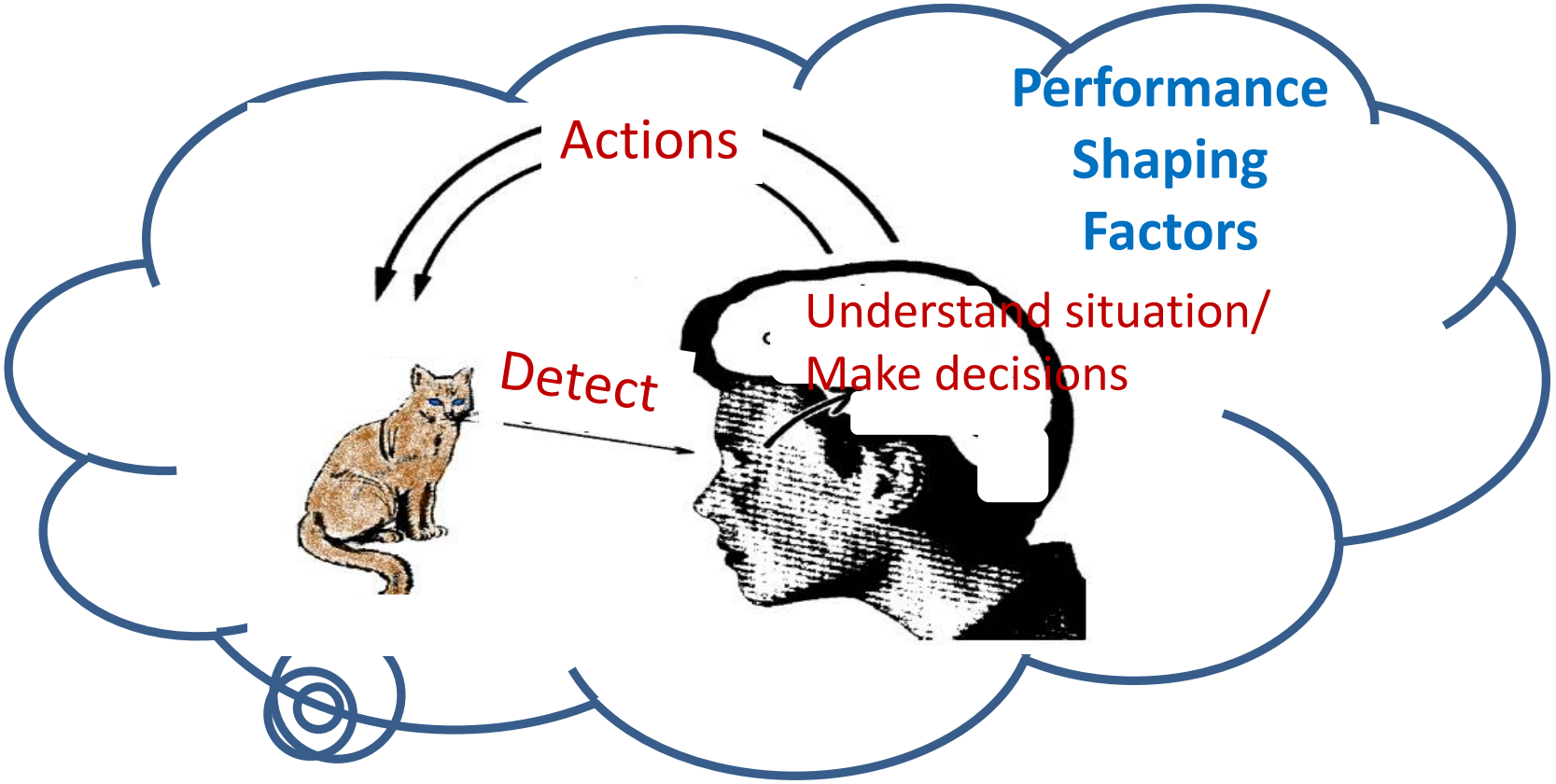
Training Department

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

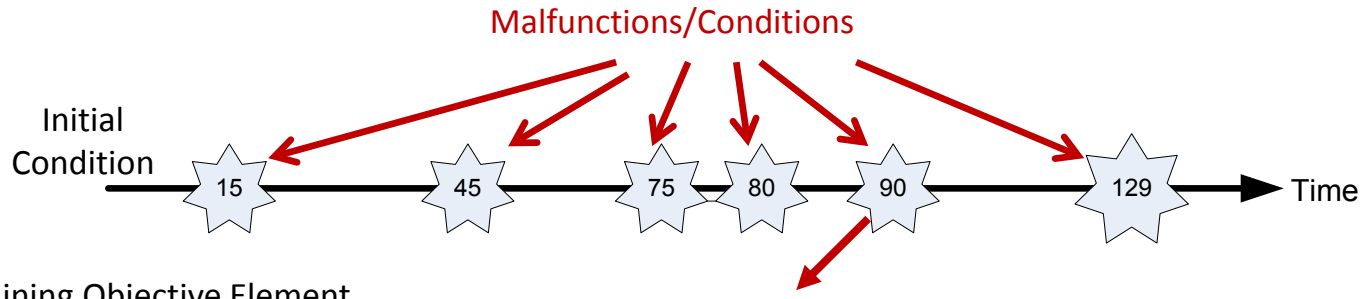
HRA Analysts

- 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



Training Objective Element

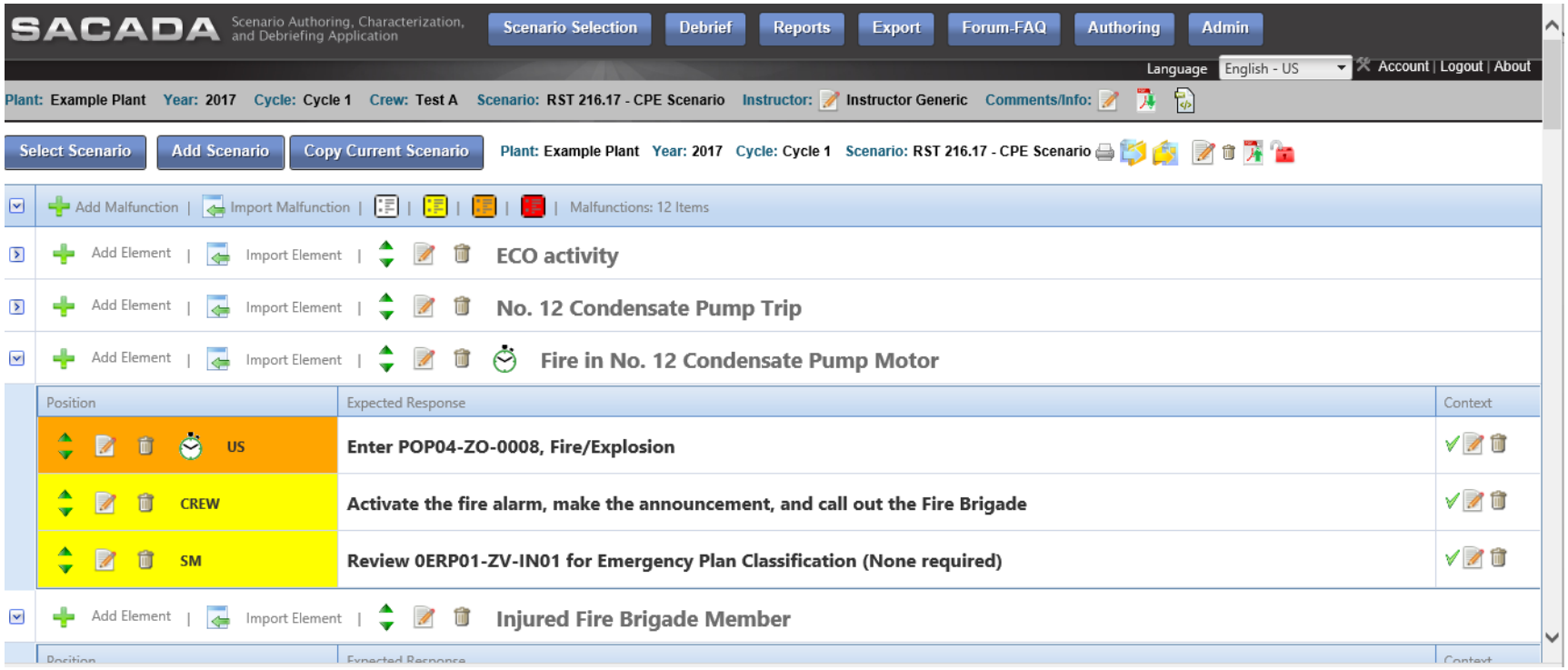
Loss of ECW 1A	
POSITION	**EXPECTED RESPONSE**
CREW	Recognize loss of EW flow to A train.
Crew	Secure ECW pump 1A
SM	Manually trip Diesel Generator prior to any of Diesel Generator trips
Crew	Ensure CCP 1A is in service
Crew	Verifies Natural Circulation
SM	Determines need to cooldown
SM	Declare an Alert HA1/EAL2 due to damage to EW structure or notify ED that escalation is appropriate.

Predictive Information:
- Task type
  - Detect information
  - Understand the situation
  - Decide
  - Action
- PSFs
  - Workload
  - Time availability
  - Task type-dependent PSFs

Retrospective Information:
- Performance rating
- Performance analysis
- Corrective action

Beef Up Training Departments' Interests

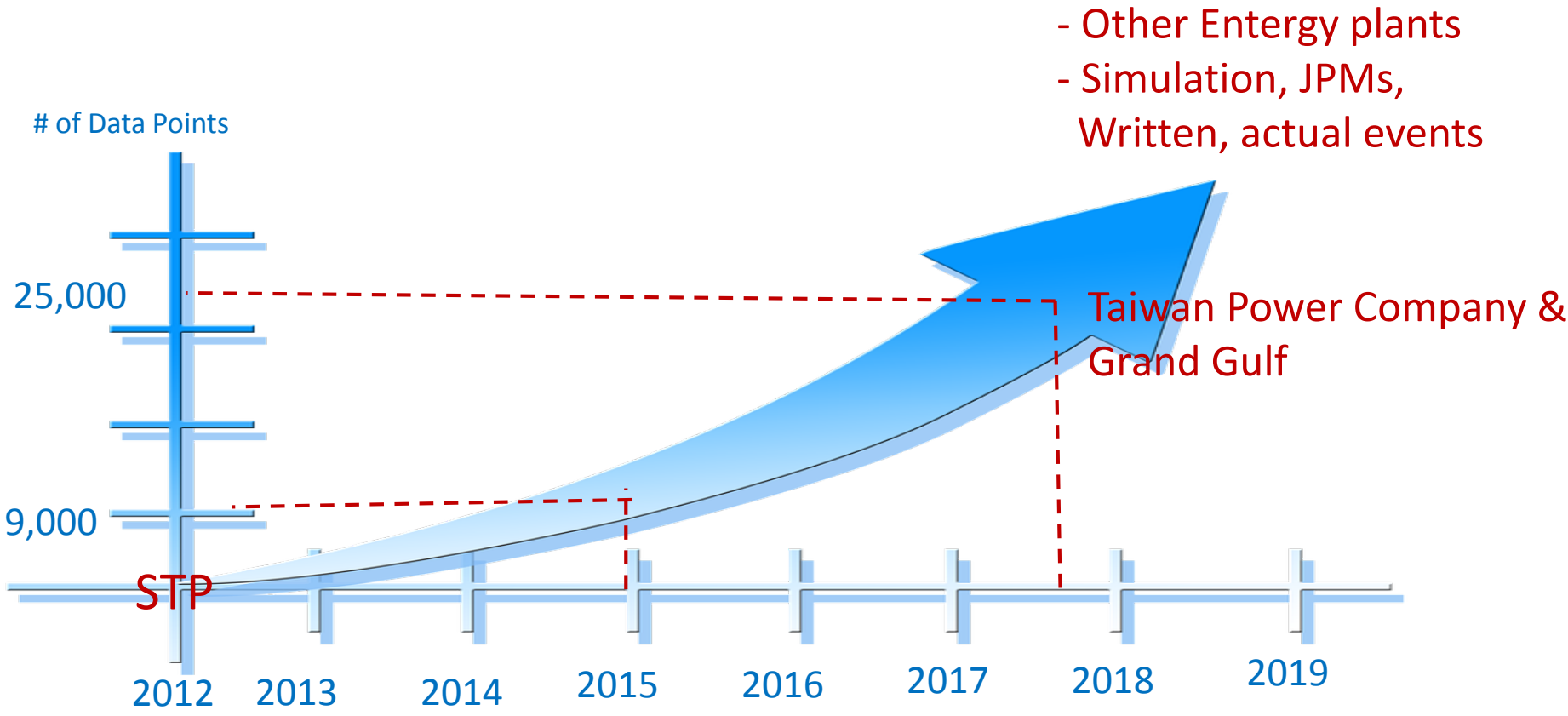
- Computerization to reduce simulation preparation efforts
- Mobile device for flexibility in data collection
- Instant emails to improve crew performance communication
- Data output to identify crew performance issues



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	**SG Tube Rupture in 1B Steam Generator**	**3**	**200**	**4**	**1**	**208**
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	**Loss of 250VDC**	**1**	**78**	**1**	**0**	**80**
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

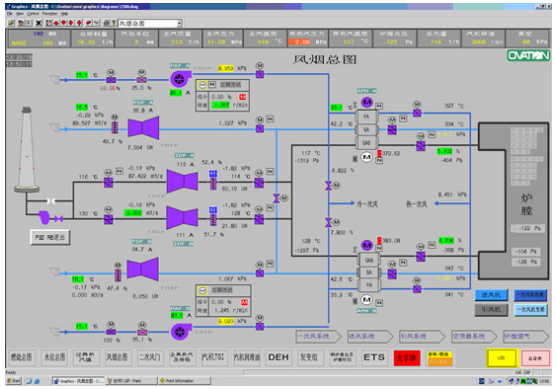
- Three NRC contractors will present their methods of how to use SACADA data to estimate HEPs in this workshop
  - Each contractor should demonstrate how to use SACADA data to estimate an HFE's HEP
- Encourage you to critique their methods
  - Please focus on method, not numbers
- Your opinions will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

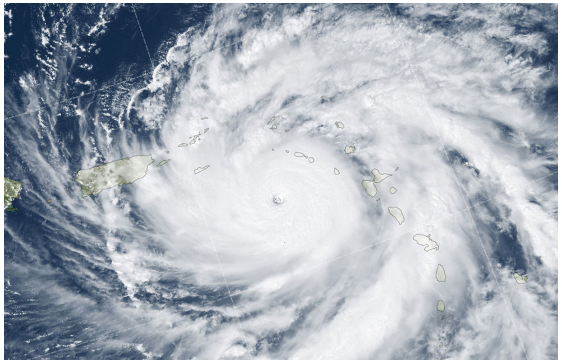
“New” Data Domains

Severe Accidents

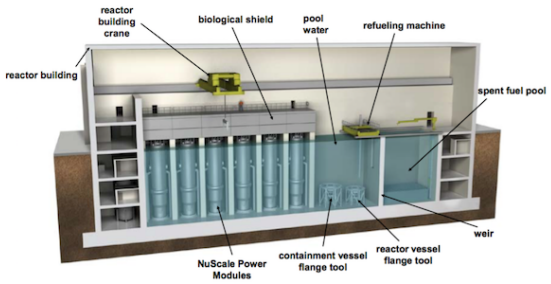


Digitalized Controls

Portable Equipment



Extreme Hazards



Small Modular Reactors

Actual Events

Enhance Collaboration

- Each organization has its own method to collect human performance information fro 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)?