



OSIsoft[®]

UC2010

Real Time Information — Currency of the New Decade

Hilton San Francisco Union Square | San Francisco, CA

April 26-28, 2010

U.S. Nuclear Regulatory Commission (NRC)

- License / regulate civilian use of nuclear materials
 - 104 U.S. commercial nuclear power plants
- Incident response
 - Staff ready to respond
 - Monitor plant protective actions and mitigation strategies
- Emergency Response Data System (ERDS) used to receive plant data

Emergency Response Data System (ERDS)

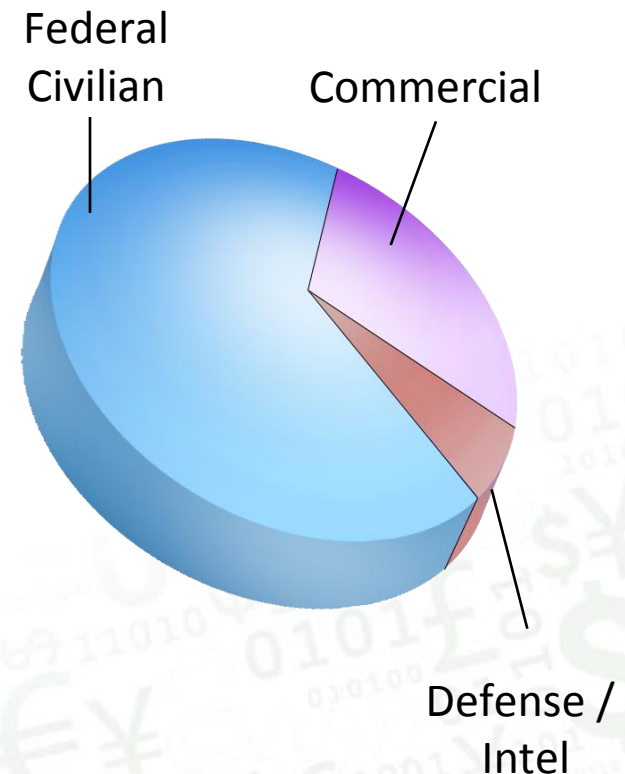
- NRC requirement of licensed nuclear power plants
- NUREG-1394 defines
 - ERDS protocol
 - Data Point Library (DPL) and Plant Attribute Library (PAL) files
 - Both sent by nuclear power plant to NRC
 - DPL is metadata about real-time data sent to ERDS
 - PAL is information about the connecting utility process computer and contact information.
- Actively receives near real-time Data
 - Quarterly Testing
 - Plant drills
 - Incidents
- Viewed by two different types of users
 - NRC Incident Response staff
 - State Regulators

ERDS Replacement

- Motivation
 - Antiquated system – 1985 vintage
 - Hardware support discontinued
- Needs
 - Short delivery timeframe
 - Limit impact on 104 nuclear power plants at 65 sites
 - Phase I existing modem connection with ERDS protocol
 - Phase II VPN connection secured by certificate
- Software vendor selection meets all NRC prerequisites and compliance standards
- Project Performance Corporation selected as prime contractor to provide a solution and architecture design

Project Performance Corporation (PPC)

- Management and IT consulting firm founded 18 years ago
- Headquartered in McLean, VA
- Germantown, MD office supports NRC
- Diverse business base
- Awarded CMMI Maturity Level 3 rating and ISO 9001:2008-registered



ERDS Background

- 1985 vintage
- Replacement parts very hard to find
- Many software limitations
- Need for modern technology that would be readily available
- Design only allowed a small number of plants to be connected at once via modem pool



Major Challenges

- State Regulators need connectivity
- Need similar interface for both NRC and State Regulators
- Users located at multiple facilities
- Verify that the data being sent is the same data that is being displayed – Need easier way to tell when a plant is disconnected.

High Availability Solution

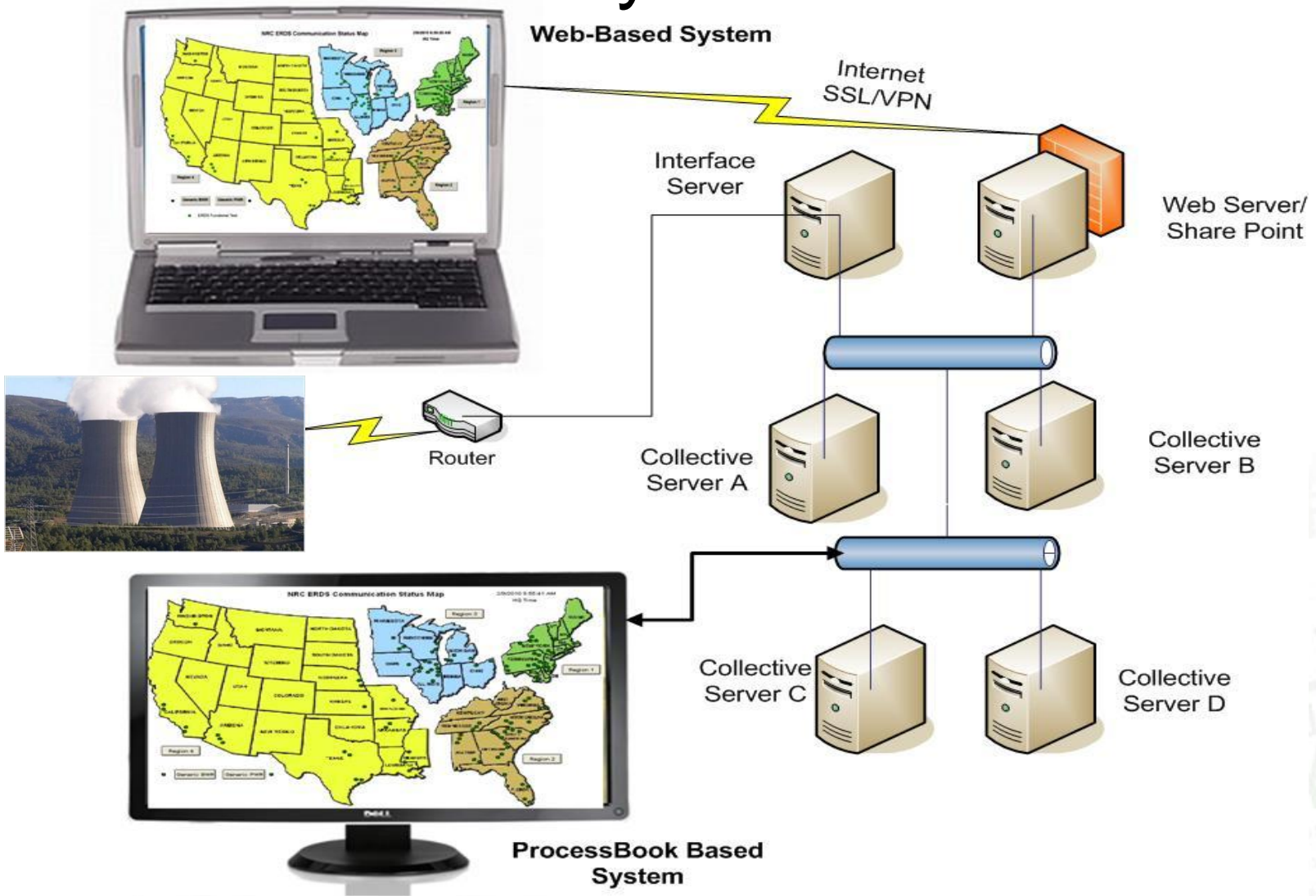
- NRC stores and presents data from nuclear power plants for the purpose of review and analysis
 - All 104 NRC licensed commercial nuclear power plants can be displayed
- Provided two phase approach to modernize the hardware and software for NRC
- Install OSIsoft PI High Availability and redundancy using PI Collective and Interface
- Leverage OSIsoft nuclear expertise and best practices to design solution
- Build for the possibility of continuous data feeds from all plants

Complete OSIsoft Solution

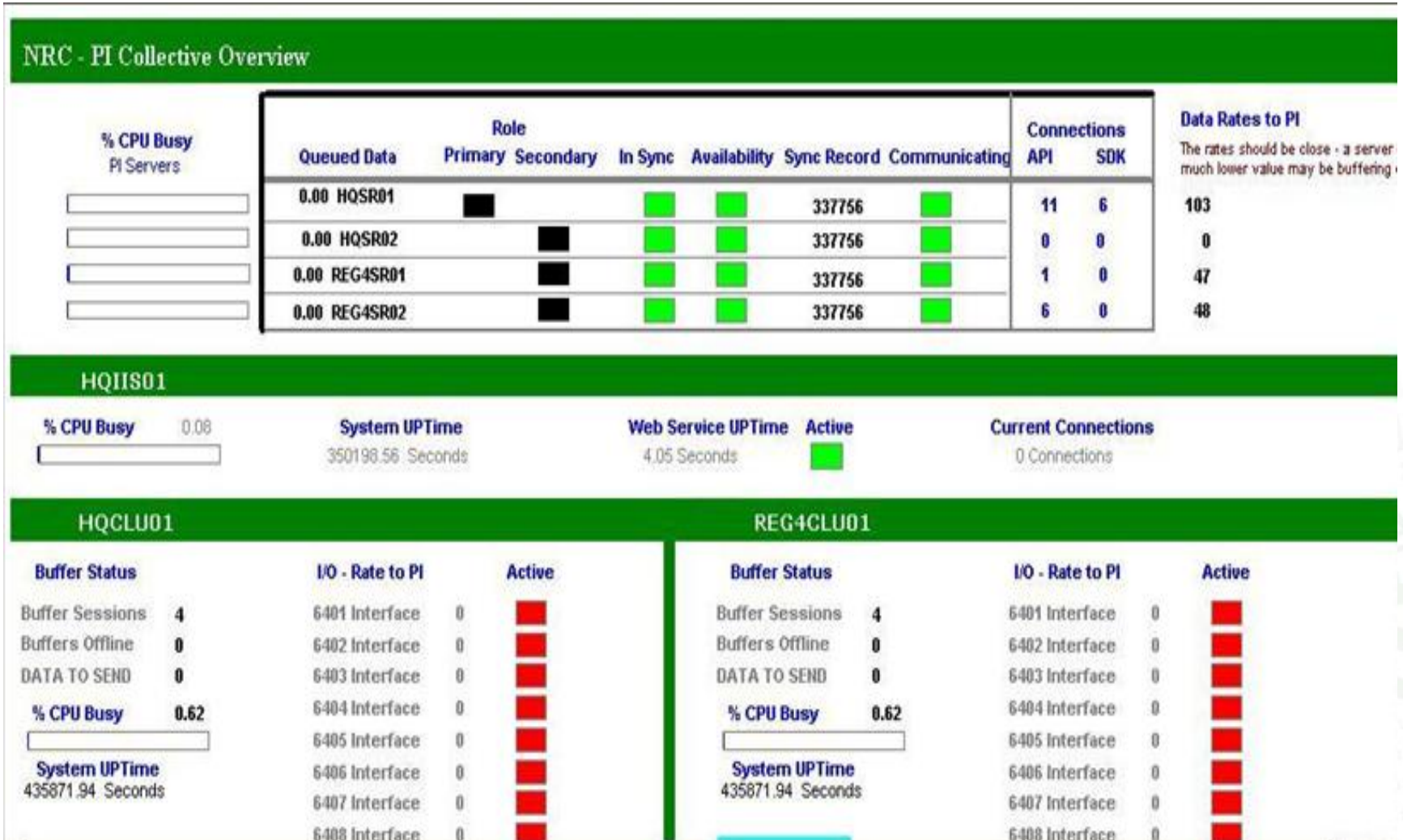
OSIsoft Software and Services used

- HA Replicated PI Servers
 - Allows NRC to keep the system online while doing software updates (patches, etc.)
 - No downtime for system maintenance!!!
- PI Module Database
- ProcessBook
- PI Webparts (PI Graphics)
- Custom Interface for ERDS protocol
- Enterprise Agreement (EA)
- Center of Excellence (CoE)

Infrastructure Layout and Architecture



PI System Overview



PPC Application Development

- VBA code on ProcessBook displays
 - Form for interface control (via output tags)
 - Form for manual data entry
 - Form to display DPL metadata in PI Module Database
 - Form to display PAL metadata in PI Module Database
- Applications for maintenance and day-to-day operations
 - DPL workflow Automation
 - GUI wrapper for command line tool
- Use of many ProcessBook Multi-State Symbols

Design for ProcessBook Displays

- Displays designed to be as generic as possible but still show needed information for each nuclear power plant.
- Meetings with NRC staff determined that they needed to differentiate between “good” data quality and any quality other than “good”
- Standardized each data point to show black text with white background to show “good” data quality
- White text with black background to show “other than good” data quality

Good Quality

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Other Than Good Quality

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Main Reasons for Application Coding

- Two different types of users
 - NRC Incident Response Staff
 - Local/WAN users
 - State Regulators
 - Have a Memorandum of Understanding
 - Have remote access to the NRC PI system
- More than just the data in the PI Point Database and PI Archive needs storing, retrieval, and display

User Authentication Solutions

- PI WebParts zone modifications within SharePoint
- Microsoft Active Directory Rights Management and group creations for each State end user
- Shared network folder for image delivery for ProcessBook users
- SharePoint folder permissions for displays and automatic document protection integrated with A.D. groups
- VeriSign digital certificates required for HTTPS connectivity to the website

Users

- NRC Incident Response Staff
 - Connected to the NRC WAN
 - ProcessBook easily used
 - Allowed access to all 104 nuclear power plants
- State Regulators
 - Not connected to the NRC WAN.
 - Only allowed access to some nuclear power plants
 - within their state
 - in close proximity to their state's border.

PI-SMT Security Groups

- Set up groups in PI-SMT that are based on particular nuclear power plant.
 - Easy to automate creating security groups.
- Assign PI Point datagroup and pointgroup to the above name. (Using PI-SMT Add-In) Setting dataaccess and pointaccess to: **o:rw g:r w:**
- Add users that are allowed to “see” that plant to the group in PI-SMT and voila! Security allows the users to “see” only the plants they are supposed to see. All others appear as “No Data.”

Security Groups SharePoint

- Matching the naming convention in the Share Point web site allowed us to extend this model and provide default Share Point error messages that read Access not allowed.
- PI Trust table set up for each user in user database.
- Microsoft Active Directory Rights Management and group creations for each State and user.
- SharePoint folder permissions for displays and automatic document protection integrated with A.D. groups.
- VeriSign Digital Certificates for supporting two-factor user authentication.

Manual Data Entry Display

GENERIC BWR MANUAL DATA ENTRY Actual 1/19/2010 2:46:09 PM HQ Time

Description	Value
TAG 1 REACTOR VESSEL LEVEL (%)	100
TAG 2 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 3 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 4 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 5 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 6 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 7 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 8 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 9 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 10 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA

Description	Value
TAG 11 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 12 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 13 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 14 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 15 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 16 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 17 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 18 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 19 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA
TAG 20 ENTER TAG DESCRIPTION (AND UNITS)	NO DATA

Manual Data Written.

**Insert the Description (with units) and Value
If necessary, enter the date and time.**

Enter Site Date/Time
DD/MM/YYYY HH:MM (:SS optional) (24 Hour Time)

Use Current Time
 Enter SITE Date/Time MM/DD/YYYY

Generic BWR – “ALL” Display

GENERIC BWR - ALL

OVERVIEW CSF RAD MET ALL MANUAL ADHOC

1/19/2010 2:53:36 PM

HQ TIME

ACTUAL

NO_ERDS
SITE TIME

COND_AE_RAD1	NO_ERDS	O2_CONC	NO_ERDS
CR_SPRAY_FL1	NO_ERDS	RCIC_FLOW1	NO_ERDS
CR_SPRAY_FL2	NO_ERDS	RCS_PRESSURE	NO_ERDS
CST_LEVEL1	NO_ERDS	REAC_VES_LV1	NO_ERDS
DW_PRESS1	NO_ERDS	REAL_SIM	ACTUAL
DW_RAD1	NO_ERDS	SP_LEVEL1	NO_ERDS
DW_RAD2x	NO_ERDS	SP_TEMP1	NO_ERDS
DW_TEMP1	NO_ERDS	STAB_CLASS1	NO_ERDS
EFF_GAS_RAD1	NO_ERDS	STAB_CLASS2	NO_ERDS
H2_CONC1	NO_ERDS	STAB_CLASS3	NO_ERDS
HPCI_FLOW	NO_ERDS	WIND_DIR1	NO_ERDS
LPCI_FLOW1	NO_ERDS	WIND_DIR2	NO_ERDS
LPCI_FLOW2	NO_ERDS	WIND_DIR3	NO_ERDS
MAIN_FD_FLW1	NO_ERDS	WIND_SPEED1	NO_ERDS
MN_STM_RAD1	NO_ERDS	WIND_SPEED2	NO_ERDS
MN_STM_RAD2	NO_ERDS	WIND_SPEED3	NO_ERDS
MN_STM_RAD3	NO_ERDS		
MN_STM_RAD4	NO_ERDS		
NI_INTER_RNG	NO_ERDS		
NI_POWER_RNG	NO_ERDS		
NI_SOURC_RNG	NO_ERDS		

ProcessBook Additional Information

- Needed the ability to display metadata for every transmitted data point.
- “ALL” display shows every transmitted data point.
- Custom code behind the form links to Module Database whenever blue text is double clicked to display metadata (stored in the PI Module Database) in a user form.

Additional Info in Module Database

PI-MDB Properties

ERDS_PARM:	WIND_SPEED1
CSF_CAT:	MET
ERDS_DESC:	WIND SPEED - UPPER LEVEL
FAIL_MODE:	LOW
INST_MAX:	50
INST_MIN:	0
NUM_INPUT:	1
POINT_ID:	WSPEED
POINT_TYPE:	A
PROC_DESC:	N/A
PWR_CUT_DF:	N/A
PWR_CUT_ON:	N/A
REF_LEG:	N/A
REF_NOTES:	N/A
SET_INFO:	NO ALARMS
SITE_DESC:	AVERAGE WIND SPEED (25 MIN AVG)
SNSR_FLAG:	S
SNSR_LOC:	AT THE 100 METER LEVEL OF THE MET TOWER
SYS_DESC:	
TEMP_COMP:	N
UNITS_CONV:	N/A
UNITS_TAG:	M/SEC
ZERO_REF:	N/A

PRINT

ProcessBook Interface Control

- PPC provided a ProcessBook display that controls each nuclear power plant's connection to the system

The screenshot displays the 'NRC ERDS Interface CONTROL Map' interface. At the top right, the date and time are shown as '1/19/2010 3:01:44 PM' and 'HQ Time'. Below the title, the 'ERDS Interface Mode' is set to 'Auto', with three buttons labeled 'Auto', 'Manual', and 'Status Map'. At the bottom, two status indicators are shown: 'Generic BWR (BWR)' and 'Generic PWR (PWR)', each accompanied by a green dot.

ProcessBook Interface Control

- Needed the ability to control connections to the system
 - Mechanism to determine each plant's interface connection – The interface number.
 - Ability to terminate existing plant's connection at any time.
 - Ability to Deny, Suspend and Resume connections in Manual Mode.
- OSIsoft provided the UniInt based interface for the ERDS protocol

ProcessBook Interface Control

- Transmitting Data

NRC ERDS Interface CONTROL Map

1/19/2010 3:03:04 PM
HQ Time

ERDS Interface Mode: **Auto**

Auto

Manual

Status Map

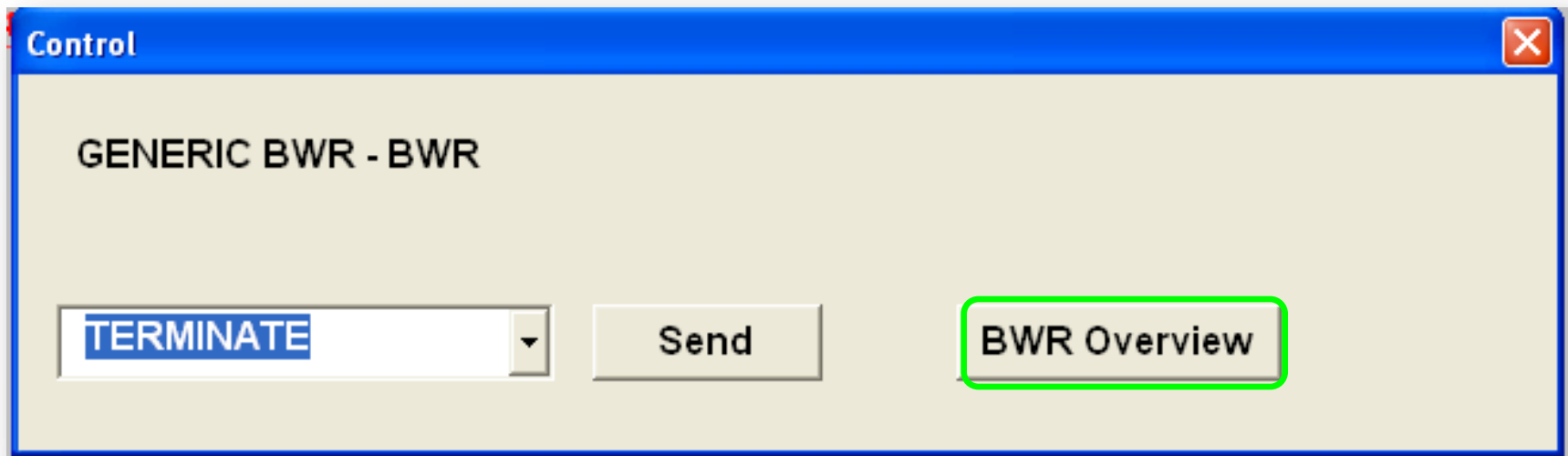
Generic BWR (BWR) **6401** ●

Generic PWR (PWR) **6401** ●

Double click on interface number to bring up control form.

ProcessBook Interface Control

- Uses custom VBA code to terminate connections



PI Plant Simulator/Run Simulator

- OSIssoft created the PI Plant Simulator
 - “simulate” transmission from a nuclear power plant
 - command line application with no GUI
- PPC created a GUI wrapper for the command line application
 - allow users a simple way to run the simulator
 - training with a generic plant
 - specific plant using previously transmitted data.

Run Simulator

Run Simulator

File Configure Help

Plant: GENERIC BWR

Port: 6401

Replay: 5

Interval: 5000

File: C:\sample1.txt

IP/Node Address: LT-4838

Modify Time

Dial Modem

File Type

Simulation

Preset Data

Reset

Other File: ...

Run

Run All

Cancel

Close

Cmd Line: "C:\PIPLANTSIMULATOR.EXE" /replay=5 /modifytime=1 /TZOffset=-1 /interval=5000 /tsport=6401 /plantfile="C:\sample1.txt" /tsaddress=LT-4838

Data Point Library (DPL) Workflow

- Licensees use DPL file to communicate to NRC metadata about the real-time data.
- Each DPL entry has information that is stored in the PI Point Database and the PI Module Database. Whenever this information changes, it is necessary to change it BOTH places so the information matches.
- Whenever a specific data point changes (PI TAG), All the ProcessBook displays that contain that point must be changed.
- PPC developed a PI SDK application to automate
 - updating the PI Point Database
 - updating the PI Module Database
 - updating the ProcessBook displays

DPL Maintenance

ERDS MAINT

File Actions View Help

Plant: Plant Type: BWR PWR Time Zone: EST CST MST PST Docket Number: Add Plant

REACTOR: Region: Update Plant

Plant Info Point Maintenance Clone Plant

Point Maintenance

CSF Category: REAC_VES_LV1 - SPDS0007 REFERENCE POINT NOTES:

NRC ERDS PARAMETER: PROC OR SENS: SENSOR (S) Process (P)

POINT ID: Clear Clone NUMBER OF SENSORS:

PLANT SPEC POINT DESC: HOW PROCESSED:

GENERIC/COND DESC: SENSOR LOCATIONS:

POINT TYPE: Analog Digital ALARM/TRIP SET POINTS:

ENGR UNITS/DIG STATES: NI DETECTOR POWER SUPPLY CUT-OFF POWER LEVEL:

ENGR UNITS CONVERSION: NI DETECTOR POWER SUPPLY TURN-ON POWER LEVEL:

MINIMUM INSTR RANGE: INSTRUMENT FAILURE MODE:

MAXIMUM INSTR RANGE: TEMPERATURE COMPENSATION FOR DP TRANSMITTERS:

ZERO POINT REFERENCE: LEVEL REFERENCE LEG:

UNIQUE SYSTEM DESC:

POINT SOURCE: 38 Data Points Update Processbook Displays Update Point

DPL Maintenance Functionality

- Creates Full/Partial DPL Listing (in Excel)
 - DPL file format defined by NRC regulation
- Compare PI configuration to DPL
 - Verify all DPL entries are in the PI Point Database
 - Verify that all points in the PI Point Database have DPL entries
- Create “Preset Data” files useful in testing the ProcessBook displays

DPL Maintenance Functionality (cont)

- Create “import” spreadsheet from corrected full DPL listing for use in the PI-SMT add in in Excel.
 - DPL Import - Used to create/modify the full PI Module Database DPL section that populates items for the “ALL” display.
 - PI TAG Import - For creating/modifying the PI Point database.
 - PAL_IMPORT - used to create/modify the Plant Attribute Library (PAL) section of the Module Database.
- Create an exact copy of a plant’s PI displays and log files with a new three character designation to make a training plant
 - Useful for training on a plant without affecting actual data
 - Eliminates the need for an additional PI Server for training

Modify Multi-State Symbol

- Modifies the Multi-State Symbol on all displays of the selected plant -
 - Change Unknown quality to look like good quality

Good Quality

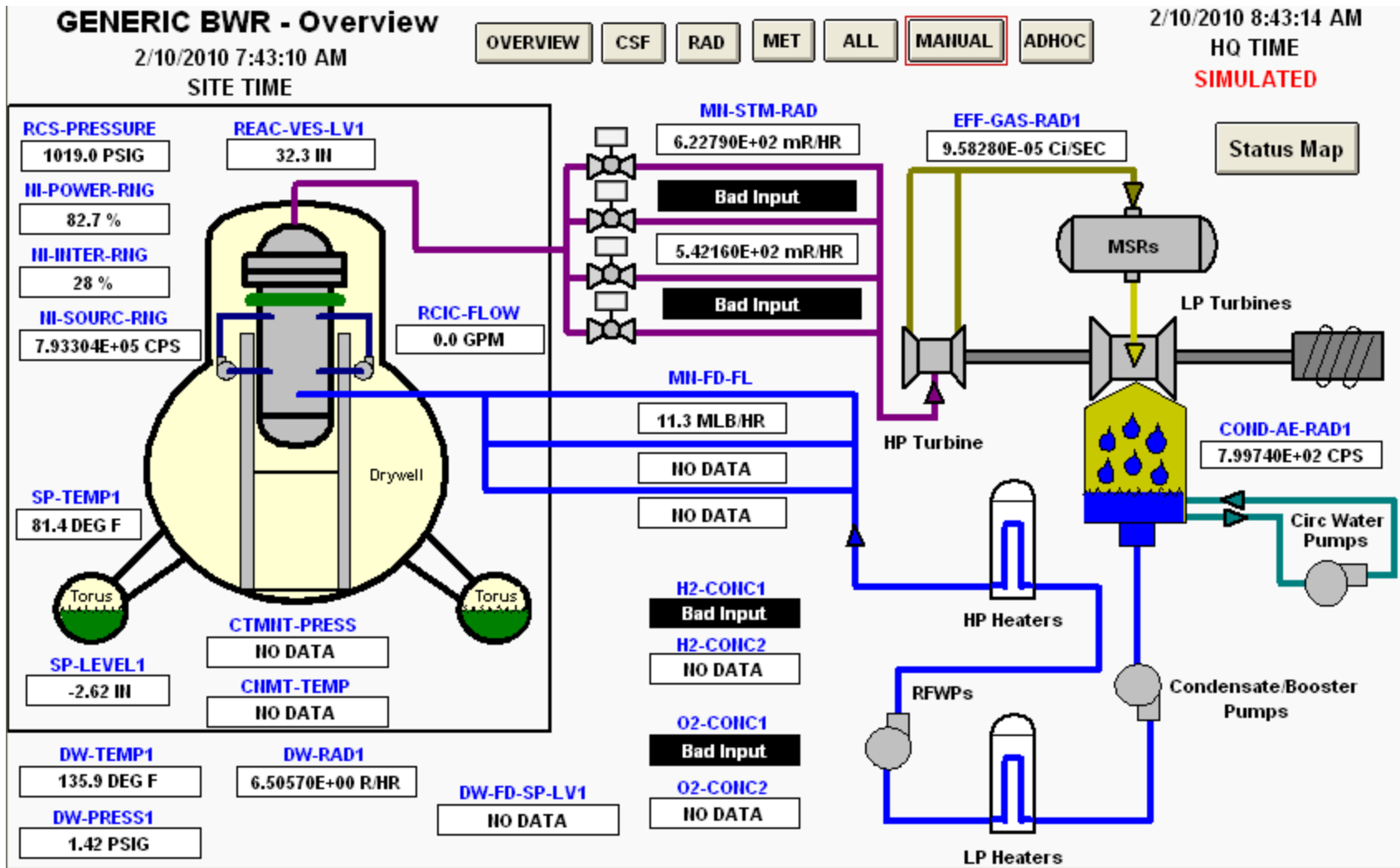
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Other Than Good Quality

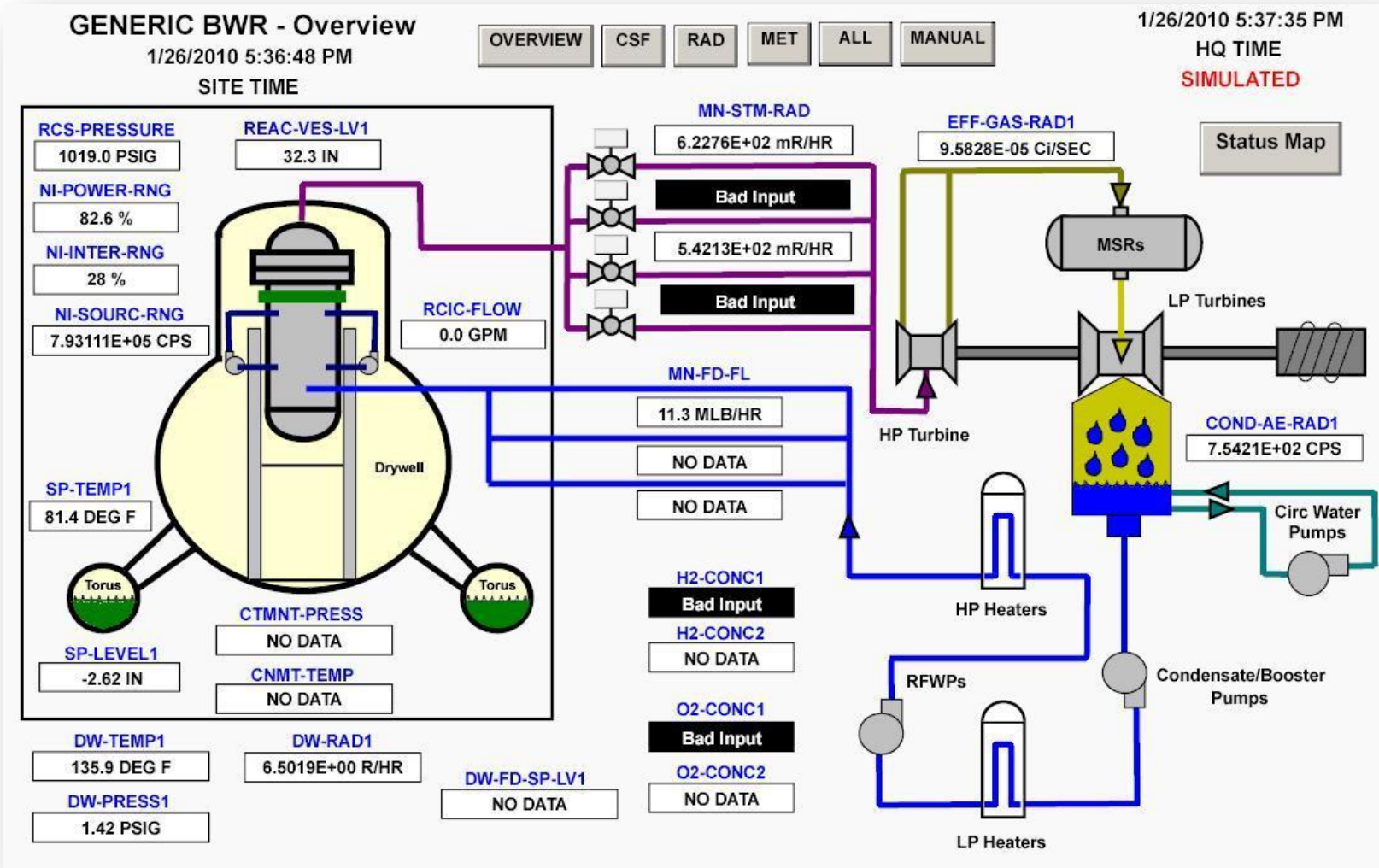
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- Change the Multi-State Symbol based on previously saved defaults

BWR Overview - ProcessBook



BWR Overview Web



Results

- **Productivity** – More plants can connect at a given time – More can be monitored at once.
- **Visibility** – NRC supervision has recognized this system as a key tool in emergency response
- **Security** – Replacement System is much more secure than the original system.
- **Reliability** – Redundancy of servers has provided for a VERY reliable system (High Availability)
- **Compliance** – System was able to comply with stringent government (FISMA) security compliance as well as passing the NIST DISA Gold scan

Results (continued)

- **Availability** – System is designed to be available 24x7. OSIsoft has assisted with maintaining the system operation as close as possible
- **Ease of Maintenance** –
 - Both the PI Point Database and the PI Module Database are updated at the same time keeping all configuration data synchronized
 - By using the plant name as the security group, additional plants can be easily added.
 - Adding a plant can be automated.
 - System Maintenance is only performed once. No chance of erroneous information.

Tangible Benefits

- Retired aging hardware
 - Very expensive parts, hard to find.
- New technology applied
 - Existing ERDS protocol
 - Low impact on nuclear power plants
 - Same DPL file format
 - Seamless transfer to new system
- System allows more plants connected
- Remote Access
 - Very limited before
 - Now in place for many users

More Tangible Benefits

- Ability to show PI points configured but not defined by DPL file to be in the data stream
- Maintenance of PI Module Database and PI Point Database cut in half

Intangible Benefits

- Many more simultaneous user connections
- More secure ERDS connection
 - Phase II TCP/IP vs. Phase I modem
- DPL Workflow Automation
 - PI SDK Application
 - Update the PI Point Database
 - Update the PI Module Database
 - Update ProcessBook displays if necessary
- System is very easy to use despite being customized for 104 nuclear power plants.

Future Plans – Next Steps

- Complete Phase II Implementation for all nuclear power plants
- Reduce the number of displays (AF)
- Incorporate DataLink into system
- UPGRADE ProcessBook!
- Evolution of NRC towards receiving continuous data feeds

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